

# NRC INSPECTION MANUAL

EEB

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## Temporary Instruction 2515/165

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### OPERATIONAL READINESS OF OFFSITE POWER AND IMPACT ON PLANT RISK

CORNERSTONE: INITIATING EVENTS  
MITIGATING SYSTEMS

APPLICABILITY: This Temporary Instruction (TI) applies to all holders of operating licenses for nuclear power reactors, except nuclear power reactors that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

#### 2515/165-01 OBJECTIVE

The objective of this TI is to gather information to support the assessment of nuclear power plant (NPP) operational readiness of offsite power (OSP) systems and impact on plant risk in accordance with NRC requirements prescribed in Plant Technical Specifications and 10 CFR 50.65(a)(4), "Requirements for monitoring the effectiveness of maintenance at nuclear power plants."

#### 2515/165-02 BACKGROUND

The loss of all alternating current (AC) power at NPPs involves the loss of offsite power (LOOP) combined with the loss of the onsite emergency power supplies (typically emergency diesel generators (EDGs)). This is also referred to as a station blackout (SBO). Risk analyses performed for NPPs indicate that the loss of all AC power can be a significant contributor to the core damage frequency. Although NPPs are designed to cope with a LOOP event through the use of onsite power supplies, LOOP events are considered to be precursors to a SBO. An increase in the frequency or duration of LOOP events increases the risk of core damage.

The NRC has been evaluating the reliability of offsite power for NPPs over the last several years as a result of the changes in the operation of the surrounding electrical power grids due to deregulation and other legislative and economic forces. The NRC issued a regulatory issue summary ((RIS) 2004-5, "Grid Operability and the Impact on Plant Risk and the Operability of Offsite Power," dated April 15, 2004) to advise NPP addressees of the requirements in Title 10 of the Code of Federal Regulations (10 CFR) Section 50.65,

“Requirements for monitoring the effectiveness of maintenance at nuclear power plants;” 10 CFR 50.63, “Loss of all alternating current power;” 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 17, “Electric power systems;” and Plant Technical Specifications on operability of offsite power. In addition, the NRC issued TI 2515/156, “Offsite Power System Operational Readiness,” dated April 29, 2004, and TI 2515/163, “Operational Readiness of Offsite Power,” dated May 5, 2005, which provided instructions for site specific reviews of the issues identified in the RIS. The staff also issued Generic Letter 2006-02, “Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power,” on February 1, 2006.

## 2515/165-03          INSPECTION REQUIREMENTS

The inspector shall review licensees’ procedures and determine that the procedures address the following areas to ensure the operational readiness of OSP systems in accordance with NRC requirements such as 10 CFR 50.65(a)(4); Plant Technical Specifications for OSP systems; and the design criteria provided in 10 CFR 50 Appendix A, GDC 17. Please note that if the licensee’s procedures do not address the information in 03.01 and 03.02 below this does not necessarily constitute non-compliance with NRC regulations. NRR may follow up with licensees in these cases.

### 03.01 Offsite Power Operability

Review the operating procedure(s), used to assure the functionality/operability of the OSP system. Using Attachment 1, provide the following:

- (1) A list of the actions identified when notified by the transmission system operator (TSO) that the post-trip voltage of the OSP system at the NPP will not be acceptable to assure the continued operation of the safety-related loads without transferring to the onsite power supply.
- (2) A list of the compensatory actions identified to be performed if it is not possible to predict the post-trip voltage at the NPP for the current grid conditions.

### 03.02 Maintenance Rule

Review the risk assessment, emergent work and/or grid reliability procedure(s), to assess the operability and readiness of the OSP system. Using Attachment 1, provide the following:

- (1) Identify the plant procedures that require the re-assessment of plant risk based on maintenance activities which could affect grid reliability, or the ability of the transmission system to provide OSP.
- (2) List the acceptance criteria and identify the procedures for when the plant staff should notify the TSO of changes at the NPP that could impact the transmission system or the capability of the transmission system to provide adequate OSP.

## General Guidance

### Offsite Power Operability

*Appendix A, General Design Criterion (GDC) 17-Electric Power Systems, to 10 CFR Part 50* requires an offsite electric power system to permit functioning of structures, systems, and components important to safety to shutdown the plant under normal and emergency conditions. The capability of the OSP system to provide adequate voltage and capacity have to be verified in light of the varying power flow conditions on the grid including the possibility of a unit trip. The safety function shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents. GDC 17 also requires that provisions be included to minimize the probability of losing electric power from the offsite power system as a result of, or coincident with, the loss of power generated by the nuclear power unit.

Plant Technical Specifications typically require at least two OSP supplies when a plant is operating in modes 1, 2 or 3. 10 CFR 50.72 requires notification of the NRC of the occurrence of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to shutdown the plant under normal and emergency conditions.

In order to accomplish these requirements, the OSP system must provide sufficient voltage to the safety-related loads both during normal operation, post-trip conditions and accident conditions.

### Maintenance Rule

*Section 50.65 of 10 CFR Part 50, Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants*, Section 50.65(a)(4) requires that licensees assess and manage the increase in risk that may result from proposed maintenance activities before performing the maintenance activities. These activities include, but are not limited to, surveillances, post-maintenance testing, and corrective and preventive maintenance. The scope of the assessment may be limited to structures, systems, and components (SSCs) that a risk-informed evaluation process has shown to be significant to public health and safety.

### Specific Guidance

Inspectors should complete Attachment 1, "TI 2515/165, Operational Readiness of Offsite Power Results."

#### 04.01 Offsite Power Operability

A licensee's ability to comply with Technical Specifications for OSP may depend on grid conditions and plant status; in particular, maintenance on, and degraded conditions of, key elements of the plant switchyard and offsite power grid can affect the operability of the OSP system, especially during times of high grid load and high grid stress. A communication interface with the plant's TSO is important to enable the licensee to determine the effects of these changes on the operability of the OSP system.

Inadequate NPP contingency post-trip switchyard voltages will result in Technical Specification inoperability of the NPP OSP system due to actuation of NPP degraded voltage protection circuits during certain events that result in an NPP trip. NPPs of certain designs have occasionally experienced other inoperabilities in these circumstances (e.g., overloaded EDGs or loss of certain safety features due to interaction with circuit breaker logic). Safety-related motors may also be started more than once under these circumstances, which could result in operation outside the motors' specifications and actuation of overload protection. Unavailability of plant-controlled equipment such as voltage regulators, transformer auto tap changers, and generator automatic voltage regulation can contribute to the more frequent occurrence of inadequate NPP post-trip voltages.

Analysis tools in use by the TSOs, together with properly implemented NPP licensee/TSO communication protocols, can keep NPP operators better informed about conditions affecting the NPP offsite power system. However, the analysis tools are not always available to the TSO. This was the case during the period leading up to the August 14, 2003, major blackout in the Northeast; and events have shown that the data used in the programs sometimes do not represent actual conditions and capabilities. These shortcomings have been offset to some degree by notification of the unavailability of analysis tools to NPP operators. The NPP operators then perform operability determinations to assess post-trip switchyard voltages following inadvertent NPP trips.

#### 04.02 Maintenance Rule

The offsite power system is required to support the operation and safe shutdown of the NPP by being the preferred power supply for the safety-related equipment. Loss of offsite power is a transient initiator. The likelihood of LOOP and SBO should be considered in the maintenance risk assessment, whether quantitatively or qualitatively. If the grid reliability evaluation indicates that marginally adequate grid conditions may exist during maintenance activities, the licensee should consider rescheduling maintenance activities that tend to increase the LOOP frequency or reduce the capability to cope with a LOOP or SBO. Conversely, planned or emergent maintenance activities which have the potential to affect grid reliability should be promptly identified to the grid operator.

RG 1.182, "Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants," endorsed the February 22, 2000, revision to Section 11 of NUMARC 93-01, Revision 2, as providing methods that are acceptable for meeting 10 CFR 50.65(a)(4). The revised Section 11 addressed grid stability and offsite power availability in several areas. Section 11.3.2.8 states:

Emergent conditions may result in the need for action prior to conduct of the assessment, or could change the conditions of a previously performed assessment. Examples include plant configuration or mode changes, additional SSCs out of service due to failures, or significant changes in external conditions (weather, offsite power availability). The following guidance applies to this situation:

The safety assessment should be performed (or re-evaluated) to address the changed plant conditions on a reasonable schedule commensurate with the safety significance of the condition. Based on the results of the assessment, ongoing or planned maintenance activities may need to be suspended or rescheduled, and SSCs may need to be returned to service.

#### 2515/165-05 REPORTING REQUIREMENTS

The responses to the inspection requirements specified in Sections 03.01, and 03.02, including applicable licensee procedure numbers and titles, should be submitted electronically to their Region contact point who will then forward the responses to NRR/DE, to the attention of Matthew McConnell ([MXM4@nrc.gov](mailto:MXM4@nrc.gov)) and George Morris ([GWM2@nrc.gov](mailto:GWM2@nrc.gov)) no later than April 3, 2006.

Document inspection results in a resident inspectors' routine inspection report (i.e., quarterly integrated inspection report). At a minimum, the inspectors should be able to briefly describe the areas reviewed and any observations/findings in Section 4OA5, "Other," of the integrated inspection report. The inspection results should be documented in the second calendar quarter report.

If applicable, the Office of Nuclear Reactor Regulation will assist the regions in making a determination of non-compliance with NRC regulations.

#### 2515/165-06 COMPLETION SCHEDULE

This TI will be completed no later than April 3, 2006.

#### 2515/165-07 EXPIRATION

This TI will expire on September 1, 2006.

#### 2515/165-08 CONTACTS

For technical support regarding the performance of this TI and emergent issues, contact George Morris at 301-415-4074 or Eva Brown at 301-415-2315. For administrative/reporting/documentation question, contact Matthew McConnell at 301-415-

1597 or Jim Strnisha at 301-415-1092.

## 2515/165-09 STATISTICAL DATA REPORTING

All direct inspection effort expended on this TI is to be charged to 2515/165 for reporting by the STARFIRE/HRMS system with an IPE code of SI.

## 2515/165-10 ORIGINATING ORGANIZATION INFORMATION

### 10.01 Organizational Responsibility

This TI was initiated by the Electrical Engineering Branch (NRR/DE/EEEB).

### 10.02 Resource Estimate

The estimated direct inspection effort to perform this TI is estimated to be 8-12 hours per site.

### 10.03 Training

No specialized training is needed to perform inspection requirements in this TI beyond basic training for inspectors (specified in IMC 1245, "Inspector Qualifications"). However, if technical support is needed during the inspection, contact EEEB technical contact stated in this TI.

## 2515/165-11 REFERENCES

NRC Regulatory Issue Summary 2004-05, "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power" (ADAMS Accession No. ML040990550)

NRC Regulatory Issue Summary 2000-24, "Concerns about Offsite Power Voltage Inadequacies and Grid Reliability Challenges Due to Industry Deregulation" (ADAMS Accession No. ML003695551)

Information Notice 2000-06, "Offsite Power Voltage Inadequacies" (ADAMS Accession No. ML003695551)

NUREG-1784, "Operating Experience Assessment - Effects Of Grid Events On Nuclear Power Plant Performance"

NRC Generic Letter 2006-02, "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power" (ADAMS Accession No. ML060180352), dated February 1, 2006

NRC Regulatory Guide 1.155, "Station Blackout" (ADAMS Accession No. ML003740034), dated August 31, 1988

NRC Regulatory Guide 1.182, "Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants," (ADAMS Accession No. ML003740117), dated May 31, 2000

END



## ATTACHMENT 1

### TI 2515/165, Operational Readiness of Offsite Power Results

Facility Name:	Docket Number(s): 50-
<i>Please note that if the licensees procedures do not address the information below this does not necessarily constitute non-compliance with NRC regulations. NRR may follow-up with licensees in these cases.</i>	
<b>Offsite Power (OSP) Capability</b>	
List the actions identified when notified by the TSO that the post-trip voltage of the OSP at the NPP will not be acceptable to assure the continued operation of the safety-related loads without transferring to the onsite power supply. (For example perform operability assessment/ supported system review, enter abnormal/emergency operating procedure, confirm functionality of alternate AC source, restore AC SSCs, etc...)	
List the compensatory actions identified if it is not possible to predict the post-trip voltage at the NPP for the current grid conditions. (For example perform operability/functionality review, reschedule planned maintenance, re-evaluate risk assessment, restrict access to/protect mitigating SSCs, restore out of service AC SSCs, etc...)	
<b>Maintenance Rule</b>	
Identify the plant procedures that require the re-assessment of plant risk based on maintenance activities which could affect grid reliability, or the ability of transmission system to provide OSP.	
List the acceptance criteria and identify the procedures for when the plant staff should notify the TSO of changes at the NPP that could impact the transmission system or the capability of the transmission system to provide adequate OSP.	

## ATTACHMENT 2

Revision History For  
TI 2515/165  
OPERATIONAL READINESS OF OFFSITE POWER AND IMPACT ON PLANT RISK

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
N/A	03/03/06	This TI is being issued to gather information to support the assessment of NPP operational readiness of offsite power (OSP) systems and impact on plant risk in accordance with NRC requirements prescribed in Plant Technical Specifications and 10 CFR 50.65(a)(4), "Requirements for monitoring the effectiveness of maintenance at nuclear power plants."	NO	N/A	ML060550037