

INSPECTION OF THE LICENSEE'S INTERIM COMPENSATORY MEASURES ASSOCIATED WITH THE OPEN PHASE CONDITION DESIGN VULNERABILITIES IN ELECTRIC POWER SYSTEMS

Effective Date: 11/09/2016

CORNERSTONE: INITIATING EVENTS AND MITIGATING SYSTEMS

APPLICABILITY: This Temporary Instruction (TI) applies to the holders of operating licenses for operating nuclear power reactors who have not completed permanent plant modifications to address the OPC design vulnerability issue. This TI is to be performed at all operating plants except Seabrook Station, Unit 1 and sites that have moved to decommissioning process (i.e., Electric Power Systems are no longer required to be operable per plant Technical Specifications) .

2515/192-01 OBJECTIVES

The objective of this performance based TI is to verify implementation of interim compensatory measures associated with an open phase condition (OPC) design vulnerability in electric power system for operating reactors.

2515/192-02 BACKGROUND

OPCs have occurred throughout the electric power industry on three-phase alternating current (AC) power systems. However, the safety significance and design vulnerability of OPCs were not well understood, and therefore not specifically identified as an issue during the licensing reviews of the current operating nuclear power plants. A January 30, 2012, operating event at Byron Station, Unit 2, revealed a design vulnerability which resulted in a loss of certain AC electric power system safety functions.

Based on the Byron Station operating event, the staff issued NRC Information Notice 2012-03, "Design Vulnerability in Electric Power System," dated March 1, 2012 (Agencywide Document Access System (ADAMS) Accession No. [ML120480170](#)). On July 27, 2012, the staff issued NRC Bulletin 2012-01, "Design Vulnerability in Electric Power System," (ADAMS Accession No. [ML12074A115](#)) to require licensees to confirm whether they comply with *Title 10 of the Code of Federal Regulations* (CFR) 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 17, "Electric Power Systems;" or principal design criteria specified in the Updated Final Safety Analysis Report (UFSAR), 10 CFR 50.55a(h)(2), "Protection Systems," and 10 CFR 50.55a(h)(3), "Safety Systems."

The staff reviewed the responses provided by the NRC licensees in accordance with 10 CFR 50.54(f), "Conditions of licenses," and the detail of this review is documented in a summary report dated February 26, 2013 (ADAMS Accession No. [ML13052A711](#)). The staff used this information to determine whether further regulatory action is warranted.

In addition to these generic communications, the NRC staff has been working with nuclear industry representatives, and licensees for operating and new reactors to resolve the OPC issue. These outreach activities have included numerous public meetings held between March 2012 and January 2015. The NRC staff provided a response to the industry's initiative, including its planned open phase isolation system (OPIS), in a letter to NEI dated November 25, 2014 (ADAMS Accession [ML14120A203](#)). In addition, considerations that should be addressed by the licensees for future licensing actions when determining the extent of the design vulnerability within an electric power system are detailed in the Branch Technical Position 8-9, "Open Phase Condition in Electric Power System," (ADAMS Accession No. [ML15057A085](#)).

Based on staff's review of the responses to requests for additional information, the staff will use the compensatory measures listed in section 03.01 below as guidance to assess whether a licensee has taken appropriate risk management actions for an OPC design vulnerability until permanent plant modifications have been completed.

2515/192-03 INSPECTION REQUIREMENTS AND INSPECTION GUIDANCE

The inspector(s) will only perform this TI one-time for those licensees who have not completed permanent plant modifications to address the OPC design vulnerability issue.

03.01 Inspection Requirement/Guidance

The inspectors will conduct a one-time verification that the licensee has implemented the following or equivalent interim compensatory measures. The compensatory measures will be in place until permanent automatic detection and protection schemes are installed and declared operable for OPC design vulnerability. If an inspector identifies deficient or lacking interim compensatory measures, the inspector should inform the technical contact listed in Section 7.0 of this TI for further assistance. The inspector shall verify:

- (1) The licensee has identified and discussed with applicable plant staff the lessons-learned from the OPC events at the US operating plants including the Byron station OPC event and its consequences. This includes conducting operator training for promptly diagnosing, recognizing consequences, and responding to an OPC event.
- (2) The licensee has updated applicable plant operating procedures to help operators promptly diagnose and respond to OPC events on off-site power sources credited for safe shutdown of the plant. As an example, procedures may include monitoring voltages on all three phases on a routine basis, or alternate monitoring methods and, additional monitoring following electrical equipment malfunctions, such as a trip of rotating equipment.
- (3) The licensee has established and continues to implement periodic walkdown activities to inspect switchyard equipment such as insulators, disconnect

switches, and transmission line and transformer connections associated with the offsite power circuits to detect a visible OPC.

- (4) The licensee has ensured that routine maintenance and testing activities on switchyard components have been implemented and maintained. Such activities may include visual inspections and routine thermography or thermal imaging of insulators, connections, and other components in high voltage switchyards. As part of the maintenance and testing activities, the licensee will assess and manage plant risk in accordance with 10 CFR 50.65(a) (4) requirements.

2515/192-04 REPORTING AND DOCUMENTATION REQUIREMENTS

The inspection results should be included in the integrated quarterly report documenting whether the licensee has implemented the compensatory measures specified in TI Section 03.01 to mitigate the potential impact of an OPC.

2515/192-05 COMPLETION SCHEDULE

This TI is to be completed by March 31, 2017.

2515/192-06 EXPIRATION

The TI will expire on April 30, 2017.

2515/192-07 CONTACT

Any technical questions regarding this TI shall be addressed to Roy Mathew at (301) 415-8324. Questions can also be sent electronically to Roy.Mathew@nrc.gov. Any Reactor Oversight Process-related questions shall be addressed to Stephen Campbell at (301) 415-3353 or at Stephen.Campbell@nrc.gov.

2515/192-08 STATISTICAL DATA REPORTING

All direct inspection effort expended on this TI is to be charged to 2515/192 with an IPE code of TI. All indirect inspection effort expended on this TI for preparation and documentation will be attributed to activity code TPD.

2515/192-09 RESOURCE ESTIMATE

The estimated average time to complete the inspection requirements described is 4-8 hours per site for inspection.

2515/192-10 TRAINING

None required, inspector qualification training is sufficient.

2515/192-11 REFERENCES

MC 2515 App D, "Plant Status"

IP 71111.13, "Maintenance Risk Assessments and Emergent Work Control"

IP 71152, "Problem Identification and Resolution"

END

Attachment 1

Revision History for TI 2515/192

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public)
	ML16181A170 11/09/16 CN 16-029	Initial issuance. Researched commitments for the last four years and found none.		ML16182A316