SEQUOYAH NUCLEAR PLANT
DIESEL GENERATOR VOLTAGE RESPONSE IMPROVEMENT PLAN

PREPARED BY: M. D. Bowman — Date: 6/15/88
TVA
Electrical Engineer

W. H. Nelson — Date: 6/15/88
TVA
Electrical Engineer
Technical Specialist

REVIEWED BY: J. D. Hutson — Date: 6/16/88
TVA
Assistant Chief
Electrical Engineer

M. R. Sedlacik — Date: 6-17-88
TVA
SQN Lead Electrical Engineer

C. Concordia — * Date: 6/16/88
Private Consultant

J. V. Pospisil — * Date: 6/16/88
NEI Peebles, Inc.
Manager of Engineering

* - Per telecon on 6/16/88 with J. D. Hutson.

APPROVED BY: W. S. Raughley — Date: 6/16/88
TVA
Chief Electrical Engineer

J. B. Hosmer — Date: 6/17/88
TVA
SQN Project Engineer

SEQUOYAH NUCLEAR PLANT

DIESEL GENERATOR VOLTAGE RESPONSE IMPROVEMENT PLAN

I. PURPOSE

The purpose of this report is to document the acceptability of the voltage response improvement plan for the Sequoyah Nuclear Plant (SQN) emergency diesel generators (DG). This report fulfills TVA's commitment to evaluate various ways of improving the DG transient-voltage response.

II. BACKGROUND

On February 29, 1988, TVA provided NRC with the SQN Diesel Generator Evaluation Report (DGER) in reference 2. This report documented that the SQN safety-related systems/components would perform their intended safety function when powered by the DGs with acceptable margin. Charles Concordia, a recognized industry expert retained by TVA to review this report, mentioned several factors that could be considered to improve the transient-voltage performance of the DGs. TVA subsequently committed to review these recommendations to determine the optimum improvement.

III. EVALUATION OF OPTIONS

TVA has conducted an extensive evaluation of several DG improvement options. The options considered for evaluation included those previously mentioned by Mr. Concordia in reference 2 as well as other options that were recognized as having a high possibility of improving the DG voltage response after further review of the existing DG test data. The evaluation was performed by TVA engineers along with Mr. Concordia and SQN's generator vendor, NEI Peebles - Electric Products, Inc. Each of the selected options was evaluated to determine the expected effect on exciter performance, system-voltage response, and DG reliability.

IV. OPTIMUM IMPROVEMENT

The following options have been selected as the optimum improvement.

1. Optimize the load current compounding of the existing exciter by resetting the exciter-current transformer taps such that the current transformer contribution to field current is increased to achieve flat compounding.

2. Replace the existing pneumatic-load-sequence timers with more accurate electronic timers as previously planned.

3. Install a voltage overshoot-reduction device on the existing exciter. This device will consist of silicon-controlled rectifiers (SCR) placed across each phase of the exciter's bridge rectifier which are triggered by an electronic circuit when it senses an overvoltage condition beyond a preset value.

V. EXPECTED RESULTS

Option 1 will improve the inherent voltage regulation of the excitation system, thereby reducing the amount of required voltage regulator action. This will result in less transient voltage dip and better overall performance of the excitation system, and it is expected to reduce transient-voltage overshoot.

Option 2 will increase the accuracy and repeatability of the DG load sequence. This will enhance the diesel generator voltage response by increasing the starting time bandwidth for those loads whose starting time interval is less than that predicted. This enhancement will allow more time for voltage recovery in the load sequence time intervals.

Option 3 will instantly remove the exciter field-forcing voltage during excessive transient-voltage overshoot conditions. This will significantly reduce the amount of transient-voltage overshoot.

VI. CONCLUSION

Options 1, 2, and 3 have been selected as the optimum improvement with respect to DG voltage response. A qualitative evaluation of these options has shown that they will improve the voltage response. However, further testing of the DG system is necessary in order to quantify the amount of improvement related to each option.

Initially, option 1 and 2 will be performed on one DG unit followed by the performance of the appropriate postmodification test (PMT) to ascertain the amount of voltage response improvement. An evaluation of the results from options 1 and 2 will be performed. If further improvement is desired, option 3 will also be performed on the same unit and the amount of additional improvement determined using another PMT. Upon completion of this effort, implementation of the appropriate options will be performed on the remaining diesel generators by the end of the unit 1 cycle 4 outage.

ENCLOSURE 2

COMMITMENT LIST

1. TVA will perform the following modifications to enhance the DG transient-voltage response for one SQN DG:

   a. Reset the exciter-current transformer taps to achieve flat compounding and,

   b. Replace the existing pneumatic-load-sequence timers with more accurate electronic timers.

2. Upon completion of item 1 above, TVA will perform a PMT on the affected DG and evaluate the results to determine if the improvement in the DG transient-voltage response is acceptable.

3. If the evaluation from item 2 above is found to be unacceptable, TVA will install a voltage-overshoot-reduction device on the existing DG exciter in which item 1 above was implemented.

4. TVA will perform another PMT on the DG affected by item 3 above, evaluate the results, and determine if the transient-voltage response improvement is acceptable.

5. TVA will implement the modifications (i.e., either item 1 or 3 above) that provide an acceptable improvement in the transient-voltage response on the three remaining SQN DGs.

6. TVA will perform the associated PMTs upon completion of item 5 above on the three remaining DGs, evaluate the results, and determine if the transient-voltage response for these DGs is acceptable.

7. TVA will provide NRC with the evaluation and test results of the PMTs which provide acceptable improvement in the four SQN DG transient-voltage responses.