

PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION

P. O. BOX A

SANATOGA, PENNSYLVANIA 19464

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M. J. MCCORMICK, JR., P.E.
PLANT MANAGER
LIMERICK GENERATING STATION

April 25, 1990
Docket Nos. 50-352
50-353

License Nos. NPF-39
NPF-85

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

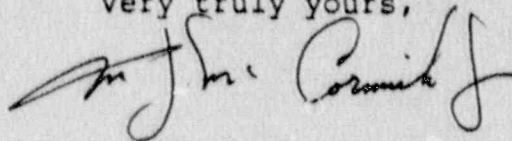
SUBJECT: Licensee Event Report
Limerick Generating Station - Units 1 and 2

This LER reports automatic actuations of the Unit 2 Primary Containment and Reactor Vessel Isolation Control System and other Engineered Safety Features due to a loss of power to the '2B' Reactor Protection System/Uninterruptible Power Supply power distribution panel from a failed inverter inductor.

Reference:	Docket Nos. 50-352 50-353
Report Number:	2-90-007
Revision Number:	00
Event Date:	March 30, 1990
Report Date:	April 25, 1990
Facility:	Limerick Generating Station P.O. Box A, Sanatoga, PA 19464

This LER is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(iv).

Very truly yours,



DCS:cah

cc: T. T. Martin, Administrator, Region I, USNRC
T. J. Kenny, USNRC Senior Resident Inspector, LGS

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LICENSEE EVENT REPORT (LER)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OAS NO. 3105-018

EXPIRES 8/31/98

FACILITY NAME (1)

Limerick Generating Station, Unit 2

DOCKET NUMBER (2)

0 5 0 0 0 3 5 3 1 OF 0 5

PAGE (3)

TITLE (4)

Primary Containment and Reactor Vessel Isolation Control System actuations resulting from a Reactor Protection System/Uninterruptible Power Supply inverter inductor

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 (9)			
0	3	3	0	9	0	9	0	0	0	0	3	5	2
0	3	3	0	9	0	9	0	0	0	0	3	5	2

OPERATING MODE (10)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 8. (Check one or more of the following) (11)																								
OPERATING MODE (10)	4	20.000(b)	20.000(c)	20.000(d)	20.000(e)	20.000(f)	20.000(g)	20.000(h)	20.000(i)	20.000(j)	20.000(k)	20.000(l)	20.000(m)	20.000(n)	20.000(o)	20.000(p)	20.000(q)	20.000(r)	20.000(s)	20.000(t)	20.000(u)	20.000(v)	20.000(w)	20.000(x)	20.000(y)	20.000(z)
POWER LEVEL (16)	1010	20.000(b)(1)(i)	20.000(b)(1)(ii)	20.000(b)(1)(iii)	20.000(b)(1)(iv)	20.000(b)(1)(v)	20.000(b)(1)(vi)	20.000(b)(1)(vii)	20.000(b)(1)(viii)	20.000(b)(1)(ix)	20.000(b)(1)(x)	20.000(b)(1)(xi)	20.000(b)(1)(xii)	20.000(b)(1)(xiii)	20.000(b)(1)(xiv)	20.000(b)(1)(xv)	20.000(b)(1)(xvi)	20.000(b)(1)(xvii)	20.000(b)(1)(xviii)	20.000(b)(1)(xix)	20.000(b)(1)(xx)	20.000(b)(1)(xxi)	20.000(b)(1)(xxii)	20.000(b)(1)(xxiii)	20.000(b)(1)(xxiv)	20.000(b)(1)(xxv)

LICENSEE CONTACT FOR THIS LER (12)

NAME		TELEPHONE NUMBER	
Gil J. Madsen, Regulatory Engineer, Limerick Generating Station		2 1 5 3 2 7 - 1 2 0 0	

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC										
X	J	C	I	N	V	T	E	3	5	3	Y								

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)		NO		EXPECTED SUBMISSION DATE (15)		MONTH		DAY		YEAR	
		X									

ABSTRACT (Limit to 1000 words, i.e., approximately 8000 characters) (16)

On March 30, 1990, at 0338 hours, with Unit 2 in cold shutdown, a failure of the Unit 2 '2B' Reactor Protection System (RPS)/Uninterruptible Power Supply (UPS) inverter inductor caused a loss of power to the '2B' RPS/UPS power distribution panel, 2BY160. As a result, various automatic actuations of the Primary Containment and Reactor Vessel Isolation Control System, an Engineered Safety Feature (ESF), occurred, including isolation of Residual Heat Removal (RHR) shutdown cooling. In addition, the Unit 2 Reactor Enclosure and common Refuel Floor ventilation systems isolated and the Reactor Enclosure Recirculation System and the Standby Gas Treatment System started (also ESF actuations). All systems responded as designed. The inverter was bypassed, all isolations were reset, and the systems were returned to service promptly. There was no adverse impact on plant operations as a result of this event. An increase of less than one degree F in the reactor coolant temperature occurred before RHR shutdown cooling was restored 17 minutes after the isolation. The proximate cause of the loss of power to the RPS/UPS power distribution panel was a gross failure of an inductor in the '2B' RPS/UPS inverter. The inductor was replaced and the inverter was energized for two days before being returned to service, to verify proper operation. A review of possible alternatives for providing a more reliable power supply to the RPS/UPS power distribution panel is underway.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED ONS NO. 3100-0104

EXPIRES 03/1/88

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TEXT 10 more spaces if required, use additional NRC Form 804's (17)

Unit Conditions Prior to the Event:

	Unit 1	Unit 2
Operating Condition:	1 (Power Operation)	4 (Cold Shutdown)
Power Level:	100%	0%

Description of the Event:

On March 30, 1990, at 0338 hours, a failure of the Unit 2 '2B' Reactor Protection System (RPS)/Uninterruptible Power Supply (UPS) inverter inductor caused a loss of power to the '2B' RPS power distribution panel (2BY160). This loss of power resulted in automatic actuations of the Primary Containment and Reactor Vessel Isolation Control System (PCRVICS) (EIIS:JM), an Engineered Safety Feature (ESF), causing isolations of the following systems or subsystems by closing their outboard primary containment isolation valves:

- o Unit 2 'B' loop of Residual Heat Removal (RHR) (EIIS:BO) Shutdown Cooling,
- o Unit 2 Drywell Chilled Water (DWCW) (EIIS:KM),
- o Unit 2 Reactor Enclosure Cooling Water (RECW) (EIIS:CC),
- o Unit 2 Primary Containment Instrument Gas (PCIG) (EIIS:LK),
- o Unit 2 Reactor Water Cleanup (RWCU) (EIIS:CE), and
- o Unit 2 Primary Containment exhaust to Reactor Enclosure Equipment Compartment Exhaust.

In addition, the following other ESF or partial ESF actuations occurred:

- o Unit 2 Reactor Enclosure ventilation system isolation (EIIS:VA),
- o Common Refuel Floor ventilation system isolation (EIIS:VA),
- o '2B' Reactor Enclosure Recirculation system (EIIS:VA) initiation,

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OSG NO. 3100-0104
EXPIRES 6/31/86

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TEXT (If more space is required, use additional NRC Form 308A's) (17)

- o 'B' Standby Gas Treatment System (SGTS) (EIIS:BM) initiation, and
- o Unit 2 'B' channel half scram.
- o Unit 1 PCRVICES isolation valves received isolation signals but no valve motion occurred as all valves were already closed.

At 0341 hours a fire alarm annunciated in the Main Control Room (MCR) indicating smoke in the Unit 2 static inverter area. Operations personnel in the fire brigade responded to the alarm and found the '2B' static inverter transformer smoldering and extinguished the fire with a hand held CO2 fire extinguisher at 0344 hours.

MCR operators restored RHR Shutdown Cooling, DWCW, RECW and PCIG systems by 0355 hours using PCRVICES isolation bypass switches in accordance with the Event Procedure E-2BY160, "Loss of 2B RPS and UPS Power," Off Normal Procedure ON-113, "Loss of RECW," and General Plant Procedure GP-8, "Primary and Secondary Containment Isolation Verification and Reset." The duration of the loss of RHR shutdown cooling was 17 minutes, during which time the reactor coolant temperature increased less than one degree F. The power to the RPS/UPS power distribution panel was restored and the remainder of the isolations were reset by 0418 hours on March 30, 1990. The duration of the loss of power to the 2BY160 panel was 40 minutes.

A four hour notification was made to the NRC at 0538 hours on March 30, 1990 in accordance with 10 CFR 50.72(b)(2)(ii), since this event resulted in automatic ESF actuations. Accordingly, this report is being submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(iv).

Consequences of the Event:

There was no release of radioactive material to the environment as a result of this event. All systems responded as designed during the loss of power to the RPS/UPS power distribution panel. The isolations were bypassed or reset and the systems were restored expeditiously by operators in accordance with plant procedures preventing any adverse impacts on plant systems. The loss of 'B' RHR Shutdown Cooling for 17 minutes resulted in less than a one degree F increase in reactor

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TEXT (If more space is required, use additional NRC Form 206A's) (17)

coolant temperature. If shutdown cooling could not have been re-established using the 'B' loop of RHR, the 'A' loop of RHR was operable and could have been used to ensure adequate residual heat removal.

Immediate and follow up actions for this type of event (loss of power to an RPS power distribution panel) are provided in plant procedures E-2BY160, ON-113 and GP-8. Licensed operators receive requalification training to review and practice responses to simulated plant transients of this type. This training reinforces immediate operator actions, minimizing the time that systems are isolated and reducing the impact on the plant. Additionally, the impact on Unit 2 was minimal because the unit was shutdown.

Unit 1 operation was not affected by this event except for the common Refuel Floor Ventilation isolation and SGTs initiation. Unit 1 PCRVICES Group VI B isolation valves received isolation signals as designed but were already closed.

Cause of the Event:

The proximate cause of this event was the unexpected gross failure of the '2B' RPS/UPS inverter inductor. The failure of the inductor caused a reduction in output voltage of the inverter allowing the undervoltage relays to trip, causing the loss of power to the '2B' RPS/UPS power distribution panel and resultant ESF actuations. Instrumentation and Controls (I&C) technicians performed tests of the inverter circuitry which verified that only the inductor failed. An investigation is being conducted by the vendor/supplier (EXIDE) to determine the cause of the inductor failure.

Corrective Actions:

The fire in the '2B' RPS/UPS inverter was extinguished by 0344 hours on March 30, 1990. The RHR shutdown cooling, PCIG, RECW, and DCCW system isolations were bypassed and restored to normal operation by 0355 hours. The inverter was bypassed, the shunt trip breaker was closed restoring power to the RPS/UPS power distribution panel, and all remaining isolations were reset by 0418 hours on March 30, 1990. I&C technicians obtained thermography readings on the remaining three

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TEXT (If more space is required, use additional NRC Form 306A's) (17)

RPS/UPS static inverters and verified that all were within vendor recommended operating temperatures. The failed inductor was replaced and the '2B' RPS/UPS inverter was energized for two days to verify proper operation before being placed back in service on April 2, 1990.

Actions Taken to Prevent Recurrence:

Possible alternatives for providing a more reliable power supply to the RPS/UPS power distribution panel are being investigated in light of previous failures of the existing static inverters. The failed inductor has been sent to the vendor/supplier for further evaluation. The failure of the inductor is thought to be an isolated unexpected equipment failure. No further actions are planned at this time, however, results of the evaluation of alternatives will be reviewed and appropriate actions considered.

Previous Similar Occurrences:

LERs 1-84-030, 1-84-040, 1-85-007, 1-85-008, 1-85-011, 1-85-024, 1-85-026, 1-85-043, 1-85-074, 1-87-021, 1-87-027, 1-87-029, 1-87-038, 1-89-015, 1-89-055, and 2-90-005 reported PCRVICS isolations due to loss of power to the RPS panel. None of these previous events resulted from inductor failure and therefore the actions to prevent recurrence of these events most likely would not have prevented the event reported in this LER.

Tracking Codes:

B15 - Failure due to normal wear.