

LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F-830), 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) Perry Nuclear Power Plant, Unit 1 DOCKET NUMBER (2) 05000440 PAGE (3) 1 OF 15

TITLE (4) Control Rod Scram Insertion Time Testing Results in Discovery of Common Mode Failure and Technical Specification Required 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		
10	06	91	91	018	0	10	04	1992	DOCKET NUMBER(S): 050000		
									DOCKET NUMBER(S): 050000		

OPERATING MODE (9) 0184

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50. Check one or more of the following: (11)

<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.406(c)	<input type="checkbox"/> 50.73(a)(2)(vi)	<input type="checkbox"/> 73.71(b)
<input type="checkbox"/> 20.406(a)(1)(iii)	<input type="checkbox"/> 50.36(a)(1)	<input checked="" type="checkbox"/> 50.73(a)(2)(vi)	<input type="checkbox"/> 73.71(a)
<input type="checkbox"/> 20.406(a)(1)(iv)	<input type="checkbox"/> 50.36(a)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> OTHER (Specify in 401001 show end in Text NRC Form 366A)
<input type="checkbox"/> 20.406(a)(1)(v)	<input checked="" type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(viii)	
<input type="checkbox"/> 20.406(a)(1)(vi)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 50.73(a)(2)(ix)	
<input type="checkbox"/> 20.406(a)(1)(vii)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME Henry L. Hegrat, Compliance Engineer, Extension 5185 TELEPHONE NUMBER 2116 2591-1373

AREA CODE 2116

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

CAUSE	SYSTEM	COMPONENT	MANUFAC TURE	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFAC TURE	REPORTABLE TO NRC
X	A	A P I S I V	A 6 1 1 0	Yes					

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 October 6, 1991, at 1037, control rod 46-23 exceeded its maximum scram time to position 43. Operators then took action to demonstrate that the eight adjacent control rods surrounding control rod 46-23 could satisfy the maximum scram insertion time limits. Control rod 42-19 also exceeded its maximum scram insertion time to position 43. Because control rods 46-23 and 42-19 are adjacent rods, the plant was required by Technical Specifications to be in at least Hot Shutdown within 12 hours. On October 6, 1991, at 1436, operators commenced a shutdown of the plant.

The cause of the "slow" control rods is attributed to component failure. The Automatic Switch Company (ASCO) Model Number HVA176-816-1 Scram Solenoid Pilot Valve (SSPV) for each of the affected control rods was determined to be the cause of the "slow" control rods. A combination of contaminants found on the valve disk and seats is believed to have formed an adhesive which could have bound the valve seat. All of the suspect SSPVs were from the same lot remanufactured by ASCO in November, 1990.

After shutdown of the plant, all 49 of the SSPVs from lot number 184010001 were removed from their associated HCUs and replaced. A maintenance instruction will be revised to further restrict the contaminants that may have been introduced at Perry. As part of the established requalification training program, all plant licensed operators will be instructed on the lessons learned from this event.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATIONESTIMATED 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 20555 AND TO
THE PAPERWORK REDUCTION PROJECT (3150-0104) OFFICE
OF MANAGEMENT AND BUDGET WASHINGTON DC 20503

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Perry Nuclear Power Plant, Unit 1	0500044091	—	0118	—	0102 OF 05

TEXT (if more space is required, use additional NRC Form 388A's) (17)

I. Introduction

On October 6, 1991, at 2334, operators completed a shutdown of the plant in accordance with Technical Specifications as a result of two adjacent control rods exceeding maximum insertion scram time limits. At the time of the control rod scram time failures, the plant was in Operational Condition 1 (Power Operation) at 84 percent of rated thermal power, with the Reactor Pressure Vessel (RPV) at saturated conditions at approximately 1000 psig. The required non-emergency four-hour notifications were made to the NRC pursuant to the requirements of 10CFR50.72(b)(2)(iii) and (b)(1)(i)(A). This event is being reported under the requirements of 10CFR50.73(a)(2)(i), (a)(2)(v) and (a)(2)(vii).

II. Description of Event

On July 20, 1991, at 1055, while performing Surveillance Instruction (SVI-C11-T1006) "Control Rod Maximum Scram Insertion Time", control rod 26-59 exceeded its maximum scram time to position 43. Technical Specification 3.1.3.2 prescribes a maximum insertion time to notch position 43 of 0.31 seconds. The time to notch position 43 for control rod 26-59 was 0.32 seconds. This resulted in control rod 26-59 being classified in accordance with Technical Specification 3.1.3.2 Action a.1 as "slow".

Operators then took action to demonstrate that the adjacent control rods surrounding control rod 26-59 could satisfy the maximum scram insertion time limits in accordance with Technical Specification 3.1.3.2 Action c. After successful testing of the eight adjacent rods, testing of other control rods continued. The Scram Solenoid Pilot Valve (SSPV) was replaced and control rod 26-59 was successfully retested. As a result of this event, scram time testing frequency was increased.

On October 6, 1991, at 0445, while performing SVI-C11-T1006, control rod 26-19 exceeded its maximum scram time to position 43. The time to notch position 43 for control rod 26-19 was 0.38 seconds. This resulted in control rod 26-19 being classified in accordance with Technical Specification 3.1.3.2 Action a.1 as "slow".

Operators then took action to demonstrate that the eight adjacent control rods surrounding control rod 26-19 could satisfy the maximum scram insertion time limits in accordance with Technical Specification 3.1.3.2 Action c. After successful testing of the eight adjacent rods, testing of other control rods continued.

On October 6, 1991, at 1037, control rod 46-23 exceeded its maximum scram time to position 43. The time to notch position 43 for control rod 46-23 was 0.37 seconds. This resulted in control rod 46-23 being classified as "slow". Operators then took action to demonstrate that the eight adjacent control rods surrounding control rod 46-23 could satisfy the maximum scram insertion

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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 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

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TEXT (if more space is required, use additional NRC Form 388A's) (17)

time limits. On October 6, 1991, at 1150, control rod 42-19 also exceeded its maximum scram insertion time to position 43. The time to notch position 43 for control rod 42-19 was 0.32 seconds which resulted in this control rod being classified as "slow". Because control rods 46-23 and 42-19 are adjacent rods, the plant was required by Technical Specification 3.1.3.2 Action a.4 to be in at least Hot Shutdown within 12 hours. The failure of the three hydraulic control units (HCUs) associated with the "slow" control rods was considered to be a common mode failure and was reported to the NRC via the Emergency Notification System (ENS) at 1313. On October 6, 1991, at 1436, operators commenced the plant shutdown, and at 1443, notified the NRC via the ENS. Operational Condition 3 (Hot Shutdown) was entered on October 6, 1991, at 2334.

III. Cause of Event

The cause of the "slow" control rods is attributed to component failure. The Automatic Switch Company (ASCO) Model Number HVA176-816-1 SSPV for each HCU of the affected control rods was determined to be the cause of the "slow" control rods. All four of the SSPVs were from the same lot number (184010001) ordered October 15, 1990 and remanufactured by ASCO exclusively for the Perry Plant on November 9, 1990. Initial examination of the internals of the SSPVs for control rod HCUs 42-19 and 46-23 did not reveal a specific reason for the malfunctions. The valves operated but not fast enough to meet requirements; therefore, physical evidence of the cause of the malfunction was not readily apparent.

On April 1, 1992, General Electric (GE) completed a failure analysis of the affected SSPVs, using infrared measurement techniques on contaminant samples found inside the valves. The valve disk and seats were found to be contaminated with slight traces of a chlorinated or chlorofluorinated solvent, silicone lubricant, alcohol, Dioctyl Phthalate (a plasticizer found in Buna-N material), nylon (an embedded fiber in the Buna-N diaphragm) and a polymethacrylate ester (threadlocker). The combination of these chemicals can form two types of adhesives (migrating and non-migrating) which could bind the valve seat and cause slow shifting.

IV. Analysis of Event

The control rod system is designed to bring the reactor subcritical at a rate fast enough to prevent the Minimum Critical Power Ratio (MPCR) from becoming less than 1.07 during the limiting power transient analyzed in Chapter 15 of the USAR. This analysis shows that the negative reactivity rates resulting from the scram with the average response of all the drives as given in the specifications, provide the required protection and MPCR remains greater than 1.07. The occurrence of scram times longer than those specified should be viewed as an indication of a systematic problem with the rod drives.

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TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST 50.9 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F530), 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 366A's (17)

Control rods 26-19, 42-19, and 46-23 did not meet the most stringent scram insertion time testing requirements to position 43 due to problems with the associated SSPVs; however, all three control rods met the requirements to positions 29 and 13 and as such were declared "slow operable". Even with the three "slow" control rods, the negative reactivity rates resulting from a scram with the average response of all the drives would have provided the required protection and the MPCR would have remained greater than 1.07; therefore, this event is not considered to be safety significant. Additionally, during this event, all action requirements of Technical Specification 3.1.3.2 were satisfied within the prescribed time limits and the plant was successfully shut down for repairs.

A previous similar event occurred as documented by LER 89-030. On November 25, 1989, the malfunction of two SSPVs due to improper seating material resulted in a violation of Technical Specifications. The causes for the November, 1989 event were inadequate implementation of the Nonconformance Control Program and personnel error in the assessment of test results. An event that occurred on October 1, 1990 resulted in the discovery of malfunctioning SSPVs from a single lot installed in the plant during the refueling outage, and resulted in a 10CFR21 notification on December 11, 1990. Because neither of these events involved contamination of the SSPVs disk and seat, none of the corrective actions from LER 89-030 or the October 1990 event could have prevented the October 6, 1991 event.

A review of the contaminants analyzed by GE determined the silicone lubricant and the threadlocker could have been introduced at Perry. Silicone grease was used during the rework of the Hydraulic Control Unit Scram Air Header Isolation Valve and the threadlocker was used on the fittings directly upstream of the SSPVs. Based on restrictions of the chemical control program at Perry, site work practices, and valve design, it is highly unlikely the chlorinated or chlorofluorinated solvent, alcohol, Dioctyl Phthalate, or nylon would have been introduced at Perry.

The GE analysis determined that a combination of adhesive effects were required to cause the sticking or slow valve performance. Valves subjected to one effect and not another would show no evidence of sticking. If contaminants introduced by installation or maintenance practices were solely responsible, it would be expected that valve failure would be independent of manufacturing lot and would increase with time in service. The failed SSPVs had been in service for a relatively short time period when compared with those from other lots. Additionally, during a rapid plant shutdown in December, 1991, all control rods scrambled within the required times to all positions. Due to these factors, it has been determined that the problems experienced were related specifically to lot 184010001, remanufactured by ASCO on November 9, 1990.

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TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST 900 HRS FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-5201) 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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V. Corrective Actions

After shutdown of the plant, all 49 of the SSPVs from lot number 184010001 were removed from their associated HCUs and replaced with new (not remanufactured) valves from two other lots and the associated control rods were successfully tested for maximum scram insertion times. Generic Maintenance Instruction (GMI-122) "Hydraulic Control Unit Equipment Qualification Maintenance" will be revised to specify the use of Teflon tape to seal the threads rather than a liquid threadlocker and will specify the use of only approved aqueous cleaning agents. With regards to the contaminants possibly introduced at the manufacturer, GE has stated they are addressing the entire issue of valve contaminants with ASCO and will be taking appropriate action as required. This GE investigation would include a close look at both the possible introduction of Freon based degreasers and/or alcohol. As part of the established requalification training program, all plant licensed operators have been instructed on the lessons learned from this event.

Energy Industry Identification System Codes are identified in the text as [XX].