UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 28, 1997

MEMORANDUM TO: Jon R. Johnson, Director
Division of Reactor Projects
Region II

FROM: Frederick J. Hebdon, Director
Project Directorate II-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

SUBJECT: NRR RESPONSE TO TIA 94-021, SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - OFFSITE POWER TECHNICAL SPECIFICATIONS (TAC NOS. M93319 & M93320)

This is the Office of Nuclear Reactor Regulation (NRR) response to the request for technical assistance regarding the Sequoyah Nuclear Plant offsite power distribution system. The request was made via memorandum from Ellis W. Merschoff to John A. Zwolinski dated August 11, 1995. This response closes out Task Interoffice Agreement (TIA) No. 94-021.

During an inspection at Sequoyah in 1993 (Inspection Report 50-327,328/93-02), concerns were identified regarding the adequacy of the 161 kV offsite power grid voltage when the Sequoyah 500 kV to 161 kV intertie transformer was not available. The TIA requested that NRR to review various grid load studies and design calculations provided with the TIA and to reach a conclusion regarding whether a special Technical Specification (TS) should be requested by TVA to cover the contingency of the intertie transformer not being available. Specifically, The TIA aked the following questions:

1. Based on the new Transmission System Study and the new Common Station Service Transformers, does the plant have an acceptable immediate preferred offsite power source if the 500 kV to 161 kV intertie transformer is not operable? Does the 161 kV analysis demonstrate that the plant can achieve safe shutdown without the intertie transformer?

2. Should the plant's technical specifications be amended to require that [Limiting Condition for Operation] LCO 3.8.1.1, Action C, be entered following a loss of the intertie transformer?

NRR has completed its evaluation as summarized in the attachment. The staff concluded that the Sequoyah plant will not have an acceptable immediate preferred offsite power source when the 500 kV to 161 kV intertie transformer is out of service because the offsite source will not meet commitments (design description) specified in Update 12 of the Sequoyah Updated Final Safety Analysis Report (UFSAR). The 161 kV analysis, however, demonstrates that the plant will have sufficient capacity so that plant shutdown can be achieved when the intertie transformer is out of service. The staff also concluded that a requirement to amend the

TS is not necessary to assure that LCO 3.8.1.1, Action C, will be entered following a loss of the intertie transformer. The basis for these conclusions is described in the attachment.

NRR understands that TVA is making changes (Update 13) to the UFSAR that may be related to the subject matter. TVA has opted to not submit Update 13 to the NRC until such time as 10 CFR 50.59 guidelines, including changes to the UFSAR, have been finalized and published by the NRC. This will probably not occur until the end of calendar 1997, at the earliest.

In the meantime, NRR's staff responses to your questions remain valid until such a time that new information is submitted for staff review. Any further review of this subject, if necessary, will be done under a separate TAC. We consider our response to TIA 94-021 complete and the corresponding TACs are closed.

If you have any questions regarding this response, please contact Ronald W. Hernan, the Sequoyah Project Manager.

Attachment: As stated

Docket Nos. 50-327 and 50-328

cc: C. Hehl, Region I
G. Grant, Region III
T. Gwynn, Region IV

OFFICE OF NUCLEAR REACTOR REGULATION RESPONSE TO TIA 94-021 RELATING TO OFFSITE POWER FOR SEQUOYAH NUCLEAR PLANT UNITS 1 AND 2 DOCKET NOS. 50-327 AND 50-328

BACKGROUND

At the Sequoyah Nuclear Plant, the Tennessee Valley Authority (TVA) replaced their preferred offsite power system's Common Station Service Transformers (CSSTs) with new transformers equipped with automatic load tap changers. In connection with this replacement, TVA revised their analysis that demonstrated that the 161 kV transmission network remains stable and thus available as a reliable offsite power supply to ensure safe shutdown of the Sequoyah units in the event of: (1) anticipated operational occurrences and accidents at the nuclear facility; or (2) anticipated contingencies on the transmission network such as the loss of the transformer that interties the 161 kV and 500 kV switchyards located near the Sequoyah plant.

By memorandum dated August 11, 1995, Region II requested the Office of Nuclear Reactor Regulation's (NRR's) review of the licensee's revised transmission network analysis. Region II specifically requested that this review include answers to the following questions:

1. Based on the new Transmission System Study and the new Common Station Service Transformers, does the plant have an acceptable immediate preferred offsite power source if the 500 kV to 161 kV intertie transformer is not operable? Does the 161 kV analysis demonstrate that the plant can achieve safe shutdown without the intertie transformer?

2. Should the plant's Technical Specifications be amended to require that [Limiting Condition of Operation] LCO 3.8.1.1, Action C, be entered following a loss of the intertie transformer?

To accomplish this review, NRR issued a task order (Task No. 102 under Contract No. NRC-03-95-026) to obtain the technical expertise of Scientech, Inc. Scientech reviewed TVA's revised transmission analysis and concluded, in part, that the immediate availability of an offsite power source could not be substantiated. The analysis indicated that the transmission network will be capable of providing adequate post event steady state voltage and frequency. Scientech considered the licensee's analysis to be acceptable; however, the analysis did not specifically address transient voltages which will occur during the transition from pre to post-event conditions. Transient voltages can exceed protective relay set points causing disconnection of offsite circuits. If offsite circuits are disconnected due to these transient voltages, the immediate availability of offsite power to safety loads will be lost when needed following an event. Thus, based on analysis which addressed only steady state conditions after an event, Scientech was not able to substantiate the immediate availability of offsite circuits.

Subsequently, by letters dated July 17, 1996, and June 2, 1997, TVA provided results of transient stability analysis for an undefined (normally anticipated) transmission network configuration. The results indicated that voltage recovery times are within the time limits required to ensure that protective relaying will not cause disconnection of offsite circuits for the following postulated transmission disturbances:

1. a 3-phase fault and a stuck breaker on either the 500 kV bus 1 or 2 or the 161 kV bus 1 or 2; or

2. a phase-phase-ground fault on the 161 kV side of the 500/161 kV intertie transformer bank and a stuck breaker in the 161 kV switchyard.

During a July 10, 1997, telephone conference call and subsequently by letter dated August 5, 1997, TVA restated that these transients are considered worst case conditions and thus encompass transient conditions that would be caused by simultaneous trip of both Sequoyah units plus simultaneous connection of required loads.

Response to the first question -- Part 1:

The answer is no. Based on analysis results, the Sequoyah plant will not have an acceptable immediate preferred offsite power source when the intertie transformer is out of service. When the transmission network is operating with the intertie transformer out of service, the Sequoyah plant will not meet the following design commitment and will, thus, not have an acceptable immediate preferred offsite power source.

> The eight 161-kV transmission lines connected to the 161-kV switchyard, the 500-161-kV intertie transformer bank, two 84 [megavolt-ampere reactive] MVAR capacitor banks for the 161-kV switchyard, and the five 500-kV transmission lines have sufficient capacity to supply the total required power to the plant's electrical auxiliary power system under normal, shutdown, and loss of coolant accident (LOCA) conditions for any single transmission contingency...
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> (Ref: last paragraph on page 8.2-20 of the Updated Final Safety Analysis Report (UFSAR) amendment 12)

Current analysis results for operation with the intertie transformer out of service, documented on page 8.2-21 of UFSAR Amendment 12, indicates that if the capacitor bank becomes unavailable (as a single transmission system event) it will require 10 minutes for the system dispatcher to adjust the transmission network so that the remaining eight 161 kV transmission lines will be fully capable of providing adequate voltage and power. Thus, because analysis results indicate that the design commitment (defined above) will not be met, the Sequoyah plant will not have an acceptable immediate preferred offsite power source when the intertie transformer is out of service.

The answer to the above question has been predicated on our interpretation of the Sequoyah plant's design as described in the UFSAR (defined above) and accepted by the staff's Safety Evaluation Report (SER), NUREG-0011, for issuing the Sequoyah operating licenses. With respect to capacity and capability following a LOCA (i.e., the GDC 17 immediate access circuit), we believe that our SER acceptance was based on a steady state transmission network analysis which demonstrated network stability following any single transmission contingency. In addition, because of a safety system design criteria which permits extensive sharing of systems between units and UFSAR commitments relating to capacity of the offsite system following LOCA, we believe our SER acceptance was based on network stability assuming simultaneous tripping of both units and loading of safety buses for both units as a result of a LOCA in one unit.

Response to the first question -- Part 2:

The answer is yes. The 161 kV analysis demonstrates that the plant can achieve safe shutdown without the intertie transformer. Based on Scientech's review of load flow studies (defined below) for an out of service intertie transformer and based on transient analysis results subsequently provided by the licensee, we agree that the licensee's analysis results demonstrate that the plant can achieve safe shutdown without the intertie transformer.

> Load flow studies have been performed for the normal power flow around the Sequoyah 500- and 161-kV buses. Studies have been performed for power flow assuming a design basis event on one unit, and orderly shutdown of the other unit and one of the following: (1) a normal transmission network, (2) the loss of the 500-kV intertie transformer bank, (3) the loss of the 161-kV bus 1, (4) the loss of the 161-kV bus 2, (5) the loss of the 500-kV bus 1, (6) the loss of the 500-kV bus 2, (7) the loss of the largest generating unit, or (8) the loss of the most critical 500-kV transmission line.
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> (Ref: UFSAR page 8.2-21)

Response to the second question

The answer is no. It is not necessary to amend the plant's Technical Specifications (TS) to require that LCO 3.8.1.1, Action C, be entered following a loss of the intertie transformer. The TS require two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system that are each operable. Operability is predicated on compliance of these circuits with the commitments that have been accepted by the staff in its SER and have been described/analyzed in the plant's UFSAR as meeting the requirements of GDC 17 (i.e., the TS basis). For Sequoyah, the commitment, in part, as defined in the first paragraph of section 8.2.2 of the UFSAR and accepted by the staff in its SER, specifies that these circuits have sufficient capacity to supply the total required power to the plant's electrical auxiliary power system under normal, shutdown, and LOCA conditions for any single transmission contingency. When the 500 kV to 161 kV intertie transformer is out of service (or when any other component of the offsite system is out of service), we believe that it is the licensee's responsibility to assure continued system operability. If analysis does not support sufficient capacity following a LOCA for any transmission system contingency (or analysis is not available), we believe the licensee is obligated in accordance with their TS basis to enter the appropriate TS LCO. Based on documented information provided by the licensee, it appears that an out of service intertie transformer, for example, may create an operating configuration for which appropriate analysis is not available; thus, anytime the intertie transformer is out of service, we believe the licensee is obligated in accordance with their TS basis to enter the appropriate TS LCO. An out of service intertie transformer can, thus, be considered inherently included in the TS. It is not considered practicable to include in the TS one of many components that may or may not cause the loss of operability based on continuously changing system operating conditions and analysis results or based on the unavailability of appropriate analysis.