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PROBST,J.R. Iowa Electric Light & Power Co.
HANNEN,R.L. Iowa Electric Light & Power Co.
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SUBJECT: LER 89-013-00:on 890915,MSIV have unacceptable leak test results due to misalignments & excessive clearances.
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Iowa Electric Light and Power Company

November 10, 1989
DAEC-89-0793

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 DPR-49
Licensee Event Report #89-013

Gentlemen:

In accordance with 10 CFR 50.73 please find attached a copy of the subject Licensee Event Report, submitted for information.

Very truly yours,

Rick Hannen 10-13-89

Rick L. Hannen
Plant Superintendent - Nuclear

RLH/JRP/gt

cc: Director of Nuclear Reactor Regulation
Document Control Desk
U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D. C. 20555

NRC Resident Inspector - DAEC

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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)
Duane Arnold Energy Center (DAEC)	0 5 0 0 0 3 3 1	1 OF 0 7

TITLE (4) Main Steam Isolation Valves Have Unacceptable Leak Test Results Due to Misalignments, Excessive Clearances and Valve Orientation

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 9	1 5	8 9	8 9	0 1 3		0 0	1 1	1 0	8 9	None	0 5 0 0 0
											0 5 0 0 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	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)	XX 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)	FOR INFORMATION
		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
James R. Probst, Technical Support Engineer	AREA CODE 3 1 9 8 5 1 - 7 3 0 8

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	
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X	S B	I S V	R 3 4 4	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)

During a recent plant maintenance outage, Local Leak Rate Testing was performed on three Main Steam Isolation Valves (MSIVs) due to previous performance problems, in accordance with discussions between Iowa Electric and the Nuclear Regulatory Commission. As one of the three valves tested failed to meet the established criteria, the remaining five MSIVs were also tested. A second valve did not meet the leakage criteria, and a third, which had passed the initial testing, exhibited excessive leakage during a second test six days later. The causes were found to be: a) incorrect seat contact with lack of concentricity due to a slight misalignment of the valve bore with respect to the valve seat, b) excessive clearance between the valve bore and valve internals, and c) the valve's 35 degree canted orientation which makes it more susceptible to alignment problems. Only partial contact was noted at the top of the seat upon disassembly for this valve. Corrective actions taken included re-machining of valve discs and seats and installation of oversized internals. Long term upgrades to all MSIVs are planned for the 1990 refueling outage.

This LER is being submitted for information only.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER(6)			PAGE(3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Duane Arnold Energy Center	0 5 0 0 0 3 3 1	8 9	- 013	- 00	2 OF 7

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

I. DESCRIPTION OF EVENT:

On September 15, 1989, the plant was in cold shutdown to perform Main Steam Isolation Valve (MSIV) (EIIS System and Component Codes SB-ISV) Local Leak Rate Testing. In accordance with previous discussions between Iowa Electric and Nuclear Regulatory Commission Region III personnel, three MSIV's were to be tested initially. If any of these valves were found to have leakage exceeding the 11.5 Standard Cubic Feet per Hour (SCFH) specified in Technical Specification 4.7.A.2.c.3 for Type C tests, the remaining five MSIV's would also be tested, and corrective actions would be taken as appropriate. The tests were performed by pressurizing one side of a valve or valve(s) with air, and then monitoring the amount of air required to maintain the given pressure. The highest leak rate over a fifteen minute period was considered the as-tested leak rate.

TEST RESULTS

The three valves to be tested were CV4412 - the "A" Inboard MSIV, CV4413 - the "A" Outboard MSIV, and CV4419 - the "C" Outboard MSIV.

Date: September 15, 1989

Valve(s)	Location	Acceptance Criteria	As Tested
		SCFH	SCFH
CV4412 & CV4413 --combination test--	"A" Inboard "A" Outboard	< 11.5 per valve	< 5.3 total
CV4419	"C" Outboard	< 11.5	25.4

SCFH = Standard Cubic Feet per Hour of Air

Because CV4419 exceed the maximum leakage standard, the remaining five MSIVs were also tested:

Date: September 16, 1989

Valve(s)	Location	Acceptance Criteria	As Tested
		SCFH	SCFH
CV4415	"B" Inboard	< 11.5	9.4
CV4416*	"B" Outboard	< 11.5	>173.7

CV4418	"C" Inboard	< 11.5	4.2
CV4420	"D" Inboard	< 11.5	6.3
CV4421	"D" Outboard	< 11.5	3.7

*A single stroke of CV4416 reduced the leakage to 7.8 SCFH

Corrective maintenance was subsequently performed on the two valves which failed the initial LLRTs. The main seat and disc were ground for a better fit on the "C" Outboard (CV4419) and internals on the "B" outboard (CV4415 were replaced. Post maintenance tests were performed with the following results.

Valve(s)	Location	Acceptance Criteria	As Tested
		SCFH	SCFH
CV4415	"B" Inboard	< 11.5	32.6-37.9
CV4416	"B" Outboard	< 11.5	1.25
CV4419	"C" Outboard	< 11.5	3.4

Maintenance was then performed on the "B" inboard valve (CV4415), which, after passing its initial test, had failed a second test (being performed in combination with CV4416 by pressurizing between them). CV4415 had its main seat and disc ground. The "B" inboard valve was then tested alone, from the reactor side, by pressurizing the reactor vessel:

Valve(s)	Location	Acceptance Criteria	As Tested
		SCFH	SCFH
CV4415	"B" Inboard	< 11.5	1.0

II. CAUSE OF EVENT:

A. CV4419 - "C" Outboard MSIV:

Upon testing on September 15th, this valve had an as-found leakage of 25.4 SCFH versus the maximum allowable leak rate of 11.5 SCFH. Subsequently, the valve's packing was adjusted and it was stroked, but no significant change in leak rate was noted. The valve was disassembled and inspected. No misalignment of the valve topworks or

actuator was observed. Inspection of the valve seat indicated a runout of 0.007 inches, versus a maximum acceptable value of 0.0035 inches. The pattern on the seat indicated the disc was hitting high on the bore (upward angle from the centerline), a conclusion corroborated by examination of the seat contact line on the disc and valve seat.

The primary cause of the failure of CV4419 to pass its LLRT test was incorrect seat contact, with lack of concentricity a contributing factor. Examination of the valve indicated the root cause of the leakage was a slight misalignment of the valve bore with respect to the valve seat, although the interaction of numerous moving components might also have contributed to the problem.

B. CV4416 - "B" Outboard MSIV:

CV4416, the "B" Outboard MSIV had an as-found leakage of greater than 173.7 SCFH. The valve was stroked, with leakage being reduced to 7.8 SCFH, below the maximum allowable value of 11.5 SCFH. The valve was disassembled for further inspection. Inspection of the valve seat indicated a 0.004 runout versus the acceptable value of 0.0035 inches. The valve seat pattern indicated the disc was hitting parallel to the centerline but shifted to one side. This lateral misalignment did not appear to be enough to prevent a good contact line from forming between the disc and valve seats. Measurements indicated that the disc to bore clearance, although in the middle of the manufacturer's recommended range, was larger by approximately 0.004 inches than that of any other MSIV.

Because CV4416 passed subsequent tests after stroking it is possible that the valve had something on its seat that prevented initial full closure, or that frictional forces played a factor, or that the valve clearances were open enough for it to seat differently during various cycles. Examination of the valve found some evidence of a foreign body in the form of scratches in the seat and disc, but neither appeared to be very deep and no particles were found in the valve body. Oxidation buildup and packing load were no different than normally experienced, indicating the frictional possibility unlikely. The valve bore was found to have a ridge at the top of the bottom rib, which may have affected the initial start of the stem travel. From the investigation into the problems with CV4416, it appears the most likely root cause of it failure to pass LLRT on the initial closure was excessive clearance between the valve bore and the valve internals.

C. CV4415 - "B" Inboard MSIV:

CV4415, the "B" Inboard MSIV, successfully passed its initial LLRT on September 16th with an as-found leak rate of 9.4 SCFH when tested in combination with CV4416, the "B" Outboard MSIV. Six days later, following repairs to CV4416, CV4415 was again tested in combination with

CV4416. CV4415 had not been cycled or worked on. At that time, leakage of 32.6 to 37.0 SCFH was noted for CV4415, versus the allowable maximum of 11.5 SCFH.

CV4415 was disassembled and inspected. This MSIV is canted 35 degrees clockwise, and a review of past history indicated this might be a reason for excessive leakage. The fact that the test CV4415 failed was performed with the valve "cold" (six days after the initial testing) also is believed to be a factor, as is the conservative nature of the test, which applied air pressure to the "outboard" side of the valve. The MSIVs are constructed so that reactor steam pressure against the "inboard" side of the valve will enhance the seating force. The valve seat was found to have a runout of 0.005 inches, versus the acceptable 0.0035 inches. Measurement of the valve bore and disc/piston assembly show the clearances are still at minimum clearances. The valve disc was found to be hitting low at the bottom of the bore, which is consistent with the valve's orientation. Good seat contact was observed on the bottom of the seat, but only partial contact at the top. The root cause of the failure of CV4415 to successfully pass an LLRT is the valve orientation itself, which results in the travel path of the internals not being in the bore centerline. Testing of the valve "cold" may have also been a factor in the markedly changed test results.

III. ANALYSIS OF EVENT:

Local Leak Rate Testing of the MSIVs in 1989 found that upon initial testing, two of the eight MSIVs had leak rates in excess of the required 11.5 SCFH. (The "C" outboard and the "B" outboard). The initial LLRT's demonstrated that each of the four steam lines had at least one of its two redundant MSIV's capable of maintaining the total leakage rate under the required 11.5 SCFH. Subsequently, excess leakage was noted through the "B" inboard valve six days later. A significant factor in this second test of the "B" MSIVs was the cooling down of the closed "B" inboard valve. The initial testing of the valve in the "hot" condition shortly after shutdown is considered a better indication of what the valve's performance would have been under real conditions.

IV. CORRECTIVE ACTION:

In addition to the specific corrective actions noted for each valve, MSIV upgrades to be undertaken during the 1990 refueling outage will also aid in preventing recurrence of leakage problems. These are discussed in Section IV.(D).

A. CV4419 - "C" Outboard MSIV:

In order to ensure proper sealing of the CV4419 ("C" Outboard MSIV) the valve disc and seat were re-machined. The valve was not re-bored as the

extent of leakage was only slightly over twice the maximum allowable and it was felt the effect of machining would be marginal because of the small amount of metal to be removed. The re-testing of the valve at 3.4 SCFH versus the maximum allowable value of 11.5 SCFH required demonstrated the effectiveness of corrective actions. As an additional corrective action, the bore of this valve will be re-machined during the upcoming refueling outage as part of IV.(D).

B. CV4416 - "B" Outboard MSIV:

The ridge on the valve bore was smoothed. The valve internals were oversized to reduce clearance and the valve and disc seats were re-machined. These actions were proven effective by the subsequent test results of 1.25 SCFH versus the required 11.5 SCFH. The bore of this valve will be re-machined during the upcoming refueling outage, which should aid in reducing any concentricity problems.

C. CV4415 - "B" Inboard MSIV:

Immediate corrective actions were to re-machine the valve disc and seat to within acceptable runout values. Retesting of this valve following its reassembly indicated an as-left leakage of 1.0 SCFH versus the required 11.5 SCFH. Additional upgrades planned for the 1990 refuel outage (see Section IV.(D)) are expected to provide adequate long-term compensation for the values's orientation.

D. Additional Long-Term Corrective Actions:

Upgrades to all the MSIVs to be performed next outage should provide additional long-term corrective actions. Short guide pads will be added to provide local guiding as the disc enters the seat. Harder valves stems will be installed to reduce stem galling. A stiffer top works assembly to be provided will aid in preventing misalignments during valve closure. The new, lighter one piece (versus two) disc/piston assembly to be installed should reduce inertial forces during valve closure, and also help minimize cocking of the valve internals by moving their center of gravity. A larger actuator and stronger springs will be installed, which will increase seating force and minimize the likelihood of a valve seating differently upon subsequent stroking.

V. ADDITIONAL INFORMATION:

A. Failed Component Identification

The MSIVs are 20X16X20 inch Y-pattern stop valves built by the Rockwell Manufacturing Company, Figure No. 1612 JMMNY.

B. Previous Similar Events

The Duane Arnold Energy Center has, in the past, experienced greater than allowable leakage through MSIV's during local leak rate testing. These have been reported via LERs 85-005, 87-005 Rev 1, and in the 1988 Iowa Electric 10 CFR 50 submittal (NG-89-0723).

Regarding the valves which were repaired following the recent testing, in the five previous LLRTs (1981, 1983, 1985, 1987, 1988) the following results were noted:

CV4419: Passed in 1983 & 1987, failed to meet criteria in 1981, 1985 & 1988
CV4416: Passed in 1985, 1987 & 1988, failed to meet criteria in 1981 & 1983
CV4415: Passed in 1981, failed to meet criteria in 1983, 1985, 1987 & 1988

Leakage values in SCFH.

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