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10 CFR Part 50
Section 50.73

Director of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Failure Of Redundant Heat Trace Circuits
As Result of Electrical Fault

The Licensee Event Report for this occurrence is attached.

Please contact us if you require additional information related to this event.

Thomas M Parker
Manager - Nuclear Support Services

c: Regional Administrator - Region III, NRC
NRR Project Manager, NRC
Senior Resident Inspector, NRC
MPCA
Attn: Dr J W Ferman

Attachment

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LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (8)

PAGE (3)

YEAR SEQUENTIAL
NUMBER REVISION
NUMBER

Prairie Island Nuclear Gen Plant Unit 1 0 5 0 0 0 2 8 2 9 1 — 0 0 4 — 0 0 0 2 OF 0 5

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

EVENT DESCRIPTION

On May 9, 1991, Unit 1 was at 85% power, coasting down to a planned refueling in June. An outplant operator was in the process of hanging a replacement identification tag on a valve. In order to reach the valve, the operator stepped on an insulated pipe which is a section of heat traced safety injection piping containing concentrated boric acid solution. When he stepped down off the pipe, at 1255, the operator smelled and observed smoke emitting from beneath the pipe insulation.

The operator called the Control Room and called additional outplant operators to the scene. Operators locally de-energized nearby heat trace (EHS Component Identifier EHTR) circuits to prevent additional arcing in the area. The Control Room operators processed an Emergency Work Request and called the Station Electrician and the System Engineer to the scene. An electrician began continuity checking of heat trace circuits to determine which had been shorted. Insulators arrived to remove the affected section of insulation. Selected heat trace circuits were restored as their continuity was checked and operability was determined.

Circuit continuity checks showed, at 1345, that both ET-53 Normal and Redundant (ET-53N and ET-53R) heat trace circuits had failed. As continuity checking continued, the System Engineer informed the Control Room that circuits ET-53N and ET-53R were failed. The Control Room operator logged the circuits out of service at 1345. Temperature monitoring of the pipe was begun to insure it remained greater than 145°F for boric acid solubility. Repairs began immediately.

Control Room operators began making preparations to bring Unit 1 to hot shutdown. It was determined that Technical Specification 3.0.C became applicable at 1345 because the Technical Specifications had no allowance for the inoperability of both heat trace circuits. Per the requirements of Technical Specification 3.0.C the unit would have to be in hot shutdown at 2045. At 1430, after conferring with NRC Region III management, it was determined that commencement of the unit shutdown could be delayed, as long as an orderly plant shutdown was commenced within a time frame that would place the unit in hot shutdown by 2045.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (5)

PAGE (3)

YEAR	SEQUENTIAL NUMBER	REVISION NUMBER
91	004	00

Prairie Island Nuclear Gen Plant Unit 1

05000282

91-004-00

03 OF 05

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

At 1745 repairs to the ET-53R heat trace circuit were completed, the circuit was tested operable and placed in service. (One circuit of heat tracing is sufficient to maintain the line above 145°F even if the fluid is stagnant.) The unit shutdown plan was terminated. Technical Specification 3.2.C.4 was now invoked which allowed the other circuit, ET-53N, inoperable for 72 hours starting at 1345. Heat trace circuit ET-53N was repaired the next day.

CAUSE OF THE EVENT

The event was initiated by an operator stepping on an insulated section of piping while performing a task in the immediate area of these heat trace circuits. The arcing fault on ET-53R was caused by one of the heat trace conductors shorting to the stainless steel banding that supports the power head box, which is a heat trace junction box attached to the pipe. The banding (similar to an adjustable automotive hose clamp) is wrapped on the pipe under the heat trace cable. It is believed that the free end of the banding contacted the cable.

The action of stepping on the pipe caused the free end of the banding to penetrate the heat trace cable insulation, initiating a ground. While the penetration of the heat trace cable insulation initiated a ground, that action in and of itself would not have caused this event. Since this is an ungrounded 120V AC system, an undetected ground must have pre-existed in a circuit that had a common neutral to allow a fault path to exist. This additional ground was subsequently located (and repaired) on a control switch for Unit 2 heat trace circuit ET-69R. Both circuits are fed from different phases of the same three phase switchrack and have a common neutral. The fault path was of high enough impedance to limit the fault current to a value that would not trip the 30-amp switchrack breaker, but caused the heat trace circuit ET-53R to quickly overheat and fail. It is not known how or when the ground on ET-69R occurred. Post-installation ground checking was not required by the heat trace installation procedure; however, ground checking is routinely performed prior to energizing a new installation. Since its installation in 1985, no maintenance has been required for ET-69R.

Heat trace circuit ET-53R is located at the 10 o'clock position on a horizontal section of 8" diameter piping, and circuit ET-53N is located at the 7 o'clock position. Overheating of circuit ET-53R charred the heat trace insulation and melted some of the copper conductors and the stainless steel banding. Spattering of this molten metal caused degradation of the insulation of circuit ET-53N, which allowed a phase-to-neutral arcing fault within the heat tracing itself and its subsequent failure.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-630), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (5)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Prairie Island Nuclear Gen Plant Unit 1	01500028291	—	004	—	0004	OF 05

TEXT (If more space is required, use additional NRC Form 356A's) (17)

ANALYSIS OF THE EVENT

The Safety Injection System piping remained operable at all times during the event. The affected area was suction piping from the boric acid storage tanks to the Unit 1 Safety Injection Pumps. The affected area of the suction line is continually in recirculation; during recirculation the fluid is heated by four additional heat trace circuits and the boric acid storage tank heaters. Temperature monitoring during the event showed the fluid throughout the affected section of piping remained well above the Technical Specification of 145°F. Therefore, the Safety Injection System remained operable throughout this event, and the health and safety of the public were unaffected.

This event is reportable pursuant to 10CFR50.73(a)(2)(i)(B) since Technical Specification 3.0.C was applicable.

CORRECTIVE ACTION

Upon discovery, the operator called the Control Room and called additional outplant operators to the scene. Operators locally de-energized nearby heat trace circuits to prevent additional arcing in the area. The Control Room operators processed an Emergency Work Request and called the Station Electrician and the System Engineer to the scene. An electrician began continuity checking of heat trace circuits to determine which had been shorted. Insulators arrived to remove the affected section of insulation. Selected heat trace circuits were restored as their continuity was checked and operability was determined.

Circuit continuity checks showed that both ET-53N and ET-53R heat trace circuits had failed. As continuity checking continued, the System Engineer informed the Control Room that circuits ET-53N and ET-53R were failed. The Control Room operator logged the circuits out of service at 1345. Temperature monitoring of the pipe was begun to insure it remained greater than 145°F for boric acid solubility. Repairs began immediately. Control Room operators began making preparations to bring Unit 1 to hot shutdown in case the repairs were not completed within the time requirements of Technical Specification 3.0.C.

At 1745 repairs to the ET-53R heat trace circuit were completed, the circuit was tested operable and placed in service. The unit shutdown plan was terminated. Heat trace circuit ET-53N was repaired the next day.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-430), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

Prairie Island Nuclear Gen Plant Unit 1 0 5 0 0 0 2 8 2 9 1 — 0 0 4 — 0 0 0 5 OF 0 5

TEXT (If more space is required, use additional NRC Form 366A (1) (17))

All safety-related heat tracing circuits are being electrically checked. The results of this testing will define the need for further visual inspections of heat trace installations.

Circuit breakers for the affected heat trace circuits will be tested to prove proper operation; there is no reason to suspect breaker malfunction. The breakers were determined to be sized correctly.

The electrical faulting may have caused some surface defects such as arc strikes in the affected area of piping; the piping will be subject to inservice inspection during the refueling outage now in progress.

Further corrective actions under way are:

- Evaluation of the need for a ground detection system or a periodic ground detection test.
- Evaluation of the need for instructions concerning climbing on heat traced piping.
- Evaluation of a change in Technical Specifications to clarify the heat trace requirements and basis.

FAILED COMPONENT IDENTIFICATION

Raychem Chemelex Auto-Trace Self-Limiting Heater System; Cable 20 PVTI.

PREVIOUS SIMILAR EVENTS

There have been no previous similar events reported at Prairie Island.