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SUBJECT: LER 98-015-00:on 980808,discovered reactor coolant pressure boundary leak during shutdown conditions.Caused by leakage from socket weld (FWB 63) on elbow connection.Failed piping connection was replaced.With 980902 ltr.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM
P.O. Box 968 • Richland, Washington 99352-0968

September 2, 1998
GO2-98-159

Docket No. 50-397

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

Gentlemen:

Subject: **NUCLEAR PLANT WNP-2, OPERATING LICENSE NPF-21, LICENSEE EVENT REPORT NO. 98-015-00**

Transmitted herewith is Licensee Event Report No. 98-015-00 for WNP-2. This report is submitted pursuant to 10 CFR 50.73 and discusses the items of reportability, corrective action taken, and action to preclude recurrence.

Should you have any questions or desire additional information regarding this matter, please call me or Mr. Paul Inserra at (509) 377-4147.

Respectfully,

PR Bemis
Vice President, Nuclear Operations
Mail Drop PE23

Enclosure

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LICENSEE EVENT REPORT (LER)

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TITLE (4)

Discovery of Reactor Coolant Pressure Boundary Leak During Shutdown Conditions

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV. NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	08	98	98	015	00	09	02	98	FACILITY NAME N/A	DOCKET NUMBER

OPERATING MODE	3
POWER	0

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

	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)		50.73(a)(2)(vii)		OTHER
	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 (Include Area Code)
Bill Pfitzer, Licensing Engineer	509-377-2419

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED	MONTH	DAY	YEAR
YES (If yes, completed EXPECTED SUBMISSION DATE).	NO				

ABSTRACT:

In July of 1998, after plant restart from a forced outage, WNP-2 experienced indications of reactor coolant system (RCS) leakage inside primary containment. These indications were the presence of unidentified leakage as indicated by drywell floor drain sump flow, and elevated gaseous radiation levels inside primary containment. The unidentified leakage peaked at 0.56 gpm during plant shutdown, well within the Technical Specification 3.4.5.b limit of 5.0 gpm.

A subsequent plant shutdown afforded the opportunity on August 8, 1998 for personnel to enter the drywell to inspect the source of the leakage. The inspection was performed at an RCS pressure of 200 psig and revealed the leakage to be from socket weld (FWB 63) on an elbow connection in a 3/4 inch instrument sensing line (PI(1)-4S-X62d) attached to reactor recirculation (RRC) loop B piping.

The failed piping connection has been replaced. A metallurgical evaluation of the failed piping connection confirmed that the failure was attributable to fatigue.

Small leaks of this magnitude (0.56 gpm) are bounded by the small piping break accident analysis and the instrument line break accident analysis of the WNP-2 Final Safety Analysis Report. Also, leakage caused by fatigue cracking failure is generally manifested by a slow increase in leakage which is detectable and trendable. Therefore, the safety significance of this event is considered minimal.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Event Description

During the month of July, 1998, after plant restart from a forced outage, WNP-2 experienced indications of reactor coolant system (RCS) leakage inside primary containment. These indications were the presence of unidentified leakage as indicated by drywell floor drain sump flow, and elevated gaseous radiation levels inside primary containment. The unidentified leakage peaked at 0.56 gpm during plant shutdown, well within the Technical Specification 3.4.5.b limit of 5.0 gpm.

A subsequent plant shutdown afforded the opportunity on August 8, 1998 for personnel to enter the drywell to inspect the source of the leakage. The inspection was performed at an RCS pressure of 200 psig and revealed the leakage to be from socket weld (FWB 63) on an elbow connection in a 3/4 inch instrument sensing line (PI(1)-4S-X62d) attached to reactor recirculation (RRC)[AD] loop B piping.

An event notification call was made to the NRC Headquarters Operations Officer at 1216 PDST on August 8, 1998 per the requirements of 10 CFR 50.72(b)(2)(i). Event number 34620.

Immediate Corrective Action

A problem evaluation request was initiated for the condition and repair activities for the leak were initiated.

Further Evaluation

Industry experience has shown that the main causes of small bore piping failures at socket weld joints are fatigue and intergranular stress corrosion cracking (IGSCC). INPO Operations and Maintenance Report (O&MR) 424 indicates that approximately 80% of these failures are due to fatigue, and 20% are due to IGSCC. Most of these failures were in cantilevered lines (unsupported test, vent or drain connections), versus complex lines (continuous spans), such as the subject instrument line.

Fatigue cracking resulting in leakage can be induced by vibration stresses or thermal stresses. The initial flaw is introduced either by fatigue or a material defect, and crack growth occurs due to cyclic stresses from vibration or thermal cycling. These cyclic stresses can propagate a crack through the piping wall, resulting in leakage. A flaw can also be introduced in small bore piping by stresses generated from events such as being stepped on or used for climbing support.

Also considered was the possible effect of the removal in 1994 of a hanger support from the subject line; a modification which increased the piping flexibility. It should be noted that removal of the hanger was performed to lower thermal stresses on the instrument line socket weld attachment to the RRC piping. However, the hanger removal made the line more susceptible to loads potentially induced during maintenance activities.

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As an immediate corrective action in association with the piping repair activities, and upon further analysis of the thermal stresses, a piping support was added to the subject instrument line.

The effect of RRC adjustable speed drive (ASD) vibration on the attached small bore piping was considered as part of the ASD installation vibration assessment program and was documented in GENE-B3500502-10, dated January 1997. The failed line was analyzed as part of this assessment and screened out as not significantly impacted by ASD vibrations.

The subject instrument line was included in R-13 startup walkdowns and no leak was visible.

Cause of Event

The metallurgical evaluation of the failed piping connection confirmed that the socket weld failure was attributable to fatigue and not IGSCC. The cracking initiated at the root of the socket weld and progressed from the inside to the outside on the elbow side of the socket weld.

Fatigue steps were observed along the course of the cracking that appear to be due to randomly applied mechanical loading during maintenance activities or from other unanalyzed conditions. This type of loading could have provided enough flaw depth to allow further propagation by operational stresses such as system induced vibration, eventually extending through-wall and causing leakage.

Further Corrective Action

The failed piping section was replaced per approved maintenance procedures.

After removal of the failed piping section, metallurgical laboratory analysis of the failed welded connection was performed.

A piping support was installed for the subject piping run. The support was installed in accordance with applicable ASME Code limits.

Similar piping connections were identified on both of the RRC loops and an examination of the highest load locations were conducted using dye penetrant. There were no other crack indications identified as a result of the examinations.

During the next refueling outage a walkdown will be performed of similar instrumentation lines that may be susceptible to damage due to maintenance. The need for additional piping supports will be evaluated at that time.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

A warning concerning improper use of small bore piping for footholds, handholds and shielding support will be placed in the outage handbook.

Assessment of Safety Consequences

Small leaks, such as the leakage caused by the subject piping failure (0.56 gpm), are bounded by the small piping break accident analysis and the instrument line break accident analysis of the WNP-2 Final Safety Analysis Report. Also, leakage caused by fatigue cracking failure is generally manifested by a slow increase in leakage which is detectable and, as in this case, can be trended by control room personnel and verified to be less than the Technical Specification 3.4.5 limit for unidentified leakage of less than 5.0 gpm. Therefore, the safety significance of this event is considered minimal.

Similar Events

Small bore piping connection failures, both socket weld and compression fitting types, have been an industry concern and continue to occur frequently as discussed in INPO's O&MR 424 referenced above.

A review of the WNP-2 repair activities for failed socket welds indicates that the majority of failures are in cantilevered lines, and are due to fatigue failure with crack propagation occurring from the outside to the inside of the pipe at the toe of the weld. Only three complex (instrument) line cracks or leaks have been documented at WNP-2 including the failure documented in this report. Of the two previously documented complex instrument line failures, one was attributed to IGSCC initiated/fatigue failure and the other was a fabrication defect/fatigue failure.