

## PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION

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SANATOGA, PENNSYLVANIA 19464

(215) 327-1200 EXT. 2000

June 20, 1991

Docket No. 50-353

License No. NPF-85

J. DOERING, JR.  
PLANT MANAGER

LIMERICK GENERATING STATION

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555SUBJECT: Licensee Event Report  
Limerick Generating Station - Unit 2

This LER revision reports an event where the Unit 2 High Pressure Coolant Injection (HPCI) system was in a degraded condition which alone could have prevented the fulfillment of its safety function. This was due to a personnel error which resulted in condensate accumulating inside the HPCI turbine exhaust pipe.

Reference:	Docket No. 50-353
Report Number:	2-89-010
Revision Number:	01
Event Date:	October 13, 1989
Report Date:	June 20, 1991
Facility:	Limerick Generating Station P.O. Box A, Sanatoga, PA 19464

This LER has been revised to reflect changes which were made to the actions to prevent recurrence. The changes are indicated by revision bar markers in the right hand margins. This LER is submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(v)(A) and (D).

Very truly yours,



DMS:rgs

cc: T. T. Martin, Administrator, Region I, USNRC  
T. J. Kenny, USNRC Senior Resident Inspector, LGS9106260278 910620  
PDR ADDCK 05000353  
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## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Limerick Generating Station, Unit 2										DOCKET NUMBER (2) 0 5 0 0 0 3 5 3 1 OF 0 17										PAGE (3) 1 OF 0 17			
TITLE (4) Unit 2 HPCI System in a Degraded Condition due to a Personnel Error Which Resulted in Condensate Accumulating Inside the Turbine Exhaust Pipe.																							
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 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0									
1	0	1	3	8	9	8	9	0	1	0	0	1	0	6	2	0	9	1	0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0				
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.73 (Check one or more of the following) (11)																					
1		20.402(b)				20.405(a)				50.73(a)(2)(i)				73.71(b)									
POWER LEVEL (10)		0 5 4				20.405(a)(1)(i)				50.73(a)(2)(i) X				73.71(c)									
		20.405(a)(1)(ii)				50.73(a)(2)(ii)				50.73(a)(2)(iii)				OTHER (Specify in Abstract below and in Text, NRC Form 366A)									
		20.405(a)(1)(iii)				50.73(a)(2)(iii)				50.73(a)(2)(iv)													
		20.405(a)(1)(iv)				50.73(a)(2)(iv)				50.73(a)(2)(v)													
		20.405(a)(1)(v)				50.73(a)(2)(v)				50.73(a)(2)(vi)													
		20.405(a)(1)(vi)				50.73(a)(2)(vi)				50.73(a)(2)(vii)													
LICENSEE CONTACT FOR THIS LER (12)																							
NAME G. J. Madsen, Regulatory Engineer, Limerick Generating Station										TELEPHONE NUMBER AREA CODE 215 327-1200													
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	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC				
SUPPLEMENTAL REPORT EXPECTED (14)										EXP. CTED SUBMISSION DATE (15)													
YES (If yes, complete EXPECTED SUBMISSION DATE)										X NO													
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																							

On October 13, 1989, the Unit 2 High Pressure Coolant Injection (HPCI) system was declared inoperable due to a condensate accumulation inside the HPCI turbine exhaust pipe resulting from a drain pipe flow orifice (FO) blockage. This event resulted in the HPCI system being in a degraded condition which alone could have prevented the fulfillment of its safety function needed to shutdown the reactor and mitigate the consequences of an accident. An accident condition did not occur during the time which the HPCI system was inoperable or could have been degraded, and HPCI was not called upon to perform its intended safety function. If HPCI had become unavailable due to the accumulation of condensate in the turbine exhaust pipe, sufficient Emergency Core Cooling Systems and the Reactor Core Isolation Cooling system were available to ensure safe shutdown of the reactor. A personnel error lead to the inadvertent overfilling of the suppression pool and flooding of the HPCI turbine exhaust pipe during start-up activities. This resulted in the addition of debris into the turbine exhaust pipe which later resulted in the FO blockage. Compressed air was utilized to unblock the FO and the accumulated condensate then drained to the barometric condenser. Quarterly routine tests are being performed to verify flow through both Unit 1 and 2 HPCI system FOs. A flush of the Unit 2 HPCI drain pot was performed during a HPCI system outage.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104

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TEXT (If more space is required, use additional NRC Form 366A-1 (17))

Unit Conditions Prior to the Event:

Unit 2

Operating Mode: 1 (Power Operation)

Reactor Power: 54.72%

Description of the Event:

On October 13, 1989, at 1855 hours, the Unit 2 High Pressure Coolant Injection (HPCI) (E11S:BQ) system was declared inoperable due to a condensate accumulation inside the HPCI turbine exhaust pipe resulting from a drain pipe flow orifice (FO) (E11S:OR), FO-56-2D017, blockage (Refer to figure 1). This event resulted in the HPCI system being in a degraded condition which alone could have prevented the fulfillment of its safety function needed to shutdown the reactor and mitigate the consequences of an accident.

While performing a housekeeping inspection of the Unit 2 HPCI pump room on October 13, 1989, at 1600 hours, station Maintenance personnel heard a "bubbling" sound inside of the drain pot for the HPCI turbine exhaust pipe. HPCI was available but not in operation at this time. They immediately notified the HPCI system engineers.

The HPCI system engineers discovered that steam was leaking past the seat of the HPCI Steam Supply Valve (HV-55-2F001) to the above valve seat drain of the HPCI Turbine Stop Valve (FV-56-212). The above seat drain for FV-56-212 empties into the HPCI turbine exhaust pipe drain pot, which empties to the HPCI barometric condenser (E11S:CDU) through a 1 inch diameter drain line that contains the 1/8 inch FO. The engineers observed that the piping below the FO was not hot indicating that the leaking steam and resultant condensate was not passing through the FO. The engineers concluded that the FO was clogged which resulted in the collection of condensate in the exhaust piping. The leaking steam was passing through the collected condensate resulting in the observed "bubbling" sound.

The HPCI system engineers notified the Main Control Room (MCR) Shift Supervision of the problem, and Operations personnel declared the Unit 2 HPCI system inoperable on October 13, 1989 at 1855 hours. Under the controls of a Troubleshooting Control Form (TCF), the HPCI system engineers cleared the blocked FO utilizing compressed air. The accumulated condensate then drained to the barometric condenser. The operators then placed HPCI in service in accordance with the system procedure S55.1.D, "HPCI Full Flow Functional Test." The HPCI system engineers verified that the HPCI system operated satisfactorily and that the drain pot was draining to the barometric condenser. Additionally, valve HV-55-2F001 was cycled opened and closed during the HPCI system operation, and the steam leakage stopped. HPCI was then declared operable at 2220 hours. HPCI was inoperable for less than four (4) hours.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 365A.) (17)

The amount of condensate which had accumulated was estimated to be approximately seventy-five gallons based on the observed number of cycles of operation of the HPCI barometric condenser condensate pump after the FO was unblocked. As a result, Engineering concluded that a condensate level of approximately ten inches existed inside the HPCI turbine and its connecting eighteen inch diameter exhaust pipe. It is estimated that over one-half of the available HPCI turbine exhaust pipe area was filled with water prior to clearing the FO blockage.

The Unit 2 HPCI system is a single train safety system and based on an evaluation conducted subsequent to declaring the HPCI system inoperable, station personnel determined that the discovered condition could have prevented the HPCI system from performing its intended safety function needed to shutdown the reactor and mitigate the consequences of an accident. As a result, a notification was made to the NRC in accordance with the requirements of 10CFR 50.72 (b)(2)(iii)(A) and (D) at 1830 hours on October 14, 1989. Accordingly, this written report is being submitted in accordance with the requirements of 10CFR 50.73 (a)(2)(v)(A) and (D).

Consequences of the Event:

The consequences of this event were minimal in that no radioactive material was released to the environment as a result of the HPCI system being in a degraded condition. Additionally, an accident condition did not occur during the time in which the HPCI system was inoperable or could have been degraded, and therefore HPCI was not called upon to perform its intended safety function. If HPCI had become unavailable due to the accumulation of condensate in the turbine exhaust pipe, sufficient Emergency Core Cooling Systems (ECCS) and the Reactor Core Isolation Cooling (RCIC) system were available to ensure safety shutdown of the reactor and mitigate the consequences of an accident.

The potential consequences of HPCI operating in the "as found" condition have been evaluated by Engineering. An initiation of the HPCI system with over one-half of its turbine exhaust area being obstructed could have resulted in any one or combination of the following.

- o A HPCI turbine trip due to high turbine exhaust pressure.
- o A water hammer transient in the HPCI turbine exhaust piping causing potential damage to the exhaust piping and its supports.
- o Condensate being forced through the turbine seals and ultimately into the HPCI hydraulic lube oil system. The hydraulic lube oil system opens the HPCI turbine stop valve and regulates the HPCI turbine control valve during system operation. With water in the lube oil system, the ability of HPCI to function as designed through the duration of an accident condition can not be assured. Additionally, water in the lube oil could result in inadequate lubrication of the turbine bearings and damage to the turbine shaft.



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

- o Inability of HPCI to achieve its required TS response time.

If this condition went undiscovered, operation of the HPCI system with the HPCI turbine and turbine exhaust pipe completely filled with condensate would increase the severity and probability of the conditions identified above.

Cause of the Event:

The cause of this event was the accumulation of small pieces of debris which blocked the 1/8 inch FO which prevented condensate from draining from the HPCI turbine exhaust pipe to the barometric condenser. A personnel error is the most probable cause that lead to the addition of debris into the turbine exhaust pipe which later resulted in the FO blockage. The condensate accumulation inside the drain pot and the turbine exhaust pipe was a combined effect of steam leaking past the seat of HV-55-2F001 and the blocked FO.

Plant Staff and Engineering have determined the probable cause of the FO blockage to be the result of the accumulation of scale, rust, or grinding debris from original construction. This debris was introduced into the HPCI exhaust pipe when the Suppression Pool (SP) (E1S:BT) was inadvertently overfilled during Unit 2 start-up activities on April 18, 1989 (prior to initial fuel load). This resulted in advertently flooding of the Unit 2 HPCI turbine and exhaust pipes. Overfilling of the SP occurred when water was being transferred from the refueling water storage tank to the SP for temporary storage. During this transfer, the permanent plant SP level indicators and alarms were not in service and temporary local level indication was installed. However, a start-up engineer failed to open the isolation valve for the temporary level indicator, and actual water level was not indicated. The SP water flowed through the normally open HPCI Turbine Exhaust Isolation Valve, HV-55-2F072, and leaked past the seat of the HPCI Turbine Stop Check Valve, 55-2F021, to the turbine. The SP water leaked past the check valve due to insufficient differential pressure to close the valve. While water was being transferred from the refueling water storage tank to the SP, and individual in the Unit 2 HPCI pump room noticed water flowing from the turbine shaft seals. The MCR was immediately notified and the transfer of water was stopped. The debris then settled inside the HPCI turbine exhaust pipe drain pot, and later accumulated inside the FO creating the blockage. The condensate from the leaking steam collected in the drain pot and eventually started to fill the turbine exhaust line and turbine.

The FO blockage may have existed since the Suppression Pool (SP) (E1S:BT) overfill incident on April 18, 1989, but the accumulation of condensate probably existed only since August 20, 1989 when the HPCI system was last operated.

Corrective Actions:

Immediately following the discovery of the condensate accumulation inside the Unit 2 HPCI turbine exhaust pipe and drain pot, the HPCI system engineers notified the MCR, and Operations personnel removed HPCI from service and

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TEXT (If more space is required, use additional NRC Form 3664's (17))

declared HPCI inoperable at 1855 hours on October 13, 1989. Under a TCF, the HPCI system engineers utilized compressed air to unblock the FO. The accumulated condensate then drained to the barometric condenser. The Unit 2 HPCI system was then placed in service, and the HPCI system engineers verified that the HPCI system was operating satisfactorily. HPCI was then declared operable on October 13, 1989, at 2220 hours. Additionally, the MCR operators cycled valve HV-55-2F001 opened and closed, and the steam leaking past its seat was stopped.

Actions Taken to Prevent Recurrences:

Engineering has concluded that the current design of the HPCI turbine exhaust pipe drain pot with a FO is adequate for draining of anticipated condensate. Since the debris causing the FO blockage was blown back up towards the drain pot, this problem may recur. Therefore, the following actions are being taken to verify flow through the FO and preclude further FO blocking.

1. For the Unit 1 and 2 HPCI systems, weekly routine tests (RT) will be written and performed to verify flow through both FCs. Although the Unit 1 HPCI turbine exhaust drain system has not experienced any problems, the system will be inspected weekly as an added precaution. These tests are expected to be written and implemented by November 30, 1989.
2. For the Unit 2 HPCI system, a flush of the HPCI drain pot will be performed during the next appropriate HPCI outage. The steam flow during HPCI system testing adequately flushes the turbine casing and exhaust pipe. Since the bottom of the exhaust pipe drain pot is not in the flow path of the exhaust steam, this is a collection point for any debris, and a flush of the drain pot and its drain pipe is necessary.
3. The blocked FO has been flushed per Action 2 stated above, and the weekly RTs implemented in Action 1 have been performed satisfactorily for a period of eight (8) months. Based on an evaluation of the satisfactory test performances, and no recurrence of the FO blockage, the RT frequency has been changed from weekly to quarterly, and a modification was deemed unnecessary.

Since the SP overflow incident on April 18, 1989, the Unit 2 SP water has been filtered removing the rust, scale or grinding debris. Additionally, the permanent Unit 2 SP level indicators and alarms are now in service to help preclude overflowing of the SP. Therefore, it is not expected that any debris from the SP will enter the turbine exhaust piping in the future.

Other industry events and HPCI system designs were reviewed and no other similar problems were identified.

Since the steam leaking past the seat of valve HV-55-2F001 stopped when the valve was cycled, no further corrective actions are planned.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

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TEXT (If more space is required, use additional NRC Form 388A's/112)

The only other system that was affected by the SP overflow incident was the Unit 2 RCIC system. However, flooding of the RCIC turbine exhaust pipe did not result in any operability problems of the RCIC system. The RCIC turbine exhaust pipe drain pot is instrumented with a high level alarm which annunciates in the MCR. The RCIC drain system utilizes a 1/2 inch steam trap rather than a FO. Additionally, if blockage of the steam trap would occur, a level switch activated bypass valve allows drainage of the drain pot to prevent accumulation of condensate in the exhaust pipe. Therefore, a similar problem with RCIC is not expected to occur.

Previous Similar Occurrences:

None

Tracking Codes: A Personnel Error  
B 99 Other Deficiency

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		89	010	01	

TEXT (If more space is required, use additional NRC Form 366A (9-83))

## FIGURE 1

