10 CFR 50.73

PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION
P. O. BOX A
SANATOGA, PENNSYLVANIA 19464

(215) 327-1200 EXT. 2000

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

December 3, 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 Primary Containment and Reactor Vessel Isolation Control System (PCRVICS) actuations, Engineered Safety Feature actuations, as a result of a loss of power to the '2B' Reactor Protection System/Uninterruptible Power Supply (RPS/UPS) power distribution panel due to a damaged connector in the RPS static inverter circuitry coupled with troubleshooting by Operations personnel.

Reference:	Docket Nos. 50-352 50-353
Report Number:	2-90-019
Revision Number:	00
Event Date:	November 1, 1990
Report Date:	December 3, 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,

M. J. McCormick, Jr.

DCS:rgs

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

IE22
1/1

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Limerick Generating Station, Unit 2	0 5 0 0 0 3 5 3	1 OF 0 6

TITLE (4): Half-scram and various isolations resulting from a loss of power to a Reactor Protection System/Uninterruptible Power Supply panel due to inverter damage.

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)
1 1	0 1	9 0	9 0	0 1 9	0 0	1 2	0 3	9 0	LGS Unit 1	0 5 0 0 0 3 5 2
										0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	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, NRC Form 366A)
		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
Gil J. Madsen, Regulatory Engineer	AREA CODE 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 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)

On November 1, 1990, at 0602 hours, various actuations of the Primary Containment and Reactor Vessel Isolation Control System (PCRVICS), an Engineered Safety Feature (ESF), and a channel 'B' Reactor Protection System (RPS) half-scram occurred, due to the unexpected tripping of the '2B2' RPS static inverter or alternate power supply output circuit breaker, resulting in a loss of power to the RPS/Uninterruptible Power Supply (UPS) power distribution panel. The consequences of this event were minimal and there was release of radioactive material to the environment. 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. The cause of this event was a damaged connector in the '2B' RPS static inverter circuitry coupled with troubleshooting being performed by plant operators. All static inverters were inspected for damaged connectors and no other problems were identified. Preventive and Corrective Maintenance work was completed on the Technical Support Center (TSC) and RPS static inverters, and the alternate power supply was restored on November 21, 1990. Procedures will be revised by December 7, 1990, to add steps to inspect the static inverters for any identified trouble prior to placing or removing the TSC modules from service.

Unit Conditions Prior to the Event:

Unit 2 was in Operating Condition 1 (Power Operation) at 100% power level.

Unit 1 was in Operating Condition 5 (Refuel) at 0% power level.

The Technical Support Center (TSC) Static Inverters were being removed from service to support maintenance activities.

Description of the Event:

On November 1, 1990, at 0602 hours, various actuations of the Unit 1 and Unit 2 Primary Containment and Reactor Vessel Isolation Control System (PCRVICS) (EIIS:JM), an Engineered Safety Feature (ESF), and a Unit 2 'B' channel Reactor Protection System (RPS) (EIIS:JD) half-scram, occurred due to the unexpected tripping of the '2B2' RPS static inverter or alternate power supply output circuit breaker (EIIS:BKR). This output breaker trip resulted in a loss of power to the Reactor Protection System/Uninterruptible Power Supply (RPS/UPS) power distribution panel (EIIS:PNL), 2BY160.

This loss of power resulted in isolation of the following systems or subsystems by closing their outboard primary containment isolation valves:

- Unit 2 Drywell Chiller Water (DWCW) (EIIS:KM),
- Unit 2 Reactor Enclosure Cooling Water (RECW) (EIIS:CC),
- Unit 2 Primary Containment Instrument Gas (PCIG) (EIIS:LK),
- Unit 2 Reactor Water Cleanup (RWCU) (EIIS:CE),
- Unit 2 Residual Heat Removal (RHR) (EIIS;BO) heat exchanger vacuum breaker (EIIS;BO) lines,
- Unit 2 Primary Containment Nitrogen Inerting, and
- Unit 2 Drywell Sump, Suppression Pool Cleanup (EIIS:CG) and Traversing Incore Probe System (EIIS:IG).

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

- Unit 2 Reactor Enclosure ventilation system isolation (EIIS:VA),
- Common Refuel Floor ventilation system isolation,
- '2B' Reactor Enclosure Recirculation system initiation and,
- 'B' Standby Gas Treatment System (SGTS) (EIIS:BM) initiation.

The following system lines received isolation signals but no valve motion occurred since the associated valves are normally closed during power operation:

- o Unit 2 Main Steam line drains (EIIS:SB) and sample lines,
- o Unit 2 Reactor Sample Lines,
- o Unit 2 RHR shutdown cooling, sample, and drain lines,
- o Unit 2 Primary Containment purge supply and exhaust, and
- o Unit 2 Primary Containment Exhaust to Reactor Enclosure Equipment Compartment Exhaust.

Unit 1 PCRVICS Group VI A, Primary Containment Purge Supply and Exhaust, and VI B, Primary Containment Exhaust to Reactor Enclosure Equipment Compartment Exhaust and Nitrogen Block Valves, also received isolation signals but no valve motion occurred as all valves were already closed due to plant conditions at the time of the event.

MCR operators restored the Unit 2 DWCW, RECW and PCIG systems by 0609 hours using PCRVICS 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 power to the RPS/UPS power distribution panel was restored and the remainder of the isolations were reset by 0638 hours. The elapsed time of this event was 36 minutes.

A four hour notification was made to the NRC at 0923 hours on November 1, 1990, in accordance with 10CFR 50.72(b)(2)(ii), since this event resulted in automatic ESF actuations. This report is being submitted in accordance with the requirements of 10CFR 50.73(a)(2)(iv).

Analysis of the Event:

The consequences of this event were minimal and there was no release of radioactive material to the environment. 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 expeditiously restored by operators in accordance with plant procedures preventing any adverse impacts on plant systems.

Immediate and follow up actions for this type of event (loss of power to an RPS power distribution panel) are provided in 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. The elapsed time of this event was 36 minutes.

Unit 1 was shutdown for refueling and was not affected by this event except for the common Refuel Floor Ventilation system isolation and SGTS initiation. Unit 1 PCRVICS Group VI A and VI B isolation valves received isolation signals as designed but were already closed, due to plant conditions.

Cause of the Event:

The cause of this event was an equipment problem in the '2B' RPS static inverter that had been previously identified, coupled with troubleshooting being performed by Operations personnel due to a loss of power to the TSC computers. A contributing cause was a delay in repairing a previously identified problem with '2B' RPS static inverter synchronization circuit.

During normal operation, the static inverters are supplied by a primary (DC) supply (Diagram 1, item 1) and are aligned to an alternate (AC) supply (item 2) as a backup to the primary supply. The static inverters automatically synchronize their output to match the frequency of the alternate (AC) supply. This synchronization precludes voltage transients when switching from the primary to alternate supply. The '2B' RPS static inverter "OUT OF SYNC" light was illuminated indicative of a problem in the phase synchronization circuitry. The synchronization circuit problem had been identified by Operations personnel and an Equipment Trouble Tag (ETT) had been attached to the static inverter. Corrective Maintenance on the static inverter had not yet been performed when this event occurred due to a delay in processing of the ETT. The synchronization problem was caused by a damaged (crimped) connector in the static inverter circuitry.

On November 1, 1990, preparations were being made to perform maintenance on the TSC static inverters (item 3), which act as the alternate supply through the RPS inverter. The Maintenance Bypass Breaker (MBB) (item 4) was closed by Operations personnel to provide the alternate (AC) power to loads normally supplied by the TSC static inverters, including the alternate supply to the RPS static inverters. When the primary supply was removed from the TSC static inverters, the TSC computers (item 5), supplied by the TSC inverters, lost power. It was determined that the MBB was open although it was indicating closed. Per Shift Supervision direction, the MBB was cycled open and closed. This restored the AC power to the loads.

When the alternate supply was restored, the '2B' RPS static inverter automatically attempted to synchronize its output with the alternate supply frequency. Due to the damaged connector in the RPS static inverter circuitry, the output sensed was a square wave-form. The RPS static inverter could not synchronize the square wave output with the sinusoidal wave of the alternate supply. This inability to synchronize resulted in an output condition that tripped the '2B' RPS undervoltage breaker (item 6) and caused the loss of power to the RPS/UPS power distribution panel, 2BY160.

Corrective Actions:

All static inverters were inspected for damaged connectors and no other problems were identified. Preventive and Corrective Maintenance work including repair of the damaged connector was completed on the TSC and RPS static inverters and the alternate power source was restored on November 21, 1990. The routine Preventive Maintenance (PM) work for each static inverter currently inspects for damaged and degraded equipment within the static inverter, including cabling and connectors. This PM work is scheduled for the upcoming first Unit 2 Refueling Outage, currently scheduled to begin in March, 1991. The reason for the MBB indicating closed when it was actually open could not be determined. Subsequent testing demonstrated that the MBB was functioning properly.

System Procedures S.94.1.I, "Placing Technical Support Center UPS Modules in Service," and S.94.2.I, "Removing Technical Support Center UPS Modules from Service," will be revised by December 7, 1990. These revisions will add steps to inspect the RPS and TSC static inverters for any identified trouble prior to placing or removing the modules from service and to ensure that no half-scram signals are present to minimize the potential for a full SCRAM should a transient occur.

A review of the delay in processing the ETT has concluded that this is an isolated occurrence. There are adequate procedures in place to ensure that equipment problems are identified, and corrective actions prioritized and implemented.

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, 1-85-048, 1-85-074, 1-87-021, 1-87-027, 1-87-029, 1-87-038, 1-89-055, 2-90-005 and 2-90-007 reported PCRVICS isolations due to loss of power to the RPS panel. The corrective actions implemented for these events could not have prevented this event as the previous events resulted from different causes.

Tracking Codes: B17 - Deficient Equipment

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Limerick Genereting Station, Unit 2	0 5 0 0 0 3 5 3	9 0	— 0 1 9	— 0 0	0 6 OF 0 6

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

DIAGRAM 1