Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-19-062

August XX, 2019

10 CFR 50.90

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

Watts Bar Nuclear Plant, Units 1 and 2
Facility Operating Licenses No. NPF-90 and NPF-96
Docket Nos. 50-390 and 391

Subject: **Response to Second-Round NRC Request for Additional Information Regarding Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2 (WBN-TS-18-09) (EPID L-2018-LLA-0494)**

References:

1. TVA letter to NRC, CNL-18-118, "Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2, 'DC Electrical Rewrite - Update to TSTF -360' (WBN-TS-18-09)," dated November 29, 2018 (ML18334A389)

2. NRC Electronic Mail to TVA, "Watts Bar Nuclear Plant - Final Request for Additional Information Related to Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2 (EPID L-2018-LLA-0494)" dated May 3, 2019 (ML19011A349)

3. TVA letter to NRC, CNL-19-056, "Response to NRC Request for Additional Information Regarding Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2, 'DC Electrical Rewrite - Update to TSTF -360' (WBN-TS-18-09)," dated June 7, 2019 (ML19158A394)

4. NRC electronic mail to TVA, "Watts Bar Nuclear Plant - Second-Round Request for Additional Information Related to Application to Revise Technical Specifications Regarding DC Electrical Systems, TSTF-500, Revision 2 (EPID L-2018-LLA-0494)," dated August 2, 2019 (ML19218A030)

In Reference 1, TVA submitted a request for an amendment to the technical specifications (TS) for Watts Bar Nuclear Plant (WBN), Units 1 and 2. The proposed amendment revises TS requirements related to direct current (DC) electrical systems in accordance with Technical Specification Task Force (TSTF) Traveler TSTF-500, Revision 2, "DC Electrical Rewrite - Update to TSTF-360."

In Reference 2, the Nuclear Regulatory Commission (NRC) issued a Request for Additional Information (RAI. In Reference 3, TVA provided a response to the NRC RAI. In Reference 4, the NRC issued a second-round RAI and requested TVA respond by August 30, 2019. Enclosure 1 to this letter provides the TVA response to the second-round RAI. Enclosure 2 provides changes to the TS 3.8.4, “DC Sources – Operating,” and Bases markups that reflect the information in Enclosure 1. Enclosure 3 provides revised (clean) TS pages. The proposed TS changes in Enclosures 2 The revised TS 3.8.4 and Bases changes in Enclosure 2 supersede those provided in References 1 and 3.

The enclosures to this letter do not change the no significant hazard considerations nor the environmental considerations contained in Reference 1. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosure to the Tennessee Department of Environment and Conservation.

Enclosure 4 provides the new regulatory commitment associated with this submittal. Please address any questions regarding this request to Kimberly D. Hulvey at (423) 751-3275.

In Reference 1, TVA requested approval of the proposed license amendment within one year from the date of submittal, with implementation of the amendment within 90 days to support the WBN Unit 1 Cycle 16 refueling outage scheduled for Spring 2020. TVA requests that the implementation date be revised to 60 days within NRC approval of Reference 1.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this XXth day of August 2019.

Respectfully,

James T. Polickoski
Director, Nuclear Regulatory Affairs

Enclosures:

1. Response to Second-Round NRC Request for Additional Information Regarding Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2 (WBN-TS-18-09) (EPID L-2018-LLA-0494)
2. WBN Units 1 and 2 Technical Specifications 3.8.4 and Bases Changes (Marked-up)
3. WBN Units 1 and 2 Technical Specifications 3.8.4 Changes (Re-typed)
4. New Regulatory Commitment

cc (see page 3)

cc (Enclosures):

NRC Regional Administrator – Region II
NRC Project Manager – Watts Bar Nuclear Plant
NRC Senior Resident Inspector – Watts Bar Nuclear Plant
Director, Division of Radiological Health – Tennessee State Department of Environment and Conservation

bcc: (Enclosures)

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Response to Second-Round NRC Request for Additional Information Regarding Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2 (WBN-TS-18-09) (EPID L-2018-LLA-0494)

Background

By letter dated November 29, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18334A389), as supplemented by letter dated June 7, 2019 (ADAMS Accession No. ML19158A394), Tennessee Valley Authority (the licensee), requested an amendment to Facility Operating Licenses NPF-90 and NPF-96 for Watts Bar Nuclear Plant (WBN), Units 1 and 2. The proposed license amendment request would revise the WBN Units 1 and 2 Technical Specifications (TSs) to adopt Technical Specifications Task Force (TSTF) Traveler TSTF-500, Revision 2, "DC [direct current] Electrical Rewrite – Update to TSTF-360" (ADAMS Accession No. ML092670242). Specifically, the licensee proposed changes to the TS requirements related to DC electrical power systems in TS 3.8.4, "DC sources – Operating," TS 3.8.5, "DC Sources – Shutdown," and TS 3.8.6, "Battery Cell Parameters." Additionally, the licensee proposed to add to the TS Section 5.7, "Procedures, Programs, and Manuals," a new program titled "Battery Monitoring and Maintenance Program."

The licensee's letter dated June 7, 2019, responded to the Electrical Engineering Operating Reactors Branch (EEOB) staff's request for additional information (RAI) dated May 3, 2019 (ADAMS Accession No. ML19126A121). The EEOB staff has reviewed the licensee's responses and has determined that the following additional information is needed to complete the review of the WBN license amendment request.

Regulatory Requirements
Title 10 of the Code of Federal Regulations (10 CFR), Section 50.36, "Technical Specifications," requires, in part, that the operating license of a nuclear production facility include TSs. Section 50.36(c)(2) of 10 CFR requires that the TS include limiting conditions for operation (LCOs) which are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When an LCO of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met.

Appendix A, "General Design Criteria [GDC] for Nuclear Power Plants," to 10 CFR Part 50. GDC-17, "Electric power systems," states, in part:

> *An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. […] The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure.*

Regulatory Guidance

TSTF-500, Revision 2.

EEOB RAI-7.b.01

In its June 7, 2019, letter, in response to EEOB RAI-7, the licensee proposed to revise the TS LCO 3.8.4 statement for the diesel generator (DG) DC electrical power subsystems from "four DG DC electrical power subsystems" to "Train A and Train B DG DC electrical power subsystems"; and to revise the TS 3.8.4 and TS 3.8.6 conditions related to the DG electrical power subsystems. The licensee stated that the proposed change to the LCO 3.8.4 with respect to the DG DC electrical power subsystem supports the redundancy of the standby electrical power subsystem. The licensee provided the following explanation (emphasis added):

> *Each DG DC electrical power system is independent and dedicated to its respective DG. The DGs that are supported by the DG DC electrical power systems are arranged in redundant trains (i.e., DG 1A-A and DG 2A-A are in Train A, and DG 1B-B and DG 2B-B are in Train B). When one or two DGs in a train are inoperable, that train of standby electrical power is incapable of performing the safety function and must rely on the redundant DG train to mitigate an event. Likewise, if one or two of the DG DC trains that support the DGs in that train are inoperable, that train of standby electrical power is incapable of performing the safety function and must rely on the redundant train to mitigate an event. Therefore, the LCO requires Train A and Train B DG DC electrical power subsystems to be OPERABLE to support the redundancy of the standby electrical power system.*

In its November 29, 2018, letter, Enclosure 1, Section 2.0, "Assessment," the licensee states (emphasis added):

> *A DG battery subsystem is provided for each DG. Each subsystem is comprised of a battery, dual battery charger assembly, distribution center, and cabling.*

The NRC staff has identified the following apparent discrepancies:

- *It appears that the DC power for a DG is provided by a DG DC electrical power system in the June 7, 2019, letter but by a DG battery subsystem in the November 29, 2018, letter.*
- *It appears that a discussion provided in the June 7, 2019, letter did not describe the relationship between the DG DC trains and the DG DC subsystems.*

The NRC staff requests the following information to address these discrepancies:

1- *Clarify whether a DG DC subsystem or DG DC system supports each DG.*

2- *Clarify the relationship between the DG DC trains and the DG DC electrical power subsystems in the above-mentioned paragraph in the June 7, 2019, letter.*

TVA Response to EEOB RAI-7-b.01

1. Each DG is supported by its own dedicated DG DC electrical power subsystem.

2. The following markup of the statement provided in the June 7, 2019 letter clarifies the relationship between DG DC electrical power trains and DG DC electrical power subsystems:

   Each DG DC electrical power subsystem is independent and dedicated to its respective DG. The DGs ~~that are supported by the DG DC electrical power systems~~ are arranged in redundant trains (i.e., DG 1A-A and DG 2A-A are in Train A, and DG 1B-B and DG 2B-B are in Train B). Therefore, two DG DC electrical power subsystems support each train of DGs. When one or two DGs in a train are inoperable, that train of standby electrical power is incapable of performing the safety function and must rely on the redundant DG train to mitigate an event. Likewise, if one or two of the DG DC ~~trains~~ subsystems that support the DGs in that train are inoperable, that train of DGs ~~standby electrical power~~ is incapable of performing the safety function and must rely on the redundant train to mitigate an event. Therefore, the LCO requires Train A and Train B DG DC electrical power subsystems to be OPERABLE to support the redundancy of the standby electrical power system.

   Enclosure 2 to this submittal provides the revised TS 3.8.4 Bases markups that reflect the information in this RAI response. Additionally, TVA will revise the WBN UFSAR to reflect consistent terminology regarding the arrangement of the four DG DC electrical power subsystems, with one subsystem supporting each DG. Enclosure 4 contains the new regulatory commitment.

EEOB RAI-9

In its June 7, 2019, letter, the licensee proposed a revised TS 3.8.4 Condition D and associated Required Actions D.1, D.2, and D.3 to state:

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or two DG DC battery charger(s) on one train inoperable.	D.1 Restore DG battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	D.2 Verify battery float current ≤ 1 amp.	Once per 12 hours
	AND	
	D.3 Restore DG battery charger(s) to OPERABLE status.	72 hours

In its November 29, 2018, letter, Enclosure 1, Section 2.0, the licensee states:

> *A DG battery subsystem is provided for each DG. Each subsystem is comprised of a battery, dual battery charger assembly, distribution center, and cabling. […] Each of the chargers (normal and alternate) in the dual charger assembly has a dedicated AC source from two respective 480V AC Diesel Generator Auxiliary Boards. If the normal charger is unavailable, the alternate charger is selected by the 125V DC transfer switch included in the assembly.*

The TSTF-500, Revision 2, allows for a 72-hour CT for an inoperable battery charger based on the condition that an alternate means (e.g. spare battery charger) of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used. The NRC staff has identified the following apparent discrepancies:

- *If the WBN DG dual battery charger for each DG battery subsystem on one train is designed such that the alternate battery charger is selected automatically when the normal battery charger becomes inoperable, TS 3.8.4 Condition D will be entered only after both the normal and alternate battery chargers become inoperable. In this case, it appears that there would be no alternate charger that would be used to restore the DG battery terminal voltage to greater than or equal to the minimum established float voltage within 2 hours (Required Action D.1); and thus, the proposed 72-hour CT for restoring the inoperable DG battery charger to operable status (Required Action D.3) could not be used.*

The NRC staff requests the following information

1. *Discuss the TS requirements for an operable DG battery subsystem and an operable DG DC train. Include in the discussion the number of operable battery charger in the dual assembly that is required for an operable DG battery subsystem and for an operable DG DC train.*
2. *Explain when Condition D will be entered and provide the alternate means that will be used to restore DG battery terminal voltage to greater than or equal to the minimum established float voltage within 2 hours to allow the 72-hour CT for the inoperable DG battery charger.*

TVA Response to EEOB RAI-9

1. Each DG DC electrical power subsystem is comprised of a battery, dual battery charger assembly, distribution center, and cabling. Each DG DC electrical power subsystem requires one battery charger for operability. The alternate battery charger in each dual battery charger is an installed spare and is only relied upon when the manual selector switch on that dual battery charger assembly is positioned to the alternate battery charger.

   Each DG DC electrical power subsystem is independent and dedicated to its respective DG. Two DG DC electrical power subsystems support each train of DGs. As noted in the revised proposed TS changes in Reference 1, the LCO for TS 3.8.4 requires Train A and Train B DG DC electrical power subsystems to be OPERABLE to support two trains of DGs. Therefore, two DG DC battery chargers, each connected to its respective DG battery, are required to be operable in each DG DC electrical power train. With one or two DG DC battery charger(s) on one train inoperable, then TS 3.8.4 Condition D applies. Further information on TS 3.8.4 Condition D is provided in the response to RAI-9.2.

2. When one or both required DG DC battery charger(s) in a DG DC electrical power train are inoperable, TS LCO 3.8.4, Condition D, is entered. Upon declaring the DG DC battery charger(s) inoperable, the Completion Times for Required Actions D.1, D.2, and D.3 run concurrently. Upon discovery of an inoperable DG DC battery charger, the alternate DG battery charger is manually selected at the respective dual battery charger, thereby providing a qualified means to charge the respective DG battery.

   DG DC battery terminal voltage would be restored to greater than or equal to the minimum established float voltage after the alternate DG DC battery charger(s) are manually selected at the respective DG DC dual battery charger. Selecting the alternate DG DC battery charger provides a qualified means to charge the respective DG battery, thereby allowing Condition D to be exited.

   However, the test results on the spare battery charger could prove inconclusive or otherwise show that the charger could not be considered operable. The battery charger may nonetheless be capable of restoring the battery terminal voltage to the minimum established float voltage. It could, therefore, still be connected to the appropriate DG DC subsystem as a standby charger. Therefore, operation could continue until the 72-hour Completion Time (CT) expires, or until the DG DC battery charger is restored to an operable status.

   While TSTF-500 does not specifically addresses DG DC battery chargers, the two-hour CT to restore DG battery terminal voltage to greater than or equal to the minimum established float voltage and the 72-hour CT to restore an inoperable DG DC battery charger to an operable status has precedence. Specifically, in Reference 2, the NRC approved the same CTs for a DG DC battery charger for the Edwin I. Hatch Nuclear Plant, Units 1 and 2. In Reference 2, NRC states:

   > "In Question 4 of its request for additional information (RAI) dated October 17, 2016 (Reference 22), the NRC staff requested the licensee to provide the HNP basis for the 72-hour CT. By letter dated November 16, 2016 (Reference 8), the licensee stated that the 72 hours will allow, in many cases, a sufficient period of time to correct a charger problem. The 72-hour CT is commensurate with the importance of maintaining the DC system's capability to adequately respond to a design basis event. The 72-hour CT reflects a reasonable time to effect restoration of the qualified battery charger to operable status, because there is an available spare charger with the same capacity and capability of performing its design function. The action to restore the battery chargers to operable status within 72 hours is consistent with TSTF-500, and the 72-hour CT is applicable to HNP. The NRC staff finds the proposed new Required Action B.3 and its associated CT acceptable."

   The WBN DG DC battery system is similar to Hatch in that there is a dual DG DC battery charger per battery and one charger is normally in service and one is in standby. Also, each dual DG DC battery charger has a manual switch to align either the normal or the alternate charger to the respective DG battery. Therefore, the basis for the 72-hour CT, as noted in Reference 2, is also applicable to WBN.

   During development of the response to RAI-9, it was identified that the proposed Actions for an inoperable DG DC battery chargers did not address the condition of one or more inoperable DG DC battery chargers in redundant trains. Therefore, in the event that there were inoperable DG DC battery chargers in redundant trains, LCO 3.0.3 would be required to be entered, thereby requiring initiation of a plant shutdown to MODE 3 in 1 hour. These required actions are more restrictive than the required actions of TS 3.8.1, "AC Sources – Operating," for one or more DGs inoperable in Trains A and B (i.e., TS Condition F). Therefore, TS 3.8.4, Condition F (Required Acton and associated Completion Time of Condition D or E not met) is being revised to also apply when one or more DG DC battery charger(s) are inoperable in redundant trains, with a required action to immediately declare the associated DG(s) inoperable. This proposed change to LCO 3.8.4 will align the required actions for inoperable DG DC battery chargers in redundant trains to the required actions specified for the affected DGs. Enclosure 2 provides the revised TS markups to reflect the proposed change to TS 3.8.4, Condition F.

Reference

1. TVA letter to NRC, CNL-19-056, "Response to NRC Request for Additional Information Regarding Application to Revise Technical Specifications Regarding DC Electrical Systems TSTF-500, Revision 2, 'DC Electrical Rewrite - Update to TSTF -360' (WBN-TS-18-09)," dated June 7, 2019 (ML19158A394)
2. NRC letter to Southern Nuclear Operating Company, "Edwin I. Hatch Nuclear Plant, Units 1 and 2 - Issuance of Amendments Regarding the Adoption of TSTF-500, 'DC Electrical Rewrite - Update To TSTF-360' (CAC Nos. MF6611 and MF6612)," dated August 29, 2017 (ML17208A231)

Enclosure 2

WBN Units 1 and 2 Technical Specifications 3.8.4 and Bases Changes (Marked-up)

Enclosure 2

WBN Unit 1 Technical Specifications 3.8.4 and Bases Changes (Marked-up)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

LCO 3.8.4 ~~Four channels of~~ The Train A and Train B vital DC and ~~four~~ Diesel Generator (DG) DC electrical power subsystems shall be OPERABLE.

---NOTES---

1. Vital Battery V may be substituted for any of the required vital batteries.

2. The C-S DG and its associated DC electrical power subsystem may be substituted for any of the required DGs and their associated DC electrical power subsystem.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required vital battery charger(s) on one subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore vital battery charger(s) to OPERABLE status.	7 days
B~~A~~. One vital DC electrical power subsystem inoperable for reasons other than Condition A.	~~A~~B.1 Restore vital DC electrical power subsystem to OPERABLE status.	2 hours
C~~B~~. Required Action and Associated Completion Time of Condition A or B not met.	~~B~~C.1 Be in MODE 3.	6 hours
	AND	
	~~B~~C.2 Be in MODE 5.	36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or two DG DC battery charger(s) on one train inoperable.	D.1 Restore DG battery terminal voltage to greater than or equal to the minimum established float voltage. AND D.2 Verify battery float current ≤ 1 amp. AND D.3 Restore DG battery charger(s) to OPERABLE status.	2 hours Once per 12 hours 72 hours
~~C~~E. One DG DC ~~electrical power subsystem~~ train inoperable for reasons other than Condition D.	~~C~~E.1 Restore DG DC ~~electrical power subsystem~~ train to OPERABLE status.	2 hours
~~D~~F. Required Action and associated Completion Time of Condition ~~C~~D or E not met. OR One or more DG DC battery charger(s) in redundant trains inoperable.	~~D~~F.1 Declare associated DG(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify vital battery terminal voltage is greater than or equal to the minimum established float voltage~~≥ 128 V (132 V for vital battery V) on float charge~~.	7 days
SR 3.8.4.2	Verify DG battery terminal voltage is greater than or equal to the minimum established float voltage~~≥ 124 V on float charge~~.	7 days
SR 3.8.4.3	Verify for the vital batteries that the alternate feeder breakers to each required battery charger are open.	7 days
SR 3.8.4.4	Verify correct breaker alignment and indicated power availability for each DG 125 V DC distribution panel and associated battery charger.	7 days

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.5	Verify no visible corrosion at terminals and connectors for the vital batteries. OR Verify connection resistance for the vital batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 ohm for inter-rack connections, ≤ 120 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	92 days
SR 3.8.4.6	Verify no visible corrosion at terminals and connectors for the DG batteries. OR Verify connection resistance for the DG batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	92 days
SR 3.8.4.7	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	12 months
SR 3.8.4.8	Remove visible terminal corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.	12 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.9	Verify connection resistance for the vital batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 for inter-rack connections, ≤ 120 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	12 months
SR 3.8.4.10	Verify connection resistance for the DG batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	12 months
SR 3.8.4.511	------------------------------NOTE------------------------------ This Surveillance is normally not performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. --- Verify each vital battery charger supplies ≥ 200 amps at greater than or equal to the minimum established float voltage for ≥ 4 hoursis capable of recharging its associated battery from a service or capacity discharge test while supplying normal loads. OR Verify each vital battery charger can recharge the battery to the fully charged state within 36 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 stateis capable of operating for ≥ 4 hours at current limit 220 - 250 amps.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.6~~12~~	------------------------------NOTE------------------------------ Credit may be taken for unplanned events that satisfy this SR. -- Verify each ~~diesel generator~~DG battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state~~is capable of recharging its associated battery from a service or capacity discharge test while supplying normal loads~~.	 18 months
SR 3.8.4.7~~13~~	-----------------------------NOTES------------------------------ 1. The modified performance discharge test in SR 3.8.6.7~~4.14~~ may be performed in lieu of the service test in SR 3.8.4.7~~13 once per 60 months~~. 2. This Surveillance is not performed in MODE 1, 2, 3, or 4 for required vital batteries. 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 and any connected nonsafety loads for the design duty cycle when subjected to a battery service test.	 18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.14	-------------------------NOTES------------------------- This Surveillance is not performed in MODE 1, 2, 3, or 4 for required vital batteries. Credit may be taken for unplanned events that satisfy this SR. --	
	Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months AND 12 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources - Operating

BASES

BACKGROUND

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

125 V Vital DC Electrical Power Subsystem

The vital 125 VDC electrical power system is a Class IE system whose safety function is to provide control power for engineered safety features equipment, emergency lighting, vital inverters, and other safety-related DC powered equipment for the entire unit. The system capacity is sufficient to supply these loads and any connected nonsafety loads during normal operation and to permit safe shutdown and isolation of the reactor for the "loss of all AC power" condition. The system is designed to perform its safety function subject to a single failure.

The 125V DC vital power system is composed of the four ~~redundant~~ channels (Channels I and III are associated with Train A and Channels II and IV are associated with Train B) and consists of four lead-acid-calcium batteries, eight battery chargers (including two pairs of spare chargers), four distribution boards, battery racks, and the required cabling, instrumentation and protective features. Each channel is electrically and physically independent from the equipment of all other channels so that a single failure in one channel will not cause a failure in another channel. Each channel consists of a battery charger which supplies normal DC power, a battery for emergency DC power, and a battery board which facilitates load grouping and provides circuit protection. These four channels are used to provide emergency power to the 120V AC vital power system which furnishes control power to the reactor protection system. No automatic connections are used between the four ~~redundant~~ channels.

Battery boards I, II, III, and IV have a charger normally connected to them and also have manual access to a spare (backup) charger for use upon loss of the normal charger.

(continued)

BACKGROUND

125 V Vital DC Electrical Power Subsystem (continued)

Additionally, battery boards I, II, III, and IV have manual access to the fifth vital battery system. The fifth 125V DC Vital Battery System is intended to serve as a replacement for any one of the four 125V DC vital batteries during their testing, maintenance, and outages with no loss of system reliability under any mode of operation.

Each of the vital DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, 6.9 kV switchgear, and 480 V load centers. The vital DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC vital buses. Additionally, they power the emergency DC lighting system.

The vital 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."

~~Each vital battery has adequate storage capacity to carry the required load continuously for at least 4 hours in the event of a loss of all AC power (station blackout) without an accident or for 30 minutes with an accident considering a single failure. Load shedding of nonrequired loads will be performed to achieve the required coping duration for station blackout conditions.~~

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

Each battery has adequate storage capacity to 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.

The batteries for the vital DC electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles~~, derated for minimum ambient temperature~~ and the

(continued)

BACKGROUND

125 V Vital DC Electrical Power Subsystem (continued)

100% design demand. The minimum design voltage limit is 105 V.The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery (132 V for Vital Battery V). The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).

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 60 cell battery (i.e., cell voltage of 2.063 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. 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 132 V for a 60 cell battery as discussed in the FSAR, Chapter 8 (Ref. 4).

Each Vital DC electrical power subsystem battery charger has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient excess capacity to restore the battery bank from the design minimum charge to its fully charged state within 12 hours (with accident loads being supplied) following a 30 minute AC power outage and in approximately 36 hours (while supplying normal steady state loads following a 2 hour AC power outage), (Ref. 65).

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.

(continued)

BACKGROUND (continued)

125 V Diesel Generator (DG) DC Electrical Power Subsystem

Control power for the DGs is provided by five DG battery subsystems, one per DG. Each subsystem is comprised of a battery, a dual battery charger assembly, distribution center, cabling, and cable ways. The DG 125V DC control power and field-flash circuits have power supplied from their respective 125V distribution panel. The normal supply of DC current is from the associated charger. The battery provides control and field-flash power when the charger is unavailable. The charger supplies the normal DC loads, maintains the battery in a fully charged condition, and recharges (480V AC available) the battery while supplying the required loads regardless of the status of the unit. The batteries are physically and electrically independent. The battery has sufficient capacity when fully charged to supply required loads for a minimum of 30 minutes following a loss of normal power. Each battery is normally required to supply loads during the time interval between loss of normal feed to its charger and the receipt of emergency power to the charger from its respective DG.

APPLICABLE SAFETY ANALYSES

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

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 plant. This includes maintaining the DC sources OPERABLE during accident conditions in the event of:

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

b. A worst case single failure.

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

(continued)

LCO

~~Four~~ Two 125V vital DC electrical power subsystems (Train A and Train B)~~, each vital subsystem~~ consist of two channels each. Each channel consisting of a battery bank, associated battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated DC bus within the channel; and ~~four~~ one DG DC electrical power subsystem~~s~~ for each DG, consisting of a battery, a dual battery charger assembly, and the corresponding control equipment and interconnecting cabling are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (A00) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE vital DC electrical power subsystem requires all required batteries and respective chargers to be operating and connected to the associated DC buses.

Each DG DC electrical power subsystem is independent and dedicated to its respective DG. The DGs that are supported by the DG DC electrical power subsystems are arranged in redundant trains (i.e., DG 1A-A and DG 2A-A are in Train A, and DG 1B-B and DG 2B-B are in Train B). Therefore, there are two DG DC electrical power subsystems associated with each train of DGs. When one or two DGs in a train are inoperable, that train is incapable of performing the safety function and must rely on the redundant train to mitigate an event. Likewise, if one or two of the DG DC electrical power subsystems that support the DGs in that train are inoperable, that train is incapable of performing the safety function and must rely on the redundant train to mitigate an event. Therefore, the LCO requires Train A and Train B DG DC electrical power subsystems to be OPERABLE to support the redundancy of the standby electrical power system.

The LCO is modified by ~~two~~ a Note~~s~~. The Note ~~1~~ indicates that Vital Battery V may be substituted for any of the required vital batteries. However, the fifth battery cannot be declared OPERABLE until it is connected electrically in place of another battery and it has satisfied applicable Surveillance Requirements. ~~Note 2 has been added to indicate that the C-S DG and its associated DC subsystem may be substituted for any of the required DGs. However, the C-S DG and its associated DC subsystem cannot be declared OPERABLE until it is connected electrically in place of another DG, and it has satisfied applicable Surveillance Requirements.~~

APPLICABILITY

The ~~four~~ vital DC electrical power sources and ~~four~~ DG DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe plant operation and to ensure that:

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

(continued)

BASES

APPLICABILITY (continued)

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

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

ACTIONS

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

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

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

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

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

(continued)

ACTIONS

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

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

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 7 day Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

~~A~~B.1

Condition ~~A~~B represents one vital ~~channel~~ DC electrical power subsystem with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is, therefore, imperative that the operator's attention focus on stabilizing the plant, minimizing the potential for complete loss of DC power to the affected ~~train~~ subsystem. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution subsystem ~~train~~.

If one of the required vital DC electrical power subsystems is inoperable for reasons other than Condition A (e.g., ~~inoperable battery, inoperable battery charger(s), or~~ inoperable battery charger and associated inoperable battery), the remaining vital DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure of the OPERABLE subsystem ~~would~~ could, however, result in ~~a situation where the ability of the 125V DC electrical power subsystem to support its required ESF function is not assured,~~ the loss of the minimum necessary vital DC electrical power subsystems to mitigate a worst-case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. ~~8~~7) and reflects a reasonable time to assess plant status as a function of the inoperable vital DC electrical power subsystem and, if the vital DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe plant shutdown.

~~B.1 and B.2~~C,1 and C.2

If the inoperable vital DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the

(continued)

ACTIONS (continued)

~~B.1 and B.2~~C,1 and C.2 (continued)

plant 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 plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the plant to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. ~~8~~7).

D.1, D.2, and D.3

Condition D represents one DG DC train with one or two battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action D.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage.

Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action D.2) from any discharge that might have occurred due to the charger inoperability.

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

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

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DG DC subsystem, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive,

(continued)

ACTIONS

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

and there is not adequate assurance that it can be recharged within 12 hours (Required Action D.2).

Required Action D.2 requires that the battery float current be verified as less than or equal to 1 amp. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it is now fully capable of supplying the maximum expected load requirement. The 1 amp value is based on returning the battery to 98% charge and assumes a 2% design margin for the battery. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 1 amp this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action D.3 limits the restoration time for the inoperable battery charger to 72 hours. The 72 hour Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

~~C.1~~E.1

Condition ~~C~~E represents one DG with a loss of ability to completely respond to an event. Since a subsequent single failure on the opposite train could result in a situation where the required ESF function is not assured, continued power operation should not exceed 2 hours. The 2 hour time limit is consistent with the allowed time for an inoperable vital DC electrical power subsystem.

~~D.1~~F.1

If the DG DC electrical power subsystem cannot be restored to OPERABLE status in the associated Completion Times of Condition D or E or if one or more DG DC battery chargers in redundant trains are inoperable, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable. This declaration also requires entry into applicable Conditions and Required Actions for an inoperable DG, LCO 3.8.1, "AC Sources-Operating."

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1 and SR 3.8.4.2

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 ~~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 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 ~~critical~~ nominal design voltage of the battery and are consistent with the ~~initial voltages assumed in the battery sizing calculations~~ minimum float voltage established by the battery manufacturer (2.20 Vpc times the number of connected cells or 132 V at the battery terminals for a 60 cell vital battery; 127.6 V at the battery terminals for a 58 cell DG battery). This voltage maintains the battery plates in a condition that supports maintaining the grid life. The 7 day Frequency is consistent with manufacturer recommendations ~~and IEEE-450 (Ref. 9)~~.

SR 3.8.4.3

Verifying that for the vital batteries that the alternate feeder breakers to each required battery charger is open ensures that independence between the power trains is maintained. The 7-day Frequency is based on engineering judgement, is consistent with procedural controls governing breaker operation, and ensures correct breaker position.

SR 3.8.4.4

This SR demonstrates that the DG 125V DC distribution panel and associated charger are functioning properly, with all required circuit breakers closed and buses energized from normal power. The 7 day Frequency takes into account the redundant DG capability and other indications available in the control room that will alert the operator to system malfunctions.

~~SR 3.8.4.5 and SR 3.8.4.6~~

~~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.~~

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.5 and SR 3.8.4.6 (continued)

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

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

SR 3.8.4.7

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

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

SR 3.8.4.8, SR 3.8.4.9 and SR 3.8.4.10

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 3.8.4.8. For the purposes of trending, inter-cell (vital and DG batteries) and inter-tier (vital and DG batteries) connections are measured from battery post to battery post. Inter-rack (vital batteries), inter-tier (DG Batteries), and terminal connections (vital and DG batteries) are measured from terminal lug to battery post.

(continued)

SURVEILLANCE REQUIREMENTS

~~SR 3.8.4.8, SR 3.8.4.9 and SR 3.8.4.10 (continued)~~

~~The connection resistance limits for SR 3.8.4.9 and SR 3.8.4.10 shall be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.~~

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

SR 3.8.4.~~11~~5

This SR ~~requires that each vital battery charger be capable of recharging its associated battery from a capacity or service discharge test while supplying normal loads, or alternatively, operating at current limit for a minimum of 4 hours at a nominal 125 VDC. These requirements are based on~~ verifies the design capacity of the vital battery chargers ~~(Ref. 4) and their performance characteristic of current limit operation for a substantial portion of the recharge period. Battery charger output current is limited to 110% - 125% of the 200 amp rated output. Recharging the battery or testing for a minimum of 4 hours is sufficient to verify the output capability of the charger can be sustained, that current limit adjustments are properly set and that protective devices will not inhibit performance at current limit settings~~. According to Regulatory Guide 1.32 (Ref. ~~6~~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, irrespective of the status of the plant during these demand occurrences. ~~Verifying the capability of the charger to operate in a sustained current limit condition~~ The minimum required amperes and duration ensure~~s~~ that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying 200 amps at the minimum established float voltage (132 V DC) for 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power.

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

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.~~11~~5 (continued)

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

~~This SR is modified by a Note. The reason for the Note is that performing the Surveillance may perturb the electrical distribution system and challenge safety systems. This Surveillance is normally performed during MODES 5 and 6 since it would require the DC electrical power subsystem to be inoperable during performance of the test. However, this Surveillance may be performed in MODES 1, 2, 3, or 4 provided the Vital Battery V is substituted in accordance with LCO Note 1. 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.~~

SR 3.8.4.~~12~~6

This SR ~~requires that each diesel generator battery charger be capable of recharging its associated battery from a capacity or service discharge test while supplying normal loads, or alternatively, operating at current limit for a minimum of 4 1/2 hours at a nominal 125 VDC. This requirement is based on~~ verifies the design capacity of the DG battery chargers ~~(Ref. 13) and their performance characteristic of current limit operation for a substantial portion of the recharge period. Battery charger output current is limited to a maximum of 140% of the 20 amp rated output. Recharging the battery verifies the output capability of the charger can be sustained, that current limit adjustments are properly set and that protective devices will not inhibit performance at current limit settings~~. According to Regulatory Guide 1.32 (Ref. ~~6~~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, irrespective of the status of the plant during these demand occurrences. ~~Verifying the capability of the charger to operate in a sustained current limit condition~~ The minimum required amperes and duration ensure~~s~~ that these requirements can be satisfied.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.126 (continued)

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

The Surveillance Frequency is acceptable, given the plant 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 the DG DC electrical subsystem, this Surveillance may be performed in MODES 1, 2, 3, or 4 in conjunction with LCO 3.8.1.B since the DG DC electrical power subsystem supplies loads only for the inoperable diesel generator and would not otherwise challenge safety systems supplied from vital electrical distribution systems. If available, the C-S DG and its associated DC electrical power subsystem may be substituted in accordance with LCO Note 2. Additionally, 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.

SR 3.8.4.137

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 worst case design duty cycle requirements based on References 108 and 1210.

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.~~13~~7 (continued)

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. ~~6~~5) and Regulatory Guide 1.129 (Ref. ~~11~~9), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests, not to exceed 18 months.

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test~~ once per 60 months~~. ~~The modified performance discharge test is a simulated duty cycle consisting of just two rates; the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Since the ampere-hours removed by a rated one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.~~

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

The reason for Note 2 is that performing the Surveillance may perturb the vital electrical distribution system and challenge safety systems. However, this Surveillance may be performed in MODES l, 2, 3, or 4 provided that Vital Battery V is substituted in accordance with LCO Note l. For the DG DC electrical subsystem, this surveillance may be performed in MODES l, 2, 3, or 4 in conjunction with LCO 3.8.l.B since the supplied loads are only for the inoperable diesel generator and would not otherwise challenge safety system loads which are supplied from vital electrical distribution systems. If available, the C-S DG and its associated DC electrical power subsystem may be substituted in accordance with LCO Note 2. Additionally, 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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.137 (continued)

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.

SR 3.8.4.14

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

A battery modified performance discharge test is described in the Bases for 3.8.4.13. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.14; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.14 while satisfying the requirements of SR 3.8.4.13 at the same time.

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

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥ 10% below the manufacturer rating. These Frequencies are consistent with the recommendations in IEEE-450 (Ref. 9).

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.14 (continued)

This SR is modified by a Note. The reason for the Note is that performing the Surveillance may perturb the vital electrical distribution system and challenge safety systems. However, this Surveillance may be performed in MODES I, 2, 3, or 4 provided that Vital Battery V is substituted in accordance with LCO Note I. For the DG DC electrical subsystem, this surveillance may be performed in MODES I, 2, 3, or 4 in conjunction with LCO 3.8.I.B since the supplied loads are only for the inoperable diesel generator and would not otherwise challenge safety system loads which are supplied from vital electrical distribution systems. If available, the C-S DG and its associated DC electrical power subsystem may be substituted in accordance with LCO Note 2. Additionally, 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 (continued)

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 17, "Electric Power System."

2. Regulatory Guide 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems," U.S. Nuclear Regulatory Commission, March 10, 1971.

3. IEEE-308-1971, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronic Engineers.

4. Watts Bar FSAR, Section 8.3.2, "DC Power System."

~~5. IEEE-485-1983, "Recommended Practices for Sizing Large Lead Storage Batteries for Generating Stations and Substations," Institute of Electrical and Electronic Engineers.~~

~~6~~5. Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants," February 1977, U.S. Nuclear Regulatory Commission.

~~7~~6. Watts Bar FSAR, Section 15, "Accident Analysis" and Section 6 "Engineered Safety Features."

~~8~~7. Regulatory Guide 1.93, "Availability of Electric Power Sources," U.S. Nuclear Regulatory Commission, December 1974.

~~9. IEEE-450-1980/1995, "IEEE Recommended Practice for Maintenance Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Subsystems," Institute of Electrical and Electronic Engineers.~~

~~10~~8. TVA Calculation WBN EEB-MS-TI11-0003, "125 VDC Vital Battery and Charger Evaluation."

~~11~~9. Regulatory Guide 1.129, "Maintenance Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Subsystems," U.S. Nuclear Regulatory Commission, February 1978.

(continued)

BASES

REFERENCES (continued)

~~12~~10. TVA Calculation WBN EEB-MS-TI11-0062, "125 V DC Diesel Generator Control Power System Evaluation."

~~13. Watts Bar FSAR, Section 8.3.1, "AC Power System."~~

Enclosure 2

WBN Unit 2 Technical Specifications 3.8.4 and Bases Changes (Marked-up)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

LCO 3.8.4 ~~Four channels of~~ The Train A and Train B vital DC and ~~four~~ Diesel Generator (DG) DC electrical power subsystems shall be OPERABLE.

---NOTE--

Vital Battery V may be substituted for any of the required vital batteries.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required vital battery charger(s) on one subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	AND	
	A.3 Restore vital battery charger(s) to OPERABLE status.	7 days
~~A~~B. One vital DC electrical power subsystem inoperable for reasons other than Condition A.	~~A~~B.1 Restore vital DC electrical power subsystem to OPERABLE status.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
BC. Required Action and Associated Completion Time of Condition A or B not met.	BC.1 Be in MODE 3. AND BC.2 Be in MODE 5.	6 hours 36 hours
D. One or two DG DC battery charger(s) on one train inoperable.	D.1 Restore DG battery terminal voltage to greater than or equal to the minimum established float voltage. AND D.2 Verify battery float current ≤ 1 amp. AND D.3 Restore DG battery charger(s) to OPERABLE status.	2 hours Once per 12 hours 72 hours
CE. One DG DC electrical power subsystem train inoperable for reasons other than Condition D.	CE.1 Restore DG DC electrical power subsystem train to OPERABLE status.	2 hours
DF. Required Action and associated Completion Time of Condition CD or E not met. OR One or more DG DC battery charger(s) in redundant trains inoperable.	DF.1 Declare associated DG(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.4.1	Verify vital battery terminal voltage is ≥ 128 V (132 V for vital battery V) on float charge greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.2	Verify DG battery terminal voltage is ≥ 124 V on float charge greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.3	Verify for the vital batteries that the alternate feeder breakers to each required battery charger are open.	7 days
SR 3.8.4.4	Verify correct breaker alignment and indicated power availability for each DG 125 V DC distribution panel and associated battery charger	7 days
SR 3.8.4.5	Verify no visible corrosion at terminals and connectors for the vital batteries. OR Verify connection resistance for the vital batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 ohm for inter-rack connections, ≤ 120 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	92 days
SR 3.8.4.6	Verify no visible corrosion at terminals and connectors for the DG batteries. OR Verify connection resistance for the DG batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	92 days
SR 3.8.4.7	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration.	12 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.8	Remove visible terminal corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.	12 months
SR 3.8.4.9	Verify connection resistance for the vital batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 ohm for inter-rack connections, ≤ 120 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	12 months
SR 3.8.4.10	Verify connection resistance for the DG batteries is ≤ 80 E-6 ohm for inter-cell connections, ≤ 50 E-6 ohm for inter-tier connections, and ≤ 50 E-6 ohm for terminal connections.	12 months
SR 3.8.4.115	----------NOTE---------- This Surveillance is normally not performed in MODE 1, 2, 3, or 4. However, credit may be taken for unplanned events that satisfy this SR. ---------- Verify each vital battery charger is capable of recharging its associated battery from a service or capacity discharge test while supplying normal loads supplies ≥ 200 amps at greater than or equal to the minimum established float voltage for ≥ 4 hours. OR Verify each vital battery charger can recharge the battery to the fully charged state within 36 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 is capable of operating for ≥ 4 hours at current limit 220 – 250 amps.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.126	-------------------------------NOTE------------------------------ Credit may be taken for unplanned events that satisfy this SR. --- Verify each diesel generator DG battery charger is capable of recharging its associated battery from a service or capacity discharge test while supplying normal loads can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	18 months
SR 3.8.4.137	-------------------------------NOTES----------------------------- 1. The modified performance discharge test in SR 3.8.4.146.7 may be performed in lieu of the service test in SR 3.8.4.137 once per 60 months. 2. This Surveillance is not performed in MODE 1, 2, 3, or 4 for required vital batteries. 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 and any connected nonsafety loads for the design duty cycle when subjected to a battery service test.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.14~~	~~-----NOTE-----~~ ~~This Surveillance is not performed in MODE 1, 2, 3, or 4 for required vital batteries. Credit may be taken for unplanned events that satisfy this SR.~~ ~~-----~~ ~~Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.~~	~~60 months~~ ~~AND~~ ~~12 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating~~ ~~AND~~ ~~24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating~~

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources - Operating

BASES

BACKGROUND

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

<u>125 V Vital DC Electrical Power Subsystem</u>

The vital 125 VDC electrical power system is a Class 1E system whose safety function is to provide control power for engineered safety features equipment, emergency lighting, vital inverters, and other safety related DC powered equipment for the entire unit. The system capacity is sufficient to supply these loads and any connected non-safety loads during normal operation and to permit safe shutdown and isolation of the reactor for the “loss of all AC power” condition. The system is designed to perform its safety function subject to a single failure.

The 125V DC vital power system is composed of the four ~~redundant~~ channels (Channels I and III are associated with Train A and Channels II and IV are associated with Train B) and consists of four lead-acid-calcium batteries, eight battery chargers (including two pairs of spare chargers), four distribution boards, battery racks, and the required cabling, instrumentation and protective features. Each channel is electrically and physically independent from the equipment of all other channels so that a single failure in one channel will not cause a failure in another channel. Each channel consists of a battery charger which supplies normal DC power, a battery for emergency DC power, and a battery board which facilitates load grouping and provides circuit protection. These four channels are used to provide emergency power to the 120V AC vital power system which furnishes control power to the reactor protection system. No automatic connections are used between the four ~~redundant~~ channels.

Battery boards I, II, III, and IV have a charger normally connected to them and also have manual access to a spare (backup) charger for use upon loss of the normal charger.

(continued)

BACKGROUND

125 V Vital DC Electrical Power Subsystem (continued)

Additionally, battery boards I, II, III, and IV have manual access to the fifth vital battery system. The fifth 125V DC Vital Battery System is intended to serve as a replacement for any one of the four 125V DC vital batteries during their testing, maintenance, and outages with no loss of system reliability under any mode of operation.

Each of the vital DC electrical power subsystems provides the control power for its associated Class 1E AC power load group, 6.9 kV switchgear, and 480 V load centers. The vital DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC vital buses. Additionally, they power the emergency DC lighting system.

The vital 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.”

~~Each vital battery has adequate storage capacity to carry the required load continuously for at least 4 hours in the event of a loss of all AC power (station blackout) without an accident or for 30 minutes with an accident considering a single failure. Load shedding of non-required loads will be performed to achieve the required coping duration for station blackout conditions.~~

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

Each battery has adequate storage capacity to 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.

The batteries for the vital DC electrical power subsystems are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles, ~~de-rated for minimum ambient temperature~~ and the 100% design demand. The minimum design voltage limit is 105 V.~~The voltage limit is 2.13 V per cell, which corresponds to a total minimum voltage output of 128 V per battery (132 V for Vital Battery V). The criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).~~

(continued)

BACKGROUND

125 V Vital DC Electrical Power Subsystem (continued)

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 60 cell battery (i.e., cell voltage of 2.063 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. 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 133.2 V for a 60 cell battery as discussed in the FSAR, Chapter 8 (Ref. 4).

Each Vital DC electrical power subsystem battery charger has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient excess capacity to restore the battery bank from the design minimum charge to its fully charged state within 12 hours (with accident loads being supplied) following a 30 minute AC power outage and in approximately 36 hours (while supplying normal steady state loads following a 2 hour AC power outage), (Ref. ~~6~~5).

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

BACKGROUND (continued)

125 V Diesel Generator (DG) DC Electrical Power Subsystem

Control power for the DGs is provided by four DG battery subsystems, one per DG. Each subsystem is comprised of a battery, a battery charger, distribution center, cabling, and cable ways. The DG 125V DC control power and field-flash circuits have power supplied from their respective 125V distribution panel. The normal supply of DC current is from the associated charger. The battery provides control and field-flash power when the charger is unavailable. The charger supplies the normal DC loads, maintains the battery in a fully charged condition, and recharges (480V AC available) the battery while supplying the required loads regardless of the status of the unit. The batteries are physically and electrically independent. The battery has sufficient capacity when fully charged to supply required loads for a minimum of four hours following a loss of normal power. Each battery is normally required to supply loads during the time interval between loss of normal feed to its charger and the receipt of emergency power to the charger from its respective DG.

APPLICABLE SAFETY ANALYSES

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

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 plant. 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).

LCO

~~Four~~ Two 125V vital DC electrical power subsystems (Train A and Train B)~~, each vital subsystem~~ consist of two channels each. Each channel consisting of a battery bank, associated battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated DC bus within the channel; and ~~four~~ one DG DC electrical power subsystem~~s~~ for each DG, consisting of a battery, a dual battery charger assembly, and the corresponding control equipment and interconnecting cabling are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (A00) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4).

An OPERABLE vital DC electrical power subsystem requires all required batteries and respective chargers to be operating and connected to the associated DC buses.

Each DG DC electrical power subsystem is independent and dedicated to its respective DG. The DGs that are supported by the DG DC electrical power subsystems are arranged in redundant trains (i.e., DG 1A-A and DG 2A-A are in Train A, and DG 1B-B and DG 2B-B are in Train B). Therefore, there are two DG DC electrical power subsystems associated with each train of DGs. When one or two DGs in a train are inoperable, that train is incapable of performing the safety function and must rely on the redundant train to mitigate an event. Likewise, if one or two of the DG DC electrical power subsystems that support the DGs in that train are inoperable, that train is incapable of performing the safety function and must rely on the redundant train to mitigate an event. Therefore, the LCO requires Train A and Train B DG DC electrical power subsystems to be OPERABLE to support the redundancy of the standby electrical power system.

The LCO is modified by one Note. The Note indicates that Vital Battery V may be substituted for any of the required vital batteries. However, the fifth battery cannot be declared OPERABLE until it is connected electrically in place of another battery and it has satisfied applicable Surveillance Requirements.

APPLICABILITY

The ~~four~~ vital DC electrical power sources and ~~four~~ DG DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe plant operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOs 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.

BASES

APPLICABILITY (continued)

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, A.2, and A.3

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

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

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

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

(continued)

BASES

ACTIONS

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

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it is now fully capable of supplying the maximum expected load requirement.

The 2 amp value is based on returning the battery to 98% charge and assumes a 2% design margin for the battery. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 7 day Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

~~A~~B.1

Condition ~~A~~B represents one vital ~~channel~~ DC electrical power subsystem with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is, therefore, imperative that the operator's attention focus on stabilizing the plant, minimizing the potential for complete loss of DC power to the affected ~~train~~ subsystem. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution subsystem ~~train~~.

If one of the required vital DC electrical power subsystems is inoperable for reasons other than Condition A (e.g., ~~inoperable battery, inoperable battery charger(s), or~~ inoperable battery charger and associated inoperable battery), the remaining vital DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure of the OPERABLE subsystem ~~would~~ could, however, result in ~~a situation where the ability of the 125V DC electrical power subsystem to support its required ESF function is not assured,~~ the loss of the minimum necessary vital DC electrical power subsystems to mitigate a worst-case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. ~~8~~7) and reflects a reasonable time to assess plant status as a function of the inoperable vital DC electrical power subsystem and, if the vital DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe plant shutdown.

(continued)

BASES

ACTIONS (continued)

B.1 and B.2C,1 and C.2

If the inoperable vital DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the plant to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 87).

D.1, D.2, and D.3

Condition D represents one DG DC train with one or two battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action D.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage.

Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action D.2) from any discharge that might have occurred due to the charger inoperability.

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

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

ACTIONS

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

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DG DC subsystem, 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 D.2).

Required Action D.2 requires that the battery float current be verified as less than or equal to 1 amp. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it is now fully capable of supplying the maximum expected load requirement. The 1 amp value is based on returning the battery to 98% charge and assumes a 2% design margin for the battery. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 1 amp this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action D.3 limits the restoration time for the inoperable battery charger to 72 hours. The 72 hour Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to OPERABLE status.

~~C.1~~E.1

Condition ~~C~~E represents one DG with a loss of ability to completely respond to an event. Since a subsequent single failure on the opposite train could result in a situation where the required ESF function is not assured, continued power operation should not exceed 2 hours. The 2 hour time limit is consistent with the allowed time for an inoperable vital DC electrical power subsystem.

~~D.1~~F.1

If the DG DC electrical power subsystem cannot be restored to OPERABLE status within the associated Completion Times of Condition D or E, or if one or more DG DC battery chargers in redundant trains are inoperable, then the associated DG may be incapable of performing its intended function and must be immediately declared inoperable. This declaration also requires entry into applicable Conditions and Required Actions for an inoperable DG, LCO 3.8.1, "AC Sources-Operating."

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1 and SR 3.8.4.2

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 ~~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 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 ~~critical~~ nominal design voltage of the battery and are consistent with the ~~initial voltages assumed in the battery sizing calculations~~ minimum float voltage established by the battery manufacturer (2.20 Vpc times the number of connected cells or 132 V at the battery terminals for a 60 cell vital battery; 127.6 V at the battery terminals for a 58 cell DG battery). This voltage maintains the battery plates in a condition that supports maintaining the grid life. The 7 day Frequency is consistent with manufacturer recommendations ~~and IEEE-450 (Ref. 9)~~.

SR 3.8.4.3

Verifying that for the vital batteries that the alternate feeder breakers to each required battery charger is open ensures that independence between the power trains is maintained. The 7 day Frequency is based on engineering judgment, is consistent with procedural controls governing breaker operation, and ensures correct breaker position.

SR 3.8.4.4

This SR demonstrates that the DG 125V DC distribution panel and associated charger are functioning properly, with all required circuit breakers closed and buses energized from normal power. The 7 day Frequency takes into account the redundant DG capability and other indications available in the control room that will alert the operator to system malfunctions.

~~SR 3.8.4.5 and SR 3.8.4.6~~

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

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.5 and SR 3.8.4.6 (continued)

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 3.8.4.7

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

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

SR 3.8.4.8, SR 3.8.4.9 and SR 3.8.4.10

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 3.8.4.8. For the purposes of trending, inter-cell (vital and DG batteries) and inter-tier (vital and DG batteries) connections are measured from battery post to battery post. Inter-rack (vital batteries), inter-tier (DG Batteries), and terminal connections (vital and DG batteries) are measured from terminal lug to battery post.

The connection resistance limits for SR 3.8.4.9 and SR 3.8.4.10 shall be no more than 20% above the resistance as measured during installation, or not above the ceiling value established by the manufacturer.

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

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.115

This SR requires that each vital battery charger be capable of recharging its associated battery from a capacity or service discharge test while supplying normal loads, or alternatively, operating at current limit for a minimum of 4 hours at a nominal 125 VDC. These requirements are based on verifies the design capacity of the vital battery chargers (Ref. 4) and their performance characteristic of current limit operation for a substantial portion of the recharge period. Battery charger output current is limited to 110% - 125% of the 200 amp rated output. Recharging the battery or testing for a minimum of 4 hours is sufficient to verify the output capability of the charger can be sustained, that current limit adjustments are properly set and that protective devices will not inhibit performance at current limit settings. According to Regulatory Guide 1.32 (Ref. 65), 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, irrespective of the status of the plant during these demand occurrences. Verifying the capability of the charger to operate in a sustained current limit condition The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying 200 amps at the minimum established float voltage (132 V DC) for 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power.

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

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

This SR is modified by a Note. The reason for the Note is that performing the Surveillance may perturb the electrical distribution system and challenge safety systems. This Surveillance is normally performed during MODES 5 and 6 since it would require the DC

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.115 (continued)

electrical power subsystem to be inoperable during performance of the test. However, this Surveillance may be performed in MODES 1, 2, 3, or 4 provided the Vital Battery V is substituted in accordance with LCO Note 1. 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.

SR 3.8.4.126

This SR requires that each diesel generator battery charger be capable of recharging its associated battery from a capacity or service discharge test while supplying normal loads, or alternatively, operating at current limit for a minimum of 4 1/2 hours at a nominal 125 VDC. This requirement is based on verifies the design capacity of the DG battery chargers (Ref. 13) and their performance characteristic of current limit operation for a substantial portion of the recharge period. Battery charger output current is limited to a maximum of 140% of the 20 amp rated output. Recharging the battery verifies the output capability of the charger can be sustained, that current limit adjustments are properly set and that protective devices will not inhibit performance at current limit settings. According to Regulatory Guide 1.32 (Ref. 65), 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, irrespective of the status of the plant during these demand occurrences. Verifying the capability of the charger to operate in a sustained current limit condition The minimum required amperes and duration ensuress that these requirements can be satisfied.

This SR requires that each DG battery charger be capable of recharging the battery after a service test coincident with supplying the largest coincident demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur).

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.4.~~12~~6 (continued)

This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is ≤ 1 amp.

The Surveillance Frequency is acceptable, given the ~~plant 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 the DG DC electrical subsystem, this Surveillance may be performed in MODES 1, 2, 3, or 4 in conjunction with LCO 3.8.1.B since the DG DC electrical power subsystem supplies loads only for the inoperable diesel generator and would not otherwise challenge safety systems supplied from vital electrical distribution systems. Additionally, 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.

SR 3.8.4.~~13~~7

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 worst case design duty cycle requirements based on References ~~10~~8 and ~~12~~10.

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. ~~6~~5) and Regulatory Guide 1.129 (Ref. ~~11~~9), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests, not to exceed 18 months.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.137 (continued)

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test once per 60 months. The modified performance discharge test is a simulated duty cycle consisting of just two rates; the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Since the ampere-hours removed by a rated one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

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

The reason for Note 2 is that performing the Surveillance may perturb the vital electrical distribution system and challenge safety systems. However, this Surveillance may be performed in MODES 1, 2, 3, or 4 provided that Vital Battery V is substituted in accordance with LCO Note 1. For the DG DC electrical subsystem, this surveillance may be performed in MODES 1, 2, 3, or 4 in conjunction with LCO 3.8.1.B since the supplied loads are only for the inoperable diesel generator and would not otherwise challenge safety system loads which are supplied from vital electrical distribution systems. Additionally, 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 3.8.4.14

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

A battery modified performance discharge test is described in the Bases for 3.8.4.13. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.14; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.14 while satisfying the requirements of SR 3.8.4.13 at the same time.

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

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is ≥ 10% below the manufacturer rating. These Frequencies are consistent with the recommendations in IEEE-450 (Ref. 9).

This SR is modified by a Note. The reason for the Note is that performing the Surveillance may perturb the vital electrical distribution system and challenge safety systems. However, this Surveillance may be performed in MODES 1, 2, 3, or 4 provided that Vital Battery V is substituted in accordance with LCO Note 1. For the DG DC electrical subsystem, this surveillance may be performed in MODES 1, 2, 3, or 4 in conjunction with LCO 3.8.1.B since the supplied loads are only for the inoperable diesel generator and would not otherwise challenge safety system loads which are supplied from vital electrical distribution systems. Additionally, 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;

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~SR 3.8.4.14 (continued)~~

~~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

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 17, “Electric Power System.”

2. Regulatory Guide 1.6, “Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems,” U.S. Nuclear Regulatory Commission, March 10, 1971.

3. IEEE-308-1971, “IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations,” Institute of Electrical and Electronic Engineers.

4. Watts Bar FSAR, Section 8.3.2, “DC Power System.”

~~5. IEEE-485-1983, “Recommended Practices for Sizing Large Lead Storage Batteries for Generating Stations and Substations,” Institute of Electrical and Electronic Engineers.~~

~~6~~5. Regulatory Guide 1.32, “Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants,” February 1977, U.S. Nuclear Regulatory Commission.

~~7~~6. Watts Bar FSAR, Section 15, “Accident Analysis” and Section 6 “Engineered Safety Features.”

~~8~~7. Regulatory Guide 1.93, “Availability of Electric Power Sources,” U.S. Nuclear Regulatory Commission, December 1974.

~~9. IEEE-450-1980/1995, “IEEE Recommended Practice for Maintenance, Testing and Replacement of Vented Lead - Acid Batteries for Stationary Applications,” Institute of Electrical and Electronics Engineers, Inc.~~

~~10~~8. TVA Calculation EDQ00023620070003, “125V DC Vital Battery System Analysis”

~~11~~9. Regulatory Guide 1.129, “Maintenance Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Subsystems,” U.S. Nuclear Regulatory Commission, February 1978.

~~12~~10. TVA Calculation WBN EEB-EDQ00023620070003, “125V DC Vital Battery System Analysis.”

~~13. Watts Bar FSAR, Section 8.3.1, “AC Power System.”~~

Enclosure 3

WBN Units 1 and 2 Technical Specifications 3.8.4 Changes (Re-typed)

WBN Unit 1 Technical Specifications 3.8.4 Changes (Re-typed)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

LCO 3.8.4 The Train A and Train B vital DC and Diesel Generator (DG) DC electrical power subsystems shall be OPERABLE.

--NOTES--

1. Vital Battery V may be substituted for any of the required vital batteries.

2. The C-S DG and its associated DC electrical power subsystem may be substituted for any of the required DGs and their associated DC electrical power subsystem.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required vital battery charger(s) on one subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	<u>AND</u>	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	<u>AND</u>	
	A.3 Restore vital battery charger(s) to OPERABLE status.	7 days
B. One vital DC electrical power subsystem inoperable for reasons other than Condition A.	B.1 Restore vital DC electrical power subsystem to OPERABLE status.	2 hours
C. Required Action and Associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3.	6 hours
	<u>AND</u>	
	C.2 Be in MODE 5.	36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or two DG DC battery charger(s) on one train inoperable.	D.1 Restore DG battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	AND	
	D.2 Verify battery float current ≤ 1 amp.	Once per 12 hours
	AND	
	D.3 Restore DG battery charger(s) to OPERABLE status.	72 hours
E. One DG DC train inoperable for reasons other than Condition D.	E.1 Restore DG DC train to OPERABLE status.	2 hours
F. Required Action and associated Completion Time of Condition D or E not met. OR One or more DG DC battery chargers in redundant trains inoperable.	F.1 Declare associated DG(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify vital battery terminal voltage is greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.2	Verify DG battery terminal voltage is greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.3	Verify for the vital batteries that the alternate feeder breakers to each required battery charger are open.	7 days
SR 3.8.4.4	Verify correct breaker alignment and indicated power availability for each DG 125 V DC distribution panel and associated battery charger.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.5	Verify each vital battery charger supplies ≥ 200 amps at greater than or equal to the minimum established float voltage for ≥ 4 hours. <u>OR</u> Verify each vital battery charger can recharge the battery to the fully charged state within 36 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

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.6	------------------------------NOTE------------------------------ Credit may be taken for unplanned events that satisfy this SR. --	
	Verify each DG battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	18 months
SR 3.8.4.7	------------------------------NOTES------------------------------ 1. The modified performance discharge test in SR 3.8.6.7 may be performed in lieu of the service test in SR 3.8.4.7. 2. This Surveillance is not performed in MODE 1, 2, 3, or 4 for required vital batteries. 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 and any connected nonsafety loads for the design duty cycle when subjected to a battery service test.	18 months

WBN Unit 2 Technical Specifications 3.8.4 Changes (Re-typed)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources - Operating

LCO 3.8.4 The Train A and Train B vital DC and Diesel Generator (DG) DC electrical power subsystems shall be OPERABLE.

---NOTE--
Vital Battery V may be substituted for any of the required vital batteries.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or two required vital battery charger(s) on one subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
	<u>AND</u>	
	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
	<u>AND</u>	
	A.3 Restore vital battery charger(s) to OPERABLE status.	7 days
B. One vital DC electrical power subsystem inoperable for reasons other than Condition A.	B.1 Restore vital DC electrical power subsystem to OPERABLE status.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and Associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours
D. One or two DG DC battery charger(s) on one train inoperable.	D.1 Restore DG battery terminal voltage to greater than or equal to the minimum established float voltage. AND D.2 Verify battery float current ≤ 1 amp. AND D.3 Restore DG battery charger(s) to OPERABLE status.	2 hours Once per 12 hours 72 hours
E. One DG DC train inoperable for reasons other than Condition D.	E.1 Restore DG DC train to OPERABLE status.	2 hours
F. Required Action and associated Completion Time of Condition D or E not met. OR One or more DG DC battery charger(s) in redundant trains inoperable.	F.1 Declare associated DG(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify vital battery terminal voltage is greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.2	Verify DG battery terminal voltage is greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.3	Verify for the vital batteries that the alternate feeder breakers to each required battery charger are open.	7 days
SR 3.8.4.4	Verify correct breaker alignment and indicated power availability for each DG 125 V DC distribution panel and associated battery charger	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.5	Verify each vital battery charger supplies ≥ 200 amps at greater than or equal to the minimum established float voltage for ≥ 4 hours. OR Verify each vital battery charger can recharge the battery to the fully charged state within 36 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

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.6	-------------------------------NOTE------------------------------ Credit may be taken for unplanned events that satisfy this SR. --- Verify each DG battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	18 months
SR 3.8.4.7	-------------------------------NOTES----------------------------- 1. The modified performance discharge test in SR 3.8.6.7 may be performed in lieu of the service test in SR 3.8.4.7. 2. This Surveillance is not performed in MODE 1, 2, 3, or 4 for required vital batteries. 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 and any connected nonsafety loads for the design duty cycle when subjected to a battery service test.	18 months

New Regulatory Commitment

Commitment	Due Date/Event
TVA will revise the WBN UFSAR to reflect consistent terminology regarding the arrangement of the diesel generator (DG) direct current electrical power system in four subsystems, with one subsystem supporting each DG.	Prior to implementation of the approved TSTF-500 license amendment