Commonwealth Edison
Dresden Nuclear Power Station
R.R. #1
Morris, Illinois 60450
Telephone 815/942-2920

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E. D. Eenigenburg
Station Manager
Dresden Nuclear Power Station

EDE/jmt

Enclosure

cc: A. Bert Davis, Regional Administrator, NRC Region III
File/NRC
File/Numerical

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LICENSEE EVENT REPORT (LER)

Form Rev 2.0

Facility Name (1)	Docket Number (2)	Page (3)
Dresden Nuclear Power Station, Unit 3	0 5 0 0 0 2 4 9	1 of 1 0

Title (4)

Unit 3 Reactor Scram Due to MSIV 3-203-3A Pilot Solenoid Air Line Break

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)
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OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)			
N		___ 20.402(b)	___ 20.405(c)	X 50.73(a)(2)(iv)	___ 73.71(b)
POWER LEVEL (10)	0 9 4	___ 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)	___ Other (Specify in Abstract below and in Text)
		___ 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
R. Hunnicutt, Technical Staff System Engineer Ext. 2546	8 1 5 9 4 2 - 2 9 2 0

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	S B	F C V	A 6 1 3	N	X	A D	2	B 3 4 5	N
X	E L	3 2	G 0 8 0	N					

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)

At approximately 2030 hours on March 10, 1990, an automatic Unit 3 scram on an Average Power Range Monitor (APRM) high flux signal occurred. The air line to the pilot solenoid for Outboard Main Steam Isolation Valve (MSIV) 3-203-2A had failed prior to the scram causing closure of the MSIV and a resulting reactor vessel pressure transient which led to the scram on APRM high flux. The resulting main steam line flow increase and corresponding low reactor water level condition resulted in Group I, II and III Primary Containment Isolations via main steam line high flow (greater than 120% of rated steam flow) switch and +8 inch reactor water low level switch actuations. Corrective action included repairs, inspection of other similar lines, and evaluation of improved air line configurations. The safety significance of this transient was mitigated by the fact that reactor water was maintained well above the automatic Emergency Core Cooling System (ECCS) initiation setpoint at all times and multiple systems were available for reactor pressure control including Isolation Condenser, High Pressure Coolant Injection (HPCI) and Main Steam Relief valves. Although previous failures of inboard MSIV pneumatic lines at the manifold block have occurred, this is believed to be the first failure of an outboard air line fitting connection.

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2527 MWt rated core thermal power.

Nuclear Tracking System (NTS) tracking code numbers are identified in the text as (XXX-XXX-XX-XXXXX).

EVENT IDENTIFICATION:

Unit 3 Reactor Scram Due to MSIV 3-203-2A Pilot Solenoid Air Line Break

A. CONDITIONS PRIOR TO EVENT:

Unit: 3 Event Date: March 10, 1990 Event Time: 2030 hours

Reactor Mode: N Mode Name: Run Power Level: 94%

Reactor Coolant System (RCS) Pressure: 1000 psig

B. DESCRIPTION OF EVENT:

At 2030 hours on March 10, 1990 with Unit 3 in the Run mode at 94% rated core thermal power, the Channel B Main Steam Line High Flow alarm on Control Room Panel 903-5 was received. Control Room personnel observed an Average Power Range Monitor (APRM) [IB] High Flux Scram and a Group I Primary Containment Isolation had occurred. Immediately thereafter, Group II and Group III Primary Containment Isolations occurred resulting in Primary Containment isolation, Reactor Building ventilation system [VA] isolation and initiation of Standby Gas Treatment (SBGT) system [VA], and Reactor Water Cleanup system (RWCU) [CE] isolation. It was noted that the position indication for drywell air sampling valve 3-8501-5B, designed to close as a result of Group II Primary Containment Isolations, indicated that the valve was in a mid (not fully closed) position. Operations Department personnel responded in accordance with Dresden General Procedure (DGP) 2-3, Unit 2/3 Reactor Scram. The Isolation Condenser [BL] was manually initiated to control reactor pressure. The Feedwater pumps [SJ] were tripped causing an automatic run back of the Recirculation [AD] pumps on less than 20% feedwater flow as expected; however, the 3A Recirculation pump appeared to fail to run back properly and was subsequently run back manually. An expected reverse power main generator [TB] trip failed to occur within the expected time frame. In accordance with DGP 2-3, tripping of the Generator and opening of the Output Circuit Breakers were then accomplished via operator action. In order to assist with reactor pressure control, the RWCU system was restarted, and the Main Condenser [SC] was re-established as a heat sink for reactor decay heat by equalizing the pressure around and then reopening Main Steam [SB] Isolation Valves (MSIVs) 3-203-1B, 1C, 1D, 2B, 2C and 2D which had closed as a result of the Primary Containment Group I isolation signal. It was noted at this time that MSIV 3-203-2A, which had also isolated, could not be opened. When use of the Isolation Condenser was no longer needed, an attempt was made to secure it by closing the outboard condensate return valve MO3-1301-3. However, steam was observed to continue exhausting from the system's shell side vent indicating that valve MO3-1301-3 may not have been fully closed. Additional attempts to close the valve were unsuccessful. The Isolation Condenser was then secured by closing condensate return valve MO3-1301-4, which is in line with valve MO3-1301-3. The following Work Requests (WRs) were initiated requiring the corresponding actions:

1. WR 91530, Investigation of any problem associated with and any necessary repair of MSIV 3-203-2A.

2. WR 91533, Investigation of any problem associated with and any necessary repair of the 3A Recirculation Pump controller.

3. WR 91532, Investigation of any problem associated with and any necessary repair of Isolation Condenser condensate return valve MO3-1301-3.

The Scram Investigation Committee was organized immediately in accordance with Dresden Administrative Procedure (DAP) 7-15, Scram/Engineered Safety Features (ESF) Actuation Investigation Program. The scram was reset at 2150 hours on March 10, 1990; normal plant recovery and preparations for reactor startup were then initiated.

Subsequent investigations revealed that this incident had been initiated due to a break in the 3/8 inch copper air line to the pilot solenoid of MSIV 3-203-2A. Visual examination of the failed air line indicated that the break had occurred adjacent to a fitting, where the line appeared to be slightly distorted. A subsequent walkdown of the remaining outboard MSIV pilot air lines was conducted by the Mechanical Maintenance and Technical Staff Departments as a precautionary measure. No abnormalities were found for the air lines for MSIVs 3-203-2B and 2D. Two possible problems were found, however, with the air line for MSIV 3-203-2C. First, the 3/8 inch pilot line appeared to be somewhat degraded. Although its structural integrity seemed unaffected, WR 91535 was written requiring its replacement. The replacement was completed on March 11, 1990 prior to Unit 3 startup. Secondly, an elbow on the 1 1/2 inch section of the air line had been slightly bent. The extent of the damage to the elbow was determined to be minimal, requiring no immediate actions. WR 91536 was written to replace it during the upcoming refuel outage.

In addition, an inspection of the drywell air sampling valve 3-8501-5B was conducted by Operations Department personnel verifying it was properly closed. WR 91531 was then initiated requesting readjustment of the valve's limit switches.

C. APPARENT CAUSE OF EVENT:

This report is submitted in accordance with 10CFR50.73(a)(2)(iv), which requires the reporting of any unplanned automatic ESF actuation, including the Reactor Protection System (RPS) [JC]. The root causes of the occurrences are as follows:

1. Reactor Scram and Associated Primary Containment Isolations Due to MSIV Air Line Failure.

The root cause of the event was determined to be failure of the MSIV 3-203-2A pilot air line due to fatigue. The break was adjacent to a fitting. It is suspected that the line may have been weakened during previous performances of Dresden Maintenance Procedure (DMP) 200-15, Main Steam Isolation Valve Maintenance, which requires disconnecting of the air line. This procedure was last performed on February 1, 1990. During normal operation, vibration is induced in the steam lines which in turn is transferred to the attached components of the lines, in this case the MSIV pilot air lines. The resulting closure of MSIV 3-203-2A resulted in a reactor vessel pressure transient caused the APRMs to reach the high high flux setpoint, consequently scramming the reactor. The resulting main steam line flow increase and corresponding low reactor water level condition caused Group I, II and III Primary Containment Isolations via the main steam line high flow (greater than 120% of rated steam flow) switches and the +8 inch reactor water low level switches. A maintenance history review indicates that this was apparently the first failure of an outboard MSIV air line fitting connection, although previous inboard MSIV pneumatic line failures at the manifold block have occurred (refer to Section F.1 of this report).

2. Apparent Failure of 3A Recirculation Pump to Run Back.

While performing WR 91533, it was found that the cause of the 3A Recirculation pump apparent failure to run back to minimum speed during the incident was caused by a faulty time delay relay, BYA-M, for the 3B Recirculation pump control circuitry. A specific cause of failure could not be determined as the relay appeared undamaged. This relay is designed to provide a 15 second time delay for run back of the 3B Recirculation pump upon receipt of a less than 20% feedwater flow signal. The faulty relay in this case; however, provided no time delay at all. The run back of 3B Recirculation pump was initiated immediately, approximately 15 seconds prior to the 3A Recirculation pump, which actually operated properly.

A maintenance review for the BYA-M relay indicated no past failures similar to this one.

3. Main Generator Reverse Power Trip Abnormality.

The main generator is equipped with two circuits designed to automatically trip the main generator on reverse power conditions. The first, associated with a primary GGP relay (32G3), is initiated by way of a turbine trip signal and is designed to trip the generator at a real reverse power value of approximately -2.18 MWe after a five-second time delay. The primary GGP circuit also prohibits the Operator from opening the Output Circuit Breakers (OCBs), via the Main Control Room Panel 903-8 control switches, until the reverse power and time delay setpoints are satisfied. This open-prohibit interlock does not apply to the OCB control switches on the 345 KV switchyard panel, located in the common area of the Control Room. The second reverse power trip circuit is a secondary GGP relay (92G3) which is designed to trip the main generator at a real power value of approximately -2.18 MWe with a 15-second time delay.

The second GGP relay normally trips the main generator unless a turbine trip signal is present.

Following this event, the generator failed to trip within the expected setpoints. Trip of the generator and opening of the Output Circuit Breakers was accomplished via Operator action (manual trip of the turbine).

Testing of the reverse power relays in the past has indicated that the real power values at which the reverse power trip occurs are biased by significant reactive loads. As the generator was experiencing a significant reactive power loading at the time of the event, it is currently believed that this resulted in biasing of the real power trip setpoints, such that the generator trip did not occur as expected.

4. Isolation Condenser Valve MO3-1301-3 Closure Problem.

The Isolation Condenser MO3-1301-3 valve opens to initiate the Isolation Condenser during manual or automatic operation. Once the valve is fully open, the Operator may take manual control to adjust flow as desired to maintain a desired reactor pressure or cooldown rate. During manual control, the MO3-1301-3 valve will normally indicate an intermediate position between full open and full closed. However, due to the configuration of the operator torque switch bypass setting, the open indicating lamp will go out prior to the valve reaching the closed position. This concern also applies to various other valve operators; therefore, Operations personnel had been trained in accordance with Operating Order 6-90, Motor Operated Valves Set Per NRC Bulletin 85-03, to hold the valve control switches in the closed position for approximately 20 seconds after closed indication is received.

As part of the Scram Investigation Committee review prior to restart, the MO3-1301-3 valve schematics were reviewed and a closure test was performed utilizing motor operator current signature instrumentation. This review concluded that the valve MO3-1301-3 control switch must be held until the valve is fully closed and that the full closed indication prematurely occurs prior to the full closed position. Further, once full closed indication is achieved, subsequent closure attempts require first re-opening the valve to an intermediate position indication. It was then concluded that the switch had not been held long enough.

The root cause of the MO3-1301-3 valve closure problem was attributed to procedure deficiency, because Operating Order 90-6 did not specifically mention valve MO3-1301-3, or address the potential problem in completing the closure process. A contributing factor in this event was design deficiency, in that installation of a four-rotor operator limit switch assembly would provide accurate position indication. As described in Section E.4 of this report, installation of the four-rotor limit switches are planned for Dresden Units 2 and 3 (the Unit 2 MO2-1301-3 valve has similar design).

5. Drywell Air Sampling Valve 3-8501-5B Dual Indication.

The investigation of the dual indication concern for drywell sampling valve 8501-5B under WR 91531 found that the dual indication was loosening of the valve's open limit switch. The limit switch is held by a setscrew, which had loosened sufficiently to allow misalignment. A maintenance review for this valve has indicated that a similar incident occurred on February 8, 1990, during the previous refuel outage.

D. SAFETY ANALYSIS OF EVENT:

The safety analysis for each of the occurrences here discussed is provided below:

1. Reactor Scram and Associated Primary Containment Isolations.

Technical Specification Limiting Condition for Operation 3.7.D states that reactor operation is permitted provided at least one of the valves in each Primary Containment Isolation line is in the isolated condition. The failed Primary Containment Isolation valve, 3-203-2A, was operational up to and including the time of the air line failure. With the failure, it still performed its function as a Primary Containment Isolation valve by safely failing in the isolated (closed) position. Furthermore, all the remaining MSIVs, including that in line with the failed valve, operated properly during the incident.

In addition, the APRM system operated as intended in initiating the reactor scram on a high high flux condition. The automatic Group I, Group II, and Group III Primary Containment Isolations also occurred as expected when challenged by their initiating signals.

2. Apparent failure of 3A Recirculation Pump to Run Back.

Failure of the time delay relay associated with 3B Recirculation pump was of minimal safety significance. The 15 second time delay associated with the relay is intended to prevent short lived run back actuation signals from affecting pump operation; for example, a feedwater flow downscale spike will not cause a pump run back. Following this scram, the run back signal (less than 20% Feedwater flow) was valid. The immediate run back of the 3B Recirculation pump had no adverse affect other than allowing it to run back sooner than the 3A Recirculation pump. This was also of no concern as the recirculation pump speed mismatch circuit, designed to prevent defeating of the Low Pressure Coolant Injection (LPCI) [BM] recirculation loop selection logic due to gross differences in speed between the two pumps, was operational at the time of the incident and performed as intended.

3. Main Generator Reverse Power Trip Abnormality.

The fact that significant reactive load delayed the actuation of the reverse power relays was mitigated by manual Operator action to provide the generator trip, as described in Section B of this report.

4. Isolation Condenser Valve MO3-1301-3 Closure Abnormality.

As described in Section C above, no actual problem existed with the operation capabilities of valve MO3-1301-3 at any time during the incident. At the time of the MO3-1301-3 valve closure anomaly, alternate sources (the Main Condenser and RWCU) had been aligned for reactor pressure control, and an attempt was being made to secure the Isolation Condenser as it was no longer required. Any adverse effects that could have occurred as a result of not having totally secured the Isolation Condenser while the other systems were in use were mitigated by the fact that the system was able to be alternately secured by closing valve MO3-1301-4.

5. Drywell Air Sampling Valve 3-8501-5B Dual Indication.

The drywell air sampling valve is required to close as a result of a Group II Primary Containment Isolation, thereby maintaining Primary Containment integrity. As previously stated, no problem existed with valve 3-8501-5B at the time of the incident; only its position indication was affected. Primary Containment integrity was, therefore, maintained.

E. CORRECTIVE ACTIONS:

A summary of the corrective actions is provided below:

1. Reactor Scram and Associated Primary Containment Isolations Due to MSIV Air Line Failure.

The air line to the pilot solenoid of MSIV 3-203-2A was replaced and satisfactorily leak tested under WR 91530. A precautionary walkdown was also performed of the air lines for the remaining outboard MSIVs. As a result of observations made during the walkdown, the air line for MSIV 3-203-2C was replaced and leak tested (WR 91535), and WR 91536 was initiated requesting replacement of a 1 1/2 inch elbow in the air line for the same valve (249-200-90-04601). As a long term corrective action, an investigation will be made by the Mechanical Maintenance Department and the Technical Staff System Engineer into the possibility of altering the MSIV air lines such that they will be less susceptible to damage due to vibration or normal maintenance activities (249-200-90-04602). Tentatively, the use of high pressure braided flexible hose instead of the existing tubing is viewed as the most likely possibility.

2. Apparent failure of 3A Recirculation Pump to Run Back.

The faulty time delay relay for the 3B recirculation pump control circuitry was replaced and satisfactorily tested (237-200-90-04603).

3. Main Generator Reverse Power Trip Abnormality.

As a long term corrective action, the Division Operational Analysis Department is presently investigating similar incidents in which the main generator reverse power trip failed to occur. Once the investigation is completed, a follow-up report will be issued documenting any recommended actions (237-200-90-00512).

Additionally, Temporary Procedure Change 90-158 to DGP 2-3 was submitted with clarifications regarding the required Operator responses in the event that the main generator fails to trip on reverse power. The legibility of the pages of the procedure was also upgraded to aid in performance of the procedure. These actions were initiated in accordance with Operator comments to the Scram Investigation Committee. A permanent revision to the procedure will also be made to incorporate these changes (249-200-90-04604).

4. Isolation Condenser Valve MO3-1301-3 Closure Abnormality.

To inform Operations personnel of the characteristics of valve MO3-1301-3, Operating Order 12-90 was written to address the valve's function (249-200-90-04605). As a long term corrective action, Modification M12-2(3)-88-63 had been previously initiated. This modification consists of the elimination of the torque switch bypass limit switch setting affecting other portions of the valve control logic. This will be performed on selected valves at Dresden, among them MO3-1301-3, via one of the following changes:

a. Increasing the number of limit switch rotors for the valve such that its torque switch bypass limit switch is on a separate rotor than its intermediate/open limit switch.

b. Elimination of the torque switch bypass limit switch entirely and the resetting of the operator limit switches to more accurately reflect its position.

The change discussed in 4.a above will be made to valve MO3-1301-3 and MO2-1301-3 (Dresden Unit 2) (249-200-90-04606).

5. Drywell Air Sampling Valve 3-8501-5B Dual Indication.

The open limit switch was adjusted and secured for valve 3-8501-5B and correct Control Room position indication verified under WR 91531 (249-200-90-04607). The Technical Staff System Engineer also subsequently inspected the limit switch assembly to verify that no further loosening had occurred (249-200-90-04608).

F. PREVIOUS EVENTS:

1. Reactor Scram and Associated Primary Containment Isolations Due to MSIV Air Line Failure.

Three previous events involving inboard MSIV pneumatic line failure are listed below. No previous failures of outboard MSIV air line fitting connections were recorded.

Non-Reportable Event No.	Title
12-2-87-166	203-1B Inboard Main Steam Isolation Valve Drifting Partially Closed Due to a Loose Pneumatic Line on the Manifold Block

The Unit 2 inboard MSIV 2-203-1B was found to have drifted partially closed with Unit 2 at 93% power on December 12, 1987. Cycling of the valve was attempted with no response. Subsequent investigation revealed that the pneumatic line to the manifold block on the valve operator had been pulled out. The air line was reattached, and plans were made to further inspect all inboard MSIV pneumatic lines during the next unit outage.

12-2-88-45	Unit 2 Main Steam Isolation Valve (MSIV) Air Leak Due to Loose Air Line Coupling

During a drywell entry on April 14, 1988 to perform unrelated work, it was discovered that the Unit 2 inboard 2-203-1B MSIV had developed a leak in a 1 1/2 inch pneumatic line coupling. The coupling was repaired, and constraints were added to the coupling to prevent the fitting from loosening during reactor operation. In addition, an engineering review of the supports for the inboard MSIV pneumatic lines was initiated. This review resulted in support improvements.

12-2-88-51	Inboard Main Steam Isolation Valve 2-203-1B Drifted Partially Closed Due to a Disconnected Manifold Block Pneumatic Line

Unit 2 inboard MSIV 2-203-1B was found to have drifted partially closed with Unit 2 at 88% power on April 27, 1988. Cycling of the valve was attempted with no response. Subsequent investigation revealed that a pneumatic line to the manifold block on the valve operator had been pulled out. This failure was attributed to vibration. The line was repaired.

2. Apparent failure of 3A Recirculation Pump to Run Back.

No previous events could be found similar to this one.

3. Main Generator Reverse Power Trip Abnormality.

12-3-87-48 (LER 87-13/050249)	Unit 3 Shutdown Due to Failure of Standby Gas Treatment Valve A03-1601-63

The Unit 3 generator appeared to motor in excess of the reverse power setpoints following a scram, and the OCBs were opened via Operator action. Cleaning of the primary reverse power relay was completed and a special test was performed during startup to verify proper tripping of the secondary circuit.

Non-Reportable Event No.	Title
12-3-89-20 (LER 89-2/050249)	Reactor Scram Due to the Failure of an Electrical Protection Assembly Breaker
12-3-89-31 (LER 89-6/050249)	The Unit 3 generator OCBs were again manually opened following a March 30, 1989 Unit 3 scram. Initially, it was believed that the Operator had opened the OCBs before the trip circuitry could actuate. However, further investigation was performed following an April 15, 1989 reactor scram. Dust was found in the secondary relay, which was then cleaned and tested. The relay calibration procedure was also changed to require checking for mechanical problems.
12-2-90-2 (LER 90-1/050237)	Primary Containment Group I Isolation and Reactor Scram Due to Procedure Deficiency The Unit 2 generator appeared to motor in excess of the reverse power trip setpoints following a January 5, 1990 scram. The OCBs were manually tripped. The relays were inspected satisfactorily, and a special test was performed during reactor startup.
12-2-90-5 (LER 90-2/050237)	Reactor Scram Following Condensate/Condensate Booster Pump Failure and Subsequent Loss of Offsite Power The Unit 2 generator appeared to motor in excess of the reverse power trip setpoints following a January 16, 1990 scram. The OCBs were manually tripped. The primary and secondary relays were replaced, and a follow-up investigation initiated.

4. Isolation Condenser Valve MO3-1301-3 Closure Abnormality.

   No previous events could be found similar to this one.

5. Drywell Air Sampling Valve 3-8501-5B Dual indication.

   As described in Section C.5, a previous problem with the 3-8501-5B valve limit switch occurred during the previous refuel outage.

G. COMPONENT FAILURE DATA:

Manufacturer	Nomenclature	Model Number	Mfg. Part Number
General Electric	Main Generator Reverse Power Trip Circuitry	GGP53C	N/A

This component is not reportable to the NPRDS data base. An industry-wide search for this relay model listed no similar events.

Manufacturer	Nomenclature	Model Number	Mfg. Part Number
Gulf and Western Industries, Inc.	BYA-M B MG set Aux. Circuit Relay	BR14A601-3G76	N/A

This component is not reportable to the NPRDS data base. An industry-wide search for this relay yielded no information.

Automatic Valve Corporation	3-203-2A MSIV	Avco Drawing #C-5512	N/A

This component is not reportable to the NPRDS data base. An industry-wide search for this valve model yielded no information.