TENNESSEE VALLEY AUTHORITY

CHATTANOOGA. TENNESSEE 37401

400 Chestnut Street Tower II

June 4, 1981

SQRD-50-328/81-38

Mr. James P. O'Reilly, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Region II - Suite 3100
101 Marietta Street
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

SEQUOYAH NUCLEAR PL[illegible]T UNIT 2 - PLANT/GRID INTERFACE CONTROLS - SQRD-50-328/81-38 - [illegible]AL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector P. Taylor on May 5, 1981 in accordance with 10 CFR 50.55(e) as NCR SQN QAB 8102. Enclosed is our final report.

If you have any questions, please get in touch with D. L. Lambert at FTS 857-2581.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L M Mills by DSK

L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosure

cc: Mr. Victor Stello, Director (Enclosure)
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555



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ENCLOSURE
SEQUOYAH NUCLEAR PLANT UNITS 1 AND 2
PLANT/GRID INTERFACE CONTROLS
SQRD-50-328/81-38
10 CFR 50.55(e)
FINAL REPORT

## Description of Deficiency

In a QA review, the accuracy of the instrumentation/control system used by TVA to control the 161-kV grid voltage at Sequoyah Nuclear Plant was questioned.

The minimum acceptable voltage at the primary windings of the common station service transformers was determined to be 164 kV for unit 1 operating with unit 2 in preoperational testing, and 165 kV for both units operating (until completion of certain auxiliary power system modifications). These voltage requirements were based on maintaining adequate voltage on the terminals of electric motors driving safety-related equipment during their starting, with the auxiliary power system supplied through only one common station service transformer. Loading was taken to be unit 1 in a LOCA shutdown with 23,824 MVA supplied to unit 2, or to be one unit in a LOCA shutdown and the other in a full load rejection. It was subsequently determined that the grid should be operated at least two kV above these minimum levels. This was based on the maximum voltage sag expected from loss of the two Sequoyah units with the transmission grid in the worst acceptable configuration.

It was expected that the grid voltage would be monitored at Sequoyah Nuclear Plant and normally adjusted within scheduled limits using the 500-kV to 161-kV intertie transformer at Sequoyah. However, it was not clear that the accuracy of the instrumentation/control system had been considered in establishing controls for maintaining the necessary plant/grid interface conditions.

## Safety Implications

If the accuracy of the instrumentation/control system used to maintain the 161 kV grid had not been considered and this lack of consideration led to a voltage outside the lower limit (yet still measured within the limit), then the operation of certain safety-related motors (identified in NCR SQN EEB 8115) could have been jeopardized.

## Corrective Actions

It has been determined that failure to consider the accuracy of the instrumentation/control system used to maintain 161-kV grid voltage at Sequoyah Nuclear Plant could not have jeopardized the safe operation of the plant as long as the present system design and equipment calibration procedures were in use. This determination is discussed below is detail.

The equipment used to monitor the 161-kV grid voltage at Sequoyah in the main control room consists of two recording voltmeters (G.E. type CH-1), one indicating voltmeter (G.E. type AB-40), and one undervoltage annunciation relay (Lamarche type ERA). Each of these devices has an accuracy of one percent and is calibrated on a six-month to three-year cycle using a laboratory instrument (Weston 904) with an accuracy of 0.5 percent which is periodically calibrated against Bureau of Standards instruments. The undervoltage annunciation relay is also compensated for voltage drop from the switchyard to the control room. All of this instrumentation obtains its voltage from two sets of potential transformers with an accuracy of 0.3 percent. The charts on the recording voltmeters have an expanded scale such that two kV in the switchyard covers 1/8 of an inch on the recording chart. The maximum error expected in reading 161-kV grid voltage is less than 1.5 percent of the value read.

The intertie transformer bank at Sequoyah has load tap changers on its 500-kV windings that are adjustable in 6250-volt steps (1.25 percent of 500 kV).

The calculation methods and assumptions that established the minimum 161-kV grid voltages are conservative. The 480V system loading used assumed all connected loads except intermittent loads such as valves, hoists, etc. were operating continuously. All cable impedances for voltage calculations were based on maximum manufacturing tolerances and operating temperature. For those motors for which documentation was not available, locked rotor current and starting power factor were assumed to be worst values for the class of motor. This conservatism in the minimum grid voltage calculations taken with the conservatism in the design bases, plus the fact that safety-related 460-volt motors are NEMA type B with conservative torque ratings, leads to the conclusion that the maximum error expected in controlling minimum grid voltage is acceptable.

A maximum limit on the 161-kV grid voltage at Sequoyah has not been established since no safety-related equipment is normally connected to the 161-kV system. With voltage scheduled between 167 kV and 168 kV and the maximum expected low reading error, the voltage could be approximately 170 kV. The common station service transformers are the equipment most vulnerable to damage from high grid voltage. Since their primary winding taps are at 152.95 kV, they could be subjected to slightly over 11 percent overvoltage. However, since core heating due to overexcitation is not generally considered for less than 12 percent overvoltage, the error expected in controlling maximum grid voltage is acceptable.

Since the maximum expected grid voltage error with the present instrumentation/control system design is acceptable, no equipment modifications or interface requirement changes are necessary. However, system accuracy requirements will be added to controlling drawings to ensure that any future changes do not result in unacceptable instrumentation errors. This will be accomplished in the next drawing revision, or no later than the end of 1981.

TVA is in the process of evaluating its other nuclear facilities to determine if any similar conditions exist that might affect their operation. Any deficiencies of this nature discovered will be documented as nonconformances and dispositioned in accordance with 10 CFR 50.55(e).