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 1	0 5 0 0 0 3 6 9	1 OF 0 4

TITLE (4) Reactor Trip (Reactor Protection System Actuation) caused by Spurious Undervoltage Relay Actuation

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)
0 6	0 6	8 4	8 4	0 2 0	0 0	0 7	0 6	8 4		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 0 9 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)
Phillip B. Nardoci, Licensing Engineer	7 0 4 3 7 3 - 7 4 3 2

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
X	E A	R L Y	I 0 0 5	Y					

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 June 6, 1984, Unit 1 reactor tripped at 1756 when a spurious undervoltage relay actuation deenergized one of the reactor coolant (NC) pumps. The relay which protects 7KV bus 1TC from undervoltage operation by monitoring the normal incoming power, malfunctioned and tripped the normal incoming power circuit breaker 1TC-6. Loss of this power source deenergized 7KV bus 1TC, which included NC pump 1C. Since the unit was operating at a power level above the automatic trip setpoint of 48% (90% actual thermal power), loss of the NC pump caused an immediate reactor and turbine trip. The relay was replaced and the reactor restarted.

The event is attributed to Component Malfunction since the relay spuriously actuated with normal voltage on the normal incoming power source. Initial testing indicated that the relay appears to be working correctly. Further testing of the relay will be conducted to determine the failure mechanism of the device.

The undervoltage relay failed in the conservative direction, and plant response to the trip was well controlled.

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

On June 6, 1984, Unit 1 reactor tripped at 1756 when a spurious undervoltage relay [EIIS:RLY] actuation deenergized one of the reactor coolant (NC) [EIIS:AB] pumps [EIIS:P]. The relay which protects 7KV bus 1TC [EIIS:CON] from undervoltage operation by monitoring the normal incoming power, malfunctioned and tripped the normal incoming power circuit breaker 1TC-6 [EIIS:BRK]. Loss of this power source deenergized 7KV bus 1TC [EIIS:EA], which included NC pump 1C. Since the unit was operating at a power level above the automatic trip setpoint of 48% (90% actual thermal power), loss of the NC pump caused an immediate reactor and turbine [EIIS:TRB] trip. The relay was replaced, and the reactor subsequently restarted and returned to 90% power (unit was temporarily limited to 90% power due to an unrelated power peaking problem). The event is attributed to Component Malfunction since the relay actuated spuriously with normal voltage on the normal incoming power source.

On June 5, 1984, during normal rounds, Nuclear Equipment Operators found the target (indication of undervoltage relay actuation) showing several times on the 27N relay on bus 1TC. Each time the NEOs reset the target, using the reset pushbutton, but took no other action. At ~1200 on June 6, Operators found the target showing on the 27N relay on bus 1TC. They were unable to reset the target, and wrote a work request to repair the relay.

At 1756 on June 6, relay 27N on bus 1TC actuated. Circuit breaker 1TC-6 (Normal incoming power to 1TC) tripped, deenergizing the bus and NC pump 1C. Unit 1 reactor trip was subsequently initiated because of low flow in one NC loop with reactor power above 48%. Reactor trip breakers [EIIS:BRK] A and B, and generator power circuit breakers [EIIS:BRK] A and B opened. The plant was stabilized at hot standby conditions. At ~1900 it was discovered that the 27N relay was still actuated although input signal voltage was 118.4 VAC (relay setpoint was 90 VAC decreasing). The undervoltage relay was replaced and power circuit breaker 1TC-6 reclosed.

Motors can be damaged by operating with low voltage power. To prevent this situation, undervoltage relays monitor the two power sources, normal and standby, to the 7KV busses. The relays will trip an incoming circuit breaker whenever the associated power source voltage drops below the relay setpoint. The undervoltage relay involved in this event is an ITE Circuit Shield, Type ITE 27, Cat. 211B1171, Solidstate device. It consists of a solid state logic circuit, reed relay (Automatic Electric, Model PD 13003-9, 4160 ohm), and electrically operated target. Three, normally open, reed switches [EIIS:XIS] are included in the relay (27/A1, 27/A2, and 27/A3). 27/A1 energizes coil S which sets the red target on the front of the undervoltage relay. 27/A2 energizes auxiliary relay 27NX/RD which trips normal incoming circuit breaker 1TC-6. 27/A3 is not used.

The undervoltage relay is designed so the reed relay will remain deenergized when conditions are normal, i.e. DC control voltage and AC signal voltage supplied. If DC voltage is removed, the reed relay will still remain deenergized. (DC power is sometimes removed when technicians are hunting battery grounds.) When the AC voltage signal decreases below the setpoint; however, the reed relay will be energized. All three reed switches will close; relay 27NX/RD will actuate; and target coil S will be energized, turning the target so the red side shows. If the AC signal returns to a normal value, the reed relay will return to the deenergized state and the reed switches will open. Relay 27NX/RD will be deenergized and the target coil S will be deenergized. The target, which is a mechanical bi-stable device, will remain in the red side visible position. Later, operators will reset the target by pushing a pushbutton energizing coil R which turns the target so the black side shows.

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

The operators who found and reset the target on the 1TC 27N relay knew that voltage on bus 1TC was normal because of the voltmeter indication and the fact that loads on the bus were still operating satisfactorily. In the flurry of activity following reactor trips or transients, operators sometimes fail to find and reset all of the protective relay targets that have occurred. Therefore, it is not uncommon for NEOs to find and reset protective relay targets during their normal rounds. The NEOs who found the target on June 5, had no reason to be alarmed since they were able to reset it. When the target was found on June 6, the operators could not reset it and the work request was written. The operators still viewed the spurious target as a minor problem. They had no way of knowing that the reed relay that actuated the target should have also initiated a trip of incoming circuit breaker 1TC-6.

The ITE relay had been in use since the 7KV busses were placed in service in 1976. Periodic maintenance for the relays is scheduled at two year intervals, with the last maintenance being performed on the 1TC 27N relay on February 29, 1984. Two spurious actuations of this model relay have occurred at McGuire. One relay was found to have a defective capacitor in the timing circuit. The relay was repaired and returned to service. No problems were found with the other relay and it has not been returned to service. Spurious targets without relay actuation have not been observed prior to this event. It may be possible that the logic circuit could malfunction in a way that would produce varying amounts of current in the reed relay coil. If the current and corresponding magnetic field were raised to a critical level, one reed switch might close with the other switch still open. Such a theory would explain the spurious targets before the circuit breaker tripped.

The relay manufacturer was contacted about failure history on the relay, and has responded that no spurious targets have been reported to them. They also stated that no generic problems have been found with these relays.

The 1TC 27N relay is connected to the normal incoming power source to 7KV bus 1TC. Voltage on busline 1A remained normal throughout the event. The undervoltage relay was verified to be malfunctioning when it was found actuated with the AC signal voltage above the actuation setpoint. The fact that the target could not be reset indicated that the reed relay was energized, providing power to target coil S. The undervoltage relay was removed from bus 1TC and later tested. The relay was energized with DC power and supplied with a 118 VAC test signal. The following morning the relay was checked and found not actuated. The AC signal was varied and the relay appeared to be working correctly.

McGuire does not have an undervoltage transfer scheme on the 7KV busses; although, such transfers do occur on certain fault conditions. Such a scheme could have prevented this event by closing 1TC-10, 7KV bus 1TC standby power source, within eight cycles.

Further testing of the relay will be conducted to determine the failure mechanism of the device. All unexplained relay targets will be investigated. Operators will be advised to initiate a checkout of any relay that displays an unexplained target. This checkout should occur during the first normal work day following discovery of the target. Duke Power Company will also review the lack of an automatic transfer scheme for the McGuire 7KV busses in the event of undervoltage relay actuations.

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

The undervoltage relay failed in the conservative direction, ensuring that the 7KV bus would not continue to supply loads with under voltage power. The reactor tripped on low flow in one out of four coolant loops with the reactor power above 48%. This trip precludes possible inadequate core cooling and prevents core damage. Plant response to the trip was well controlled.

Reactivity was promptly controlled by the reactor trip. Pressurizer pressure responded properly, decreasing to a minimum of 1975 psig before recovering and reaching its reference value within 20 minutes after the reactor trip. The reactor coolant loop average temperatures decreased to their minimum value of ~550°F before recovering to ~554°F within 10 minutes after the trip. This is slightly lower than the expected no-load temperature of 557°F. (The slightly lower than normal primary system minimum and final temperatures were caused by steam pressure control anomalies.) Pressurizer level responded as expected, dropping sharply to ~35%, and then settling out to its no-load target within 30 minutes after the trip.

Steam pressure peaked at ~1150 psig. This is below the first bank Main Steam [EIIS:SB] Safety Valve [EIIS:V] Setpoint (1170 psig). Steam pressure decreased to a minimum of 1005 psig before recovering. This minimum pressure was ~40 psig below the pre-trip value and was caused by a steam dump valve [EIIS:V] sticking open. The steam dumps were taken to manual to control steam pressure until the isolation valve could be closed. The operators responded promptly and properly to prevent excessive primary cooling (Tave was only 3° below target.)

Steam generator [EIIS:GEN] levels behaved normally, dropping sharply after the trip to their minimum values of ~33% narrow range. Main feedwater [EIIS:SJ] was isolated shortly after the trip, as expected, on reactor trip with coincident low Tave (564°F). The main feedwater pumps [EIIS:P] tripped on high discharge pressure following the feedwater isolation. Following the reactor trip, auxiliary feedwater [EIIS:BA] pumps initiated on indicated low-low steam generator level and were used to recover level. Level had recovered to the expected no-load value (38%) within 30 minutes after the trip and was well controlled by the operators.

No safety injection [EIIS:BG] actuation occurred. The pressurizer PORV's and code safety valves were not challenged. Indicated pressurizer and steam generator levels remained on-scale. The primary temperature decrease was within the 100°F/hour Technical Specification Limit. There was no abnormal release of radioactivity during this event, and no abnormal reactor coolant leakage. The health and safety of the public were not affected.

DUKE POWER COMPANY
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HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
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July 6, 1984

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

Subject: McGuire Nuclear Station, Unit 1
Docket No. 50-369
LER 369/84-20

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 369/84-20 concerning a reactor trip caused by a spurious under voltage relay actuation 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 June 6, 1984. This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

H. B. Tucker /PBN

Hal B. Tucker

PBN:glb
Attachment

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