400 Chestnut Street Tower II

May 28, 1981

SQRD-50-328/81-36

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 - MOTORS RATED 440 VOLTS ON A 480-VOLT SYSTEM - SQRD-50-328/81-36 - FIRST INTERIM REPORT

The subject deficiency was initially reported to NRC-OIE Inspector R. V. Crlenjak on April 27, 1981 in accordance with 10 CFR 50.55(e) as NCR SQN EEB 8111. Enclosed is our first interim report. We expect to submit our next report by August 26, 1981. The enclosure contains justifications for operations of Sequoyah unit 2 before correcting this NCR.

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

B019
s
1/1

ENCLOSURE
SEQUOYAH NUCLEAR PLANT UNIT 2
MOTORS RATED 440 VOLTS ON A 480-VOLT SYSTEM
SQRD-50-328/81-36
10 CFR 50.55(e)
FIRST INTERIM REPORT

Description of Deficiency

There are six motors in unit 2 that have a nameplate voltage rating of 440 volts ac and are supplied from the 480-volt ac Class IE auxiliary power system of units 1 and 2. NEMA MG1-12.43, 1967, requires that induction motors must be capable of operating under the steady-state running conditions with a voltage variation of plus or minus 10 percent at rated frequency. The maximum voltage these motors can withstand is 484 volts. This contrasts with 506 volts that a motor rated 460 volts can withstand. TVA design allows a maximum voltage of 506 volts at the motor terminals which is 15 percent above rated voltage for those motors rated 440 volts. This discrepancy was discovered in the preparation of the field nameplate verification list on the 480-volt shutdown board load. This deficiency also exists at Watts Bar Nuclear Plant and is documented as nonconformance report WBN EEB 8104. The following are the affected motors at Sequoyah unit 2.

(1) Component Cooling System Pumps 2A-A and 2B-B to C-S Inlet Isolation Valve (2-FCV-70-78)

(2) Component Cooling System Pumps 2A-A and 2B-B to C-S Inlet Isolation Valve (2-FCV-70-76)

(3) Diesel Generator 2A-A Engine 2A1 Lube Oil Circulation Pump Motor

(4) Diesel Generator 2A-A Engine 2A2 Lube Oil Circulation Pump Motor

(5) Diesel Generator 2B-B Engine 2B1 Lube Oil Circulation Pump Motor

(6) Diesel Generator 2B-B Engine 2B2 Lube Oil Circulation Pump Motor

Interim Progress

TVA is in the process of contacting the vendors of the six affected motors to determine if the motors are actually rated 460 volts ac or if the motors can withstand a normal operating voltage of the 460 volts plus 10 percent, or 506 volts. If the former is correct, the vendor will be requested to supply new nameplates indicating the correct rating. If the latter is true, the vendor will be requested to submit documentation supporting their judgement. If both are false, new motors rated 460 volts will be required and placed in operation at the earliest possible opportunity.

Interim Justification for Operation

The maximum voltage available at the motor terminals from the 480-volt ac, Class IE auxiliary power system is 460 volts plus 10 percent, or 506 volts ac, which is in excess of 110 percent of 440 volts. If the motors are repeatedly and continuously exposed to terminal voltages in excess of 110 percent of their rated values, the motors may suffer some loss of life over an extended period of time. This loss of life could be attributed to two conditions that would be present:

1. The available locked rotor current would increase but would be accompanied by a corresponding decrease in the accelerating time characteristic of the motor.

2. There may be a very slight rise in the total temperature of the motor. Although a decrease of approximately 4 degrees C could result due to a decrease in the full load amperes at 115 percent rated voltage, an increase in the core losses may offset the decrease. The core losses would increase due to an increase in the total flux.

Loss of life depends upon several factors such as how often the motors are started and how long the motors remain under locked rotor conditions. The core losses are predominantly a function of the reluctance of both the core and the air gap and the total flux. The reluctance of the iron core is usually disregarded due to its relatively small magnitude in comparison with the reluctance of the air gap. Therefore, what increase occurs in the iron core losses may offset the temperature decrease cited in No. 2.

In any case, whether the loss of life is realized due to condition No. 1 or 2, the destructive mechanism would be a loss of mechanical durability and dielectric strength of the motor insulation system. The total failure of the insulation system would result in a surge of current, the magnitude of which should trip the motor circuit breaker. If the motor breaker failed to open, the feeder breaker to the board would be required to trip. This would constitute a failure in that train.

Simultaneous failure of "identical" motors subjected to identical operating conditions is very unlikely. The destructive mechanism discussed above works on the "weak link" of the motor insulation system. It is not probable that this vulnerability will occur in the same location and to the same degree in each motor. As a result, the destructive mechanism will act upon the vulnerable areas of different motors at a different rate, thereby making the probability of simultaneous failure of these motors quite small.

An additional operating characteristic is that the motor will develop 132 percent of motor-rated torque when subjected to 115 percent motor-rated voltage.

This situation should not affect the ability of the plant to operate safely. The four lube oil circulation pump motors are not required either for start up or operation of the diesel generators. The one-horsepower motors are required solely to circulate lube oil and maintain minimum lube oil temperature when the diesels are not operating. Failure of these motors would result in a low lube oil temperature indication in the MCR. Because an individual lubricating oil system is provided for each diesel generator, a failure of this nature in one lubricating oil system will not jeopardize the operation of the other diesel engines.

Loss of life in the component cooling system pumps isolation valves is also nonsignificant in terms of safety. These motors are periodically inspected, tested, and serviced. Any damage which might be detected during these inspections would be dealt with in such a manner as to ensure operation of the motors. The continued schedule of maintenance considered in light of the low probability of failure of the insulation system coupled with the redundant (trained) nature of these motors represents a justification for operation of unit 2 at Sequoyah until such time as the alternatives listed in "Interim Progress" above can be exercised.