



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

December 18, 2019

Mr. John Dent, Jr.
Vice President-Nuclear and CNO
Nebraska Public Power District
Cooper Nuclear Station
72676 648A Avenue
P.O. Box 98
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION – TEMPORARY INSTRUCTION 2515/194
(INSPECTION REPORT 05000298/2019013)

Dear Mr. Dent:

On November 7, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Cooper Nuclear Station and discussed the results of this inspection with Mr. K. Dia, Director of Engineering, and other members of your staff. The results of this inspection are documented in the enclosed report.

No findings or violations of more than minor significance were identified during this inspection.

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 Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Nicholas H. Taylor, Chief
Engineering Branch 2
Division of Reactor Safety

Docket No. 05000298
License No. DPR-46

Enclosure:
As stated

cc w/ encl: Distribution via LISTSERV®

COOPER NUCLEAR STATION – TEMPORARY INSTRUCTION 2515/194 (INSPECTION REPORT 05000298/2019013) – DECEMBER 18, 2019

DISTRIBUTION:

SMorris, ORA
 MShaffer, ORA
 TVegel, DRP
 TInverso, DRP
 RLantz, DRS
 GMiller, DRS
 PVossmar, DRP
 CYoung, DRP
 DProulx, DRP
 LFlores, DRP
 MStafford, DRP
 APatz, DRP
 AElam, DRP
 VDricks, ORA
 TWengert, NRR
 RAzua, DRS
 PJayroe, DRS
 MHerrera, DRMA
 R4Enforcement
 DCylkowski, ORA
 JWeil, OWFN
 AMoreno, OWFN
 JQuichocho, OEDO
 BMaier, ORA

DOCUMENT NAME: S:\DRS\REPORTS\Reports Final\CNS2019013 RPT STM
 ADAMS ACCESSION NUMBER: ML19352E279

<input checked="" type="checkbox"/> SUNSI Review		<input checked="" type="checkbox"/> Non-Sensitive <input type="checkbox"/> Sensitive		<input checked="" type="checkbox"/> Publicly Available <input type="checkbox"/> Non-Publicly Available	
OFFICE	RI:EB2	C:EB2	C:DRPC	C:EB2	
NAME	S. Makor	N. Taylor	P. Vossmar by D. Proulx	N. Taylor	
DATE	12/17/2019	12/18/2019	12/18/2019	12/18/2019	

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

Docket Number: 05000298

License Number: DPR-46

Report Number: 05000298/2019013

Enterprise Identifier: I-2019-013-0020

Licensee: Nebraska Public Power District

Facility: Cooper Nuclear Station

Location: Brownville, Nebraska

Inspection Dates: November 4, 2019, to November 7, 2019

Inspectors: S. Makor, Reactor Inspector

Approved By: Nicholas H. Taylor, Chief
Engineering Branch 2
Division of Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a temporary instruction 2515/194 at Cooper Nuclear Station, 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 or violations of more than minor significance were identified.

Additional Tracking Items

None.

INSPECTION SCOPE

Inspections were conducted using the appropriate portions of the Temporary Instruction (TI) in effect at the beginning of the inspection unless otherwise noted. Samples were declared complete when the TI requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspector reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

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)

This inspection was conducted using Temporary Instruction 2515/194 (ADAMS Accession No. ML17137A416) effective November 1, 2017, 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. The inspector reviewed the licensee's implementation of Nuclear Energy Institute Voluntary Industry Initiative in compliance with Commission guidance. The inspector reviewed and discussed the licensee's open phase condition system design, installation, testing and maintenance plans with plant staff, and performed system walkdowns to verify that the installed equipment was supported by the design documentation.

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

Nebraska Public Power District, LLC. selected the open phase detection system designed and manufactured by Power System Sentinel Technologies, LLC (PSSTech) as the design vendor for Cooper Nuclear Station.

During normal plant operation the Engineered Safety Feature (ESF) buses, 4160 Volt Bus 1F (Division 1) and 4160 Volt Bus 1G (Division 2), are normally powered from the Normal Station Service Transformer (NSST) via 4160 Volt Bus 1A for ESF Bus 1F and 4160 Volt Bus 1B for ESF Bus 1G. The NSST is powered from the main generator. The NSST supplies power to ESF buses during normal at power operation. During startup and shutdown or whenever the NSST becomes unavailable, the Startup Station Service Transformer (SSST) provides power to the ESF buses. Additionally, the Emergency Station Service Transformer (ESST) provides a second source of offsite power to the ESF buses in the event that both the NSST and SSST are unavailable. The SSST and ESST are the credited offsite power sources.

Cooper Nuclear Station prepared the design modification and associated documentation for this transition in Engineering Change 6038060, "Installation of PSSTech OPP System on SSST and ESST," Revision 00. At the end of the inspection, the licensee had installed all four detectors on the SSST and the ESST. The licensee installed and tested redundant open phase detection systems on the SSST and ESST to support enabling the trip function and is in the monitoring mode of operations (tripping function disabled). Currently, all function switches are in the "Alarm Only" position with plans to

have an approved risk evaluation in place before the end of the year. If the licensee fails to show that the risk reduction of an automatic trip versus a manual trip is small, then they will transition to full operation (tripping functions enabled) in December 2019.

INSPECTION RESULTS

Observation: Temporary Instruction 2515/194-03.01 – Voluntary Industry Initiative (Part 1)	2515/194
<p>Based on discussions with the licensee staff; review of design, installation and testing documentation; tour of the control room and discussions with operators; and walkdowns of the installed equipment, the inspector had reasonable assurance that the licensee has appropriately implemented the voluntary industry initiative.</p> <p><u>Detection, Alarms, and General Criteria</u></p> <p>(1) Open phase conditions will be detected and alarmed in the control rooms.</p> <p>(2) Detection circuits are sensitive enough to identify an open phase condition for all credited loading conditions.</p> <p>(3) The licensee demonstrated that the actuation circuit design did not result in lower overall plant operation reliability. The PSSTech system is designed to minimize misoperation or spurious actuation in the range of voltage unbalance normally expected in the transmission system that could cause separation from an operable offsite power source. The Open Phase Protection (OPP) System will automatically detect and alarm an open phase condition and/or trouble alarm in the control room.</p> <p>(4) No Class-1E circuits were replaced with non-Class 1E circuits in the design.</p> <p>(5) The licensee proposed an Updated Safety Analysis Report change to Chapter VIII, Section 2.2.5 and Chapter VIII, Section 3.5 to describe the OPP system and address the design features and analyses related to the effects of, and protection for, any open phase condition vulnerabilities.</p> <p><u>Protective Actions Criteria</u></p> <p>(1) Startup Station Service Transformer (SSST) and Emergency Station Service Transformer (ESST) were identified as susceptible to an open phase condition and the licensee implemented design changes to mitigate the effects.</p> <p>(2) With an open phase condition present and no accident condition signal present, the PSSTech system would not adversely affect the function of important-to-safety systems, structures, or components. The licensee’s open phase condition design solution added a set of additional tripping inputs in parallel with existing transformer isolation controls. This addition added a new tripping condition (open phase) to the previously analyzed electrical faults which result in isolation of the transformers. The credited plant response was unaffected and would be the same independent of the conditions that generated the isolation of the transformer.</p> <p>(3) The PSSTech OPP affects the 161 kV SSST and 69 kV ESST offsite power circuits by</p>	

tripping the circuit breakers between the transformer and the plant buses if they are not supplied with 3-phase power as designed by the manufacturer for steady state operation. With an open phase condition present and accident condition signal present, the PSSTech system would not adversely affect the transfer of 4160 Volt engineered safeguards buses to the onsite emergency diesel generators as required by the current licensing bases; only tripping condition (open phase) was added to the electrical faults which result in isolation of the alternate offsite source of power.

(4) During normal plant operation the Engineered Safety Feature (ESF) buses, 4160 Volt Bus 1F (Division 1) and 4160 Volt Bus 1G (Division 2), are normally powered from the Normal Station Service Transformer (NSST) via 4160 Volt Bus 1A for ESF Bus 1F and 4160 Volt Bus 1B for ESF Bus 1G. The NSST is powered from the main generator. The NSST supplies power to ESF buses during normal at power operation. During startup and shutdown or whenever the NSST becomes unavailable, the SSST provides power to the ESF buses. Additionally, the ESST provides a second source of offsite power to the ESF buses in the event that both the NSST and SSST are unavailable. The SSST and ESST are the credited offsite power sources. Additionally, the existing electrical protective devices are sufficiently sensitive to detect design basis conditions like a loss of voltage or a degraded voltage, but were not designed to detect a single phase open circuit condition. The 4160 Volt system is a high impedance grounded system and is therefore a grounded detection scheme. The ground detection will alarm for a 1.5 amp ground on the secondary windings of the NSST, SSST, or ESST to alert the operator of a ground condition.

(5) The inspector held discussions with the licensee staff and identified that the vendor guidance, including periodic tests, setpoint verification, and equipment maintenance and inspections had been integrated into plant procedures and processes. The licensee performed a pre-inspection self-assessment, 2019-0099, "TI 2515/194 Pre-Inspection Focused Self-Assessment," July 2, 2019, which documented, in part, whether the licensee appropriately implemented the Nuclear Energy Institute Voluntary Industry Initiative on open phase conditions. The licensee at the time of the inspection considered the maintenance rule program and integrated previous operating experience into their program. The licensee was in the process of developing additional procedures and processes to inspect and maintain the PSSTech equipment in addition to that recommended by the vendor, and to meet North American Reliability Council standards. At the end of the inspection, the licensee was completing a risk evaluation to determine whether they would transition from monitoring to fully activated. The expected determination is prior to December 31, 2019.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On November 7, 2019, the inspectors presented the Temporary Instruction 2515/194 results to Mr. K. Dia, Director of Engineering, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
2515/194	Calculations	NEDC 16-023	Review of Zachary Nuclear Calculation 16-101	0
2515/194	Corrective Action Documents Resulting from Inspection	2019-05776	Open Phase SAT Test Not in Records	11/6/2019
2515/194	Corrective Action Documents Resulting from Inspection	2019-05800	Open Phase Neutral Conductor Question	11/7/2019
2515/194	Drawings	3012	Main Three Line Diagram Sheet #4	AG/18
2515/194	Drawings	3700 SH 13	Annunciator Elementary Ladder Diagram	AE/10
2515/194	Drawings	3701 SH 17	Annunciator Legends Panel C Annunciator	AC/09
2515/194	Drawings	3771 SH 3	Annunciator Loop Diagram ANN-MUX-21	AC/05
2515/194	Drawings	4038	Civil Transformer Area Foundations	AE/11
2515/194	Drawings	CNS-EE-319	SSST OPP Cabinets #1 and #2 Connection Diagram	AB/01
2515/194	Drawings	CNS-EE-320	ESST OPP Cabinets #1 and #2 Connection Diagram	AB/01
2515/194	Drawings	NC02161	One-line Switching Diagram 345KV/161KV/4160V	AJ34
2515/194	Drawings	NC43456	Cooper 161KV Substation One-line Switching Diagram	AI13
2515/194	Drawings	NC66688	Cooper 345KV Substation One-Line Switching Diagram	AM
2515/194	Drawings	OPP-ELE-B101	Open Phase Detection and Protection System	AB/01
2515/194	Miscellaneous	15-L22-139	Contract No. 15-010A	8/6/2015
2515/194	Miscellaneous	EC 6038060	Open Phase Protection (OPP) System Operating and Maintenance Manual	00
2515/194	Miscellaneous	NLS2012081	90-Day Response to NRC Bulletin 2012-01, Design Vulnerability in Electric Power System Cooper Nuclear	10/24/2012
2515/194	Miscellaneous	NLS2014014	Response to Request for Additional Information Regarding Bulletin 2012-01 Cooper Nuclear Station, Docket No. 50-298, DPR-46	2/3/2014
2515/194	Procedures	15.EE.701	Open Phase Protection Active System Functional Test	3

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
2515/194	Procedures	2.1.11.3	Radwaste and Augmented Radwaste Building Data	111
2515/194	Work Orders	5065106	CED 6038060 Byron Open Phase Issue	11/7/2016
2515/194	Work Orders	5143406	Rev-3 ESST OPP Installation	5/22/2017