Nebraska Public Power District

COOPER NUCLEAR STATION
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CNSS948057

February 17, 1994

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

Dear Sir:

Cooper Nuclear Station Licensee Event Report 93-031, Revision 1, is forwarded as an attachment to this letter.

Sincerely,

R. L. Gardner
Plant Manager

RLG/nc

Attachment

cc: L. J. Callan
G. R. Horn
J. M. Meacham
R. E. Wilbur
V. L. Wolstenholm
D. A. Whitman
INPO Records Center
NRC Resident Inspector
R. J. Singer
CNS Training
CNS Quality Assurance
CNS Regulatory Compliance Specialist

250029

IE22

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 6

TITLE (4)
HPCI System Inoperability Resulting From A Dislodged Motor Operated Valve Pinion Gear Key And Motor Starter Contaminants

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 8	3 0	9 3	9 3	— 0 3 1	— 0 1	0 2	1 7	9 4		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)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)	1 0 0	20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
		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
John R. Myers	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	
E	B J	2 0	L 2 0 0	Y							
E	B J	M S T R	N 4 3 1	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 August 30, 1993, following surveillance testing, HPCI-MO-MO20, the High Pressure Coolant Injection (HPCI) Pump Discharge valve, failed to open upon operator demand. Subsequently, at 2:25 pm, the HPCI system was declared inoperable. Investigation determined that the motor pinion gear key was dislodged from its required position, allowing the motor pinion gear to freely rotate on the motor shaft. On September 1, during post maintenance testing following repair of the valve, it again failed to properly stroke. Upon investigation, paint and metal chips were found in the starter cabinet (starter). During subsequent investigation, a paint chip was observed to fall from the vicinity of one of the contactors in the starter.

Operators supplied by the factory have the motor shaft staked to capture the motor pinion gear key. Motors replaced in the field require re-staking to ensure the key remains correctly positioned. Limitorque Maintenance Update 89-1 addresses this concern. Although procedures were revised to require staking, no inspection of previously rebuilt motor operators (including HPCI-MO-MO20) was conducted. The failure of the valve to close following maintenance is attributable to debris (a small paint chip) lodged in a contactor. The debris is believed to be the result of either recent modifications or inadequate cleaning during periodic maintenance.

HPCI-MO-MO20 and its starter were repaired, tested, and returned to service. Maintenance history was reviewed to identify operators which may have unstaked keyways, and inspections planned to verify key installations. Inspection and cleaning of essential starters and MCC cubicles (MCC) has been completed. Procedures for design changes will be revised to ensure cleanliness requirements are clearly stated. The requirements for periodic inspections and cleaning will be enhanced.

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

A. Event Description

During system restoration following performance of Surveillance Procedure 6.2.2.3.1 (HPCI Steam Line High Flow Calibration And Functional/Functional Test) on August 30, 1993, HPCI-MO-M020, the High Pressure Coolant Injection (HPCI) Pump Discharge valve, failed to open when the control switch was placed to the open position. Subsequently, at 2:25 pm, the HPCI system was declared inoperable and the Technical Specifications Limiting Condition For Operation 3.5.C.2 was entered. Preliminary investigation of the valve failure determined that the motor pinion gear key was dislodged from its required position, allowing the motor pinion gear to freely rotate on the motor shaft.

On September 1, 1993, during post-maintenance testing following repair of HPCI-MO-M020, the valve failed to close upon demand from the Control Room. Upon investigation, debris, consisting of paint and metal chips, was found in the bottom of the starter cabinet (starter). During subsequent inves gation, a paint chip was observed to fall from the vicinity of on the contactors in the starter.

B. Plant Status

Normal power operation at approximately 100 percent power.

C. Basis for Report

Inoperability of the HPCI system, a condition that could have prevented the fulfillment of the safety function of a system needed to mitigate the consequences of an accident, reportable in accordance with 10CFR50.73(a)(2)(v).

D. Cause

The failure of HPCI-MO-M020 to open upon demand on August 30 was a result of the motor pinion gear key being dislodged from the keyway due to the failure to stake the keyway on the motor shaft following previous repair activities. Based on correspondence with Limitorque and subsequent field verification, motor operators supplied by the factory are staked to capture the motor pinion gear key. Motors replaced in the field would require re-staking to prevent this failure mode. Limitorque issued Limitorque Maintenance Update 89-1 to address this concern. Although procedures were revised to require staking, no action was taken to inspect motor operators rebuilt prior to implementation of the revised procedure. The motor on HPCI-MO-M020 was replaced following receipt of the Limitorque bulletin but prior to revision of the appropriate procedures.

The most probable cause for the failure of the valve to close on September 1 was debris (a small paint chip) lodged between the contacts of the 72C or 72M contactor in the DC motor starter, preventing proper operation of the contactor. The source of the debris could not be

D. Cause (continued)

conclusively determined. It is possible it resulted from drilling done during recent modifications, however, an inspection of seven additional starters modified by the same design change found six of the seven contained metal and paint chips, although only two had drilling performed by the design change. The other potential explanation of the debris is inadequate cleaning of the starters during periodic maintenance.

E. Safety Significance

The HPCI system is designed to provide core cooling and vessel depressurization for transient and accident conditions, particularly for small and intermediate sized LOCAs. For a large LOCA the vessel is depressurized rapidly and the HPCI system does not provide a significant contribution. For small and intermediate breaks the HPCI system can provide sufficient flow to maintain vessel level and to depressurize the vessel to the point where the low pressure ECCS systems can provide long term core cooling. As the break size becomes larger, there is a point where the HPCI system cannot maintain vessel water level, but the vessel pressure remains above the point where the low pressure ECCS systems can inject into the vessel to provide core cooling. In this situation, the Automatic Depressurization System (ADS) functions to depressurize the vessel below the pressure threshold of the low pressure ECCS systems.

HPCI-MO-M020 is a normally open valve, which receives an automatic open signal. It is closed for testing. The failure of the valve to open via the control switch following testing resulted in HPCI being declared inoperable. The valve could be manually opened. CNS Technical Specifications provide an allowable out of service time of 7 days for HPCI being inoperable. ADS would still be able to accomplish its safety function so that there would be no net effect on the accident consequences. The small break LOCA analysis applicable to the Cooper Nuclear Station assumes a total loss of HPCI as a limiting single failure.

F. Safety Implications

The inoperability of HPCI is most significant during full power operation. As such, the safety implications associated with HPCI are fully addressed in the section above.

The generic aspects of the as found conditions are addressed below in Corrective Actions. As addressed in that section, the keys in a few valve operators were found to be installed without the motor shaft being staked, however, the keys were correctly located and the associated components (i.e., gear, set screw) tight such that the valves would have functioned properly. Although other motor starters were also found to have debris present, the debris was less extensive, and there was no immediate concern for their operability.

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G. Corrective Action

The key was replaced, the shaft properly staked, and the operator reassembled and tested. During post maintenance testing on September 1, as noted above, the valve failed to properly stroke. Testing was discontinued until the failure could be investigated. During the investigation, debris (i.e., paint and metal chips) was discovered in the starter. Upon opening the contactor cover, a small paint chip was observed to come from the vicinity of the contactor. The starter and internal components were cleaned. The valve was subsequently exercised several times, with satisfactory results. Upon completion of surveillance testing, HPCI was declared operable at 6:36 pm on September 2.

The motor operators susceptible to the loss of the pinion gear key were those with motors replaced prior to implementation of the upgraded procedural requirements. A review of operational requirements and motor operated valve maintenance history was conducted to determine those valve operators subject to motor replacement. After eliminating Size 00 and 000 motor operators which by design do not require staking, the valves susceptible to this condition were categorized as follows:

1. 15 Motor Operators - Safety Related With Active Safety Function
2. 16 Motor Operators - Safety Related With No Active Safety Function
3. 22 Motor Operators - BOP And Classified Important-To-Availability
4. 25 Motor Operators - Remaining BOP

A search of maintenance history focusing on operators in Categories 1, 2, and 3, and Category 4 operators having EOP support requirements, was conducted to identify those motors that had been replaced prior to implementation of the revised maintenance procedure. For those motors which had been replaced, the maintenance documentation was reviewed to determine if instructions had been included to stake the shaft. Based on the results of this review, the following motor operators were determined to potentially have unstaked keyways. These operators were visually inspected to verify the expected shaft condition:

HPCI-MO-M025	HPCI Pump Minimum Flow Bypass Isolation valve
HPCI-MO-M024	HPCI Pump Test Bypass Shutoff valve
RHR-MO-M013D	RHR Pump D Suction from Suppression Chamber
RHR-MO-M039B	Suppression Chamber Cooling Loop B Outboard Isolation
RHR-MO-M015A	RHR Pump A Shutdown Cooling Suction
RHR-MO-M015D	RHR Pump D Shutdown Cooling Suction

In each case, the shaft was unstaked as anticipated; all components, however, including the pinion gear, key, set screw, and locking wire, were found in good physical condition, tight, and properly positioned.

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

G. Corrective Action (continued)

Although there is a high level of confidence that all unstaked motor operators were identified and corrected (excluding those classified as Category 4/non-EOP), additional inspections of Size 0 or larger motor operators are planned based on the following criteria:

1. Category 1 and 2 motor operators not previously inspected or confirmed to be staked through documentation review will be inspected during the next outage of sufficient duration. Five operators remain to be inspected.

2. Based on the results of additional inspections done per item 1, the need for additional inspections of Category 3 and 4 motor operators not previously inspected or confirmed to be staked through documentation review will be assessed.

3. The remaining warehouse inventory of Limitorque motor operators, if any, will be assessed for the need for visual inspection.

Upon discovery of the debris in the HPCI-MOV-MO20 starter, inspections of seven additional starters associated with the HPCI system were conducted. Based on finding minor amounts of debris in these starters, it was determined that additional starters and MCC cubicles (MCCs) should be inspected. To assess the extent of debris in the electrical equipment, inspections of all EQ DC starters manufactured by Nutherm International and EQ MCCs (except spares) were conducted. The results of the inspections were categorized using the following priorities:

Priority 1 — Debris or foreign material resting on top of internal components that could migrate.

Priority 2 — Debris or foreign material resting on the bottom of the box with no potential for migration.

Priority 3 — Minor dust judged to be acceptable.

In addition to the eight DC starters initially inspected as noted above, a total of 182 MCCs and 19 additional DC starters were inspected. The results of these inspections are categorized below:

Priority	MCC Cubicles	DC Starters
1	12	5
2	41	9
3	129	5

One DC starter, for HPCI-MO-MO14, Steam Supply to HPCI Turbine, was found to have degrading internal paint.

G. Corrective Action (continued)

Cleaning of MCCs and starters classified as Priority 1 was completed on September 3, 1993. MCCs and starters classified as Priority 2 were cleaned by October 1, 1993, with the exception of the starter for PC-MOV-1302MV (Suppression Chamber Dilution Supply Isolation Valve - Train B). Due to an administrative error, cleaning of this starter was not completed until November 24, 1993.

As additional corrective action, the following actions will be accomplished:

1. The remaining essential and non-essential MCCs and starters will also be inspected. These inspections will be completed by March 31, 1994. Followup cleaning will be accomplished based on priority assigned by the inspections.

2. The scope, frequency, and sequencing of periodic actions to clean and inspect MCCs and starters will be reviewed and upgraded. The review will include all MCCs and starters.

3. Procedures that direct MCC or starter inspections will be reviewed to ensure that adequate and clear acceptance criteria is provided.

4. Procedures used to develop and implement design changes (including temporary modifications) will be reviewed to ensure that post-modification inspections address cleanliness.

5. A Deficiency Report was written to document and evaluate the degrading paint found in the starter for HPCI-MO-MO14. Until the cause is determined and/or the condition permanently corrected, the HPCI-MO-MO14 starter will be inspected on an increased frequency to ensure that continued degradation does not create an operability problem.

Finally, to address the failure to inspect the rebuilt operators upon receipt of the Limitorque bulletin, all previously issued Limitorque maintenance bulletins are being reviewed again, and a sample of operating experience reports is being reviewed to ensure that the necessary actions have been taken upon receipt of information such as that contained in the Limitorque maintenance bulletin.

H. Similar Events

None.

Supplemental Information

HPCI-MO-MO20 is a Limitorque motor operator, Model SB 3. EIIS System Code - BJ. EIIS Component Code - 20.

The DC starter for HPCI-MO-MO20 is manufactured by Nutherm International, Model 1417. EIIS System code - BJ. EIIS Component Code - MSTR.