Commonwealth Edison Company
Dresden Generating Station
6500 North Dresden Road
Morris, IL 60450
Tel 815-942-2920

ComEd

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TPJLTR 94-0007

U.S. Nuclear Regulatory Commission
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Washington, D. C. 20555

Supplemental Report number 2 to Licensee Event Report 94-005-02, Docket 50-237 is being submitted as required by Technical Specification 6.6, NUREG 1022 and 10CFR50.73(a)(2)(iv).

Sincerely,

T. P. Joyce

Thomas P. Joyce
Site Vice President

TPJ/PKG:cfq

Enclosure

cc: J. Martin, Regional Administrator, Region III
NRC Resident Inspector's Office
File/NRC
File/Numerical

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, 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) |
|---|---|---|
| Dresden Nuclear Power Station, Unit 2 | 0500237 | 1 OF 6 |

TITLE (4)
Manual Reactor Scram Due to Loss of Instrument Air from Air Receiver Pipe Failure

| 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 NAME | DOCKET NUMBER |
| 04 | 30 | 94 | 94 | -- 005 -- | 02 | 08 | 08 | 94 | None | |
| | | | | | | | | | FACILITY NAME | DOCKET NUMBER |

| OPERATING MODE (9) | N |
|---|---|
| POWER LEVEL (10) | 099 |

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

| | | | | | |
|---|---|---|---|---|---|
| | 20.2201(b) | | 20.2203(a)(3)(i) | | 50.73(a)(2)(iii) | | 73.71(b) |
| | 20.2203(a)(1) | | 20.2203(a)(3)(ii) | X | 50.73(a)(2)(iv) | | 73.71(c) |
| | 20.2203(a)(2)(i) | | 20.2203(a)(4) | | 50.73(a)(2)(v) | | OTHER |
| | 20.2203(a)(2)(ii) | | 50.36(c)(1) | | 50.73(a)(2)(vii) | | (Specify in Abstract below and in Text, NRC Form 366A) |
| | 20.2203(a)(2)(iii) | | 50.36(c)(2) | | 50.73(a)(2)(viii)(A) | | |
| | 20.2203(a)(2)(iv) | | 50.73(a)(2)(i) | | 50.73(a)(2)(viii)(B) | | |
| | 20.2203(a)(2)(v) | | 50.73(a)(2)(ii) | | 50.73(a)(2)(x) | | |

LICENSEE CONTACT FOR THIS LER (12)

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Ken Yates, System Engineer Ext. 2715 | (815) 942-2920 |

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 |
|---|---|---|---|---|---|---|---|---|---|---|
| X | LD | PSF | X999 | | | | | | | |
| | | | | | | | | | | |

| 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 15 single-spaced typewritten lines) (16)


On April 30, 1994 at 2334, Unit 2 was manually scrammed from 99% power due to rapid depressurization of the Instrument Air (IA) [LD] header. All eight main steam isolation valves (MSIV) were manually closed. All systems operated as expected.

The loss of Instrument Air was due to a circumferential failure of the 2A IA compressor supply line to the 2A air receiver, attributed to excessive pipe wall thinning from moisture induced corrosion.

Following the scram and MSIV isolation, a reactor water level transient occurred that resulted in water overflow into the HPCI steam supply and Isolation Condenser lines. The lines were drained following the event, and no damage to components, piping, or supports was observed.

The 2A receiver tank, inlet and discharge pipe were replaced and the compressor returned to service on August 3, 1994. A check valve was installed at the receiver tank discharge to prevent future header depressurization.

A previous reactor scram on loss-of-instrument-air was reported on January 16, 1993. That event was the result of failure of a dryer exhaust valve to close concurrent with failure of the backup service air cross-tie valve to open in sufficient time to prevent low air header pressure.

EVENT IDENTIFICATION:

Manual Reactor Scram Due to Loss of Instrument Air Resulting from Air Receiver Pipe Failure

A. PLANT CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: April 30, 1994 Event Time: 23:33:26

Reactor Mode: N Mode Name: Run Power Level: 99%

Reactor Coolant System Pressure: 1005 psig

B. DESCRIPTION OF EVENT:

On April 30, 1994 at 2333, with Unit 2 operating at 99 % reactor power, a Control Room Annunciator, 2A Instrument Air Dryer trouble alarm/bypass open, was received. At 23:33:10 and 23:33:26, Unit 2 Instrument Air Pressure and Unit 2 Service Air Pressure Lo Alarms were recorded on the Control Room Sequence of Events Recorder (SER), respectively. The Unit 2 Shift Supervisor (SS) was dispatched to investigate the cause of the low pressure conditions. At 23:34:44, a manual reactor scram was initiated by the Unit 2 NSO per Dresden Abnormal Operating Procedure (DOA 4700-01), at 55 psig instrument air (IA) header pressure.

The cause of the rapid loss of air was a circumferential failure of the 2A IA compressor supply line at the 2A IA receiver tank inlet. The Unit 2 SS verified the backup Service Air to Instrument Air cross-tie valve had opened as required. The backup air supply, however, was unable to maintain header pressure due to the size of the break (3") and the lack of a receiver tank discharge check valve. IA header pressure decreased to approximately 40 psig before the manual isolation valve from the 2A receiver/IA header was closed and pressure recovery began.

Following the manual scram and MSIV closure, reactor water level decreased as expected due to shrink. The Nuclear Station Operator (NSO) manually closed the 2A Feedwater Regulating Valve (FWRV) per procedure as level reached -3" increasing. The 2B FWRV was in automatic control and opening to restore level to the 15" Feedwater Level Control System (FWLCS) level setpoint. The reactor feedwater pumps (RFP) were operating near runout flow conditions and level was increasing about 3" per second. Review of post SCRAM reactor vessel level data indicates that as level passed 15" increasing, the feedwater flow rate began to decrease due to the 2B FWRV closing in automatic control. A drop in reactor vessel rate of level increase, however, was not apparent to the NSO. The NSO realized that high level would trip the RFPs. At 20" Reactor Vessel Level the NSO placed the 2B FWRV in manual control and closed the valve some amount to reduce vessel level rate of rise. During reactor vessel level recovery, the NSO reasoned the FWLCS could control level and transferred back to automatic control. Vessel level subsequently reached 55" causing the RFPs and Main Turbine to trip. RFP inertia coast down resulted in vessel level increase to 62 inches with water intrusion into the HPCI and Isolation Condenser inlet steam lines.

The operator's actions were within the procedures and current training. It was noted during the review of the data that no decrease in flow occurred corresponding to the manual flow control actions. Operators stated that training does not stress the elevation of the steam lines for HPCI or the Isolation Condenser in sufficient detail to realize their close proximity to the high level trip. Review of the transient indicated the feedwater level control system appeared to be operating properly prior to operator actions. The trip setpoints for the high level trips were verified and found to be within tolerances however the setpoint was reevaluated and reset to prevent future flooding of the steam lines.

Water was drained from the HPCI steam line to the Inlet Drain Pot causing a high level alarm. The Inlet Drain Pot was aligned to the Main Condenser and Suppression Pool to allow draining. Approximately forty minutes after the event the Inlet Drain Pot Hi Level Alarm cleared. Additional draining was performed following the event to insure the HPCI turbine was completely free of water. The HPCI System was considered operable during the entire event. Isolation Condenser operation was initiated following the reactor scram for reactor vessel pressure control, and performed as expected. A system walkdown of accessible steam supply and condensate return lines was performed on May 1, 1994 to inspect for possible water hammer. No evidence of water hammer was observed.

C. APPARENT CAUSE OF EVENT:

This report is submitted in accordance with 10CFR50.73(a)(2)(iv), which requires reporting of any event that results in unplanned manual or automatic actuation of any engineered safety feature, including the Reactor Protection System.

The initiating event was mechanical failure of the threaded portion of the inlet air supply piping to the Unit 2A Instrument Air Receiver Tank. The piping had thinned due to oxidation of the carbon steel pipe in the presence of moisture. The layered appearance of the oxide indicates the corrosion had taken place over a period of years, the pipe eventually failed when it could no longer withstand system operating pressure. Contributing to this failure is the application of threaded receiver inlet and discharge connections versus a welded flange connection. Threaded connections are susceptible to failure due to pipe wall thinning which occurs during the threading process. Threaded connections are also more susceptible to corrosion and do not allow for accurate pipe thickness measurement at the thread or the ability to determine thread engagement depth.

The backup Service Air to Instrument Air supply failed to maintain header pressure because the IA system does not include a check valve to prevent depressurization of the IA header in the event of a break at the receiver.

The cause of the excessive moisture in the IA piping/receiver tank appears to be improper moisture separator (MS) and receiver tank moisture trap mechanical operation. Maintenance history review found seven instances of trap replacement and six instances of trap cleaning, with no apparent effort to find and correct the root cause. The 2A moisture separator drain trap was disassembled and inspected. The float was found to move freely. The drain orifice was plugged but easily cleaned with slight back pressure. It is not certain if this trap was working; operation however, did appear degraded.

Comparison of moisture separator field installation to design drawings indicated the MS drain line is improperly installed, allowing excess moisture to remain in the separator and possibly be carried into the piping and receiver. Inspection of the MS determined this is not a concern as discussed in the corrective action section.

D. SAFETY ANALYSIS:

The safety significance of this event was minimal. On the loss of instrument air, the operators scrammed the reactor and shut all MSIVs in accordance with plant Operating Abnormal Procedures. All systems operated as expected, and all safety related air operated valves operated as expected.

Following the scram, reactor water level rose above the HPCI Steam Line Supply Nozzle, and an unknown amount of water entered the line. The water drained from the steam line to the Inlet Drain Pot, which was aligned to the Main Condenser and Suppression Pool. Approximately forty minutes after the event the Inlet Drain Pot Hi Level Alarm cleared. Additional draining was performed following the event to insure that the HPCI turbine was completely free of water.

The HPCI turbine is designed to ingest some water, and would have operated if required.

E. CORRECTIVE ACTIONS:

The 3C IA compressor, normally aligned to supply Unit 2, was out-of-service for scheduled maintenance. The 3C IA compressor was expeditiously returned-to-service to allow Unit 2 start up.

The 2A IA compressor receiver tank, moisture separator, drain traps and portions of the inlet and discharge pipe were replaced and the compressor return to service August 3, 1994. A check valve was installed at the receiver discharge to prevent header depressurization following a tank, compressor, relief valve or pipe failure.

Tank Inspections

Thickness measurements and an engineering evaluation were performed on the 2B and 3C IA systems to determine receiver and inlet pipe thinning and the potential for a similar failure. The 2B and 3C receiver tanks were found to have similar but not as severe thinning. During removal of the 2B receiver tank in October 1994, it was decided by Station Management to upgrade the receiver tanks and the inlet/outlet piping using a stainless steel material and to add an epoxy coating to the receiver tanks. The additional time required for the approval and review of the upgraded replacement along with the time required for application of the epoxy coatings increased the time needed for the replacement of the 2B and 3C receiver tanks. The receiver tank replacements will be accomplished through work request D26108 and modification P12-2-94-222 for the 2B receiver tank and work request D26146 and modification P12-3-94-258 for the 3C receiver tank. Installation of both tanks, 2B and 3C, are expected during Winter and Spring, 1995.

During the Unit 3 refuel outage, State of Illinois Department of Nuclear Safety (IDNS) inspections of the tank internals and thickness measurements were performed on the 3A and 3B air receiver tanks. The 3B tank was found acceptable; the 3A tank requires replacement. Due to the upgrade of the receiver tank replacement, completion of the 3A receiver tank will be determined upon the resolution of Plant Change Request (PCR) 0541 and the return to service date of the 3C IA compressor. All replacement tanks will have welded inlet and discharge pipe design. The threaded inlet and discharge connections at the 3B receiver will be replaced with welded connections. Inspections will continue to be performed in accordance with IDNS requirements.

Moisture Separator/Trap Inspection

Location of the 2A moisture separator drain line presented a concern regarding moisture removal operation. The moisture separator drain trap is connected at a sight glass port five (5) inches above the base of the tank. The sight glass had not been installed. A manual drain valve was connected at the base of the moisture separator. A 12 x 5 inch rectangular section was cut from the moisture separator to facilitate destructive examination. The tank base drain location was found plugged solid with debris, approximately two to three inches of rust and scale had accumulated in the base of the tank. The port at the sight glass location was free of any blockage and debris. The moisture separator internal design provides a common 4 inch inlet and discharge pipe with a center baffle to direct air flow. Openings are located at the base of the inlet and top of the discharge to direct flow for effective moisture removal. Because of this design it is unlikely that standing water to the 5 inch drain location would result in increased moisture carry over. This space however does provide a debris trap and minimizes drain blockage potential.

The drain on the replacement moisture separator is connected at the base of the tank. An improved moisture trap design was installed which is much less susceptible to debris plugging. Operation of this replacement moisture separator will be monitored by Operations and System Engineering. Changes will be made if deemed necessary.

Moisture Trap Replacements

The 2B and 3C moisture traps will be replaced by a trap with improved design which is much less susceptible to debris plugging.

2A IA Compressor Aftercooler Inspection

The 2A IA Compressor Aftercooler was removed and inspected for heat exchanger tube leakage. Tube leakage was considered as a potential source for increased moisture content. The heat exchanger was pressure tested and found to have no leakage. The heat exchanger was flushed and returned to service.

Feedwater Level Excursion

The Feedwater level excursion has been reviewed in continuing training with licensed operators. Additional training will be performed to emphasize the level of the steam lines versus the RFP trip point. The operators did not act outside their procedures or training. During the review alternate methods may

be discussed to prevent overfilling the reactor. The setpoint for the RFP and Turbine trip instruments was verified to be 54.5". The setpoint methodology was re-evaluated to conservatively apply all instrument and calibration uncertainties under normal operating conditions and a new setpoint was derived at 48". A setpoint change was made prior to unit startup along with appropriate procedure changes.

HPCI and Isolation Condenser Steam Line Inspection

A walkdown of all accessible steam inlet piping was performed on the HPCI and Isolation Condenser systems to ensure support integrity. Dresden Operating Surveillance (DOS) 2300-3, HPCI Monthly Verification was performed during startup to verify the HPCI system drains were functional.

F. PREVIOUS OCCURRENCES:

| LER/Docket Number | Title |
|---|---|
| 93-05/05000249 | Instrument Air Header Pressure Loss Via 3A Instrument Air Dryer Due to Management Deficiency |
| 90-47/05000249 | Manual Reactor Scram Due to Loss of Instrument Air Through Unit 3A IA Dryer Inlet Valve and Failure of SA/IA Cross-tie Valve to Open. |

G. COMPONENT FAILURE DATA:

The Instrument Air System is not NPRDS reportable.