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SUBJECT: Responds to violations noted in Insp Rept 50-331/89-18.

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Iowa Electric Light and Power Company

December 20, 1989
NG-89-3723

Mr. A. Bert Davis
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Response to Inspection Report 89018

File: A-102, A-103

Dear Mr. Davis:

This letter and attachments are provided in response to NRC Inspection Report 89018. Attachment 1 contains our response to two open items identified in Inspection Report 89018. Attachment 2 contains a description of the background, test program, and technical analysis pertaining to our Main Steam Isolation Valve improvements. This information is submitted per your request in the inspection report.

If you have any questions regarding this response, please feel free to contact this office.

Very truly yours,

Daniel L. Mineck
Manager, Nuclear Division

Attachment: 1. Response to Inspection Report 89018
2. Main Steam Isolation Valve Test Program

DLM/VJC/gt

cc: V. Crew
U. S. NRC Document Control Desk (Original)
L. Liu
L. Root
R. McGaughy
J. R. Hall (NRR)
NRC Resident Inspector - DAEC
Commitment Control No. 890383

IE01

Iowa Electric Light and Power Company
Response to Inspection Report 89018

1. WEAKNESSES

a. PMARs

DCP No. 1424 added a CRD low suction pump trip time delay relay to each pump to prevent spurious trips due to short duration pressure fluctuations in the pump suction line. The relays have a 5 to 50 second delay capability. The relays are set to delay pump trip by 15 seconds. The pumps have a limited life if the low suction pressure trip fails to occur. A review of station surveillances showed no periodic tests are planned to ensure the relay functions as required. According to the licensee, testing of these relays would be covered by the Preventive Maintenance Action Request (PMAR); however, a computer search of PMARs showed no periodic testing scheduled. The PMAR Coordinator could not explain why no periodic tests were planned other than to note he probably missed it when reviewing the numerous Equipment Database Update Requests (EDBURs) he receives. Licensee management will review the causes(s) for the lack of a PMAR on the CRD pumps low suction trip time delay relay to correct the problem and to ensure other components have not been missed as a result. (Open Item 331/89018-01(DRS)).

RESPONSE

1) Corrective Actions Taken and the Results Achieved:

These relays have been added to the preventive maintenance program thereby assuring periodic testing of their functioning.

2) Corrective Actions to be Taken to Prevent Recurrence:

We are revising the applicable administrative control procedure to clearly define and assign the responsibilities for PMAR identification and implementation.

We are also continuing to review the problem concerning PMARs on modified equipment and plan to have a program in place to address this problem. The program will be established as part of the reorganization of the engineering groups, described in our response to NRC Inspection Report 88023 amended by our letter (NG-89-2936) of October 16, 1989.

This reorganization will be completed by February 16, 1990. Substantive revision to the PMAR Program will be aggressively pursued following the reorganization.

b. DOCUMENTATION PROCESSING TIMELINESS

During the review of DCP No. 1424, the inspector noted that the modification was completed in October 1988 and accepted by the Plant Superintendent in January 1989, yet it still was going through final closure process during the time of our inspection on August 31, 1989. The inspector questioned why it required eight months to process the final closure of the DCP.

RESPONSE

1) Corrective Actions Taken and the Results Achieved:

At the time of the inspection this package was being closed as part of an aggressive program we had begun to reduce the backlog of design change packages/minor modifications (DCP/MM) awaiting final closures. During the 1st quarter of 1989 we recognized that the modification backlog was unacceptable and began this reduction effort on April 1, 1989. Our procedures define this backlog as any modification which is not through engineering final closure in 90 days from plant superintendent acceptance.

The number of packages (greater than 90 days since Plant Superintendent acceptance) on April 1, 1989 was:

DCP/MM awaiting final closure = 57

The number of packages (greater than 90 days since Plant Superintendent acceptance) in December 19, 1989 is:

DCP/MM awaiting final closure = 4

The four DCP/MM remaining will be closed by February 15, 1990.

Modifications accepted by the Plant Superintendent since April 1, 1989 have had final closure completed within 90 days. There was one exception to this which required a few additional days for final document distribution.

2) Corrective Actions to be Taken to Prevent Recurrence:

The current process and resources devoted are adequate to ensure no new backlog develops.

No further corrective actions are needed.

c. DOCUMENTATION PROCESSING TIMELINESS

During the review of DCP No. 1436 the inspector noted that the modification had been accepted by the Plant Superintendent on August 31, 1989. While the applicable station procedures in the control room had been updated, at least one other controlled set of station procedures (the Plant Library) still had the old revisions as of September 19, 1989, almost 3 weeks later.

The licensee was asked to determine the cause(s) for these delays and to implement corrective actions to improve the timeliness of documentation processing, especially for the controlled sets of station procedures.

RESPONSE

1) Corrective Actions Taken and the Results Achieved:

The Document Control Center has established a set of procedures in the Library that, along with the Control Room and Simulator sets, will be updated immediately (within one working day). This will allow plant and design engineers to have an updated copy readily available.

A memo has been sent to plant personnel from the Document Control Supervisor to explain that the Library has updated operating procedures and the Document Control Center will continue to maintain the other controlled sets throughout the plant. The Document Control Center has established a goal of distributing controlled procedure updates within one working week.

This change ensures that updated procedures are not only available to the Control Room and Simulator as in the past, but also readily available in the Library if needed by plant staff/engineering personnel.

2) Corrective Actions to be Taken to Prevent Recurrence:

No further corrective actions are needed.

Main Steam Isolation Valve Test Program

NRC Region III in Inspection Report 89018 asked that we propose a test program for the Main Steam Isolation Valves (MSIVs) at Duane Arnold Energy Center (DAEC). It was recognized in that Inspection Report that the maintenance corrective actions taken to date have reduced the MSIV's leakage rate problems and that modifications to be installed in the upcoming refuel outage appear capable of resolving historical problems. This requested test program should demonstrate that the "new design will perform as expected."

BACKGROUND

We have been gathering historical data since the early 1980s to provide a basis for identifying improved maintenance techniques and modifications to the valve design to improve the LLRT performance and minimize forced outages to repair MSIVs. LLRT performance since 1980 is included in Supplement A. The maintenance techniques have primarily focused on improving tooling to ensure all the valve seats are round and concentric within the valve bore. Modifications to the valve design have focused on minimizing problems that could lead to forced outages, improving materials, and minimizing friction forces external to the valve body.

The improved maintenance techniques and modifications to the valve design had shown only a marginal improvement in LLRT performance. In 1987 DAEC began a program to reduce the clearance between the disk/piston assembly and the valve bore. This program has shown success in improving LLRT performance. A preventive maintenance program is in place which will preserve the reduced clearances and continue to gather historical data.

Information provided by Region III in Inspection Report 88022 and from the GE BWR Owners Group shows that closing the MSIVs hot and with flow and performing the LLRT while the valves are still hot reduces the LLRT leakage rate. During the outage in September 1989, we tested all MSIVs mid-cycle and achieved an improvement in LLRT performance by incorporating this information into the test method. We are continuing to evaluate the test method to further improve LLRT performance.

We recognize that the improvements in maintenance techniques, the design modifications, and the improvements in LLRT method made to date will improve the LLRT performance but not to the degree which we believe is necessary. With this in mind we have been working with General Electric, the NSSS supplier for DAEC, and the other equipment manufacturers to identify upgrades to the MSIVs which could significantly improve LLRT performance. This team approach to improving LLRT performance has identified several modifications that will be installed during the 1990 refueling outage. These modifications are listed in Supplement B. In general, the modifications are intended to improve LLRT performance by:

1. Increasing the seating force.

2. Decreasing the side loads that detract from the seating force.

3. Minimizing the lateral movement of the disk as it seats by reestablishing concentricity, adding additional guiding, and reducing clearances.

In addition to installing modifications to improve LLRT performance, modifications will be installed to improve overall valve reliability (see Supplement C). By this team approach and by improving the total valve performance, the MSIVs at DAEC will be able to meet leakage criteria consistently.

TEST PROGRAM

The test program we have developed is based on tests required by regulations and an assessment of our MSIV history coupled with the new design modifications that will be installed in 1990.

We are required by 10 CFR 50 Appendix J and the DAEC Technical Specifications to conduct local leak rate tests (type C per Appendix J) on the MSIVs "during each reactor shutdown for major refueling or other convenient interval but in no case at intervals greater than two years".

We are required by 10 CFR 50.55a(g) to perform inservice tests of the MSIVs in accordance with Subsection IWV to the ASME Boiler and Pressure Vessel Code 1980 with winter 1981 addenda. The MSIVs are defined by the DAEC Inservice Testing Program as being category A valves. Paragraph IWV-3420 establishes the interval of leak rate testing as at least once every two years. This test is performed in conjunction with the Appendix J type C LLRT. IWV-3427 provides for increased testing (frequency doubled) if the margin as defined by IWV-3427 is reduced by more than 50 percent until repairs can be accomplished. We presently have one valve on increased testing for seat leakage.

We will evaluate any valve which does not meet the allowable LLRT limits on successive tests and, if necessary, increase the testing frequency for that valve. The test interval and conditions for returning a valve to the original test frequency, if appropriate, would be similar to those provided in IWV-3427.

A preventive maintenance program for the MSIVs is designed to maintain the reduced clearances between the disk/piston assembly and the valve bore. The established program frequency requires that the two canted valves be disassembled every other refueling outage and the six non-canted valves every third outage. NRC IR 88022 suggested that three valves would be disassembled every refuel outage, one canted and two non-canted. Reviews conducted by Iowa

Electric in deciding which modifications would be installed also recommended that the frequency of preventive maintenance remain unchanged but that the number of valves scheduled for requiring preventive maintenance each refuel outage be revised to zero after the first cycle, four after the second cycle (inboard MSIVs including the canted valves), and four after the third cycle (outboard MSIVs). DAEC will record historical data similar to that obtained now during all valve disassemblies. Based on the data gathered, we will adjust the preventive maintenance (PM) program as necessary. We have coupled the PM program on the actuators and topworks with the valves.

ANALYSIS

The modified MSIVs are expected to have significantly improved leak test success rates compared to historical performance. Supplement C is a matrix of improvement features and contributing causes of failures. The features to be installed have been shown to improve leakage performance by proven application - at DAEC or other sites, by tests performed by EPRI or valve manufacturers, or by studies conducted by the BWR Owners Group. The improvement features address all the primary contributors to LLRT failure as presented by the BWR Owners Group and technically analyzed by the NRC in NUREG 1169. The primary contributor, improper maintenance, is addressed by restoring the valve to design dimensional tolerances, replacing components that may have been improperly maintained, and reviews performed in the modification process to ensure that procedures and tooling are appropriate for the modification and adequate training is conducted. Further, secondary contributors that are specific to DAEC are being addressed.

By reducing leakage the benefits to be gained include; consistent technical specification compliance reduction of repair and refurbishment costs, reduction in dose exposures to maintenance personnel, reduction in scheduled outage time, extension of the effective service life of the MSIVs, and a minimization of the potential for outage extension.

The success of the modifications will be determined by physical examination of the valves as well as leak rate tests. The presented preventive maintenance program incorporates this examination thereby ensuring the long term success of the modifications by correcting any hidden problems, maintaining acceptable dimensions, and replacing subcomponents before failure. Based on the established frequency the MSIVs that will be disassembled for preventive maintenance is 0 at the end of the first cycle, 4 at the end of the second cycle, and 4 at the end of the third cycle. This frequency takes into account the technical finding of NUREG 1169 that 'two or more operating cycles of maintenance and test experience may be needed to establish the effectiveness of the improved practices', a finding that is applicable to hardware modifications as well.

The test program also states that the preventive maintenance program will be evaluated at the end of the third cycle. This allows adjustment of the preventive maintenance program to ensure the valves are not disassembled excessively. NUREG 1169 also stated in its technical findings that during disassembly of MSIVs and attempted correction of "nonexistent or minimal defects in the valves under less-than-optimum field maintenance conditions, it is likely that some actual defects have been introduced that led to later leak test failure."

Repeated failure of a MSIV to pass leak rate testing is of concern to us. Provisions have been made in the test program to evaluate a valve which exhibits repeat failures and, if necessary, to increase the test frequency to ensure that problems are corrected promptly and stay corrected.

The technical analysis shows that the features to be installed are comprehensive in addressing known problems, proven through industry experience or testing, and appropriate to ensure a significant improvement in leakage performance. Therefore, the testing program presented is adequate to demonstrate that the new design performs as expected.

REFERENCES

1. NRC Region III Inspection Report 50-331/88022(DRS), January 25, 1989.

2. NRC Region III Inspection Report 50-331/89018(DRS), October 20, 1989.

3. NUREG 1169, "Resolution to Generic Issue C-8, An Evaluation of Boiling Water Reactor Main Steam Isolation Valve Leakage and the Effectiveness of Leakage Treatment Methods", August 1986.

4. EPRI NP-2454, "Comparison of Generic BWR-MSIV Configurations", June 1982.

5. EPRI NP-2381, Volumes 1 and 2, "Measurements and Comparisons of Generic BWR Main Steam Isolation Valves", July 1982.

6. GE Nuclear Energy, NEDC-13643-P, "Increasing Main Steam Isolation Valve Leakage Rate Limits and Elimination of Leakage Control Systems", November 1988.

LOCAL LEAK RATE TEST AS FOUND PERFORMANCE SINCE 1980

ACCEPTANCE CRITERIA <11.5 SCFH

VALVE/DATE	1980	1981	1983	1985	1987	1988	1989
CV4412 A IN	FAILED	38.6	0	0	0	36.0	5.3[1 2]
CV4413 A OUT	FAILED	65.7	1.8	GROSS	21.6	478.8	5.3[1 2 3]
CV4415 B IN	PASS	0	GROSS	GROSS	GROSS	13.2[2]	9.4[2]
CV4416 B OUT	PASS	53.0	49.8	0	3.4	0.2	>148
CV4418 C IN	FAILED	8.5	0	3.4	77.3	1.5[2]	4.2[2]
CV4419 C OUT	FAILED	GROSS	3.6	GROSS	0	13.1	25.4[2 3]
CV4420 D IN	FAILED	GROSS	0	0	0	40.3	6.3[2]
CV4421 D OUT	PASS	37.7	0.76	17.8	4.7	0	3.7[2]

1 - Combination test
2 - After clearance reduction
3 - After valve reboring

MODIFICATION PACKAGE FEATURES

Design features to improve MSIV leak tightness.

1. Increase the diameter of the actuator from 14 inches to 20 inches.
2. Increase the size of the external springs.
3. Machine the body bore to restore the as design dimensions.
4. Add four guide pads to assist alignment of the main disk for valve enclosure.
5. Machine the guide ribs to restore alignment and to reduce the clearance between the main disk and the guideribs.
6. Redesign the main disc assembly to reduce wear and improve alignment.

Design features to improve valve reliability.

1. Stiffen the topworks to reduce misalignment.
2. Incorporate a modified coupling between the valve stem and the actuator stem.
3. Incorporate a modified bonnet.
4. Incorporate graphite packing rings with proven field success.
5. Revise the stem material to reduce the potential of galling.

MATRIX OF IMPROVEMENT FEATURES AND CONTRIBUTING CAUSES OF MSIV FAILURES

	Primary Contributors							Secondary Contributors		
	▪ Improper maintenance	▪ Valve orientation	▪ Excessive clearance/seat to guide misalignment	▪ Lack of concentricity	▪ Incorrect seat contact	▪ Excessive coefficient of friction/corrosion		▪ Inadequate actuator loading	▪ Leakage sources other than seat	
1. Increase actuator diameter.						X		X		
2. Increase spring size.						X		X		
3. Machine body bore.	X			X	X					
4. Add guide pads.		X	X							
5. Machine guide ribs.	X			X	X					
6. Redesign main disk.					X	X				
1. Stiffen topworks.			X			X				
2. Incorporate modified coupling.			X			X				
3. Incorporate modified bonnet.	X			X						X
4. Incorporate graphite packing.						X			X	
5. Revise stem material.										