NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92
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.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Perry Nuclear Power Plant, Unit 1	0 5 0 0 0 4 4 0	1 OF 0 4

TITLE (4)
Failure of Two Main Steam Isolation Valves to Fast Close Following Successful Slow Closures.

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)
0 9	0 7	9 0	9 0	— 0 2 1	— 0 0	1 0	0 5	9 0		0 5 0 0 0
										0 5 0 0 0

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

OPERATING MODE (9)	3									
POWER LEVEL (10)	0 1 0 0		20.402(b)		20.405(c)		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)	X	50.73(a)(2)(vii)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
			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 (AREA CODE)
Henry L. Hegrat, Compliance Engineer, Extension 6855	2 1 6 2 5 9 - 3 7 3 7

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	J M	F S V	A 6 1 0	Yes					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		1 1	1 5	9 0

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

On September 7, 1990, during cooldown of the Perry Nuclear Power Plant, Unit 1 in preparation for the second refueling outage, directions were given to close the Main Steam Isolation Valves (MSIV's) in order to maintain control of the reactor cooldown rate. All eight of the MSIV's slow closed properly, however, two of them (1B21-F022C and -F028B) failed to remain closed when their control switches were placed in the "close" position. These valves later closed on their own, with the control switch left in the "close" position. Centerior Energy letter PY-CEI/OIE-0327 L to the NRC dated September 11, 1990 documented this event. Similar events occurred on October 29, 1987, November 3, 1987, and November 29, 1987. These events were caused by degraded Ethylene Propylene Diene Monomer (EPDM) elastomers in the ASCO 3-way dual coil solenoid valves (10/29/87 and 11/03/87), and by a sliver of EPDM inside a solenoid causing it to stick (11/29/87). The elastomers degraded because of locally high temperatures resulting from steam leaks. Corrective actions for these events included cycling of the valves, local temperature monitoring, an air quality check, and rebuilding of the 3-way dual solenoid valves. The EPDM elastomers were replaced with Viton in a complete solenoid valve changeout during RF01.

The cause(s) of the September 7 events have not yet been determined. Based upon preliminary analysis it is believed that the failures are associated with the ASCO 3-way dual coil solenoid valves. Root cause analysis, along with laboratory analysis of the pertinent components, is proceeding. Corrective actions will be determined following completion of the root cause analysis.

On September 7, 1990 at 0625 and at 0626 hours respectively, Main Steam Isolation Valves (MSIV's) 1B21-F022C and -F028B failed to remain closed following successful slow closures of these valves and the positioning of their control switches to "close". At the time of these events, the plant was in Operational Condition 3 (Hot Shutdown), with all control rods inserted. Reactor pressure was approximately 450 psig with the reactor coolant at saturated conditions.

Following shutdown of the Perry Nuclear Power Plant, Unit 1, directions were given to the operators to close the MSIV's in order to maintain control of the reactor cooldown rate. At 0625 hours on September 7, the operators placed the control switch for 1B21-F022C in the "test" position and depressed the "test" push button. This resulted in a successful slow closure of the MSIV. Following this, with F022C still closed, the operator repositioned the control switch to the "close" position, at which time air should have been applied to the closing side of the MSIV air actuator and an additional exhaust path opened from its opening side, thus allowing the MSIV to remain closed. The valve however, reopened, indicating that the fast closure sequence had not operated properly. The control switch was left in the "close" position and F022C eventually closed, sometime between 1500 and 1913 hours on September 8, 1990. Emergency Response Information System (ERIS) data was not obtained for this closure and thus, the exact time of closure and the actual closing stroke time were not obtained.

Similarly, the control switch for 1B21-F028B was placed in the "test" position and the "test" push button depressed at 0626 hours on September 7. Once again the MSIV slow closed properly; however, it failed to remain closed when its control switch was placed in "close". This valve closed approximately fourteen minutes later, at 0640 hours on September 7, with its control switch remaining in the "close" position. ERIS data was obtained for this closure and it showed that the MSIV fast closed in approximately 3 seconds.

The other six MSIV's closed properly on September 7, using the sequence of slow (test) close followed by fast close. The last time these valves were satisfactorily fast closed from a full open position was during surveillance testing activities on January 8, 1990.

Based upon the successful slow closure of both of these MSIV's and their subsequent failure to fast close, the problem is suspected to be associated with the air pack and not with the MSIV internals. Therefore, the air packs from both failed valves along with a third from a non-failed valve (1B21-F028C) as a control, were removed from the MSIV'S, functionally tested, visually inspected and electrically checked. All three of the air packs cycled properly on the bench. Due to air leakage, the air pack for 1B21-F022C required retightening of several bolts which had been inadvertently loosened during air pack removal before it was functionally tested. Several components of the air packs contained traces of a foreign material adhering to their internal surfaces. With this exception, they appeared to be generally clean inside. Nothing obvious was observed that could have explained the failures. Electrical testing to date suggests that the solenoid coils had not degraded significantly from their new

condition nor is there indication that a high current situation existed. Results of these inspections and tests have been recorded and are being reviewed and evaluated further. NRC has been kept informed of the status of these investigations.

Root cause analysis is being performed and discussions have been held with the solenoid and air pack vendors. The air pack is composed of a 3-way, dual coil solenoid valve (ASCO Model NP-8323-A20V) for opening and closing, a 3-way, single coil solenoid valve (ASCO Model NP-8320-A185V) for testing, and individual 2-way (Norgren Model B0004A), 3-way (Norgren Model C0007A) and 4-way (Norgren Model F0013A) air shuttle valves for controlling air to and from the MSIV air actuators. An analysis of the possible failure mechanisms has been made and it has been determined that both the 2-way and the 4-way Norgren air shuttle valves must fail to shift position following transfer of the control switch to the "close" position in order for the MSIV's to have failed to remain closed following the slow closure. There are two possible scenarios that could allow both of these Norgren valves to have remained in their original position following positioning of the control switch to "close". They are:

1. Simultaneous failure (sticking or binding) of both the 2-way and the 4-way Norgren valves to shift when the control switch was taken to "close", or

2. Failure of the ASCO 3-way, dual coil solenoid valve to shift positions when the control switch was taken to "close."

Selected components, along with samples of foreign material found inside the air packs, have been taken to an independent laboratory for analysis. An analysis and investigation path based upon the failure mechanisms discussed above is being pursued.

The purpose of the MSIV's is to provide protection against the release of radioactive materials from the containment to the environment and to provide a means of isolating the RPV to minimize the loss of coolant inventory during an accident. There are two MSIV's in each Main Steam line. These valves are automatically closed upon a signal from the Nuclear Steam Supply Shutoff System when critical parameters are exceeded. One MSIV in each Main Steam line is sufficient to prevent the release of radioactive material provided that the other penetration isolation valves function properly. The September 7, 1990 event was not safety significant because the plant was shutdown and at least one MSIV in each Main Steam line closed properly. This event however, could potentially have been safety significant because of the possibility of a common mode failure occurring in both the inboard and outboard MSIV's. This could have resulted in both the inboard and outboard MSIV's in the same Main Steam line being open following an expected isolation of this line. Further investigation is needed in order to determine whether or not a common mode failure existed.

Prior failures of this type occurred on October 29, 1987, November 3, 1987 and November 29, 1987 (NRC Inspection Report 50-440/87027, dated February 10, 1988). These events were caused by degraded Ethylene Propylene Diene Monomer (EPDM) material inside the solenoid valves (10/29/87 and 11/3/87), and by a sliver of EPDM material inside a solenoid causing it to stick (11/29/87). Corrective actions taken for these events included periodic cycling of the valves, local temperature monitoring, an air quality check, and rebuilding of the 3-way dual solenoid valves. The 3-way dual solenoid valves were replaced with new valves containing Viton rather than EPDM during the first refueling outage.

Corrective actions for the September 7, 1990 failures will be determined following completion of the inspections and root cause analysis and reported in a revision to this LER prior to startup from the current refueling outage.

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