10 CFR 50.73

BOSTON EDISON
Pilgrim Nuclear Power Station
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BECo Ltr. 94-037

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

Docket No. 50-293
License No. DPR-35

The enclosed Licensee Event Report (LER) 94-002-00, "High Pressure Coolant Injection System Inoperable Due to Inoperable Motor Operated Valve", is submitted in accordance with 10 CFR Part 50.73.

Please do not hesitate to contact me if there are any questions regarding this report.

E.T. Boulette, PhD

JPC/dmc/94037A

Enclosure: LER 94-002-00

cc: Mr. Thomas T. Martin
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Standard BECo LER Distribution

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U.S. NUCLEAR REGULATORY COMMISSION

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ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
PILGRIM NUCLEAR POWER STATION	05000 - 293	1 of 6

TITLE (4)

High Pressure Coolant Injection System Inoperable Due to Inoperable Motor Operated Valve

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 NAME	DOCKET NUMBER
									N/A	05000
03	09	94	94	002	00	04	08	94	FACILITY NAME: N/A	DOCKET NUMBER: 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	100	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)(D)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
		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 (Include Area Code)
Jeffrey P. Calfa - Senior Compliance Engineer	(508) 830-8108

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
B	BJ	84	L200	Y						

SUPPLEMENTAL REPORT EXPECTED (14)

	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On March 9, 1994, at 1035 hours, Operations personnel declared the High Pressure Coolant Injection (HPCI) System inoperable based on the inoperability of a HPCI motor operated valve that could not be opened after being closed for a surveillance test.

Operations discovered the problem during the performance of a monthly surveillance procedure. The operators closed the valve remotely from the main control room and received a valve operator motor electrical overload alarm. Upon investigation the valve operator motor was found hot to the touch, the valve's breaker was found tripped open, and there was a burnt smell in the vicinity. The motor operator torque switch drive pinion gear roll pin had failed due to the pin design. Suspected causes contributing to the roll pin failure include hardened grease in the motor operator spring pack and the magnitude of the forces on the valve starting and stopping transients . Either cause could result in higher force on the roll pin. The valve is currently maintained open with a temporary modification to allow the HPCI System to be made operable. The HPCI System was tested satisfactorily and declared operable on March 10, 1994. Corrective action planned includes installation of a torque switch with an improved design and a new spring pack resistant to grease buildup into the valve. Other valves potentially susceptible to torque switch drive pinion gear roll pin failure have been identified and evaluated for operability with satisfactory results.

The event was discovered with reactor power at 100 percent and the reactor mode selector switch in the RUN position. The reactor vessel pressure was approximately 1030 psig with the reactor vessel temperature at approximately 550 degrees Fahrenheit.

BACKGROUND

The High Pressure Coolant Injection (HPCI) System pump injects water into the reactor vessel through two in-series motor-operated injection valves. These valves are MO-2301-9, and normally closed MO-2301-8. The valves receive an open signal upon receipt of HPCI initiation. MO-2301-9 is normally open, DC powered, and located outside the Primary Containment in the HPCI quadrant. The valve is an Anchor Darling 14x10x14" - 900 pound pressure seal flexi-wedge gate valve and the motor operator is a Limitorque Corporation model SMB-1.

EVENT DESCRIPTION

On March 9, 1994, at 1035 hours, upon closing MO-2301-9 plant operators received an alarm on Main Control Room Panel C-903 annunciator C-3, "HPCI Injection Valves Overload". Personnel investigated and found the MO-2301-9 operator motor hot to the touch, the breaker tripped open, and the operators perceived a burnt smell in the vicinity. Because the valve would not open as designed, the HPCI System was inoperable.

At the time Operations personnel determined that MO-2301-9 was inoperable, Operations personnel were performing surveillance procedure 8.5.4.4, "HPCI Valve Operability Test". The operators were performing step 8.1[1](a) of that procedure which requires plant operators to close the normally open MO-2301-9 prior to testing MO-2301-8.

Operations personnel wrote Problem Report (PR) 94.9104 and Maintenance Request (MR) 19400662 on March 9, 1994, to document and correct the problem. The NRC Operations Center was notified in accordance with 10 CFR 50.72 on March 9, 1994, at 1129 hours.

The event was discovered during power operation with the reactor mode selector switch in the RUN position. The reactor vessel pressure was approximately 1030 psig with the reactor vessel temperature at approximately 550 degrees Fahrenheit. The reactor power level was 100 percent.

CAUSE

The direct cause of the problem with MO-2301-9 was the failure of the valve motor operator torque switch drive pinion gear roll pin.

Nuclear Engineering Support Department (NESD) personnel performed an initial investigation and made recommendations to Electrical Maintenance for problem investigation under MR 19400662. MO-2301-9 was verified to be fully closed. Electrical Maintenance personnel performed testing of the motor and power cables and found no significant problems. The NESD personnel suspected the torque switch had failed as the torque switch is designed to stop the operator motor when the MO-2301-9 disk reaches the valve seat in the closing direction. The MOV cover was opened and the torque switch was removed. Maintenance personnel found that the torque switch drive pinion gear had become detached from the torque switch shaft. The drive pinion gear is normally attached to the shaft via a 3/32" roll pin. The pinion gear roll pin in MO-2301-9 was found sheared.

NESD personnel recommended MO-2301-9 be opened manually while measuring the force to open the valve to determine if any damage had occurred to the valve stem components. Electrical maintenance personnel measured the force required as the valve was opened. This measurement was evaluated. The evaluation concluded the valve is structurally sound. MO-2301-9 was left in the open position. NESD personnel completed an engineering evaluation that stated that the HPCI System could be declared operable if MO-2301-9 was left in the open position, provided the system could demonstrate full injection flow. The evaluation was based on the valve having no safety- related closing function.

Operations personnel subsequently performed surveillance procedure 8.5.4.1, "High Pressure Coolant Injection System Pump and Valve Monthly/Quarterly Operability" to determine if the system could provide full flow. Operations successfully completed procedure 8.5.4.1 at 2252 hours on March 9, 1994. Surveillance procedures 8.5.4.1 and 8.5.4.4 were temporarily revised to remove the requirement to re-position MO-2301-9 to the closed position during the tests. As a result of the engineering evaluation and the successful performance of full flow testing, operations personnel declared HPCI operable at 0139 hours on March 10, 1994. NESD personnel wrote Temporary Modification (TM) 94-05 on March 10, 1994. TM 94-05 provided for installation of a clamp on the MO-2301-9 valve stem to maintain the valve in the open position while electrical maintenance personnel acquired information for problem investigation and perform repairs to the valve motor operator. The Operations Review Committee (ORC) recommended approval and the Plant Manager approved TM 94-05 on March 10, 1994. Electrical Maintenance personnel implemented TM 94-05 on March 10, 1994.

During the overhaul of the MO-2301-9 motor operator, hardened grease was found in the spring pack. This could have caused increased impact load on the torque switch pinion gear pin when the valve was opened. The spring pack in use in MO-2301-9 had a tendency towards grease buildup and hardening. Spring packs with internal grease relief are available and work to prevent internal grease buildup and subsequent hardening. Additionally, NESD personnel have evaluated diagnostic testing results of MO-2301-9 and determined that the magnitude of pullout thrust for the valve disk leaving the seat in the opening direction may be higher than for other valves that have been similarly diagnostically tested. The hardened grease and the magnitude of the pullout thrust appear to be factors in increased impact load on the torque switch pinion gear roll pin.

The failure of the pinion gear roll pin in MO-2301-9 was the cause of the motor overload alarm and the subsequent HPCI inoperability. NESD investigations of the failed roll pin have found the pin design to be the root cause of the failure. The pin material was found to be AISI 1070, a relatively brittle high carbon steel. The 3/32" size combined with the relatively brittle material used to make the roll pin contribute to the design problem.

NESD personnel researched and found that on August 20, 1993, another licensee wrote a letter to the Limitorque Corporation regarding torque switch pinion gear roll pin failures on Limitorque SB/SMB 0, 1, 2, 3, 4 and 5 motor operators. The letter identified a problem with the roll pins. Apparently, certain Limitorque motor operators for flex-wedge gate valves were found by the licensee to be subject to unique dynamic conditions upon opening. Some valves tended to stick in the valve seat when closed and experienced a hammering effect on the torque switch when the valve seat frees during open stroke unseating. Manufacturer's of valves for that licensee have concluded measured unseating pullout

torques are within expected values on the affected valves. This hammering is converted to excessive torsional forces that are transferred to the torque switch shaft and the 3/32" pinion gear roll pin. The dynamic condition upon opening was probably a contributing factor to the torque switch pin failure in MO-2301-9.

NESD personnel performed a search of Pilgrim maintenance records and identified one failure of a motor operator 3/32" torque switch pin that occurred during testing while shutdown in July of 1991. The affected motor operated valve was Residual Heat Removal (RHR) System MO-1001-43A, the RHR Pump 'A' Shutdown Cooling Suction Valve. The plant was shutdown for a refueling outage and the torque switch pinion gear pin failed during scheduled maintenance. The torque switch was replaced. Subsequent material analysis of the MO-1001-43A failed pin found it to be a less than an optimum design. The material was a cadmium plated material that was too ductile for that application. Maintenance personnel knowledgeable of that failure recall no motor overload occurred during the testing. Although motor bearing housing cracks were not expected without a motor overload, an external inspection of the housing was performed on MO-1001-43A. No evidence of external damage was found in the housing.

CORRECTIVE ACTION

NESD personnel wrote TM 94-05 and Electrical Maintenance personnel installed the temporary modification on March 10, 1994. This modification allowed MO-2301-9 to be maintained open and HPCI to be operable during MO-2301-9 motor operator overhaul.

NESD personnel identified that Limitorque SB/SMB 0, 1, 2, 3, 4 and 5 motor operators use the 3/32" pinion gear roll pins. There are no SB/SMB 4 operators at Pilgrim Station. The investigators further identified several motor operated valves installed in safety related systems at Pilgrim Station with the potential to be exposed to similar dynamic forces as MO-2301-9. The valves of particular concern are those which could conceivably close during an accident scenario and then would subsequently need to be automatically or manually opened if necessary. The NESD personnel determined that the torque switches with 3/32" pinion gear roll pins in Pilgrim motor operated valves and in MO-2301-9 should be replaced with torque switches equipped with thicker pins of an improved material.

An engineering evaluation for PR 94.9104 was completed on March 28, 1994 that concluded the systems containing the affected valves are operable with the existing motor operator torque switch roll pin design. After discussion of this problem with Limitorque Corporation, Limitorque submitted a potential 10CFR Part 21 notification for the torque switches.

Plant Design Changes will be generated to make the torque switch replacement and to install a new spring pack on MO-2301-9 prior to returning the valve to service. Implementation of the torque switch modification on the other identified valves will be in accordance with the regular valve motor operator maintenance schedule. Additionally, the MO-2301-9 will be opened and inspected as a precautionary measure prior to the valve being fully returned to service. Scheduling of this inspection is currently being evaluated for inclusion in the next mid cycle outage.

Investigation into the spring packs currently in stock found some without internal grease relief. All spring packs without internal grease relief currently in the warehouse inventory will be removed and replaced with spring packs with internal grease relief. Pilgrim Motor Operator diagnostic testing requires spring pack removal and replacement with pre-tested spring packs. Replacement will then be with spring packs with internal grease relief in accordance with the scheduled diagnostic testing.

SAFETY CONSEQUENCES

This event posed no threat to the public health and safety.

The Core Standby Cooling System (CSCS) consists of the HPCI System, Automatic Depressurization System (ADS), Core Spray System, and Residual Heat Removal/Low Pressure Coolant Injection (LPCI) mode. Although not part of the CSCS, the RCIC System is capable of providing water to the Reactor Vessel for core cooling, similar to the HPCI System. During the time period HPCI was inoperable the other CSCS Systems and the RCIC System were operable.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(v)(D) because the HPCI System became inoperable due to the failure of MO-2301-9 to open after being closed during the surveillance on March 9, 1994.

SIMILARITY TO PREVIOUS EVENTS

A review was conducted of Pilgrim Station Licensee Event Reports (LERs) submitted since January 1984. The review focused on LERs submitted in accordance with 10 CFR 50.73(a)(2)(v)(D) that involved the inoperability of the HPCI or RCIC Systems due to motor operated valve actuator torque switch problems. The review identified LER 89-013-00 and LER 93-007-01.

In LER 89-013-00, the HPCI System became inoperable because MO-2301-3, the HPCI Turbine Supply Valve, normally in the closed position, would not open. The cause was two loose screws used to adjust the valve's torque switch setting. The loose screws resulted in the failure of the valve actuator motor windings. The valve was repaired and the motor was replaced. The cause for the event was no specified torque requirement for the torque switch setting screws in a procedure used for motor operator valve maintenance.

In LER 93-007-01, the RCIC System became inoperable due to an automatic Primary Containment Isolation Control (PCIS) System Group 5 actuation. The actuation resulted from a high steam isolation flow signal while operators attempted to jog open the RCIC turbine steam supply valve MO-1301-16. After several attempts, the valve opened rapidly and caused an actuation of the steam flow sensors. The inability to open MO-1301-16 on initial attempts was caused by a failure to re-install a jumper wire that bypasses the torque switch in the open circuit. The jumper was reinstalled and the valve satisfactorily tested.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are as follows:

COMPONENTS	CODES
Motor (MO-2301-9)	MO
Operating Mechanism (Motor Operator)	84
Valve, Electrically Operated (MO-2301-9)	20

SYSTEMS

High Pressure Coolant Injection (HPCI) System	BJ