

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) **Duane Arnold Energy Center** DOCKET NUMBER (2) **0 5 0 0 0 3 3 1 1** PAGE (3) **1 OF 0 4**

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) |
| 0 4 | 0 8 | 8 6 | 8 6 | 0 1 0 | 0 0 | 0 5 | 0 8 | 8 6 | None | | 0 5 0 0 0 |
| | | | | | | | | | | | 0 5 0 0 0 |

OPERATING MODE (9) **N**

POWER LEVEL (10) **0 4 3**

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)

| | | | |
|--|---|--|--|
| <input type="checkbox"/> 20.402(b) | <input type="checkbox"/> 20.406(a) | <input type="checkbox"/> 50.73(a)(2)(iv) | <input type="checkbox"/> 73.71(b) |
| <input type="checkbox"/> 20.406(a)(1)(i) | <input type="checkbox"/> 50.36(a)(1) | <input checked="" type="checkbox"/> 50.73(a)(2)(v) | <input type="checkbox"/> 73.71(a) |
| <input type="checkbox"/> 20.406(a)(1)(ii) | <input type="checkbox"/> 50.36(a)(2) | <input type="checkbox"/> 50.73(a)(2)(vii) | OTHER (Specify in Abstract below and in Text, NRC Form 366A) |
| <input type="checkbox"/> 20.406(a)(1)(iii) | <input type="checkbox"/> 50.73(a)(2)(i) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) | |
| <input type="checkbox"/> 20.406(a)(1)(iv) | <input type="checkbox"/> 50.73(a)(2)(ii) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) | |
| <input type="checkbox"/> 20.406(a)(1)(v) | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(ix) | |

LICENSEE CONTACT FOR THIS LER (12)

NAME **James R. Probst, Technical Support Engineer** TELEPHONE NUMBER **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 | MANUFACTURER | REPORTABLE TO NPROS | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPROS |
|-------|--------|-------------|--------------|---------------------|-------|--------|-----------|--------------|---------------------|
| B | B J | S C W | 2 9 0 | YES | | | | | |
| B | B J | T R B T | 1 4 7 | YES | | | | | |

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15)

| MONTH | DAY | YEAR |
|-------|-----|------|
| | | |

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 a very small burr on a recently modified hydraulic control tappet valve body which prevented tappet movement. The root cause was a deficiency in the modification and re-installation of the tappet, although the overspeed trip was thoroughly tested with no problems following reinstallation. Following refurbishment of the tappet assembly, the HPCI turbine was successfully tested and declared operable on April 12, 1986. Presently a task force is addressing HPCI/RCIC reliability problems including moving and/or upgrading control instrumentation. Additionally, the manufacturer has been informed of the overspeed trip reset mechanism's susceptibility to failure from small deficiencies.

IE 22

1/1

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

| | | | | | | |
|---|--|----------------|------------------------------------|------------------------------|----------|----------|
| FACILITY NAME (1) Duane Arnold Energy Center | DOCKET NUMBER (2) 0 5 0 0 0 3 3 1 | LER NUMBER (6) | | | PAGE (3) | |
| | | YEAR 8 6 | SEQUENTIAL NUMBER - 0 1 0 | REVISION NUMBER - 0 0 | 0 2 | of 0 4 |

TEXT (If more space is required, use additional NRC Form 365A (1/77))

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 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. 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 system's ability to maintain reactor vessel water 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 85-28. 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 valve is normally closed except

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

| | | | | | | |
|---|--|----------------|-------------------|-----------------|----------|--------|
| FACILITY NAME (1) Duane Arnold Energy Center | DOCKET NUMBER (2) 0 5 0 0 0 3 3 1 8 6 - 0 1 0 - 0 0 | LER NUMBER (5) | | | PAGE (3) | |
| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | 0 3 | OF 0 4 |
| | | 8 6 | 0 1 0 | 0 0 | | |

TEXT (If more space is required, use additional NRC Form 368A's) (17)

during testing. As a result of these valve problems, an Operator was transferring turbine speed control to manual. System 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 disk 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 disk. 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 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 manufacturer's 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 turbine's failure to automatically reset following an overspeed is 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. The HPCI/RCIC Task Force will be examining the HPCI tappet assembly problem in detail to determine if a recommendation should be made to the turbine vendor to modify the tappet assembly to prevent small imperfections or problems from disabling the entire turbine.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

| | | | | | | | |
|---|--|----------------|-------------------|-----------------|----------|----|-----|
| FACILITY NAME (1) Duane Arnold Energy Center | DOCKET NUMBER (2) 0 5 0 0 0 3 3 1 | LER NUMBER (6) | | | PAGE (3) | | |
| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | | | |
| | | 8 6 | - 0 1 0 | - 0 0 | 0 4 | of | 0 4 |

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

The tappet assembly was refurbished prior to installation and checked to assure freedom of movement. The HPCI turbine overspeed and reset were tested successfully following the completion of repairs. The HPCI system successfully completed its post-maintenance testing at 2255 hours on April 12, 1986, and was then declared operable, canceling the seven day LCO.

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 of 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.

Iowa Electric Light and Power Company

May 8, 1986
DAEC-86-0348

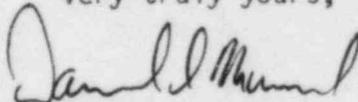
U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

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

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/JRP/pl

Attachment - LER 86-010

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

IE22
11