ENCLOSURE 3

PROPOSED TECHNICAL SPECIFICATIONS

Marked-up pages:

Technical Specification	Bases
3.8.12	B 3.8-28
3.8.28	B 3.8-64
3.8.29	B 3.8-66
	B 3.8-67

Revised pages incorporating the proposed change:

Technical Specification	Bases
3.8.12	B 3.8-28
3.8.28	B 3.8-64
3.8.29	B 3.8-66
	B 3.8-67
	B 3.8-68
	B 3.8-69

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.13	-------------------NOTE------------------ This Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR. --- Verify each DG's automatic trips are bypassed on automatic or emergency start signal except: a. Engine overspeed; and b. Generator differential current.	18 months
SR 3.8.1.14	-------------------NOTES------------------ 1. Momentary transients outside the load and power factor ranges do not invalidate this test. 2. **For performance of this test in MODE 1, 2, 3 or 4, three DGs must be maintained operable and in a standby condition.** 3. ~~This Surveillance shall not be performed in MODE 1 or 2. However, c~~ Credit may be taken for unplanned events that satisfy this SR. --- Verify each DG operating at a power factor ≥ 0.8 and ≤ 0.9 operates for ≥ 24 hours: a. For ≥ 2 hours loaded ≥ 4620 kW and ≤ 4840 kW and ≥ 3465 kVAR and ≤ 3630 kVAR; and b. For the remaining hours of the test loaded ≥ 3960 kW and ≤ 4400 kW and ≥ 2970 kVAR and ≤ 3300 kVAR.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.14

Regulatory Guide 1.9 (Ref. 3), paragraph C2.2.9, requires demonstration once per 18 months that the DGs can start and run continuously for an interval of not less than 24 hours, ≥ 2 hours of which is at a load between 105% and 110% of the continuous duty rating and the remainder of the time at a load equivalent to 90-100% of the continuous duty rating of the DG. The DG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelubricating and warmup, discussed in SR 3.8.1.2, and for gradual loading, discussed in SR 3.8.1.3, are applicable to this SR.

In order to ensure that the DG is tested under load conditions that are as close to design conditions as possible, testing must be performed using a power factor of ≥ 0.8 and ≤ 0.9. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience. The load band is provided to avoid routine overloading of the DG. Routine overloading may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY.

~~The 18 month Frequency is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1, takes into consideration plant conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.~~

This Surveillance is modified by <u>three</u> ~~two~~ Notes. Note 1 states that momentary transients due to changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the power factor limit will not invalidate the test. ~~The reason for~~ Note 2 ~~is that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, plant safety systems.~~ <u>establishes that this SR may be performed on only one DG at a time while in MODE 1, 2, 3, or 4. This is necessary to ensure the proper response to an operational transient (i.e., loss of offsite power, ESF actuation). Therefore, three DGs must be maintained operable and in a standby condition during performance of this test. In this configuration, the plant will remain within its design basis, since at all times safe shutdown can be achieved with two DGs in the same train. Note 3 establishes that</u> credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.12	-------------------NOTE-------------------- ~~This Surveillance is normally not performed in MODE 1, 2, 3, or 4. However, c~~ Credit may be taken for unplanned events that satisfy this SR ~~while in MODE 1, 2, 3, or 4~~. --- Verify each diesel generator battery charger is capable of recharging its associated battery from a service or capacity discharge test while supplying normal loads.	18 months
SR 3.8.4.13	-------------------NOTES-------------------- 1. The modified performance discharge test in SR 3.8.4.14 may be performed in lieu of the service test in SR 3.8.4.13 once per 60 months. 2. This Surveillance is ~~normally~~ not performed in MODE 1, 2, 3, or 4 **for required vital batteries.** ~~However, c~~ Credit may be taken for unplanned events that satisfy this SR ~~while in MODE 1, 2, 3, or 4~~. --- 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

SURVEILLANCE		FREQUENCY
SR 3.8.4.14	-------------------NOTE------------------- This Surveillance is ~~normally~~ not performed in MODE 1, 2, 3, or 4 **for required vital batteries.** ~~However, c~~ 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

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.12 (continued)

plant during these demand occurrences. Verifying the capability of the charger to operate in a sustained current limit condition ensures that these requirements can be satisfied.

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 DG 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 C-S DG and its associated DC electrical power subsystem is substituted in accordance with LCO Note 2. Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:~~ 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.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.13 (continued)

~~The reason for Note 2 is that performing the Surveillance may perturb the 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 or the C-S DG and its associated DG electrical power subsystem is substituted in accordance with Notes 1 or 2 respectively. Credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:~~
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. 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 3.8.4.14

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.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.14 (continued)

A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

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).

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~~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. However, this Surveillance may be performed in MODES 1, 2, 3, or 4 provided that Vital Battery V or the C-S DG and its associated DC electrical power subsystem is substituted in accordance with Notes 1 or 2 respectively. 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.

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Insert A

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.13	-------------------NOTE------------------------ This Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR. --- Verify each DG's automatic trips are bypassed on automatic or emergency start signal except: a. Engine overspeed; and b. Generator differential current.	18 months
SR 3.8.1.14	-------------------NOTES----------------------- 1. Momentary transients outside the load and power factor ranges do not invalidate this test. 2. For performance of this test in MODE 1, 2, 3 or 4, three DGs must be maintained operable and in a standby condition. 3. Credit may be taken for unplanned events that satisfy this SR. --- Verify each DG operating at a power factor $\geq$ 0.8 and $\leq$ 0.9 operates for $\geq$ 24 hours: a. For $\geq$ 2 hours loaded $\geq$ 4620 kW and $\leq$ 4840 kW and $\geq$ 3465 kVAR and $\leq$ 3630 kVAR; and b. For the remaining hours of the test loaded $\geq$ 3960 kW and $\leq$ 4400 kW and $\geq$ 2970 kVAR and $\leq$ 3300 kVAR.	18 months

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.14

Regulatory Guide 1.9 (Ref. 3), paragraph C2.2.9, requires demonstration once per 18 months that the DGs can start and run continuously for an interval of not less than 24 hours, ≥ 2 hours of which is at a load between 105% and 110% of the continuous duty rating and the remainder of the time at a load equivalent to 90-100% of the continuous duty rating of the DG. The DG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelubricating and warmup, discussed in SR 3.8.1.2, and for gradual loading, discussed in SR 3.8.1.3, are applicable to this SR.

In order to ensure that the DG is tested under load conditions that are as close to design conditions as possible, testing must be performed using a power factor of ≥ 0.8 and ≤ 0.9. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience. The load band is provided to avoid routine overloading of the DG. Routine overloading may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY.

This Surveillance is modified by three Notes. Note 1 states that momentary transients due to changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the power factor limit will not invalidate the test. Note 2 establishes that this SR may be performed on only one DG at a time while in MODE 1, 2, 3, or 4. This is necessary to ensure the proper response to an operational transient (i.e., loss of offsite power, ESF actuation). Therefore, three DGs must be maintained operable and in a standby condition during performance of this test. In this configuration, the plant will remain within its design basis, since at all times safe shutdown can be achieved with two DGs in the same train. Note 3 establishes that credit may be taken for unplanned events that satisfy this SR. Examples of unplanned events may include:

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.12	--------------------NOTE-------------------- Credit may be taken for unplanned events that satisfy this SR. -- Verify each diesel generator battery charger is capable of recharging its associated battery from a service or capacity discharge test while supplying normal loads.	18 months
SR 3.8.4.13	--------------------NOTES-------------------- 1. The modified performance discharge test in SR 3.8.4.14 may be performed in lieu of the service test in SR 3.8.4.13 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

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 <u>AND</u> 12 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating <u>AND</u> 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.12 (continued)

plant during these demand occurrences. Verifying the capability of the charger to operate in a sustained current limit condition ensures that these requirements can be satisfied.

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.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.13 (continued)

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. 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

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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.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.14 (continued)

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.

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.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.14 (continued)

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. 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.

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

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BASES

REFERENCES (continued)

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

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

11. 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. 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 4

DIESEL GENERATOR (DG) ONLINE TESTING
ISSUES ADDRESSED WITH NRC
REGARDING ONLINE TESTING

I. Issue from Section 8.3.1.12 of NRC's letter to TVA dated June 20, 1991:

"In Amendment 63 to the FSAR, page 8.2-11, the applicant stated that for test and exercise purposes, a diesel generator may be manually paralleled with the normal or preferred power source. While offsite and onsite sources are paralleled, the applicant also indicated that both a loss of offsite power and a safety injection signal are required to automatically override the manual controls and establish the appropriate alignment.

When there is a safety injection signal alone without a loss of offsite power or when there is a loss of offsite power by itself without a safety injection signal, the staff is concerned that the capability and independence of offsite and onsite sources may be compromised when they are paralleled during testing. To complete this review, additional information is required to demonstrate in accordance with the requirements of GDC 17 that appropriate provisions have been included in the design to minimize the probability of losing both offsite and onsite power supplies given an accident or loss of offsite power during testing with the offsite and onsite sources paralleled."

Response from Section 8.3.1.12 of TVA's letter to NRC dated September 13, 1991:

". . .Loss of the offsite supply would cause the instantaneous overcurrent relay to trip the standby circuit breaker, the loss of voltage relays to trip the supply breaker and loads, and subsequently the diesel generator load sequencer to load the shutdown board with the non-LOCA loads. If an accident signal is initiated during testing of the standby supply, the parallel connection is maintained unless loss of offsite power also occurs. Should a LOCA and a loss of offsite power occur when the diesel generator is parallel with the grid under test, the same sequence of events take place as loss of offsite power except the diesel generator sequencer will load the accident loads. Only one diesel generator will be in the test mode at any given time."

II. Issue from a teleconference with NRC staff on July 14, 1993 (Refer to TVA's letter to NRC dated August 5, 1993):

"NRC requested that TVA submit a detailed explanation of how WBN's electrical power system responds to a LOOP and an accident signal when a DG is operating in parallel with offsite power. In particular, NRC requested TVA to describe how WBN's design complies with Regulatory Guide 1.108, Revision 1, Regulatory Position C.1.b(3). This position states: 'Periodic testing of diesel generator units should not impair the capability of the unit to supply emergency power within the required time. Where necessary, diesel generator unit design should include an emergency override of the test mode to permit response to bona fide signals."

Response from TVA's letter to NRC dated August 5, 1993:

"The design of WBN's electrical power system complies with the above regulatory position. As stated in FSAR Chapter 8 (pages 8.2-15, 8.2-16, 8.3-10, 8.3-11, and 8D-2 in Amendment 75), the parallel connection between a DG in test and offsite power is maintained if an accident signal alone is received. In this situation, there is no need to supply emergency power and any automatic design feature to trip or realign the DG would impose an unnecessary transient on the plant's 6.9-kV shutdown boards. However, if a LOOP occurs concurrently with an accident signal, the DG's output breaker (connecting it to its respective 6.9-kV shutdown board) would trip on instantaneous overcurrent and the DG would then be aligned in its 'emergency start' mode with the manual controls for the 'test' mode overridden.

The following details explain how a DG that is being tested in parallel with offsite power will realign to its emergency start mode whenever a LOOP and accident signal occur simultaneously. For some LOOP scenarios, the preferred (offsite) feeder breaker to the 6.9kV shutdown board with the DG in test will remain closed initially. For this situation, the DG would clearly be overloaded and trip on instantaneous overcurrent since it would attempt to power the loads normally supplied by the offsite grid upstream of the 6.9kV shutdown board. If the preferred feeder breaker trips open at the time the LOOP occurs, the DG output breaker will still trip on instantaneous overcurrent due to the large starting current drawn by the emergency loads which start on receipt of an accident signal. For instance, the following three accident loads are not used during normal plant operation and, therefore, would start immediately on receipt of an accident signal: safety injection pump, residual heat removal pump, and auxiliary feedwater pump. The total starting current for these three loads alone is greater than 700 amps, which exceeds the DG breaker instantaneous overcurrent trip setpoint of 600 amps. The start signals that are sent to each of these three pumps should be simultaneous since the load sequencer has not been activated (i.e., there has been no loss of voltage on the 6.9kV shutdown board). However, even if the start signals are separated by a few milliseconds due to random circuit differences, the individual starting currents will still overlap and draw a combined current of at least 700 amps since each of the pumps requires 2 seconds or more to accelerate to its rated speed. Normal running loads that were connected to the 6.9kV shutdown board before the LOOP and accident signal occurred would add at least 100 amps more to the overcurrent condition.

After the DG output breaker trips on instantaneous overcurrent, loss-of-voltage relays for the 6.9kV shutdown board initiate load shedding as discussed on FSAR pages 8.3-6 and 8.3-10. The instantaneous overcurrent relay for the DG breaker resets automatically with no operator action required after the breaker opens to interrupt the overcurrent condition. As soon as load shedding is complete, permissive control circuitry allows the DG output breaker to close whenever the DG engine reaches operating speed. For a DG previously in test, its engine would already be running at rated speed and, therefore, its output breaker would close immediately. Note that while the DG in test is connected to its 6.9kV shutdown board, an accident signal (SI signal) is blocked from initiating the 'emergency start' mode. However, once the DG breaker trips on instantaneous overcurrent, the emergency start mode is instated. In this mode, many of the DG protective devices, which are described on FSAR pages 8.3-11 and 8.3-12, are bypassed. Also, once the DG is in its emergency start mode, the DG load sequencer is activated so that accident loads are connected to the 6.9kV shutdown board in a preset time sequence as soon as the DG output breaker closes to reenergize the 6.9kV shutdown board.

In summary, for a DG being tested in parallel with offsite power, a concurrent LOOP and accident signal will result in the DG's output breaker tripping on instantaneous overcurrent. Once this occurs, the DG will operate in its emergency start mode and perform identically to a DG that receives an accident signal with a LOOP while in its standby (non-test) alignment. WBN's design basis for accident analysis requires that a DG is capable of providing power to its accident loads within 10 seconds after receipt of an accident signal. This is stated on FSAR page 15.4-13. For a DG being tested in parallel with offsite power, the instantaneous overcurrent relay for the DG breaker is set to trip open the breaker within 10 cycles. Then, the load shedding relays are set to remove all loads connected to the 6.9kV shutdown board within 3-5 seconds. Finally, the DG's output breaker will close in about 50 milliseconds. Based on these times, the DG that was in test will be reconnected to its 6.9kV shutdown board in about 5 seconds. Thus, accident loads will begin to sequence on well before the design basis time of 10 seconds."

III. Issue from TVA's letter to NRC dated February 7, 1994:

"This letter supplements and corrects information that was previously provided in letters dated August 5, 1993, and September 13, 1991, about WBN's design provisions for testing a DG in parallel with offsite power. In particular, the letter describes a recent design modification that was done to conform with applicable regulatory guidance by tripping the output breaker of a DG in test when an accident signal is initiated. The information in the letter also updates TVA's response to Item 8.3.1.12 included in a request for additional information (RAI) dated June 20, 1991. This item in the RAI expressed an NRC staff concern about the capability and independence of WBN's offsite and onsite electric power sources when paralleled during testing."

Response from TVA's letter to NRC dated February 7, 1994:

"The RAI identified 32 issues concerning the design of WBN's electric power system. Item 8.3.1.12 (one of the 32 issues) requested justification of the design features related to receipt of an accident signal (i.e., safety injection (SI) signal) and loss of offsite power (LOOP) while a DG is being operated in parallel with offsite power for testing. TVA responded to the RAI, including Item 8.3.1.12, in a letter dated September 13, 1991. During the ensuing two years, the NRC staff and TVA discussed the various RAI issues in a series of telephone conversations and meetings. The NRC staff eventually requested a detailed written statement for Item 8.3.1.12 describing how WBN's design complies with Regulatory Guide (RG) 1.108, Revision 1, Regulatory Position C.1.b(3), which states: 'Periodic testing of diesel generator units should not impair the capability of the unit to supply emergency power within the required time. Where necessary, diesel generator unit design should include an emergency override of the test mode to permit response to bona fide signals.' TVA provided the requested information about the design provisions that were believed to meet the intent of this regulatory guidance in a letter dated August 5, 1993.

In summary, TVA's letters dated August 5, 1993, and September 13, 1991, as well as related information in WBN's Final Safety Analysis Report (FSAR), stated that WBN's design was adequate to met the intent of RG 1.108, Revision 1, Regulatory Position C.1.b(3). These letters and the FSAR explained that the output breaker of a DG being tested in parallel with offsite power would trip open on instantaneous overcurrent if an accident signal occurred concurrent with a LOOP. Once the DG was disconnected from its 6.9kV shutdown board, the DG's emergency start mode would be enabled and it would perform identically to a DG that had received an accident signal concurrent with a LOOP while in its standby (non-test) alignment.

During reviews in preparation for preoperational testing of WBN's DGs and subsequent to the letter dated August 5, 1993, TVA identified a set of conditions that could prevent a DG from responding to an accident signal concurrent with a LOOP as described above. Specifically, the instantaneous overcurrent relay on the DG breaker would be disabled for a LOOP that is caused by or results in tripping of the supply breaker to the 6.9kV shutdown board from the in-service common station service transformer (CSST) which is supplying the shutdown board in parallel with the DG under test. Tripping of the supply breaker from the in-service CSST could occur due to a transformer overcurrent or fault condition or a switchyard fault. For this scenario, the DG breaker may not trip and, if it did not trip, automatic load shedding for the 6.9kV shutdown board would not occur since the shutdown board would not experience an undervoltage or loss of voltage condition. The DG would attempt to supply power to all of the loads that are already connected to its shutdown board and to the emergency loads that are started in response to the accident signal. Consequently, the DG would be overloaded with the emergency loads that are powered from the shutdown board when they start simultaneously. . .

. . .TVA has issued a design change to WBN's electric power system to correct the deficiency and reestablish compliance with RG 1.108, Revision 1, Regulatory Position C.1.b(3). The design change modifies the DG control circuitry to trip the output breaker of any DG that is in its test mode and is operating in parallel with offsite power whenever an SI signal or a fault signal associated with the normal offsite power source is actuated. Tripping open the DG breaker satisfies a control logic interlock within the accident response circuits so that an SI signal will realign the DG to its 'emergency start' mode and override the manual controls used in its 'test' mode. Also, opening the DG breaker when LOOP conditions exist ensures that the associated 6.9kV shutdown board is deenergized and that its undervoltage relays will pickup to initiate load-shedding. After this occurs, the DG operates identically to the way it would have operated if it had been in its standby alignment when the SI signal was actuated. Once the DG is in its emergency start mode and loads have been stripped from its shutdown board, control circuits associated with the load shedding logic and DG voltage/speed status signals close the DG breaker to reenergize the 6.9kV shutdown board. These circuits also start the load sequencer to connect emergency loads to the shutdown board at preset time intervals.

FSAR changes have been prepared for a future amendment to incorporate the design modification for tripping the DG breaker when an accident signal is initiated and the DG is being tested in parallel with offsite power. A set of FSAR page markups showing these changes is enclosed. (Refer to markups of pages 8.2-15, 8.2-16, 8.3-12, and 8.3-19.)

For completeness, the enclosure also includes page markups showing the other changes to FSAR Chapter 8 ('Electric Power') that have been identified since it was last updated in Amendment 75. Note that one of these changes describes WBN's compliance with RG 1.9, Revision 3, which was issued in July 1993 and which provides more recent regulatory guidance superseding RG 1.108. However, the guidance in Regulatory Position 1.5 of RG 1.9, Revision 3, is essentially the same as that quoted above for Regulatory Position C.1.b(3) of RG 1.108, Revision 1. Regulatory Position 1.5 states: 'The (emergency diesel generator) units should be designed to automatically transfer from the test mode to an emergency mode upon receipt of emergency signals.' As with Regulatory Position C.1.b(3), WBN also complies with Regulatory Position 1.5 based on the recent design modification to trip the output breaker of a DG being tested in parallel with offsite power when an accident signal is initiated."

IV. Issue from NRC's letter to TVA dated March 28, 1994:

"TVA indicated that fault conditions associated with the normal offsite source to which the emergency diesel generator (EDG) is connected are indicative of a loss-of-offsite-power (LOOP) condition. A discussion of the specific fault conditions and how they are indicators of a LOOP needs to be provided.

TVA also indicated that if the offsite source for the associated shutdown board was through the alternate feeder, a LOOP condition would not result in the EDG output breaker directly tripping. In this scenario, the EDG overcurrent relays would prevent the EDG from being overloaded. A discussion of whether these relays lockout and of any associated manual action in response to a lockout condition (if applicable) needs to be provided."

Response from TVA's letter to NRC dated June 29, 1994:

"When the EDG is connected to its 6.9kV shutdown board for testing purposes and it is operating in parallel with the normal offsite power source for the shutdown board, the following fault conditions trip both the EDG breaker and the normal supply breaker for the shutdown board:

- Common station service transformer (CSST) transformer differential
- CSST overcurrent
- CSST neutral overcurrent
- CSST sudden pressure
- Tripping of the 161kV feeder breaker at the Watts Bar Hydro Plant (WBHP) switchyard

These five fault conditions are either a direct indication that a LOOP has occurred or a closely associated precursor indicating that a LOOP is imminent. A fault condition that trips the feeder breaker for the 161kV offsite power supply line also sends a command via a microwave link between WBN and WBHP to trip the secondary breakers of the respective 161kV line's CSSTs. CSST A and CSST D are connected to one of the two 161kV lines. CSST B and CSST C are connected to the other. Relays for CSST transformer differential, overcurrent, neutral overcurrent, and sudden pressure trip the breakers on the secondary side of the pair of CSSTs (i.e., CSSTs A and D or CSSTs B and C) and initiate a trip command for the 161kV line's feeder breaker. Tripping of the 161kV feeder breaker at WBHP results in the loss of one of the two preferred offsite power sources and the loss of the normal source for two of the four 6.9kV shutdown boards. The relays for the fault conditions listed above also trip the normal feeder breaker on each of the associated 6.9kV shutdown boards (i.e., CSST C is associated with Train A and CSST D is associated with Train B) and the EDG breaker if the EDG is in test.

When the EDG is being tested in parallel with offsite power that is supplied via the 6.9kV shutdown board's normal breaker, automatic transfer from the normal offsite power source to the alternate offsite power source is administratively disabled (i.e., the auto/manual transfer switch is placed in its manual position). Therefore, in the event that any of the above fault conditions occurs for the normal offsite power source, both the EDG breaker and the normal feeder breaker trip and voltage on the shutdown board is lost. The redundant 6.9kV shutdown boards are both physically and electrically independent. Consequently, the shutdown board experiences a loss of voltage that is equivalent to a LOOP condition, even though the redundant 6.9kV shutdown board may still have offsite power available.

With respect to the EDG overcurrent relays that prevent overloading when an EDG is being tested in parallel with the alternate offsite source for its 6.9kV shutdown board, this relay does not lockout. The EDG overcurrent relays are Westinghouse Type SC relays, which provide instantaneous pickup and dropout and include a self-resetting feature. No manual action is required to reset the trip mechanism for the EDG breaker after the overcurrent relays are actuated. Note that the contacts for the EDG overcurrent relays are in protective circuits that only trip the EDG breaker if it is closed and either the shutdown board's normal, alternate, or maintenance supply breaker is also closed. The overcurrent relays for the EDG are disabled unless the EDG is in test with both its breaker closed and either the normal, alternate, or maintenance supply breaker also closed. In the event of an overload while testing the EDG, the EDG overcurrent relays directly trip the EDG breaker through contact logic which uses the shutdown board's normal, alternate, and maintenance supply breakers' auxiliary contacts.

Whenever the EDG is being tested in parallel with the alternate offsite power source and if any one of the previously identified fault conditions occurs on the alternate source, the alternate source's supply breaker on the secondary side of the CSST is tripped. At the 6.9kV shutdown board, neither the alternate supply breaker nor the EDG breaker receives a trip command. When the breaker on the secondary side of the CSST trips, the EDG remains connected to the shutdown board and attempts to maintain board voltage. However, the EDG overcurrent relays are enabled and can trip the EDG breaker in the event of an overload since the alternate supply breaker on the shutdown board is still closed. The nominal setpoint for the EDG overcurrent relays is 600 amps. Also, as previously described in TVA's letter dated February 7, 1994, the EDG breaker would trip if an accident occurred. The trip logic for accident conditions is actuated by receiving a safety injection signal while the EDG is in its test configuration."

V. Issue from NRC's letter to TVA dated March 28, 1994:

"In a letter dated February 7, 1994, the applicant indicated that the FSAR would be revised to describe compliance with RG 1.9, Revision 3, 'Selection, Design, Qualification, Testing, and Reliability of Diesel Generator Units Used As Class 1E Onsite Electric Power Systems at Nuclear Power Plants.' As part of the FSAR revision, the applicant is deleting compliance statements for RG 1.108, which has been withdrawn by the staff. Since this, in effect, negates the staff's previous review conclusions pertaining to RG 1.108 and its guidance for diesel generator testing, the applicant's new compliance with RG 1.9, Revision 3 (and exceptions thereto), is considered an open item, pending the staff's review of the proposed FSAR amendment."

Response from TVA's letter to NRC dated June 29, 1994:

"The proposed changes to FSAR Chapter 8 that were identified in TVA's letter dated February 7, 1994, were incorporated in WBN's FSAR as part of Amendment 86, which was submitted on April 2, 1994. As stated in the question and based on these recent FSAR changes, WBN is now committed to RG 1.9, Revision 3 (with clarifications and exceptions as noted in FSAR Section 8.1.5.3), in place of RG 1.9, Revision 2, and RG 1.108, Revision 1, both of which were superseded by RG 1.9, Revision 3, when it was issued in July 1993. TVA has adopted the latest version of RG 1.9 for use at WBN because it incorporates updated diesel generator (DG) testing requirements and test frequencies that were the result of an industry effort to improve DG reliability.

In a meeting with Messrs. Virgil Beaston, Fred Burrows, and Julio Lara of the NRC staff on April 28, 1994, TVA was told that the primary concern with WBN's adopting RG 1.9, Revision 3, involved TVA's explanation of compliance with Position C2.2.5. This position in RG 1.9, Revision 3, states: 'Demonstrate that, on a safety injection actuation signal (SIAS), the emergency diesel generator starts on the autostart signal from its standby conditions, attains the required voltage and frequency within acceptable limits and time, and operates on standby for greater than or equal to 5 minutes.' In FSAR Section 8.1.5.3, TVA explains its compliance with Position C2.2.5 as follows: 'WBN meets the intent of this position. The diesel generators associated with the nuclear unit affected by the SI event are started by 1E circuits. However, the starting of the diesel generators of the non-SI unit is implemented with a non-1E circuit (common start circuit). The intent of this position is to have all the DGs started in case there is a loss of offsite power (LOOP). WBN meets this precautionary requirement with the common start circuit. In the event of a LOOP, the 1E LOOP circuits also start the DGs, independent of the common start circuit.' The NRC staff is concerned with the use of a circuit which is not Class 1E to start the DGs for the non-SI unit since the DGs for that unit are required to operate to mitigate the accident conditions in the affected unit.

In response to this concern, TVA discussed the details of the DG starting circuits with the NRC staff members present at the meeting on April 28, 1994. The common start circuit that is used for the DGs of the non-SI unit contains electrical components (relays, contacts, actuation logic circuitry, etc.) which are identical to the Class 1E components in the start circuit for the DGs of the affected unit. The common start circuit cannot be designated as Class 1E because it does not satisfy applicable Class 1E criteria for independence and separation. TVA considers that this design approach is justified because starting the DGs of the non-SI unit is only a precaution. These DGs are not actually needed to mitigate the accident unless a LOOP also occurs. However, if a LOOP does occur, it actuates separate DG starting circuits which are Class 1E and which send separate start signals to all of the DGs (including both DGs for the affected unit and both DGs for the non-SI unit)."