

## PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION

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SANATOGA, PENNSYLVANIA 19464

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J. DOERING, JR.  
PLANT MANAGER  
LIMERICK GENERATING STATION

January 17, 1992  
Docket No. 50-352  
License No. NPF-39

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

SUBJECT: Licensee Event Report  
Limerick Generating Station - Unit 1

This LER reports the discovery of the Unit 1 High Pressure Coolant Injection (HPCI) system being inoperable which alone could have prevented the fulfillment of its safety function needed to shutdown the reactor and mitigate the consequences of an accident. During maintenance on the HPCI system, the steam supply inboard isolation valve motor failed rendering the system inoperable.

Reference:	Docket No. 50-352
Report Number:	1- 028
Revision Number:	00
Event Date:	December 18, 1991
Report Date:	January 17, 1992
Facility:	Limerick Generating Station P.O. Box 2300, Sanatoga, PA 19464-2300

This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(v).

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) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104  
EXPIRES 8/31/85

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
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TEXT IF MORE SPACE IS REQUIRED, USE ADDITIONAL NRC FORM 2664 (11/73)

Unit Conditions Prior to the Event:

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

The Unit 1 High Pressure Coolant Injection (HPCI, E11S:BJ) system had been removed from service on December 10, 1991, to facilitate maintenance work on the HPCI system steam supply line outboard isolation valve (E11S:ISV), HV-55-1F003. The HPCI system inboard isolation valve, HV-55-1F002, was closed in conjunction with this work and the 14 day Technical Specifications (TS) Limiting condition for Operation was entered.

Description of the Event:

On December 18, 1991, following completion of maintenance on the HPCI system steam supply outboard isolation valve, HV-55-1F003, operations personnel attempted, unsuccessfully, to open the HPCI system steam supply inboard isolation valve, HV-55-1F002. Subsequent investigation by maintenance personnel led to the determination that the valve motor (E11S:MD) had failed upon closure of valve HV-55-1F002 on December 10, 1991. A Unit 1 shutdown was initiated on December 18, 1991, at 1800 hours, to facilitate repair of the valve.

The inability to open HV-55-1F002 constituted a condition which alone could have prevented the fulfillment of the safety function of the HPCI system needed to shutdown the reactor and mitigate the consequences of an accident.

The valve motor was repaired on December 20, 1991, the HPCI system was declared operable, and Unit 1 was restarted on December 30, 1991.

A one hour non-emergency notification was completed on December 18, 1991, at 1800 hours to report the initiation of a Technical Specifications (TS) required shutdown in accordance with 10CFR50.72(b)(1)(i)(A), since the shutdown was required to repair the HPCI system. This notification also satisfied the reporting requirement for the occurrence of a condition which alone could have prevented the fulfillment of the safety function of the HPCI system that is needed to shutdown the reactor and mitigate the consequences of an accident. This report is being submitted in accordance with the requirements of 10CFR50.73(a)(2)(v). Since the repairs to the HPCI system were completed prior to the expiration of the 15 Action Time limit, the reporting requirement for the completion of a plant shutdown required by TS, 10CFR50.73(a)(2)(i)(A), does not apply.

Analysis of the Event:

The actual consequences of this event were minimal in that an accident condition did not occur during the time in which the HPCI system was inoperable. Additionally, no radioactive material was released to the environment as a result of the HPCI system being inoperable. Prior to closure of the HV-55-1F002 on December 10, 1991, the HPCI system was operable.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED ONE NO. 3190-0104  
EXPIRES 8/31/95

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TEXT IF MORE SPACE IS REQUIRED, use additional NRC Form 2664 (1/77)

If an accident had occurred while the HPCI system was inoperable, sufficient Emergency Core Cooling Systems were available to ensure safe shutdown of the reactor and to mitigate the consequences of an accident. Additionally, the Reactor Core Isolation Cooling (RCIC, EISS:BN) system and the Main Steam Relief Valves (MSRVs, EISS:SB) were operable and could have been utilized by the operators to assist in reactor pressure and level control.

Cause of the Event:

The cause of this event was the failure of the HPCI steam supply inbound isolation valve motor. Upon valve closure on December 10, 1991, the torque switch did not trip resulting in the valve motor running continuously, eventually stalling and causing a ground fault in the motor windings. An examination of the bearings cartridge stem by maintenance personnel revealed "bite" marks or indication that the belleville washers were binding.

The design of the Primary Containment Isolation Valves (PCIV) is such that a valve closure signal is stopped only after the torque switch is tripped indicating the valve is fully closed. In this case, the torque switch was not tripped due to a failure of the motor operator gear spring pack. The spring pack in the actuator internals consists of a series of belleville washers attached to the actuator worm in a housing cavity. During actuator operation, the worm gear rotation becomes hindered by increasing levels of resistance caused by the valve seating. This results in an increase of torque buildup within the actuator causing a lateral worm movement that compresses the spring pack. This normal movement is the result of the worm threads attempting to turn out of the worm gear teeth. The torque switch operates solely on the basis of torque induced linear movement as a result of the compression of the spring pack by the worm gear. Once the appropriate level of torque is produced, the worm gear moves and trips the torque switch resulting in the motor stopping. The spring pack failed to compress when the valve closed due to the spring pack belleville washers binding on the bearing cartridge stem. The gear assembly stopped when the valve fully seated causing the motor to stall. Electrical power was continuously supplied to the stalled motor until the motor windings failed, causing a ground fault which caused the motor breaker to trip on overcurrent. A failure of the belleville washers is very unusual.

Corrective Actions:

The following actions were or will be taken:

- The valve motor and spring pack were replaced on December 20, 1991.
- The original spring pack will be sent to the manufacturer for further examination and analysis.
- Several grease samples were taken from the actuator. These will be sent to an EPRI lubricant specialist as samples of naturally aged grease for evaluation.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

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TEXT (If more space is required, use additional NRC Form 3054's (17))

- An inquiry has been put on Nuclear Network to determine if others in the industry have experienced this type of binding phenomenon.

If any additional information regarding the exact cause of the binding phenomenon is obtained then any appropriate additional corrective actions will be taken and included in a supplement to this report.

Previous Similar Occurrences:

None

Tracking Codes: B17 Deficient Equipment