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JUN 29 1994

U.S. Nuclear Regulatory Commission
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Washington, DC 20555

Gentlemen:

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

WATTS BAR NUCLEAR PLANT (WBN) - FINAL SAFETY ANALYSIS REPORT (FSAR) CHAPTER 8, ELECTRIC POWER SYSTEMS (TAC M89109 AND M89110)

This letter provides TVA's response to the NRC request for additional information (RAI) dated March 28, 1994. The RAI identified five issues relating to electric power system design implementation at WBN as described in FSAR Chapter 8. The enclosure restates these five issues and gives TVA's response to each one, except Issue No. 4 as discussed below.

Note that additional information on the five issues has already been provided to NRC staff members Messrs. Virgil Beaston, Fred Burrows, Julio Lara, and Glenn Walton during a site visit on April 28, 1994. Also, several of the issues were clarified and/or revised during a conference call with Messrs. Virgil Beaston, Fred Burrows, Paul Frederickson, Fred Hebdon, John Knox, Julio Lara, Peter Tam, and Eric Weiss of the NRC staff on May 12, 1994. As a result of this conference call, Issue No. 4 was expanded significantly and it was agreed that TVA would respond to it in a separate submittal at a later date.

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JUN 29 1994

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

Sincerely,

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ENCLOSURE

REQUEST FOR ADDITIONAL INFORMATION
WATTS BAR NUCLEAR PLANT FSAR CHAPTER 8
ELECTRIC POWER SYSTEMS

NRC ISSUE 1:

The staff's review of TVA's February 7, 1994, letter resulted in the following questions:

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.

TVA RESPONSE:

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.

NRC ISSUE 2:

Verification of correct alignments every 7 days has been included in the plant's Technical Specifications for breakers used to connect dc loads to an alternate source. An example (SOI-211.01 Revision 1) of a procedure to control the use of the alternate feeders was provided for the staff's review. As a result of the staff's review, the following issues need to be addressed:

On Page 6 of SOI-211.01 a note states that Technical Specification LCO action may be required if the alternate feeders for the breaker control power are used. This is counter the TVA commitment to take positive action per the Technical Specifications to control the use of the alternate feeders discussed above.

The same note states that the alternate source for control power for a Train A shutdown board would be Train B. This is also counter the September 13, 1991, TVA statement that loads would only be transferred within the same train in the opposite unit.

TVA RESPONSE:

The note on Page 6 of System Operating Instruction (SOI) 211.01, Revision 1, was in error. Both the normal and the alternate dc control power sources for each 6.9kV shutdown board are supplied from the same train. The train assignments for normal and alternate dc control power are correctly described in Final Safety Analysis Report (FSAR) Section 8.3.2.2. The error in the procedure note was not considered significant because the note was informational in nature and was not used as a basis for any specific operator action. However, SOI-211.01 has been revised to indicate that normal and alternate dc control power for a 6.9kV shutdown board are supplied from the same train. The procedure was also revised to clarify that use of alternate dc control power does not require any action related to a proposed Technical Specification limiting condition for operation (LCO) because no LCO is violated.

NRC ISSUE 3:

Section 8.3.1.2.3 of Amendment 63 to the FSAR indicates that Class 1E cables routed underground between the auxiliary building, the diesel generator building, and the intake pumping station are provided with waterproof splices in the potentially submersible sections of the duct runs. Position 9 of Regulatory Guide 1.75 states that cable splices in raceways should be prohibited. The basis for Position 9 further states that if cable splices exist, the resulting design should be justified by analysis and that the analyses should be submitted as part of the safety analysis report. In order to evaluate the use of cable splices in raceways, additional justifying analyses were required which would demonstrate compliance with the requirements of GDC 2, 4, and 17.

During an August 7 and 8, 1991, site review and in the September 13, 1991, letter, the applicant indicated that splices are included in manholes of the underground duct run. During the site review, the applicant indicated that splices are not permitted by the Watts Bar design basis to be installed in raceways, and that the FSAR would be clarified to state that splices are not allowed to be installed in raceways.

Contrary to this, the applicant in a December 17, 1993, response to issues raised in Inspection Report Nos. 50-390/93-74 and 50-391/93-74, described two methods of splicing cables in open cable trays allowed by Watts Bar Standard Drawing SD-E12.5.9. The staff's opposition to splices in raceways is centered on the prevention of fires caused by improper splices. If splices are used in raceways that are part of the raceway system (not used for device terminations), then an analysis justifying their use should be made and documented in the FSAR as recommended by Revision 1 to RG 1.75.

TVA RESPONSE:

TVA has not committed to follow the recommendations of RG 1.75 or to justify exceptions to RG 1.75 as part of WBN's licensing basis. RG 1.75 was originally issued in February 1974 and both Revisions 1 and 2 state that it applies to "construction permit applications for which the issue date of the Safety Evaluation Report (SER) is February 1, 1974, or after." WBN's construction permit (and associated SER) was issued on January 23, 1973. Consequently, WBN's original design work predates RG 1.75. TVA's position that RG 1.75 is not applicable to WBN has previously been presented in FSAR Section 8.1.5.3, Note 2, and also in TVA's letter dated December 17, 1993.

Although WBN's design is not intended to conform with each recommendation in RG 1.75, WBN's design does address the general subject of RG 1.75, which is the physical independence of electric systems. FSAR Section 8.3.1 includes a general discussion of WBN's design provisions for electrical independence.

As stated in the above question, FSAR Section 8.3.1.2.3 describes the use of waterproof splices in potentially submersible sections of underground conduit duct bank runs. Such splices are contained within manholes, which are enclosed structures with very little space. A manhole provides many of the functions of a junction box such as serving as a cable pull point and as an enclosure to house splices. The cable tray raceway in the manhole provides support and protection for the contained cables and any splices that they may have. Also, redundant cable divisions are installed either in separate manholes or in manholes with a concrete barrier between the divisions. These design provisions are considered adequate to ensure that a fire in one division does not propagate to the other division. Automatic sump pumps are provided to keep the manholes drained, and WBN has established an inspection program to ensure that the sump pumps are operating properly and that the manholes are not flooded.

In addition to splices in manholes, there are two instances of splicing in wireway extensions at WBN. These are: (1) in the trenches (walkways) beneath the main control boards and (2) on the outboard side of primary containment electrical penetrations in the reactor building annulus. In this second case, cables are spliced to the penetration pigtails in junction boxes attached to the penetration nozzle for penetrations with cables entering them by conduit only or in splice boxes for penetrations with cables entering them by cable tray. Each of these splice boxes consists of solid-bottom cable tray with a cover and a firestop seal located approximately 8 feet from the end of the penetration nozzle. The solid enclosure and the firestop seal prevent a fire caused by a splice failure from spreading to other sections of the cable tray system.

In other areas of the plant, splices in cable trays are not permitted except in extraordinary situations which have been reviewed and approved by WBN Engineering. For those very few situations approved by Site Engineering, splices in cable trays are performed in accordance with two detailed methods shown on Standard Drawing SD-E12.5.9. In one method, the splice is located inside a rigid conduit sleeve within the tray with a fire seal at each end of the sleeve. In the other method, the splice is located in the tray with a solid metal barrier between each spliced cable section and other cables. A fire seal is located at each end of the tray section containing the splices. A cable tray cover is mounted on the top and bottom of the tray section containing the splice if it is not contained in a rigid conduit sleeve. Any fire resulting from a splice failure is prevented from propagating along the cable tray by the previously mentioned firestops that are part of the splice installation.

In summary, the preceding paragraphs have explained that WBN is not committed to the recommendations in RG 1.75 and that splicing of cables in cable trays is restricted to 1) manholes in conduit duct bank runs, 2) walkways under the main control boards, 3) connections to primary containment electrical penetrations, and 4) extraordinary situations for which special engineering evaluation and approval must be obtained. Based on these arguments, TVA does not consider it necessary to perform a specific analysis and document it in the FSAR to justify splices in raceways at WBN.

In a conference call with Messrs. Virgil Beaston, Fred Burrows, Paul Frederickson, Fred Hebdon, John Knox, Julio Lara, Peter Tam, and Eric Weiss of the NRC staff on May 12, 1994, TVA was asked to restrict the splicing of cables in cable trays at WBN to a single method which would entail locating each splice in an enclosed "box" outside of the cable tray. TVA has used this method to rework a number of splices that were found to be unacceptable during NRC onsite inspections. However, TVA does not commit to this single method for splicing in cable trays. WBN's design documents allow for other approved methods of splicing in cable trays as noted above. TVA considers these methods to be technically adequate and justifiable for the reasons already presented in the letter dated December 17, 1993. The methods have been in use at WBN and other TVA plants for many years.

NRC ISSUE 4:

In the SER the staff stated that separation between conduits and open-top cable trays was not described in the FSAR or in additional information provided by TVA. Currently, Section 8.3.1.4.2 of the FSAR states that there is no established minimum separation between open-top non-Class-1E cable trays and conduits containing redundant cables, and that credit is taken for fire-resistant cable coating installed prior to October 18, 1984, together with adequate circuit protective device(s) as meeting the intent of RG 1.75. Coating is not used after October 18, 1984, on cables which meet IEEE Standard 383-1974, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations." Further, there is no discussion in the current FSAR of separation distances between Class 1E open cable trays and conduits.

NRC Inspection Report Nos. 50-390/93-74 and 50-391/93-74 raised concerns related to the minimum separation distance between divisional open cable trays and conduits as described in Watts Bar General Design Criterion WB-DC-30-4, "Separation/Isolation." Appendix C of that document provides the rationale (unsupported by analysis/test) for distances down to one inch when the cable tray is not covered. The appendix states that the metal conduit (twice as thick as a cable tray cover) is sufficient as a heat shield/sink to provide protection for cables contained in the conduit against the physical energy associated with a fault in an open cable tray located as close as one inch to the conduit. The appendix further states that the conduit thickness and the lack of sufficient oxygen needed to support combustion inside the conduit ensure that damage to cables in cable trays as close as one inch is unlikely if a fault should occur inside the conduit. Credit is also taken in the appendix for the fire detection/suppression systems to minimize the propagation of a fire, for the use of fire-retardant material in specific cases, for certain cable passing vertical flame tests, and for the protection provided by primary breakers.

Staff guidance from RG 1.75 states that if the minimum separation distance (much greater than an inch) cannot be maintained, the redundant circuits should be run in solid enclosed raceways (enclosed cable trays, conduits, etc.) that qualify as barriers, or other barriers should be provided with a minimum separation of one inch between the enclosed raceways and between the barriers and raceways.

A comparison between RG 1.75 and WB-DC-30-4 revealed several differences such as the use of a cable tray cover allowed by WB-DC-30-4 versus a completely enclosed tray recommended by RG 1.75. Also, the use of a barrier without an additional one-inch air gap is allowed by WB-DC-30-4. As noted above, the appendix to WB-DC-30-4 allows exceptions (such as no tray cover required between a cable tray and a conduit for separations down to an inch) to the separation requirements based on a case-by-case analysis without supporting test results, which also deviates from RG 1.75.

In a December 17, 1993, response to the inspection report, the applicant referred to IEEE Standard 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," as providing guidance for separation distances between open cable trays and conduits. Although this revision to the IEEE standard has not been formally endorsed by the staff, the staff's review indicated that it does provide guidance (with limiting assumptions) for minimum separation distances based on actual, credible test results. Unfortunately, as noted in the applicant's letter, WB-DC-30-4 allows separation distances less than that supported by the IEEE standard.

Because of the differences noted between WB-DC-30-4 and RG 1.75 pertaining to the separation between open cable tray and conduits, the staff will review TVA's case-by-case justification (supported by analysis/test) for deviations from RG 1.75 with further current industry guidance contained in IEEE Standard 384-1992 and its supporting documentation.

TVA RESPONSE:

In a conference call with Messrs. Virgil Beaston, Fred Burrows, Paul Frederickson, Fred Hebdon, John Knox, Julio Lara, Peter Tam, and Eric Weiss of the NRC staff on May 12, 1994, the above issue was redefined and expanded. The NRC staff requested that TVA provide a detailed description of all electrical separation criteria in use at WBN. The description is to include a justification, based on test results wherever possible, for each criterion that differs from RG 1.75.

In view of the expanded scope of the issue, it was agreed during the conference call that TVA would respond in a separate submittal at a later date.

NRC ISSUE 5:

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.

TVA RESPONSE:

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).