



10 CFR 50.73

BOSTON EDISON

Pilgrim Nuclear Power Station
Rocky Hill Road
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Roy A. Anderson

Senior Vice President -- Nuclear

February 24, 1992
BECo Ltr. 92- 15

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

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

The enclosed supplemental Licensee Event Report (LER) 91-008-01, "Three Automatic Group 1 Isolations Due to False High Reactor Water Level Signals While Shutdown", 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.


R. A. Anderson

TFM/bal

Enclosure: LER 91-008-01

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Standard BECo LER Distribution

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 600 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-300) U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TITLE (4): **Three Automatic Group 1 Isolations Due to False High Reactor Water Level Signals While Shutdown**

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)
04	30	91	19	1	01	02	24	92	N/A			0 5 0 0 0
04	30	91	19	1	01	02	24	92	N/A			0 5 0 0 0

OPERATING MODE (9): N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.73. Check one or more of the following: (11)										
POWER LEVEL (10): 1 0 0	<input type="checkbox"/> 20.402(a)	<input type="checkbox"/> 20.406(a)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(a)							
	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.38(a)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(b)							
	<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.38(a)(2)	<input type="checkbox"/> 50.73(a)(2)(vi)	OTHER (Specify in Abstract Box and in Text, NRC Form 366A)							
	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(vii)(A)								
	<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(vii)(B)								
	<input type="checkbox"/> 20.405(a)(1)(vi)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)								

LICENSEE CONTACT FOR THIS LER (12)

NAME: Thomas McElhinney - Senior Compliance Engineer	TELEPHONE NUMBER: AREA CODE: 5 0 8 NUMBER: 7 4 7 - 8 4 6 5
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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):

YES (If yes, complete EXPECTED SUBMISSION DATE): NO:

EXPECTED SUBMISSION DATE (15):

MONTH	DAY	YEAR

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

On April 30, 1991, three automatic Primary Containment Isolation Control System (PCIS) Group 1 isolations occurred while shutdown at 0116 hours, 0933 hours, and 1037 hours, respectively, due to a false high Reactor Vessel (RV) water level signal. The actuations resulted in the automatic closing of the related Primary Containment System isolation valves.

The Group 1 isolations were initiated by the reactor water level trip units downstream of reference leg condensing chamber 12B. The false high RV water level signals were primarily due to undersized RV water level head equalizing lines. Contributing causes included sensing line hanger interference, air entrapment and marginal sensing line slope. Corrective actions taken include: increasing the head equalizing line size from one inch to two inch, eliminating the hanger interference, backfilling sensing lines at a higher flush velocity and improving sensing line slope.

These events occurred when in the hot shutdown mode of operation with the reactor mode selector switch in the SHUTDOWN position. The reactor power level was zero percent. The RV pressures and RV water temperatures for the three events were as follows: first event, 60 psig and 308 degrees Fahrenheit; second event, 12 psig and 248 degrees Fahrenheit; third event, 3 psig and 168 degrees Fahrenheit. This report is submitted in accordance with 10 CFR 50.73(a)(2)(iv) and these events posed no threat to the health and safety of the public.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Pilgrim Nuclear Power Station	DOCKET NUMBER (2) 0 5 0 0 0 2 9 3	LER NUMBER (6)			PAGE (3)	
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TEXT (if more space is required, use additional NRC Form 366A's) (1)

REASON FOR SUPPLEMENT

This supplement meets the commitment in LER 50-293/91-008-00 to provide the results of our evaluation of the false high reactor water level signals. The cause of the false signals and corrective actions taken are discussed in this report.

EVENT DESCRIPTION

On April 30, 1991, three automatic Primary Containment Isolation Control System (PCIS) Group 1 isolations occurred due to a false high Reactor Vessel (RV) water level signal. The reactor had been shutdown on April 29, 1991 at 1912 hours. The reactor was shutdown due to the "B" recirculating pump seal leak that is discussed in LER 50-293/91-007-00. The three Group 1 isolations are discussed separately for clarity.

FIRST GROUP 1 ISOLATION

The first automatic Group 1 isolation occurred on April 30, 1991 at 0116 hours. The RV water level was at +35 inches as indicated on control room instruments LI-640-29A and -29B. The operators noted a spike on Control Room level recorder LR1001-604B to +47 inches. The indicated RV water level then returned to +35 inches. The high water level Group 1 isolation setpoint is calibrated at approximately +45 inches.

The Group 1 isolation signal resulted in the following designed responses. The inboard and outboard Main Steam Isolation Valves (MSIVs) automatically closed. The inboard and outboard Reactor Water Sample Valves automatically closed. The inboard Main Steamline drain valve automatically closed. The outboard Main Steamline drain valve remained open because it is controlled by circuitry not associated with the affected sensors. The isolation signal was reset and the MSIVs and the Main Steamline drain valve were reopened on April 30, 1991 at 0144 hours to facilitate decay heat removal.

Failure and Malfunction Report 91-124 was written to document the event. The NRC Operations Center was notified in accordance with 10 CFR 50.72 on April 30, 1991 at 0157 hours. This event occurred during the hot shutdown mode of operation with the Reactor Mode Selector Switch (RMSS) in the SHUTDOWN position. The reactor power level was zero percent with the control rods fully inserted. The RV pressure was approximately 60 psig with the RV water temperature at approximately 308 degrees Fahrenheit.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20546, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT IF MORE SPACE IS REQUIRED, USE ADDITIONAL NRC Form 306A's (17)

SECOND GROUP 1 ISOLATION

The second automatic Group 1 isolation occurred on April 30, 1991 at 0933 hours. The "A" RHR pump was in the SDC mode of operation with the indicated RV water level at +36 inches. The indicated RV water level spiked to approximately +50 inches. The indicated RV water level then returned to +36 inches. The Group 1 isolation signal resulted in the expected designed responses as described for the first event. The isolation signal was reset and the MSIVs and the Main Steamline drain valve were reopened at 1002 hours to facilitate decay heat removal.

Failure and Malfunction Report 91-125 was written to document this event. This event occurred with the RV pressure at approximately 12 psig and RV water temperature at approximately 248 degrees Fahrenheit. The RMSS was in the SHUTDOWN position.

THIRD GROUP 1 ISOLATION

The third automatic Group 1 isolation occurred on April 3, 1991 at 1037 hours. The "A" RHR pump was in the SDC mode of operation with the indicated RV water level at +38 inches. The indicated RV water level spiked to approximately +48 inches. The Group 1 isolation signal resulted in the expected designed responses as described for the first event. The indicated RV water level then returned to +38 inches. The isolation signal was reset and a decision was made to leave the MSIVs and Main Steamline drain valve closed using the RHR System for plant cooldown.

Failure and Malfunction Report 91-127 was written to document this event. The NRC Operations Center was notified in accordance with 10 CFR 50.72 of the second and third events on April 30, 1991 at 1039 hours. This event occurred with the RV pressure at approximately 3 psig and the RV water temperature at approximately 168 degrees Fahrenheit. The RMSS was in the SHUTDOWN position.

CAUSE

The Group 1 isolations were initiated from the Reactor Water Level trip units LIS-263-58A and LIS-263-58B. These trip units received false high RV water level signals from level transmitters LT-263-58A and LT-263-58B that are both connected via instrument piping to common condensing chamber 12B. A review of the plant information computer traces shows that trip unit LIS-263-57A along with LIS-263-58A and -58B tripped during the second event. Trip units LIS-263-57A and -57B receive a signal from LT-263-57A and -57B, respectively, that are connected via instrument piping to condensing chamber 12A. This indicates that although the "B" side trip units caused the Group 1 isolations, the "A" side also experienced some spiking. However, the "A" side spiking began later in the RV cooldown than the "B" side spiking and was lower in amplitude.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST, 305 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (if more space is required, use additional NRC Form 306A's) (17)

A Multi-Disciplined Analysis Team (MDAT) was formed to investigate the cause of the false high RV water level signals and recommend corrective actions. The MDAT conclusions are discussed below.

The RV water level instrumentation is connected via instrument piping to condensing chambers. The condensing chambers maintain the water level in the RV water level reference legs. The condensing chambers are connected to the RV water level nozzles via a head equalizing line. The head equalizing line provides an open path between the RV and the RV water level reference leg. There are two condensing chambers connected to each head equalizing line. The water from the condensing chambers drains back to the vessel via this line.

The physical arrangement of the reference level system was changed during refueling outage number 7. The original system consisted of one inch head equalizing lines connecting the RV to two condensing chambers. However, one condensing chamber was self-draining through the active leg. Plant Design Change (PDC 85-07) removed the self-draining condensing chamber. Therefore, both condensing chambers now drained condensate back to the RV through a common one inch head equalizing line.

Based on the above information, the MDAT concluded the most probable cause of the false high RV water level signals was undersized head equalizing lines. The one inch line was not sufficiently sized to allow water from the two condensate chambers to drain back constantly to the RV during shutdown. This condition did not affect normal steady state operations. As the RV depressurized, the flow to the RV was disrupted, blocking the head equalizing line. This caused condensing chamber pressure to decrease with respect to the RV resulting in water level instrument spiking. PDC 85-07 did not consider the effect of draining both condensing chambers through a common one inch line.

The MDAT identified contributing causes of the RV water level spiking that included marginal sensing line slope, pipe hanger mechanical interference and air entrapment.

- A walkdown of the RV water level instrument sensing lines inside the drywell found instances of marginal slope, particularly for the "A" train feedwater sensing chambers. The marginal slope could allow air to become entrapped leading to erratic level readings during plant depressurization.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 300 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (if more space is required, use additional NRC Form 306A's) (17)

- The RV expands approximately two inches longitudinally upon heatup. If the small diameter RV water level sensing lines do not grow proportionately, then the condensing chambers could lose their higher elevation with respect to the RV. This would allow air to be trapped during plant cooldown causing water level spiking. A walkdown of the piping identified some hard contact points that could impede sensing line thermal growth. However, none of the identified hard contact points was severe enough to cause lockup of the piping during operating conditions.

CORRECTIVE ACTIONS

A Plant Design Change (PDC 91-40) was implemented. This modification changed the size of the head equalizing line from one to two inches. This will improve the communication between the condensing chambers and the RV. The piping was resloped and the condensing chambers configured such that the two inch pipe connects to the top of the chamber to prevent air trap formation. This PDC also eliminated the hard contact points on the sensing lines. This will allow the sensing lines to thermally grow with the RV during plant heatup and will help prevent air trap formation. A new sensing line backfill method was developed that provides higher flush velocities. This improves removal of trapped air pockets.

A Temporary Modification (TM 91-44) was implemented to monitor the movement of the condensing chambers during plant startup and shutdown. The modification consists of connecting resistance temperature devices to the condensing chambers and sensing lines. Additionally, position transducers were connected to condensing chambers 13A and 13B and the "B" side RV nozzle. This verified that the condensing chambers and sensing lines move vertically with RV thermal expansion and contraction. This equipment will be removed in an outage of sufficient duration.

Temporary Procedure (TP 91-130), "Reactor Water Level Condensing Chamber Modification PDC 91-040" Rev. 0, was completed on August 14, 1991. The purpose of the procedure was to collect and evaluate data during the post refueling outage Power Ascension Program. This data was used to evaluate the effectiveness of the RV water level head equalizing line modification. The testing included pressurizing to approximately 380 psig and depressurizing to approximately 32 psig. The data collected indicated no instances of RV water level perturbations or transients similar to the problems experienced in April 1991.

SAFETY CONSEQUENCES

These events posed no threat to the public health and safety.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F-520), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (if more space is required, use additional NRC Form 366A (2/11))

The isolations were the designed response to a high RV water level signal. The PCIS provides timely protection against the gross release of radioactive materials from the fuel, nuclear system process barrier and from the primary containment. The purpose of the RV high water level isolation is to protect against rapid depressurization due to malfunction of the pressure regulator system during startup when RV pressure is below approximately 880 psig. This isolation is only in effect during a startup or a shutdown. For these events, a false high RV water level signal occurred. The isolation signals were reset promptly. The PCIS was able to fulfill its safety functions for each event.

This report is submitted in accordance with 10 CFR 50.73 (a)(2)(iv) because the Group 1 portion of the PCIS logic circuitry actuated.

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)(iv) that involved PCIS group 1 actuations due to false high RV water level signals. Two similar events were identified in LERs 50-293/84-019-00 and 50-293/90-003-00.

LER 84-019-00 documents a Group 1 isolation signal that occurred when reactor water level indication from the "A" level instrumentation trended up to +45 inches. The cause was excess cooling in the area of the "A" reference leg. Corrective action, related to the response of Generic Letter 84-23, included installing new reference legs outside the Drywell, minimizing the vertical piping drop inside the drywell and replacing the former reactor water level instrumentation with transmitters and electronic switching devices. The installations were completed during Refueling Outage number seven.

LER 90-003-00 documents a Group 1 isolation signal that occurred when reactor water level indication from the "B" level instrumentation rapidly increased from +25 inches to +50 inches for approximately thirty seconds. The cause was believed to be trapped air in sensing lines. A station procedure was developed that provided the necessary instructions for backfilling. Additionally, certain surveillance procedures were revised to minimize the possibility of introducing air into the system.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 366A's) (12)

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

COMPONENTS

CODES

Valve, Isolation (MSIVs)
Recorder, Level
Transmitter, Level
Switch, Level

ISV
LR
LT
LIS

SYSTEMS

Containment Isolation Control System (PCIS)
Engineered Safety Feature Actuation System (PCIS)
Incore/Excore Monitoring System (RV Water Level)

JM
JE
IG