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United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Perry Nuclear Power Plant
Docket No. 50-440
Follow-Up to Licensee Event Report 94-04 Regarding Containment Penetration Local Leak Rate Test Results Exceeding Technical Specification Limits

Gentlemen:

In Licensee Event Report (LER) 94-04, which addressed containment penetration leak rate test results exceeding Technical Specification limits, it was conservatively reported that during the fourth refueling outage in February 1994, three containment penetrations exceeded local leak rate test failure criteria for leakage. The LER committed that following corrective maintenance and successful valve retest, an LER supplement would be submitted to provide root cause and corrective action information.

The enclosed supplement, which supersedes in its entirety the preliminary information provided earlier in LER 94-04, satisfies the commitment for a supplement and represents a reclassification of this LER to Voluntary Report. If you have questions or require additional information, please contact Mr. James D. Kloosterman, Manager-Regulatory Affairs, at (216) 280-5833.

Very truly yours,

Donald C. Shelton

Enclosure: LER 94-04-01

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

IE22

NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), 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)

(See reverse for required number of digits/characters for each block)

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TITLE (4)
Containment Penetration Local Leak Rate Test Results Exceeding Technical Specification Limits

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 NAME	DOCKET NUMBER
										05000
02	08	94	94	-- 004 --	01	06	07	96	FACILITY NAME	DOCKET NUMBER 05000

OPERATING OPERATIONAL	5
POWER LEVEL (10)	000

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

20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	X OTHER
20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	Voluntary Report

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Keith R. Jury, Supervisor - Compliance	(216) 280-5594

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	BF	ISV	G202	Y		X	LF	ISV	B350	Y
X	BF	ISV	G202	Y		X	LF	ISV	F130	Y

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION	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)

VOLUNTARY REPORT

During the fourth refueling outage, two containment penetrations exceeded Local Leak Rate Test (LLRT) failure criteria for non-Main Steam Isolation Valve leakage. The two penetrations that actually exceeded the secondary containment bypass limit, versus the originally reported three, were identified during routine surveillance testing and during an OPERATIONAL CONDITION (i.e., REFUELING) for which the Technical Specification Limiting Conditions for Operation did not apply. However, it can not be positively concluded that this condition did not exist during OPERATIONAL CONDITIONS 1,2, or 3. If the LLRT leakage existed during these conditions, concurrent with postulated design basis accidents, then the condition could have been safety significant.

The causes of the penetration failures were apparently inadequate maintenance and testing practices compounded by human performance issues in one instance, and in the other, inadequate foreign material exclusion control. In Licensee Event Report (LER) 94-04, it was stated that following corrective maintenance and successful valve retest, a supplement to the LER would be submitted providing information relative to causes and corrective actions. This Voluntary Report is being submitted to fulfill this commitment and since the information described in this report may be useful to other utilities and the NRC. This report supersedes, and replaces in its entirety, the preliminary information provided in LER 94-04.

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I. INTRODUCTION

In Licensee Event Report (LER) 94-04, which addressed containment penetration leak rates exceeding Technical Specification (TS) limits, it was reported that between February 8-15, 1994, three containment penetrations exceeded Local Leak Rate Test (LLRT) failure criteria for leakage, as defined by TS Limiting Conditions for Operation (LCO) 3.6.1.2.b. and 3.6.1.2.d. The failures were conservatively reported under the requirements set forth in Title 10 of the Code of Federal Regulations (CFR), specifically 10 CFR 50.72 (b)(2)(iii) (Event Notification System Number 6748) on February 8, 1994, and 10 CFR 50.73(a)(2)(ii) and 10 CFR 50.73 (a)(2)(v) on March 8, 1994 (LER 94-04).

LLRTs are performed under the surveillance program in accordance with the requirements of TS and 10 CFR 50 Appendix J. The failure of LLRT surveillance results to satisfy appropriate acceptance criteria is considered to be a surveillance failure, and in general, requires entry into the applicable TS LCO. LLRT results are also used to determine the operability of individual valves and penetrations, as well as, the functional condition of the Containment System as a whole. The capability of the Containment safety function is determined based on specified leakage rates being within the assumptions found in the Safety Analysis. Specifically, the Containment is considered to be functional provided that actual Containment leakage does not exceed the analytical values for overall integrated leakage (L_a) or secondary containment bypass leakage (0.0672 L_a). The TS limit is set at 75 percent of 0.0672 L_a or 0.0504 L_a.

Penetration leakage rates are determined using either maximum path or minimum path criteria. Maximum pathway leakage as defined by ANSI/ANS 56.8-1992 is the maximum leakage rate that can be attributed to a penetration leakage path (i.e., the larger, not total, leakage of the two valves in series). This generally assumes a single active failure of the better of two leakage barriers in series. Maximum path leakage criteria is applied in OPERATIONAL CONDITIONS 1,2, or 3, as well as for determining "as left" conditions following a refueling outage (RFO) or other times where valve maintenance occurred. Minimum pathway leakage as defined by ANSI/ANS 56.8-1987 is the minimum leakage rate that can be attributed to a leakage path (i.e., the smallest leakage of two valves in series). The minimum pathway leakage criteria is used to determine "as found" conditions following for example, a plant shutdown.

When LER 94-04 was submitted, this condition was determined to be reportable as a result of applying maximum pathway leakage criteria to "as found" conditions. Utilization of maximum pathway leakage criteria for "as found" valve data is a conservatism which exceeds the requirements of 10 CFR 50 Appendix J, ANSI N45.4-1972, and the applicable portions of ANSI/ANS N56.8-1981. The maximum pathway leakage is used to satisfy TS 3.6.1.2.b. and 3.6.1.2.d requirements in OPERATIONAL CONDITIONS 1,2, or 3, as well as for determining "as left" leakage. Previously, the sole utilization of the maximum pathway leakage criteria in the summations of non-Main Steam Isolation Valve (MSIV) containment leakage and secondary containment bypass leakage in the leak rate testing program created problems when reporting LLRT failures and resulted in numerous conservative notifications and inconsistent reporting. Although different combinations of LLRT failures may still be reportable under separate reporting categories including a condition prohibited by TS, degraded or loss of safety function, unanalyzed condition, or a condition outside the design basis, previous reporting has been overly conservative and inconsistent.

Following further evaluation of the two actual penetration failures in RFO4 versus the originally reported three, it was determined the LLRT failures were not reportable since no firm evidence was found to indicate when the conditions which created the test failures occurred; however, PNPP can not positively conclude that the penetration leakage did not exist during OPERATIONAL CONDITIONS 1,2, or 3. If leakage existed during these OPERATIONAL CONDITIONS concurrent with postulated design basis accidents, then this condition could have been safety significant.

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II. EVENT DESCRIPTION

During RFO4, two containment penetrations exceeded LLRT acceptance criteria for total combined TS Secondary Containment [NH] bypass leakage (0.0504 L_a or 5,052 standard cubic centimeters per minute (sccm)). Using minimum pathway leakage criteria, as defined by ANSI/ANS 56.8-1987, and if these conditions existed during OPERATIONAL CONDITIONS 1,2, or 3, the leakage through these penetrations could have exceeded the total combined Secondary Containment bypass leakage rate for non-MSIV penetrations specified in TS 3.6.1.2.d. (0.0504 L_a). At no time did the total combined leak rate for non-MSIV penetrations exceed limits specified by TS 3.6.1.2.b (0.6 L_a). Note that wherever a leakage value is provided, the value is approximate and does not include instrument inaccuracies.

Penetration P208 - 1M17-F0020, Containment Vacuum Relief containment inboard isolation valve and 1M17-F0025, Containment Vacuum Relief containment outboard isolation valve

On March 14, 1994, during the performance of surveillance instruction, SVI-M17-T9208, "Type C Local Leak Rate Test of 1M17 Penetration P208," the Containment Vacuum Relief [BF] containment inboard isolation valve, 1M17-F0020, indicated excessive leakage. Subsequently, using the same surveillance instruction, the Containment Vacuum Relief containment isolation outboard isolation valve, 1M17-F0025, was also determined to be leaking excessively.

The leakage limit or acceptance criteria for each valve is 5052 sccm. The actual leakage through Check Valve 1M17-F0020 during the surveillance test was approximately 7710 sccm which exceeded the acceptance criteria. The actual leakage through Butterfly Valve 1M17-F0025 during the surveillance test was approximately 7940 sccm which also exceeded the acceptance criteria. Using minimum pathway leakage criteria, and if this condition existed during OPERATIONAL CONDITIONS 1,2, or 3, the leakage through this penetration would have exceeded the total combined Secondary Containment bypass leakage rate for non-MSIV penetrations specified in TS 3.6.1.2.d. (0.0504 L_a).

Penetration P308 - 1P51-F0530, Service Air containment inboard isolation valve and 1P51-F0150, Service Air containment outboard isolation valve

On February 9, 1994, during the performance of surveillance instruction, SVI-P51-T9308, "Type C Local Leak Rate Test of 1P51 Penetration P308," the Service Air [LF] containment inboard isolation valve, 1P51-F0530, could not be pressurized indicating excessive leakage. Quantification of the leak rate could not be determined. Subsequently, using the same surveillance instruction, the Service Air containment isolation outboard isolation valve, 1P51-F0150, was also determined to be leaking excessively. The leakage for the outboard isolation valve was approximately 5,720 sccm. Using minimum pathway leakage criteria, and if this condition existed during OPERATIONAL CONDITIONS 1,2, or 3, the leakage through this penetration would have exceeded the total combined Secondary Containment bypass leakage rate for non-MSIV penetrations specified in TS 3.6.1.2.d. (0.0504 L_a).

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III. CAUSE OF EVENT

The causes of the penetration failures were apparently inadequate maintenance and testing practices compounded by human performance issues in one instance, and in the other, inadequate foreign material exclusion control.

Penetration P208 - 1M17-F0020, Containment Vacuum Relief containment inboard isolation valve and 1M17-F0025, Containment Vacuum Relief containment outboard isolation valve

An extensive evaluation was conducted to determine the root cause of leakage which concluded the Check Valve 1M17-F0020 LLRT failure was probably caused by a combination of factors including:

- Accidental contact between the 195-pound test housing and the Check Valve 1M17-F0020 pallet (disc) during fitting and rigging operations in preparation for the LLRT which could have loosened the closure magnet set screw, closed switch magnet set screw, and the eccentric set screw, allowing the valve pallet seal to become slightly misaligned with the valve seat. This condition could create the formation of a small void, which would result in the air leakage that was experienced during the LLRT. Additionally, degradation such as shrinkage, brittleness, and elongation, of the valve resilient seal may have occurred over time and contributed to leakage.

- Following the initial LLRT, slamming of Check Valve 1M17-F0020 pallet (disc) onto its seat during maintenance could have caused some additional misalignment between the pallet resilient seal and the valve seat thus creating a small void which would result in air leakage past the valve seat during the LLRT.

The evaluation also focused on determining the root cause of leakage through the Butterfly Valve 1M17-F0025 and concluded the leakage was probably caused by a combination of factors including:

- Improperly adjusted closed limit switch of Butterfly Valve 1M17-F0025 which could have prevented the valve disc from completing its full stroke to the fully closed position. This problem was probably compounded since the closed limit switch mounting screws/bolts were slightly loose allowing the switch to rock during operation which probably did not allow 100% disc closure; and

- Hardness of the resilient rubber seal caused by dryness due to the absence of the rubber seal being immersed in a process fluid. This condition could result in minute cracks and cause the failure leakage rate that was experienced. This type of butterfly valve seal in air service applications tends to degrade faster due to the exposure of the rubber material to air and its tendency to dry out quicker.

Penetration P308 - 1P51-F0530, Service Air containment inboard isolation valve and 1P51-F0150, Service Air containment outboard isolation valve

Investigation has determined that the most likely cause of 1P51-F0530 and 1P51-F0150 leakage was inadequate maintenance practices, specifically foreign material control. The leakage in Check Valve 1P51-F0530 was due to seat damage and body to bonnet leakage. It appears that the seat damage and the subsequent seat leakage was caused by dirt/debris which was present in the valve. The leakage at the body to bonnet flanged gasket joint is considered to be a maintenance problem rather than a valve design problem. It appears that when the bonnet was removed from the body for internal repairs, either the body to bonnet bolts were not properly torqued during the reassembly or the gasket between the body and bonnet had lost its resilience and required replacement. Seat leakage in Globe Valve 1P51-F0150 was due to debris buildup and damage found to the valve seat and plug assembly. Again, the presence of debris inside the valve is most likely responsible for causing damage to the seating components which resulted in the seat leakage.

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IV. SAFETY ANALYSIS

The valves identified in this report are part of the secondary containment bypass leakage pathway. Because leakage rates identified during the performance of these LLRTs was in excess of that assumed in the accident analysis, this event is considered potentially safety significant. The leakage rates for 1M17-F0020, 1M17-F0025, 1P51-F0530, and 1P51-F0150 caused the combined leakage rate for penetrations that are Secondary Containment bypass leakage paths to exceed 75 percent of the analytical limit (75 percent of 0.0672 L_a or 0.0504 L_a).

As discussed in the Updated Safety Analysis Report for Unit 1, containment design basis accident leakage is 0.2 percent, by weight of the contained atmosphere in 24 hours at the peak accident pressure (P_a). The maximum permitted leakage rate from potential sources is 6.72 percent of the total containment leakage. The maximum allowable combined test leakage rate from potential sources is 75% of 6.72 percent or 5.04 percent of the total design basis containment leakage. The analyzed leakage rate from Secondary Containment bypass leakage sources is considered leakage that bypasses the Containment Annulus Exhaust Gas Treatment System and its limit is 0.0672 L_a.

Primary containment integrity ensures that release of radioactive material from containment atmosphere will be restricted to those leakage paths and associated leak rates assumed in the accident analysis. TS limitations on containment leakage rates ensure that the total containment leakage volume will not exceed the value assumed in the accident analysis at the peak accident pressure during OPERATIONAL CONDITIONS 1,2, or 3. Secondary containment is designed to collect the primary containment leakage during and following a postulated design basis accident, delaying release to the environment until after processing through the Annulus Exhaust Gas Treatment System [VC]. This assures that the resultant offsite doses are less than the values set forth in 10 CFR 100 and 10 CFR 50 (General Design Criteria 19).

Maintaining an OPERABLE primary containment in OPERATIONAL CONDITIONS 4 or 5 to ensure a control volume is only required during situations for which significant releases of radioactive material can be postulated; such as during movement of irradiated fuel assemblies in the Containment, during CORE ALTERATIONS, or during operations with a potential for draining the reactor vessel. Therefore, although no safety consequences resulted from this event, it can not be positively concluded that these leakage paths did not exist during OPERATIONAL CONDITIONS 1,2, or 3. The leakage from these two penetrations alone would not have resulted in offsite radiological dose values exceeding those delineated in 10 CFR 100. However, had the total secondary containment bypass leakage existed during OPERATIONAL CONDITIONS 1,2, or 3, 10 CFR 100 values could have been exceeded during certain postulated design bases accidents.

V. CORRECTIVE ACTIONS

LLRT failures are trended and analyzed in accordance with the established Plant Administrative Procedure (PAP-1120) "Leak Testing Program." No penetration failures occurred during RF05 and consequently the 0.0504 L_a LLRT RF05 surveillance passed.

Guidance was also developed and procedure revisions implemented to ensure prompt and accurate determination of reporting requirements for future testing as discussed in the introduction section.

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Penetration P208 - 1M17-F0020, Containment Vacuum Relief containment inboard isolation valve and 1M17-F0025, Containment Vacuum Relief containment outboard isolation valve

The root cause evaluation determined that there were human performance considerations that most likely caused the leakage. Therefore, corrective actions included a number of enhancements, such as using the same personnel to perform the work and to make adjustments, and increasing coordination between work groups. Additionally, the following actions were implemented.

To prevent recurrence of leakage through Check Valve 1M17-F0020, a General Maintenance Instruction (GMI) was developed that specifies maintenance requirements and directs work accomplishment. The GMI requires conducting an inspection of valve components prior to performing repairs, replacements, or adjustments of that component. The inspection checks for loose eccentric, closure magnet, and switch set screws, loose pallet nuts and bolts, and loose pallet retainer ring nuts. The GMI also reinforces that repair, adjustment, and testing work will be performed in the proper sequence. Periodic inspection of the pallet seal is also performed to determine if the seal shows any evidence of deterioration. Precautions and guidance are provided in GMIs regarding proper handling, maintenance, and rigging operations. This should prevent the accidental slamming of the valve pallet and test housing into the valve.

To prevent recurrence of leakage through the Butterfly Valve 1M17-F0025, caution will also be exercised when making adjustments or establishing the closed limit switch setpoint, and each time an inspection or other work is conducted on the valve the limit switch mounting screws/bolts will be verified tight.

Penetration P308 - 1P51-F530, Service Air containment inboard isolation valve and 1P51-F150, Service Air containment outboard isolation valve

A root cause failure analysis following valve repair was performed. The analysis concluded Check Valve 1P51-F0530 leakage was due to seat damage and body/bonnet leakage. The valve seat was lapped and the bonnet assembly (bonnet arm, disk, and gasket) was replaced. The analysis also concluded Globe Valve 1P51-F0150 seat leakage was due to debris buildup and damage found to the valve seat and plug assembly. Seat repairs were performed and the valve/stem plug assembly was replaced. Both valves were successfully retested in accordance with SVI-P51-T9308, "Type C Local Leak Rate Test of 1P51 Penetration P308."

From the review of the causes of the seat leakage problems encountered on these valves (i.e., the presence of dirt/debris inside the valves which caused damage to valve internals and subsequent seat leakage), valves of a different design would not have performed any better in these applications. Any valve with debris trapped between the seating surfaces would develop a leak. Foreign material exclusion control procedures have been enhanced.

VI. SIMILAR EVENTS

Previous LLRT failures were documented in LERs 86-080, 88-004, 89-006, 90-026, and 92-005 and were conservatively reported as a loss of safety function. Although historically there have been individual LLRT valve failures at PNPP, typically this would not result in a loss of safety function notification. PNPP reportability guidance has been modified since LER 94-04 to consistently and accurately report LLRT event. [illegible]otential significance.