

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

5N 157B Lookout Place

February 12, 1986

Director of Nuclear Reactor Regulation  
Attention: Mr. B. Youngblood, Project Director  
PWR Project Directorate No. 4  
Division of Pressurized Water Reactors (PWR)  
License: A  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Youngblood:

In the Matter of )  
Tennessee Valley Authority ) Docket Nos. 50-327  
50-328

As documented in your January 31, 1986 letter to Steven A. White regarding the Sequoyah Nuclear Plant, TVA and members of the NRC staff have discussed questions regarding the computer model used by TVA to analyze the auxiliary power system. Enclosed is a response to NRC questions expressed by NRC in the January 8, 1986 telephone conversation and the January 14-16, 1986 site visit. This response takes into consideration NRC's comments expressed in your January 31, 1986 letter and concludes that no additional calculations are required to verify the calculational methods, and that no further testing, with respect to PSB-1, is required.

Our evaluation of employee concern issues associated with electrical calculations will be provided in a later submittal.

If you have any questions regarding the subject, please call Jerry Wills at FTS 858-2683.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

*R. Gridley*  
R. Gridley  
Manager of Licensing

Sworn to and subscribed before me  
this 12<sup>th</sup> day of Feb. 1986

*Paulette H. White*  
Notary Public

My Commission Expires 8-24-88

Enclosure  
cc: See page 2

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Director of Nuclear Reactor Regulation

February 12, 1986

cc (Enclosure):

U.S. Nuclear Regulatory Commission  
Region II  
Attn: Dr. J. Nelson Grace, Regional Administrator  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

Mr. Carl Stahle  
Sequoyah Project Manager  
U.S. Nuclear Regulatory Commission  
7920 Norfolk Avenue  
Bethesda, Maryland 20814

ENCLOSURE  
RESPONSE TO NRC CONCERNS  
ON ELECTRICAL CALCULATIONS  
VERIFICATION OF AUXILIARY POWER SYSTEM VOLTAGE STUDY  
SEQUOYAH NUCLEAR PLANT

In question 8.33 to the Sequoyah FSAR (SQN FSAR) dated July 28, 1978 and in a May 5, 1980 letter from A. Schwencer of NRC to H. G. Parris, the NRC position was that the adequacy of the ac auxiliary power system design be verified by actual measurement and by correlation of measured values with analysis results. This position was issued before NRC required utilities to perform a Power System Branch, PSB-1, test.

On July 12 and July 16, 1980, TVA conducted tests of the SQN ac auxiliary power system. The purpose of the tests was to collect data (current, voltage, kilowatts, and running motors) for a specific load configuration on a specified part of the power system (outlined below). Calculations were made for the same loading configuration on the same portion of the power system. TVA and NRC had previously agreed upon the test scope in a June 24, 1980 telephone conversation with Faust Rosa, PSB. In particular, voltages were measured from the offsite power system down through one in-plant power distribution train (161-kV switchyard, 6.9-kV start bus, 6.9-kV unit board, 6.9-kV shutdown board, 480V shutdown board, and 480V motor control center) for an identified steady-state loading at each power distribution bus. Also, as agreed to by the NRC staff, no voltages were measured on the 120V ac buses. Voltages were also measured over the same path and at the motor terminals of an emergency raw cooling water (ERCW) pump motor (700 HP) while it was started and of an auxiliary building general exhaust fan motor (150 HP) while it

was started. The voltages for these test cases were then calculated using an in-house FORTRAN program, VNEW, run on Control Data Corporation's (CDC) time sharing system. VNEW calculation results had been checked previously by comparison to hand calculations results and to calculations results from General Electric Company's LFLOW\$ time share program. The Sequoyah calculations package and test data were issued in a test report dated October 2, 1980, and submitted to NRC on October 3, 1980 by letter from L. M. Mills to A. Schwencer.

The SQN validation tests accomplished two things: (1) the equipment parameters and assumptions used in the calculations were shown to be valid, and (2) the calculation methods (both hand calculations and computer calculations) were shown to give acceptable answers. Additionally, on April 2, 1981, agreement was reached in a telephone conversation between TVA and NRC (J. Knox) that additional testing of the ac auxiliary power system for unit 2 would not provide any additional benefit. TVA's position not to conduct additional testing on unit 2 was formally submitted to NRC on April 2, 1981 by letter from L. M. Mills to A. Schwencer.

Subsequent to issuance of the SQN calculations package, several modifications were made at SQN that affected the existing voltage analyses including splitting the existing start buses to add a third common station service transformer. The new transformer was a spare that had been procured to the

same specifications as the original two transformers. This modification added no new impedance to be considered in voltage calculations, but simply reduced the maximum loading for any single winding.

Other modifications included replacing approximately 100 valve motors for equipment qualification concerns. Additionally, changes in plant operating procedures required new system loadings to be analyzed. Rather than revise existing calculation documents, TVA chose to prepare new calculations by use of more modern and faster personal computer methodology.

The new voltage analyses for SQN and the original calculations for Watts Bar Nuclear Plant (WBN) were made using an in-house Basic program, RADIAL, for the grid interface and 6.9-kV system, and in-house Basic programs, VOLT and VOLT2 for the 480V system. These programs were run on personal computers.

The computer programs used for these new calculations were shown to give correct answers by the following procedure: RADIAL was checked by comparison to hand calculations, and to calculations made with other computer programs. Specifically, the PSB-1 test calculations performed for WBN were made using VNEW and were checked using RADIAL. The NRC approval of the WBN system design is documented in section 8.3.1 of the June 1982 WBN SER (NUREG-0847) and acceptance of the WBN analysis is documented in the section 8.3.1.2 of the January 1984 supplement to the WBN SER. The test results of WBN did verify the accuracy of the WBN electrical calculations using VNEW (that were checked by RADIAL).

Additionally, VOLT and VOLT2 were checked by hand calculations and compared to VNEW. The Bellefonte 480-V auxiliary power system review (revision 0) was made using VOLT and VOLT2 and were checked using VNEW. Therefore, our current computer programs have been checked against hand calculations and to VNEW, which was used for the original SQN verification calculations.

The SQN calculations utilizing RADIAL, VOLT, VOLT2 were performed as described by the following:

- (1) Voltages were calculated at each 6900 volt and 480 volt Class 1E system distribution board, at the terminals of all three-phase safety-related equipment, and at the primary windings of the Class 1E 480-120V transformers.
- (2) Class 1E system voltages for the range of unit generator voltages were calculated, and acceptable grid voltage ranges for station service transformer tap settings were determined. The results of these analyses did not affect current degraded voltage relay voltage setpoints as defined in the technical specifications.

In summary, TVA believes no additional calculations or tests are required to verify its calculational methods for the following reasons:

1. The original Sequoyah Verification Test and calculations demonstrated TVA's ability to duplicate test results by its calculational methods.
2. Although modifications to the Sequoyah auxiliary power system have occurred since the original test and calculations were performed, these modifications do not affect TVA's ability to analyze the auxiliary power system. Specifically, TVA's calculational methodology applies to any system configuration that may be modeled.

3. As previously stated in detail, the RADIAL, VOLT and VOLT2 computer programs have been acceptably validated by proven computer and/or hand calculations.
4. The test results at WBN did verify the accuracy of the WBN electrical calculations using VNEW and checked by RADIAL.
5. The acceptability of TVA's computer programs to adequately perform voltage analyses have been approved by the NRC review of the WBN auxiliary system and documented in NUREG-0847, section 8.3.1.2.

In addition based on the above, TVA further concludes that no additional testing, with respect to PSB-1, is required.

Our evaluation of employee concern issues associated with electrical calculations will be provided in a later submittal.