Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401-1927
Telephone (612) 330-5500

June 26, 1989

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

Unit 2 Trip Due to Component Failure in the Turbine E-H System

The Licensee Event Report for this occurrence is attached.

This event was reported via the Emergency Notification System in acordance with 10 CFR Part 50, Section 50.72, on May 26, 1989. 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

IE22
1/1

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)
PRAIRIE ISLAND NUCLEAR GENERATING PLANT UNIT 2	0 5 0 0 0 3 0 6	1 OF 0 4

TITLE (4)

Unit 2 Trip Due to Component Failure in the Turbine E-H System

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 5	2 6	8 9	8 9	0 0 2	0 0	0 6	2 6	8 9		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)			
N		20.402(b)	20.405(c)	XX 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
1 0 0		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
Arne A Hunstad, Staff Engineer	6 1 2 3 8 8 - 1 1 2 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	
X	J J	C A P		Y							
X	J J	X X X		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 May 26, 1989, Unit 2 was at 100% power. At 0605 Unit 2 tripped on steam generator low level. Investigation of plant data revealed that the turbine control valves had closed just prior to the trip. Investigation of the turbine control system led to the power supply drawers, where failed components were found on a speed error amplifier card. The failed components were an electrolytic capacitor and an inductor. The speed error amplifier card was replaced and inspection of all other circuit cards was completed. The speed error amplifier was tested and the control system returned to service. Unit 2 was returned to service at 0353 on May 27, 1989.

Cause of the event was failure of an electrolytic capacitor. The capacitor failure shorted the control system power supply to ground, causing loss of electronic control power to the turbine control valves. This caused the control valves to close. The short circuit cleared about 7 seconds later, allowing the control valves to reopen, but the low steam generator level trip setpoint had been reached and Unit 2 tripped.

The speed error amplifier card was replaced. Other circuit cards were inspected.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Prairie Island Unit 2	0 5 0 0 0 3 0 6	8 9	— 0 0 1 2	— 0 0	0 2 OF 0 4

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

EVENT DESCRIPTION

On May 26, 1989, Unit 2 was at 100% power. At 0605 the control room received alarms and indication of an automatic Unit 2 reactor trip as a result of low steam generator level. All plant systems and components responded to the reactor trip as designed and the plant was stabilized in accordance with plant procedures.

Subsequent investigation of plant post-trip data revealed that just prior to the low steam generator level trip, the turbine control valves had closed and after approximately a seven second delay began to reopen. However, as a result of the shrinkage in indicated steam generator level resulting from the rapid reduction in steam load, the steam generator low level trip setpoint of 13% was reached and the reactor tripped.

The problem was investigated by the backup system engineer for the turbine control system and I&C personnel. Indications of continuing intermittent failures of the control power to the turbine control system (EIIS System Identifier JJ) led the investigation to the turbine control system power supply drawers. The turbine control system secondary and primary power supply drawers were inspected and the primary power supply was replaced as part of the trouble shooting effort. No problems were found in the primary power supply drawer that was removed.

Further investigation by the system engineer for the turbine control system revealed that a dual component failure on the turbine control system speed error amplifier card was the cause of the turbine control problems which led to the reactor trip. The two failed components were an electrolytic capacitor (EIIS Identifier CAP) and an inductor. The speed error amplifier card was replaced and inspection of all other circuit cards was completed. The speed error amplifier was tested successfully and the turbine control system returned to service at 1510 on May 26, 1989.

Unit 2 was returned to service at 0353 on May 27, 1989.

CAUSE OF THE EVENT

Cause of the event was failure of an electrolytic capacitor. The capacitor failure shorted the turbine control system power supply +15V DC bus to ground, causing an overcurrent condition on the inductor component and loss of electronic control power to the turbine control valves. This caused the control valves to close. The short circuit cleared approximately 7 seconds later, allowing the control valves to reopen. However, as a result of the shrinkage in indicated steam generator level resulting from the rapid reduction in steam load, the steam generator low level trip setpoint was reached and the reactor tripped.

The electrolytic capacitor failure was consistent with failures caused by internal shorting. The heat generated from the increased leakage paths forms hydrogen and oxygen gases which burst the case. No apparent cause for the failure of the electrolytic capacitor has been identified.

ANALYSIS OF THE EVENT

The plant responded as would be expected to the rapid closure of the turbine control valves. The turbine valve closure caused a rapid reduction in the steam demand from the steam generators which resulted in a rapid shrink in indicated steam generator level to the low level reactor trip setpoint. All plant systems and components responded to the resulting reactor trip signal as designed and the plant was stabilized in accordance with plant procedures.

Because the plant response to the inadvertent closure of the turbine control valves and the resulting reactor trip was as expected based on the plant design, and because all plant safeguards equipment remained available for service throughout this event, there was no effect on the health and safety of the public.

Since this event resulted in an unplanned actuation of the reactor protection system, it is reportable under 10CFR50.73(a)(2)(iv).

CORRECTIVE ACTION

In response to indications of continuing intermittent failures of the control power to the turbine control system, the turbine control system secondary and primary power supply drawers were inspected, and the primary power supply was replaced as part of the trouble shooting effort. No problems were found in the primary power supply drawer that was removed.

Further investigation found that the closure of the turbine control valves was caused by the loss of control power to the valves as a result of component failures on the turbine control speed error amplifier card. A capacitor failure on the speed error amplifier card caused a short of the turbine control system power supply to ground, which caused an overcurrent condition on an speed error amplifier card inductor and a loss of control power to the turbine control valves. The speed error amplifier card was replaced and inspection of all other circuit cards was completed. The speed error amplifier card was tested successfully and the turbine control system returned to service at 1510 on May 26, 1989.

A diode in the auctioneering circuit between the primary and secondary turbine control power supplies was also found to be defective during the investigation of this event. This defective diode would have prevented the secondary power supply from assuming the turbine control system control power loads if the primary power supply had failed. The defective auctioneering circuit was determined not to be the cause nor contributory to the turbine control system problems that led to the trip. The auctioneering circuit was repaired.

COMPONENT IDENTIFICATION

The components that failed were:

- Electrolytic capacitor: 100 Microfarad, 25 VDC

- Inductor: 39 Microhenry

Both components are part of a Westinghouse Mark IV Analog Electro-Hydraulic Governor Control System, Speed Error Amplifier A (498793-B).

PREVIOUS SIMILAR EVENTS

There have been no previous similar events at Prairie Island.