

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8706300366 DOC. DATE: 87/06/26 NOTARIZED: NO DOCKET #  
 FACIL: 50-331 Duane Arnold Energy Center, Iowa Electric Light & Pow 05000331  
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SUBJECT: LER 87-010-01: on 870408, HPCI declared inoperable. Caused by turbine speed versus flow demand mismatch within HPCI turbine governor control sys. New tappet assembly installed & HPCI overspeed trip mechansim bi-wkly tested. W/870626 ltr.

DISTRIBUTION CODE: IE22D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 5  
 TITLE: 50.73 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR ENCL
	PD3-1 LA	1 1	PD3-1 PD	1 1
	CAPPUCCI, A	1 1		
INTERNAL:	ACRS MICHELSON	1 1	ACRS MOELLER	2 2
	AEOD/DOA	1 1	AEOD/DSP/ROAB	2 2
	AEOD/DSP/TPAB	1 1	DEDRO	1 1
	NRR/DEST/ADE	1 0	NRR/DEST/ADS	1 0
	NRR/DEST/CEB	1 1	NRR/DEST/ELB	1 1
	NRR/DEST/ICSB	1 1	NRR/DEST/MEB	1 1
	NRR/DEST/MTB	1 1	NRR/DEST/PSB	1 1
	NRR/DEST/RSB	1 1	NRR/DEST/SGB	1 1
	NRR/DLPQ/HFB	1 1	NRR/DLPQ/GAB	1 1
	NRR/DOEA/EAB	1 1	NRR/DREP/RAB	1 1
	NRR/DREP/RPB	2 2	NRR/PMAS/ILRB	1 1
	NRR/PMAS/PTSB	1 1	<u>REG FILE</u> 02	1 1
	RES DEPY GI	1 1	RGN3 FILE 01	1 1
EXTERNAL:	EG&G GROH, M	5 5	H ST LOBBY WARD	1 1
	LPDR	1 1	NRC PDR	1 1
	NSIC HARRIS, J	1 1	NSIC MAYS, G	1 1

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) <b>Duane Arnold Energy Center (DAEC)</b>	DOCKET NUMBER (2) <b>0 5 0 0 0 3 3 1</b>	PAGE (3) <b>1 OF 0 4</b>
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TITLE (4)  
**High Pressure Coolant Injection System Inoperability Due to a Turbine Control Problem**

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)
									None		0 5 0 0 0
0 4	0 8	8 6	8 6	0 1 0	0 1	0 6	2 6	8 7			0 5 0 0 0

OPERATING MODE (9) <b>N</b>	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)											
POWER LEVEL (10) <b>0 4 3</b>	20.402(b)			20.406(c)			60.73(a)(2)(iv)			73.71(b)		
	20.406(a)(1)(i)			60.38(c)(1)			<input checked="" type="checkbox"/> 60.73(a)(2)(v)			73.71(c)		
	20.406(a)(1)(ii)			60.38(c)(2)			60.73(a)(2)(vii)			OTHER (Specify in Abstract below and in Text, NRC Form 366A)		
	20.406(a)(1)(iii)			60.73(a)(2)(i)			60.73(a)(2)(viii)(A)					
	20.406(a)(1)(iv)			60.73(a)(2)(ii)			60.73(a)(2)(viii)(B)					
20.406(a)(1)(v)			60.73(a)(2)(iii)			60.73(a)(2)(ix)						

LICENSEE CONTACT FOR THIS LER (12)

NAME <b>James R. Probst, Technical Support Engineer</b> <b>Bradford N. Thomas, Technical Support Engineer</b>	TELEPHONE NUMBER AREA CODE <b>3 1 1 9 8 5 1 1 - 7 3 1 0 9</b>
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUF. TURER	REPORTABLE TO NPROS	CAUSE	SYSTEM	COMPONENT	MANUF. TURER	REPORTABLE TO NPROS
B	B J	S C W 2 9 0		YES					
B	B H	T R T 1 4 7		YES					

SUPPLEMENTAL REPORT EXPECTED (14) <input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15) MONTH DAY YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On April 8, 1986, with the reactor in run mode, the High Pressure Coolant Injection System (HPCI) failed to meet its discharge pressure and flow requirements during the performance of its quarterly operability test. Per Technical Specifications, a seven day Limiting Condition for Operation (LCO) was entered. Troubleshooting revealed a component in the turbine (Terry Corporation Type CS) control circuitry, the Woodward EG-M Control Box, required recalibration, which was undertaken. Discussions with the turbine vendor indicate the probable root cause of the drift is the susceptibility of the instrumentation to fluxuations due to the ambient temperatures. During post-maintenance testing later the same day, the HPCI turbine overspeed trip failed to automatically reset. The cause was originally thought to be a very small burr on the modified hydraulic control tappet valve body which prevented tappet movement. Based on information supplied by General Electric (GE), and Terry Turbine, the tappet problem can now be attributed to polyurethane swelling due to a combination of turbine oil and elevated temperatures. The root cause is a design deficiency. A new tappet assembly, modified by the turbine vendor, was recently installed during the cycle 8/9 refuel outage. On May 23, 1987, using auxiliary boiler steam, the HPCI turbine was successfully tripped and automatically reset several times.

This LER is being submitted based on new information received from General Electric on improved HPCI turbine mechanical overspeed trip design.

IEZ2  
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		8 6	- 0 1 0	- 0 1	0 2	OF	0 4

TEXT (If more space is required, use additional NRC Form 308A's) (17)

On April 8, 1986, at 1406 hours, with the reactor in run mode at 43% power, the High Pressure Coolant Injection System (HPCI, EIIS System BJ) was declared inoperable after it failed to meet its required discharge pressure and flow requirements during the performance of the quarterly HPCI operability Surveillance Test Procedure. The turbine reached 1070 psig and 2925 gpm versus the required minimum of 1100 psig and 3000 gpm. Per Technical Specification 3.5.D.2, a seven day Limiting Condition for Operation (LCO) was entered, contingent upon the continuing operability of the Reactor Core Isolation Cooling System (RCIC, EIIS System BN), the Automatic Depressurization System (ADS, EIIS System SB), the Low Pressure Coolant Injection System (BO), and the Core Spray System (BM). Their operability tests were successfully completed at 2201 hours on April 8, 1986. ADS and RCIC were successfully tested daily thereafter to demonstrate their continued availability until the HPCI system was declared operable. The effect of HPCI inoperability with the reactor in run mode, the worst case, is to lose this systems ability to maintain reactor vessel inventory after small line breaks which do not depressurize the vessel. Other systems, including ADS and low pressure Emergency Core Cooling Systems, provide full redundancy during HPCI inoperability.

Troubleshooting of the HPCI turbine revealed a turbine speed versus flow demand mismatch within the HPCI turbine governor control system which prevented the turbine (BJ-TRB-1S201, Terry Corporation Model CS) from reaching the necessary speed. A component of the turbine governor control circuitry, the Woodward EG-M Control Box (BJ-SC-2201), was recalibrated to within specification. Calibration of the control circuitry is presently performed once per refuel outage and was last performed in July, 1985. This was initiated in response to problems with the RCIC turbine governor instrumentation reported in LER 85-028. Discussions with the turbine vendor have indicated the probable root cause of the Woodward EG-M Control Box not remaining properly calibrated is the location of this instrumentation on the turbine itself. The instrumentation is susceptible to fluxuations due to environmental temperature. The HPCI/RCIC Task Force formed to study system reliability (see LER 85-044) is addressing turbine control instrumentation as part of its work scope. Under consideration will be items such as the possibility of moving such instrumentation to a more desirable environment, upgrading the instrumentation, and enhancing preventive maintenance activities. The final HPCI/RCIC Task Force report will be forwarded to the NRC Region III Office as previously arranged.

Post-maintenance testing of the HPCI turbine following the control circuitry calibration was initiated at 1652 hours on April 8, 1986. During the course of this test, at 1935 hours, problems with the HPCI test return valve position were noted. The HPCI test return is normally closed except during testing. As a result of these valve problems, an Operator was transferring turbine speed control to manual. System

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 308A's) (17)

operation does not usually involve transfer from automatic to manual mode. During this transition the turbine tripped on overspeed. The turbine trip did not automatically reset as designed. An investigation was initiated.

The overspeed trip mechanism works as follows: The HPCI control valve (BJ-FCV-2200) is hydraulically controlled. A tappet is suspended over a disc which rotates with the turbine shaft. A weight is attached by a pivot to the disc and is held in place by a spring. At the designated overspeed trip point, the centrifugal force on the weight overcomes the force of the spring and the free end of the weight extends beyond the outer edge of the disc. It then strikes the bottom of the tappet, driving the tappet upward into a valve body which uncovers oil ports and results in valve closure. The overspeed trip is reset as a spring above the tappet returns the tappet to its initial position.

Investigation revealed the turbine trip did not reset due to the tappet being stuck within its valve body. The cause was originally thought to be a very small burr at the bottom of the valve body. The bottom portion of the valve body had been machined off during the 1985 refueling outage in response to a recommendation by General Electric to install a modified tappet assembly. Instructions from the turbine manufacturer, Terry Corporation (T147), included a note to deburr all sharp areas after machining. During the 1985 refueling outage, following the modification and installation of the tappet assembly using the manufacturers instructions, the tappet assembly and overspeed trip were thoroughly tested with no problems. The burr found following the trip on April 8, 1986, was very small and hard to detect, and did not effect the overspeed trip performance during post-modification testing. The root cause of the HPCI turbines failure to automatically reset following an overspeed was originally considered deficient modification work on the tappet assembly. Upon examination of the tappet following the overspeed trip on April 8, 1986, it was noted the portion of the tappet struck by the weight was worn down, indicating a larger than normal force or repeated impacts by the rotating weight may have been required to move the tappet. This may have begun to occur during post-modification testing, but as the tappet was successfully moved and reset at that time it went unnoticed. No previous problems of this type have been noted at the Duane Arnold Energy Center. The turbine vendor has been informed of the problem. The RCIC Turbine (BN-TRB-1S203, Terry Corporation Model GS) contains a similar tappet assembly within its overspeed mechanism which was not recommended for modification. Based on information from General Electric (GE) Service Information Letter (SIL) No. 392 it was determined that the tappet assembly had become frozen (unable to reset) in its valve body due to polyurethane swelling caused by being exposed to an environment of turbine oil and elevated temperatures. The root cause is a design deficiency by the turbine manufacturer.

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TEXT (If more space is required, use additional NRC Form 306A's) (17)

Terry Turbine has furnished Iowa Electric with a modified tappet assembly. This new tappet assembly was installed during the cycle 8/9 refuel outage. On May 23, 1987, using auxiliary boiler steam, the HPCI turbine was successfully tripped and automatically reset several times.

The HPCI overspeed trip mechanism was successfully tested bi-weekly from June, 1986 to February, 1987 when the HPCI system was required to be operable. This testing was done to assure proper overspeed trip tappet operation.

The failure of the HPCI system to develop its specified flow and discharge pressure and the failure of the turbine to reset following an overspeed trip are being reported pursuant to 10CFR50.73(a)(2)(v) as 'event(s) or condition(s) that alone could have prevented the fulfillment of safety function needed to mitigate the consequences of an accident.'

This LER revision is being submitted to document new information received from General Electric and Terry Turbine on the cause of the HPCI turbine mechanical overspeed trip tappet deficiency.

Iowa Electric Light and Power Company

June 26, 1987  
DAEC-87-0750

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

Subject: Duane Arnold Energy Center  
Docket No. 50-331  
Op. License DPR-49  
Licensee Event Report No. 86-010 Rev 1

Gentlemen:

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

Very truly yours,

A handwritten signature in cursive script, appearing to read "Rick L. Hannen", followed by the date "6/24/87".

Rick L. Hannen  
Plant Superintendent - Nuclear

RLH/BNT/go

Attachment - LER 86-010 Rev 1

cc: Mr. A. Bert Davis  
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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