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PECO ENERGY

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10CFR50.73

February 3, 1995

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 1 Primary Containment and Reactor Vessel Isolation Control System and other Unit 1 and Common Plant Engineered Safety Features due to a loss of power to the Unit 1 "A" Reactor Protection System (RPS)/ Uninterruptible Power Supply (UPS) power distribution panel caused by an unexpected equipment failure within the 1A RPS/UPS static inverter.

Reference:	Docket Nos. 50-352 50-353
Report Number:	1-95-001
Revision Number:	00
Event Date:	January 5, 1995
Discovery Date:	January 5, 1995
Report Date:	February 3, 1995
Facility:	Limerick Generating Station P.O. Box 2300, Sanatoga, PA 19464-2300

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

Very truly yours,

Robert W Boyce

GHS

cc: T. T. Martin, Administrator Region I, USNRC
N. S. Perry, USNRC Senior Resident Inspector, LGS

IE22

NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

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.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Limerick Generating Station, Unit 1	05000352	1 OF 6

TITLE (4) PCRVICS and other Engineered Safety Feature Actuations as a Result of the Unexpected Malfunction of an RPS/UPS Static Inverter System Control Board

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
									Limerick, Unit 2	05000353
01	05	95	95	-- 001 --	00	02	03	95	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (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
	20.405(a)(1)(iii)		50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
	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 (Include Area Code)
J. L. Kantner, Manager - Experience Assessment, LGS	(610) 718-3400

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
B	EE	CBD	C782	Y						

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 15 single-spaced typewritten lines) (16)

On January 5, 1995, at 1755 hours, the 1A Reactor Protection System (RPS)/Uninterruptible Power Supply (UPS) static inverter series output breaker tripped on overvoltage. This caused a loss of power to the 1A RPS/UPS power distribution panel resulting in automatic actuations of the Primary Containment and Reactor Vessel Isolation Control System, and other various Unit 1 and Common Plant Engineered Safety Features. Operations personnel bypassed the static inverter, restored power to the distribution panel, and reset the isolations. All systems responded as designed during the loss of power event. The cause of this event was an unexpected malfunction of the static inverter's system control board in conjunction with a failure of the inverter to transfer to its alternate power source due to an incorrect overvoltage transfer setpoint. The system control board was replaced and sent to the vendor for a failure analysis. In addition, the overvoltage transfer setpoint of the static inverter was lowered.

Unit Conditions Prior to the Event

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

Unit 2 was in Operational Condition 1 (Power Operation) at 62% power level.

Description of the Event

On January 5, 1995, at 1755 hours, the Unit 1 'A' Reactor Protection System (RPS) (EIIS:JC)/Uninterruptible Power Supply (UPS) (EIIS:EE) static inverter (EIIS:INVT) series output breaker (EIIS:BKR), 52-AY24801, tripped on overvoltage. This caused a loss of power to 1A RPS/UPS power distribution panel (EIIS:PL) 1AY160. 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 Unit 1 systems or subsystems:

- Drywell Chilled Water (DWCW) (EIIS:KM),
- Reactor Enclosure Cooling Water (RECW) (EIIS:CC),
- Primary Containment Instrument Gas (PCIG) (EIIS:LK), and
- Reactor Water Cleanup (RWCU) (EIIS:CE).

The following system lines received isolation signals but no valve motion occurred since the associated valves were in the normally closed position:

- Unit 1 Shutdown Cooling Mode of the Residual Heat Removal (RHR) system (EIIS:BO),
- Unit 1 RHR Heat Exchanger Sample Drains and RHR Drain to Radwaste lines,
- Unit 1 and Unit 2 Primary Containment Nitrogen Inerting,
- Unit 1 and Unit 2 Primary Containment Purge Supply and Exhaust, and
- Unit 1 and Unit 2 Primary Containment Exhaust to Reactor Enclosure Equipment Compartment Exhaust.

In addition, the following ESFs also initiated as designed during the loss of power to the RPS/UPS distribution panel. The Unit 1 Reactor Enclosure (RE) Heating, Ventilation and Air Conditioning (HVAC) system

(EIIS:VA) isolated. The 'A' train of the Standby Gas Treatment System (SGTS) (EIIS:BM), a common plant system, and the Unit 1 Reactor Enclosure Recirculation System (RERS) (EIIS:VA) automatically initiated following the isolation of normal RE HVAC. Additionally, the common Refuel Floor HVAC system isolated.

An 'A' channel half scram signal was generated as designed due to the loss of power to the RPS/UPS power distribution panel. Additionally, a Main Steam Isolation Valve (MSIV) (EIIS:ISV) inboard and outboard half isolation logic actuation occurred.

All expected alarms annunciated and all isolations were verified. All systems responded properly to the loss of power event as verified in accordance with Event procedure E-1AY160, "Loss of 1A RPS and UPS Power."

Shortly thereafter, the second 1A RPS/UPS static inverter series output breaker, 52-CY24801, also tripped on overvoltage, indicating that the cause of the breaker trippings was due to an unexpected malfunction in the 1A RPS/UPS static inverter. Main Control Room (MCR) operators restored the DWCW, RECW and PCIG systems by 1800 hours using PCRVICS isolation bypass switches in accordance with procedure E-1AY160, Off Normal procedure ON-113, "Loss of RECW," and General Plant procedure GP-8, "Primary and Secondary Containment Isolation Verification and Reset." Operations personnel bypassed the static inverter at 1845 hours and reclosed the series output breakers at 1849 hours on January 5, 1995, thereby restoring power to power distribution panel 1AY160. All of the isolations were reset by 2040 hours on January 5, 1995 (a duration of 2 hours and 45 minutes) with the exception of the RWCU system, which was restored by 0239 hours on January 6, 1995, and the Primary Containment Purge Supply and Exhaust isolations, which were reset at 0510 hours on January 6, 1995.

A four hour notification was made to the NRC at 2105 hours on January 5, 1995, in accordance with the requirements of 10CFR50.72(b)(2)(ii), since this event resulted in automatic ESF actuations. This report is being submitted in accordance with the requirements of 10CFR50.73(a)(2)(iv).

Analysis of the Event

All systems responded as designed during the loss of the power to the 1A RPS/UPS power distribution panel. The isolations were bypassed or reset in accordance with plant procedures, and the isolated systems were restored by operations personnel in a sufficient period of time to prevent any adverse impacts on plant systems. There was no release of radioactive material to the environment as a result of this event.

The RWCU system was out of service for 8 hours and 44 minutes. During this time period, there was no significant increase in reactor coolant conductivity (an indicator of reactor water purity) which remained within the limits specified by Limerick Generating Station (LGS) Technical Specifications during the entire event.

If corrective actions were not taken quickly enough by licensed MCR Operations personnel, the potential exists that this event could have resulted in a plant shutdown due to the need to secure the reactor recirculation pumps due to a lack of pump and motor cooling caused by the RECW system isolations. A plant shutdown could also have been required due to drywell temperature and pressure increases as a result of the DWCW system isolation and the resultant loss of drywell cooling. Additionally, if the PCIG system remained isolated for an extended period of time, the MSIVs could have drifted closed resulting in a reactor trip and subsequent challenges to safety-related systems.

Immediate and follow-up actions for this type of event, loss of power to an RPS/UPS power distribution panel, are provided in procedures E-1AY160, ON-113, and GP-8. Licensed MCR 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 plant systems are isolated, and reducing the impact on the plant. Therefore, as a result of this adequate procedural guidance, training, and prompt operator actions, the consequences of this type of event are minimized.

Cause of the Event

The cause of this event was an overvoltage condition on the output of the 1A RPS/UPS static inverter 1A-D160 due to an unexpected equipment malfunction. The system control board (EIIS:CBD) within the static inverter controls the inverter output voltage. This board is suspected

to have caused the overvoltage conditions considering both inverter output breakers eventually tripped on overvoltage. The system control board was sent back to the vendor, Cyberex, for a failure analysis.

A contributing factor to this event was that the static inverter did not transfer to its alternate power source when the overvoltage condition occurred because the inverter's overvoltage transfer setpoint was set too high. Both the Unit 1 and Unit 2 RPS/UPS static inverters (four total) were replaced with Cyberex inverters through implementation of Modification 6112. This modification was approved for implementation in February 1992. The overvoltage transfer setpoint was set at 132V (110%) based on the vendor specifications. However, this value is higher than the overvoltage trip setpoint of 125-127V for the 1A RPS/UPS static inverter series output breakers. Transfer of the static inverter from the normal DC input source to the alternate AC source prior to tripping of the output breakers would have prevented the loss of power to the 1AY160 power distribution panel and the resultant ESF actuations. However, PECO Energy reviews of the design specifications during the development of this modification were less than adequate in that they failed to identify the need to lower this overvoltage transfer setpoint.

Corrective Actions

The static inverter's system control board was replaced and the failed board was returned to the vendor for failure analysis. In addition, the static inverter overvoltage transfer setpoint was lowered from 132V to 124V. This will allow transfer of the static inverter on an overvoltage condition from the DC input source to the alternate AC source prior to tripping the series output breakers. Operations personnel returned the static inverter to its normal lineup at 1419 hours on January 11, 1995.

PECO Energy will evaluate the failure analysis of the inverter's system control board once received from the vendor to determine if any other significant corrective actions are required.

Work orders have also been initiated to lower the overvoltage transfer setpoints of the remaining Unit 1 static inverter (1B-D160) and the similar Unit 2 static inverters (2A-D160 and 2B-D160) from 132V to 124V. In addition, Modification 6112 will be re-reviewed to ensure the appropriateness of all other setpoints.

Previous Similar Occurrences

Static inverter equipment failures have occurred at LGS in the past; however, these failures occurred on inverters manufactured by a different manufacturer. There have been no similar failures of the Cyberex static inverters since their installation at LGS. In addition, the vendor is not aware of any other similar failures within the industry.

There have been no recent incidents resulting from inadequate design review during a modification at LGS. The latest incidents were identified in the 1989 time frame, or earlier, and were generally related to inadequate design reviews which occurred prior to that time period. The factors contributing to those inadequate design reviews have been corrected thro gh changes to the modification process since that time. Although the incident reported by this LER is not considered a generic pr lem, generic corrective actions are under consideration by Engi ing Management.