



Stephen L. Smith  
Plant Manager

June 19, 2014

WO 14-0058

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555

Subject: Docket No. 50-482: Licensee Event Report (LER) 2014-003-00, "Failure of Safety Injection Accumulator Vent Line due to Low Stress – High Cycle Fatigue Results in Degraded Reactor Coolant Boundary"

Gentlemen:

The enclosed Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(A) regarding a principal safety barrier being degraded at the Wolf Creek Generating Station.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-8831 ext. 4554, or Mr. Michael J. Westman at (620) 364-4009.

Sincerely,

A handwritten signature in black ink, appearing to read "SLS", written over a horizontal line.

Stephen L. Smith

SLS/rlt

Enclosure

cc: M. L. Dapas (NRC), w/e  
C. F. Lyon (NRC), w/e  
N. F. O'Keefe (NRC), w/e  
Senior Resident Inspector (NRC), w/e

JE22  
NRR



# **LICENSEE EVENT REPORT (LER)**

(See Page 2 for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [Infocollcts.Resource@nrc.gov](mailto:Infocollcts.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

**1. FACILITY NAME**  
WOLF CREEK GENERATING STATION

**2. DOCKET NUMBER**  
05000 482

**3. PAGE**  
1 OF 4

**4. TITLE** Failure of Safety Injection Accumulator Vent Line due to Low Stress – High Cycle Fatigue Results in Degraded Reactor Coolant Boundary

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	20	2014	2014	003	00	06	19	2014	FACILITY NAME	DOCKET NUMBER
										05000
										05000

**9. OPERATING MODE** 5

**11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)**

<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

## **12. LICENSEE CONTACT FOR THIS LER**

**FACILITY NAME** Michael Westman, Manager Regulatory Affairs **TELEPHONE NUMBER (Include Area Code)** (620) 364-4009

## **13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	EP	PSF	N/A	Yes					

## **14. SUPPLEMENTAL REPORT EXPECTED**

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

## **15. EXPECTED SUBMISSION DATE**

MONTH DAY YEAR

## **ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)**

On April 20, 2014 at 1030 Central Daylight Time (CDT) during the Wolf Creek Generating Station (WCGS) Mid-Cycle Outage 20, a Health Physics technician observed water leaking approximately 2.5 gallons per hour from the 3/4-inch line upstream of Safety Injection (SI) system valve EPV0109. This is the 3/4-inch vent line on the combined Safety Injection and Residual Heat Removal (SI/RHR) outlet piping to SI Accumulator Tank 'D.'

The flawed socket weld and vent valve assembly was replaced with a like-for-like valve assembly on April 25, 2014. A hardware failure analysis (HFA) was performed on the failed portion of the vent line. The results of the analysis indicate the cause of the through-wall cracking to be low stress - high cycle fatigue.

The safety significance of this event is low. The Reactor Coolant System (RCS) leakage that resulted from the cracked vent line is within the capability of reactor makeup systems and a complete failure is bounded by the Loss of Coolant Accident (LOCA) analysis.

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

APPROVED BY OMB: NO.3150-0104

EXPIRES: 01/31/2017

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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**NARRATIVE****PLANT CONDITIONS PRIOR TO THE EVENT**

Mode - 5

Power - 0%

Reactor Coolant System (RCS) Pressure was approximately 0 psig. RCS Temperature was approximately 113 degrees Fahrenheit. The B train of the Residual Heat Removal (RHR) System was providing shutdown cooling. There were no systems, structures or components (SSC) that were inoperable at the start of the event and contributed to the event.

**BACKGROUND**

The Safety Injection (SI) System [EIS Code: BQ] functions to deliver borated water from an accumulator tank installed on each RCS [EIS Code: AB] cold leg during the post-Loss of Coolant Accident (LOCA) injection phase in order to mitigate the consequences of a design basis accident (DBA). Each SI accumulator is connected to its respective RCS cold leg piping through a ten-inch pipe. Accumulator 'D' is equipped with a 3/4-inch manual vent valve (EPV0109) [EIS Code: BQ-V], used to support maintenance activities for the accumulator, connected to the six-inch return line from the SI and RHR [EIS Code: BP] System pump return lines, which then connect to the ten-inch accumulator discharge line. A 3/8-inch diameter orifice is drilled into the fitting at the vent piping connection and defines the boundary between the American Society of Mechanical Engineers (ASME) Code Class 1 RCS piping and the ASME Code Class 2 accumulator vent piping. By design, this orifice ensures that flow through this line, in the event of a catastrophic guillotine-type break, is within the capability of the reactor makeup water systems. The vent valve is normally closed and a closure flange is installed during normal operation.

**DESCRIPTION**

On April 20, 2014 at 1030 Central Daylight Time (CDT) during Mid-Cycle Outage 20, a Health Physics technician reported a stream of water coming from a SI line inside the bioshield on the 'D' RCS loop. Operators were dispatched to containment and found the leak in close proximity to EPV0109. Leakage, of approximately 2.5 gallons per hour, was confirmed to be at the weld on the sockolet upstream of EPV0109.

The flawed socket weld and vent valve assembly was replaced with a like-for-like valve assembly on April 25, 2014. Vibration testing was performed following the repair.

This same location on the EPV0109 vent line had a through-wall crack in November 2003 during Refueling Outage 13. At that time, the socket weld and cracked pipe were removed and the vent line was repaired. An action was implemented in October 2006 in Refueling Outage 15 by replacing the existing weld with a 2:1 taper socket weld and shortening the vent piping below EPV0109. The length was shortened a total of three inches, from ten to seven inches.

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**NARRATIVE**

**REPORTABILITY**

This condition constitutes degradation of a principal safety barrier and is reportable to the requirements of 10 CFR 50.73(a)(2)(ii)(A), Degraded or Unanalyzed Condition. Guidance provided in section 3.2.4 of NUREG 1022, states that conditions that represent "welding or material defects in the primary coolant system which cannot be found acceptable under ASME Section XI, IWB-3600, "Analytical Evaluation of Flaws" or ASME Section XI, Table IWB-3410-1, "Acceptance Standards," are reportable to this criterion."

**CAUSE**

The cause of the through-wall cracking was low stress – high cycle fatigue. The cracking was outside diameter (OD) initiated at the toe of the fillet weld. The evaluation of the November 2003 failure at this location failed to include margin for vibrational impacts and variance in operational parameters resulting in inadequate corrective action to reduce vibration on the EPV0109 vent line.

A hardware failure analysis (HFA) was performed on the failed portion of the vent line. The results of the analysis indicate the cause of through-wall cracking to be low stress - high cycle fatigue. This is evident by the presence of visible beach marks, striations and a thumb nail shaped crack front. The fine fatigue striations were noted by electron microscopy. The features at the approximate fracture center confirm the cracking as OD initiated at the toe of the fillet weld. No initiating weld defects were observed.

**CORRECTIVE ACTIONS**

The flawed socket weld and vent valve assembly was replaced like-for-like on April 25, 2014.

Dye penetrant examinations were performed in Mid-Cycle Outage 20 on similar unsupported socket weld vent/drain assemblies connected to ASME Code Class 1 piping with no indications identified.

A support on the EPV0109 vent line is planned to be installed during Refueling Outage 20 to reduce vibration.

**SAFETY SIGNIFICANCE**

The safety significance of this event is low. A 3/8-inch diameter orifice at the vent piping connection to the main piping run ensures that flow through this line in the event of a catastrophic guillotine-type break is within the capability of the reactor makeup water systems. Such a failure is bounded by the LOCA analysis.

**OPERATING EXPERIENCE/PREVIOUS EVENTS**

LER 2013-002-00 - On February 4, 2013, an active through-wall leak was discovered in the pipe-to-valve circumferential butt weld up-stream of valve BBV0130, Reactor Coolant Pump (RCP) 'A' Seal Water Injection Line Drain Valve. Leakage at this location is considered RCS pressure boundary leakage. The HFA report showed the failure was due to inside diameter (ID) initiated low stress - high cycle fatigue.

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NARRATIVE

The most probable initiation site for the crack was discontinuities at the toe of the root weld forming a notch/edge/crevice (an abrupt change in surface causing a stress concentration/riser). For the EPV0109 leak, there were no weld defects identified in the HFA and the failure was OD initiated. However, both failures were low stress - high cycle fatigue.

LER 2003-004-00 - On November 17, 2003, valve EPV0109 vent line was discovered to have a through-wall crack in Refueling Outage 13. At that time, the socket weld and cracked pipe were removed and the vent line was repaired. An action was implemented in October 2006 in Refueling Outage 15 by replacing the existing weld with a 2:1 taper socket weld and shortening the vent piping below EPV0109. The length was shortened a total of three inches, from ten to seven inches.