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Robert A. Fenech
Vice President, Sequoyah Nuclear Plant

December 27, 1993

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE DPR-79 - LICENSEE EVENT REPORT (LER) 50-328/93006

The enclosed LER provides details concerning a reactor trip as the result of generator exciter problems. This condition is being reported in accordance with 10 CFR 50.73(a)(2)(iv) as a reactor protection system actuation.

Sincerely,

M L Bellamy for

Robert A. Fenech

Enclosure
cc: See page 2

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NRC Form 366 (5-92) | U.S. NUCLEAR REGULATORY COMMISSION | Approved OMB No. 3150-0104 Expires 5/31/95

LICENSEE EVENT REPORT (LER)

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TITLE (4)
Reactor Trip As The Result of Generator Exciter Problems

EVENT DAY (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 2	0 3	9 3	9 3	0 0 7	0 0	1 2	2 7	9 3		0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following)(11)					
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	XX	50.73(a)(2)(iv)		73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)		50.73(a)(2)(v)		73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)		50.73(a)(2)(vii)		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)(viii)(A)		
		20.405(a)(1)(iv)	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)		
		20.405(a)(1)(v)	50.73(a)(2)(iii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
K. E. Meade, Compliance Licensing	6 1 5 8 4 3 - 7 7 6 6

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	T L	E X C	W 1 2 1	NO					
E	T J	T S	F 0 8 0	NO					

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

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

On December 3, 1993, at 1055 Eastern standard time, with Unit 2 operating at approximately 100 percent rated thermal power, Unit 2 experienced a turbine trip and subsequent reactor trip. Operations personnel observed erratic indications associated with the generator excitation system. Subsequently, a generator stator cooling failure alarm actuated. This circuit starts a 45-second time delay relay that results in a turbine/generator trip. Based on these conditions, the shift operations supervisor decided to manually trip the reactor. However, before manually tripping the reactor, the generator stator cooling failure relay actuated causing the turbine/generator trip and subsequent reactor trip. The root cause of the event was the overexcitation of the generator. The overexcitation was determined to have been caused by multiple grounds in the generator exciter. The Unit 2 exciter has been replaced.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

I. PLANT CONDITIONS

Unit 2 was operating at approximately 100 percent rated thermal power.

II. DESCRIPTION OF EVENT

A. Event

On December 3, 1993, at 1055 Eastern standard time (EST), Unit 2 experienced a turbine trip and subsequent reactor trip from approximately 100 percent rated thermal power. The trip was determined to have been caused by grounds in the generator exciter causing voltage regulation problems.

The event started with main control room annunciations (EIIS System Code IB) associated generator excitation controls (EIIS System Code TL) and shutdown board (EIIS System Code EK) overvoltage conditions. Operations personnel observed erratic indications associated with the generator excitation system. The operators attempted to manually control the generator excitation system to reduce excitation voltage. This attempt achieved no response. Subsequently, a generator stator cooling (EIIS System Code TJ) failure alarm actuated. This circuit starts a 45-second time delay relay that results in a turbine/generator trip if the conditions that actuate the relay do not reset. Based on these conditions, the shift operations supervisor and the assistant shift operations supervisor discussed and agreed to manually trip the reactor. However, before manually tripping the reactor, the generator stator cooling failure relay actuated, causing the turbine/generator trip and subsequent reactor trip. The entire event from the first annunciation alarm until the turbine/generator trip lasted less than three minutes.

Operations personnel entered the appropriate emergency instructions. The unit was stabilized in mode 3 (hot standby).

B. Inoperable Structures, Components, or Systems That Contributed to the Event

None.

C. Dates and Approximate Times of Major Occurrences

The date for all the subsequent information is December 3, 1993 The times are listed in hours, minutes, and seconds.

10:52:34 EST — The excitation rectifier power loss/loss of pulse annunciator returned to normal. This was unusual because the alarm had been lit for several days as the result of a known annunciation problem with the voltage regulator and no work was being performed on the circuit.

10:53:25 EST	The excitation rectifier power loss/loss of pulse annunciator alarmed and remained annunciated.
10:53:30 EST	The 6.9 kilovolt shutdown board overvoltage alarm was received from both Unit 2 shutdown boards.
10:54:02 EST	The generator exciter field overcurrent alarm annunciated. This alarm is generated from an overexcitation condition.
10:54:03 EST	The generator volts/hertz alarm annunciated. This indicates that generator voltage is 107 percent of normal voltage.
10:54:40 EST	The generator stator cooling system failure alarm annunciated. This alarm is generated from either high cooling water temperature at the discharge of the stator or low differential pressure across the stator.
10:55:23 EST	A generator cooling failure turbine trip occurred.
10:55:23 EST	A reactor trip occurred as the result of the turbine trip.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

The main control room alarms alerted the operators to the condition.

F. Operator Actions

Operations personnel attempted to manually reduce excitation voltage as the result of plant conditions. This action produced no results.

Once the reactor trip occurred, Operations personnel entered the appropriate emergency instructions and stabilized the unit in Mode 3.

G. Safety System Response

All safety systems responded as required during this event.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

III. CAUSE OF EVENT

A. Immediate Cause

The immediate cause of this event was the generator cooling system failure that caused the turbine trip. The generator cooling system failure circuit actuated as the result of high temperature sensed by the temperature switch at the discharge of the stator cooling water system. However, there is no indication that stator water temperature ever reached the temperature switch actuation setpoint (90 degrees Celsius/194 degrees Fahrenheit). Data points from the plant computer and a calculation from Westinghouse Electric Company indicate the highest stator cooling water discharge temperature was approximately 160 degrees F. The most plausible cause of the temperature switch actuation was the setpoint for the switch had drifted low since the original calibration. This lower setpoint in combination with the sudden rate of rise from the overexcitation resulted in premature actuation of the temperature switch.

Root Cause

The root cause of the event was the overexcitation of the generator. The overexcitation was determined to have been caused by multiple grounds in the generator exciter. Missing insulation in the exciter was determined to be the most probable cause of the grounds. The multiple grounds in the exciter initiated the voltage regulation problems that were a precursor to the event. This condition also created the rise in stator cooling temperature that actuated the subject temperature switch.

IV. ANALYSIS OF EVENT

An evaluation of the overvoltage condition was performed by Nuclear Engineering to ensure the overvoltage condition that existed before the turbine/generator trip did not damage plant equipment. The review concluded the overvoltage condition peaked at approximately 107 percent of normal generator voltage. Engineering personnel evaluated the effect of the overvoltage on both safety- and quality-related components. This evaluation entailed a review of design requirements as well as field observation for potential overvoltage degradation. The evaluation concluded that no overvoltage damage occurred as a result of the subject condition. The review further concluded that all parameters remained within the generator capability curve.

The plant response to the reactor trip was consistent with responses described in the Final Safety Analysis Report. There were no major anomalies associated with any primary or secondary side parameters. Operator response to the transient was consistent with Operations training practices.

Therefore, there was no danger to the health and safety of the public as a result of this event.

V. CORRECTIVE ACTION

A. Immediate Corrective Action

A team of specialists from TVA and Westinghouse performed a comprehensive review of the generator excitation system in order to determine the cause of the overexcitation condition. This review discovered multiple grounds in the generator exciter.

B. Corrective Action to Prevent Recurrence

The Unit 2 exciter has been replaced with the exciter from Unit 1 (Unit 1 is in a refueling outage). The Unit 2 exciter has been shipped offsite in order to perform a complete refurbishment.

The stator cooling water temperature switch that initiated the turbine/generator trip has been replaced with a new switch. In order to enhance the performance of the subject switch, an evaluation is being performed to determine the proper calibration frequency for the switch.

VI. ADDITIONAL INFORMATION

A. Failed Components

The generator exciter had multiple grounds. The stator cooling water temperature switch was out of calibration.

B. Previous Similar Events

A review of previous similar events identified one previous LER on Unit 2 that involved a reactor trip as the result of overexcitation problems. LER 50-328/93001 involved a reactor trip as the result of a steam leak on the voltage regulator. This caused an overvoltage condition to exist on the main generator. Subsequent maintenance did not identify the grounds in the generator exciter.

VII. COMMITMENTS

None.