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Dresden Nuclear Power Station
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July 3, 1991

EDE LTR #91-415

U.S. Nuclear Regulatory Commission
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Licensee Event Report #91-011, 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/dwh

Enclosure

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

ZDVR/253

IE22

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 6

Title (4) Unit 2 Reactor Scram Following Turbine Trip Due to Main Turbine Thrust Bearing Wear Detector Malfunction

Event Date (5) Month	Day	Year	LER Number (6) Year	Sequential Number	Revision Number	Report Date (7) Month	Day	Year	Other Facilities Involved (8) Facility Names	Docket Number(s)
0 6	0 9	9 1	9 1	0 1 1	0 0	0 7	0 3	9 1	NONE	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 0 4 2

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

	20.402(b)		20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
	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	
Kelly Spencer, Technical Staff System Engineer Ext. 2851	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	T A	3 8	G 0 8 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 0302 hours on June 9, 1991 with Unit 2 at 42% power, a reactor scram occurred due to a high reactor pressure signal. At the time, operations personnel were testing the turbine thrust bearing wear detector when a turbine trip occurred. All turbine bypass valves fully opened. However, reactor pressure began to increase due to loss of feedwater heating. The reactor operators attempted to control reactor pressure by inserting control rods in reverse sequence. One control rod had been inserted before reactor pressure reached 1048 psig and initiated a reactor scram. Investigation revealed that foreign material in the turbine bearing oil had fouled the thrust bearing wear detector causing it to drift close to the trip setpoint. During testing, the wear detector reached its setpoint before the turbine trip bypass interlocks had actuated. Review of thrust bearing plate temperatures revealed no abnormalities, indicating that an actual turbine thrust was not present. Corrective actions included a change to the thrust bearing wear detector testing procedure which lowers the acceptance criteria for movement of the detector, evaluation of an improved wear detector design, and simulator training. The safety significance was minimal, in that safety systems performed as required and post-scram recovery was normal. Operations personnel promptly responded to the scram in accordance with procedures and training.

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 2 Reactor Scram [JE] Following Turbine [TA] Trip Due to Main Turbine Thrust Bearing Wear Detector Malfunction

A. CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: June 9, 1991 Event Time: 0302 Hours

Reactor Mode: N Mode Name: Run Power Level: 42%

Reactor Coolant System (RCS) Pressure: 930 psig

B. DESCRIPTION OF EVENT:

At 0300 hours on June 9, 1991 with Unit 2 in normal power operation at 42% rated core thermal power, Dresden Operating Surveillance (DOS) 5600-2, Monthly and Weekly Turbine [TA] Checks, was in progress. Operations personnel proceeded to perform the Main Turbine Thrust Bearing Wear Detector Test portion of DOS 5600-2. The operator first tested the generator [TB] end of the thrust bearing by pressing the appropriate push button. The test alarm annunciated as expected and the wear detector ran up to approximately 64 mils. The operator released the test button, allowed the wear detector to run back to zero and cleared the test alarm. The operator then tested the turbine end by pressing the appropriate push button. The test alarm annunciated as expected but the needle did not move. The operator released the pushbutton and reset the test alarm. The turbine then immediately tripped.

After the turbine trip, the operator noted that all turbine bypass valves [JI] were indicating full open. Approximately ten seconds after the turbine trip, Unit 2 auxiliary power [EL] transferred successfully to the Unit 2 reserve auxiliary power transformer [FK]. During the power transfer, several Primary Containment Group I and Group II isolation [JM] valves repositioned. Reactor power and reactor pressure began to increase due to lack of additional turbine bypass capability and loss of feedwater [SJ] heating. The operators noted the reactor pressure increase and began to insert control rods [AA] in reverse sequence to control reactor pressure. One control rod was inserted before the reactor scrammed on high reactor pressure.

All control rods fully inserted. Group II and Group III isolations were also received as expected after the reactor scram. At 0320 hours, the Reactor Water Cleanup System [CE] was unisolated and used to control reactor pressure, level, and temperature. The reactor was brought to a hot shutdown condition with the mode switch in shutdown and reactor pressure less than 600 psig at 0405 hours on June 9, 1991.

Prior to the scram, the channel A and channel B Reactor Protection System (RPS) [JE] scram annunciators [IB] spuriously alarmed. This was verified by the operators who noted that all of the RPS scram solenoid lights remained illuminated with the scram annunciators alarmed. Operations personnel promptly reviewed Control Room panel indications and annunciators and concluded that no valid scram signals were indicated. Normally, upon receiving a reactor scram signal, the RPS deenergizes the scram solenoids and their associated control room light indications while simultaneously alarming the scram annunciator.

C. APPARENT CAUSE OF EVENT:

This event is being reported in accordance with 10CFR50.73(a)(2)(iv); any event that results in manual or automatic actuation of any Engineered Safety Feature, including the RPS.

The cause of the turbine thrust bearing wear detector malfunction was attributed to foreign material in the turbine bearing oil [TD] which caused the detector to be offset. The wear detector uses turbine bearing oil for lubrication and as a hydraulic fluid to determine thrust movement of the turbine shaft. During remote testing, the detector is moved in such a way as to determine the length of travel before the trip setpoint is reached. The length of travel gives an indication of axial thrust of the turbine shaft. The wear detector normally has a total length of travel of 65-70 mils between the trip setpoints and is adjusted by centering it in the length of travel.

The thrust bearing wear detector circuitry has interlocks and limit switches that are designed to block the turbine trip signal [JJ] during testing. One interlock disables the trip circuit when the test pushbutton is pressed. The other interlock is a mechanical limit switch which disables the trip circuit after the wear detector has travelled 3-5 mils during a test. The limit switch also interlocks the test motor to run the detector back to its original position during testing. The limit switch interlock enables the trip when the detector is within 3-5 mils of its original position and after a five second time delay.

The turbine thrust bearing wear detector was experiencing fouling problems with the hydraulic balance used to measure the thrust movement of the turbine shaft. The wear detector had been exhibiting erratic behavior in earlier surveillances. On April 20, 1991, Work Request (WR) 00975 was written to repair the wear detector when the detector moved 25 mils toward the generator end and 43 mils toward the turbine end during the surveillance test. However, one month later on May 18, 1991, the detector moved 50 mils toward the generator end and only 16 mils toward the turbine end. The wear detector exhibited similar readings in subsequent surveillances until the day of the turbine trip and reactor scram. The fouling in the hydraulics of the wear detector is believed to have been caused by foreign material in the turbine bearing oil. It should be noted that adjustment of the wear detector had been scheduled for June 11, 1991 in order to coordinate this activity with removal of the hydrogen water chemistry system from service to minimize radiation exposure to the workers performing the adjustment.

During the performance of DOS 5600-2 on June 9, 1991, the operator was able to move the wear detector approximately 64 mils toward the generator end. The 64 mils represents almost the entire length of travel allowed for the detector. Foreign material had fouled the hydraulic balance in the wear detector to a point where the detector was offset towards the turbine end and very close to the trip setpoint. When the operator attempted to test the turbine end, he pressed the appropriate pushbutton which blocked the trip circuit. The wear detector is believed to have moved several mils which was not noticed on the gauge in the control room. The small movement of the wear detector was enough to exceed the trip setpoint; however, the detector did not move far enough to actuate the limit switch. When the operator released the pushbutton, the wear detector stayed in a trip position and did not run back because the limit switch was never actuated. The trip signal activated when the five second time delay interlock timed out.

After the main turbine trip, the Unit 2 auxiliary power transferred successfully to the reserve auxiliary power transformer. During the transfer, a voltage drop on the Unit 2 instrument bus caused several relays in the Group I and Group II isolation logic system to drop out. The Group I isolation valves, 1301-17, 1301-20, 220-44, and 220-45, closed as designed for loss of power. Light indication for seven of the eight Main Steam Isolation Valves (MSIV) [SB] AC solenoids also deenergized but the valves remained open as the DC MSIV solenoids remained properly energized. It was determined that the relays actuated due to the voltage drop during transfer of the auxiliary power. A modification has been designed to correct this problem.

Prior to the reactor scram on reactor high pressure, the channel A and channel B scram annunciators spuriously alarmed before the RPS scram solenoid valves had deenergized. The operators noted that the RPS scram solenoid lights remained illuminated with the annunciators alarming. Review of the control room event recorder and computer points indicate that reactor pressure was at 1040.5 psig when the scram annunciators alarmed at approximately 03:02:07 hours, and that no other scram initiating conditions approached their trip setpoints. The reactor pressure at this time was lower than the setpoints on the reactor scram pressure switches. A post-scram calibration of the pressure switches indicated that the lowest as-found pressure switch setpoint was 1053 psig (including a 10 psig head correction). Reactor pressure therefore reached 1043 psig at 03:02:17, tripped the pressure switch setpoint, and initiated a half scram. Eight seconds later, reactor pressure reached the next pressure switch setpoint and initiated a full scram. All RPS scram solenoids deenergized at that time.

The spurious scram annunciator alarms were attributed to a ground in the annunciator input cabinet, 902-34. Station personnel were unable to reproduce the spurious signals after the event. The ground was located and corrected. The scram circuitry and annunciators were tested satisfactorily before unit startup.

D. <u>SAFETY ANALYSIS OF EVENT</u>:

Operations personnel responded promptly to the scram in accordance with procedures and training. The reactor scrammed on a valid high reactor pressure signal. All control rods fully inserted. The expected reactor water level drop due to void collapse initiated Primary Containment Group II and Group III Isolations. The reactor pressure peaked at 1048 psig which is within the design for the reactor coolant system as stated in the Updated Final Safety Analysis Report (UFSAR).

The turbine thrust bearing wear detector's protective function worked properly when given a trip signal. The turbine tripped and coasted down normally. There were no excessive vibrations as the turbine slowed down.

A review of the turbine thrust bearing plate temperatures revealed that the turbine was not axially thrusting toward either end. Plate temperatures were normal before and during the event, indicating that the thrust bearing plates had not been damaged.

The Group I and Group II isolation valves that closed during the auxiliary power transfer functioned as expected upon a loss of power condition. When the relays in the valve circuitry dropped out, the valves properly closed.

After the reactor scram, the Instrument Maintenance Department checked the calibration of the reactor high pressure scram pressure switches. The pressure switch setpoints were found to range from 1053 psig to 1059 psig, which is within the Technical Specification limit of 1060 psig (plus a 10 psig head correction). The pressure relays were also verified for operability and found to be working properly.

E. CORRECTIVE ACTIONS:

A temporary procedure change (91-126) was made to DOS 5600-2. The temporary change instructs operators to terminate the thrust bearing wear detector test and write a nuclear work request if the detector travels more than 45 mils in either direction. DOS 5600-2 will be permanently revised by the Operations Staff to incorporate the 45 mil detector travel restriction (237-200-91-09401).

A maintenance history review indicated that on June 6, 1991 a ground was located in the annunciator input cabinet, 902-34. The ground was measured to be positive 125 vdc to ground which required the ground to be located and repaired within 14 days, as instructed in Dresden Operating Procedure (DOP) 6900-06, 125 VDC Ground Detection - Unit 2. The ground was located and repaired in panel 902-34 reducing the voltage to positive 70 volts to ground (below the action level requiring the 14 day administrative limit) prior to Unit 2 startup on June 10,1991. Trouble-shooting to locate the remaining grounds continued. Normal battery ground detector readings were recorded on June 11, 1991.

The turbine thrust bearing wear detector was readjusted by Mechanical Maintenance under WR 00975.

The issue concerning the relays dropping out during auxiliary power transfer is being addressed by Modification 12-(2)3-88-60. The modification will replace the affected relays with a model that has a five second time delay to allow it to respond to the power supply transient without dropping out. This modification is currently scheduled to be installed during the next refuel outage on both Units 2 and 3 (237-200-87-10902).

The Technical Staff will evaluate possible ways to improve the circuitry of the turbine thrust bearing wear detector to avoid future unplanned turbine trips during wear detector testing (237-200-91-09402).

The Technical Staff will also evaluate the possibility of replacing the existing thrust bearing wear detector with a wear detecting system utilizing proximity switches (237-200-91-09403).

The Technical Staff will trend the thrust bearing wear detector movement during DOS 5600-2 so that any abnormal behavior can be identified (237-200-91-09404).

TEXT Energy Industry Identification System (EIIS) codes are identified in the text as [XX]

Reactivity management issues relating to this type of event were reviewed. It was noted that the reactor pressure upswing following the turbine trip was turned by beginning to insert control rods in reverse sequence. It is believed that the use of CRAM arrays (high worth control rod insertion instructions which are provided for use in response to loss of feedwater [SJ] heating) or a reduction in reactor recirculation [AD] flow would potentially have prevented the scram. Further evaluation of this topic will be performed by the Reactor Engineer (237-200-91-09405).

A review of this event will be included in an upcoming continuing Operator Training Cycle. (237-200-91-09406). There will also be additional simulator training conducted on the event for licensed operators (237-200-91-09407).

F. PREVIOUS OCCURENCES:

A review of system records indicates this was the first occurrence of this type.

G. COMPONENT FAILURE DATA:

Manufacturer	Nomenclature	Model Number	Mfg. Part Number
General Electric	Thrust Bearing Wear Detector	170X326	DWG 753E297

An industry wide NPRDS data base search revealed no similar failures of the main turbine thrust bearing wear detector.