TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

August 28, 1981

SQRD-50-328/81-39

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 PLANT UNIT 2 - SI ACTUATED SIMULTANEOUS MOTOR STARTING - SQRD-50-328/81-39 - REVISED FINAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector R. V. Crlenjak on May 5, 1981 in accordance with 10 CFR 50.55(e) as NCR SQN EEB 8116. An interim report was submitted on June 4, 1981. Our final report was submitted on June 15, 1981. Enclosed is our revised final report as discussed with Inspector R. V. Crlenjak on August 5 and August 17, 1981.

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, 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

IE27
S/1

ENCLOSURE

SEQUOYAH NUCLEAR PLANT UNIT 2
SI ACTUATED SIMULTANEOUS MOTOR STARTING
SQRD-50-328/81-39
10 CFR 50.55(e)
REVISED FINAL REPORT

Description of Deficiency

During our review of preoperational test results, it was discovered that for a safety injection actuation with offsite power available a simultaneous start signal is sent to the residual heat removal pump, safety injection pump, containment spray pump, centrifugal charging pump, ERCW pump, auxiliary feedwater pump, component cooling system pump, and several valve operators.* During the time the medium-voltage pumps are accelerating, the voltage at the terminals of the unit 2, 350 horsepower component cooling system pumps could be as low as 354 volts or 77 percent of rated voltage. The revised report is being provided because final design verification studies had not taken into account the simultaneous start of the medium and low voltage SI actuation motors. (In previous studies, medium- and low-voltage motor starting was considered separately.)

Safety Implications

These motors are only rated to start at rated voltage. The acceleration times for the medium-voltage motors during their simultaneous starting (98 percent rated voltage) were approximated at two to five seconds. During this time, some of the unit 2 low-voltage motors (i.e. component cooling system pump motors) could trip because of overcurrent and become unavailable for providing their safety function. Usually, during normal operation three of the plant's five component cooling system pumps are running. Should an SI occur, only one pump maximum per unit plus the swing pump would be required to start at the same time. Also, should a CCS pump fail to start, it could depress the voltage on the system supplying it so that other safety-related motors could not start.

Corrective Action

The vendors of the CCS pump motors have furnished TVA with documentation that the motors will start and accelerate their load with 75 percent of rated voltage at the motor terminals. In order to verify this, TVA also tested CCS pump motor 2A-A fed from 480V shutdown board 2A1-A.

This test was performed by connecting the diesel generator (2A-A) to 6.9-kV shutdown board 2A-A. The diesel generator was adjusted to produce 430 volts on 480V shutdown board 2A1-A. With no other loads connected to that

*The starting of the ERCW and auxiliary feedwater pumps have been added to the "description of deficiency" as they were left out previously but had been included in our calculations.

board, CCS pump motor 2A-A was started. The voltage at the motor dipped to approximately 67 percent of rated but recovered to approximately 73 percent after the exciter brought the generator voltage back to its value of approximately 6100 volts. The 480V board voltage completely recovered in approximately two seconds, and the pump was delivering full load within five seconds. As a result of this test, the documentation supplied by the vendor is verified.

In order to determine the effects of a possible overcurrent trip, The undervoltage trip setting of the motor's feeder breaker was reviewed. The undervoltage relay is set so that the motor will remain connected to the bus during the depressed voltage caused by simultaneous motor starting and then accelerate when adequate starting voltage is restored (After the 6.6-kV safety motors have accelerated).

TVA has also completed its analysis of other 460-volt motors that may be actuated by a SI signal or by process control. There are no other motors powered directly from the Class IE 480-volt switchgear that would be started simultaneously with the 6600-volt motors named in the description of deficiency. There are several valve operators and other motors powered from Class IE 480-volt motor control centers that are started on SI signal. However, the overload heaters for these valve operators and other motors were tested during construction. It was shown that valve operators would not trip on locked-rotor current in less than 16 seconds, and that the other motors would not trip on six times full-load current in less than 12 seconds (Construction Inspection Test No. 17, Revision 3). Therefore, these motors and valve operators will remain connected to the bus during the depressed voltage caused by simultaneous motor starting and then accelerate when adequate starting voltage is restored.

From the results of the unit 2 integrated emergency safeguard actuation test (TVA W6.1F), it has been determined that the medium voltage motor will depress the voltage for four seconds. At that time the CCS pumps will have adequate voltage and will accelerate within two seconds.

The depressed voltage caused by simultaneous motor starting will have a duration of less than 10 seconds. As the medium-voltage motors reach normal running speed and consequently draw less current, the voltage at the 460-volt motor terminals will become adequate for starting. Therefore, the 460-volt motors will start within the same time allowed for a transfer to onsite power and will meet the safety response time. TVA concludes that no repair or physical rework is required.

Because of this deficiency, TVA has modified our design verification methods to include, where applicable, the simultaneous starting of medium- and low-voltage motors. If other TVA plants are affected by this deficiency, the problems will be identified in scheduled design review studies.