



10 CFR 50.73

BOSTON EDISON

Pilgrim Nuclear Power Station
Rocky Hill Road
Plymouth, Massachusetts 02360

George W. Davis
Senior Vice President - Nuclear

May 29, 1991
BECO Ltr. 91- 072

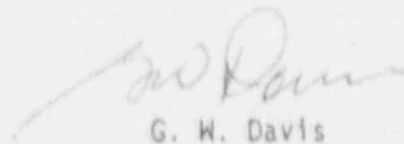
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

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

Dear Sir:

The enclosed Licensee Event Report (LER) 91-007-00, "Completion of a Shutdown Due to Drywell Floor Sump Leakage Rate and Subsequent Scram Signal 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.



G. W. Davis

DWE/bal

Enclosure: LER 91-007-00

cc: Mr. Thomas T. Martin
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ESTIMATED BURDEN IN RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST SEE HHS FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F500), U.S. NUCLEAR REGULATORY COMMISSION WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3160)DCM, OFFICE OF MANAGEMENT AND BUDGET WASHINGTON, DC 20503

TABLE 13

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LICENSEE CONDUCT FOR THIS LEH (12)

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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

SUPPLEMENTAL REPORT EXPECTED 1141

[illegible]

YES / If yes, complete EXPECTED SUBMISSION DATE:

YES	NO
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ABSTRACT. (2011) 36 (40) 3483–3498. doi:10.1017/S0007122611000603 Printed in the United Kingdom
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On April 29, 1991 at 1912 hours, a Technical Specification required shutdown was completed. A voluntary shutdown had been initiated at 1415 hours because of fluctuating recirculation pump seal pressures. The required shutdown was initiated at 1650 hours as a result of Drywell sump monitoring data. An Unusual Event (UE) was declared at 1650 hours because the Drywell floor sump (unidentified leakage) leakage rate was greater than 5 gpm. The shutdown was required by Technical Specification 3.6.C.3. After the shutdown, an unplanned Reactor Protection System (RPS) scram signal occurred at 1935 hours when the Scram Discharge Volume (SDV) high water level scram bypass switch was moved to the NORMAL position while a sensed SDV high water level condition existed. The RPS was reset at 1937 hours. The UE was terminated on April 30, 1991 at 0025 hours. The cause for the shutdown was the end of useful life of the Recirculation System Loop 'B' pump cartridge type dual mechanical seal that was manufactured by Byron Jackson Pumps, Inc. The Recirculation System Loops 'A' and 'B' pump seals were previously scheduled for replacement and will be replaced prior to startup from the current refueling outage. The cause for the scram signal was utility licensed operator error. The responsible operator was counseled. The approved procedure for resetting the RPS was strengthened. The required shutdown was initiated when the reactor mode selector switch was in the RUN position, the RV pressure was 958 psig with the RV water temperature at 539 degrees Fahrenheit, and the reactor power level was 48 percent. This report is submitted in accordance with 10 CFR 50.73 subparts (a)(2)(i)(A) and (a)(2)(iv), and these events posed no threat to the public health and safety.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THE 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 20555, 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 (3)			PAGE (3)		
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TEXT (If more space is required, use additional NRC Form 355A's) (17)

BACKGROUND

The leakage of water and/or steam within the Drywell (primary containment) is detected and monitored by the Drywell sumps and atmosphere sampling systems. There are two Drywell sumps. The Drywell equipment drain sump receives drainage from identified sources and has a cover and raised curb to prevent floor drainage from intermixing with equipment drainage. The floor drain sump receives leakage from unidentified sources. Each sump is routinely pumped every four hours in accordance with Procedure 2.1.15 (currently Rev. 85). The leakage rate is calculated, and the rate from each sump and the combined leakage rate for both sumps are reviewed to detect increases. Identified or unidentified leakage in excess of normal background amounts is potentially indicative of a reactor coolant leak. In addition to the Drywell sumps, the Drywell atmosphere sampling system provides for monitoring airborne radioactivity levels within the Drywell. The system consists of two permanently installed panels (C-19A/B). Each panel is capable of monitoring the Drywell atmosphere for particulate, halogen, and gaseous activity.

Each Recirculation System pump is provided with a seal cartridge assembly consisting of an inner seal (number 1) and an outer seal (number 2). The seals function to minimize the leakage of water from the pump where the pump shaft penetrates the pump housing. Each seal in the cartridge is capable of sealing against pump design pressure so that any one seal can limit leakage if the other seal should fail. A labyrinth seal (breakdown bushing) is provided along the pump shaft to minimize leakage if a gross failure of both seals occurs. Each pump is equipped with instrumentation that includes seal pressure, seal staging flow, and seal temperature. The instrumentation provides signals for monitoring and alarm functions on Control Room Panels C-904C and C-904R. A seal purge system provides high pressure Control Rod Drive (CRD) System water that cools the seals and improves the useful life of the seals by providing clean water to the seals.

On December 25, 1990 at approximately 2000 hours, routine pumping of the equipment and floor sumps revealed an increase of approximately 0.4 gpm since the previous (at 1600 hours) pumping of the floor sump. An additional increase of approximately 0.3 gpm was identified at the subsequent (at 2400 hours) pumping of the floor sump. Investigation revealed that the seal pressure of the outer seal had decreased from a normal value of approximately 540 psig to approximately 75 psig, and a decrease in the equipment sump leakage rate from approximately 1.7 gpm to 1.3 gpm with a similar increase in the floor sump leakage rate. Those changes indicated the outer seal (number 2) was deteriorating.

On April 28, 1991 at 1540 hours, a Recirculation System pump 'B' seal staging flow alarm and a step increase in the outer seal temperature occurred. The equipment sump and floor sump were pumped and the leakage rates were approximately 1.0 gpm and 3.0 gpm, respectively. The sumps were pumped hourly until 2000 hours; the equipment sump leakage rate was steady at 0.9 gpm and the floor sump leakage rate was relatively steady at 1.6 gpm. Subsequent pumping revealed varying floor sump leakage rates between 1.4 gpm to 2.7 gpm. The individual Drywell sumps leakage rates and total leakage rate remained below the limits specified by Technical Specification 3.6.C and identified in Generic Letter 84-11 Attachment 1 Item B that is incorporated into Procedure 2.1.15.

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-630), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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Pilgrim Nuclear Power Station	0 5 0 0 0 2 9 3	9 1	0 0 7	0 0 0 3	OF	0 7

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

EVENT DESCRIPTION

On April 29, 1991 at 1912 hours, a Technical Specification required shutdown was completed when the reactor mode selector switch (RMSS) was moved from the RUN position to the SHUTDOWN position. This action was taken in accordance with Procedure 2.1.5 (Rev. 5), "Controlled Shutdown from Power", and resulted in the expected Reactor Protection System (RPS) scram signal and scram. The shutdown was specified by Technical Specification 3.6.C.3 because the Drywell floor sump (unidentified) leakage rate was identified to be greater than 5 gpm at 1650 hours. Because the leakage rate was greater than 5 gpm (the leakage rate was approximately 6.8 gpm), an Unusual Event (UE) was declared in accordance with the administrative requirements of Pilgrim Station Emergency Plan Implementing Procedure EP-IP-100 (Rev. 2), "Emergency Classification", Attachment 1 section 3.3.1.1 at 1650 hours.

Failure and Malfunction Report (F&MR) 91-122 was written to document that the Drywell floor sump leakage rate had exceeded 5 gpm. The NRC Operations Center was notified of the initiation of the required shutdown in accordance with 10 CFR 50.72 on April 29, 1991 at 1711 hours.

The scram that occurred as a result of moving the RMSS to the SHUTDOWN position at 1912 hours resulted in an expected decrease in the RV water level due to shrink (i.e., a decrease in the void fraction in the RV water). The level momentarily decreased to approximately -10 inches (narrow range). The decrease in the RV water level to less than the low RV water level setpoint (calibrated at approximately +12 inches) resulted in actuations of the Primary Containment Isolation Control System (PCIS) and Reactor Building Isolation Control System (RBIS).

The PCIS actuation resulted in the following designed responses:

- The inboard and outboard Primary Containment System (PCS) Group 2/Sampling System isolation valves that were in the open position, closed automatically.
- The inboard and outboard PCS Group 3/Residual Heat Removal (RHR) System isolation valves, in the closed position, remained closed.
- The inboard and outboard PCS Group 6/Reactor Water Cleanup (RWC) System isolation valves, in the open position, closed automatically.

The RBIS actuation resulted in the following designed responses:

- The Secondary Containment System (SCS)/Reactor Building Trains 'A' and 'B' supply and exhaust ventilation dampers closed automatically.
- The SCS/Standby Gas Treatment System (SGTS) Trains 'A' and 'B' started automatically.

The PCIS and RBIS circuitry was reset at approximately 1923 hours and the affected systems were returned to normal service.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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 (F-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)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
Pilgrim Nuclear Power Station		YEAR 91	SEQUENTIAL NUMBER 07
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TEXT (If more space is required, use additional NRC Form 306A's) (17)

After the shutdown, and with the control rods in the inserted position, an unplanned RPS scram signal occurred on April 29, 1991 at 1935 hours when the Scram Discharge Volume (SDV) high water level scram bypass switch was moved from the BYPASS position to the NORMAL position while the RMSS was in the SHUTDOWN position. This action was taken as part of resetting the RPS circuitry after the RMSS was moved to the SHUTDOWN position at 1912 hours. The RPS was reset at 1937 hours. F&MR 91-123 was written to document the unplanned scram signal. The NRC Operations Center was notified in accordance with 10 CFR 50.72 on April 29, 1991 at 2020 hours.

The UE was terminated on April 30, 1991 at 0025 hours when the Drywell floor sump leakage rate was approximately 1.8 gpm.

On April 30, 1991 at 0117 hours, the RV water level was being increased to approximately +35 inches as part of stroke testing the RHR System/Shutdown Cooling (SDC) suction piping isolation valve MO-1001-50. A PCIS Group 1/Main Steam isolation signal occurred and is separately reported in LER 50-293/91-008.

Cold shutdown was achieved by 0855 hours when the RV water temperature was approximately 208 degrees Fahrenheit. The RHR System was put into service in the SDC mode at 0934 hours.

After the Drywell was de-inerted, an initial Drywell inspection began on April 30, 1991 at approximately 1200 hours. The inspection revealed evidence that leakage from the Recirculation System Loop 'B' pump outer seal had occurred.

The required shutdown was initiated when the RMSS was in the RUN position, the RV pressure was 958 psig with the RV water temperature at approximately 539 degrees Fahrenheit, and the reactor power level was 48 percent.

CAUSE

The reason for the Technical Specification required shutdown was an increase in the Drywell floor sump leakage rate to greater than 5 gpm. The cause for the increase in the leakage rate was the end of useful life of the inner seal (number 1) of the Recirculation System Loop 'B' pump. On April 29, 1991, and prior to the initiation of the required shutdown, the Drywell floor sump leakage rate was relatively steady at approximately 2.5 gpm and the Drywell equipment sump leakage rate was steady at approximately 0.9 GPM. At 1350 hours, rapid fluctuations in Recirculation System Loop 'B' pump seal pressures were observed, and a slight increase in Drywell temperatures and pressure also occurred. The Drywell temperatures and pressure decreased to normal values after additional Drywell cooling and SGTS venting from the Torus atmosphere was initiated. A voluntary shutdown was initiated at 1415 hours. The Recirculation System Loop 'B' pump was secured from operation at 1450 hours. At 1650 hours the Drywell floor sump leakage rate was confirmed to have increased to approximately 6.8 gpm and the Technical Specification required shutdown was initiated at that time.

The Recirculation System pumps 'A' and 'B' are vertical recirculating pumps and were manufactured by Byron Jackson Pumps Inc., size 28x28x28, type DVSS. The seal, a cartridge type dual mechanical seal, was also manufactured by Byron Jackson pumps.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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 (F-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 366A's) (17)

The cause for the unplanned scram signal was utility licensed operator error. As a result of moving the RMSS to the SHUTDOWN position at 1912 hours, an expected RPS scram signal and scram occurred. A scram results in the introduction of CRD System water into the SDV tanks. As part of resetting the RPS, the SDV bypass switch was moved to the BYPASS position in accordance with Procedure 2.1.6 (Rev. 29), "Reactor Scram". While in the BYPASS position, the bypass switch provides an SDV high water level scram bypass function. The bypass function is provided by the SDV high water level scram bypass relays. The bypass relays enable the RPS circuitry to be reset and the SDV tanks (west and east) to be drained. After the SDV tanks were drained, an SDV high water level signal existed. The signal existed because the high water level sensors, i.e. resistance temperature detectors (RTDs), were not then sufficiently reheated. The movement of the SDV bypass switch to the NORMAL position at that time was contrary to Procedure 2.1.6 (section 5.0) because the SDV high water level scram indication had not cleared. The sensed SDV high water level condition together with the movement of the SDV bypass switch to the NORMAL position resulted in the unplanned scram signal.

CORRECTIVE ACTION

The following actions have been taken or planned for the Recirculation System pumps 'A' and 'B' seals.

- The seal cartridges were previously scheduled for replacement during this refueling outage (RFO 8) and will be replaced prior to startup. The refueling outage began on May 4, 1991.
- The replacement of the seal cartridges is currently scheduled for every second refueling outage (approximately every three and one-half years). The frequency is based on the average time between pump seal replacements since 1981 for the pump 'A' (4.85 years average) and pump 'B' (3.66 years average). The pump 'A' seal cartridge was last replaced in December 1984 and the pump 'B' seal cartridge was last replaced in September 1985. The preventive maintenance program is controlled in accordance with Procedure 1.8.2, "Preventive Maintenance Tracking Program". The frequency for replacing the cartridges may be changed as additional experience indicates.

The following actions have been taken or planned for the unplanned scram signal.

- The responsible operator was counseled.
- Procedure 2.1.6 was revised. The revision (to Rev. 30) added a verification action to step [7](f) in section 5.0. Essentially, the action is for the shift Nuclear Operating Supervisor (senior licensed operator) to verify that the SDV water level alarm indications (high level and not drained) have cleared prior to moving the SDV bypass switch to the NORMAL position.
- An Engineering Service Request (ESR 91-326) has been written. The ESR was written to review the SDV circuitry for possible improvements relative to operator information and control.

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-530) U.S. NUCLEAR REGULATORY COMMISSION WASHINGTON, DC 20555, 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 386A's) (17)

SAFETY CONSEQUENCES

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

The Drywell sumps were operable and the Drywell atmosphere sampling Panel C-19B was operable. Therefore, adequate means for detecting and monitoring leakage within the Drywell existed during the period of power operation when the Drywell sumps and atmosphere sampling systems were required to be operable and when the Drywell floor sump leakage rate exceeded 5 gpm.

The maximum Drywell floor sump leakage rate that occurred during the shutdown was approximately 12.2 gpm. That leakage rate was less than the RV water makeup capabilities of the Feedwater System or CRD System.

The manual scram resulted in a decrease in the RV water level to approximately -10 inches (narrow range). The decrease was the expected response to the scram and accompanying shrink in the RV water. The PCIS and RBIS actuations were the designed responses to a low RV water level (less than +12 inches).

The Technical Specification 2.1.I Limiting Safety Setting for actuation of the Core Standby Coupling Systems (CSCS) is -49 inches. During the event the lowest RV water level that occurred, approximately -10 inches, was approximately 36 inches above the CSCS setpoint (calibrated at approximately -46 inches). In addition, the level was approximately 117.5 inches above the level that corresponds to the top of the active fuel zone.

The unplanned SDV high water level scram signal occurred when the SDV bypass switch was moved to the NORMAL position because the high water level sensors (RTDs) had not reheated sufficiently after the SDV tanks were drained. The water that had been introduced into the SDV tanks was the expected result of the scram that was manually initiated for the completion of the shutdown. The keylocked SDV high water level scram bypass switch was put in the BYPASS position in order to reset the RPS circuitry and drain the water from the SDV tanks. The bypass function provided by the SDV bypass switch is available only when the RMSS is in the REFUEL or SHUTDOWN position.

This report is submitted in accordance with 10 CFR 50.73(a)(2)(i)(A) because of the completion of a Technical Specification required shutdown.

This report is also submitted in accordance with 10 CFR 50.73(a)(2)(iv) because the scram signal resulting from moving the SDV bypass switch to the NORMAL position while a sensed SDV high water level condition existed was not planned.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 60.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-330), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3160-0108), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (if more space is required, use additional NRC Form 386A's) (17)

SIMILARITY TO PREVIOUS EVENTS

A review was conducted of Pilgrim Station LERs submitted since January 1984. The review focused on shutdowns caused by the leakage rate of the Drywell sumps, and scram signals occurring while resetting the RPS that were caused by operator error. The review revealed no previous shutdowns caused by the Drywell equipment sump or floor sump leakage rate.

For scram signals occurring while resetting the RPS, the review identified a similar event reported in LER 50-293/89-020-00.

For LER 89-020-00, a scram signal occurred while shutdown. At the time of the event, the RMSS was in the SHUTDOWN position, the control rods were in the inserted position, the RV pressure was zero psig and the RV water temperature was 189 degrees Fahrenheit. The scram signal occurred when the SDV bypass switch was moved to the NORMAL position while a sensed SDV high water level condition existed. The cause was utility licensed operator error. The responsible operator was verbally reprimanded for failing to follow the approved procedure (2.1.6 Rev. 24). The procedure was also revised after the event. The revision added a supplemental step to check the process computer alarm typer for the status of the SDV water indications (high water level and not drained) after the Panel C-905R indications have cleared and prior to moving the SDV bypass switch to the NORMAL position.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are as follows:

COMPONENTSCODES

Pump
Seal
Switch, Hand (SDV Bypass Switch)

P
SEAL
HS

SYSTEMS

Containment Environmental Monitoring System (Drywell Sump System)
Control Rod Drive System (SDV)
Engineered Safety Features Actuation System (RPS/PCIS/RBIS)
Reactor Recirculation System

IK
AA
JE
AD