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December 19, 1991

CWS LTR #91-046

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Licensee Event Report 90-002-1, Docket #050237 is being submitted in accordance with Technical Specification 6.6, NUREG 1022 and 10 CFR 50.73(a)(2)(iv). This revised report is submitted in order to provide an updated status of corrective actions taken regarding a January 1990 event involving a reactor scram following failure of a condensate/condensate booster pump motor.

L. F. Gerner for
Charles W. Schroeder
Station Manager
Dresden Nuclear Power Station

CWS/dwh

Enclosure

cc: A. Bert Davis, Regional Administrator, Region III
NRC Resident Inspector's Office
File/NRC
File/Numerical

(ZDVR/402)

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LICENSEE EVENT REPORT (LER)

Form Rev 2.0

Facility Name (1)	Docket Number (2)	Page (3)
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Title (4) Reactor Scram Following Condensate/Condensate Booster Pump Failure and Subsequent Loss of Offsite Power

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 5 0 0 0
0 1	1 6	9 0	9 0	0 0 2	0 1	0 2	1 5	9 0		0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 1 0 0

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	
R. Whalen, Assistant Technical Staff Supervisor Ext. 2462	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 J	M O	G 0 8 0	Y	X	S B	S O L	A 6 1 3	Y
X	E A	X F M R	G 0 8 0	Y	X	S B	I L	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 1724 hours on January 16, 1990, an automatic Unit 2 reactor scram on a low reactor water level (Technical Specification setpoint of eight inches above instrument zero) signal occurred. The 2D Condensate/Condensate Booster pump failed due to an internal motor fault approximately 13 seconds prior to the scram, precipitating automatic trip of the running Reactor Feed pumps on low suction pressure and thus resulting in reduction of reactor water level to the low level scram setpoint. Additionally, Reserve Auxiliary Transformer (TR) 22 tripped during automatic transfer of house loads, resulting in interruption of normal AC auxiliary power until the emergency Diesel Generators automatically loaded. Cold Shutdown conditions were achieved by 0210 hours on January 17, 1990. Comprehensive root cause investigations were immediately initiated for all component performance problems, and corrective actions implemented. The safety significance of this transient was mitigated by the fact that reactor water level was maintained well above the automatic emergency core cooling system initiation setpoint at all times, and multiple systems were available for reactor pressure control including Isolation Condenser, High Pressure Coolant Injection, and Main Steam Relief Valves. A previous event involving a Unit 3 loss of offsite power is reported by LER 89-1/050249.

LICENSEE EVENT REPORT (LER) FAILURE CONTINUATION

Form Rev 2.0

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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	E L	3 2	G 0 8 0	N							
X	B O	2 0	L 2 0 0	Y							

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION					Form Rev 2.0
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TEXT Energy Industry Identification System (EIIS) codes are identified in the text as [XX]

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor (BWR) - 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:

Reactor Scram Following Condensate/Condensate Booster Pump Failure and Subsequent Loss of Offsite Power

A. CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: January 16, 1990 Event Time: 1724 hours

Reactor Mode: N Mode Name: Run Power Level: 100%

Reactor Coolant System (RCS) Pressure: 999 psig

B. DESCRIPTION OF EVENT:

At 17:24:06 hours on January 16, 1990, while Unit 2 was operating at 100% power, the 2D Condensate/Condensate Booster [SJ] pump tripped. Approximately two seconds later, the running 2A and 2C Reactor Feed Pumps (RFPs) [SJ] tripped, apparently on low suction pressure. An automatic low reactor water level scram then occurred at 17:24:19, although the standby 2B RFP had automatically started ten seconds earlier. Primary Containment Group II and Group III Isolation Valve closure occurred as designed at the low water level condition. The 2A RFP was manually restarted to assist with restoration of normal reactor water level. At 17:25 hours, the main turbine [TA] and RFPs tripped on a high reactor water level signal. Then, at 17:26, Reserve Auxiliary Transformer (TR) 22 [EA] tripped due to an internal fault. Thus, upon separation of the main generator [EL] at 17:27:04, normal onsite AC auxiliary power [EA] was interrupted. The Unit 2 and 2/3 Diesel Generators (DGs) [EK] automatically loaded onto their emergency buses at 17:27:08 and 17:27:14, respectively.

At 17:27:09, outboard Main Steam Isolation Valve (MSIV) [SB] 2-203-2C spuriously closed; at 17:27:46, the remaining MSIVs were manually closed to conserve reactor inventory in accordance with Dresden General Abnormal (DGA) procedure DGA-12, Partial or Complete Loss of Offsite Power. At 17:30, fire was reported in the Condensate/Condensate Booster pump room and was promptly extinguished by a Radiation Protection Technician and Shift Supervisor in the area. The fire siren was sounded and the fire brigade was dispatched. The fire brigade then confirmed that a fire in the 2D Condensate/Condensate Booster pump motor had been extinguished. The Isolation Condenser [BL] was utilized for reactor pressure control. However, when the 2-203-3B Electromatic Relief Valve (ERV) [SB] control switch was placed to MANUAL at 17:36 to open the ERV to assist with reactor pressure control, its open indicating lamp shorted. The control switch was then returned to AUTO to close ERV 2-203-3B and ERV 2-203-3C was used. The Isolation Condenser and High Pressure Coolant Injection (HPCI) [BJ] systems were also used to assist with reactor pressure control. An Unusual Event was declared at 17:48 based on loss of offsite AC power to the unit. Clean demineralized water [KC] was used for isolation condenser shell side makeup, and surveys of the Isolation Condenser vent area by Radiation Protection verified that no radioactive contamination occurred outside the Reactor Building.

A management team was immediately assembled to assist with response to this event. Comprehensive root cause analyses were initiated. The scram investigation committee was also assembled in accordance with Dresden Administrative Procedure (DAP) 7-15, Scram/Engineered Safety Feature Actuation Investigation. Cold Shutdown conditions were achieved at 0210 hours on January 17, 1990. The Unusual Event was terminated at 0605 hours on January 17, 1990. An NRC Augmented Inspection Team (AIT) was also dispatched to the site on January 17, 1990.

Refer to Attachment 1 for a detailed sequence of events. A Unit 2 electrical arrangement is provided by Figure 1. Note that the event times listed throughout this report are approximate, based on computer output data, Operator log books, chart recorder traces, etc. The following apparent problems were initially identified by the Scram Investigation Committee.

1. The fire in the 2D Condensate/Condensate Booster pump motor.

2. The apparent failure of the 2B Condensate/Condensate Booster pump to automatically start and restore RFP suction pressure.

3. The Reserve Auxiliary Transformer TR 22 unexpected failure.

4. The premature closure of the 2-203-2C outboard Main Steam Isolation Valve (MSIV).

5. The 2-203-3B ERV open indication lamp socket failure.

6. A potential failure of the main generator to trip properly on reverse power circuitry.

7. A failure of 2B Shutdown Cooling [BO] pump discharge valve MO2-1001-4B to open electrically.

Additionally, the AIT staff requested specific review of Operator intervention taken during the event involving manual start of the Unit 2 DG just prior to separation of the main generator.

C. APPARENT CAUSE OF EVENT:

This report is submitted in accordance with 10CFR50.73(a)(2)(iv), which requires the reporting of any automatic engineered safety feature (ESF) actuation, including the Reactor Protection System [JE]. As stated previously, the automatic low reactor water level scram was precipitated by failure of the 2D Condensate/Condensate Booster pump motor and subsequent trip of the running RFPs on low suction pressure.

A summary of the root causes behind the identified concerns is provided below. Also refer to Section E of this report for further information.

1. Fire in the 2D Condensate/Condensate Booster pump motor.

   Initial investigation indicates that an internal fault occurred within the motor windings. A maintenance history review indicates that electrical meggering and polarization index tests had been performed on the 2D pump motor in July, 1987. These polarization index results, based on motor meggering, were 1.9. The megger data recorded at that time was well above minimum requirements and, as such, the motor was in satisfactory condition for further service in accordance with IEEE Standard 43, Recommended Practices for Testing Insulation Resistance of Rotating Machinery. Therefore, replacement of the 2D pump motor was not judged appropriate in July, 1987.

   Review of maintenance and system history records also indicates that Condensate/Condensate Booster pump motor failures have occurred at the Dresden site in 1981 and 1987. The 1981 event involved a bearing failure, and the 1987 event involved a motor internal fault. (See Section F.1.) The Electrical Maintenance Department had previously instituted cleaning of the Condensate/Condensate Booster pump motors. Two of the four Unit 3 pumps and three of the four Unit 2 pumps (all except the 2D pump) had been cleaned under this program prior to this event.

Additionally, a thermography program is currently under development by the station Technical Staff to assist with predictive maintenance. November, 1989 vendor demonstration thermography data indicated that the 2D pump motor windings were operating at a slightly higher temperature than the other Condensate/Condensate Booster pumps. Periodic vibration monitoring data taken by the Technical Staff did not indicate any abnormalities. Therefore, it is currently believed that the 2D pump failure was due to an internal fault. It is not clear that cleanliness of the motor windings was a contributing factor.

2. Apparent failure of the 2B Condensate/Condensate Booster pump to automatically start and restore RFP suction pressure.

At the time of the event, the 2B Condensate/Condensate Booster pump was selected as the standby pump and, as such, would have been expected to start upon failure of the 2D pump. The standby pump logic is designed to provide automatic start of the standby Condensate/Condensate Booster pump on decreasing RFP suction header pressure or trip of any running Condensate/Condensate Booster pump. The standby pump logic system, including feed breaker logic and suction pressure instruments, was functionally tested satisfactorily. It was then concluded that the 2B Condensate/Condensate Booster pump did, apparently, start upon failure of the 2D pump. This was not observed by Control Room Operations personnel during the approximate two-minute period before failure of Reserve Auxiliary Transformer TR 22 caused loss of feed to all the Condensate/Condensate Booster pumps and RFPs, due to the many required Operator actions in progress during this period. No alarm printer line item is provided for start of the standby pump. Approximately two seconds after failure of the 2D Condensate/Condensate Booster pump, the running RFPs tripped, apparently on low suction pressure, even though the standby 2B Condensate/Condensate Booster pump had apparently started. The selected standby 2B RFP then automatically started; an Operator also restarted the 2A RFP. Adequate RFP suction pressure was then supplied by the 2A, 2B, and 2C Condensate/Condensate Booster pumps.

3. Unexpected failure of Reserve Auxiliary Transformer TR 22.

Oil sample analyses indicated that significant insulation breakdown had occurred. Investigation by Operational Analysis Department (OAD) and Station Electrical Engineering Department (SEED) personnel indicates that the failure resulted from coil movement during the 2D Condensate/Condensate Booster pump motor failure. This coil movement allowed turns on the second layer of the X1 winding to rub together, thereby damaging insulation on the adjacent CTC conductors. The damaged insulation, although not immediately broken through, was degraded sufficiently to result in a turn-to-turn type failure of TR22 approximately 2 minutes after failure of the 2D condensate/condensate booster pump motor. The coil looseness which allowed the initial conductor movement within TR22 was attributed to insulation aging. Normal aging of an in-service transformer can cause the paper insulation on the windings and in the coil blocking to shrink, thus reducing the coil clamping force overtime. The repair of TR22 included a complete three-phase rewind with all winding construction meeting the latest short circuit design requirements. The rebuilt transformer was also equipped with an enhanced coil clamping configuration. A system history review indicates that this was the first failure of this type.

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

4. Premature closure of the 2-203-2C outboard MSIV.

Outboard MSIV 2-203-2C was observed to spuriously close approximately three minutes into the event, immediately after the main generator field breaker opened. Investigation revealed that the DC solenoid for MSIV 2-203-2C had failed due to an open coil. This resulted in spurious closure of MSIV 2-203-2C upon loss of feed to its AC solenoid upon interruption of onsite AC auxiliary power. The MSIVs are equipped with normally energized AC and DC solenoids; deenergization of both solenoids is required to cause MSIV closure. In this event, failure of Reserve Auxiliary Transformer TR 22 (coincident with separation of the main generator) resulted in a momentary loss of onsite AC auxiliary power while the Unit 2 and 2/3 Emergency Diesel Generators (DGs) automatically loaded onto the emergency buses. A maintenance history review indicates that MSIV DC solenoid failure has not been a recurring problem.

5. Failure of the 2-203-3B ERV open indicator lamp socket.

Upon placing the 2-203-3B ERV control switch to the MANUAL position in order to open the 2-203-3B ERV to assist with reactor pressure control, its open indicator lamp shorted. The Operator then returned the control switch to the AUTO position to close the valve, and proceeded to open the 2-203-3C ERV. Review of ERV temperature recorder data verified that the 2-203-3B ERV did open and close properly. The failure of the socket assembly could have been caused by foreign material within the socket. A list of similar control panel socket problems is provided in Section F of this report; this type of failure has not been an adverse trend.

6. Potential failure of the main generator to trip properly on reverse power circuitry.

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 5-second time delay. The primary GGP circuit also prohibits the Operator from opening the Output Circuit Breakers (OCBs), via main Control Room panel 902-8 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 reverse power value of approximately -2.18 MWe with a 15-second time delay. Thus, the secondary GGP relay normally trips the main generator unless a turbine trip signal is present.

Following this event, the generator appeared not to trip within the expected setpoints. The Operator, as directed by the Shift Engineer, then attempted to open the OCBs via the panel 902-8 control switches. As this was unsuccessful, the OCBs were then opened via the 345 KV switchyard panel. Reactor scram procedure DGP 2-3 provides for taking these actions in order to trip the generator if the generator appears not to trip within the expected setpoints. Opening the OCBs provided an automatic generator trip as expected.

Testing of the reverse power relays was then performed on-site by OAD personnel. The primary and secondary GGP relays were then taken to the Company Technical Center for further testing. Initial results of this testing indicates that the relay trip setpoints were, in fact, set in accordance with vendor recommendations. However, the real power values at which the reverse power trip occurs were demonstrated in laboratory testing to be 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.

7. Failure of the 2B Shutdown Cooling (SDC) discharge valve MO2-1001-4B to open electrically.

While preparing to align the "B" SDC loop, 2B SDC pump discharge valve MO2-1001-4B failed to open via its control switch. An Operator was then dispatched to open the valve manually, but this required assistance from the Mechanical Maintenance Department because the valve operator disengage arm was not functioning properly.

Disassembly and inspection of the valve motor on January 18, 1990, revealed that the initial cause of failure was shearing of an original equipment type motor pinion gear key, which effectively uncoupled the operator assembly from the motor. Subsequent disassembly of the operator gear train revealed that a declutch fork mechanism was slightly out of phase. This condition resulted in the manual disengage arm only actuating partially, preventing proper manual operation of the valve. The valve operator torque switches were also verified to be set properly. This valve was last operated electrically following a previous January 5, 1990, Unit 2 reactor scram.

Following a previous similar failure of the Unit 3 MO3-1001-4B valve, a program of replacing the motor pinion keys with a harder material currently specified by the manufacturer had been instituted. Installation of the improved keys for these types of operators during preventative maintenance overhauls was in progress at the time of this event. Also refer to section E for a description of other related preventative maintenance program improvements.

8. Operator action to manually start the Unit 2 DG.

Approximately three minutes following failure of the 2D Condensate/Condensate Booster pump, manual Operator action was taken to start the Unit 2 DG. At this point during the transient, the Operators manning the control panels, as well as the Shift Engineer (who had command authority), were aware that a reactor scram had occurred, that Reserve Auxiliary Transformer TR 22 had tripped, and that normal onsite AC power would be interrupted upon trip of the main generator. The Operator was preparing for this condition, and as such, felt that starting the Unit 2 DG was an appropriate preparatory measure. When the trip of the main generator occurred, the Unit 2 DG closed automatically onto its emergency bus (4 KV bus 24-1). Review of the DG load shedding logic indicates that the purpose for allowing the automatic DG start (as opposed to taking Operator action to start the DG prior to the existence of DG auto-start signals) is to prevent the possibility of exceeding the DG load-carrying capacity. A procedure deficiency within DGA 12 was identified in that no specific precaution against manual DG starts in this type of scenario was provided. Review of this concern with the Station Training Department concluded that further review and training on this topic was also needed.

D. SAFETY ANALYSIS OF EVENT:

A safety analysis for each identified concern is provided below.

1. Fire in the 2D Condensate/Condensate Booster pump motor.

   Trip of the 2D Condensate/Condensate Booster pump occurred after the motor internally faulted. This initiated automatic start of the selected standby 2B pump. Loss of the 2D Condensate/Condensate Booster pump is of itself not of concern because the remaining three Condensate/Condensate Booster pumps were available.

2. Apparent failure of the 2B Condensate/Condensate Booster pump to automatically start and restore RFP suction pressure.

   As described previously, it is believed that the selected standby pump did start automatically, as is proper. However, this did not prevent automatic trip of the running RFPs approximately two seconds later on low suction pressure, thus precipitating the automatic low reactor water level scram. The reactor scram, and Primary Containment Group II and III isolations, did occur as expected when challenged by the low reactor water level signal.

3. Unexpected failure of reserve Auxiliary Transformer (TR) 22.

   Automatic trip of TR 22 occurred properly upon receipt of the sudden pressure signal due to the internal fault. This initiated automatic start of the Unit 2/3 DG on undervoltage (the Unit 2 DG had been manually started just prior to receipt of the undervoltage signals) and automatic loading of the Unit 2 and Unit 2/3 DGs onto their emergency buses.

4. Premature Closure of the 2-203-2C Outboard Main Steam Isolation Valve (MSIV).

   Closure of the 2-203-2C MSIV occurred properly upon failure of its DC solenoid. Closure is designed to occur upon de-energization of the AC and DC solenoids; as such the MSIVs fail in the conservative (isolated) position. Had this event occurred under normal power operation at high power levels, a Primary Containment Group I Isolation (precipitating closure of all MSIVs) and reactor scram would be expected on a Main Steam Line High Flow signal. In this event, however, a reactor scram had previously occurred and spurious closure of the 2-203-2C MSIV had minimal effect.

5. Failure of the 2-203-3B ERV open indicator lamps socket.

   The lamp socket failure had no effect on functional operability of the 2-203-3B ERV, as demonstrated by review of acoustic monitor and tailpipe temperature data. Additionally, the remaining ERVs, safety valves, and the target rock safety/relief valve were operable.

6. Potential failure of the main generator to trip properly on reverse power circuitry.

   As described previously, the reverse power relays were demonstrated to be set properly. The fact that significant reactive load delayed their actuation was mitigated by Operator action to trip the main generator Output Circuit Breakers at the 345 KV switchyard control panel in accordance with Dresden General Procedure (DGP) 2-3, Reactor Scram Procedure.

7. Failure of the 2B SDC pump discharge valve MO2-1001-4B to open electrically.

   Failure of the MO2-1001-4B valve was mitigated by alignment of the 'A' SDC loop and use of other systems to assist with cooldown. The MO2-1001-4B valve is not a primary containment isolation valve.

8. Operator action to manually start the Unit 2 DG.

   Dresden General Abnormal (DGA) Procedure 12, Partial or Complete Loss of AC Power, directs the Operator to verify automatic start of the Unit 2 and Unit 2/3 DGs, as well as automatic closure of the DGs onto their respective emergency buses. Entrance into the Dresden Emergency Operating Procedures (DEOPs), series 100, Reactor Control, was also performed in accordance with DGA 12. Verification of DG automatic start, by definition, requires taking manual action to accomplish it if these functions do not occur automatically. However, in this case, the Operator action was taken to manually start the Unit 2 DG, as opposed to allowing it to start automatically on undervoltage. The Operator, anticipating the loss of off-site power, was preparing the plant for this eventual occurrence when the trip of the main generator took place and the Unit 2 DG closed automatically onto its emergency bus (4 KV Bus 24-1). Review of the DG load shedding logic indicates that the purpose for allowing the automatic DG start (as opposed to taking Operator action to start the DG prior to the existence of DG auto-start signals) is to prevent the possibility of exceeding the DG load-carrying capability.

   The manual start and synchronization of the DG prior to the loss of off-site power could potentially result in an overload of the DG when the feed breaker from the auxiliary transformer to Bus 24 open on a loss of off-site power. Since Bus 24 is the normal AC electrical feed to Bus 24-1 and the Unit 2 DG output breaker to Bus 24-1 is closed, the Unit 2 DG could potentially try and carry all the loads on both buses (Bus 24 and Bus 24-1). If the DG were allowed to auto-start, the Bus 24 to Bus 24-1 feed breaker would open, and load shedding on Bus 24-1 would occur. The DG would then be manually loaded with the essential loads required for safe shutdown and cooldown of the reactor as needed. Operator actions conducted during the event would have mitigated the consequences of a DG overload because of the manual load shedding that was performed per DGA 12.

   This potential configuration of DG loads is within the original design basis, and also occurs during routine required monthly DG operability surveillances. During the DG operability surveillances, the DG is started and loaded manually onto its respective emergency bus and functionally verified to carry rated capacity. If design-basis LOCA conditions were then to cause automatic start of the LPCI/Core Spray pumps fed via that emergency bus, potential overload of the DG until trip of its loads could also occur. This would have no effect on the remaining LPCI/Core Spray pumps fed from the opposite emergency bus, and is of extremely low probability.

E. CORRECTIVE ACTIONS:

A summary of the corrective actions for each identified concern is provided below.

1. Fire in the 2D Condensate/Condensate Booster pump motor.

   The Station Technical Staff completed implementation of a thermography program to assist with predictive maintenance activities (237-200-90-00501). Periodic vibration monitoring of Balance of Plant rotating equipment, such as the Condensate/Condensate Booster pumps, will also continue. The Electrical Maintenance Department also cleaned the remaining Unit 3 Condensate/Condensate Booster pump motors (3A and 3D) on an expedited basis, although initial inspection of the failed 2D pump motor did not conclude that winding cleanliness was a contributing factor. Megger and polarization index tests were also performed on the 3A and 3D pump motors on January 23 and January 22, 1990, respectively; all of the data tests were satisfactory (237-200-90-00502). The Station Electrical Maintenance Department also revised the meggering/polarization index procedure to clarify the acceptance criteria and review process (237-200-90-00503). The 2D Condensate/Condensate Booster pump motor replacement work was completed by Electrical Maintenance on January 26, 1990; the failed 2D pump motor was also disassembled and inspected further in an attempt to determine the root cause of failure. The inspection concluded that the failure may have been contributed to by the winding configuration utilized by a vendor firm during a 1981 rewind. Improved rewind specifications are now utilized (237-200-90-00504). The Maintenance Staff also developed a program for periodic polarization index testing of all 4 KV pump motors, such that trending of this data can be utilized as a predictive maintenance indicator (237-200-90-00505).

2. Apparent failure of the 2B Condensate/Condensate Booster pump to automatically start and restore RFP suction pressure.

   The standby pump automatic start logic was functionally tested satisfactorily, as described previously. It was concluded that the standby 2B Condensate/Condensate Booster pump did start properly upon sensing an undervoltage condition after failure of the 2D pump. It was noted during the investigation that the undervoltage start signal was a recent modification, which had been implemented following a similar Condensate Booster pump failure on Unit 3 in 1987. The purpose of the modification was to provide more rapid start of the standby pump to support RFP suction pressure, such that automatic trip of the RPFs on low RFP suction pressure would be prevented.

   Prior to this event, three of the four Condensate/Condensate Booster pumps were operating, and the 2B pump was in standby. Although the selected standby pump did start properly, this was not sufficient to prevent automatic trip of the RFPs on low suction pressure. The Technical Staff System Engineer and the Nuclear Engineering Department are continuing to evaluate the RFP suction header pressure recovery issue, in order to determine if further actions can be taken to prevent automatic trip of the RFPs on low suction pressure in this type of event. Potential logic improvements and/or setpoint changes are currently under evaluation (237-200-90-00506).

3. Unexpected failure of Reserve Auxiliary Transformer TR 22.

   A team of OAD, SEED, and Substation Construction Department personnel was mobilized to replace TR 22 with a spare transformer. The transformer was then energized on January 23, 1990. Further investigation concerning the failure of TR 22 is in progress. A formal report was issued by SEED documenting this investigation. An action plan has also been developed by SEED concerning inspection of other similar TRs for satisfactory clamping configuration (237-200-90-00507).

4. Premature closure of the 2C outboard MSIV.

   The 2-203-2C MSIV DC solenoid was tested and found to have an internal open. The DC solenoid was then replaced. The MSIV DC solenoids are replaced on a preventative maintenance interval of every third refuel outage. The 2-203-2C MSIV DC solenoid was last replaced on February 11, 1989.

Periodic preventative maintenance replacements of the MSIV solenoids will continue. Also, the Technical Staff implemented performance of functional checks of the DC MSIV solenoids in conjunction with cold shutdown valve testing (237-200-90-00508).

5. Failure of the 2-203-3B ERV open indicator lamp socket.

The 2-203-3B ERV open indicator lamp socket was removed and replaced; the remaining Unit 2 ERV light sockets were also vacuumed to remove any accumulated foreign material. Various other control panel light sockets were also checked for cleanliness. The Operations Staff also implemented a procedure revision requiring vacuuming of control panel light sockets whenever lamps are replaced order to maintain their cleanliness (237-200-90-00509).

6. Possible failure of the main generator to trip properly on reverse power conditions.

As described in Section C, the reverse power relays were functionally verified to be set in accordance with vendor recommendations. However, the real reverse power trip values were demonstrated to bias the trip setpoints. Therefore, the following corrective actions were initiated:

a. The primary and secondary reverse power relays were replaced prior to startup (237-200-90-00510).

b. Operator response procedures were reviewed/revised as appropriate prior to startup, in order to provide guidance concerning Operator action to be taken to trip the generator (237-200-90-00511).

c. The Nuclear Engineering Department and OAD staff are continuing to investigate this issue; an improved relay scheme has been designed and is undergoing testing at one of the Commonwealth Edison fossil sites (237-200-90-00512).

7. Failure of the 2B Shutdown Cooling (SDC) discharge valve MO2-1001-4B to open electrically.

The MO2-1001-4B valve was rebuilt prior to startup. Installation of the improved type of motor pinion keys had already been initiated, as described previously. Additionally, a comprehensive Motor Operated Valve (MOV) Improvement Program was underway at the time of this event. The following items were included in this program (237-200-90-00513):

a. Comprehensive revision of MOV maintenance procedure had been completed.

b. All safety-related MOVs had been overhauled in accordance with the upgraded procedures.

c. A schedule for overhaul of non-safety-related Balance of Plant valves (such as MO2-1001-4B) within the next 2-1/2 years had been established. Additionally, the Maintenance Staff completed overhaul of the remaining Unit 2 and 3 SDC pump discharge valve motor operators containing the original equipment pinion keys on May 18, 1990.

d. Enhanced MOV preventative maintenance overhaul frequencies had been established, such that safety-related MOVs are scheduled for inspection at every other refuel outage.

8. Operator Action to manually start the Unit 2 DG.

Formal training on this event was initiated by the Training Department on January 22, 1990, including specific clarification that manual action should not be taken to start the DGs in this type of event unless they fail to start upon receipt of an automatic start signal. This training was performed with all Licensed Shift Operations personnel prior to their assuming Shift duties under power operation, and was completed with all Licensed Shift Operations personnel by January 29, 1990. This training was also performed with individuals holding inactive Licenses on an expedited basis, and will also be included in the Licensed Operator Initial Training program (237-200-90-00514).

The Operations Staff also reviewed and revised DGA 12 in order to ensure that adequate precautions relative to manual start of the DGs are provided. Dresden Administrative Procedure (DAP) 7-2, Conduct of Operations, and Nuclear Operations Directive NOD-OP.1, Conduct of Operations, were also reviewed for consistency in this area (237-200-90-00515).

F. PREVIOUS EVENTS:

A summary of recent events related to the identified concerns is provided below.

1. Fire in the 2D Condensate/Condensate Booster Pump motor.

Non-Reportable Event No.	Description
12-3-87-39 (LER 87-14/050249)	Describes a May 12, 1987 event involving trip of the Unit 3 3C Condensate/Condensate booster pump due to an internal motor short. As described in Section E, cleaning of the Condensate/Condensate booster pump motors was initiated.
12-2-81-82	Describes a July 24, 1981 trip of the 2D Condensate/Condensate pump due to a bearing failure while Unit 2 was operating at 91% power. The selected standby pump auto-started, and no RFP trips occurred.

2. Apparent failure of the 2B Condensate/Condensate booster pump to automatically start and restore RFP suction pressure.

Non-Reportable Event No.	Description
See Item F.1 above	In the above-referenced Unit 3 event, the selected standby 3D Condensate/ Condensate Booster pump started on decreasing RFP suction header pressure. However, RFP suction header pressure did not recover quickly enough to prevent automatic trip of the running RFPs on low suction pressure. Modification M12-2(3)-87-47 was then implemented on Units 2 and 3 to install logic for automatic start of the selected standby Condensate/Condensate booster pump upon trip of any running Condensate/Condensate booster pump (undervoltage signal).

3. Unexpected failure of Reserve Auxiliary Transformer TR 22.

Non-Reportable Event No.	Description
12-2-85-98 (LER 85-34/050239)	This report described an August 16, 1985 Unit 2 loss of offsite power that was initiated by a fault in Unit 1 reserve auxiliary transformer TR 12 [EA]. Circuitry for various 86T22HEA contacts was modified to allow automatic transfer of offsite power from TR 22 to auxiliary power transformer TR 21 [EA] independent of the cause of power interruption to TR 22.

4. Premature closure of the 2-203-2C outboard MSIV.

Non-Reportable Event No.	Description
N/A	Approximately 13 events involving MSIVs were reviewed from 1987 through 1990. None were related to DC solenoid failures. NRC Information Notice 86-57, "Operating Problems with Solenoid Valves at Nuclear Power Plants," advises of a series of failures at several plants. However, DC solenoid failure has not been a problem at the Dresden site; additionally, a different manufacturer of DC solenoid is utilized at Dresden than that listed in the Notice.

5. Failure of the 2-203-3B ERV open indicator lamp socket.

Non-Reportable Event No.	Description
12-3-89-128	Unit 3 DG Control panel indication lamp short. Occurred during modification testing of the Unit 2/3 DG. Currently under investigation.
12-3-83-24	Unit 3 3A CRD [AA] pump OFF lamp short. Occurred while broken pieces of bulb were being removed.
12-2-81-121	Isolation condenser service water valve 2-4102 position indicating light socket failure. Power supply had been changed from 125VDC to 250VDC and a series resistor had not been installed during this modification.
12-2-86-80 (LER 86-19/050237)	During replacement of a light bulb on the control panel for reactor recirculation [AD] lubricating pump B1, a short occurred. This resulted in a recirculation pump trip. The procedure for removal of a broken light bulb was revised to require de-energizing the indicating lamp circuit.

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

6. Potential failure of the main generator to trip properly on reverse power circuitry.

Non-Reportable Event No.	Description
12-3-87-48 (LER 87-13/050249)	The Unit 3 generator appears to motor in excess of the reverse power setpoints following a scram, and the Output Circuit Breakers 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.
12-3-89-20 (LER 89-2/050249), 12-3-89-31 (LER 89-6/050249)	The Unit 3 generator Output Circuit Breakers (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)	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.

7. Failure of the 2B SDC pump discharge valve MO2-1001-4B to open electrically.

Non-reportable event No.	Description
12-3-88-124	The Unit 3 MO3-1001-4B valve failed to operate electrically on December 5, 1988 due to failure of an original equipment motor pinion gear key. Replacement of the motor pinion gear keys for these types of operators with an improved key was initiated.

No previous reports involving the manual DG start (Item 8) concern were identified.

G. COMPONENT FAILURE DATA:

Manufacturer	Nomenclature	Model Number	Mfg. Part Number
General Electric	2D Condensate/ Condensate Booster Pump Motor	5K8311	N/A

An industry-wide NPRDS search listed seven similar motor failures, three of which were attributed to dirt accumulation/lack of cooling.

General Electric	Reserve Auxiliary Transformer TR22	9T21B9110	N/A

An industry-wide NPRDS search listed two similar transformer failures, but neither involved a sudden pressure trip.

Automatic Valve Co.	2-203-2C MSIV DC Solenoid	N/A	C6930-010

An industry-wide NPRDS search listed one MSIV problem attributed to a DC solenoid failure.

General Electric	2-203-3B Electromatic relief Valve Open position switch lamp	CR103C1102B	N/A

An industry-wide NPRDS search revealed no similar failures of this model socket.

General Electric	Main Generator Reverse Power Trip Circuitry	GGP53C	N/A

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

Limitorque	2B SDC Pump Discharge Valve MO2-1001-4B	SMB-4-200	N/A

An industry-wide NPRDS search listed six similar failures involving the motor pinion gear key.

Attachment 1

SEQUENCE OF EVENTS

Unit 2 was at 100% rated core thermal power, and Unit 3 was shut down for a scheduled refuel outage. The 2A and 2C RFPs were operating, with the 2B RFP selected as standby. The 2A, 2C, and 2D Condensate Booster Pumps were operating, with the 2B selected as the standby pump. Both the Unit 2 and Unit 2/3 Emergency DGs were available.

Date	Time	Description
1/16/90	17:24:06	2D Condensate/Condensate Booster Pump Trips.
	17:24:08	2A and 2C RFPs trip, apparently on low suction pressure.
	17:24:09	2B RFP auto-starts.
	17:24:19	Automatic reactor scram on low reactor water level. A manual scram signal was also initiated. Primary containment Group II and III isolations also were received from the low reactor water level signal.
	17:24:37	2A RFP restarted by Operator. Reactor water level increasing.
	17:25:00	Main Turbine and RFPs trip, apparently on high reactor water level signal. (Trip setpoint is +55".)
	17:26:00	Reserve aux transformer TR 22 trips on sudden pressure. TR 22 deluge system also initiates.
	17:27:04	Generator field breaker opens. Operator has manually opened Output Circuit Breakers (OCBs) from 345 KV yard panel due to concern that the main generator may be motoring in excess of reverse power trip setpoints. OCBs could not be opened from panel 902-8. Reactor level was approximately +60" at this time.
1/16/90	17:27:08	Unit 2 DG closes on Bus 24-1 after being started by Operator.
	17:27:09	2C MSIV closes.
	17:27:14	Unit 2/3 DG auto-starts and loads onto Bus 23-1.
	17:27:46	Per DGA 12, Operator closes MSIVs to conserve reactor inventory and places ECCS pumps in Pull-to-Lock to prevent overloading the diesel while backfeeding Bus 24.
	1730	Report of fire in Condensate Pump room received. All Condensate/Booster Pumps then taken to Pull-to-Lock. Fire alarm is sounded and fire brigade dispatched. Flames observed coming from 2D Condensate Booster Pump vents. Fire was promptly extinguished with dry chemical extinguisher.

Attachment 1

SEQUENCE OF EVENTS (Continued)

Date	Time	Description
1/16/90	1732	Operator initiates Isolation Condenser by opening MO3-1301-3 valve at 1000 psig reactor pressure as directed by the Shift Engineer. An Operator was also dispatched to align clean demineralized fill to the Isolation Condenser shell.
	1736	Opened 2-203-3B ERV to assist with reactor pressure control. Immediately closed it because the control panel "open" lamp shorted.
	1737	Opened the 2-203-3C ERV.
	1740	Racked out the 2D Condensate Booster Pump power supply breaker.
	1742	Closed 2-203-3C ERV. Also began lowering reactor level via the Reactor Water Cleanup (RWCU) [CE] 1201-11 valve. Reactor level was approximately +60 inches at this time.
	1748	Unusual Event declared.
	1900	Suppression Chamber [BT] cooling put on. Closed Isolation Condenser MO3-1301-3 valve; shell side level was about 3.6 feet at this time.
	1930	Opened Isolation Condenser MO3-1301-3 valve; shell side level was approximately 4.5 feet at this time.
	1956	RWCU system put on, utilized to lower reactor level to below +48 inches to facilitate starting of the HPCI system for reactor pressure control.
	2000	HPCI system put on for reactor pressure control.
	2030	HPCI system is secured. Reactor level is approximately +15 inches at this time.
	2055	Used Isolation Condenser for pressure control (cycled MO3-1301-3 valve).
	2115	Scram reset.
	2235	Suppression Chamber cooling secured.
	2300	Used Isolation Condenser twice more while getting ready to put on SDC system.
		2A SDC pump put on. Recirculation loop temperature was approximately 340°F at this time.

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

Attachment 1

SEQUENCE OF EVENTS

Date	Time	Description
1/17/90	0100	Tried to open 2B SDC pump discharge valve MO 2-1001-4B. Would not operate electrically or manually. Requested assistance from Mechanical Maintenance.
	0005	Secured 2B CRD pump.
	0105	Started RWCU blowdown to condenser hotwell.
	0210	Reactor water temperature below 212°F. Cold shutdown conditions achieved.
	0315	Mechanical Maintenance manually opened MO 2-1001-4B. 2B SDC pump was then started.
	0444	LPCI and Core Spray pumps taken out of Pull-to-Lock.
	0605	Bus 34-1 to 24-1 closed in and Unit 2 DG secured. Unusual Event terminated.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

Form Rev 2.0

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			Page (3)
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Dresden Nuclear Power Station	0 5 0 0 0 2 3 7	9 0	- 0 0 2	- 0 1	1 9 OF 1 9

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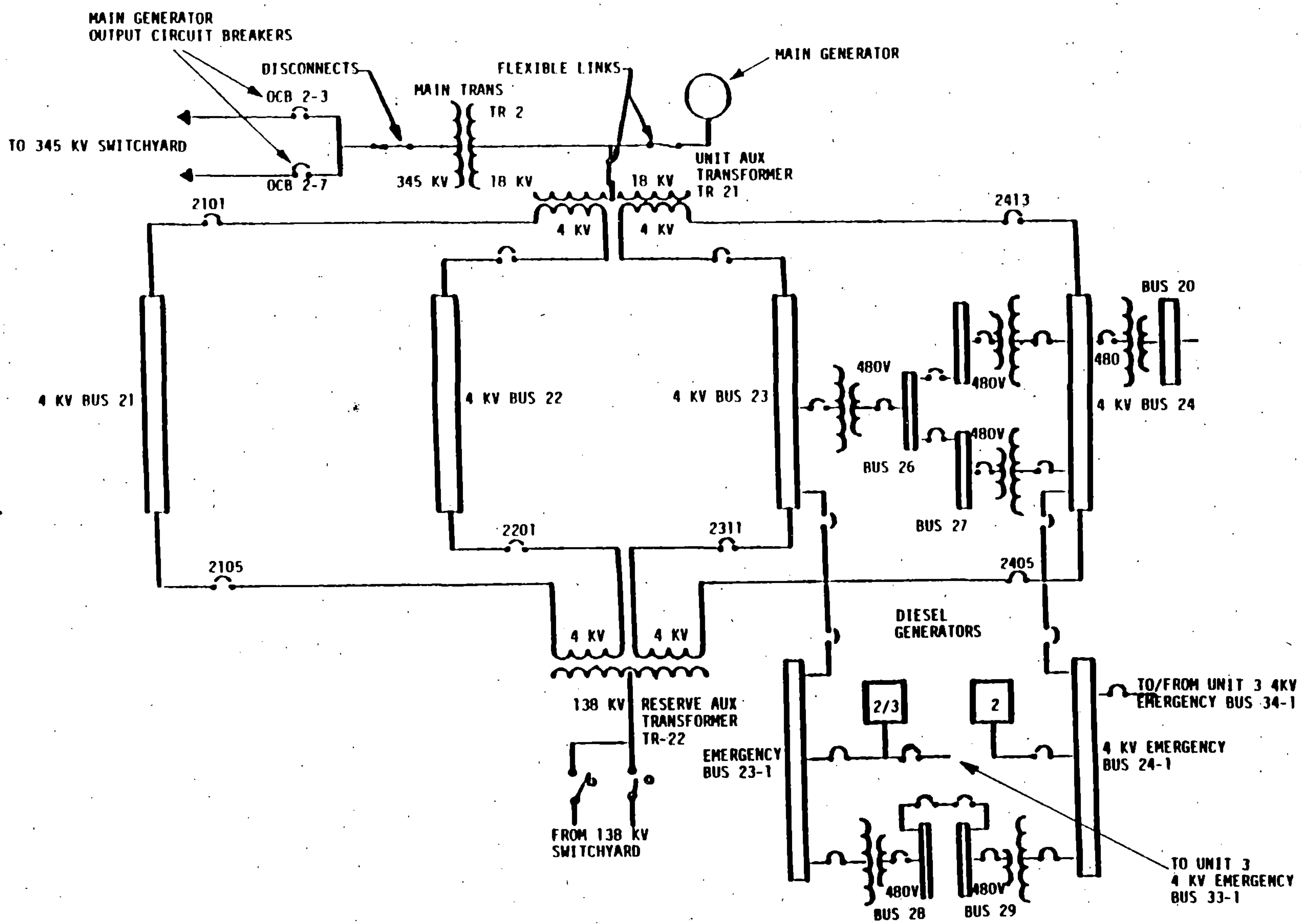

Figure 1