NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Duane Arnold Energy Center	0 5 0 0 0 3 3 1	1 OF 0 5

TITLE (4)
MSIV Failure Due to Disc Separation

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 2	8 4	8 4	0 1 6	0 0	0 6	0 1	8 4	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 8 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)	X 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
Wendell Keith/William Miller - Technical Support Engineering	AREA CODE 3 1 9 — 8 5 1 - 7 3 3 9

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	J M	I S V	R 3 4 0	Yes							

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 reactor operation on May 2, 1984 at approximately 80% power, a decrease in flow in the "C" steam line from 1.5 to 1 million pounds per hour was observed. Following shutdown on May 17, 1984, the "C" inboard MSIV was found to have the main disc separated from the rest of the valve assembly. This is similar to failures previously described in IE IN 81-28 except the disc was lying on its side in the valve body rather than being seated. Further inspection determined that the failure resulted from the disc not being tightened fully against the piston shoulder during an earlier (1982) valve reassembly. Two additional valves were inspected and showed no indications of similar problems. It was concluded that this is a one-time occurrence and is unlikely to recur. The vendor's updated recommendations for piston/disc torquing have been incorporated into approved repair procedures. The three disassembled valves have been reassembled using the updated procedure.

This item, as identified above, is being submitted under the "other" reportability category because of the convenient means of disseminating information in this manner and the interest in the experience expressed by the NRC.

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

Description of Event

During reactor operation at approximately 80% power on May 2, 1984, with no significant evolutions in progress, operators noted a minor (approximately 5 to 7 psig) reactor pressure increase. Investigation of plant instrumentation revealed a decrease in main steam line "C" flow from approximately 1.5 to 1 million pounds per hour. Attempts to "slow" cycle the "C" inboard main steam isolation valve (EIIS System JM, Component ISV) were unsuccessful in affecting steam flow. Therefore, in accordance with DAEC Technical Specification, Section 3.7.D.2, the "C" inboard isolation valve was declared inoperable and the "C" outboard isolation valve closed to effect containment isolation. Reactor power was administratively reduced to approximately 75%. The "C" MSIV Leakage Control System was declared inoperable, due to the open MSIV position, thus entering a 30-day limiting condition for operation in accordance with Technical Specification, Section 3.7.E.2. Reactor shutdown was scheduled for investigation and repair of the MSIV. Cold shutdown was achieved on 5/17/84.

Following shutdown, maintenance activities were initiated on the "C" inboard MSIV. This component is a Rockwell International 16" valve (See Figure 1). The as-found condition of the "C" inboard valve was that the main disc had separated from the piston and was turned 90 degrees from its normal position in the valve body. This is the first occurrence of MSIV main disc failure at Duane Arnold. Previous failures at other facilities resulted in the disc seating in the closed position (See, for example, IE Information Notice 81-28).

Removal and inspection of the valve assembly and the loose disc found that: 1) the main disc to piston pin was still in the disc but had been "rolled over" following the separation, 2) the pin hole in the piston was elongated in the axial direction, 3) the piston and main disc threads where the main thread engagement had been were stripped, and 4) the top 2 to 3 piston threads showed no indications of having been engaged. Metallurgical defects or flaws were determined not to be a contributing cause. It was determined that the maintenance reassembly activities when the valve was last reassembled during the Spring, 1982 outage were the cause of the eventual piston/disc separation. The Repair Procedure and instruction manual used to attach the disc to the piston required the disc/piston assembly to be "torqued tight". In this specific case, this left the top threads unengaged and the disc not threaded completely onto the piston. Normal flow conditions caused the disc to vibrate on the piston and eventually wear the threads and locking pin to the point where the assembly separated. Material wear markings on top of the stem-disc indicated the piston/disc assembly was oscillating against it. Over the past two years of operation, the disc began to move on the piston until the threads were finally worn down and only the pin held the disc in place. The final result was a piston/disc separation. This failure mode is the joint conclusion of Iowa Electric Engineering, Maintenance, and an onsite Rockwell service representative. Rockwell has recently revised the torque recommendation for reassembled piston/disc assemblies to 500 ft-lb. However, Rockwell and IE Engineering agree that the revised recommendation does not necessitate piston/disc disassembly and retorquing of the remaining valves in service. As discussed below, our lack of prior piston/disc failures, inspections during previous valve maintenance activities and dissassembly of two additional MSIVs support this conclusion.

It was decided to disassemble and inspect two additional valves in order to have a representative sample of the eight MSIVs. The "C" outboard and the "B" inboard valves were chosen. This provided a check of the downstream valve in the same line and the other valve installed with a "mirror image" piping configuration. This inspection found no similar failures, wear, or unusual conditions in the piston to piston disc assembly. In both cases, the pins were secure and the discs were fully tightened up against the piston shoulder.

As noted above, DAEC has not experienced piston/disc failures in 10 years of operation. Further, although not previously an inspection criteria, maintenance personnel have not observed incomplete thread engagement between the main disc and piston during previous disassemblies of MSIVs.

Based on the determined failure mode, the additional inspections performed, and past maintenance, it is our technical conclusion that this is a one time occurrence and is not attributable to valve design or material properties. It appears unlikely that a similar failure will occur. It was decided that disassembly of more valves was not necessary to address our safety concerns. Two of the valves ("B" and "C" inboard) were reassembled with spare valve assemblies of a modified configuration which were on site prior to this event. The third valve, "C" outboard, will be reassembled and installed using the existing valve assembly. All three valves will be reassembled using a repair procedure which has been updated with the new torque requirements.

Safety Consequences

When it was first determined that "C" inboard MSIV was inoperable, "C" outboard was closed in accordance with DAEC Technical Specification, Section 3.7.D.2. This closure was confirmed by valve position indication and steam flow indication. Primary containment isolation operability was at all times maintained. Power was administratively reduced to 75% to reflect the unavailability of one steam line.

Previous disc separations at other facilities have resulted in the disc assembly seating. Two items are suspected to have contributed to the main disc not seating in this case. The disc entry angle of the "C" inboard valve is installed at a 45 degree angle within a horizontal run of pipe. It is also "rolled" approximately 30 degrees from the vertical. When the disc separated from the piston, it did not have a vertical path to the seat. Also, the Rockwell valve used at DAEC is smaller than at other BWRS (16" diameter valve). The disc thickness is less than that of other plants which have had failures. It is suspected that this nonvertical drop to the seat, combined with thinner edge, made it possible for the disc to turn on its side. This "rolled" piping configuration applies only to the "B" and "C" inboard MSIVs.

It is our technical judgment that this is a one time occurrence and that it is unlikely that a similar failure will occur. If a failure were to occur, it would be self-revealing and immediately detectable as was this failure. We conclude that if a similar failure occurs in any of the other MSIVs, the disc would most likely seat as has been the experience at other facilities. Were the disc not to seat, the redundant valve could be isolated as in this case. Primary containment isolation capability would, therefore, still be maintained. Routine surveillance testing will continue to cycle all MSIVs at regular intervals.

As required by 10CFR50.73, the consequences of a similar failure under different conditions needs to be addressed. A double MSIV failure concurrent with a LOCA event would be required before a radiological release could be possible. The dual valve isolation and the detectability of any failure will ensure the protection of the health and safety of the public. Further, although not credited in the accident analysis, the downstream piping to the turbine stop valves will also minimize potential radiological releases (See UFSAR, Section 6.7).

During disassembly of the "C" inboard MSIV, it was noted as well that the stem disc was loose on the stem. During disassembly of the "C" outboard and "B" inboard, it was noted that the stem to stem disc assemblies were also loose, but not to the extent noted in the "C" inboard. Our conclusions relative to the "C" inboard is that the vibration load induced prior to and following the main disc to piston separation caused this deteriorated condition. The "C" outboard and "B" inboard exhibited a loss of preload in the lower threads that was evaluated by IE Engineering. Our conclusion, supported by Rockwell, is that the as-found condition of the stem to stem disc assemblies on these two valves would not adversely impact MSIV operability. Although the stem to stem disc would continue to perform their function, the three reassembled valves were torqued and pinned in accordance with manufacturers' recommendations. As stem to stem disc failure would cause an MSIV to close, and the as-found condition of these assemblies did not affect operability, the disassembly and inspection of additional MSIVs is judged unnecessary.

Corrective Actions

The following actions have been taken:

1) MSIV repair procedure have been updated to include the new torque recommendations.
2) "B" and "C" inboard MSIVs are being reassembled and reinstalled using the new valve assemblies and the updated repair procedure.
3) "C" outboard MSIV have been reassembled and reinstalled using the existing valve assembly and the updated repair procedure.
4) Each of the three reassembled valves will pass a local leak rate test which is standard practice for a reworked valve.
5) The remaining five MSIVs will be disassembled for inspection at the next refueling outage.

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

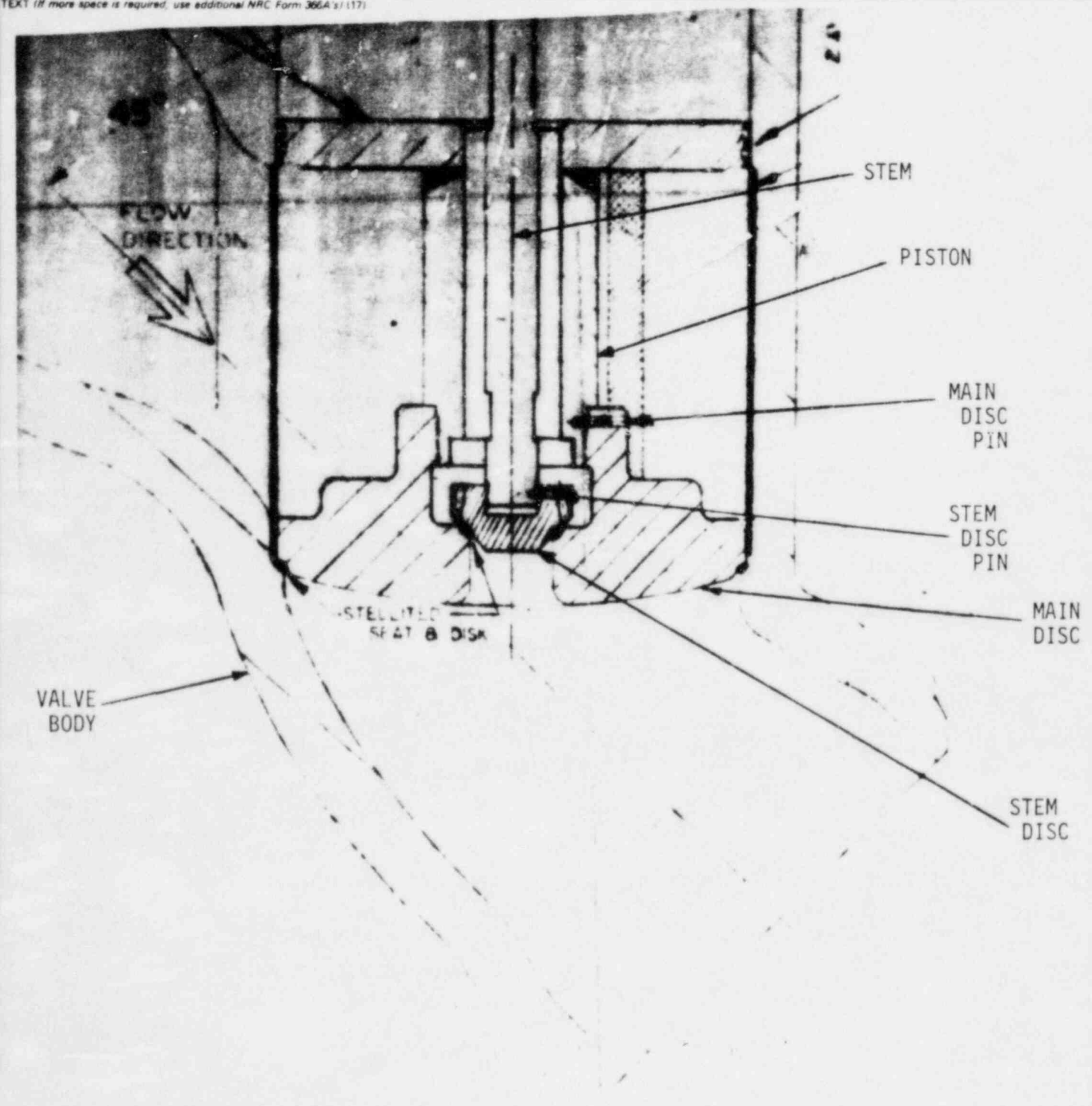

FIGURE 1

Iowa Electric Light and Power Company

May 31, 1984
DAFC-84-328

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

Subject: Duane Arnold Energy Center
Docket No. 50-331
Op. License DPR-49
Licensee Event Report No. 84-016

Gentlemen:

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

Very truly yours,

Daniel L. Mineck
Plant Superintendent - Nuclear
Duane Arnold Energy Center

DLM/WRK/kp

attachment

cc: Mr. James G. Keppler
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

NRC Resident Inspector - DAEC

File A-118a

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