

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Sequoyah, Unit 1 DOCKET NUMBER (2) 0 5 0 0 0 3 2 7 1 OF 0 4 PAGE (3)

"Diesel Generator Voltage Low When Output Breaker Closes Because Of A Component Defect Found During Surveillance Testing And A Design Deficiency Outside Of Plant's Design Basis"

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)											
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		DOCKET NUMBER(S)									
1	0	2	1	8	7	8	7	0	7	0	0	1	0	2	0	1	8	8	Sequoyah, Unit 2	0 5 0 0 0 3 2 8
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OPERATING MODE (9) 5
 POWER LEVEL (10) 0 0 0
 THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50. (Check one or more of the following): (11)
 20.402(b) 20.406(c) 50.73(a)(2)(iv) 73.71(b)
 20.405(a)(1)(i) 50.38(e)(1) 50.73(a)(2)(v) 73.71(c)
 20.405(a)(1)(ii) 50.38(e)(2) 50.73(a)(2)(vi) XX OTHER (Specify in Abstract below and in Text, NRC Form 366A)
 20.405(a)(1)(iii) 50.73(a)(2)(i) 50.73(a)(2)(vii)(A)
 20.405(a)(1)(iv) XX 50.73(a)(2)(vii)(B)
 20.405(a)(1)(v) 50.73(a)(2)(iii) 50.73(a)(2)(ix)
 10 CFR Part 21

LICENSEE CONTACT FOR THIS LER (12)
 NAME: J. L. Long, Plant Operations Review Staff
 TELEPHONE NUMBER: 61 5 8 7 0 - 7 2 5 4
 AREA CODE: 61 5 8

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs

SUPPLEMENTAL REPORT EXPECTED (14) YES (If yes, complete EXPECTED SUBMISSION DATE) XX NO
 EXPECTED SUBMISSION DATE (15) MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)

This report is being submitted under 10 CFR 21 and 10 CFR 50.73, paragraph a.2.ii, as a condition allowed outside the plant's design basis. On October 21, 1987, at 1100 EST with both units 1 and 2 in mode 5 (cold shutdown), it was discovered, while troubleshooting a voltage regulator problem on emergency Diesel Generator (D/G) 2A-A, that a voltage regulating diode was incorrectly installed. During the performance of Special Test Instruction (STI)-77, "Loss of Offsite Power With Safety Injection - D/G 2A-A Containment Isolation Test," D/G 2A-A, came up to speed, and the circuit breaker that connects the D/G to the 6,900 volt shutdown board closed with the D/G terminal voltage at approximately 5,200 volts. The cause of the slow development of voltage was a diode installed with its polarity reversed, and the D/G output breaker closing permissive having a relay tolerance allowing voltage to be less than minimum design voltage. The root cause of not detecting this condition during previous testing was determined to be the lack of adequate post modification test procedures to identify voltage regulator deficiencies. The voltage regulator with the reversed diode was installed on November 8, 1986, following troubleshooting for voltage swing problems. The post maintenance test did not detect the reversed diode at that time. The defective voltage regulator with the reversed diode has been repaired, the D/G governor actuators were adjusted to temporarily prevent the low voltage condition, and STI-77 has been performed with acceptable results. The voltage regulators for the remaining D/Gs and a spare in stores were inspected, and all were found with correctly installed diodes. Post modification test procedures will be issued within 30 days of unit 2 restart (mode 2) for voltage regulator maintenance. Calculations will be performed to determine minimum voltage requirements and adjustable relays with greater accuracy will be installed to permanently precluded low voltage conditions.

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TEXT (if more space is required, use additional NRC Form 368A's) (17)

This revision is being submitted to provide the current status of the root cause investigation on the 2A-A diesel generator (D/G) slow voltage response and to provide additional corrective actions.

DESCRIPTION OF CONDITION

On October 20 through 23, 1987, the 2A-A D/G was removed from service for testing in accordance with Special Test Instruction (STI)-77. On October 21, 1987, at 1100 EST with both units 1 and 2 in mode 5 (cold shutdown), it was discovered while troubleshooting a voltage regulator problem on emergency D/G 2A-A (EIIS Code EK) that a voltage regulating diode was incorrectly installed. Troubleshooting was initiated because, during the performance of STI-77, D/G 2A-A came up to speed, and the circuit breaker that connects the D/G to the 6,900 volt shutdown board (EIIS Code EB) closed with the D/G terminal voltage at approximately 5,200 volts.

Investigation into the cause of the slow voltage rise revealed that a zener diode in the voltage regulator was installed with the polarity reversed. However, after correcting the diode problem, slow development of voltage still existed with respect to breaker closure time. This resulted in an investigation of the relays (relays "AX" and "CX") which comprise part of the D/G output breaker closing permissive when adequate D/G output voltage is available. The governor actuators were then adjusted, and STI-77 was reperformed. Test results were satisfactory, and 2A-A D/G was returned to service. The other D/G units have the same type of relay and have been tested to ensure a similar low voltage condition does not exist at the time of their output breaker closure.

The voltage regulator with the reversed diode was manufactured by Basler Electric Company (Model No. 32101-102) and was installed on November 8, 1986, following troubleshooting for voltage swing problems. The voltage regulators for the remaining D/Gs were inspected, and all were found with correctly installed diodes. Additionally, a spare voltage regulator in stores was inspected and found to be correct.

A 10 CFR 21 report was approved by the Manager of Division of Nuclear Licensing and Regulatory Affairs on November 18, 1987, and notification was made by R. H. Shell, Manager, Regulatory Affairs, to J. Brady, NRC Region II, the same day. This report satisfies the requirements of 10 CFR Part 21 with the exception of subpart (vi) regarding the number and location of such components in use.

No operator action was required as a result of this finding since both 'B' train D/Gs were operable at the time of discovery as required by technical specifications (TSs). The D/Gs provide emergency power to equipment that is common to both units in addition to the unit equipment for which the D/G is designated.

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TEXT (If more space is required, use additional NRC Form 386A's) (17)

CAUSE OF EVENT

Although the reversed diode in the 2A-A D/G contributed to the low voltage condition at the time of breaker closure by impeding the voltage buildup, it is not considered the major contributor to the low voltage condition. The "AX" and "CX" relays in the D/G output breaker closing permissive circuit are the root cause of the low voltage condition.

The cause of the D/G voltage permissive relays allowing the D/G output breaker to close with less than the minimum design voltage is an inadequate relay tolerance of ± 10 percent. The original design required that the relay permit breaker to close at 80 percent nominal voltage; however, the relay would allow the breaker to close at 70 percent voltage.

The root cause of not detecting this during previous testing was determined to be the lack of adequate guidelines for writing test procedures to ensure the requirements are satisfied. Previously performed test procedures did not consider the D/G output voltage at the time the voltage permissive relay is energized; although, the procedures did test voltage at breaker closure time. Since series contacts must close, one for speed and one for voltage, to energize the closing coil of the D/G output breaker, the terminal voltage at time (t)=0 is also a function of governor response time (i.e., a slower governor response time will allow voltage to build up as the breaker permissive awaits the speed contact to close).

ANALYSIS OF EVENT

This event is reportable under 10 CFR 21 as a defect that could have created a substantial safety hazard assuming a single failure and under 10 CFR 50.73, paragraph a.2.ii.B, as a condition outside the design basis of the plant.

The D/Gs are the Class 1E power source for backup emergency power for safe shutdown. Based on the FSAR Section 8.3, when the D/G has reached a speed of 850 RPM and a voltage of 80 percent of nominal, the D/G is automatically connected to the 6,900 volt shutdown board. The majority of equipment that would be powered by the D/Gs during a loss of offsite power is qualified to start at a minimum of 80 percent of nameplate rating. The test showed that the voltage level was below that of 80 percent of nameplate level, but all motors started, accelerated, and ran. However, there is no assurance that the motors will consistently start at less than their qualified voltage level.

To determine D/G operability, the Surveillance Requirements (SRs) of TSs 4.8.1.1.1 and 4.8.1.1.2 are used. These SRs are implemented through the performance of Surveillance Instruction (SI)-26.2A, "Loss of Offsite Power With Safety Injection - D/G 2A-A Containment Isolation Test," performed every 18 months and SI-7.2A, "Electrical Power System: Diesel Generators," performed monthly. The special test conducted via STI-77 was to aid in the determination of compliance with Regulatory Guide 1.9, revision 0.

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TEXT (If more space is required, use additional NRC Form 306A's) (17)

CORRECTIVE ACTION

The defective voltage regulator with the reversed diode was repaired, the governor actuators were adjusted to preclude the low voltage condition, and then STI-77 was completed. Standard Practice SQM-66, "Post Maintenance Testing," was revised on December 16, 1987, to ensure testing requirements will be evaluated on any voltage regulator work on an individual case basis until the appropriate post maintenance tests are in place.

To correct the root cause and to prevent recurrence of the low D/G terminal voltages, calculations will be made to determine the actual minimum required voltage relay setpoint for "AX" and "CX" relays. Once determined, new voltage relays, with adjustable setpoints and greater accuracy, will be procured and installed in all D/G output breaker close permissive circuits. A schedule for implementation will be provided with the Sequoyah RG 1.9 compliance submittal before unit 2 restart (mode 2).

To correct inadequate post maintenance testing following voltage regulator and governor maintenance, guidelines will be issued before unit 2 restart (mode 2). Procedures will subsequently be written in accordance with these guidelines within 30 days following unit 2 restart (mode 2).

The discovery of the reversed diode found in the voltage regulator circuit card was entered in the Office of Nuclear Power Nuclear Experience Review program on December 7, 1987.

ADDITIONAL INFORMATION

The voltage regulator was purchased under TVA Contract No. 78P13-24251 dated March 31, 1987, from Basler Electric Company, Box 269, Route 143, Highland Illinois, 62249. Sequoyah Nuclear Plant is the only licensed TVA facility with Basler Model No. 32101-102 voltage regulators installed.

The D/Gs were supplied by Morrison-Knudsen Company Inc., with Basler voltage regulators.

The D/G governors have Woodward EG-B 13P actuators.

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TENNESSEE VALLEY AUTHORITY

Sequoyah Nuclear Plant
Post Office Box 2000
Soddy-Daisy, Tennessee 37379

February 1, 1988

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 - DOCKET NO.
50-327 - FACILITY OPERATING LICENSE DPR-77 - REPORTABLE OCCURRENCE REPORT
SQRO-50-327/87070 REVISION 1

The enclosed revised licensee event report provides details of an investigation resulting from a diesel generator voltage regulator that had a slowed voltage response during surveillance testing. This event was reported in accordance with 10 CFR 21. It has also been determined to be reportable in accordance with 10 CFR 50.73 (a) (2) ii.

Very truly yours,

TENNESSEE VALLEY AUTHORITY


S. J. Smith
Plant Manager

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