



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

REGION IV  
1600 EAST LAMAR BOULEVARD  
ARLINGTON, TEXAS 76011-4511

January 14, 2019

Mr. Adam C. Heflin, President  
and Chief Executive Officer  
Wolf Creek Nuclear Operating Corporation  
P.O. Box 411  
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION, UNIT 1 – NRC INSPECTION  
OF TEMPORARY INSTRUCTION 2515/194, INSPECTION  
REPORT 05000482/2018011

Dear Mr. Heflin:

On December 13, 2018, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Wolf Creek Generating Station. On December 13, 2018, the inspector discussed the results of this inspection with Mr. J. McCoy, Site Vice President, and other members of your staff. The results of this inspection are documented in the enclosed report.

The NRC inspector did not identify any findings or violations of more than minor significance.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <http://www.nrc.gov/reading-rm/adams.html> and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

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James F. Drake, Acting Chief  
Engineering Branch 2  
Division of Reactor Safety

Docket Nos. 50-482  
License Nos. NPF-42

Enclosure:  
Inspection Report 05000482/2018011  
w/ Attachment: TI 2515/194 Inspection  
Documentation Request

**U.S. NUCLEAR REGULATORY COMMISSION  
Inspection Report**

Docket Number: 05000482

License Number NPF-42

Report Number: 05000482/2018011

Enterprise Identifier: I-2018-011-0051

Licensee: Wolf Creek Nuclear Operating Corporation

Facility: Wolf Creek Generating Station

Location: Burlington, Kansas

Inspection Dates: December 3, 2018, to December 13, 2018

Inspector: B. Correll, Reactor Inspector

Approved By: James F. Drake  
Acting Chief, Engineering Branch 2  
Division of Reactor Safety

Enclosure

## **SUMMARY**

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring licensee's performance by conducting Temporary Instruction 2515/194, "Inspection of the Licensee's Implementation of Industry Initiative Associated with the Open Phase Condition Design Vulnerabilities in Electric Power Systems (NRC Bulletin 2012-01)," at Wolf Creek, in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to <https://www.nrc.gov/reactors/operating/oversight.html> for more information.

### **List of Findings and Violations**

No findings were identified.

## **INSPECTION SCOPE**

This inspection was conducted using Temporary Instruction 2515/194 (ADAMS Accession No. ML17137A416), dated October 31, 2017. The inspector reviewed the licensee's implementation of Nuclear Energy Institute voluntary industry initiative in compliance with Commission guidance. The inspector discussed the licensee's open phase condition system design and ongoing implementation plans with plant staff. The inspector reviewed licensee and vendor documentation, and performed system walkdowns to verify that the installed equipment was supported by the design documentation. The inspector verified that the licensee had completed the installation and testing of equipment (with the exception of the tripping functions), installed and tested alarming circuits both local and in the control room, and analyzed potential impacts associated with the design implementation on the current licensing basis.

## **OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL**

Temporary Instruction 2515/194 - Inspection of the Licensees' Implementation of Industry Initiative Associated With the Open Phase Condition Design Vulnerabilities in Electric Power Systems (NRC Bulletin 2012-01)

The objective of Temporary Instruction 2515/194 is to verify that licensees have appropriately implemented the Nuclear Energy Institute voluntary industry initiative (ADAMS Accession No. ML15075A454), dated March 16, 2015, including updating their licensing basis to reflect the need to protect against open phase conditions.

Temporary Instruction 2515/194-03.01 - Voluntary Industry Initiative (Part 1)

Wolf Creek Generating Station selected the open phase detection system designed and manufactured by Power System Sentinel Technologies, LLC. At the end of this inspection the system remained in the monitoring mode of operation to facilitate continued data gathering of grid perturbations for evaluation of alarm and trip setpoints. The equipment was installed on the start-up transformer XMR01 and transformer 7. The licensee is scheduled to transition the open phase detection system to full implementation (tripping functions enabled) by May 18, 2020, in accordance with Nuclear Energy Institute Open Phase Condition Initiative, dated September 2018, Revision 2. The licensee was preparing associated documentation for this transition, however only proposed changes were available for review at the time of inspection.

## **INSPECTION RESULTS – OBSERVATIONS/ASSESSMENT**

Based on discussions with the licensee staff, review of available design, testing, grid data trending results documentation, and walkdowns of installed equipment, the inspector had reasonable assurance the licensee appropriately implemented the voluntary industry initiative.

The inspector determined that:

Detection, Alarms, and General Criteria	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
<p>(1) Open phase conditions will be detected and alarmed in the control room on the common annunciator panel, with an exception for the alternate alignment path for one offsite source.</p> <p>(2) Detection circuits will be sensitive enough to identify an open phase condition for all credited loading conditions for installed equipment.</p> <p>(3) No Class-1E circuits were being replaced with non-Class 1E circuits in the design.</p>	

Protective Actions Criteria	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
<p>(1) Five transformers were susceptible to an open phase condition and the licensee had installed detection and mitigating equipment for two of the five. The remaining three transformers will be discussed as an exception.</p> <p>(2) With an open phase condition present and with or without an accident condition signal, the open phase design would not adversely affect the function of important-to-safety systems, structures, or components. The licensee's open phase condition design solution added two Power System Sentinel Technologies, LLC systems on the start-up transformer XMR01 and two systems on transformer 7. The tripping function, when enabled, will provide an additional input to the associated transformer lockout relays. The credited plant response is unaffected and will be the same regardless of the conditions that generated the lockout of the transformer.</p>	

No findings were identified.

The inspector identified the following exceptions to the Temporary Instruction criteria resulting from the incomplete design modifications:

Detection, Alarms, and General Criteria Exceptions	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
<p>(1) The licensee's design was operating in the monitoring mode with established setpoints to gather data to ensure the open phase condition design and protective schemes would minimize misoperation, or spurious actions in the range of voltage unbalance normally expected in the transmission system. Because actual demonstration of this criterion required the system to be in operation with final trip setpoints established, the inspector was not able to fully verify this criterion. After discussions with licensee staff, design document and test result reviews, the inspector had reasonable assurance that the actuation circuit design would not result in lower overall plant reliability.</p> <p>(2) The Updated Safety Analysis Report and Technical Specification Bases had not been updated to include information related to open phase conditions at the conclusion of the onsite inspection. The licensee provided the inspector with proposed changes to the licensing basis that discussed the system requirements related to the effects of, and</p>	

protection for, any open phase condition design vulnerability. The licensee continued to modify and update the proposed changes during the onsite portion of the inspection. The inspector verified the proposed change process was being tracked under document change package CP 14570 for the completion of the Updated Safety Analysis Report updates. The inspector did not identify any issues of concern.

- (3) The inspector identified an alternate alignment path for one of the credited offsite sources (start-up transformer XNB01) that was not monitored for open phase conditions associated with three transformers (transformers 4, 5, and 6). This alignment path is infrequently utilized and contains a relatively short length of conductors and equipment that would be susceptible to open phase conditions. This alternate path was infrequently used in the past and has been aligned for a cumulative 47.5 days over the previous 25 year period. Also, only about 150 yards of switchyard bus bars, circuit breakers, and transformer connections would be susceptible to open phase conditions and were not monitored for open phase conditions. These factors aided in creating a very low risk condition for this alternate path alignment. The licensee proposed corrective actions to no longer consider this alternate path alignment as a credited source for the offsite circuit for start-up transformer XNB01, and was being evaluated by Condition Report 00128627. The corrective action would require the licensee to declare start-up transformer XNB01 offsite source inoperable while aligned to this alternate source, and enter the Technical Specifications limiting condition for operation action statement when aligned to this path. The licensee has until full implementation of the Nuclear Energy Institute voluntary industry initiative to implement these corrective actions.

Protective Actions Criteria Exceptions	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
<p>(1) The licensee’s open phase condition design solution uses Power System Sentinel Technologies, LLC to detect, alarm, and provide an input to the associated transformer lockout relays. Upon transformer lockout, the existing undervoltage relays would operate as designed to initiate starting of the emergency diesel generator to restore power to the bus.</p> <p>The tripping function input to the transformer lockout relays remained disabled during the onsite portion of the inspection and was not able to be demonstrated to perform the designed function. This action was being tracked in the design change package CP 14570. Through review of design documents and discussions with licensee staff, the inspector had reasonable assurance that with an open phase condition present and with and without an accident condition signal, the open phase design would isolate the affected bus and cause an automatic restoration of power from the emergency diesel generators. Due to the configuration of Wolf Creek Generating Station’s electrical distribution system, a loss of phase on one transformer would only affect one train of equipment, and loads required to mitigate postulated accidents would be available on the non-affected train, ensuring that safety functions are preserved as required by the current licensing bases. The inspector did not identify any issues of significance.</p> <p>(2) At the time of this inspection, the licensee had not finalized documentation for periodic tests, calibrations, setpoint verifications, or inspection procedures associated with the Power System Sentinel Technologies, LLC equipment. This action was being tracked in the design change package CP 14570.</p>	

The licensee has not determined the preventive maintenance process for the installed equipment and has Work Order 13-378853-073 to perform this evaluation. Existing plant equipment will continue to be maintained according to the licensee's current preventative maintenance program. The inspector did not identify any issues of concern.

#### **EXIT MEETINGS AND DEBRIEFS**

On December 13, 2018, the inspector conducted an exit meeting to present the Temporary Instruction 2515/194 inspection results to Mr. J. McCoy, Site Vice President, and other members of the licensee staff. The inspector verified no proprietary information was retained.

## DOCUMENTS REVIEWED

### Temporary Instruction 2515/194 - Inspection of the Licensees' Implementation of Industry Initiative Associated with the Open Phase Condition Design Vulnerabilities in Electric Power Systems (NRC Bulletin 2012-01)

#### Condition Report

00128627\*

Drawings Number	Title	Revision
E-003.3A-00001	Schematic Diagram and Wiring List SUT Open Phase Detection System Channel 1	01
E-003.3A-00002	Schematic Diagram and Wiring List SUT Open Phase Detection System Channel 2	01
KD-7496, Sh. 1	One Line Diagram	67
WIP-E-11026-004-A-1	Relay Setting Tabulation	01
WIP-E-11MR01-007-B-1	Startup Transformer Single Line Metering and Relaying Diagram	00
WIP-E-12MR01-000-A-1	Startup Transformer Protection Logic Diagram	00
WIP-E-13MR10-009-B-1	Schematic Diagram Startup Transformer Protection	00

  

Engineering Reports Number	Title	Revision
E-11023	Relay Setting Tabulation and Coordination Curves System NB	10
XX-E-039	Open Phase Analysis	0

  

Miscellaneous Documents Number	Title	Date
15-00846	Interconnection Guidelines	September 17, 2015
ET 18-0032	Docket No. 50-482: Wolf Creek Nuclear Operating Corporation Change of Date for Full Implementation of Open Phase Detection System	December 7, 2018

  

Procedures Number	Title	Revision or Date
ALR 00-012A	345 KV Trouble	9

Procedures Number	Title	Revision or Date
ALR 00-014D	S/U XFMR Trouble	13
ALR 843	#7 Transformer Open Phase Detection Trouble	0
CKL ZL-009	Site Readings Sheets	109
OFN AG-025	Unit Limitations	55
SYS NB-200	Transferring XNB01 Supply Between SL7 and #7 Transformer	20
SYS NB-201	Transferring NB01 Power Sources	61
TSO 0102-00	Waverly Wind Farm Capacitor Usage	September 17, 2015

Vendor Document Number	Title	Revision
2015WCN5144	Open Phase Protection (OPP) FAT Report for Wolf Creek Generating Station Dual Cabinet System with Serial Numbers 7E0694367 and 7E0698202	4.0.0

Work Order
13-378853-047

## TI 2515/194 Inspection Documentation Request

Please provide the following documentation (Items 1 – 8) to the lead inspector prior to the onsite inspection date, preferably no later than November 5, 2018. Whenever practical, please provide copies electronically (IMS/CERTREC is preferred). Please provide an index of the requested documents which includes a brief description of the document and the numerical heading associated with the request (i.e., where it can be found in the list of documents requested).

Brian Correll, Lead Inspector  
RIV/DRS/EB2  
1600 E. Lamar Blvd.  
Arlington, TX 76011  
817-200-1565  
brian.correll@nrc.gov

1. Copies of any calculations, analyses, and/or test reports performed to support the implementation of your open phase condition (OPC) solution. If, in your implementation, OPCs are not detected and alarmed in the control room please include documentation that:
  - a. Demonstrates the OPC will not prevent functioning of important-to-safety SSCs; AND
  - b. Detection of an OPC will occur within a short period of time (e.g., 24 hours).
2. Copies of any modification packages, including 10 CFR 50.59 evaluations if performed, used for or planned for the implementation of your OPC solution.
3. Copies of periodic maintenance, surveillance, setpoint calibration, and/or test procedures implemented or planned, for your OPC solution.
4. Copies of your licensing basis changes to Updated Final Safety Analysis Report (UFSAR) and/or Technical Specifications (TS), as applicable, which discuss the design features and analyses related to the effects of, and protection for, any open phase condition design vulnerability. If these documents have not been updated, provide documentation of your plans to do so.
5. Copies of any procurement specifications and acceptance testing documents related to the installation of your OPC solution.
6. Copies of any site training the team will need to accomplish to gain access to areas with, or planned, major electrical equipment used in your OPC solution (i.e. switchyard).
7. Provide documentation showing that with an OPC occurrence and no accident condition signal present, either:
  - a. An OPC does not adversely affect the function of important-to-safety SSCs, OR
  - b. TS LCOs are maintained or the TS actions are met without entry into TS LCO 3.0.3 AND
    - i. Important-to-safety equipment is not damaged by the OPC, AND
    - ii. Shutdown safety is not compromised

8. With OPC occurrence and an accident condition signal present:
  - a. Provide documentation showing that automatic detection and actuation will transfer loads required to mitigate postulated accidents to an alternate source and ensure that safety functions are preserved, as required by the current licensing bases, OR
  - b. Provide documentation showing that all design basis accident acceptance criteria are met with the OPC, given other plant design features. Accident assumptions must include licensing provisions associated with single failures. Typically, licensing bases will not permit consideration of the OPC as the single failure since this failure is a non-safety system.

Please provide the following documentation to the team when they arrive onsite. Whenever practical, please provide copies electronically, except for drawings. Drawings should be provided as paper copies of sufficient size (ANSI "C" or "D") such that all details are legible.

9. A brief presentation describing your electric power system design and typical electrical transmission and distribution system alignments; OPC design schemes installed to detect, alarm and actuate; bus transfer schemes; and maintenance and surveillance requirements. This presentation should be a general overview of your system. Please schedule the overview shortly after the entrance meeting.
10. Plant layout and equipment drawings for areas that identify: (a) the physical plant locations of major electrical equipment used in your open phase condition solution; (b) the locations of detection and indication equipment used in the open phase condition sensing circuits.
11. If OPC actuation circuits are required, provide documentation that demonstrates continued coordination with the other protective devices in both the offsite electrical system (within Wolf Creek Generating Station's area of responsibility) and the onsite electrical systems.
12. Access to locations in which open phase condition equipment is installed or planned (i.e. switchyard, etc.)
13. Copies of documentation or testing that demonstrates your OPC solution minimizes spurious actuation or misoperation in the range of voltage imbalance normally expected in the transmission system that could cause undesired separation from an operable off-site power source.

This document does not contain new or amended information collection requirements subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing information collection requirements were approved by the Office of Management and Budget, Control Number 31500011. The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid Office of Management and Budget control number.

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WOLF CREEK GENERATING STATION, UNIT 1 – NRC INSPECTION OF TEMPORARY  
INSTRUCTION 2515/194, INSPECTION REPORT 05000482/2018011 - JANUARY 14, 2019

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