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Dresden Nuclear Power Station
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December 9, 1993

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Licensee Event Report 93-008-01, Docket 050237 is being submitted to provide updated information concerning the investigation and corrective actions taken with regard to the events of the original report.

for 12-9-93
Gary F. Spedl
Station Manager
Dresden Station

GS/AT/maf

Enclosure

cc: J. Martin, Regional Administrator, Region III
NRC Resident Inspector's Office
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 2	0 5 0 0 0 2 3 7	1 of 0 8

Title (4)

Trip of Bus 29 Feed Breaker to Motor Control Centers 29-2 and 29-4 Due to Unknown Cause

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 7	0 6	9 3	9 3	--- 0 0 8	0 1	0 7	3 0	9 3	N/A	
									N/A	

OPERATING MODE (9): N

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

POWER LEVEL (10): 0 9 0

	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
	20.405(a)(1)(i)	50.36(c)(1)	X 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)	

LICENSE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Emory Johnson, System Engineer Ext.2603	AREA CODE 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

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)

During performance of Dresden Operating Surveillance (DOS) 1500-05, Low Pressure Coolant Injection (LPCI) System Quarterly Flow Rate Test, while cycling Motor Operated Valve (MOV) 2-1501-38B, an Average Power Range Monitor (APRM) HI HI channels 1/2/3 half scram was received and 480 Volt Switchgear 29 breaker cubicle 3D opened. Motor Control Center (MCC) 29-2 and MCC 29-4 de-energized. Shortly thereafter, trips of Unit 2 125 Volt Charger 2, Unit 2/3 250 Volt Battery Charger, LPCI/Core Spray Cooling Area Fan 2B occurred. Reactor Building Ventilation System isolated and Standby Gas Treatment System auto-started. Unit 2 was placed in a 24 hour shutdown Limiting Condition for Operation. The immediate corrective actions were to restore the tripped plant equipment. The switchgear breaker was replaced. With Unit 2 in run mode, eleven days after the first trip, a second trip occurred. No plant activities were in progress. A 24 hour LCO was entered. Power was restored to the MCCs, and RPS channel A was placed on alternate power. No apparent cause has been identified, and the investigation into the tripping events is still in progress. The safety significance of the trips is considered minimal. No previous events have been identified.

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:

Trip of Bus 29 Feed Breaker to Motor Control Centers 29-2 and 29-4 Due to Unknown Cause

A. CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: July 6, 1993 Event Time: 1625 Hours

Reactor Mode: N Mode Name: Run Power Level: 90%

Reactor Coolant System (RCS) Pressure: 987 psig

B. DESCRIPTION OF EVENT:

On July 6, 1993, at approximately 1626 hours, with Unit 2 operating at 90% of core rated thermal power, while performing Dresden Operating Surveillance (DOS) 1500-05, Low Pressure Coolant Injection (LPCI)[BO] System Quarterly Flow Rate Test, an Average Power Range Monitor (APRM)[IG] HI HI channels 1/2/3 half scram was received on Reactor Protection System [JE] channel A. The half scram was received concurrently with the cycling of motor operated valve (MOV) 1501-38B. Trips of the Unit 2 125 Volt Battery Charger 2 [EJ], Unit 2/3 250 Volt Battery Charger [EJ], LPCI/ Core Spray (CS) Area Cooling Fan 2B [BN], and 2B Condensate Transfer Pump [KA] occurred. The 2/3 Emergency Diesel Generator (EDG) [EK] Trouble annunciator also alarmed. The half scram was immediately reset.

Approximately thirteen seconds later, another half scram , an APRM HI HI channels 1/2/3 alarm, and channel A Groups I, II, and III isolations were received. Subsequently, Reactor Building Ventilation [IL], Reactor Building Fuel Pool Channel A, Off Gas and Main Steam Line Rad Monitors [IL] de-energized. The Reactor Building Ventilation System (RBVS) [VA] isolated and 2/3B Standby Gas Treatment System (SBGTS)[BH] auto-started.

The High Voltage Operator (HVO) who was dispatched found Bus 29 cubicle 3D open. It was concluded that these actuations were a result of the trip of Bus 29 cubicle 3D, feed to Motor Control Center (MCC) 29-2 and MCC 29-4 [EB]. The HVO noted that no other target indicators were present on the bus.

An HVO was sent to place the Reactor Protection System (RPS)[JE] channel A on reserve power. At 1631 hours the RPS A bus was aligned to the reserve feed source. The channel A half scram was then reset.

Since MCC 29-2 and MCC 29-4 were required for EDG operability, at 1640 hours, the Unit 2 EDG control switch was put to Stop, and the Unit 2 EDG was declared inoperable. The Control Room personnel assessed the losses of B Containment Cooling Service Water (CCSW)[BO] loop, the Unit 2 High Pressure Coolant Injection (HPCI) Room Cooler [BJ], and 2B Core Spray pump. Unit 2 entered a 24 hour to Cold Shutdown Limiting Condition for Operation (LCO).

The operator proceeded to rack out the service breaker to MOV 2-1501-38B. It was believed that the event was related to the cycling of the 1501-38B valve. The HVO then tried to close in the switchgear feed to MCCs 29-2 and 29-4. The attempt to close in the switchgear breaker was unsuccessful. A second attempt to close in the breaker was also unsuccessful.

The service breaker to the 2B RPS Motor Generator (MG) Set was racked out, then the switchgear breaker was successfully closed. Upon re-energization of MCC 29-2 an operator reported that he had heard the Unit 2 Diesel Generator Cooling Water Pump (DGCWP) breaker chatter, and he immediately racked it out. The pump was not running at the time.

At 1704 hours, MOV 1501-38B was racked-in.

At 1733 hours the Center Desk Operator re-established the RBVS. The 2A, 2C, 3B and 3C Reactor Building Ventilation Fans, and the 2B, 2C, 3A and 3C Reactor Building Exhaust Fans.

At 1734 hours, the 2/3 B SBGTS was secured.

Under Work Request (WR) D20324 the Electrical Maintenance Department (EMD) bridged and meggered the Unit 2 DGCWP breaker, checked the contactor wipes, and found the breaker within tolerances.

At 2043 hours, the Unit 2 DGCWP was racked in and run. No chattering was heard, and no other problems were detected.

At 2053 the Unit 2 DGCWP was secured, the U2 EDG control switch placed to Auto. The Unit 2 EDG was declared operable, and Unit 2 exited the LCO.

Under WR D20323 the breaker to 2B MG-Set was meggered down to the 2B MG-Set motor. No grounds were found.

On July 7, 1993, under NWR 20322, a spare breaker was tested and installed into Bus 29 cubicle 3D.

At approximately 0522 hours, on July 17, 1993, with Unit 2 in run mode at 91 % of rated power, RPS channel A received a APRM HI HI on channels 1/2/3 alarm, then a half scram signal. Afterward trips of the following equipment and alarms were received:

The Unit 2 125 Volt Battery Charger, The 2B Condensate Transfer Pump, The Unit 2/3 Diesel Generator Trouble.

The actuations consistent with a trip of channel A RPS subsequently followed, half Group I, II, and III isolations, RBVS isolation, and an auto-start of 2/3 B SBGTS.

The Bus 29 feed breaker to MCC 29-2 and MCC 29-4 had opened, and Unit 2 entered a LCO to shutdown within 24 hours.

RPS was placed on reserve feed, the 2B RPS MG Set supply breaker was racked out, and at 0604 hours, MCC 29-2 and 29-4 were re-energized. No difficulties with re-establishing the MCCs were noted.

The 2/3B SBGTS was secured, and RBVS restarted.

No evidence was found that indicates that a sustained fault had occurred on the feed cables. The EMD then checked the control switch

for a possible problem with the switch. Within the switch circuit a very loose wire was found that led from the red indicator. This was ruled out as the cause, because its failure would inhibit a trip. A wire was found crushed and with what appeared to be a pinhole prick in it. The EMD personnel taped the wire. Checks of the resistance of the 3300 Ohm resistor and circuit voltage (approximately 61 Volts) to ground detected no abnormalities.

Upon reviewing the alarm typer and Sequence of Events Recorder (SER) printouts from this event and comparing this sequence with the event of July 6, 1993, it was believed that a perturbation had occurred on RPS. The nature of which is unknown. In both events an APRM HI HI alarm preceded the trip.

To verify the hypothesis, it was decided to reload channel A RPS and the Unit 2 125 Volt Battery Charger back onto MCC 29-2. The Bus 29 breaker to MCC 29-2 and MCC 29-4 would be tripped from the control switch to see if the same sequence would occur.

At approximately 1152 hours, the feed breaker to MCC 29-2 and MCC 29-4 was tripped from the control switch behind MCC 29-2. A review of the alarm typer indicated that no APRM HI HI alarms were received prior to losing the Battery Charger and RPS bus. The rest of the tripping sequence was similar.

It was decided that channel A RPS bus was to be left on reserve feed, and monitoring would be attached to specific points along the trip path on Division II. Because an APRM HI HI trip preceded each breaker trip, and a simulated trip did not produce a precursor APRM HI alarm, it was concluded that the root cause resided within the RPS feed or beyond. Thus, MCC 29-2 and MCC 29-4 were operable. At 1300 hours, Unit 2 exited the LCO.

The EMD then attached monitoring equipment to the feed cables at MCC 29-2, MCC 29-4, the output to the 2B RPS MG-Set, and the trip coil at the MCC 29-2 and MCC 29-4 feed breaker at Switchgear 29. The EMD took amperage readings at MCC 29-2. The reading prior to turning on the RPS MG-Set was 17 Amps. On MCC 29-2 the maximum amperage measured was 41 Amps. No current was present on MCC 29-4. Approximately 120 Volts was present on the output of the 2B RPS MG-Set. No voltage was present on the trip coil.

C. APPARENT CAUSE OF EVENT:

This report is being submitted in accordance with 10CFR50.73(a)(2)(v)(D), which requires written notification of any event that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident. The apparent cause of the tripping events is unknown.

Upon investigating the initial tripping event. It was noted that at the time of the trip, quarterly surveillance testing of the LPCI system was in progress. Initial troubleshooting suspected that heavy loading on MCCs 29-2 and 29-4 may have contributed to the trip. As a corrective action, loads were reduced and Work Request (WR) D20332 was written to verify proper tripping characteristics of the feed breaker to the MCCs. Additional troubleshooting consisting of meggering the RPS MG-Set was performed to assure proper operation. The only anomaly discovered in all of the above troubleshooting was a failed trip device on the feed breaker. Although the trip device was found failed in the

opposite direction from that which would have caused a premature trip, it was speculated that this condition may have caused an imbalance and been a contributor to the trip. No signs of a fault or valid trip of the bus or MG set was found. The difficulty with re-establishing power to the MCCs was due to the start circuitry of the 2B RPS MG-Set. When MCC 29-2 was de-energized, the 2B RPS MG-Set was de-energized in the run condition. Upon attempting to restore power to MCC 29-2 and MCC 29-4 all un-tripped loads including the 2B MG-Set started, the combined starting current was in excess of the Bus 29 circuit breakers overcurrent trip rating. After the 2B RPS MG-Set was racked out the MCC loading was much less, and the switchgear breaker was closed.

Upon questioning the operator who had reportedly heard the DGCWP breaker chatter, the operator clarified that he had heard a clicking sound. The source of the clicking sound was attributed to the routine cycling of the contactor for the 2B Diesel Generator Starting Air Compressor breaker. This contactor is in the cubicle below the DGCWP breaker. This event is not believed to be a contributing factor to the trip.

On Saturday, July 17, 1993, this trip occurred again. At the time of this trip, no surveillance testing or alignment of plant systems was in progress. Due to this low level of activity, it was possible to perform a more detailed assessment of the trip and directed troubleshooting efforts based upon this assessment. A detailed account of all troubleshooting and assessment of the probable cause is in the following paragraphs:

Just prior to the trip, it was noticed that APRM's which are fed from the affected RPS bus read upscale and then downscale. This occurred twice in the 2 seconds just prior to the trip. APRM's are sensitive to supply voltage and thus this was considered a sign that voltage on the RPS bus was unstable prior to the trip. This information was used to further analyze the information from the initial trip. Similar performance of the APRM's was noted for this trip also. To confirm the speculation that a voltage fluctuation occurred prior to the trip, the plant was realigned to the configuration just prior to the second trip, and a manual trip of the feed breaker to MCC 29-2 and MCC 29-4 performed. This time the supplied MCCs tripped off as expected with no evidence of voltage fluctuation preceding the trip. At that time it was concluded that the most likely source of the problem was the RPS bus or associated MG-Set. After an inspection of associated busses to confirm that no obvious indications of a fault existed, the RPS bus was placed on its alternate feed, and MCC 29-2 and MCC 29-4 were declared operable. As an added measure, instrumentation was put in place to monitor bus voltage to allow additional analysis of results in the event of another trip.

A review of the events revealed evidence linking an apparent voltage perturbation on the incore monitoring system prior to both trips. A planned breaker trip conducted from the remote control station did not reproduce the event, thus the prospect of a manually produced breaker trip was ruled out.

A review of the maintenance history of the breaker and RPS systems did not reveal any activities that could have directly contributed to the event. However, in preparation to be painted, MCC 29-2 had been sanded prior to the first trip. From the review no correlation between the painting activities and the trips could be determined.

Multi-amperage testing was performed on the switchgear breaker which was removed after the first trip, the center phase dashpot had failed to trip when tested. A maintenance history search on the breaker revealed that the dashpots were installed in October 1990 under WR D92894. A failure analysis of the dashpot device performed by the vendor determined that the device had not failed. The dashpot adjustment screw had been loosened to its fullest extent, and wedged itself against the case. When the dashpot was re-adjusted, it tested successfully.

No records of Preventive Maintenance (PM) being performed on the 2B RPS MG Set were found.

The feed cables to MCC 29-2 and the control cable to Bus 29 cubicle 3D had been replaced under modification M12-2-91-027C during D2F18 in 1992.

The second breaker was replaced with a refurbished breaker equipped with a RMS-9 solid state trip device. The cubicle was inspected and cleaned. No problems were found. The removed breaker is still to be current tested.

The control circuit and feed cables to the switchgear breaker that feeds MCCs 29-2 and 29-4 were megger tested. The test results did not give indication of cable degredation.

The investigation of the RPS MG-Set contribution into the 480 Volt Switchgear breaker trips did not confirm that MG-Set performance was the root cause. Therefore, the 2B RPS MG-Set was placed back on line, and temporary monitoring was installed on the output breaker to the 2B RPS MG-Set for trending.

D. SAFETY ANALYSIS OF EVENT:

Station Auxiliary Power is comprised of two independent divisions that perform redundant functions. Each train supplies power to various plant loads. This power is continuously supplied during all modes of plant operation.

The 480 Volt Switchgear breaker that powers MCC 29-2 and 29-4 is part of Division II. The MCC 29-2 and MCC 29-4 feed breaker is designed with two types of trips. The first trip is electrical. The breaker is externally tripped remotely from its remote control switch. The control switch possesses a contact which is in series with the trip coil. When the trip contact is made up, a potential is put across the trip coil, which in turn initiates the trip. The second trip is essentially electro-mechanical. An overcurrent trip device, a dashpot, is mounted in series on the breaker's load side. The dashpot senses current through a coil, and is equipped with a magnet and trip paddle. There is a dashpot for each breaker phase. The larger the load current, the greater the magnetic flux, and a greater force of attraction is exerted on the trip paddle. A trip paddle when actuated hits a corresponding trip finger within the breaker. The trip finger rotates the trip shaft, opening the breaker. The settings of the dashpots are maintained through the armature length and tension placed upon it by series of springs and linkages. The third trip is manual. The breaker can be tripped locally by depressing the manual trip button located on the front of the breaker.

RPS monitors critical plant parameters during all plant modes. RPS is comprised of four subsystems forming two independent trip channels. RPS is configured in a fail safe design, such that failure of a

component within its subsystems will initiated a channel trip. Primary Containment Isolation System (PCIS) [JM] logic is powered from RPS. Thus, the half Group I, II and III isolations, actuation of SBGTS, and half scrams associated with the de-energization of the RPS A bus were in the conservative direction.

During both events the other division and its related equipment were available and capable of performing its function, thus the safety significance of each event is considered minimal.

E. CORRECTIVE ACTIONS:

The immediate corrective actions were to restore power to affected plant systems. An LCO to be in shutdown within 24 hours was entered.

On July 7, 1993, the suspected breaker was replaced with a spare breaker equipped with new dashpots.

To affirm proper loading on MCC 29-2 and 29-4, the following loads were started:

The 2B RPS MG-Set and left unloaded,
The 2B Condensate Transfer Pump,
The 2B LPCI/CS Room Cooler,
The 1501-38B valve.

The combined loading of the both MCCs was less than 100 Amps.

RPS bus was loaded back onto the 2B RPS MG-Set. No change in current on MCC 29-2 was detected.

On July 8, 1993, the removed breaker was current tested. The 'A' and 'C' phase tripped within expected current limits. Conversely, the 'B' phase did not trip even when a current of 10,000 Amps was applied.

Under WR 20380, the 1501-38B valve was votes tested. The current signature was evaluated as acceptable.

Following the second tripping event the following actions were taken:

The unit was placed in a LCO. Power to the MCCs was restored.

An inspection of the physical condition of control cables to the remote trip station for the bus feed breaker was performed. One loose lead and degradation of insulation which was found. An analysis of this condition determined that had this condition been of sufficient magnitude to fail, the failure mode would have been a failure to trip manually from the remote control station. Therefore, it is believed that this condition did not contribute to the event.

Resistance readings were taken to determine if the potential for a shorted indicating light or decreasing resistor resistance values could have caused a spurious trip. No abnormalities were noted.

Load monitoring equipment was installed on key points along the suspected trip path. This data will be used to analyze any additional trips.

Under WR D20733 the 2B RPS MG-Set was loaded with a load box to approximate the RPS load. The load was carried by the MG-Set for approximately five hours, and voltage and current were monitored. In

addition, vibration readings of the 2B RPS MG-Set were taken. Moreover, Dynamic Response Testing of the voltage regulator, surge comparison testing of the motor windings, and intermittent fault recording of the 2B RPS MG-Set supply cables have been performed. No anomalies were found.

A review of ground detectors at the time of the July 6, and July 17 events revealed no DC grounds which could have caused a spurious trip.

A review of cable routing for associated control cables was performed to determine if a spike due to operation of equipment in other parts of the plant or fed from other sources was generated. The review determined that the APRM cables, RPS bus cables, the switchgear feed cables and control cables are isolated from each other.

On July 23, 1993, oscilloscope readings taken on the bus feeds to MCC 29-2 and MCC 29-4 did not detect any substantial noise. Proper waveforms were noted.

RPS bus A was left on reserve feed until the conclusion of the investigation. Under WR D20863 the feed breaker was replaced with a refurbished breaker equipped with a RMS-9 solid state static trip device. Under WR D23176 the removed breaker will be current tested.

The dashpot was sent to the vendor for a failure analysis. The analysis indicates that there was no failure of the device. The device was found to be out of adjustment.

Under NWR D20960 Megger testing of the control circuit to the breaker 293D, and of the feed cables to MCC 29-2 was performed. The MCC 29-2 supply breaker to 2B RPS MG-Set was current tested. All testing was successfully completed.

Following the switchgear cable megger test and breaker replacement, the load monitoring equipment was removed, and the 2B RPS MG-Set was re-aligned to the 2A RPS bus. Under NWR D21815, monitoring was installed on the output breaker to the 2B RPS MG-Set, to monitor for approximately three months.

F. PREVIOUS OCCURRENCES:

Through a review of available documentation, no previous events of this type were identified.

G. COMPONENT FAILURE DATA:

Manufacturer	Nomenclature	Model Number	Mfg. Part Number
General Electric	Overcurrent Trip Device EC-2A	549D97G1	

An industry wide Nuclear Plant Reliability Database System (NPRDS) search revealed 405 records related to the EC-2A associated with breakers. There were 4 records involving failures of dashpots. At this time it is unknown whether the failure of this device is related to the initial trip of the feed breaker.