

# WOLF CREEK

NUCLEAR OPERATING CORPORATION

March 28, 2016

Stephen L. Smith  
Plant Manager

WO 16-0015

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

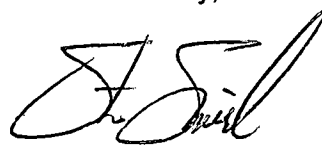
Subject: Docket No. 50-482: Licensee Event Report 2016-001-00, "Power Potential Transformer Overloading Results in Emergency Diesel Generator Inoperability "

Gentlemen:

The enclosed Licensee Event Report (LER) 2016-001-00 is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(v)(B), (C), and (D).

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4093, or Cynthia R. Hafenstine (620) 364-4204.

Sincerely,



Stephen L. Smith

SLS/rit

Enclosure: LER 2016-001-00

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

IEZZ  
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 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.

**1. FACILITY NAME**

WOLF CREEK GENERATING STATION

**2. DOCKET NUMBER**

05000 482

**3. PAGE**

1 OF 4

**4. TITLE**

Power Potential Transformer Overloading Results in Emergency Diesel Generator Inoperability

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	28	2016	2016	001	00	03	28	2016	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 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)
	<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)
100	<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 checked="" 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 checked="" 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 checked="" 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 Cynthia R. Hafenstine, Manager Regulatory Affairs	TELEPHONE NUMBER (Include Area Code) 620-364-4204
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
D	EK	DIODE	W351	Y	D	EK	XPT	W351	Y

**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 October 6, 2014, at approximately 1326 Central Daylight Savings Time (CDT) during a scheduled 24-hour Run, the 'B' Emergency Diesel Generator (EDG) unexpectedly tripped and a fire was observed in the electrical cabinet (NE106). This resulted in an unplanned entry into a 72 hour shutdown Limiting Condition of Operation (LCO) and an ALERT emergency classification. The source of the fire was the Power Potential Transformer (PPT). On 1/28/16, a Hardware Failure Analysis concluded that the failure of the PPT was most likely due to overloading which resulted from failure of a diode in the power rectifier of the EDG excitation system. Failure of the diode mostly likely occurred during load transients on June 11, 2014.

The PPT and associated cabling were replaced. All power diodes in each power rectifier were replaced. Further corrective actions are being tracked by Condition Report (CR) 88665.



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

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, 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  05000 482	6. LER NUMBER			3. PAGE  2 OF 4
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		2016	- 001	- 00	

NARRATIVE

PLANT CONDITIONS PRIOR TO THE EVENT

100 % reactor thermal power  
Mode 1

DESCRIPTION

On October 6, 2014, at approximately 1326 Central Daylight Savings Time (CDT) during a scheduled 24-hour Run, the 'B' Emergency Diesel Generator (EDG) [EIS: EK] unexpectedly tripped and a fire was observed in the electrical excitation control cabinet (NE106). Just prior to the trip, Operations personnel observed smoke coming from the cabinet and identified the source as the Power Potential Transformer (PPT) [EIS: XPT]. The smoke was a deficiency first identified during a post maintenance test run on June 11, 2014. The PPT exhibited the same symptoms during the subsequent surveillances after June 11, 2014.

A failure investigation was performed using available site information as well as offsite hardware failure analysis (HFA), modeling, testing, and third party reviews. It was concluded that the smoking and eventual failure of the PPT on October 6, 2014 was most likely due to overloading. The overloading of the PPT likely resulted from failure of a diode in the power rectifier [EIS: RECT] of the EDG excitation system. Failure of the diode most likely occurred during load transients on June 11, 2014, resulting from a governor actuator [EIS: EK, 65] malfunction. The failure of the diode was the only structure, component or system (SSC) that was inoperable at the start of the event and contributed to the event.

Upon failure of an exciter power rectifier diode, current boost to the generator field is reduced. The voltage regulator compensates by increasing the output of the power amplifier, supplied by the PPT, beyond the load capability of the PPT. The overloaded condition of the PPT leads to increased temperatures which accelerate insulation breakdown and reduce service life. Though a diode failure results in high temperatures of the PPT, the exciter system can sustain this condition for a short period of time. Sustained high temperatures of the PPT eventually lead to voltage break over of the winding insulation, creating a rapidly progressing turn to turn short. The short initiates on the primary side due to the higher voltage, resulting in a phase to phase fault on the generator output. As the PPT is down stream of the boost current transformers (CT) [EIS: XCT], the CT's are exposed to the fault current, generating a high current/voltage transient on the power rectifier, subsequently damaging an additional diode. Generator protective relays, detecting the fault, trip the EDG.

The A-EDG was started within 24 hours of the inoperability of the B-EDG for Common Cause Failure, as required by Technical Specification (TS) 3.8.1 Condition B.3.1. The 'A' EDG was loaded and thermography was performed on the PPT to identify any overheating conditions. The thermography data determined that the 'A'-EDG had tested satisfactorily and remained operable on October 6, 2014.

The 'B' EDG was declared operable on October 9, 2014 at 1717 CDT.

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NARRATIVE

REPORTABILITY

Technical Specification (TS) 3.8.1, 'AC Sources - Operating,' requires two diesel generators capable of supplying the onsite Class 1E power distribution subsystem(s) be operable in Modes 1, 2, 3 and 4. As a result of the HFA, the 'B' EDG was most likely inoperable from June 11, 2014 until October 9, 2014. This exceeded the allowed outage time for one EDG. This event is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B) as a Condition prohibited by TS from June 11, 2014 until October 9, 2014.

The 'B' EDG was most likely inoperable from June 11, 2014 until October 9, 2014. During the time period, the 'A' EDG was taken out of service for maintenance on July 21, 2014 creating a condition where both trains may have been inoperable. This event is reportable in accordance with 10 CFR 50.73(a)(2)(v)(B), (C) and (D) as an event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to: (B) Remove residual heat; (C) Control the release of radioactive material; or (D) mitigate the consequences of an accident.

ROOT CAUSE

The station did not have the ability to assess the degradation of the PPT within the EDG's excitation system that led to the continual operation of a degraded component, resulting in significant equipment failure. Additionally, there were limited preventative maintenance, obsolescence issues that had not been addressed, limited knowledge of the exciter, and the design of the system lacked overcurrent protection/detection of the PPT.

The station continued using the PPT after it was identified as degraded on June 11, 2014. When the smoking was first identified, the PPT was determined to be degraded, but could still perform its safety function due to the EDG satisfactorily performing its surveillances.

The most probable cause of the event is that a single diode failure led to the thermal failure of the PPT. Due to the reduced contribution of field current and voltage from the Power Current Transformer (PCT) circuitry from a single diode failure, the voltage regulator would task the PPT to supply the remainder of the required current to the field. This increased current would increase the internal temperatures of the PPT, leading to degraded windings within the PPT. A single diode failure would not be noticed immediately as the PPT is appropriately sized to maintain field current and voltage, for short durations. This condition could only be noticed by the observed smoke from the PPT. The most likely scenario is that the PPT was compromised and failed prior to the companion diode. The turn to turn short on the primary side would cause a high current demand that would be observed by the PCT. That current would then exceed the capability of the companion diode, causing it to fail, shorted. Once the first diode failed the diesel could not perform its function for more than 12 hours. The first indication of EDG excitation deficiency was on June 11, 2014.

CONTINUATION SHEET

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NARRATIVE

**CORRECTIVE ACTIONS**

The Power Potential Transformer and associated cabling have been replaced.

The Current Transformers that feed the loss of fuse relay have been replaced.

All power diodes in each Power Rectifier on both diesels have been replaced.

Further corrective actions are being tracked by Condition Report (CR) 88665.

**SAFETY SIGNIFICANCE**

The 'B' EDG was most likely inoperable from June 11, 2014 until October 9, 2014. During that time period, the 'A' EDG was taken out of service for maintenance on July 21, 2014, creating a condition where both trains may have been inoperable. When the 'A' and 'B' EDGs are inoperable, there are no remaining safety related on-site stand-by AC sources. However, in the event of a complete loss of AC electric power Wolf Creek Generating Station (WCGS) has three (3) non-safety related "Station Blackout" diesel generators that are capable of supplying power to the required engineered safety feature (ESF) functions following a station blackout event. There was no demand for on-site power during the time that both DGs were likely inoperable as power was available from the off-site power sources.

**OPERATING EXPERIENCE/PREVIOUS EVENTS**

A root cause was completed in 2010 on Safety System Function Failures (SSFFs) that identified safety system failures were occurring due to inadequate preventive maintenance (PM). In addition, Root Cause Evaluation (RCE) 24445, 'NRC Performance Indicator (PI) Unplanned Scrams per 7000 Critical Hours Exceeding Threshold,' identified that the root cause was "Content and timeliness of PM activities were insufficient to support reliable plant operation." The corrective action for RCE 24445 was to 'Develop and Implement a PM Optimization Plan.' A RCE (CR 23119) for 10 SSFFs in a two-year period and the RCE (CR 24445) for four unplanned scrams in a year period both identified insufficient as a root cause. The action plan to address the preventive maintenance issues was coordinated between the two root cause evaluations and was implemented through CR 24445.