



**Commonwealth Edison**  
Dresden Nuclear Power Station  
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Morris, Illinois 60450  
Telephone 815/942-2920

May 4, 1994

GFSLTR 94-145

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D. C. 20555

Licensee Event Report 94-005, Docket 50-249 is being submitted as required by Technical Specification 6.6, NUREG 1022 and 10CFR50.73 (a) (2) (v) (D).

Sincerely,

Gary R. Spedl  
Station Manager  
Dresden Station

GFS/EJ: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)**

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

<b>FACILITY NAME (1)</b> Dresden Nuclear Power Station, Unit 3	<b>DOCKET NUMBER (2)</b> 05000249	<b>PAGE (3)</b> 1 OF 5
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**TITLE (4)**  
Non Conservative Second Level Undervoltage Protection Relay Settings Due to Defective Testing Equipment

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 NAME	DOCKET NUMBER
04	11	94	94	-- 005 --	00	05	04	94	Dresden Unit 2	05000237
									FACILITY NAME	DOCKET NUMBER

<b>OPERATING MODE (9)</b> N	<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)</b>									
<b>POWER LEVEL (10)</b> 000	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)						
	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)						
	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> OTHER						
	<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)						
	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)							
<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(x)								

**LICENSEE CONTACT FOR THIS LER (12)**

<b>NAME</b> Emory Johnson, System Engineer	<b>TELEPHONE NUMBER (Include Area Code)</b> (815) 942-2920
<b>Ext.</b> 2603	

**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		OSL	C034	N					

<b>SUPPLEMENTAL REPORT EXPECTED (14)</b>				<b>EXPECTED SUBMISSION DATE (15)</b>		
<b>YES</b> (If yes, complete EXPECTED SUBMISSION DATE).	<input checked="" type="checkbox"/>	<b>NO</b>	<input type="checkbox"/>	MONTH	DAY	YEAR

**ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)**

During a routine calibration of second level undervoltage relays removed from 4160 Volt Bus 34-1, the as found settings were found out of tolerance in the non-conservative direction. The relays had been replaced prior to the calibration. The cause of the non-conservative settings was identified to be a defective power supply used for the bench calibration. Unit 2 second level undervoltage protection was conservatively declared inoperable at 1500 hours on April 13, 1994, and Unit 2 entered Action 1 to Technical Specification Table 3.2.2, a 24 Hours to Shutdown Limiting Condition for Operating (LCO). Commonwealth Edison Company requested Enforcement Discretion with NRC Region III, and received verbal approval to delay completion of Action 1 until April 20, 1994. No power reductions were commenced. Unit 3 Bus 33-1 second level undervoltage relays were replaced, and the as found settings of the removed relays were also out of tolerance. The relays for Unit 2 4160 Volt Buses 23-1 and 24-1 were found out of tolerance and recalibrated. Unit 2 exited the LCO on April 15, 1994 at 1415 hours. Unit 3 was in a refueling outage during the event, and second level undervoltage protection was not required. This is the first reported instance of this type.

NRC FORM 366A (5-92)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95			
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<b>FACILITY NAME (1)</b>		<b>DOCKET NUMBER (2)</b>		<b>LER NUMBER (6)</b>		<b>PAGE (3)</b>	
Dresden Nuclear Power Station		05000249		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 5
				94	-- 005 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

EVENT IDENTIFICATION:

Non Conservative Second Level Undervoltage Protection Relay Settings Due to Defective Testing Equipment

A. PLANT CONDITIONS PRIOR TO EVENT:

Unit: 3                                      Event Date: April 11, 1994                                      Event Time: 0815  
 Reactor Mode: N                                      Mode Name: Refuel                                      Power Level: 0%  
 Reactor Coolant System Pressure: 0 psig

B. DESCRIPTION OF EVENT:

On April 11, 1994, at approximately 0815 hours, with Unit 3 in a refueling outage, during a routine calibration of the ABB model ITE 27N undervoltage relays removed from Emergency Bus 34-1 [EB], both relays were found out of tolerance in the non-conservative direction. The as found calibration was being performed for Dresden Operating Surveillance, (DOS) 6600-09, Testing of Emergency Core Cooling System (ECCS) Undervoltage and Degraded Voltage Relays, and as part of the planned relay replacement with ABB model ITE 27N-R relays. The replacement to the 27N-R relays for Bus 34-1 had previously been completed under Work Request (WR) D16331.

Additional testing of the 27N relay determined that the relay trip point was influenced by the polarity of the lead wires from the bench testing oscillator which was producing the AC voltage signal. The power supply anomaly was diagnosed and verified via oscilloscope to have a distortion on the positive side of the single phase 120 VAC sine wave.

Further evaluation determined that the Unit 2 second level undervoltage relays were calibrated using this same power supply in October 1992 and April 1993. Because no assurance could be found to verify the test lead hook-up, the assumption was made that Unit 2 second level undervoltage protection may also be set non-conservatively. A root cause evaluation and operability determination was performed to assess the impact of this failure upon redundant Bus 33-1 and Unit 2.

On April 13, 1994, at approximately 1500 hours, with Unit 2 operating at 100 % rated core thermal power, it was determined that the non-conservative settings of the second level undervoltage relays on Unit 3 could generically impact Unit 2, and that the second level undervoltage relays on Unit 2 Emergency Buses 23-1 and 24-1 may not trip prior to reaching the Technical Specification Table 3.2.2 Limiting Condition for Operation (LCO) limit. The Technical Specification required action for inoperable second level undervoltage protection on a 4160 Volt Emergency Bus is to begin an immediate and orderly shutdown.

Commonwealth Edison Company (CECo) requested Enforcement Discretion, and received verbal approval from NRC Region III at 1630 hours on April 13, 1994. No power reductions were commenced. The period of Enforcement Discretion was to expire at 1800 hours on April 20, 1994.

NRC FORM 366A (5-92)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95		
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FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Dresden Nuclear Power Station		05000249	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 5
			94	-- 005 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

On April 14, 1994, at approximately 0741 hours, with Unit 3 in a refueling outage, during the as found calibration of the second level undervoltage relays removed from Emergency Bus 33-1, those relays were also found out of tolerance in the non-conservative direction. The relays were replaced as a preplanned outage activity under WR D16330.

On April 15, 1994, at approximately 1415 hours, with Unit 2 at 100 % rated core thermal power, while performing Dresden Technical Surveillance (DTS) 6600-04, Calibration and Functional Test of the 4KV Bus Degraded Voltage Relays, the second level undervoltage relays for Buses 23-1 and 24-1 were found out of tolerance and were successfully re-calibrated. At 1415 hours, the LCO on Unit 2 was exited.

C. CAUSE OF EVENT:

This report is being submitted in accordance with 10 CFR 50.73(a)(2)(v)(D) which requires the reporting of any event or condition that alone could have prevented the fulfillment of the safety function that are needed to mitigate the consequences of an accident.

The investigation conducted by the Operational Analysis Department (OAD), Site Engineering and Construction (SEC), Nuclear Engineering Technology Services (NETS) and System Engineering, determined that when the bench testing AC power supply leads polarity were interchanged, the 27N relay under test tripped at a different setpoint. This response was repeatable with a constant variation of about one Volt. The source of the phenomenon was identified to be distortion in the AC test source output. The 27N circuitry samples on one-half of the waveform and measures the peak value. The AC test source output possessed a distortion content that gave a higher peak voltage value on only one-half of the waveform.

The 27N relay was originally equipped with a harmonic filter and time delay circuit. However, ABB issued a Part 21 Notification in 1992 which asserted that those functions would fail if the relays were subjected to an integrated radiation exposure less than the radiation exposure for which it was previously qualified. In response to the Part 21 Notification, the station modified the relays in accordance with vendor instructions to remove the harmonic filter and time delay components.

The apparent cause of the event is attributed to a defective power supply. The test AC power supply is general usage equipment and as such does not undergo periodic calibration. The testing methodology involves using a calibrated multimeter to measure the relay input voltage to determine the trip point. The multimeter measures the root mean squared (RMS) value of the oscillator output. For a symmetric AC sinusoid waveform there is a direct correlation between the RMS voltage value and the peak voltage value. With the asymmetrical distortion present in the test AC power supply waveform, the direct correlation did not exist. The harmonic filter would have removed most of the distortion prior to the relay taking a peak voltage sample.

The station is in the process of replacing the 27N relays with the 27N-R relays for second level undervoltage protection. The 27N-R relay possesses the radiation resistant harmonic filter and time delay circuitry.

NRC FORM 366A (5-92)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95			
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Dresden Nuclear Power Station		05000249		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	4 OF 5
				94	-- 005 --	00	

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A review of other relays that may have been calibrated using the oscillator have identified three additional relays on each Unit that may be susceptible to the test AC power source harmonic distortion. These relays were identified as the over voltage relay, undervoltage relay, and over/under frequency relay for the Low Pressure Cooling Injection (LPCI) Swing Bus protection on Unit 3 480 Volt Motor Control Center (MCC)[ED] 39-7 and Unit 2 MCC 29-7.

A review of the calibration histories for those six relays has determined that the amount of error that may have been introduced by the harmonic distortion is less than the range allowed by the setting tolerances.

D. SAFETY ANALYSIS:

The second level undervoltage protection relays were added to assure that adequate voltage is maintained at the 4160 Volt equipment level. The services provided by the 4160 Volt Emergency Buses include Low Pressure Cooling Injection Pumps [BO] and AC power to 480 Volt Switchgear [ED] and 480 Volt MCCs.

A degraded voltage condition is signaled after a seven second time delay to allow for normal voltage transients. After the seven second alarm, a five minute timer elsewhere within the logic initiates to allow the operator time to correct the condition. Following the five minutes, the Emergency Bus is automatically separated from the offsite auxiliary power [FK] and loaded onto an onsite emergency diesel generator [EK]. In the event of an ECCS initiation, the five minute timer is bypassed, and the emergency bus is immediately loaded onto the emergency diesel generator.

The amount of error resulted in the second level undervoltage setpoints to be approximately 35 Volts low at the 4160 volt nominal bus voltage. With the non-conservative settings during a degraded voltage event the potential existed that insufficient voltage may have been present to start and run equipment required to operate during accident conditions. This event is mitigated by the following circumstances:

The likelihood of a degraded voltage event which would result in a degraded voltage that resides in the narrow region of vulnerability is remote.

Abnormal Operating Procedures give guidance to Operating Personnel to take actions in the event of a degraded voltage condition. The Abnormal Operating Procedures are entered when the computer alarm which measures emergency bus voltage annunciates. The 4000 Volts alarm value is above the bus critical voltage value, and provides margin for the Nuclear Station Operator (NSO) to attempt to restore emergency bus voltage. Voltage restoration is accomplished by raising the switchyard voltage through raising main generator reactive power output and through switchyard configuration changes. If required, specific plant loads are started or stopped as necessitated by plant conditions.

At the time of discovery, Unit 3 was in a refueling outage and second level undervoltage protection was not required.

**LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION**

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FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
Dresden Nuclear Power Station		05000249	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	5 OF 5
			94	-- 005 --	00	

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**E. CORRECTIVE ACTIONS:**

The corrective actions taken with regard to this event are the following:

The investigation team analyzed the testing setup and concluded that the test A/C power source produced an asymmetrical waveform that impacted the relay trip point.

CECo declared the Unit 2 second level undervoltage relays inoperable at 1500 hours on April 13, 1994, entered Shutdown LCO due to Action 1 of Technical Specification Table 3.2.2, and entered Enforcement Discretion with NRC Region III.

Under WR D16330, the relays on Bus 33-1 were replaced.

The 27N relays for Buses 23-1 and 24-1 were recalibrated under DTS 6600-04, and Unit 2 then exited the LCO at 1415 hours on April 15, 1994.

The oscillator was sent to the System Operational Analysis Department for analysis. The oscillator was found to have Total Harmonic Distortion (THD) of 1.7%. It was repaired to have a THD of 0.1%.

**F. PREVIOUS OCCURRENCES:**

There were no previous occurrences of this nature found.

**G. COMPONENT FAILURE DATA:**

<u>Manufacturer</u>	<u>Nomenclature</u>	<u>Model Number</u>	<u>Mfg. Part Number</u>
Power Amplifier/ Oscillator	California Instruments	101T/800T	N/A

A review of the Nuclear Plant Reliability Database System (NPRDS) did not indicate any records for this instrument.