Nebraska Public Power District
Nebraska's Energy Leader

NLS2000032
April 3, 2000

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Gentlemen:

Subject: Licensee Event Report No. 2000-007
Cooper Nuclear Station, NRC Docket 50-298, DPR-46

The subject Licensee Event Report is forwarded as an enclosure to this letter.

Sincerely,

J. A. McDonald
Plant Manager

/rar
Enclosure

cc: Regional Administrator
USNRC - Region IV

Senior Project Manager
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector
USNRC

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NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), 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. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Cooper Nuclear Station	05000298	1 OF 5

TITLE (4)

Failed Valve Motor Places Plant in a Condition Prohibited by Technical Specifications

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 NAME	DOCKET NUMBER
03	04	2000	2000	-- 007 --	00	04	03	2000		05000
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)	3
POWER LEVEL (10)	0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
	20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
	20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
S. R. Mahler, Assistant Manager Nuclear Licensing and Safety	(402) 825-3811

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	AD	MO	P296	Y					

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X	YES (If yes, complete EXPECTED SUBMISSION DATE).		NO		05	10	2000

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On March 4, 2000, while attempting to close Reactor Recirculation (RR) System [EIIS Code: AD] Loop A Discharge Valve a 250 VDC Bus 1A ground fault alarm occurred and the valve failed to fully close. This event was caused when brushes in the 250 VDC motor [EIIS Code: MO] failed to maintain adequate contact against the commutator which provides current to the armature winding. A Probabilistic Safety Analysis evaluation indicates this event is considered to be of minimal risk significance. Actions were taken to close the valve, replace the motor, and perform comprehensive testing prior to returning the valve to service. Results of plant and industry experience reviews indicate the failure mechanism was of an isolated nature. Additional testing of similar designed DC motors has been completed. Technical Specification (TS) Limiting Condition for Operation 3.5.1, Emergency Core Cooling Systems, requires this valve to be operable to ensure full Low Pressure Coolant Injection (LPCI) subsystem flow injection in the reactor via the recirculation jet pumps. If the valve is inoperable in the open position, the associated LPCI subsystem must be declared inoperable. This event is reportable because it has been conservatively determined that the valve was inoperable for a period of time longer than allowed by Technical Specifications. Actions taken on January 14, 2000 were not sufficient to resolve the cause for ground fault alarms that provided precursor indication of the March 4, 2000 valve failure.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Cooper Nuclear Station	05000298	2000	-- 007 --	00	2 OF 5

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

PLANT STATUS

Cooper Nuclear Station (CNS) was in Mode 3, Hot Shutdown, at the time of the event.

BACKGROUND

The Reactor Recirculation (RR) System [EIIS Code: AD] consists of two recirculation loops (Loop A and B), external to the reactor vessel, which provide the piping path for the driving flow of water to the reactor vessel jet pumps located inside the reactor vessel. Each external loop contains one variable speed, motor-driven recirculation pump and two motor-operated gate valves to isolate the pump. The gate valves are located on the suction and discharge sides of each pump (four gate valves total).

In addition to isolating the discharge line for pump maintenance, Reactor Recirculation Loop A and B Discharge Valves (RR-MOV-MO53A and B, respectively) are: (1) manually operated during Reactor Recirculation System startup or shutdown; (2) manually closed to place the Residual Heat Removal System in service for shutdown cooling mode of operation; (3) and automatically closed during a postulated loss-of-coolant accident (LOCA). Automatic closure of RR-MOV-MO53A and B is necessary to isolate a postulated pipe rupture in the recirculation loop suction line to ensure that the Low Pressure Coolant Injection (LPCI) flow, essential to reactor vessel makeup, will enter the reactor vessel and not discharge through the break. After receipt of a vessel pressure permissive signal (less than 185 psig) and a LPCI actuation signal, the Reactor Recirculation Loop Discharge Valves automatically close and the LPCI System injection valves automatically open to allow injection flow into the vessel through the jet pumps to restore the water level. The discharge valves are required to close within 40 seconds.

CNS Technical Specifications Surveillance Requirement 3.5.1.5 requires that each reactor recirculation discharge valve be demonstrated as operable by cycling the valve through one complete cycle or by de-energizing the valve in the closed position. This action is required once each startup prior to exceeding 25% reactor thermal power if not performed in the prior 31 days. Cycling the discharge valves through one complete cycle of full travel demonstrates that the valves are operable and will close when signaled to close. De-energizing the valve in the closed position also ensures the proper flow path for the LPCI subsystem. If the reactor recirculation discharge valve is inoperable and in the open position, the associated Low Pressure Coolant Injection subsystem must be declared inoperable.

In January 1995, a design modification was implemented to replace the motor [EIIS Code: MO] on Reactor Recirculation System Discharge Valve RR-MOV-053A. A similar modification was completed on RR-MOV-053B. The modification replaced the 100 ft.-lb. 250 VDC motor with a 150 ft.-lb. DC motor as part of addressing NRC Generic Letter 89-10 concerns. Cabling, relays, fuses, and other changes required to install the larger motor size were also implemented. Normal maintenance and testing activities performed subsequent to installation, including routine valve stroke time testing, demonstrated acceptable motor performance. This included acceptable stroke time test results on January 9, 2000.

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Cooper Nuclear Station	05000298	2000	-- 007 --	00	3 OF 5

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

EVENT DESCRIPTION

On March 4, 2000 the plant was proceeding through controlled shutdown activities in preparation for the planned refueling outage. While attempting to close RR-MOV-MO53A to place Residual Heat Removal (RHR) Loop "A" shutdown cooling in service, the 250 VDC Bus 1A ground fault alarm activated when the valve control switch was taken to close. Indication of valve position was momentarily lost and the ground fault alarm cycled in and out a few times. When the ground alarm finally cleared, the valve position was indeterminate. Subsequent action was taken to manually close the valve. Approximately 50 to 75 handwheel turns were required to complete the closing stroke (out of a total of approximately 340 turns for the total valve stroke length).

Prior to this discovery, on January 11, 2000, Reactor Recirculation Pump A discharge valve RR-MOV-MO53A was closed in preparation for placing the "A" Loop of shutdown cooling into service. Concurrent with this action, a ground fault alarm was received and cleared on 250 VDC Bus 1A.

On January 14, 2000 as part of normal startup activities, RR-MOV-053A was manually opened. Concurrent with valve opening, a ground fault alarm on 250 VDC Bus 1A was received. Subsequent operator actions, at that time, to close and then reopen the valve resulted in recurrence of the ground fault alarm. The valve was determined to be operable as position lights indicated the valve fully closed/opened with each manual actuation. Other than the momentary ground fault alarms during valve actuation, there was no apparent evidence of a degraded motor condition as the valve fully stroked with each actuation. A problem identification report was issued to perform additional investigations. A maintenance work request was subsequently issued and closed to a "trend for now" status. As a result, no specific troubleshooting effort occurred.

A root cause investigation team was assembled to investigate the March 4, 2000 event and determine the cause for RR-MOV-053A failing to close upon demand. Field walkdowns, interviews, CNS and industry experience reviews, motor winding resistance measurements, Valve Operation and Test Evaluation System (VOTES) testing of the redundant valve (RR-MOV-MO53B) and repaired valve (RR-MOV-MO53A), and disassembly and inspection of the failed motor with support from industry experts were performed.

BASIS OF REPORT

The condition identified on March 4, 2000 is reportable under the requirements of 10CFR50.73(a)(2)(I)(B) in that CNS was in a condition prohibited by the Technical Specifications. Based on ground fault indications received on January 11 and 14, 2000 and the identified cause of the motor failure, it has been conservatively determined that the failed condition existed for a period longer than allowed by Technical Specifications. Technical Specifications require an inoperable Reactor Recirculation Discharge Valve be restored to operability within 7 days or be in Mode 3 (hot shutdown) within the next 12 hours.

CAUSE

Results of analyzing causal factors determined the root cause to be equipment part defect due to vendor manufacturing practices.

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

The failure of RR-MOV-053A to fully close upon demand was due to a failure of the motor, resulting in the valve stopping in approximately the 80% closed position. The failed motor is a Peerless-Winsmith, 250 VDC, serial number YY63473, 150 ft.-lb., 10.83 HP, D225 frame motor. The motor contains a commutator and two pairs of brushes for transfer of current to the armature winding. By design, one spring per brush applies force to maintain brush pressure on the commutator. One or more springs failed to maintain adequate force on the brush due to binding in the brush retaining clip and/or a relaxation of spring tension. Two of the four springs were found to apply noticeably less tension on their associated brushes. One of the brush retaining clips appeared to bind up some during movement. Gaps between the brushes and commutator resulted in arc strikes on the commutator, break down of the insulation, and the short to ground condition that alarmed in the control room. A broken brush was also observed (paired with one of the higher tensioned springs). The cause for the broken brush is not known but it does not appear to have any major impact on circuit continuity.

The cause for the differences identified in spring tension and the binding of the brush retaining clip are not known. Based on visual evidence, the springs appear to be the same design and manufacturer and installed to the same setting. Due to the singular nature of this motor failure and the lack of any similar occurrences identified in CNS or industry experience reviews, it appears to be an isolated case.

This event is reportable because it has been conservatively determined that the valve was inoperable for a period of time longer than allowed by Technical Specifications. Actions taken on January 14, 2000 were not sufficient to resolve the cause for ground fault alarms that provided precursor indication of the March 4, 2000 valve failure. The root cause investigation indicates that this occurred because knowledge of the indicators of ground fault alarms and procedure guidance were lacking. Problem identification reports were issued to document and investigate this contributing factor. Results of this additional investigation will be included in a supplement to LER 2000-007.

SAFETY SIGNIFICANCE

From a probabilistic safety analysis (PSA) perspective, the failure of RR-MOV-MO53A to close upon demand is of minimal risk significance. The CNS PSA does not require the isolation of the RR MOV-MO53 valves for successful reactor vessel core cooling. For the case where the LOCA break occurs on the reactor recirculation loop and the reactor recirculation discharge valve fails to close, no injection from LPCI is credited on that loop. For the case where the LOCA break occurs on the opposing loop, the injection path through the jet pumps to the reactor vessel is assumed rather than back through the reactor recirculation pump, through the suction line into the annulus region of the reactor vessel and then out the suction line on the broken loop. This success criteria is consistent with NUREG 4550, "Analysis of Core Damage Frequency from Internal Events." For the March 4, 2000 event, the valve closed to approximately 80% thus further supporting the assumed reactor vessel injection path described above. Successful core cooling is credited with one LPCI pump injecting through the intact loop.

Based on core cooling analysis for a postulated LOCA, the failure of a reactor recirculation discharge valve to close upon LPCI initiation has an adverse affect on core cooling similar to the failure of a LPCI System injection valve to open. Failure of a LPCI System injection valve to open is one of the single failures evaluated in the CNS Emergency Core Cooling System (ECCS) analysis. Calculated fuel peak cladding temperature for this event is within acceptance criteria. Failure of the discharge valve to close does not, in itself, result in an inability to: 1) shut down the reactor and maintain it in a safe shutdown condition;

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Cooper Nuclear Station	05000298	2000	-- 007 --	00	5 OF 5

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

2) remove residual heat; 3) control the release of radioactive material; or 4) mitigate the consequences of an accident. Therefore, this condition does not represent a Safety System Functional Failure.

CORRECTIVE ACTIONS

Immediate Corrective Actions:

Replaced the failed motor on RR-MOV-MO53A, completed visual inspections, performed VOTES testing, and confirmed valve operability.

In order to bound the extent of condition, performed motor current analysis testing for similar DC motors at CNS.

Issued a Standing Order to address appropriate action in response to DC ground alarms.

Additional Corrective Actions:

CNS will summarize results of the pending investigation of the response to ground fault alarms received on January 14, 2000 in a supplement to LER 2000-007.

PREVIOUS EVENTS

LER 88-003, Revision 1, "RHR Pump 'B' Motor Ground Resulting from Worn Stator Field Coil Insulation Discovered Subsequent to an Unplanned Reactor Trip." This event was attributed to excessive relative movement between a surge ring and the stator field coil.

LER 85-012, "High Pressure Coolant Injection System Inoperability." This event was attributed to a failed bearing in the motor.

Correspondence No: NLS2000032

The following table identifies those actions committed to by the District in this document. Any other actions discussed in the submittal represent intended or planned actions by the District. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITTED DATE OR OUTAGE
CNS will summarize results of the pending investigation of the response to ground fault alarms received on January 14, 2000 in a supplement to LER 2000-007.	May 10, 2000