NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Cooper Nuclear Station	0 5 0 0 0 2 9 8	1 OF 0 5

TITLE (4) RHR Pump "B" Motor Ground Resulting From Worn Stator Field Coil Insulation Discovered Subsequent to an Unplanned Reactor Trip

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 0 0 0
0 1	2 8	8 8	8 8	0 0 3	0 1	0 8	1 9	8 8		0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 0 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)	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)	X 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)
Donald L. Reeves, Jr.	4 0 2 8 2 5 - 3 8 1 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	B 0	M 0	G 0 8 0	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 January 28, 1988, subsequent to an unplanned reactor trip at 7:12 P.M. (LER 88-002), a ground alarm was received on the 1B Residual Heat Removal (RHR) Pump motor which had been in service prior to the scram. Approximately two (2) minutes later, the pump tripped. About three (3) hours later, with post scram recovery activities in progress, an attempt was made to restart the 1B RHR Pump; however, the ground condition was annunciated and the pump immediately tripped. The motor was removed and transported to the General Electric repair facility in Memphis, TN, to facilitate a detailed inspection.

A fully qualified replacement motor was installed and in-place diagnostic testing was performed to assure operability of the remaining three (3) identical RHR Pump motors and two (2) Core Spray Pump motors. These results were satisfactory and the plant was returned to service.

Upon further inspection and testing of the failed motor, it was determined that the failure was caused by relative movement between the failed coil and surge ring. A thorough examination of a second RHR Pump motor that had exhibited similar prior lower surge ring bracket failures, but had not failed in service, was also performed resulting in the determination that an insignificant amount of fretting had taken place. Due to the variation of parameters that could lead to a motor failure, it was concluded that a simultaneous failure of the remaining RHR and CS motors would not occur. Although this problem does not represent a safety concern, it is considered to be of interest industry-wide and, hence, serves as the basis for this voluntary report.

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A. Event Description

On January 28, 1988, subsequent to an unplanned reactor trip at 7:12 P.M. (LER 88-002), a ground alarm was received on the 1B Residual Heat Removal (RHR) Pump motor, resulting in a motor trip on overload. The sequence of events leading up to this discovery was as follows.

Approximately two (2) hours prior to the aforementioned reactor trip, the 1B RHR Pump had been placed in service to transfer water from the Suppression Pool (Torus) to the Radioactive Waste Facility (Radwaste) for subsequent processing and return to the Condensate Storage Tank. This activity is one that is normally conducted on a weekly basis to maintain Torus water quality. When the unplanned reactor trip occurred, the 1B RHR Pump was operating. In reconstructing the sequence of events associated with the motor fault, a ground alarm was received on the 1B RHR Pump Motor immediately following the unplanned scram and turbine trip. Approximately two minutes later, the 1B RHR Pump tripped. Subsequently, noting that the pump was tripped, the valve lineup for transferring water from the Torus to Radwaste was returned to normal. About three (3) hours later, with plant conditions stabilized and maintenance activities related to the scram in progress, an attempt was made to start the 1B RHR Pump and resume transferring water from the Torus to Radwaste. However, upon attempting to restart the pump, the ground alarm was received and the pump tripped. At 10:08 P.M., following further operational investigations, the pump was declared inoperable, and shortly thereafter, a plant cooldown was initiated.

B. Plant Status

Shutdown, maintaining the reactor in a hot standby condition, with maintenance activities in progress related to the previously noted scram.

C. Basis for Report

An item believed to be of interest industry-wide.

D. Cause

A thorough inspection of the motor, a vertical, 1250 HP, 4000V AC, 60 Hz, 3-Phase induction motor, Model Number 5K6346XC74A, manufactured by General Electric Company, revealed that the fault condition was due to worn insulation in one specific area of the bottom surge ring/stator field coil assembly. The point of contact where the failure occurred was a single location, approximately 1/16 inch in diameter. Further evaluation by General Electric has revealed that the failure was caused by relative movement between the failed coil and surge ring. The insulation on the coil was worn through its full thickness due to fretting against the surge ring. The following factors are believed to be related to the cause of fretting:

D. Cause (Continued)

1. Surge ring bracket condition:

A previous failure of the brackets (repaired in 1986) caused a variation in support condition around the periphery of the surge ring causing the assembly of moving coils to have increased relative movement at the point of fixity of the ring.

2. Instantaneous magnetic loads acting on insulated coils:

High instantaneous motor current leads to higher magnetic loads on the coils and would tend to accelerate the fretting. This situation occurs during motor starts and fast bus transfers between the normal plant transformer and the startup plant transformer.

3. Condition of the point of contact between the coil and ring:

Inspection of the failure site and of coils adjacent to the failed coil, showed that the coil was in point contact with the ring (as opposed to area contact on the latest motor designs) and the tie cord was not fully tensioned when the coils were lashed to the surge ring.

E. Safety Significance

None. The design of the RHR System incorporates two redundant, independent subsystems, each with two identical pumps. In the event that one pump in one subsystem is inoperable, plant operation may continue for up to thirty (30) days providing all other active components of the RHR (Low Pressure Coolant Injection [LPCI]) subsystems and all active components of both Core Spray subsystems and the Diesel Generators are operable (Technical Specifications, Paragraph 3.5.A.4).

F. Corrective Action

The pump motor manufacturer, General Electric Company, was immediately contacted and advised of the 1B RHR Pump motor apparent ground fault. Assistance requested included investigation and evaluation of the failed motor, technical assistance with regard to locating and installing a replacement pump motor (required prior to plant restart), and technical guidance associated with verifying the operability of the remaining three (3) RHR Pump Motors and the two (2) Core Spray Pump Motors which are identical to the failed motor.

F. Corrective Action (Continued)

With regard to the 1B RHR Pump motor, following performance of on-site testing which confirmed the existence of a motor fault, the motor was removed and transported to the General Electric repair facility located in Memphis, Tennessee. There, a detailed inspection of the failed motor stator was performed which resulted in the determination noted in Paragraph D.

To enable plant restart, the following actions were taken with respect to the RHR (LPCI) System so as to assure operability of both subsystems, required by Technical Specifications, Paragraph 3.5.A.3.

1. A suitable replacement motor was obtained and installed as authorized by Design Change 88-071, RHR Pump Motor 1B Replacement. The mechanical and electrical characteristics of the replacement motor, Model Number 5K6339XC185A, manufactured by General Electric, are virtually identical to the original motor. To provide for installation, a slight modification to the motor mounting to accommodate a smaller diameter bolt circle was required.

2. To provide assurance that the existing motors, identical to the failed motor and installed on the remaining three (3) RHR Pumps and the two (2) Core Spray Pumps were operable, in place diagnostic testing was performed as recommended by General Electric. First, a Dielectric Absorption Test was conducted on all five (5) motors. The results indicated that the insulation condition was acceptable and that there was no indication of an incipient insulation problem. Secondly, high potential testing (high-potting) was performed on the C & D RHR Pump motors. Those specific motors were selected on the basis that they enveloped the "worst case" combination of motor starts, operating hours and previous surge ring bracket conditions for the five (5) motors. The results of the high-potting performed at a voltage of 10,200 volts DC were satisfactory.

   It should be noted that approximately one year ago, during a scheduled inspection of these motors, all four (4) RHR Pump motors and the 1A Core Spray Pump motor had been found with cracked/broken surge ring support brackets. No broken surge ring brackets were found in the 1B Core Spray Pump motor. The design of the brackets installed in that motor was different than the bracket design employed in the other five (5) motors. At that time, upgraded surge ring brackets of a new design, similar to those installed in the 1B Core Spray Pump motor, were installed and the stator coils were re-insulated (see LER 86-033, dated 12/16/86).

F. Corrective Action (Continued)

Subsequently, during the 1988 Refueling Outage which commenced on March 5, 1988, the RHR C motor was replaced with a newly rewound motor using an improved end-turn bracing system. It is considered to have a reliability equivalent to a new motor. Additionally, the CS B motor end-turn supports were re-inspected and found to still be in an acceptable condition.

The motor removed from the RHR C Pump was dismantled and inspected for general condition and for signs of insulation damage similar to the damage found on the previously failed RHR B motor. The motor had an insignificant amount of fretting (less than 0.005 inch deep) relative to fretting of 0.080 inch deep that caused the ground fault on the failed motor.

The coil to ground insulation on the examined motor was also successfully tested electrically to 30kv before it failed, showing that there was approximately seven times margin beyond the operating stress. It should also be noted that this test failure occurred on an upper coil (where there is no history of bracket failure at CNS), versus the inservice failure which occurred on a lower coil.

Additionally, insulation dielectric tests were performed on the RHR D motor to evaluate the integrity of the ground insulation. The tests consisted of a polarization index test, 4000 volt DC leakage current test, and high potential test. The data showed that the motor was not similar to the RHR B motor and had adequate insulation strength. The high potential test was performed at 1.5 times rated voltage, showing that adequate margin exists.

As a result of the inspections and testing performed, it has been concluded that motor-to-motor variation exists relative to the occurrence of insulation damage. Based upon the conclusions reached, the most likely condition of the RHR A, D, and CS A motors is such that if motor failure does occur, it would not occur simultaneously on all three motors. This is due to the variation in the parameters believed to be related to the degree of insulation fretting or cracking that could lead to motor failure.

G. Past Similar Events

No failure of this type has previously occurred.

Nebraska Public Power District

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CNSS886254

August 19, 1988

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

Gentlemen:

Cooper Nuclear Station Licensee Event Report 88-003, Revision 1, is forwarded as an attachment to this letter.

Sincerely,

G. R. Horn
Division Manager of
Nuclear Operations

GRH:sg

Attachment

cc: R. D. Martin
L. G. Kuncl
R. E. Wilbur
V. L. Wolstenholm
G. A. Trevors
INPO Records Center
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