NSP

Northern States Power Company

Monticello Nuclear Generating Plant
2807 West Hwy 75
Monticello, Minnesota 55362-9637

July 9, 1996

10 CFR Part 50
Section 50.73

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

LER 96-006
Reactor Scram Due to Loss of Stator Water Cooling Flow

The Licensee Event Report for this occurrence is attached. This report contains no new NRC commitments.

Please contact Tom Parker at (612) 295-1014 if you require further information.

William J Hill

William J Hill
Plant Manager
Monticello Nuclear Generating Plant

c: Regional Administrator - III NRC
Sr Resident Inspector, NRC
NRR Project Manager, NRC
State of Minnesota, Attn: Kris Sanda

Attachment

IE22 1/1

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)
MONTICELLO NUCLEAR GENERATING PLANT	05000 - 263	1 OF 5

TITLE (4)
Reactor Scram Due to Loss of Stator Water Cooling Flow

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
06	09	96	96	006	00	07	09	96	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9): N
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)	✔	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)
Tom Parker	612-295-1014

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	TJ	P	I075	NO						

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 15 SINGLE-SPACED TYPEWRITTEN LINES) (16)
NCR FORM 366 (5-91)

The “A” stator water cooling pump tripped and the “B” stator water cooling pump automatically started as designed. Several hours later, the “B” stator water cooling pump failed. This left no operable stator water cooling pumps and led to a turbine trip and subsequent reactor trip.

The root cause of the stator water cooli[illegible] pump failures is believed to be caused by electrical discharge through the thrust bearing. The reactor was shut down by the automatic scram and operators properly responded maintaining the reactor in a safe condition at all times.

The pumps were rebuilt and the oilers were placed with a different type device. A grounding strap/brush was installed on both stator water cooling pumps.

Description

During operation at 100% power at 1600, the "A" stator water cooling pump (EIIS System Code: TJ)(EIIS Component Code: P) tripped and the "B" stator water cooling pump automatically started as designed. Engineering personnel were called in to take vibration measurements on the "B" stator water cooling pump. Readings were found to be higher than previous measurements. The "B" stator water cooling pump failed at 2010 while it was being inspected by operations and engineering personnel. This left no operable stator water cooling pumps.

The stator water cooling system supplies cooling to the main generator stator. Sensing no stator water cooling flow, the turbine runback circuitry was initiated. A turbine trip occurs 3.5 minutes following the initiation of the runback circuitry, if generator stator amperes have not been reduced sufficiently. Licensed operators reduced recirculation pump flow to minimum and started inserting control rods to further reduce reactor power.

At 2014 (or 3.5 minutes later), the turbine generator tripped causing a reactor scram and the unexpected tripping of both reactor feedwater pumps (EIIS System Code: SJ). Following the reactor scram, reactor level decreased below +9 inches causing a containment isolation (EIIS System Code: JM) and entry into Emergency Operating Procedure (C.5-1100, RPV Control).

A reactor feedwater pump was restarted and level restored. All safety related equipment performed properly.

Cause

The root cause of the stator water cooling pump failures was originally believed to be low oil bath level. Subsequent, increased, monitoring of the stator water cooling pump performance, identified that low oil level may not have been the root cause. An investigation team has identified that electrical discharge in the bearing may have been the cause of the failures. The electrical discharge in the bearing may have led to the degrading of the lubricating oil and/or physical damage to the bearing race. This degradation led to fatigue cracking in the bearing race and subsequent failure of the bearing.

During the recent refueling outage (April 1996), new stator water cooling pumps (pumps, bearing assembly, and coupling) were installed. This unit was designed and supplied to Monticello by General Electric Corp. This was believed this to be a standard configuration utilized in the industry. Since these failed prematurely, the investigation considered what had changed from the design of the previous pumps. Two differences may have been responsible for the electrical discharge in the thrust bearing, a ceramic pump seal and a non-conducting coupling (see Figure 1). Static electricity is generated by the pump impeller in the pump casing.

The conductivity of the stator water is very low, so the electrical charge is not transmitted to ground through the water to the pump casing. In the past, the charge is believed to have been harmlessly transmitted to ground through a metallic seal. With the new ceramic pump seal and non-conducting coupling, the path of least resistance was the thrust bearings. The stator water cooling pumps are lubricated with a light non-conducting turbine oil (Mobil DTE-797). The small distances between the bearing race and the ball bearings allowed the charge to travel through the non-conducting oil. The transmission through the thrust bearing causes oil degradation and small arc strikes in the bearing race.

The tripping of the reactor feedwater pumps was caused by a pressure wave associated with the turbine trip and subsequent closing of the turbine stop and control valves. The pressure wave for this turbine trip was no different from past turbine trips, but in the past, the reactor feedwater pumps have never both tripped on a false reactor high water level signal. In 1986, new more responsive reactor level instruments were installed to initiate the high reactor water level feedwater pump trip signal. This was the first turbine trip at power since installation of these more responsive instruments.

Analysis of Reportability

This event is reportable per 10 CFR Part 50, Section 50.73(a)(2)(iv) since this event resulted in an automatic actuation of the reactor protection system and an engineered safety feature (the containment isolation).

Safety Significance

This event challenged the reactor protection system and the containment isolation systems. All safety systems performed properly.

Actions

Immediate Actions

The operators responded promptly to the loss of the stator water cooling pumps by decreasing reactor power by decreasing reactor recirculation pump speed and driving in control rods.

The reactor was shutdown by the automatic scram and operators properly responded maintaining the reactor in a safe condition at all times.

The containment isolation was reset.

Corrective Actions

The pumps were rebuilt and the oilers were replaced with a different type of device.

An investigation team was established to determine the cause of the event.

The sensitivity of the reactor level instruments that trip the feedwater pumps was adjusted following a 10 CFR Part 50, Section 50.59 review of the change. The sensitivity was changed to that of similar level instruments which were relatively unaffected by the pressure wave. This change in sensitivity should prevent a false high reactor water level signal following future turbine trips.

A grounding strap/brush was installed on both stator water cooling pumps to eliminate any voltage difference between the pump shaft and ground.

Preventative Actions

The lessons learned from this event with respect to making changes to the plant design will be covered in Engineering Technical Staff Training. The training will cover the layers of protection associated with design changes, i.e., design review, pre-operational testing and post installation monitoring.

<u>Failed Component Identification</u> -

Stator Water Cooling Pump

Ingersol Rand Corp
Model 3X10ATS

<u>Previous Similar Events</u>

None.

Figure 1 - Simplified Stator Water Cooling Pump Assembly Showing Potential Electric Discharge Paths