NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
McGuire Nuclear Station - Unit 2	0 5 0 0 0 3 7 0	1 OF 5

TITLE (4)
Reactor Trip on Overtemperature-Differential Temperature

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 1	2 4	8 4	8 4	0 3 1	0 0	1 2	2 6	8 4		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (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 (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)
Scott Gewehr - Licensing	7 0 4 3 7 3 - 7 5 8 1

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	J C	I N O D	W 4 2 0						
Y	J C		W 4 2 0						

SUPPLEMENTAL REPORT EXPECTED (14)

		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	NO				

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

On November 24, 1984, Unit 2 tripped from 100 percent power when the failure of a loop power supply (NLP) card in the process control system (PCS) caused a downward spike in one channel of the overtemperature differential temperature (OTDT) setpoint circuit. The trip occurred because a second channel of the OTDT circuit was already in the test (tripped) mode, due to an inoperable instrument. With one channel in the test mode, combined with the spike in another channel, the 2-out-of-4 logic required for a reactor trip signal was satisified. The cause of the failure of the NLP card is suspected to be overheating in the PCS cabinet.

Failures of PCS cards in the past have prompted several corrective actions to be completed and/or initiated. These actions address improved PCS cabinet ventilation and use of heat sinks to avoid overheating, and implementation of programs to improve card reliability.

The intermittant failure Of Power Range (PR) Nuclear Instrumentation (NI) 41, which caused the second channel of the OTDT circuit to be in the test mode, is suspected to be caused by a poor connection in a cable, connector, or detector. The cables, connectors, or detector will be repaired or replaced. The health and safety of the public were not affected.

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INTRODUCTION: On November 24, 1984, the Unit 2 reactor tripped when a two out of four overtemperature ΔT (OTDT) reactor trip signal was generated (where ΔT is the difference in water temperature between the reactor cold leg and hot leg). The OTDT reactor trip signal occurred when channel one OTDT was in its test position and a downward spike occurred in the channel four OTDT setpoint, satisfying the two out of four trip logic. Channel one was in its test position because of earlier problems with power range (PR) nuclear instrumentation (NI) 41. (Placing a channel in its test position puts it in a trip condition.) The channel four OTDT spike is believed to have been caused by pressurizer pressure channel four failing. Pressurizer pressure channel four failed due to a faulty loop power supply card in the 7300 process control system (PCS).

Unit 2 was in Mode 1 at 100% power at the time of the event.

A Component Failure/Malfunction was the cause of the event because the loop power supply card (NLP) for pressurizer pressure channel four failed. A contributing factor to this event was the failure of PR NI 41. The problem with PR NI 41 resulted in placing channel one of OTDT in its trip condition at the time of the event.

EVALUATION: The Unit 2 reactor tripped when a spike occurred on channel four of OTDT setpoint. At the time the channel four OTDT setpoint spike occurred, channel one OTDT was in its test position due to problems with PR NI 41 instrumentation. With two out of four OTDT channels in the tripped condition, a reactor trip signal was generated. The spike on channel four of OTDT is believed to have been caused by pressurizer pressure channel four instrumentation failing in the low direction. The pressurizer pressure instrumentation failed due to a faulty 7300 PCS loop power supply card. The following paragraphs will provide additional information on the OTDT spike, problems with 7300 PCS cards, and the problem with the PR NI 41 instrumentation.

It should be noted that during the post trip review, it was discovered that a setpoint limiting jumper was not installed on the process control lead lag cards for the Unit 2 channel A and D overpower ΔT (OPDT). The OPDT problem is detailed in Licensee Event Report (LER) 50-370/84-30.

Overtemperature ΔT Setpoint Spike

The OTDT setpoint depends on several parameters as shown below:

$$\text{OTDT setpoint} = 61°F\ [1.952 - 0.0133\ (LT)\ (T_{avg} - 588.2°F) + 0.00647\ (P - 2235) - F\ (\Delta I)]$$

where LT = lead lag compensation for piping and circuit delays

P = pressurizer pressure

F(ΔI) = a penalty if a flux tilt exists in the reactor core

$\Delta T = T_h - T_c$, where T_h is water temperature in the hot leg (reactor outlet) and T_c is water temperature in the cold leg (reactor inlet)

A plot of OTDT showed that channel four OTDT dropped downward. Performance and IAE personnel attempted to determine which factor in the OTDT setpoint formula caused the spike in channel four. Data for the following factors was reviewed: ΔT, T_c, T_{ave} (where $T_{ave} = (T_h + T_c)/2$), and the upper and lower level reactor flux. No anomalies occurred in these parameters that could have caused the OTDT spike. Pressurizer pressure data was not available, so by process of elimination this parameter was suspected as the cause of the OTDT spike. If the pressurizer pressure signal momentarily failed low, it would cause the OTDT setpoint to drop. A problem with loop four pressurizer pressure was not apparent after the trip. Less than two days after the trip, the pressurizer pressure channel four failed in the low direction. It is believed that the problem with pressurizer pressure loop four existed at the time of the event, and the channel momentarily failed low to give an OTDT setpoint spike. Two days after the trip, the problem recurred and this time the pressurizer pressure loop remained in a failed condition. (When the pressurizer pressure channel failure occurred the second time, a reactor trip signal was not generated because no other channels were in the test position.)

The pressurizer pressure channel four loop power supply card in the 7300 PCS was found to be faulty, causing this channel to fail low. This card functions to convert a 4-20 MA input signal to 0-10V control and protection signals.

7300 Process Control System Card Failures

Two other reactor trips can be directly attributed to faulty cards in the 7300 PCS. On March 19, 1984 a NLP card failed, causing a Unit 2 reactor trip as detailed in LER 370/84-09. On January 30, 1984 a Unit 1 reactor trip was caused by a lead lag (NLL) card failure as detailed in LER 369/84-02.

IAE personnel have maintained a log of failed 7300 PCS cards since January 1984. A total of 48 card failures are listed in this log between January 30, 1984 and November 24, 1984.

IAE personnel believe a major contributing factor in the card failures is overheating in the 7300 PCS cabinets. In June of 1984, Maintenance personnel rebalanced the air flow in the control room ventilation system to provide additional cooling to the 7300 PCS cabinets. In the five months prior to the air balancing, 35 card failures occurred. In the five months after the air balancing, 13 card failures have occurred. Initial indications are that the improved cooling has increased the 7300 PCS card reliability. When the control room ventilation system has failed in the past, signals from the 7300 PCS have been erratic. An increased rate of erratic signals occurs for over a month after the ventilation is restored. This observation by IAE personnel emphasizes the importance of adequate cooling for 7300 PCS card reliability.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
McGuire Nuclear Station - Unit 2	0 5 0 0 0 3 7 0	8 4	0 3 1	0 0	0 4 OF 5

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

Nuclear Instrumentation Power Range 41 Failure

Unit 2 Has had problems with NI PR 41 since unit start-up. The problem with this instrument loop usually disappear by themselves. IAE personnel believe the problem is a poor connection in a cable, connector, or the detector. The cables, connections, and the detector in this instrument loop will be repaired or replaced during the upcoming Unit 2 refueling outage.

SAFETY ANALYSIS: On November 24, 1984 at approximately 1555, McGuire Unit 2 tripped from 100% power on an overtemperature delta T signal as a noise spike occurred on RPS channel 4 while channel 1 was removed from service. This satisfied the required 2-out-of-4 logic for a reactor trip.

Reactivity was promptly controlled by the reactor trip as the control rods inserted into the core. Pressurizer pressure responded as designed, reaching a minimum value of 2011 psig before recovering. The pressurizer PORV's or code safety valves were not challenged. Pressurizer level control was normal as well; the minimum indicated level during the transient was 23.6%. Letdown was not isolated.

Reactor coolant temperatures responded as designed, converging to the no-load temperature for forced circulation (557F ± 5F) within thirty minutes after the trip.

Steam pressure response was normal. Steam pressure peaked at 1127, 1121, 1130, and 1125 psig in loops A, B, C, and D, respectively. Neither the SG PORV's, atmospheric dump valves, nor main steam safety valves lifted during this transient, as pressure was controlled by the condenser dump valves.

Main feedwater was isolated shortly after reactor trip on low Tave. The main feedwater pumps then tripped on high discharge pressure. Both motor-driven auxiliary feedwater pumps and the single turbine-driven pump automatically started following reactor trip. The turbine-driven pump was secured shortly after it started since it was not required. Steam generator level response was normal following the reactor trip, as it recovered to the no-load target of 38% (±5%) within thirty minutes. Operator control of auxiliary feedwater was proper for this event.

Main steam flow dropped to near zero immediately following reactor trip.

The reactor was safely controlled at all times. No safety injection actuation occurred during this event. The pressurizer PORV's and code safety valves were not challenged; neither were the SG PORV's, atmospheric dump valves, nor main steam safety valves. Indicated pressurizer and steam generator levels remained on scale. The primary cooldown rate was approximately 30F/hr, which was below the Technical Specification limit of 100°/hr. No abnormal release of radioactivity occurred during this event and there was no abnormal reactor coolant leakage.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
McGuire Nuclear Station - Unit2	0 5 0 0 0 3 7 0	8 4	— 0 3 1	— 0 0	0 5 OF 5

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

CORRECTIVE ACTION: A study of FCS card reliability was conducted, and recommendations were made in July of 1984 to minimize card failures.

It was recommended that: 1) performance of the Heating, Ventilating and Air Conditioning (HVAC) system be improved (this has been completed); 2) maintain replacement power supplies in the warehouse in an energized state (projected completion by June 1985); 3) purchase replacement electronic components from Westinghouse, because of extensive testing program (requisition submitted).

Repairs to, or replacement of, NI PR 41 will be performed at the upcoming Unit 2 refueling outage.

DUKE POWER COMPANY
P.O. BOX 33189
CHARLOTTE, N.C. 28242

HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

December 26, 1984

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

Subject: McGuire Nuclear Station, Unit 2
Docket No. 50-370
LER 370/84-31

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 370/84-31 concerning a reactor trip resulting from a failed circuit card in the over-temperature Delta T setpoint circuit, which is submitted in accordance with §50.73 (a)(2)(iv). Initial notification of this event was made (pursuant to 50.72 Section (b)(2)(ii)) with the NRC Operations Center via the ENS on November 24, 1984. This event was considered to be of no significance with respect to the health and safety of the public.

Note that during the post-trip review of this event, it was discovered that two channels of the overpower Delta T circuitry were installed incorrectly, this situation is detailed in LER 370/84-30.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

SAG/mjf

Attachment

cc: Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Records Center
Institute of Nuclear Power Operations
1100 Circle 75 Parkway, Suite 1500
Atlanta, Georgia 30339

M&M Nuclear Consultants
1221 Avenue of the Americas
New York, New York 10020

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cc: Mr. W. T. Orders
NRC Resident Inspector
McGuire Nuclear Station

American Nuclear Insurers
c/o Dottie Sherman, ANI Library
The Exchange, Suite 245
270 Farmington Avenue
Farmington, CT 06032