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Dresden Nuclear Power Station
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August 29, 1991

EDE LTR #91-536

U.S. Nuclear Regulatory Commission
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Licensee Event Report #91-022-0, Docket #050237 is being submitted as required by Technical Specification 6.6, NUREG 1022 and 10 CFR 50.73(a)(2)(iv).

L. F. Gerner for
E. D. Eenigenburg
Station Manager
Dresden Nuclear Power Station

EDE/ade

Enclosure

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

(ZDVR/296)

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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 2	0 5 0 0 0 2 3 7	1 of 0 5

Title (4)

Control Rod Dive F-3 Drift Due to Pilot Solenoid 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 Names	Docket Number(s)
											N/A	
0 8	0 5	9 1	9 1	—	0 2 2	—	0 0	0 8	2 9	9 1	N/A	

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 8	___ 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		
		___ 20.405(a)(1)(iii)	___ 50.73(a)(2)(i)	___ 50.73(a)(2)(viii)(A)	in Abstract		
		___ 20.405(a)(1)(iv)	___ 50.73(a)(2)(ii)	___ 50.73(a)(2)(viii)(B)	below and in		
		___ 20.405(a)(1)(v)	___ 50.73(a)(2)(iii)	___ 50.73(a)(2)(x)	Text)		

LICENSEE CONTACT FOR THIS LER (12)

Name	TELEPHONE NUMBER
	AREA CODE
Walter V. Ravelo, Technical Staff System Engineer Ext. 2997	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	MANUFAC-TURER	REPORTABLE TO NPRDS	///	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	///
X	A A	S O L	A 6 1 0	Y							

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 2147 hours on August 5, 1991, with Unit 2 at 98% rated power, during main turbine Electro Hydraulic Control (EHC) low pressure scram switch calibration per Dresden Instrument Surveillance (DIS) 500-8, EHC Low Pressure Scram Switch Calibration, Control Rod Drive (CRD) F-3 suddenly inserted from position "48" to position "34". Previous to the unplanned rod insertion, a Channel A 1/2 scram signal had been received and reset per DIS 500-8. Upon initiation of a Channel B 1/2 scram signal, CRD F-3 suddenly inserted. Shortly after rod insertion, Operations personnel reported chattering in one of the two scram pilot solenoids (305-117 or 305-118). DIS 500-8 was suspended and the control rod was manually inserted to position "00" and electrically disarmed. Troubleshooting indicated that the rod insertion was caused by air leakage past the scram pilot solenoid valves. The scram pilot solenoid valves were therefore replaced and CRD F-3 was placed back in service. Further inspection will be conducted on the pilot solenoid valves that were removed to confirm the failure mode. Safety significance was minimal because no core thermal and hydraulic limits were challenged and the scram function of CRD F-3 was not affected. Review of the system history records indicates that this type of event has not been an adverse trend.

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:

Control Rod Drive F-3 [AA] Drift Due to Pilot Solenoid Failure

A. CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: August 5, 1991 Event Time: 2147 Hours

Reactor Mode: N Mode Name: Run Power Level: 98%

Reactor Coolant System (RCS) Pressure: 995.6 psig

B. DESCRIPTION OF EVENT:

At 2147 on August 5, 1991, with Unit 2 at 98% power, during main turbine [TA] Electro Hydraulic Control (EHC) low pressure scram switch calibration per Dresden Instrument Surveillance (DIS) 500-8, EHC Low Oil Pressure Switch Calibration, Control Rod Drive (CRD) F-3 suddenly inserted from position "48" to position "34". Investigation indicates that previous to rod insertion, a Channel A 1/2 scram [JE] signal had been received and reset per DIS 500-8. Upon initiation of a Channel B 1/2 scram signal in accordance with the EHC surveillance, CRD F-3 suddenly inserted. Shortly after rod insertion, Operations personnel reported chattering in one of the two scram pilot solenoid valves (305-117 or 305-118). DIS 500-8 was suspended and the control rod was manually inserted to position "00", in accordance with instructions from a Qualified Nuclear Engineer (QNE), and the CRD was electrically disarmed. Troubleshooting indicated that the rod insertion was caused by pilot air leakage past the Channel A scram pilot solenoid valve. Both scram pilot solenoid valves were replaced and CRD F-3 was placed back in service.

C. APPARENT CAUSE OF EVENT:

This report is submitted in accordance with 10CFR50.73 (a)(2)(iv), which requires the reporting of any unplanned Engineered Safety Feature (ESF) actuation.

Each CRD is controlled via a Hydraulic Control Unit (HCU), as shown in Figure 1. Normal CRD maneuvering is accomplished through the Reactor Manual Control System, which sequences the operation of the directional control valves such that the CRD drive water pressure is routed to the "under piston" area for insertion and to the "over piston" area for withdrawal. The scram function provides rapid insertion into the core by opening the scram inlet and outlet valves (126 and 127) and applying reactor and scram accumulator pressure to the "under piston" area. The scram logic is configured such that actuation of both scram pilot solenoid valves (117 and 118) is required to initiate opening of the scram valves (126 and 127) by bleeding off their pilot air.

The unplanned insertion of CRD F-3 was apparently caused by a momentary leakage of scram pilot air past the Channel A pilot solenoid valve when the Channel B 1/2 scram signal was received. The leakage momentarily allowed the scram valve (126 and 127) diaphragms to vent and then repressurize causing the control rod to insert and then stop. A Technical Staff Engineer and a General Electric (GE) Site Representative reproduced the event to observe the operation of the pilot solenoids.

With the HCU isolated and the Directional Control Valves electrically disarmed, the pilot solenoids were electrically energized and then pressurized with pilot air. It should be noted that solenoid valve chattering was found only during isolation valve manipulation. The Channel A solenoid fuse was removed to simulate the initiation of a Channel A 1/2 scram signal. The pilot solenoids operated as intended. The Channel A solenoid fuse was then replaced and the Channel B solenoid fuse was removed. Upon deenergizing the Channel B solenoid, a burst of pilot air was released from the solenoid valve exhaust port.

Conclusions indicate that due to the solenoid valve configuration (see figure 1), no pilot air should have been exhausted. Upon deenergizing the channel B pilot solenoid valve, pilot air should have remained isolated by the Channel A solenoid valve. The failure mode was therefore concluded to be leakage past the exhaust port diaphragm of the Channel A solenoid valve. When reenergizing the Channel A solenoid valve, the exhaust diaphragm may not have completely seated. Upon deenergizing the Channel B solenoid, pilot air leaking past the Channel A exhaust port diaphragm may have forced the diaphragm back into position. Inspection of the pilot solenoid valves that were removed will be conducted to verify that the failure mode is as suspected.

The current preventive maintenance program requires that 25% (approximately 88 of 354) of the pilot solenoid valves be rebuilt during each refueling outage resulting in 100% replacement in an approximate 6 year period. These pilot solenoid valves were last replaced in 1988 and were not due to be replaced again until 1995.

D. SAFETY ANALYSIS OF EVENT:

The purpose of the Control Rod Drive System is to control reactor power, provide a means to shape both axial and radial flux profiles in the reactor, and to provide adequate excess negative reactivity to shut down the reactor from any normal or accident condition at the most reactive time in core life.

Due to the nature of this event, no core thermal hydraulic limits were challenged. Since this type of failure does not affect scram functions, shutdown margin was not a concern.

Since the nature of this failure provided negative reactivity to the core and would not affect scram functions, the safety significance of this event is considered minimal.

E. CORRECTIVE ACTIONS:

Immediate corrective actions were to troubleshoot the CRD F-3, replace the scram pilot solenoid valves, and verify scram operability per Dresden Technical Procedure (DTS) 300-2, Control Rod Drive Scram Testing and Scram Valve Timing Test.

Various investigations were also conducted by:

1. Interviewing the Nuclear Station Operator (NSO) for details of the event;

2. Contacting the GE Site Representative for recommendations;

3. Reviewing the results of Total Job Management (TJM) and Nuclear Plant Reliability Data Search (NPRDS) searches for previous similar events.

As described above, the failure mode is believed to be leakage past the scram pilot solenoid exhaust port manifold diaphragm. Further testing will be conducted to verify the failure mode. If the testing reveals any further significant information, results of these tests will be provided in a supplement to this report. These actions will be tracked by Nuclear Tracking System (NTS) number 237-200-91-13201.

Because review of maintenance history indicates that this type of event has not been an adverse trend, the current preventative maintenance replacement frequency of 25% each refueling outage is deemed adequate.

F. PREVIOUS OCCURRENCES:

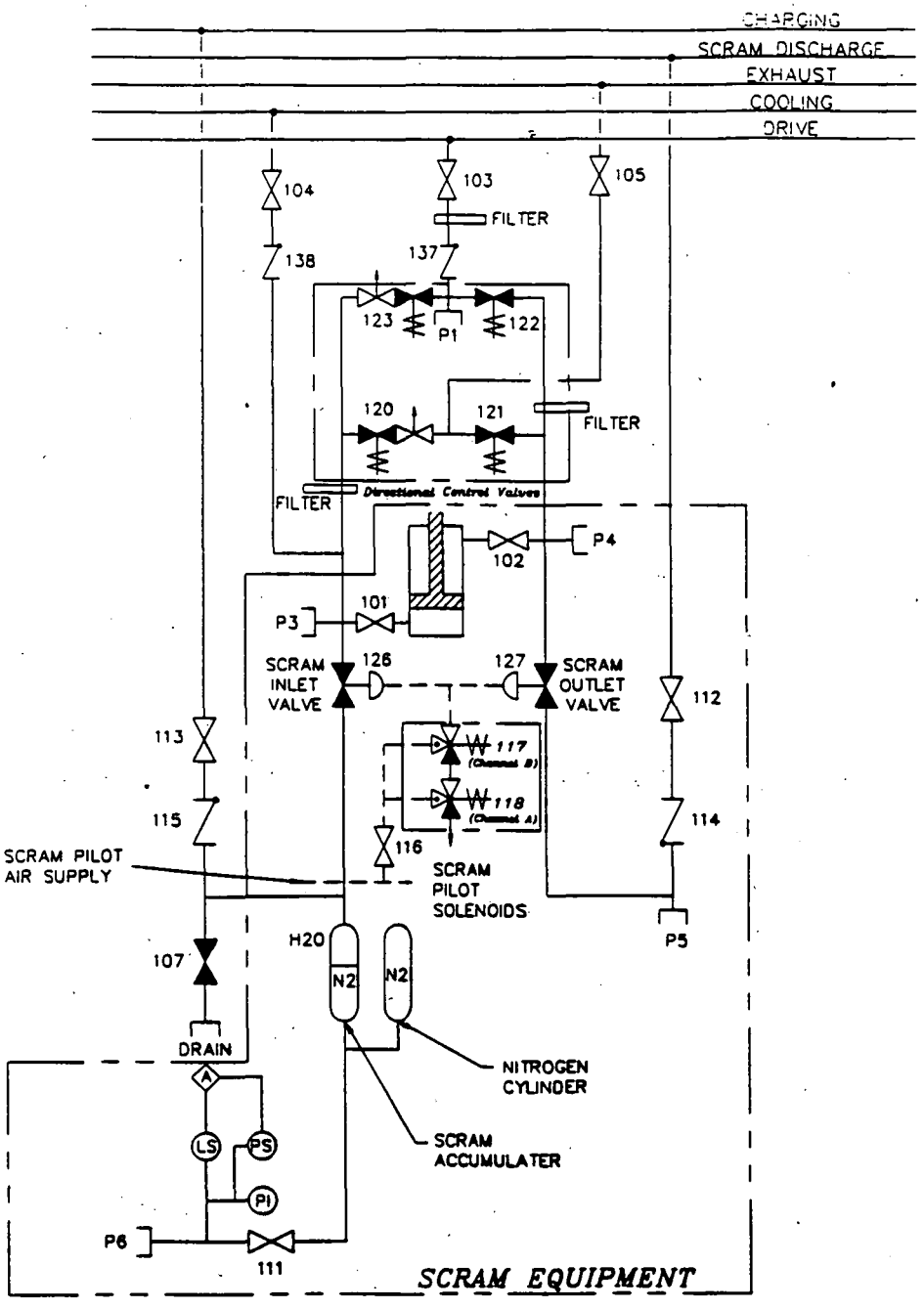
Non-Reportable Event	Title
12-2-86-87	Scram of CRD C-11 (10-43) Due to Defective Scram Pilot Solenoid Coil Failure CRD C-11 scrammed to position "00" upon inducing a Channel A 1/2 scram signal per DOS 500-9, Turbine Control Valve Fast Closure (Load Reject) Scram Circuit Functional Test. This was caused by a solenoid coil failure in the scram pilot solenoid. The corrective action was to replace the Channel B solenoid valve and verify operability by scram testing the drive.

Note: Under previous LER classification policy, similar events were not identified as Engineered Safety Feature (ESF) actuations and were therefore not classified as LERs. However, due to recent revisions in the classification policy, the event described in this report was classified as an ESF actuation.

G. COMPONENT FAILURE DATA:

Manufacturer	Nomenclature	Model Number	Mfg. Part Number
Automatic Switch Company	Pilot Solenoid	---	HVA90-405-2J

An industry wide NPRDS data base search was performed for unexpected rod drift due to scram pilot valve failures and a total of 12 records were found. 6 of the 12 records involved failures due to faulty coils, scram fuses, or scram test switches. There were 6 incidences of air leaks due to improper seating of the air diaphragms. In all cases, the corrective action was to replace the scram pilot solenoid valve.



CRD Hydraulic Control Unit (piping diagram)

FIGURE 1