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R.J. Adney
Site Vice President
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February 8, 1996

U.S. Nuclear Regulatory Commission
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Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT (SQN) UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE DPR-79 - LICENSEE EVENT REPORT (LER) 50-328/92008, REVISION 1

The subject LER is being revised to provide root cause failure analysis information. This report was originally submitted in accordance with 10 CFR 50.73(a)(2)(iv) as an automatic actuation of engineered safety features, including the reactor protection system.

Revisions to the LER are identified by vertical bars in the right-hand margin.

Sincerely,

R. J. Adney

Enclosure
cc: See page 2

130101

IE22
1/1

Enclosure
cc (Enclosure):

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Sequoyah Nuclear Plant (SQN), Unit 2	05000328	1 of 5

TITLE (4) Reactor Trip as a Result of One Protection Channel (RTD Loop) Being in the Tripped Condition When an RTD Loop in Another Channel Failed, Completing the Two-Out-Of-Four Logic.

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 NAME	DOCKET NUMBER
06	27	92	92	008	01	02	08	96	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.402(b)		20.405(c)	X	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
	20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A		(Specify in Abstract below and in Text, NRC Form 366A)
	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 (Include Area Code)
J. Bajraszewski, Compliance Licensing Engineer	(423)843-7749

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	68	PEN	W120	N						

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 15 single-spaced typewritten lines) (16)

This LER is being revised to provide root cause failure analysis information. On June 27, 1992, at approximately 1053 Eastern daylight time, with Unit 2 in power operation at approximately 100 percent, the reactor tripped because of coincident logic (two out of four channels) of over temperature, differential temperature reactor protection. The coincident logic was developed when a reactor coolant system resistance temperature device (RTD) on Loop 3 went into a failed condition while a Loop 1 RTD was out of service (the channel was in trip), because of spurious alarms and indications. Investigations identified a varying resistance condition existed in the electrical penetrations through the containment vessel associated with the two RTD channels. It was determined that this condition has been experienced with Sequoyah canister-type electrical penetrations attached to low-voltage cables in RTD applications. In the process of troubleshooting the Loop 3 RTD failure, the resistance condition cleared. The problem RTDs were removed from scan (no longer part of the protection scheme), and a current was passed through the associated penetration leads, correcting the varying resistance condition. The RTDs were verified to be operating properly and were returned to service. A root cause failure analysis determined that the most probable cause of varying resistance readings is substandard workmanship (poor crimping practices resulted in some conductors displaying poor electrical continuity).

I. PLANT CONDITIONS

Unit 2 was in power operation at approximately 100 percent.

II. DESCRIPTION OF EVENT

A. Event

On June 27, 1992, at approximately 1053 Eastern daylight time (EDT), a reactor tripped because of coincident logic (two out of four channels) of over temperature, differential temperature (OT/delta-T) reactor protection (EIIS Code JE). The coincident logic was developed when a reactor coolant system (EIIS Code JE) Loop cold leg resistance temperature device (RTD) (EIIS Code JE) went into a failed condition while a Loop 1 hot leg RTD was out of service with the channel in trip.

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

A Loop 1, hot leg RTD was removed from service (the Loop 1 delta-T/average temperature [T_{avg}] channel was placed in the trip condition) before the event because of spurious alarms and indications. Instrument mechanics had completed troubleshooting the RTD and found that one of the four RTD wires had a high resistance at the electrical penetration. They were in the process of preparing the work documents necessary to return the loop to service with the RTD out of scan (no longer part of the protection scheme) when the Loop 3 RTD failure occurred. The removal of one hot leg and one cold leg narrow-range RTD from scan is allowed because of RTD redundancy; each loop contains three hot leg and two cold leg narrow-range RTDs.

C. Dates and Approximate Times of Major Occurrences

June 27, 1992 at 0225 EDT	A delta-T deviation alarm was annunciated on the main control room panels.
June 27, 1992 at 0336 EDT	The Loop 1 delta-T/T_{avg} channel was declared inoperable and Limiting Conditions for Operation (LCOs) 3.3.1 and 3.3.2 were entered. The Loop 1 delta-T/T_{avg} protection bistables were tripped when the loop was removed from service.
June 27, 1992 at approximately 0800 EDT	Instrument mechanics began troubleshooting the Loop 1 hot leg RTD.
June 27, 1992 at 1053 EDT	The Loop 3 cold leg RTD failed low, and the reactor tripped. LCO 3.0.3 was entered because auxiliary feedwater start (LCO 3.3.2) required three delta-T/T_{avg} channels to be operable.

June 27, 1992 at 1315 EDT — LCO 3.0.3 was exited when Loop 1 delta T/T_{avg} was returned to normal.

D. Other Systems or Secondary Functions Affected

Early in the event, the operators realized that T_{avg} was increasing and steam dumps were not responding. They quickly determined that the failed T_{avg} channels had caused the steam dump logic to operate as though the system was less that 540 degrees Fahrenheit. They immediately went to "Steam Dump Interlock" bypass position on the steam dump controls and reinstated the three cooldown dump valves to recover T_{avg} control.

E. Method of Discovery

The reactor trip was annunciated on the main control room panels.

F. Operator Actions

Control room personnel responded as prescribed by emergency procedures. They promptly diagnosed the plant condition and took actions necessary to stabilize the unit in a safe condition and maintained the unit in the hot standby condition (Mode 3).

G. Safety System Responses

Safety systems performed as expected. The steam generator pressure before the reactor trip was constant at approximately 847 pounds per square inch gauge (psig). After the trip, steam generator pressure went to 1,020 psig and then decreased to 948 psig. Pressure returned to 1,020 psig as a result of steam dump isolation on the failed T_{avg} channels. When the steam dumps were placed back in service, pressure returned to the no-load setpoint. Technical specification and Final Safety Analysis Report (FSAR) requirements were not challenged.

III. CAUSE OF EVENT

A. Immediate Cause

The immediate cause of the event was coincident logic (two out of four channels) for Loop 1 and Loop 3 of OT/delta-T protection.

B. Root Cause

The root cause of the event has been determined to be varying resistance of RTD (connections in) electrical penetrations through the containment vessel. The investigation disclosed that this condition has been experienced with Sequoyah canister-type electrical penetrations attached to low-

voltage cables in RTD applications. Investigation indicated that both units have experienced problems of this type. Low-voltage modular-type penetrations and control and power canister-type penetrations have not exhibited the condition. During the Unit 2 Cycle 6 refueling outage, a canister-type electrical penetration with known high resistance conductors was removed from service for destructive inspection by an independent laboratory. The inspection evaluated twelve conductors out of more than 300 conductors associated with the one-penetration assembly. Two of the twelve conductors were found to have high resistance readings. Based on this evaluation, it was concluded that the most probable cause of varying resistance readings is substandard workmanship (poor crimping practices of electrical conductors during the manufacturing of the penetration assembly). Poor crimping practices resulted in some conductors displaying poor electrical continuity. The observed workmanship was the result of the canister penetration design in that control stop crimping tools could not be used in the confined space of the canister. To compensate for this condition, each assembly received thorough postfabrication testing, and spare conductors were incorporated in the penetrations.

C. Contributing Factors

None.

IV. ANALYSIS OF EVENT

Plant response during and after the reactor trip was consistent with responses described in the FSAR and, accordingly, the event did not adversely affect the health and safety of the public.

V. CORRECTIVE ACTIONS

A. Immediate Corrective Action

Control room personnel responded as prescribed by emergency procedures. They promptly diagnosed the plant condition and took actions necessary to stabilize the unit in a safe condition.

The subject RTDs were removed from scan and the associated channels returned to service. A current was passed through the associated RTD penetration leads, correcting the resistance condition. The RTDs were verified to be operating properly and returned to service.

B. Corrective Action to Prevent Recurrence

A plant instruction has been written to provide guidance for evaluation of delta-T/T_{avg} channel problems. This instruction will allow removal of an RTD from scan without declaring the channel inoperable when the channel problem is not process-induced, not caused by other failures, or when testing is not in progress on that protection set.

A root cause failure analysis was performed on an electrical penetration that had exhibited faulty conductors for determination of the failure mechanism. A review of low-voltage, low-current circuits using canister-type electrical penetrations was completed. The review indicated that many of these circuits are associated with penetrations that have been replaced or are scheduled for replacement. Concurrent with the failure analysis, a replacement schedule was developed for canister-type electrical penetrations that exhibit high resistance and do not contain a sufficient quantity of spare conductors. Replacement of these selected electrical penetrations began with Unit 2 Cycle 6 and Unit 1 Cycle 7 and will continue through Unit 2 Cycle 8 and Unit 1 Cycle 9 refueling outages.

VI. ADDITIONAL INFORMATION

A. Failed Components

Westinghouse canister-type electrical penetration, Model No. WX-32208.

B. Previous Similar Events

A review of previous events identified one LER (50-327/88033, Revision 2) as being similar. In that LER, a reactor trip signal was generated (the unit was in Mode 4 with all rods fully inserted) as the result of the failure of one delta-T/T_{avg} channel while another delta T/T_{avg} channel was in the tripped condition for calibration. The cause of the failure was attributed to the failure of a loop dynamic compensator. This component was not present in the current event; therefore, the previous actions would not have prevented the current event.

VII. COMMITMENTS

None.