Nebraska Public Power District

COOPER NUCLEAR STATION
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CNSS903986

December 7, 1990

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

Dear Sir:

Cooper Nuclear Station Licensee Event Report 90-012, Revision 0, is being forwarded as an attachment to this letter.

Sincerely,

J. M. Meacham
Division Manager of
Nuclear Operations
Cooper Nuclear Station

JMM:bjs

Attachment

cc: R. D. Martin
G. R. Horn
R. E. Wilbur
V. L. Wolstenholm
D. A. Whitman
INPO Records Center
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R. J. Singer
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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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)
Valve Stem Clamp Setscrew and Trim Failures Due to Vendor Design Deficiencies

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

OPERATING MODE (9): N

POWER LEVEL (10): 0 9 7

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)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
[ ] 20.405(a)(1)(iii)	[X] 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
B	B O	F C V	A 3 9 5	Y					
B	B O	F C V	A 3 9 5	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)

Two Residual Heat Removal (RHR) valves, manufactured by Anchor/Darling and modified by the manufacturer's service personnel during the 1990 Refueling Outage, failed during subsequent plant operation. On August 29, 1990, RHR-MOV-MO34B (Suppression Chamber Cooling Loop B Inboard Throttle Valve) failed to operate correctly during surveillance testing. Investigation determined that setscrews were incorrectly installed in the stem clamp due to inadequate design instructions, allowing the stem to rotate rather than move axially as required to position the disc. On October 19, during cold shutdown operation, RHR-MOV-MO27B (RHR Loop B Injection Outboard Throttle Valve) failed to operate correctly. Investigation determined that the valve trim had failed, blocking the disc and resulting in the release of loose parts into the Reactor Vessel.

The root cause of these failures is inadequate design by the vendor. Although the valves were tested satisfactorily following modification, there is reasonable doubt they could have completed their safety function if required, and thus they could be considered inoperable following the 1990 Refueling Outage.

The stem clamp design was clarified, the installation was corrected, and the 34B valve returned to service. Temporary replacement trim was designed and installed in the 27B valve, and the valve tested and returned to service. Operation with the lost parts was evaluated and determined to be acceptable. The valve trim will be re-designed, with installation during the next refueling outage.

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

A. Event Description

Two Residual Heat Removal (RHR) valves, manufactured by Anchor/Darling Valve Company and modified by the manufacturer's service personnel during the 1990 Refueling Outage, failed during subsequent plant operation. On August 29, 1990, during monthly surveillance testing, RHR-MOV-MO34B, Suppression Chamber Cooling Loop B Throttle Valve, failed to operate correctly, and was declared inoperable at 2:20 AM. Investigation into this failure revealed that, due to inadequate design drawings, Anchor/Darling service personnel incorrectly installed setscrews in the stem clamp during the valve modification in the 1990 Refueling Outage. This allowed the valve stem to rotate rather than move axially as required to position the disc. The intended design for the stem clamp was clarified, the stem clamp installation corrected, and the valve tested and declared operable at 7:33 PM.

On October 19, 1990, during startup preparations following the Reactor Scram of October 17 (LER 90-011), RHR-MOV-MO27B, RHR Loop B Injection Outboard Throttle Valve, failed to close upon manual demand. RHR flow was also noted to not correlate correctly with valve position. Following testing, the valve was declared inoperable at 1:30 PM on October 20. Investigation into this failure revealed that the throttling trim installed during the 1990 Refueling Outage had failed and moved such that it blocked the path of the valve disc, preventing it from closing. The valve was operable in the open direction. This modification was also designed by Anchor/Darling and installed by their service personnel.

The throttling trim installed during the 1990 Refueling Outage (refer to the attached illustration) consisted of eight stainless steel rings approximately 1.5 inches wide and 0.25 inch high, with an outside diameter of approximately 18.5 inches. The rings included bosses approximately 0.38 inch by 1 inch by 0.25 inch high, on approximately 6 inch spacing, to separate the rings. The rings were held in alignment by two pins (approximately 0.38 inch diameter by 3.5 inches long). This trim was intended to improve the throttling characteristics of the valve and eliminate cavitation at the valve wall.

Upon disassembly, it was found that the two trim ring alignment pins, several bosses, and one piece of trim (approximately 6 inches long) were missing. The 6 inch piece of trim was recovered; the remaining parts are believed to have been carried through the RHR and recirculation piping and jet pumps, and now reside in the lower plenum region of the Reactor Vessel. Operation with the lost parts was evaluated by General Electric and determined to be acceptable. Temporary trim was designed and installed, and, following testing, the system was declared operable at 7:00 PM on October 29.

B. Plant Status

The plant was operating at 97 percent power when RHR-MOV-MO34B failed, and was in cold shutdown when RHR-MOV-MO27B failed. From the time of startup from the 1990 Refueling Outage (May 4, 1990), the plant was in operation at power levels up to 100 percent until October 17, 1990, when an automatic scram occurred. Following the scram, the plant was placed in cold shutdown.

C. Basis for Report

Failure of these valves is being reported in accordance with 10CFR50.73 (a)(2)(i). Although the valves were tested satisfactorily following the modifications during the 1990 Refueling Outage, there is reasonable doubt that these valves would have been capable of performing their intended safety function following modification, based on the limited time of operation prior to failure. Accordingly, the valves could then be considered inoperable since startup from the 1990 Refueling Outage, thereby exceeding the Limiting Conditions for Operation specified in Technical Specifications. This condition was determined reportable on November 9.

D. Cause

The root cause of these failures is inadequate design by the vendor, Anchor/Darling Valve Company. In the case of RHR-MOV-MO34B, the stem clamp setscrews were not countersunk into the stem by vendor field service personnel, and an insufficient number were installed to resist the forces which could be developed during valve operation. The data supplied by the vendor did not indicate the details of the setscrew installation.

In the case of RHR-MOV-MO27B, it has been determined that the valve trim as designed and installed by Anchor/Darling was inadequate to withstand the internal dynamics of the valve while throttling flow, resulting in fatigue failure. This valve failed after approximately 130 hours of operation.

E. Safety Significance

No significant effect. These failures affected only the "B" train Residual Heat Removal (RHR) system. Since the modifications had not been made to the "A" train components, the "A" train was fully capable of performing its intended functions.

In the case of RHR-MOV-MO34B, a redundant valve exists which provides containment isolation capability.

In the case of RHR-MOV-MO27B, the lost parts have been analyzed and determined to not present a significant safety concern to continued Reactor operation or the redundant containment isolation valve (RHR-MOV-MO25B) which exists downstream of the 27B valve. This valve remained operable for the containment isolation function.

F. Safety Implications

RHR-MOV-MO34B is an 18 inch globe valve with an SMB-4 Limitorque operator. This valve serves two safety functions: containment isolation and suppression pool cooling. In the event of an accident, this valve receives a close signal upon low pressure core injection initiation; at an appropriate time during recovery, it is opened to initiate suppression pool cooling. For the containment isolation function, a redundant valve (RHR-MOV-MO39B, Suppression Chamber Cooling Loop Isolation) exists to provide a redundant containment isolation function. RHR-MOV-MO39B is a gate valve with a different stem design, and is not subject to this failure. Therefore, the containment isolation function could have been achieved.

F. Safety Implications (continued)

For suppression pool cooling, the USAR requires operability of RHR-MOV-MO34A or B to perform the suppression pool cooling mode of RHR operation. In the case of a large break LOCA, sufficient flow would be lost through the break to provide the necessary cooling capacity. This is not the case for small break LOCAs, and the safety analyses for these assume operability of at least one suppression pool cooling valve. Since the A RHR train was operable, the suppression pool cooling function could have been achieved.

RHR-MOV-MO27B is a 24 inch angle-globe valve with an SB-4 Limitorque operator. This valve serves two functions: containment isolation and coolant injection. This valve is normally open; in the event of an accident, it also receives an open signal when Reactor Pressure decreases to 450 psig. This valve can be remotely closed to provide containment isolation.

For the containment isolation function, automatic containment isolation is provided by RHR-MOV-MO25B. RHR-MOV-MO25B closes automatically upon a Group 2 Isolation when in the shutdown cooling mode (Reactor pressure less than 75 psig). The ability of RHR-MOV-MO25B to close could be affected by the observed failure of RHR-MOV-MO27B as the loose material could block the valve partially open. The extent of this effect would depend on the size of the failed trim pieces. As illustrated by this failure, the pieces are likely to be small, and, because of valve design and operating flow, would readily pass through the RHR valves, recirculation pipe and jet pumps. A testable check valve (RHR-AOV-AO68B) also exists downstream of RHR-MOV-MO25B, which would prevent flow out of the containment. This valve is considered a pressure isolation valve rather than a containment isolation valve. It is considered extremely unlikely that an intact ring could leave the 27B valve. Therefore, the containment isolation function could have been accomplished.

In the event of an accident requiring low pressure coolant injection, RHR-MOV-MO25B and RHR-MOV-MO27B receive an open signal, which is maintained for five minutes. Throttling f RHR-MOV-MO27B would be accomplished to control vessel water level or to provide for containment spray if containment integrity were threatened. In the injection mode, small pieces of trim would pass into the Reactor Vessel without damage or blockage. Larger pieces could lodge at various locations in the RHR system, potentially creating a partial blockage. Since the "A" RHR train was operable and a crosstie valve exists, adequate injection capability existed.

G. Corrective Action

Based on vendor direction, two additional setscrews were installed in the stem clamp for RHR-MOV-MO34B. All four setscrews were countersunk into the valve stem and mechanically locked in place, as recommended by the vendor's engineering group. The valve was satisfactorily tested and returned to service. The drawings for RHR-MOV-MO34B will be revised to reflect the as-built stem clamp configuration.

G. Corrective Action (continued)

Following discovery of the RHR-MOV-MO27B failure, independent consultants and the vendor were engaged to conduct an intensive analysis to determine the cause of the failure. Based on the preliminary root cause determination, fatigue failure, it was decided not to install identical replacement trim. New trim was designed and installed on a temporary basis, and system testing accomplished satisfactorily.

A "crawler" with remote video equipment was used to search both the upstream and downstream piping for loose parts. The upstream piping was searched into the first horizontal pipe segment, and the downstream piping as far as the next valve, RHR-MOV-MO25B, located adjacent to RHR-MOV-MO27B. One piece of trim, approximately 6 inches long, was located in the upstream piping and removed. No other loose parts from the valve were found. An analysis by General Electric concluded that, because of the flow rates involved, the lost parts had most likely passed through the RHR piping, Reactor Recirculation piping, and Jet Pumps, where they would have migrated to the Reactor Vessel lower plenum region. An analysis for the lost parts in this region concluded that there was no potential for flow blockage (with subsequent fuel damage), interference with control rod operation, or corrosion or chemical reaction concerns. This analysis also concluded that it was unlikely that the downstream valves would be affected. To ensure operability of these valves, RHR-MOV-MO25B was stroked, and RHR-AOV-AO68B, RHR Loop B Injection Line Testable Check Valve, was leak tested using a special procedure, to ensure it was properly seated.

The trim modification was designed, and parts supplied, for both RHR-MOV-MO27A and B. Since system testing required fuel in the Reactor Vessel, and fuel would be off-loaded for the 1990 Outage, the "A" train modifications were delayed. The trim for RHR-MOV-MO27A and B will be redesigned, and the temporary trim in RHR-MOV-MO27B replaced. Since this trim design is unique to RHR-MOV-MO27A and B, no additional components are affected.

H. Similar Events

There have been no previous instances of valve failures with a similar cause at Cooper Nuclear Station.

SUPPLEMENTAL INFORMATION

RHR-MOV-MO34B is an 18 inch Anchor/Darling Model 839-3 globe valve, with a Limitorque SMB-4 actuator with a 200 ft-lb motor. RHR-MOV-MO27B is a 24 inch Anchor/Darling Model 929-3 angle-globe valve, with a Limitorque SB-4 actuator with a 250 ft-lb motor.

EIIS System Code - BO

EIIS Component Function - FCV

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92

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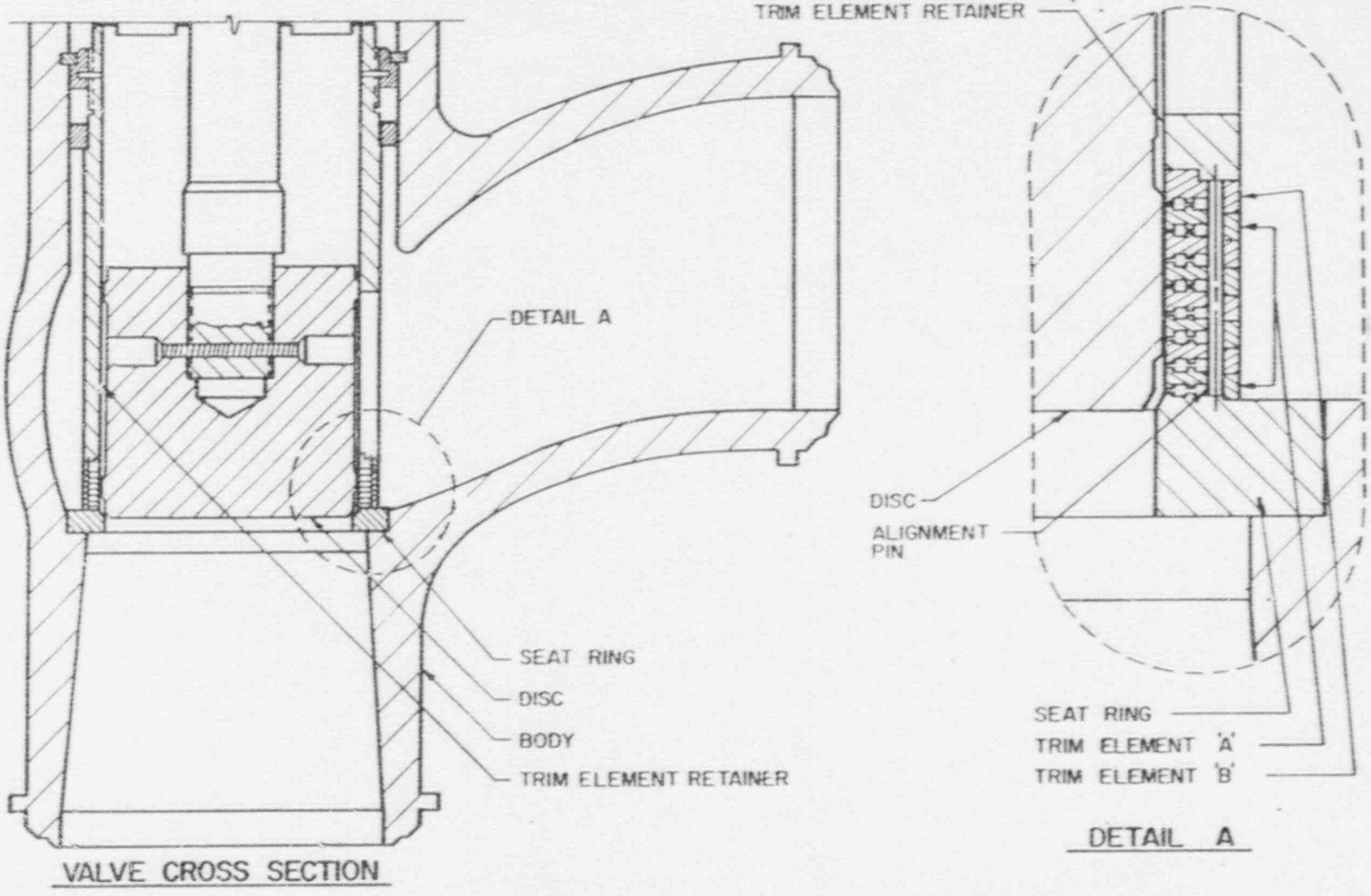
TEXT (If more space is required, use additional NRC Form 366A's) (17)



RHR-MOV-MO27B