BOSTON EDISON
Pilgrim Nuclear Power Station
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10 CFR 50.73

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BECo Ltr. 94-138

U.S. Nuclear Regulatory Commission
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Docket No. 50-293
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The enclosed supplemental Licensee Event Report (LER) 94-004-01, "Automatic Closing of the Reactor Core Isolation Cooling System Turbine Steam Supply Isolation Valves Due to High Steam Flow Signal During Surveillance Testing", 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

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RLC/lam/9400401

Enclosure: LER 94-004-01

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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)

Automatic Closing of the Reactor Core Isolation Cooling System Turbine Steam Supply Isolation Valves Due to High Steam Flow Signal During Surveillance Testing

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
08	03	94	94	--004--	01				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)	X 50.73(a)(2)(v)	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)B	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)
Robert L. Cannon - Senior Compliance Engineer	(508) 830-8321

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
D	BN	SCV	T147	Y						

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

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

On August 3, 1994, at 1122 hours, an automatic Primary Containment Isolation Control System (PCIS) group 5 actuation occurred during performance of the Reactor Core Isolation Cooling (RCIC) System quarterly surveillance test. The actuation resulted in the closing of the RCIC turbine steam supply isolation valves. This caused the RCIC system to become inoperable. The isolation resulted from a high steam flow isolation signal. Investigation revealed the direct cause for the isolation signal was the governor control valve failed to respond to the control system demand due to valve binding. Further investigation into the cause of the control valve binding determined the fulcrum dowel pins were not properly aligned. Subsequent investigation determined the maintenance procedure did not provide sufficient guidance regarding alignment of the dowel pins. Utilizing guidance provided in the vendor technical manual, the valve was rebuilt and properly aligned. The maintenance procedure will be revised to included adequate guidance for dowel pin alignment. During post work testing on August 5, 1994, the turbine had been running for approximately fifteen (15) minutes when the turbine speed began to oscillate. At this time, oil began to spray from the governor end bearing cover, oil level on the coupling end bearing housing dropped below the sight glass level and oil was observed on the skid. The turbine was manually tripped at this time to investigate the cause of these problems. The cause for the oil level change was determined to be due to air becoming entrained in the oil. Vents were added to the oil sump and system oil pressure was reduced to correct the problem. This event occurred during plant operation while at 100 percent reactor power. The reactor mode selector switch was in the RUN position. The Reactor Vessel (RV) pressure was approximately 1030 psig with RV temperature at saturation. The RCIC System was returned to operable status on August 12, 1994. The High Pressure Coolant Injection System was operable during the period the RCIC was inoperable.

REASON FOR SUPPLEMENT

This supplemental report includes the results of the root cause investigation regarding the improper alignment of the Reactor Core Isolation Cooling (RCIC) turbine steam governor control valve fulcrum alignment pins. The investigation had not been completed when the initial report was submitted.

BACKGROUND

The Reactor Core Isolation Cooling (RCIC) System turbine steam supply piping is equipped with differential pressure sensors (DPIS 1360-1A and -1B) that provide a steam line break detection function. A high steam flow signal in one or both logic channels functions to close the RCIC turbine steam supply piping isolation valves to limit the release of steam if a break in the RCIC Turbine steam supply piping occurs. The Group 5 portion of the Primary Containment Isolation Control System (PCIS) closes the RCIC turbine steam supply valves MO-1301-16 and -17 and initiates an automatic RCIC turbine trip when an isolation signal is present.

EVENT DESCRIPTION

On August 3, 1994, at 1122 hours, an automatic Primary Containment Isolation Control System (PCIS) group 5 actuation occurred during performance of surveillance procedure 8.5.5.1, Rev. 36, "Reactor Core Isolation Cooling (RCIC) Pump Operability Flow Rate and Valve Test at approximately 1000 psig." The actuation resulted in the closure of RCIC turbine steam isolation valves MO-1301-16 and 17 due to a high steam flow signal. The RCIC turbine tripped when MO-1301-16 and 17 closed. RCIC was declared inoperable and Limiting Condition for Operation (LCO) A94-176 was entered. The NRC Operations Center was notified at 1204 hours per 10CFR50.72.B.2.ii for the RCIC isolation (Engineered Safety Feature (ESF) actuation), and per 10CFR50.72.B.2.iii for the RCIC system being inoperable. Problem Report (PR) 94.9313 was issued to document the group 5 PCIS isolation, and PR94.9314 was issued to document oil identified on the turbine skid.

This event occurred during plant operation while at 100 percent reactor power. The reactor mode selector switch was in the RUN position. The Reactor Vessel (RV) pressure was approximately 1030 psig with RV temperature at saturation.

ROOT CAUSE

Subsequent investigation determined the cause for the high steam flow signal to be binding of the RCIC turbine steam governor control valve (HO-1301-159). Investigation into the binding of the governor control valve determined the direct cause to be improper alignment of the control valve fulcrum alignment pins. The alignment pins were not fully seated in the alignment holes. Investigation into the improperly aligned fulcrum dowel pins determined the root cause to be an inadequate maintenance procedure. Maintenance Procedure 3.M.4-78, Rev. 0, "RCIC Turbine 5-year Preventive Maintenance Inspection", does not provide sufficient guidance for proper alignment of the fulcrum dowel pins during governor control valve reassembly. The root cause investigation also identified that the dowel pins are not shown on Terry Turbine Drawing No. E4747 (our Drawing No. 2059-12-6). The governor control valve was supplied by Terry Turbine Company as a part of the turbine unit.

At approximately 0400 hours on 8/5/94, the RCIC system was started for post work test (PWT) using procedure 8.5.5.11, Rev. 0, "Manual Start of the RCIC Turbine for Maintenance Activity", followed by the operability surveillance procedure 8.5.5.1, Rev. 36. During the post work testing evolution, the turbine had been running for approximately fifteen (15) minutes when turbine speed began to oscillate. At this time, oil began to spray from the governor end bearing cover, oil level on the coupling end bearing housing decreased below the sight glass level and oil was observed on the skid. The turbine was manually tripped at this time to investigate the cause of these problems. Based on discussions with the vendor (Dresser Rand) and troubleshooting observations, the cause for the oil level changes was due to air becoming entrained in the system lubricating oil. The air formed a bubble in the drain line from the governor end bearing, preventing the oil from properly draining, resulting in an increase in bearing oil level. Since the oil was not fully draining from the governor end bearing, the major source of oil to the sump and oil pump was from the coupling end bearing. This resulted in a lower oil level in the coupling end bearing. Dresser Rand stated the most probable cause was the pumping action of the turbine mechanical trip disk which aerated the oil; however, other sources such as pump suction piping leaks could have been the cause.

CORRECTIVE ACTION

The governor control valve was rebuilt, properly aligned using the alignment pins, and successfully post work tested on August 5, 1994. Maintenance Procedure 3.M.4-78, Rev. 0, will be revised to include guidance from the vendor technical manual for alignment of the dowel pins during governor control valve reassembly. A Document Change Notice will be issued to revise Drawing 2059-12-6, "RCIC Turbine Longitudinal Drawing", to include the dowel pins which currently are not shown.

Several actions were taken to identify the source of the entrained air. These actions included sealing the joints on the oil pump suction tubing followed by replacement with piping to eliminate any potential sources of air in-leakage at the pump suction. Verification of oil level was performed to ensure the oil was not being agitated/aerated by the pumping action of the trip disk, and the oil was replaced with oil of the type used prior to RF09 to identify if the new oil was the cause of the foaming. The oil pump was also replaced and a new oil pump (regulator) relief valve was installed. A vent line was installed on the governor end and coupling end bearing oil drain return lines to the oil sump. After each of these actions RCIC was operated, and in each case the same symptoms occurred approximately 15 to 20 minutes into the test run, with the exception of the initial run following installation of a temporary vent line on the governor end bearing oil return drain line to the oil sump. This installation was temporary for testing purposes, and it contained non-Q parts. During this test run tygon tubing was still connected to the thermocouple wells on the bearing oil drain lines. These served two purposes: first, it allowed a path for the entrapped air to vent from and also allowed observation of the entrained air phenomenon as it occurred. From these observations, during a test run of the turbine, it was noted that at turbine speeds less than rated (4500 rpm) the oil aeration could be significantly reduced and even stopped. When the permanent vent assembly was installed, the tygon tubing was removed and the thermocouples were replaced. The subsequent test failed. The vent path provided by the tygon tubing

appeared to have contributed to the successful test run with the temporary vent assembly installed on the governor end bearing oil drain line. A permanent vent line assembly was also installed on the coupling end bearing drain line. Subsequent testing indicated the aeration and foaming of the oil had minimal improvement.

Oil discharge pressure is proportional to turbine speed as the pump is driven from the turbine shaft through a worm gear arrangement. In addition, there is a relief/pressure control valve which is adjusted to maintain proper system operating pressure. Based on observation from testing and concurrence from the turbine manufacturer, the relief valve setpoint was reduced from 12-15 psig to 8-10 psig with significant results. With the slightly reduced header pressure oil aeration was significantly reduced with no adverse effect on turbine operation. This condition is believed to be inherent in the design of the system. It had gone undetected because it requires at least fifteen (15) minutes of continuous operation at rated speed, flow and pressure to manifest itself. Surveillance testing, although routinely performed at these operating parameters, rarely lasted fifteen minutes. In addition, review of historical plant computer data indicates that when RCIC was actually called upon by Operations personnel, it was typically run at less than rated speed which would result in oil pressure less than 12 psig. Operability testing was performed and the RCIC System was returned to operable status on August 12, 1994, at 0320. Any further evaluation regarding the oil aeration is being addressed as part of our operating experience program review of Information Notice 94-84, "Air Entrainment in Terry Turbine Lubricating Oil System".

REQUEST FOR ENFORCEMENT DISCRETION

On August 10, 1994, Boston Edison Company requested (Ref. BECo Ltr. 94-086) the NRC to exercise enforcement discretion in granting a one time out-of-service (OOS) extension of the RCIC System Technical Specification 3.5.D.2 from 7 days to 14 days. The extension provided needed additional time to implement corrective actions to restore the RCIC system to Operable status.

The request for a 14 day out-of-service (OOS) reflected the Standard Technical Specification allowed RCIC system OOS time, and is consistent with Boston Edison Company's June 9, 1994 (Ref. BECo Ltr. 94-068) proposed Technical Specification change submittal that would increase Pilgrim's RCIC OOS time from 7 to 14 days.

The NRC granted enforcement discretion verbally on August 10, 1994 and documented it in an NRC letter dated August 12, 1994. On August 11, 1994, repairs to the RCIC System were completed and satisfactorily post work tested. Operability testing was satisfactorily conducted in accordance with Procedure 8.5.5.1 and the RCIC System was returned to operable status on August 12, 1994, at 0320 hours and the enforcement discretion was terminated.

OTHER ACTION TAKEN

The high steam flow trip setpoint was set conservatively low at Pilgrim Station. On August 3, 1994, the negative trip for differential pressure sensors DPIS 1360-1A and -1B was removed in accordance with PDC-94-06 and the positive trip was changed from 105 inches to 180 inches of water pressure and incorporated in revision 21 of procedure 8.M.2-2.6.1, "RCIC Steam Line High Flow." Although this action would not have precluded this event, it will help to preclude future spurious high steam flow trips.

SAFETY CONSEQUENCES

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

The group 5 high steam flow isolation is designed to mitigate the consequences of a break in the RCIC system turbine steam supply line. The automatic closing of the RCIC turbine steam supply isolation valves prevents excessive loss of reactor coolant and the release of significant amounts of radioactive materials from the nuclear system process barrier if a pipe break occurs. For this event, no break in the RCICS turbine steam line occurred.

The High Pressure Coolant Injection System was operable during the period the RCICS was inoperable as required by Technical Specifications.

This report is submitted in accordance with 10CFR50.73(a)(2)(iv) because the PCIS actuation was not a planned part of the surveillance test. This report is also submitted in accordance with 10CFR50.73(a)(2)(v)(D) because the RCIC system became inoperable.

SIMILARITY TO PREVIOUS EVENTS

A review was conducted of Pilgrim Station Licensee Event Reports (LERs) submitted since January 1984. The review was focused on LERs submitted in accordance with 10CFR50.73(a)(2)(iv) involving a similar group 5 isolation due to high steam flow signals. The review identified LER 91-001-00, LER 93-007-01 and LER 93-021-00.

LER 91-001-00 reported an event on January 25, 1991, at 0956 hours and at 1407 hours, involving an automatic closing of valves MO-1301-16 and -17 during a surveillance test. The cause was a sensed RCIC turbine steam supply line high flow condition. The high steam flow condition occurred due to a failed transistor in the system's turbine speed control electric governor (EG-M). An exact cause of the transistor failure could not be identified. However, the signal cable connecting the EG-M to the turbine control valve hydraulic actuator (EG-R) was found to be degraded. This degradation could have led to the transistor failure. The transistor and cable were replaced.

LER 93-007-01 reported an event on March 17, 1993, at 0024 hours, involving an automatic Primary Containment Isolation Control System (PCIS) group 5 actuation that occurred while attempting to place the Reactor Core Isolation (RCIC) cooling system in standby service during the performance of procedure 2.1.1, "Startup from Shutdown". The actuation closed RCIC turbine steam supply isolation valves MO-1301-16 and 17. The isolation resulted from a high steam flow isolation signal while attempting to jog open the RCIC turbine steam supply valve MO-1301-16. After several attempts, valve MO-1301-16 was opened. The opening of the valve resulted in a rapid steam line pressurization and actuation of the steam flow sensors upstream of valve MO-1301-16. The inability to open MO-1301-16 on initial attempts was caused by a missing jumper that bypasses the torque switch in the opening circuit.

LER 93-021-00 reported an event on August 24, 1993, at 1329 hours, involving an automatic Primary Containment Isolation Control System group 5 actuation that occurred while operators were using the Reactor Core Isolation Cooling System for reactor vessel pressure control in accordance with procedure. The actuation resulted in the closing of the RCIC turbine steam supply isolation valves MO-1301-16 and -17 and inoperability of the RCIC system. The isolation resulted from a high steam flow signal following a reduction in RCIC test return flow by throttling Condensate Storage Tank (CST) return valve MO-1301-53. An increase in turbine steam flow and turbine speed resulted as the RCIC control system attempted to maintain CST return flow. The steam flow increase eventually caused one high flow sensor to trip and initiate the event.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are as follows:

COMPONENTS	CODES
Valve, Isolation (MO-1301-16 and -17)	ISV
Valve, Control, Speed (HO-1301-159)	SCV
Transmitter, Differential, Pressure (DPIS 1360-1A/1B)	PDT

SYSTEMS	CODES
Engineered Safety Features Actuation System (PCIS)	JE
Reactor Core Isolation Cooling System (RCICS)	BN
High Pressure Coolant Injection System (HPCIS)	BJ