10 CFR 50.73

PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION
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J. DOERING, JR.
PLANT MANAGER
LIMERICK GENERATING STATION

April 23, 1991
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 an in advertent actuation of the Unit 2 Primary Containment and Reactor Vessel Isolation Control System and a Secondary Containment isolation, Engineered Safety Features, which occurred due to a loss of power. A fuse blew during testing of the Division III 125 VDC Safeguard Battery Charger which is suspected of causing a trip of a 2A Reactor Protection System/Uninterruptible Power Supply distribution panel power supply breaker.

Reference:	Docket Nos. 50-352 50-353
Report Number:	2-91-002
Revision Number:	00
Event Date:	March 24, 1991
Report Date:	April 23, 1991
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,

J Doering

KOS: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) Inadvertent isolation, of the Unit 2 Primary and Secondary Containments due to a blown fuse during testing of a battery changer.

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 3	2 4	9 1	9 1	— 0 0 2	— 0 0	0 4	2 3	9 1	LGS, Unit 1	0 5 0 0 0 3 5 2
										0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
	4	20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		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, Limerick Generating Station	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
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 7	2 3	9 1

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On March 24, 1991, while Unit 2 was shutdown, various actuations of the Unit 2 Primary Containment and Reactor Vessel Isolation Control System and a Unit 2 Reactor Enclosure Secondary Containment isolation occurred. These are Engineered Safety Feature actuations. The actuations are suspected to be the result of a blown 300 amp fuse in the Division III 125 VDC circuitry during load testing of the Division III Safeguard Battery Charger. This blown fuse caused a transient condition in the DC control power to the second of two sets of undervoltage and overvoltage relays for the 2A Reactor Protection System/Uninterruptible Power Supply (RPS/UPS) distribution panel power supply breakers. The loss of control power is suspected of causing one of the protective relays to trip resulting in a trip of the associated RPS/UPS distribution panel power supply breaker. The power supply breaker was reclosed and the 2B loop of Shutdown Cooling was returned to service within 24 minutes. All systems responded as designed during the loss of power. The primary cause of the blown fuse was a lack of information from the manufacturer of a battery capacity test system used to test battery chargers. The appropriate battery charger test procedures will be revised to require testing to be performed with the test equipment in the proper mode. The cause of the trip of the 2A RPS/UPS distribution panel power supply breaker is still under investigation and the results will be provided in a supplement to this LER.

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

Unit Conditions Prior to the Event:

Unit 2 was in Operational Condition 4 (Cold Shutdown) at 0% power level. The 'B' loop of the Residual Heat Removal (RHR) (EIIS:BO) system was in service in the Shutdown Cooling Mode with Reactor Coolant temperature at 124 degrees F.

The Unit 2 Division III 125 VDC Safeguard Battery 18 month inspection was being performed.

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

Description of the Event:

On March 24, 1991, at 1833 hours, various actuations of the Unit 2 Primary Containment and Reactor Vessel Isolation Control System (PCRVICS) (EIIS:JM), and a Unit 2 Reactor Enclosure Secondary Containment isolation occurred. These are Engineered Safety Feature (ESF) actuations. These actuations occurred while utility employed Instrumentation and Controls (I&C) Technicians were performing Surveillance Test (ST) procedure ST-4-095-923-2, "Division III 125 VDC Safeguard Battery 18 Month Inspection." The actuations are suspected to be the result of a blown 300 amp fuse in the Division III 125 VDC circuitry in fuse box 2CD105 which blew during load testing of the Division III 125 VDC Safeguard Battery Charger (see Figure 1). This blown fuse caused a transient condition in the DC control power to the second of two sets of undervoltage and overvoltage relays for the 2A Reactor Protection System Uninterruptible Power Supply (RPS/UPS) Distribution Panel (2AY160) power supply breakers. The loss of control power is suspected of causing one of the voltage relays to trip resulting in a trip of the associated 2A RPS/UPS distribution panel power supply breaker. This breaker trip resulted in a loss of power to the 2AY160 Panel. Main Control Room (MCR) operations personnel immediately received an "A Channel RPS Out of Service" annunciation and other annunciations associated with the loss of power to the 2A RPS channel as a result of the blown fuse in fuse box 2CD105.

This loss of power resulted in isolation of the following Unit 2 systems or subsystems by closing their inboard primary containment isolation valves:

- 'B' loop of RHR in the Shutdown Cooling mode,
- 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).

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

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

- o Unit 2 RHR heat exchanger vacuum breaker (EIIS:VACB) lines,
- o Unit 1 and Unit 2 Primary Containment Nitrogen Inerting,
- o Unit 1 and Unit 2 Primary Containment Purge Supply and Exhaust, and
- o Unit 1 and Unit 2 Primary Containment Exhaust to Reactor Enclosure Equipment Compartment Exhaust.

The following ESF's also initiated as designed due to the loss of RPS power. The Unit 2 Reactor Enclosure (RE) Heating, Ventilation and Air Conditioning (HVAC) system isolated. The 'A' trains of the Standby Gas Treatment System (SGTS) (EIIS:BM), a common plant system, and the Unit 2 Reactor Enclosure Recirculation System (RERS) (EIIS:VA) automatically initiated thus completing the Unit 2 RE Secondary Containment isolation.

Licensed MCR operators immediately entered Event (E) Procedure E-2AY160, "Loss of '2A' RPS and UPS Power," Off Normal (ON) Procedure ON-113, "Loss of RECW," and General Plant (GP) Procedure GP-8, "Primary and Secondary Containment Isolation Verification and Reset." The 2A RPS/UPS distribution panel power supply breaker was reclosed and the 2B loop of Shutdown Cooling was returned to service at 1857 hours. The elapsed time of this event was 24 minutes.

The Division III 125 VDC Safeguard battery was inspected and tested to ensure that no damage had occurred as a result of blowing the 300 amp fuse. Inspection of the affected bus section, cabling and connections was performed and no sign of damage was identified. Data taken for cell voltage, specific gravity and ductor readings were within acceptable limits.

A four hour notification was made to the NRC at 2204 hours on March 24, 1991, in accordance with the requirements of 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:

All systems responded as designed during the loss of RPS power to panel 2AY160. During the 24 minutes that shutdown cooling was not in service, reactor coolant temperature increased approximately 17 degrees from 124 degrees to 141 degrees. The maximum reactor coolant temperature allowed by Technical Specifications (TS) is 200 degrees while in Operational Condition 4. Operations personnel had ample time to restore shutdown cooling prior to exceeding the TS limit since it would have taken approximately one hour and 20 minutes to reach this temperature limit. Additionally, the redundant loop of shutdown cooling was operable in the event that the 'B' loop could not be restored to operation. The isolation of

the DWCW system, the RECW system, and the PCIG system had no affect on plant operations since the plant was shutdown for refueling. There was no release of radioactive material to the environment as a result of this event.

If this event had occurred during full power operation, the potential exists that this event could have resulted in securing of the Reactor Recirculation Pumps followed by a plant shutdown if immediate corrective actions were not taken quickly enough by licensed MCR operations personnel. Plant shutdown could have also been required due to Drywell temperature and pressure increases as a result of the isolation of DWCW and the loss of Drywell cooling. Additionally, if the PCIG system were left out-of-service for a long period of time, the Main Steam Isolation Valves (MSIVs) could have drifted closed.

Immediate and follow-up actions for this type of event, loss of power to an RPS power distribution panel, are provided in procedures E-2AY160, 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 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 were and would be minimized.

Cause of the Event:

The cause of the ESF actuations was due to the loss of power to the 2A RPS/UPS Distribution Panel when one of the power supply breakers for this panel tripped. The actuation logics of the affected ESFs perform their safety function upon loss of power, and hence, the system isolations and actuations occurred. The cause of the trip of the RPS distribution panel power supply breaker is suspected to be related to the blown fuse 300 amp in the Division III Safeguard 125 VDC circuit since no other power transients occurred prior to the event and the Division III 125 VDC circuit provides control power to the two protective relays for the breaker that tripped.

The primary cause of the blown fuse was a lack of information from Alber Engineering, Inc., the manufacturer of the BCT-1000 Battery Capacity Test System, concerning the limitations of the use of this test equipment in the automatic mode while testing battery chargers. When used in the 'AUTO' mode during performance of procedure ST-4-095-923-2 on the battery charger, the micro-processor in the BCT-1000 detected changes in voltage as a result of being connected to a rectified A.C. voltage source (i.e. the battery charger and the battery). The microprocessor in the BCT-1000 responds to a 9 millivolt change in the DC voltage being monitored. Voltage signal ripple on the output of the battery charger caused the computer memory to saturate and the test equipment to lose control of the current flow through the test equipment. A sharp increase in current flow through the test equipment exceeded the capacity of the battery charger and drew excessive current from the battery. This caused the 300 amp fuse in the battery output circuit to blow. After the initial transient, the

test equipment isolated itself from the battery charger, allowing the charger to recover and supply power to the DC bus. The vendor manual did not contain a recommendation that battery charger testing should be performed with the BCT-1000 in the 'MANUAL' mode. Conversations with the vendor following this event revealed the limitation. The ST procedure is based on information in the vendor manual, and therefore, the procedure did not contain a restriction on the use of the 'AUTO' mode.

The cause of the trip of the 2A RPS/UPS distribution panel power supply breaker is still under investigation. The overvoltage and undervoltage relays are designed to "fail-as-is" on a loss of control power. During this event, one of the relays apparently caused the power supply breaker to trip, although no flags indicating the cause for the trip were displayed on either of the relays. Testing has been performed on the undervoltage and overvoltage relays and both functioned properly. The 125 VDC spiking which occurred during this event was simulated during bench testing and the breaker trip could not be duplicated. The relays have been reinstalled in the circuit and have successfully passed a calibrational/functional surveillance test and are considered operable. No previous relay trips of this type have been experienced at Limerick Generating Station. The investigation into the breaker trip is on going and the manufacturer of the relays, Asea Brown Boveri, will be consulted. The results of the investigation will be provided in a supplement to this LER to clarify the cause and address any additional corrective actions. The supplement to this LER is expected to be submitted by July 23, 1991.

Corrective Actions:

The following Unit 1 and Unit 2 procedures for divisional safeguard battery 18-month testing and preventative maintenance will be revised. The procedures will require battery charger testing to be performed with the BCT-1000 test equipment in the 'MANUAL' mode:

ST-4-095-921-1	ST-4-095-921-2
ST-4-095-922-1	ST-4-095-922-2
ST-4-095-923-1	ST-4-095-923-2
ST-4-095-924-1	ST-4-095-924-2
and PMQ-095-001.	

Unit 2 procedures scheduled to be performed have been revised prior to performance and all indicated procedures are expected to be permanently revised by June 21, 1991.

A letter has been sent from the plant staff to Alber Engineering, Inc., the test equipment manufacturer. This letter recommended that Alber include the information that clearly describes the limitations of the use of the BCT-1000 test equipment on battery chargers in their instruction manual. Additionally, an Operating Experience Report on this event has been issued on the INPO Nuclear Network.

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

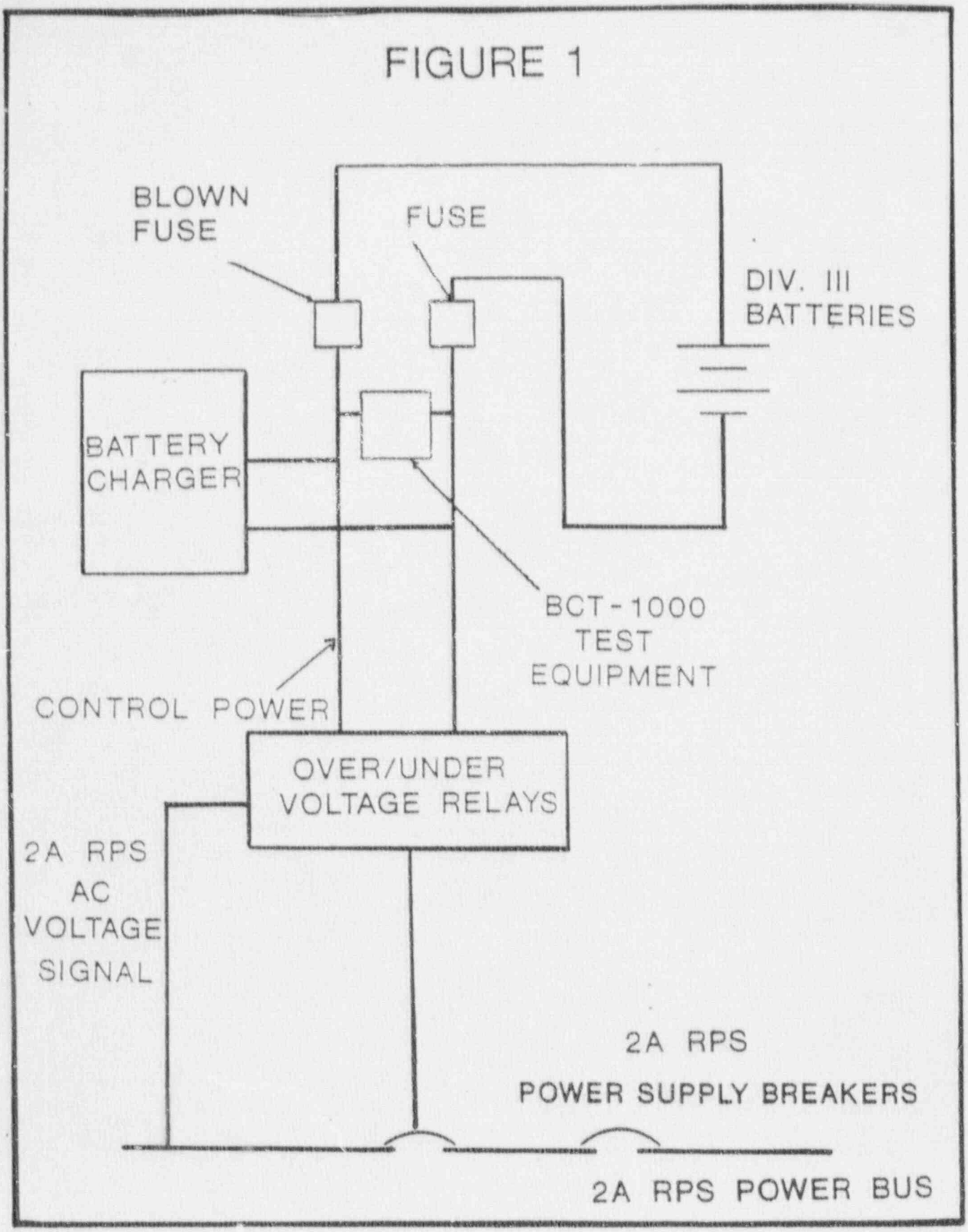
Previous Similar Occurrences:

Several LERs reported PCRVICS isolations due to loss of power to the RPS panel, however, none were due to the same cause as the event reported in this LER. Therefore, the corrective actions implemented for these events could not have prevented this event.

Tracking Codes: X3: Test Equipment malfunction or misapplication

D: Procedure Deficiency

FIGURE 1


BLOWN FUSE
FUSE
DIV. III BATTERIES
BATTERY CHARGER
BCT-1000 TEST EQUIPMENT
CONTROL POWER
OVER/UNDER VOLTAGE RELAYS
2A RPS AC VOLTAGE SIGNAL
2A RPS POWER SUPPLY BREAKERS
2A RPS POWER BUS