NRC FORM 366 (5-89) 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 7

TITLE (4): Local Leak Rate Tests Result in Exceeding Allowable Primary Containment Leakage Rates for Main Steam Lines A, B, C, and D.

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 5 0 0 0
0 9	1 6	9 0	9 0	0 2 5	0 1	1 0	2 3	9 0		0 5 0 0 0

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
5	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10): 0 0 0	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 (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)	X 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
C4	S B	I S V	A 5 8 5	N	C4	S B	I S V	B 3 5 0	N
C4	S B	I S V	R 3 4 0	N					

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 fifteen single-space typewritten lines) (16)

During the period September 16-17, 1990, following shutdown and cooldown of the Perry Nuclear Power Plant, Unit 1 for the second refueling outage, Local Leak Rate Testing (LLRT) of the Main Steam Isolation Valves (MSIV) was conducted. All four of the Main Steam line (MSL) penetrations exhibited leakage in excess of the Technical Specification 3.6.1.2(c) limit of 25 scfh when tested at P_a (11.31 psig). Several of the MSIV's had not been fast closed following the reactor shutdown. The MSL's were tested again following the opening and fast closing of each MSIV and were still found to be leaking in excess of Technical Specification requirements. The cause of these failures was inadequate seating contact on the outboard MSIV's, pilot valve seat damage on the A and D inboard MSIV's, leakby on all four outboard MSIV drain valves and leakby on the B and D MSL MSIV Leakage Control System (LCS) isolation valves.

As a result of these failures, six of eight MSIV's, all four outboard MSIV drain valves and the B and D MSL MSIV-LCS isolation valves were reworked. All of the MSL's have been tested satisfactorily. Modifications to enhance proper seating of the MSIV's are being purchased. These modifications include poppet anti-rotation devices, nose cone improvements and stem/cover modifications to minimize vibration of the poppet when the MSIV is open. They will be installed on any MSIV's requiring rework during the next refueling outage. In the interim, the MSIV's will be cycled quarterly which should help to minimize the buildup of the oxide layer on the valve seats. Evaluations are being performed to improve the leak tightness of the MSIV-LCS isolation valves and the outboard MSIV drain valves.

During the period September 16-17, 1990, it was determined that the primary containment leakage rate through the four Main Steam lines (MSL) as defined by Technical Specification 3.6.1.2(c) had been exceeded. At the time of these events, the plant was in Operational Condition 5 (Refuel) in a planned refueling outage which began on September 7, 1990. Reactor coolant temperature ranged between 85 degrees F and 98 degrees F at atmospheric pressure.

On September 16, Type C Local Leak Rate Testing (LLRT) of the MSL penetrations was initiated. Each MSL penetration is bounded by four isolation valves (ISV); the inboard and outboard Main Steam Isolation Valves (MSIV), the MSIV Leakage Control System (MSIV-LCS) steam tunnel isolation valve and the outboard MSIV drain valve.

Prior to these initial tests, the MSIV's had been stroked as follows on September 7 in order to control plant cooldown:

1B21-F0022 (Inboard MSIV's)
A - slow closed - opened - slow closed
B - slow closed
C - slow closed - failed to remain closed - closed later on 9/8/90, speed unknown
D - fast closed - opened - slow closed

1B21-F028 (Outboard MSIV's)
A - slow closed - opened - slow closed - opened - slow closed
B - slow closed - failed to remain closed - closed later, fast closed
C - slow closed
D - fast closed - opened - slow closed - opened - slow closed

The failures of 1B21-F022C and -F028B to remain closed are described in LER 90-021-01.

The results of the preliminary leak rate testing completed on September 17, were as follows: A MSL - unable to measure, B MSL - 2058 standard liters per minute (SLM) (estimated), C MSL - 6822 SLM (estimated) and D MSL- 34.35 SLM. All four of the MSL penetrations had thus exceeded their Technical Specification 3.6.1.2(c) limit of 25 scfh, which is equivalent to 11.8 SLM, when tested at P (11.31 psig). During this initial testing it was determined that the MSIV LCS[a] isolation valves in MSL's B and D were leaking as was the A outboard MSIV drain valve.

MSL LLRT's are normally performed following single fast closures of the MSIV's while the plant is still hot, which is representative of a post-accident closure. Because of the various methods used to close the MSIV's prior to the initial testing, all eight of the MSIV's were reopened and fast closed, and a second

round of MSL, LLRT's was performed. A nitrogen overpressure of 145 psig (approx. 25 psig in excess of the closing instrument air pressure) was applied to the actuators of the inboard MSIVs to counteract the upward force placed upon the inboard MSIV poppets when the volume between the two MSIV's is pressurized for testing. Additionally the leaking MSIV-LCS valves (1E32-F001 E and N) on the B and D MSL's were plugged.

The results of the second round of testing, which occurred between September 28 and 30, were as follows: A MSL-5048 SLM (estimated), B MSL-6295 SLM (estimated), C MSL-873 SLM (estimated) and D MSL-45 SLM. By placing a backpressure downstream of 1B21-F028D, it was determined that 1B21-F022D had a leakage rate of 14.21 SLM. This followup testing verified that all four MSL's leaked in excess of their Technical Specification limits.

The causes of the MSL penetration leakage were as follows: All four outboard MSIV's (F028) displayed poor seating contact between their poppets and valve seats. The upper half to one-third of the valve seat was not in contact with the poppet on each valve. The A and D inboard MSIV's (F022) leaked through the pilot poppet seats. All MSIV's inspected displayed a slight oxide layer on the valve seating surfaces. All four outboard MSIV drain valves (F067) leaked by their seats and the B and D MSL MSIV-LCS isolation valves (E32-F001) leaked by their seats. These valves were all repaired and followup LLRT's were satisfactorily performed on all four penetrations between November 1 and November 12, 1990. Table 1 provides the as-found and as-left leakage, the identified problems and the corrective actions taken for each valve. In addition to the corrective actions identified in Table 1, the six MSIV's that were disassembled were cleaned and their seats polished. All 16 springs on the B outboard MSIV were removed and checked for degradation. All checked out satisfactorily.

In addition to the data presented in Table 1, several other factors contributed to the leak rate test failures of the MSL penetrations. The MSIV-LCS isolation valves (E32-F001) have a history of leaking. During the last outage, a seal ring modification was made to correct body to bonnet leakage. This modification has proven effective. An evaluation is being performed to improve the seat leak tightness of these valves. The outboard MSIV drain valves (B21-F067) experienced their first failures since startup in 1989 when F067A was found to have seat indications and a damaged disc and F067B had a nick in the seat. All four of the F067 valves required refurbishment this outage. With this history in hand, it could be reasonably concluded that these valves have a leak tight life expectancy of four to five years, and the solution may simply be to rework or replace these valves periodically. These as well as other possible modifications or solutions for ensuring that the F067 valves remain leak tight are being evaluated.

Another possible contributor to the failures experienced this outage was the oxide buildup on the MSIV seating surfaces combined with the slow closures of the A, B and C MSL MSIV's. The oxide buildup creates additional closing friction which may prevent adequate seating. The nose guide poppet modifications being planned will overcome the problems associated with the oxide buildup. In the interim, the MSIV's will be stroked quarterly, which should help to clear the seating surfaces of any oxide buildup. To facilitate the planned MSIV modifications, the bores of the F028 B and C valves were machined this outage, in conjunction with the seat replacements, using the newly purchased Climax tool. The Climax was also used to clean the seats on F022 A and D. The accuracy with which this machine can perform seat cleanup and repair should, in itself, improve the leak tightness of the valves it was used on. Other plants have reported better success using this tool than the tools previously available. Finally, the dimensional checks of the valves taken this outage, combined with the comparison of dimensions taken during the first outage, will be useful in determining and quantifying wear on the MSIV's during future outages.

Primary containment integrity ensures that the release of radioactive materials from the containment atmosphere will be restricted to those leakage paths and associated leak rates at the peak pressure of 11.31 psi assumed in the accident analyses limiting the site boundary radiation dose to within the limits of 10 CFR Part 100. As an added conservatism, the allowable overall integrated leakage is limited to less than or equal to 75 percent of the analyzed value to account for possible degradation of containment barriers between leakage tests. Consequently, this event is considered to be of potential safety significance.

Three previous similar events have been identified. On July 5, 1987 primary containment leakage rate exceeded Technical Specification limits through the inboard and outboard MSIVs for MSLs A and B, and through the inboard MSIV and the LCS Steam Tunnel Isolation Valve for MSL D (LER 87-051). The cause of the MSIV leakage was attributed to seat wear. The cause of the MSIV-LCS valves leaking was inadequate mating and sealing of the bonnet pressure seal ring which was aggravated by use of a ANSI Class 2500 valve in a Class 900 application. The seal ring design was modified to compensate for this. The second event occurred September 6, 1987 (LER 87-067). Primary containment leakage rate through the outboard MSIV on MSL B exceeded its Technical Specification limit. The excess leakage flow path was through the outboard MSIV. The cause was due to deformation in the lower part of the valve seating surface which had not been removed by lapping during the prior maintenance outage in July 1987. As the valve was stroked, the seat contact point moved down on the seating surface into the deformation allowing excessive leakage to occur. The third event occurred on February 24, 1989, (LER 89-006), when it was determined that leakage exceeded Technical Specification limits through all four MSL's. Many factors contributed to the degraded condition of the MSIV's and the other isolation valves. Of the MSIV's, only the inboard and outboard MSIV's in MSL's A and C and the outboard MSIV in MSL D required corrective maintenance. Following corrective maintenance, the resulting leakage rates were within Technical Specification limits.

As a result of the events described in this LER, corrective maintenance as described in Table 1 was performed to return the valves to an acceptable condition. Modifications to enhance proper seating of the MSIV's are being purchased. These modifications include a poppet anti-rotation device, an improved nose guide poppet and a cover modification for the top seat of the poppet to minimize vibration of the poppet when the MSIV is open. These valve improvements will be installed during the next refueling outage on any MSIV's requiring rework at that time. In the interim, the MSIV's will be cycled quarterly, which should help to minimize the buildup of the oxide layer on the valve seats. Evaluations are being performed to improve the leak tightness of the MSIV-LCS isolation valves and the outboard MSIV drain valves.

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

TABLE 1
MSIV-LLRT Results and Corrective Action

Penetrations	Leakage AF/AL *	Identified Problems	Corrective Actions
MSL A	5048**/2.556		
F022A		- Minor valve seat depressions - Raised metal on pilot seat - Guide rib wear - Stem and spring retaining ring wear	- Lapped valve body seat - Lapped pilot poppet seat - Weld repaired lower guide rib - Replaced stem and spring retaining ring
F028 A		- Stem exceeded TIR	- Replaced stem
F067 A		- Inadequate seat contact	- Lapped seat and replaced disc
MSL B	6295**/0.417		
F028 B		- Crack in valve seat - Stellite layer not complete on poppet	- Removed and replaced valve seat - Replaced poppet
F067 B		- Inadequate seat contact	- Lapped seat and replaced disc
E32-F001 E		- Inadequate seat contact	- Lapped seat and replaced seal ring
MSL C	873**/1.748		
F028 C		- Indications on seat/bore - Scratched stem - Guide rib wear	- Removed and replaced valve seat - Replaced stem - Weld repaired lower guide rib
F067 C		- Inadequate seat contact	- Lapped seat and replaced disc

Penetration	Leakage AF/AL*	Identified Problems	Corrective Actions
MSL D	45/2.778		
F022 D		- Valve seat angle incorrect	- Machined and lapped valve seat
		- Raised metal on pilot seat	- Lapped pilot seat
		- Guide rib wear	- Weld repaired lower and upper left guide ribs
		- Stem and spring retaining ring worn and scratched	- Replaced stem and spring retaining ring
		- Stuck stud	- Drilled stud out and replaced
F028 D		- Pilot bore damage	- Lapped pilot seat
		- Star plate stuck	- Removed and replaced star plate & stanchions
		- Stem scratched	- Replaced stem
F067 D		- Inadequate seat contact, scored seat and disc.	- Lapped seat and replaced disc
E32-F001 N		- Inadequate seat contact	- Lapped seat and replaced seal ring

* AF/AL - As found/As left - Leakage rates in SLM

** Estimated