

## PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION  
 P. O. BOX A  
 SANATOGA, PENNSYLVANIA 19464  
 (215) 327-1200 EXT. 2000

J. DOERING, JR.  
 PLANT MANAGER  
 LIMERICK GENERATING STATION

December 11, 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 a condition prohibited by Technical Specifications (TS) in that eight butterfly type Primary Containment (PC) isolation valves associated with the PC Purge and Exhaust system and PC Hydrogen Recombiner were inoperable and the associated TS "Actions" were not taken in the specified time period. This condition was due to the lack of an industry testing method for torque seated motor-operated butterfly valves during the Unit 1 and Unit 2 construction and startup testing programs.

Reference: Docket Nos. 50-352  
 50-353  
 Report Number: 1-91-008  
 Revision Number: 01  
 Event Date: March 8, 1991  
 Report Date: December 11, 1991  
 Facility: Limerick Generating Station  
 P.O. Box 2300, Sanatoga, PA 19464

This revised LER is being submitted to provide the conclusions of further investigation into the cause of this event and associated corrective actions. Changes to this LER are indicated by revision bar markers in the right hand margins. The original LER was submitted pursuant to the requirements of 10CFR50.73(a)(2)(i)(B).

Very truly yours,

WGS/cah

cc: T. T. Martin, Administrator, Region 1, USNRC  
 T. J. Kenny, USNRC Senior Resident Inspector, LGS

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Limerick Generating Station, Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 3 5 2	PAGE (3) 1 OF 0 5
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TITLE (4) This LER reports a condition prohibited by TS in that eight Primary Containment isolation valves were inoperable due to inadequate torque switch settings.

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)
03	08	91	19	08	01	12	11	91	Unit 2		0 5 0 0 0 3 5 3
0 5 0 0 0											

OPERATING MODE (9) 1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.71 (Check one or more of the following) (11)									
POWER LEVEL (10) 1, 0, 0	20.402(b)		20.405(e)		50.73(a)(2)(iv)		73.71(b)			
	20.405(a)(1)(i)		50.38(a)(1)		50.73(a)(2)(v)		73.71(c)			
	20.405(a)(1)(ii)		50.38(a)(2)		50.73(a)(2)(vi)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)			
	20.405(a)(1)(iii)		X 50.73(a)(2)(i)		50.73(a)(2)(vii)(A)					
	20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(vii)(B)					
20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(viii)						

LICENSEE CONTACT FOR THIS LER (12)									
NAME G. J. Madsen, Regulatory Engineer, Limerick Generating Station							TELEPHONE NUMBER		
							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 NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC

SUPPLEMENTAL REPORT EXPECTED (14)							EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete expected submission date) <input checked="" type="checkbox"/> NO											

ABSTRACT (Limit to 1600 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On March 8, 1991, Limerick Generating Station maintenance personnel performed diagnostic testing to support the design basis engineering review for Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." This testing was performed on a Unit 2 Primary Containment (PC) motor-operated butterfly valve (MOBV) associated with the PC Purge and Exhaust system. However, maintenance personnel discovered that this valve and seven other similar type valves had torque switch settings that would result in the MOBV tripping on high torque before the valve could adequately close and seat in the event these valves were required to close during a differential pressure condition. These eight MOBVs were declared inoperable and the applicable Unit 1 and Unit 2 PC penetrations were isolated by deactivating and securing the redundant PC isolation valves in the closed position. The actual consequences of this condition were minimal and there was no release of radioactive material to the environment. The cause of this event is the result of an inadequate industry testing method used for torque seated MOBVs installed during the Unit 1 and Unit 2 construction and startup testing programs. The investigation into the cause of this event concluded that generic implications are limited to torque seated MOBVs. The torque switch settings for the eight affected MOBVs have been adjusted after application of the Valve Operator Test and Evaluation System.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		0   0   8	0   1	0   2	OF	0   5

TEXT (if more space is required, use additional NRC Form 366A (2/177))

Unit Conditions Prior to the Event:

Unit 1 Operational Condition was 1 (Power Operation) at 100% Power Level.

Unit 2 Operational Condition was 1 (Power Operation) at 100% Power Level.

There were no other structures, systems, or components out of service which contributed to this event.

Description of the Event:

On March 8, 1991, Limerick Generating Station maintenance personnel were performing diagnostic testing on motor operated butterfly valves (MOBVs) by using the Valve Operator Test and Evaluation System (VOTES) to support the design basis engineering review for NRC Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." This testing was performed on a Unit 2 Primary Containment (PC) isolation valve (EIIIS:ISV), HV-057-215, associated with the PC Purge and Exhaust system (EIIIS:BB). This valve is a MOBV. The purpose of this diagnostic testing was to determine the type of spring pack that was installed in this MOBV. However, during the diagnostic testing of HV-057-215, maintenance personnel discovered that the "as found" torque switch setting for the valve motor operator was too low. This would result in the motor-operator tripping on high torque before the valve could adequately close and seat if this valve was required to close during a differential pressure condition, e.g., 44 psig during a design basis Loss of Coolant Accident (LOCA).

Further testing by maintenance personnel indicated that the actual motor-operator torque output for HV-057-215 was limited to 992 ft-lbs due to the low torque switch setting rather than the design torque output requirement of 4584 ft-lbs of torque. As a result of this condition, HV-057-215 was not capable of performing its PC isolation design function, thereby, making this valve inoperable. Therefore, at 1448 hours, on March 8, 1991, HV-057-215 was declared inoperable and the Unit 2 PC penetration X-26 was isolated in accordance with the ACTION of Technical Specifications (TS) Section 3.6.3 by deactivating and securing HV-057-215 in the closed position.

Maintenance personnel then performed a review of the original startup test packages for all MOBVs (i.e., 22 total for Unit 1 and Unit 2). The scope of this review was limited to motor-operated valves that were tested with a similar test method utilized on MOBV HV-057-215. This review identified that the following MOBVs did not meet torque design specifications for adequate valve seating in the event of a differential pressure condition or did not have test data available to support adequacy of MOBV testing.

<u>Unit 1 MOBVs</u>	<u>Pent. #</u>	
HV-057-112	X-202	PC Exhaust Line
HV-057-115	X-26	PC Exhaust Line
HV-057-166	X-202	'A' PC Hydrogen Recombiner Return Line

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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

<u>Unit 2 MOBVs</u>	<u>Pent. #</u>	
HV-057-212	X-202	PC Exhaust Line
HV-057-215	X-26	PC Exhaust Line
HV-057-247	X-201A	PC Purge Supply Line
HV-057-261	X-26	'A' PC Hydrogen Recombiner Supply Line
HV-057-266	X-202	'A' PC Hydrogen Recombiner Return Line

Therefore, on March 8, 1991, the above listed PC isolation valves were also declared inoperable and the redundant PC isolation valves associated with Unit 1 PC penetrations X-26 and X-202 and Unit 2 PC penetrations X-201A and X-202 were deactivated and secured in the closed position.

Based upon the review of the original MOBV test packages, we have concluded that this condition has existed since October 26, 1984, and July 10, 1989, the dates of the issuance of the Unit 1 and Unit 2 Low Power Operating Licenses, respectively. The ACTIONS required by Unit 1 and Unit 2 TS Section 3.6.3 were not taken within the specified time period constituting a condition prohibited by TS. This report is being submitted in accordance with the requirements of 10CFR50.73(a)(2)(1)(B).

#### Analysis of the Event:

The actual consequences of this condition were minimal in that at no time during operation of the PC Purge and Exhaust system or the Recombiner did an event occur producing a differential pressure condition which would have prevented the MOBVs from closing and sealing. Additionally, there was no release of radioactive material to the environment as a result of this condition.

Each of the affected MOBVs has a redundant PC isolation valve which is not a MOBV and was operable while the MOBV was open providing isolation capability. In the event that an accident condition did occur involving a LOCA and the redundant PC isolation valve failed to close, Primary Containment integrity would not be maintained. The affected PC isolation valves would begin to close rapidly (i.e., less than 6 seconds after receipt of isolation signal) but would not adequately seat due to insufficient motor-operator torque resulting from the low torque switch setting. Valve seat leakage would occur with the potential for some radioactive release from either Unit 1 or Unit 2 PC penetrations to Secondary Containment. Additionally, the potential exists for the downstream Standby Gas Treatment System duct work to be damaged by pressurization resulting from the inadequate closure of the MOBVs. However, the magnitude of the pressure surge would be limited by the near full closure of the MOBVs and the limited radioactive release resulting from this condition would be contained within the Secondary Containment.

Additionally, because the PC purge and vent valves may be opened during Operational Conditions 1, 2, and 3 (i.e., Power Operation, Startup, and Hot Shutdown) for only a limited period of time (restricted to less than 90 hours per year), the probability that a LOCA would occur while the affected PC isolation valves are open is low.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Limerick Generating Station, Unit 1	0 5 0 1 0 3 5 2 9 1	0 0 8	0 1	0 4	OF	0 5

TEXT (if more space is required, use additional NRC Form 366A 2/117)

Cause of the Event:

The cause of this event (i.e., low torque switch setting on the butterfly valve motor operators) was determined to be the result of an inadequate industry testing method used for torque seated MOBVs installed in accordance with manufacturer specifications during Unit 1 and Unit 2 construction and startup testing programs.

The torque seated MOBVs used for containment isolation require fast closing times; therefore, inertia is a major effect that was considered by the manufacturer. Inertial effects continue after the torque switch trips, since the motor and gearing are moving at a relatively high speed with a given mass. The actuator continues to possess closing torque output even though the electric power to the actuator has stopped. Since the inertial effects for torque seated MOBVs were found to be high through manufacturing testing, the manufacturer could either, 1) design the valve components to withstand the higher torque output being developed, or 2) adjust the torque switch to a lower setting so the torque output produced by the valve motor operator would not result in internal valve component damage as a result of exceeding the designed valve seating torque (i.e., motor operator torque plus torque attributed to inertial effects). The manufacturer choose to reduce the torque switch setting of the valve operator during production testing thereby allowing inertial effects to aid in obtaining the valve seating torque. Prior to the development of VOTES in 1989, there was no accurate industry testing method that could directly measure valve seating torque consisting of both motor operator output torque and torque generated due to inertial effects. Therefore, design acceptance of torque seated MOBVs during Unit 1 and Unit 2 construction and startup was based upon the manufacturer's model and validation testing programs and our motor operator torque bench testing prior to valve installation. The manufacturer's model and validation testing program included a study into the dynamic air flow phenomena through scale model sized valves. As a result of this test program, the manufacturer assigned an actuator torque margin of 2.7:1 over the torque value determined to be required to overcome worst case aerodynamic torque conditions. However, there was not an accurate field test method existing at the time of valve installation to adequately set torque switch settings for MOBVs. As a result, the torque switch settings for some MOBVs were set too low to adequately ensure valve closure under accident differential pressure conditions.

Therefore, on March 8, 1991, during performance of diagnostic testing on installed MOBVs using VOTES, maintenance personnel discovered that MOBV valve seating torque was below the required value. We have concluded that this condition was the result of an inadequate industry testing method used at the time of installation. This resulted in the failure to identify the need to adjust MOBV torque settings as supplied by the manufacturer to account for inertial effects caused by varying pipe system rigidity for specific valve installations.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (3)			PAGE (3)	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Limerick Generating Station, Unit 1	0 8 0 0 0 3 5 2	9 1	0 0 8	0 1	0 5	OF 0 5

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

Corrective Actions:

The affected MOBVs for Unit 1 and Unit 2 have had their torque switch settings adjusted after using the VOTES test method to achieve proper valve seating torque as specified on the Manufacturer Motor Operator Compatibility Form. The investigation into the cause of this event, as discussed above, concluded that this condition is limited to torque seated MOBVs because these valves take into account inertial effects. There are no further generic implications associated with this event. MOBVs have an adequate minimum designed safety margin to overcome worst case aerodynamic torque and have been tested using VOTES to ensure motor-operator output torque is adequate to meet design basis conditions.

Previous Similar Occurrences:

None

Tracking Codes: (B1) Construction/Installation Deficiency (i.e., inadequate testing)