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AUG 05 1993

U.S. Nuclear Regulatory Commission
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Gentlemen:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) - DIESEL GENERATOR (DG) TESTING IN PARALLEL WITH OFFSITE POWER (TAC M63649)

This letter provides additional information about WBN's design provisions for testing a DG in parallel with offsite power to supplement the description that is already provided in Chapter 8 of the Final Safety Analysis Report (FSAR). This issue was originally identified as Item 8.3.1.12 in NRC's request for additional information (RAI) dated June 20, 1991.

The above RAI questioned the adequacy of WBN's design if an accident (i.e., safety injection (SI) signal) is received or a loss of offsite power (LOOP) occurs 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. As part of the response, TVA committed to revise several pages in Chapter 8 of the FSAR to clarify how WBN's electrical power system responds to a LOOP and an accident signal. These revisions were made in FSAR Amendment 71, which was submitted on August 5, 1992.

Subsequently, Mr. Fred Burrows of the NRC staff stated during several telephone conversations and a site visit on January 27, 1993, that Item 8.3.1.12 was still under review and that further justification of WBN's relevant electrical design features was needed. The issue was discussed again in a telephone conversation with Messrs. Carl Berlinger, Fred Burrows, and Eric Weiss of the NRC staff on July 14, 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

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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."

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 6.9-kV 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 6.9-kV 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 6.9-kV 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 6.9-kV 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 6.9-kV 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 6.9-kV 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 6.9-kV shutdown board in a preset time sequence as soon as the DG output breaker closes to reenergize the 6.9-kV 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 6.9-kV 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 6.9-kV shutdown board in about 5 seconds. Thus, accident loads will begin to sequence on well before the design basis time of 10 seconds.

If you have any questions about the information provided in this letter, please telephone John Vorees at (615) 365-8819.

Very truly yours,

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