



March 11, 2013

Russell A. Smith  
Site Vice President and Chief Nuclear Operating Officer

WO 13-0016

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

Subject: Docket No. 50-482: Licensee Event Report 2013-001-00, "Broken  
Cylinder Head Stud Causes Inoperable Diesel Generator Longer than  
Technical Specification Completion Time"

Gentlemen:

The enclosed Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) to report exceeding the Technical Specification Required Action Completion Time for the 'B' diesel generator at the Wolf Creek Generating Station.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4156, or Mr. Michael J. Westman at (620) 364-8831 ext. 4009.

Sincerely,

A handwritten signature in black ink, appearing to read "RAS", followed by a horizontal line.

Russell A. Smith

RAS/rit

Enclosure

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

IE22  
NRR

NRC FORM 366 (10-2010)		U.S. NUCLEAR REGULATORY COMMISSION			APPROVED BY OMB: NO. 3150-0104		EXPIRES: 10/31/2013			
<b>LICENSEE EVENT REPORT (LER)</b>  (See reverse for required number of digits/characters for each block)										
1. FACILITY NAME <b>WOLF CREEK GENERATING STATION</b>					2. DOCKET NUMBER <b>05000 482</b>		3. PAGE <b>1 OF 4</b>			
4. TITLE <b>Broken Cylinder Head Stud Causes Inoperable Diesel Generator Longer than Technical Specification Completion Time</b>										
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
01	11	2013	2013	001	00	03	11	2013	FACILITY NAME	DOCKET NUMBER
										05000
										05000
9. OPERATING MODE		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)								
1		<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 type="checkbox"/> 50.73(a)(2)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(viii)(A)								
10. POWER LEVEL  100		<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 checked="" 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 <b>Michael Westman, Manager Regulatory Affairs</b>								TELEPHONE NUMBER (Include Area Code) <b>(620) 364-8831 ext. 4009</b>		
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	EK	STUD	C470	Y						
14. SUPPLEMENTAL REPORT EXPECTED						15. EXPECTED SUBMISSION DATE		MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)						<input checked="" type="checkbox"/> NO				
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)										
<p>On January 8, 2013, at 0500 hours Central Standard Time (CST), Required Action B.4.1 of Technical Specification (TS) 3.8.1 was entered when the 'B' diesel generator (DG) was declared inoperable for performing voluntary preplanned maintenance activities. During the planned replacement of the o-ring between the cylinder head and valve housing on the number 7 cylinder, maintenance personnel contacted one of the eight cylinder head studs and identified that the stud was loose. The broken stud was removed by hand.</p> <p>On January 10, 2013, enforcement discretion was sought to permit noncompliance with TS 3.8.1, i.e., to permit additional time to complete repairs and restoration of the 'B' DG before a plant shutdown was required. An additional 96 hours was requested to restore the 'B' DG to operable status such that the Completion Time of Required Action B.4.1 would expire at 0500 hours CST on January 15, 2013. The NRC granted approval of the requested enforcement discretion on January 10, 2013. The replacement of the broken stud and two adjacent studs and testing to restore operability was completed at 2254 hours CST on January 12, 2013.</p>										

**CONTINUATION SHEET**

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**PLANT CONDITIONS AT THE TIME OF THE EVENT**

Mode 1  
100% power

There were no structures, components or systems that were inoperable and contributed to the initiation or limited mitigation of the event.

**DESCRIPTION OF THE EVENT**

On January 8, 2013, at 0500 hours Central Standard Time (CST), Required Action B.4.1 of Technical Specification (TS) 3.8.1 was entered when the 'B' diesel generator (DG) [EIS: EK] was declared inoperable for performing voluntary preplanned maintenance activities. One of the preplanned maintenance activities was the replacement of the o-ring between the cylinder head and valve housing on the number 7 cylinder. This maintenance activity was being performed due to an oil leak on the number 7 cylinder. During the removal of the rocker arm assembly, maintenance personnel contacted one of the eight cylinder head studs and identified that the stud was loose. At approximately 1213 hours, it was identified that the head stud was broken when it was removed by hand.

At 2342 hours on January 8, 2013, Surveillance Requirement (SR) 3.8.1.2 was performed satisfactorily on the 'A' DG in accordance with Required Action B.3.2 of TS 3.8.1. SR 3.8.1.2 verifies the DG starts from standby conditions and achieves steady state voltage and frequency. For the performance of SR 3.8.1.2, procedure STS KJ-005A, "Manual/Auto Start, Sync & Loading of EDG NE01," requires documenting any deficiencies, such as intake, exhaust or oil leaks. No deficiencies were identified.

The necessary replacement parts were available to complete repairs on the 'B' DG, however, with input from the DG vendor, it was determined that the replacement and testing of the 'B' DG to establish operability would result in exceeding the 72 hour Completion Time of TS 3.8.1, Required Action B.4.1. The repair activities include draining the crankcase oil, removing the cylinder head, removing eight studs, non-destructive examination, replacing the broken stud and installing two new studs adjacent to the broken stud, reinstalling five of the removed studs, assembly of the cylinder head, refill the DG crankcase with oil and performance of post maintenance testing.

On January 10, 2013, enforcement discretion was sought to permit noncompliance with TS 3.8.1, i.e., to permit additional time to complete repairs and restoration of the 'B' DG before a plant shutdown was required. An additional 96 hours was requested to restore the 'B' DG to OPERABLE status such that the Completion Time of Required Action B.4.1 would expire at 0500 hours CST on January 15, 2013. The NRC granted approval of the requested enforcement discretion on January 10, 2013.

A ping (ring) test was performed on the remaining seven cylinder head studs on the number 7 cylinder. This ping test was also performed on the studs of the other 13 cylinders on the 'B' DG. The ping test confirmed that there are no additional broken studs on the 'B' DG. The test only determines if the stud is fully fractured; it does not give an indication of a fatigue crack that has not yet resulted in failure. Following the ping test, an ultrasonic test (UT) was performed on all remaining studs on the 'B' DG. The UT can be performed with the studs installed and tensioned. The UT of all remaining studs was completed at approximately 2007 hours on January 9, 2013, 111 studs in total, did not identify any additional fatigue cracks in any studs of any other cylinders of the 'B' DG.

# LICENSEE EVENT REPORT (LER)

U.S. NUCLEAR REGULATORY COMMISSION

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The DGs are Colt-Pielstick/Fairbanks-Morse model 14PC2.5 engines. The broken stud on the number 7 cylinder is original to the engine and has been in service for about 30 years. The overall run time of the 'B' DG is 2321.5 hours. The DGs are subjected to a one-hour run once a month, and a 24-hour run every 18 months. The most recent run on the 'B' DG was on December 14, 2012, which consisted of two one-hour runs, whereas the last 24-hour run was on March 11, 2012.

The broken stud was sent to Exelon PowerLabs, LLC, for a hardware failure analysis. Preliminary results of the analysis indicated the cause of the failure of the broken stud from the number 7 cylinder was cyclic fatigue. Beachmarks were identified on the fracture surface, which are indicative of fatigue. A possible contributing cause may have been fretting corrosion identified on the outer diameter of the stud directly adjacent to the fracture initiation site. Fretting would cause a stress concentration on the outside diameter surface and make the material more susceptible to fatigue.

The replacement of the broken stud and two adjacent studs and testing to restore operability was completed at 2254 hours CST on January 12, 2013.

### BASIS FOR REPORTABILITY

Wolf Creek Nuclear Operating Corporation (WCNOC) requested and received a notice of enforcement discretion (NOED) from the NRC to not enforce compliance with the actions required in TS 3.8.1 Required Action B.4.1 for a period of 96 hours. The 'B' DG was inoperable for a period longer than allowed by the Completion Time of TS 3.8.1, Required Action B.4.1. As such, the event is reportable pursuant to 10 CFR 50.73(a)(2)(i)(B) for any operation or condition which was prohibited by the plant's TSs.

A review of this event determined that it did not meet the criteria for reporting under 10 CFR 50.73(a)(2)(v) as an event or condition that could have prevented the fulfillment of a safety function. As stated in NUREG-1022, Revision 2, Section 3.2.7, "The level of judgment for reporting an event or condition under this criterion is a reasonable expectation of preventing fulfillment of a safety function." The original manufacturer of the equipment was contacted regarding this condition. The manufacturer provided written communication identifying the condition would not be immediately detrimental to the function of the engine and in their opinion, the engine would operate for a period of seven days at rated continuous capacity. The manufacturer completed a formal evaluation confirming that a single broken cylinder head stud would not result in overloading the remaining seven studs if the engine would be required to operate for a period of seven days at rated continuous capacity. The evaluation assumed that the remaining studs were undamaged, installed with proper tension, and met the design requirements. During repairs of the engine, detensioning of the seven intact cylinder head studs with the hydraulic tensioning tool required hydraulic pressures as would be expected for a properly tensioned stud. In addition, a review of the work order that installed the cylinder heads in October of 2006, also had hydraulic pressures necessary for proper tensioning. Quality control personnel performed non-destructive surface examination of the intact cylinder head studs and found no cracking. The two intact adjacent studs to the broken stud were replaced as precautionary measure. Offsite lab analysis identified the broken cylinder head stud had yield strength above the design requirements identified in the manufacturers evaluation. Prior to the event on January 8, 2013, the broken cylinder head stud did not result in the inoperability of the 'B' DG.

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## ROOT CAUSE

The probable cause of this event is the fretting of the cylinder head stud from coming in contact with the cylinder liner during operation. The hardware failure analysis concluded fretting corrosion was identified on the outer diameter of the stud directly adjacent the fracture initiation site. Fretting would cause a stress concentration on the outside diameter surface and make the material more susceptible to fatigue. Examination of the cylinder head liners identified rubbing marks that suggest contact was being made between the cylinder head stud and the liner. The rubbing is the result of vibration of the diesel engine when the DG is in operation.

## CORRECTIVE ACTIONS

Non-destructive surface examination for linear indications of the intact cylinder head studs was performed. The examination showed no relevant indications. The two adjacent studs and the broken stud were replaced. A ping test and an UT was performed on all remaining studs on the 'B' DG. WCNOG performed a ping test and UT of the 'A' DG cylinder head studs on January 20, 2013. The testing results were acceptable.

A preventative maintenance activity is being established to perform UT of the DG cylinder head studs on a frequency consistent with 18 month 24-hour DG surveillance testing. An additional preventative maintenance activity is being established for the performance of a surface examination of the DG cylinder head studs on a 15-year interval. A detailed evaluation to determine the cause of the fretting is being performed by Fairbanks Morse.

## SAFETY SIGNIFICANCE

The incremental conditional core damage probability (ICCDP) and incremental conditional large early release probability (ICLERP) was quantified for the requested additional time for restoring the 'B' DG. The ICCDP calculated value was 4.39E-7 and the ICLERP calculated value was 7.89E-9. The results of the quantification are within the guidance threshold in Regulatory Issue Summary 2005-01, "Changes to Notice of Enforcement Discretion (NOED) Process and Staff Guidance."

WCNOG took the necessary actions per procedure SYS SY-120, "Sharpe Diesel Operation and Alignment to Site," to ensure that the Sharpe Station would be available during the period of the additional 96 hours. The Sharpe Station is capable of providing emergency back-up power for the Wolf Creek Generating Station (WCGS) in the event of a complete loss of all onsite emergency AC power, and grid perturbations or loss of a normal offsite power source to WCGS.

## OPERATING EXPERIENCE/PREVIOUS SIMILAR OCCURRENCES

In Refueling Outage 15, Fall 2006, during a maintenance overhaul of the 'B' DG, the detensioning of a cylinder stud on the number 4 cylinder resulted in a broken cylinder head stud. It was determined that a crack existed on the stud prior to the detensioning. A failure analysis of this broken stud was not performed, as there was clear indication of a nick that caused a stress riser.