

**LICENSEE EVENT REPORT (LER)**

FACILITY NAME (1) Shoreham Nuclear Power Station Unit #1										DOCKET NUMBER (2) 0 5 0 0 0 3 2 2										PAGE (3) 1 OF 0 6																																																												
TITLE (4) HPCI Check Valve malfunction																																																																																
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)																																									
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OPERATING MODE (9) 5									THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)																																																																							
POWER LEVEL (10) 0 0 0									20.402(b)									20.406(e)									80.73(a)(2)(iv)									73.71(b)																																												
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LICENSEE CONTACT FOR THIS LER (12)																																																																																
NAME Robert W. Grunseich, Operational Compliance Engineer																					TELEPHONE NUMBER 5 1 6 9 2 9 - 8 3 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																																																					
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YES (If yes, complete EXPECTED SUBMISSION DATE: )																					X NO																																																											
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)																																																																																
<p>On November 4, 1985, while performing maintenance on the HPCI Turbine Exhaust line, two check valves in the line were found to be inoperable due to the separation of the disc from their valve bonnets. The plant was in Operational Condition 5, with the mode switch in Shutdown. On October 30, 1985, maintenance personnel found unidentified valve internals wedged in the inlet of E41*MOV-044. On November 2, 1985, upon disassembly of the immediately upstream Check Valve, E41*18V-0022, maintenance personnel discovered valve internals missing and other valve internals wedged in the inlet of E41*18V-0022. On November 4, 1985, disassembly of another Check Valve, E41*18V-0021, further upstream, revealed the absence of certain valve internals. Plant Management was immediately notified of the situation at 1330 and at this time the situation was determined to be reportable per 10CFR50.73(a)(2)(v)(d). The NRC was notified at 1507. Efforts to resolve the problem and prevent recurrence have been implemented.</p>																																																																																
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## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

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

FACILITY NAME (1):

DOCKET NUMBER (2):

LER NUMBER (3):

PAGE (3):

Shoreham Nuclear Power Station Unit #1

0 5 0 0 0 3 2 2 8 5 - 0 5 1 - 0 1 0 2 OF 0 6

\*ER\* (If more space is required use additional NRC Form 3054's (17).

On November 4, 1985, while performing maintenance on the HPCI Turbine Exhaust line, two check valves in the line were found to be inoperable due to the separation of the disc from their valve bonnets. The plant was in Operational Condition 5 at the time, with the mode switch in Shutdown.

On October 30, 1985, prior to finding the two check valves inoperable, maintenance personnel were working on gate valve E41\*MOV-044, to reduce valve leakage when unidentified components were found in the valve. Upon further investigation, it was determined that the unidentified components were the disc, swing arm and bolt from the check valve immediately upstream, E41\*18V-022, HPCI Turbine Exhaust Downstream Check Valve. The disc was wedged at the inlet of the gate valve.

On November 2, 1985, maintenance was initiated to repair E41\*18V-022, in order to restore the valve to operational status. Maintenance personnel disassembled Check Valve E41\*18V-022 and discovered the disc and swing arm from a second check valve further upstream in the line, E41\*18V-021, HPCI Turbine Exhaust Upstream Check Valve, wedged in the inlet of E41\*18V-022. On November 4, inspection and repair of E41\*18V-021 began in order to restore the valve to operational status. Check Valve E41\*18V-021 was disassembled and absence of the disc and mechanism was confirmed. Plant Management was immediately notified of the situation at 1330 and at this time it was determined that it was reportable per 10CFR 50.73(a) (2) (v) (d). The NRC was notified at 1507.

Prior to the event, HPCI was last run on September 25, 1985 without incident. E41\*MOV-044 was last stroked satisfactorily on July 30, 1985 per Technical Specification requirements. Local Leak Rate Testing (LLRT) was last performed satisfactorily on June 14, 1984 for penetration X-13, which is composed of E41\*MOV-044, E41\*18V-022 and E41\*18V-021.

There was minimal safety significance to this event. Although the isolation valve, E41\*MOV-044, may not have completely closed if required, any leakage through the containment would have been contained by a safety system (HPCI). Indications are that the HPCI system was most likely operational for injection purposes, despite the check valve situation.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1):

DOCKET NUMBER (2):

LER NUMBER (3)

PAGE (3)

Shoreham Nuclear Power Station Unit #1

0 5 0 0 0 3 2 2 8 5 - 0 5 1 - 0 1 0 3 OF 0 6

\* LER (If more space is required, use additional NRC Form 255A &amp; (1)).

The manufacturer of these Check Valves is Anchor Darling. Both valves are the swing check variety and use cap screws to attach the hinge support piece to the valve bonnet. An analysis has shown that the failure of these check valves was the result of the lack of a suitable locking mechanism on the cap screws to prevent these screws from backing out during operation. Further, vendor drawings indicate that the cap screws should have been tack welded to the hinge support piece. Anchor Darling has informed LILCO that the cap screws could be lock wired to one another in lieu of tack welding to provide the required locking mechanism.

Based on the following, it has been concluded that the HPCI steam exhaust check valves can be returned to service with the cap screws lockwired:

- (1) An examination of recovered cap screws found them to be totally intact and showing no signs of distress, thus supporting the conclusion that the cap screws backed out.
- (2) A survey of other nuclear plants with Anchor/Darling swing check valves in a similar service revealed that the failure experienced at Shoreham has not been seen in these other plants when the subject cap screws are locked in place.
- (3) A review of the vendor documentation showed a discrepancy between actual field conditions and the design requirements for a locking mechanism (tack welding) on the cap screws.

It is expected that the modification of the existing Check Valves is a suitable means of resolving the situation and preventing recurrence. The existing check valves will be replaced with lift checks before completion of the first refueling outage. Upon completion of the modifications to the existing check valves, Local Leak Rate Tests were performed. The results of these tests are acceptable. Further testing of the modified check valves will be performed during the upcoming Startup. An initial inspection of the check valves will be performed after the start-up tests of the HPCI system (STP15 and SP24.202.01). It is anticipated that approximately ten HPCI runs will occur during the start-up testing period (below 5% power). A second and third inspection will be performed after a number of turbine starts equal to the number of starts which were actually performed during the start-up testing period or after no more than ten starts. This criteria is more stringent than the previously discussed criteria of inspecting after six months, since a six-month inspection criteria places no limits on the maximum number of runs permitted in the interim between inspections.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

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

FACILITY NAME (1):  Shoreham Nuclear Power Station Unit #1	DOCKET NUMBER (2):  0 5 0 0 0 3 2 2	LER NUMBER (6):			PAGE (3):	
		YEAR	SEQUENT. NUMBER	REVISION NUMBER		
		8 5	0 5 1	0 1	0 4	OF 0 6

TEXT (If more space is required use additional NRC Form 2042's (17))

It is believed that ten starts will be a significant test of the integrity of the lockwire, hinge, disc, and disc nut and pin. If after all three inspections there is no indication that the cap screws have begun to back out and the disc nut and pin are intact, the supplementary inspections for the HPCI steam exhaust check valves will be terminated.

An examination of other Anchor Darling Check Valves in the plant was conducted, due to the potential for this failure mechanism to be a generic condition. MWRs were written to inspect the valves for generic deficiencies.

Valves under consideration included the following:

E11*16V0020A	RHR PUMP "A" DISCHARGE CHECK VALVE
E11*16V0020B	RHR PUMP "B" DISCHARGE CHECK VALVE
E11*16V0020C	RHR PUMP "C" DISCHARGE CHECK VALVE
E11*16V0020D	RHR PUMP "D" DISCHARGE CHECK VALVE
E41*31016V-0001	HPCI PUMP SUCTION CHECK VALVE
E41*31016V-0002	HPCI PUMP SUCTION CHECK VALVE
G41*31006V-0003A	FUEL POOL COOL. PUMP "A" DISCH. CK VLV
G41*31006V-0003B	FUEL POOL COOL. PUMP "B" DISCH. CK VLV
B21*31018V-1103A	FEEDWATER INLET "A" CHECK VALVE
B21*31018V-1103B	FEEDWATER INLET "B" CHECK VALVE

The 10 valves listed above were inspected to verify that their Hinge Support Cap Screws, Set Screws and Disc Pins were secured by either being tack welded, lockwired or staked. 1E41\*16V0001 and 1E41\*16V0002 are the HPCI pump suction check valves from the condensate storage tank and the suppression pool. These two valves have not experienced any failures to date. The hinge support cap screws are intact for both valves and show no signs of loosening. The disc, disc nut, and hinge show no signs of abnormal wear. 1E11\*16V00020B is the "B" RHR pump discharge check valve. This valve experienced the loss of only one of the two hinge support cap screws. However, the hinge support mechanism was still in place showing no signs of movement, relative to the bonnet. The valve in all respects was still functional. The disc, disc nut, and hinge were inspected and found to be in acceptable condition. 1E11\*16V0020A, 1E11\*16V0020C and 1E11\*16V0020D are the discharge check valves for the "A", "C" and "D" RHR pumps, respectively. These valves had their cap screws intact and showed no abnormalities. 1G41\*06V003A and 1G41\*06V003B are the Fuel Pool Cooling Pump Discharge Check Valves. These valves have not experienced any failures to date. 1G41\*06V003A was the only valve found to have its hinge support cap screws tack welded. The disc, disc nut and hinge show no sign of abnormal wear. 1B21\*31018V-1103A and



## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1):

DOCKET NUMBER (2):

LER NUMBER (6):

PAGE (3):

Shoreham Nuclear Power Station Unit #1

0 5 0 0 0 3 2 2 8 5 - 0 5 - 1 - 0 1 0 5 OF 0 6

TEXT (If more space is required use additional NRC Form 204A s (17))

1B21\*31018V-1103B are the Feedwater Inlet Check Valves. Inspections of these valves proved satisfactory. The hinge support cap screws are intact and show no sign of loosening. The disc, disc nut and hinge show no sign of abnormal wear.

Following the inspection of the HPCI Exhaust and RHR "B" Discharge Check Valves, an investigation was initiated to determine the location of missing parts. At the time of the valve inspections, there were three socket head cap screws and two spring pins missing from the HPCI turbine exhaust. Unaccounted for from the "B" RHR Pump discharge check valve was a single socket head cap screw. Inspections were performed on the HPCI steam exhaust sparger and the suppression pool, in an effort to locate the parts. Three cap screws and one spring pin from the HPCI Check Valves were recovered from the suppression pool. The cap screw from the RHR "B" Discharge check valve was found in the suppression pool. Nothing was found in the HPCI sparger. There is still one spring pin missing from the HPCI valves. This missing pin is presumed to be in the suppression pool but poses no threat to the ECCS pumps due to the design and location of the pump suction strainers.

The check valves found without adequate securing of their cap screws, set screws and disc pin were modified as summarized in the following table:

VALVE	CAP SCREW TACKED	LOCKWIRED*	SET SCREW TACKED	STAKED	DISC PIN STAKED
E11*16V0020A	-	YES	-	YES	YES
0020B	-	YES	-	YES	YES
0020C	-	YES	-	YES	YES
0020D	-	YES	-	YES	YES
E41*18V0021	-	YES	-	YES	YES
0022	-	YES	-	YES	YES
E41*16V0001	-	YES	-	YES	LOCKWIRED*
0002	-	YES	-	YES	LOCKWIRED*
G41*06V0003A	YES	-	-	YES	YES
0003B	NR	NR	NR	NR	YES
B21*18V1103A	NR	NR	NR	NR	YES
1103B	NR	NR	NR	NR	YES

NR - Not Required

\* Lockwire used is a .065 inch diameter 316 stainless wire. The cap screw heads have been drilled to .070 inch diameter at a 60 degree interval to accommodate the wire.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1):  Shoreham Nuclear Power Station Unit #1	DOCKET NUMBER (2):  0500032285	LER NUMBER (6):			PAGE (3):	
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
		05	051	01	06	06

TEXT (If more space is required use additional NRC Form 256A s) (17)

The modifications listed above should be a suitable means of preventing the recurrence of an Anchor Darling Check Valve malfunction.

There will be an inspection of the "B" RHR Discharge Check Valve which exhibited a cap screw failures similar to the HPCI exhaust check valves one year, plus or minus one month, from the date the valve was returned to service. If this inspection reveals no loosening of the cap screws, no further inspections will be performed.

A possible secondary contributing factor to the check valve failure was a transient condition caused by the HPCI turbine control system allowing steam to be admitted to the turbine with the control valve almost completely open. Since the control valve did not start to close until the turbine was rotating, a transient was imposed on the system. Recent quick-start testing of the HPCI turbine from a cold condition has resulted in HPCI pump low suction pressure and HPCI turbine overspeed trips as a result of this transient. To prevent this condition, the HPCI turbine control system has been modified to dampen the turbine acceleration transient on start-up by adjusting the ramp generator/signal converter module and by adding a hydraulic bypass line with a check valve around the EG-R hydraulic control actuator. This modification will provide a more controlled opening of the HPCI turbine control valve during startup, thus lessening the large surge of steam and the associated overspeed and suction line low pressure transients.



## LONG ISLAND LIGHTING COMPANY

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April 4, 1985

PM-86-088

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Dear Sir:

In accordance with 10CFR50.73, enclosed is a copy of Shoreham Nuclear Power Station Unit 1's Licensee Event Report 85-051, Revision 1. This revision is being submitted as a supplemental report, per a previous commitment, to include new information on the "HPCI Check Valve malfunction" and subsequent corrective actions.

Sincerely yours,

William E. Steiger, Jr.  
Plant Manager

WES/rg

Enclosure

cc: Dr. Thomas E. Murley, Regional Administrator  
John Berry, Senior Resident Inspector  
Institute of Nuclear Power Operations, Records Center  
American Nuclear Insurers

SR.A21.0200

IE22  
11