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SUBJECT: LER 89-016-01:on 891212,HPCI sys inoperability due to failure to obtain adequate flow in required time.

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TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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Iowa Electric Light and Power Company

September 25, 1990
DAEC-90-0811

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 #89-016-01

Gentlemen:

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

Very truly yours,

Rick Hannen 9-25-90

Rick L. Hannen
Plant Superintendent - Nuclear

RLH/RMM/sjo

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File A-118a

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OCT 1 1990

NRC Form 366A (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)
Duane Arnold Energy Center	0 5 0 0 0 3 3 1	1 OF 0 5

TITLE (4) High Pressure Coolant Injection System Inoperability Due to Failure to Obtain Adequate Flow in Required Time

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)
1 2	1 2	8 9	8 9	— 0 1 6	— 0 1	0 9	2 5	9 0	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)	1 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)	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
Ron McGee, Technical Support Specialist	3 1 9 8 5 1 - 7 6 0 2

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	

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 December 12, 1989 at 1410 hours, the High Pressure Coolant Injection (HPCI) system was declared inoperable during performance of surveillance testing. The reactor was at 100% power. During the surveillance testing, the HPCI system failed to reach 3000 gallons per minute flowrate within the required 30 seconds during a cold quick start. Actual start time was 30.52 seconds. The required Emergency Core Cooling Systems were proven operable per Technical Specifications Limiting Conditions for Operation.

The cause of the event was determined to be inadequate HPCI turbine electro-hydraulic response during the turbine startup sequence. The electronic portion of the Turbine Governor (EG-M) was adjusted within allowable tolerances and a satisfactory start time was achieved. System improvements were identified and incorporated in a Design Change Package.

The HPCI system was declared operable at 1034 hours on December 19, 1989. Following completion of the modifications during the refuel outage initial test results for the HPCI system show HPCI start times improved by approximately twenty percent.

This report is being submitted as a supplement to the original Licensee Event Report to detail improvements made to the HPCI system during a recent refueling outage.

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

I. DESCRIPTION OF EVENT:

On December 11, 1989, the High Pressure Coolant Injection System (HPCI, EIIS System Code BJ) was being tested per the scheduled Surveillance Test Procedure (STP). During the cold fast start portion of the STP, HPCI obtained required flow in 26.4 seconds.

During the second portion of the STP (system leakage walkdown), an annunciator for HPCI low lube oil pressure alarmed on system start and failed to clear as the turbine (Terry Steam Turbine Component Type CS) was brought up to speed. The annunciator response procedure was carried out, including monitoring HPCI bearing temperatures. No adverse effects were noted and the turbine was manually tripped shortly after the alarm was received and investigated.

Manual lube oil pressure supply valves were adjusted per Operating Instructions to suggested ranges. The HPCI turbine was then allowed to cool down overnight to meet the intention of a "cold fast start" to verify the lube oil pressure adjustments had not affected HPCI operability.

On December 12, 1989, with the reactor at 100% power, the HPCI surveillance test was performed. The system failed to deliver 3000 gallons per minute within 30 seconds as required. Actual time was 30.52 seconds. Additionally, the turbine stop valve opening stroke time was 30.6 seconds (it is required to be </= 30 seconds). The HPCI System was declared inoperable at this time.

A seven day Limiting Condition for Operation (LCO) was entered at 1410 on December 12, 1989, as required by Technical Specifications. Required testing was initiated to verify operability of the redundant systems: Automatic Depressurization System (ADS, EIIS System Code SB), Low Pressure Coolant Injection System (LPCI, EIIS System Code BO), Core Spray System (CS, EIIS System Code BM), and Reactor Core Isolation Cooling System (RCIC, EIIS System Code BN).

II. CAUSE OF EVENT:

The results of testing/maintenance from December 12 to December 19, 1989, are as follows:

a. Management was informed early in the testing that adjustments within tolerances could be made to the starting circuitry (Component Type BJ-65) that would improve starting times. The decision was made to test for other possible causes prior to making these adjustments.

b. Evidence that oil system drain down/air accumulation was a contributing factor to slow start times was noted. The cause of system drain down could not be determined. Conversations with the Manufacturer Technical Representative revealed that oil drain down is a common occurrence. Design Change Package (DCP) 1491, initiated prior to this event, will address system oil drain down. Results of this design change, scheduled for completion during the upcoming refueling outage, will be included in the supplementary report.

c. An engineering design change, previously scheduled for completion during the upcoming refuel outage, as described in General Electric Service Information (SIL) #480 was installed. This modification installed a supply oil bypass line around the Woodward EG-R hydraulic actuator gear pump and reduced the electronic control idle voltage from -1.0 to -4.5 vDC. The expected results of the modification should have been to smooth out the startup transient speed peaks thereby allowing a more controlled ascension to rated turbine speed. The modification did not work as expected and the idle voltage was reset to the original setting. The additional oil bypass line which was left installed has no effect when the idle voltage is at the original setting. The Technical Representative has advised that the installation of a new EG-R unit may allow the modification to work. Testing and installation of a new unit are currently being conducted. Results of this action will be reported in the supplementary report.

d. A new auxiliary oil pump was obtained and installed. The performance of the new pump did not drastically differ from the originally installed pump.

e. All system oil pressure gauges were calibrated to ensure data was accurate.

f. The repositioning of lube oil supply valves on December 11, 1989, was ruled out as a possible cause for the slow start times as these valves are downstream of the governor control supply and any oil pressure changes due to valve repositioning would have been compensated for by a system pressure regulating valve. Flow orifices and a locking throttle valve in place of the present lube oil supply valves will be installed as part of DCP 1491. Completion of this action will be included in the supplementary report.

g. Suspected control oil leakage locations that could cause slow start times were inspected. No leakage was detectable.

h. The adjustments to the starting circuitry (see a. above) were completed on 12/17/89.

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

On December 18, 1989, another cold fast start test was performed. The elapsed time to obtain 3000 gpm flow was approximately 17 seconds. Traces were obtained from the recently installed HPCI transient recorder which monitors several parameters to provide a more in-depth analysis of HPCI performance. Review of these traces revealed that the steam stop valve started to open normally, however during the opening sequence the valve went rapidly full open, then returned to its expected partially open position and completed its ramp to the full open position. The uncontrolled opening of the stop valve occurred due to inadequate balance chamber pressure being established internal to the valve prior to its internal pilot assembly causing main valve actuation. The stop valve was inspected for damage and none was noted. Balance chamber pressure was adjusted and the turbine was left idle overnight to establish cold conditions for a cold fast start the following day.

On December 19, 1989, the HPCI surveillance test was satisfactorily performed, obtaining required flow in 26.03 seconds and providing satisfactory transient traces. The HPCI System was declared operable at 1034 and the LCO was exited.

III. ANALYSIS OF EVENT:

Although declared inoperable, the HPCI System was maintained in an available status during most of the testing period. Redundant systems were operable throughout this event and the previous surveillance interval. With the reactor in Run mode, the worst case effect of the failure or inability of the HPCI System to operate would be loss of the ability to maintain reactor vessel inventory after small line breaks that do not rapidly depressurize the vessel. ADS, in conjunction with the LPCI or CS Systems, provides full redundancy for HPCI. The RCIC System was also available to mitigate the loss of HPCI, but is not considered fully redundant to HPCI. The inoperability of the HPCI System had a minimal impact on the safe operation of the plant.

IV. CORRECTIVE ACTIONS:

The HPCI Turbine Electric-Governor circuitry was adjusted within allowable tolerances to improve turbine start times and reduce the time from initiation to achieving required flowrate.

Additional system improvements have been installed during the recent refueling outage. They are as follows:

1. The auxiliary oil pump suction piping was replaced with larger pipe size which significantly reduced the pump suction vacuum.

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2. The pilot valve spring was replaced with one having a smaller spring constant which allows completion of hydraulic bypass modification as described in 'Cause of Event' Paragraph C.

3. Various Turbine Control system accessory components were replaced with upgraded components.

4. Cables for turbine speed pick-ups were re-routed and shielded to prevent induced noise signals.

5. The Electro Governor (EGM) control power supply was replaced to provide a cleaner, more reliable source.

6. The ramp start logic was modified to allow smoother turbine control during startup.

7. Turbine control hydraulic oil valves had their handles removed and had positive locking devices installed to preclude inadvertent operation or misadjustment following initial setup.

8. A jockey oil pump was installed in parallel to the existing Aux oil pump to maintain the oil system full in the standby mode and achieve more consistent start times.

The results of these component modifications have been improved HPCI start times and a smoother ascension to rated speed during start-up. The post-modification acceptance test which was run without the benefit of the jockey oil pump resulted in a start time of 21.61 seconds.

V. ADDITIONAL INFORMATION:

a. Equipment:

Terry Steam Turbine (Dresser-Rand Corporation)
Woodward Governor Control System

b. Previous Similar Events:

The failure of HPCI to reach its desired discharge flow rate/pressure, slow start times and governor oil problems have been previously reported in LERs 75-057, 76-089, 77-077, 77-095, 77-096, 78-025, 83-018, 83-022, 83-056, 86-010, 88-002, 88-004, 89-002 and 89-007.

This event is being reported pursuant to 10 CFR 50.73(a)(2)(v).