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SUBJECT: LER 94-017-00:on 940711,automatic isolation of RHR sys shutdown cooling suction outboard containment isolation valve occurred due to inadequate work order.Work order process for I&C work orders will be reviewed.W/940810 ltr.

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August 10, 1994
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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Perry Nuclear Power Plant
Docket No. 50-440
LER 94-017

Gentlemen:

Enclosed is Licensee Event Report 94-017 concerning a Residual Heat Removal Shutdown Cooling System Isolation.

If you have questions or require additional information, please contact Mr. James D. Kloosterman, Manager - Regulatory Affairs at (216) 280-5833.

Very truly yours,

RAS:CRE:sc

Enclosure: LER 94-017

cc: NRC Project Manager
NRC Resident Inspector Office
NRC Region III

IE22

NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

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)

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FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Perry Nuclear Power Plant, Unit 1	05000 440	1 OF 6

TITLE (4) Inadequate Work Order Results in Residual Heat Removal "B" Shutdown Cooling System Isolation

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	11	94	94	-- 017 --	0	08	10	94		05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	4
POWER LEVEL (10)	000

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.402(b)		20.405(c)	X	50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)		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)
Charles R. Elberfeld, Compliance Engineer	(216) 280-5264

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
X	BO	OB--	G080	No						

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 July 11, 1994, at 2154, an automatic isolation of the Residual Heat Removal (RHR) System Shutdown Cooling Suction Outboard Containment Isolation Valve occurred during the pressure testing of a reactor pressure transmitter instrument isolation valve. Although the suction valve responded as designed to the isolation signal, RHR "B" pump trip logic did not function properly, and the pump was turned off by an operator. On July 11, 1994, at 2247, the RHR B loop of shutdown cooling was restored.

The cause of the event is personnel error, inattention to detail, on the part of the personnel who prepared, reviewed, and approved the work order. The work order made no provision for preventing the isolation signal, which was generated as a result of work activities, from causing the actual isolation.

The event has been reviewed with the personnel involved with the planning and approval of the work order with emphasis placed on thoroughness of reviews and responsibility for determining plant impact. The work order process for Instrumentation and Controls work orders will be reviewed to assess improvements in the areas of technical reviews and standardized methods of conveying plant impact information within work orders.

I. Introduction

On July 11, 1994, at 2154, an automatic isolation of the Residual Heat Removal (RHR) System [BO] Shutdown Cooling Suction Outboard Containment Isolation Valve [ISV] (1E12F0008) occurred during the pressure testing of a reactor pressure transmitter instrument isolation valve. At the time of the event, the plant was in Operational Condition 4 during a refueling outage with RHR "B" loop in shutdown cooling and Reactor Recirculation Pump "B" running in slow speed. The reactor vessel pressure was atmospheric and reactor coolant temperature was approximately 100 degrees Fahrenheit.

On July 11, 1994, at 2338, notification was made to the NRC as required by 10CFR50.72(b)(2)(ii). This event is being reported pursuant to 10CFR50.73(a)(2)(iv) as an engineered safety feature actuation.

II. Description of Event

On July 11, 1994, at 1035, replacement of a leaking instrument isolation valve proceeded under the guidance of an Instrumentation and Controls (I&C) work order. To ensure that the newly replaced valve would not leak under operating conditions, the valve was hydrostatically tested in its normally open position which allowed the test pressure to be sensed by the associated transmitter. The transmitter (1B21-N0078D) is designed to sense reactor steam dome pressure and provide a signal output to a master [PIS] and a slave [PS] trip unit. The master trip unit provides a trip output to the Reactor Protection System (RPS) "D" channel (Reactor Vessel Steam Dome Pressure High, </= 1064.7 psig). The slave trip unit provides a trip output to the RHR outboard containment isolation logic (Reactor Vessel Pressure High, RHR Cut In Permissive, </= 135 psig). The work order directed the I&C technicians to pressurize the valve and its associated transmitter to 1200 psig prior to post maintenance inspection for leakage.

On July 11, 1994, at 2154, the I&C technicians pressurized the instrumentation as prescribed by the work order. This action resulted in an RPS Channel "D" half scram, which was expected under the work order, and also resulted in the closure of the 1E12-F0008 containment isolation valve, which was not expected under the work order. Although the 1E12-F0008 valve responded as designed in response to the trip signal from the slave trip unit, logic to trip the RHR "B" pump (upon less than 90 percent of 1E12-F0008 valve opening) did not function properly and the pump continued to run with its suction path being closed by the containment isolation.

Control Room operators received the "RHR B SUCTION PRESS LOW" annunciator, observed RHR B flow decreasing, and observed that the position lights for 1E12-F0008 indicated that the valve was in a mid-stroke position. The operators

secured the RHR B pump and took appropriate actions to secure the loop in accordance with Off-Normal Instruction (ONI) E12-2, "Loss of Decay Heat Removal". Reactor coolant level increased approximately 10 inches due to the RHR system operating after the logic malfunction.

The operators considered the level increase to be an expected result of the event, performed a fill and vent of the RHR B shutdown cooling loop in accordance with System Operating Instruction (SOI) E12, "Residual Heat Removal System (Unit 1)," and on July 11, 1994, at 2247, restored RHR B shutdown cooling as required by Technical Specification LCO 3.4.9.2 ACTION a.

During the shutdown cooling restoration, reactor coolant level decreased approximately 10 inches and a single "booming" noise was heard by an operator in the plant when the suction pathway for the RHR B loop was established. Operators attributed this noise to the repositioning of the discharge check valve. No movement of piping was observed when the noise was heard or when the RHR B pump was started. It is believed that air was introduced to the loop through the RHR B pump shaft seal during the period that the pump was running with its suction isolated. The fill and vent that was performed on the RHR B loop was, in retrospect, considered to be inadequate. Subsequent system walkdowns, performance testing, and discussions with the pump vendor provided confidence that the reliability of the equipment involved in the event was not adversely affected.

The I&C work order was later revised to install a temporary jumper that prevented the isolation actuation when pressure was applied to the pressure transmitter. A malfunctioning optical isolator card [OB] (General Electric Company Part No. 204B6188AAG002) was found to be the cause of the RHR B pump not tripping. The card was replaced and the logic was tested with satisfactory results. The corresponding optical isolator for the RHR "A" pump trip logic was also functionally tested with satisfactory results. The optical isolators associated with the RHR pump trip logic are not routinely tested.

III. Cause of Event

The cause of the isolation is personnel error, inattention to detail, on the part of the personnel who prepared, reviewed, and approved the I&C work order. Plant Administrative Instruction (PAP-0905), "Work Order Process" requires both the work order planner and the Control Room Unit Supervisor to ensure that work activities can be performed under plant conditions without adversely impacting plant operations. The work order in this event made no provision for preventing the isolation signal, which was generated as a result of work activities, from causing the actual shutdown cooling containment isolation.

A Human Performance Enhancement System (HPES) investigation was conducted to better understand the factors that resulted in this event.

Although the work order was intended to replace the leaking isolation valve for transmitter 1B21N0078D, the transmitter senses pressure from a reference leg which also provides a pressure input to six additional reactor pressure vessel coolant level transmitters. These transmitters have associated trip logic and indication outputs. A major focus of the work order planning effort was to ensure that the various trip signals associated with these transmitters would not inadvertently be initiated. An I&C engineer and planner utilized Instrument Maintenance Instruction (IMI) E2-35, "Filling Reactor Vessel Reference Leg D0004D," as the primary methodology for performing the leak test of the instrument isolation valve and ensuring the other instruments would not respond to the test with adverse consequences. However, both the engineer and the planner did not perform a complete review of the impact of using this methodology.

During the filling of the reference leg under IMI-E2-35, a demineralized water source, which has an operating pressure less than 135 psig, is utilized. Because the pressure being applied to pressure transmitter 1B21-N0078 is less than the slave trip unit setpoint (135 psig), no provisions for the slave trip unit are made for the IMI filling evolution. Provisions are made for the other instrumentation associated with the reference leg. These provisions were utilized for the development of the work order without consideration for preventing the slave trip unit from initiating an RHR shutdown cooling isolation when the leak test pressure (1200 psig as prescribed by the work order) exceeded the 135 psig setpoint.

Due to the technical complexity of the details included in the work order, the ommission was not noted by the Control Room Unit Supervisor during the review and release of the work order package to the field for work.

IV. Safety Analysis

The RHR Cut-in Permissive (</= 135 psig) is provided to protect the RHR system from pressures exceeding its design. The design objective for the containment isolation systems is to allow normal or emergency passage of fluids through the containment boundary to prevent or limit the escape of fission products that may result from postulated accidents so that site boundary dose guidelines specified by 10CFR100 are not exceeded. The objective is achieved by provision for automatic isolation of appropriate lines that penetrate the containment boundary. The RHR System Isolation valves and logic are part of that provision and they functioned as designed during the event.

The RHR shutdown cooling mode of operation is designed to remove decay heat from the reactor pressure vessel during shutdown conditions. The plant had entered Operational Condition 4 (Cold Shutdown) approximately 19 days prior to this event and had been in Operational Condition 5 (Refueling) approximately 37 days prior to entering Cold Shutdown as part of the refueling outage. Reactor coolant temperature was being maintained in a control band of 90 to 110 degrees Fahrenheit prior to this event. During the event, reactor coolant temperature increased from approximately 100 to 102 degrees Fahrenheit over the 53 minutes that shutdown cooling to the vessel was isolated. A reactor pressure vessel coolant level control band of 200 to 300 inches above top of active fuel was established during the event until shutdown cooling could be re-established. Level was maintained within this band during the event. Shutdown cooling was promptly restored and no damage to the RHR "B" pump was incurred. This event is not considered to be safety significant.

V. Similar Events

A previous similar event was documented by LER 90-032, in which the performance of work activities under an inadequately planned I&C work order resulted in an RHR Shutdown Cooling Isolation. The I&C personnel involved with the planning and review of work orders were trained to the event and to the importance of proper sequencing of actions in all work orders.

LER 92-010 documented an event in which work activities under an inadequately planned I&C work order resulted in an inadvertent Balance of Plant Containment isolation. The I&C personnel involved with the planning and review of work orders were trained to the event with emphasis placed on the importance of attention to detail in all aspects of work order preparation.

LER 92-013 documented an event in which troubleshooting activities under an inadequately planned I&C work order resulted in a Main Steam Line Drain isolation. A note was placed in the generic guidance for developing work orders for the related equipment. All licensed operators, I&C technicians, and I&C planners were trained on the lessons learned.

A thorough review of the effectiveness of corrective actions for the three previous LERs was performed in response to an unresolved item from Inspection Report No. 50-440/92014(DRS). Conclusions drawn from this review indicated that the previous corrective actions were appropriate and reasonable to minimize the possibility of human error in work order preparation. This was based the broad scope of work order activities, the complexity of the activities, the large volume of I&C work orders being planned, and the number of actual errors that were not

caught by the process. The July 11, 1994 event is being evaluated in the context of these past events as well as in the context of the details of present requirements and expectations for personnel performance. Reinforcement of expectations in the planning and review process continues to be the proper corrective action.

A recent review of the work order planning and review process has indicated that some changes in expectations and responsibilities have occurred since the response to the unresolved item. Responsibility and expectations for ensuring that work orders do not adversely affect the plant has moved from the work supervisor's review to the Control Room Unit Supervisor's review and approval.

VI. Corrective Actions

This event has been reviewed with the I&C personnel involved with the planning of the work order package. The requirement to perform a thorough review of a package's impact on the plant was emphasized. The event is being reviewed with the Operations personnel responsible for the review/approval of the work order package. The Unit Supervisor's ultimate responsibility to determine the impact of work order packages on the plant is being emphasized.

The work order process for I&C work orders will be reviewed for improvement in the areas of technical reviews, assignment of responsibilities, and standardized method of conveying plant impact information within the work order packages (to assist Unit Supervisors with review/approval responsibilities).

An HPES investigation is in progress to determine the appropriateness of operator actions in returning the RHR "B" loop of Shutdown Cooling to service without an adequate fill and vent being performed. Appropriate corrective actions will be determined and implemented based on results of this investigation. All licensed plant operators will receive training on this event as part of requalification training. This training will be completed by November 30, 1994.

The malfunction of the optical isolator card was considered to be due to random failure. Engineering is evaluating the appropriateness of periodic testing or replacement of optical isolator cards in RHR pump trip circuitry.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].