

## Standard TPL-003-0a — System Performance Following Loss of Two or More BES Elements

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### A. Introduction

1. **Title:** System Performance Following Loss of Two or More Bulk Electric System Elements (Category C)
2. **Number:** TPL-003-0a
3. **Purpose:** System simulations and associated assessments are needed periodically to ensure that reliable systems are developed that meet specified performance requirements, with sufficient lead time and continue to be modified or upgraded as necessary to meet present and future System needs.
4. **Applicability:**
  - 4.1. Planning Authority
  - 4.2. Transmission Planner
5. **Effective Date:** April 23, 2010

### B. Requirements

- R1. The Planning Authority and Transmission Planner shall each demonstrate through a valid assessment that its portion of the interconnected transmission systems is planned such that the network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services, at all demand Levels over the range of forecast system demands, under the contingency conditions as defined in Category C of Table I (attached). The controlled interruption of customer Demand, the planned removal of generators, or the Curtailment of firm (non-recallable reserved) power transfers may be necessary to meet this standard. To be valid, the Planning Authority and Transmission Planner assessments shall:
  - R1.1. Be made annually.
  - R1.2. Be conducted for near-term (years one through five) and longer-term (years six through ten) planning horizons.
  - R1.3. Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category C of Table 1 (multiple contingencies). The specific elements selected (from each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).
    - R1.3.1. Be performed and evaluated only for those Category C contingencies that would produce the more severe system results or impacts. The rationale for the contingencies selected for evaluation shall be available as supporting information. An explanation of why the remaining simulations would produce less severe system results shall be available as supporting information.
    - R1.3.2. Cover critical system conditions and study years as deemed appropriate by the responsible entity.
    - R1.3.3. Be conducted annually unless changes to system conditions do not warrant such analyses.
    - R1.3.4. Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.
    - R1.3.5. Have all projected firm transfers modeled.



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### D. Compliance

#### 1. Compliance Monitoring Process

##### 1.1. Compliance Monitoring Responsibility

Compliance Monitor: Regional Reliability Organizations.

##### 1.2. Compliance Monitoring Period and Reset Timeframe

Annually.

##### 1.3. Data Retention

None specified.

##### 1.4. Additional Compliance Information

None.

#### 2. Levels of Non-Compliance

**2.1. Level 1:** Not applicable.

**2.2. Level 2:** A valid assessment and corrective plan for the longer-term planning horizon is not available.

**2.3. Level 3:** Not applicable.

**2.4. Level 4:** A valid assessment and corrective plan for the near-term planning horizon is not available.

### E. Regional Differences

1. None identified.

### Version History

| Version | Date             | Action   | Change Tracking |
|---------|------------------|--|-----------------|
| 0       | April 1, 2005    | Effective Date   | New             |
| 0       | April 1, 2005    | Add parenthesis to item “e” on page 8.   | Errata          |
| 0a      | October 23, 2008 | Added Appendix 1 – Interpretation of TPL-002-0 Requirements R1.3.2 and R1.3.12 and TPL-003-0 Requirements R1.3.2 and R1.3.12 for Ameren and MISO | Revised         |
| 0a      | April 23, 2010   | FERC approval of interpretation of TPL-003-0 R1.3.12   | Interpretation  |

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Table I. Transmission System Standards – Normal and Emergency Conditions

| Category   | Contingencies  | System Limits or Impacts  |  |                                |
|--|--|---|--|--------------------------------|
|  | Initiating Event(s) and Contingency Element(s)   | System Stable and both Thermal and Voltage Limits within Applicable Rating <sup>a</sup> | Loss of Demand or Curtailed Firm Transfers                               | Cascading <sup>c</sup> Outages |
| <b>A</b><br>No Contingencies   | All Facilities in Service  | Yes   | No   | No                             |
| <b>B</b><br>Event resulting in the loss of a single element.                   | Single Line Ground (SLG) or 3-Phase (3Ø) Fault, with Normal Clearing:<br>1. Generator<br>2. Transmission Circuit<br>3. Transformer<br>Loss of an Element without a Fault.  | Yes<br>Yes<br>Yes<br>Yes  | No <sup>b</sup><br>No <sup>b</sup><br>No <sup>b</sup><br>No <sup>b</sup> | No<br>No<br>No<br>No           |
|  | Single Pole Block, Normal Clearing <sup>c</sup> :<br>4. Single Pole (dc) Line  | Yes   | No <sup>b</sup>  | No                             |
| <b>C</b><br>Event(s) resulting in the loss of two or more (multiple) elements. | SLG Fault, with Normal Clearing <sup>c</sup> :<br>1. Bus Section   | Yes   | Planned/<br>Controlled <sup>c</sup>                                      | No                             |
|  | 2. Breaker (failure or internal Fault)   | Yes   | Planned/<br>Controlled <sup>c</sup>                                      | No                             |
|  | SLG or 3Ø Fault, with Normal Clearing <sup>c</sup> , Manual System Adjustments, followed by another SLG or 3Ø Fault, with Normal Clearing <sup>c</sup> :<br>3. Category B (B1, B2, B3, or B4) contingency, manual system adjustments, followed by another Category B (B1, B2, B3, or B4) contingency | Yes   | Planned/<br>Controlled <sup>c</sup>                                      | No                             |
|  | Bipolar Block, with Normal Clearing <sup>c</sup> :<br>4. Bipolar (dc) Line Fault (non 3Ø), with Normal Clearing <sup>c</sup> :   | Yes   | Planned/<br>Controlled <sup>c</sup>                                      | No                             |
|  | 5. Any two circuits of a multiple circuit towerline <sup>f</sup>   | Yes   | Planned/<br>Controlled <sup>c</sup>                                      | No                             |
|  | SLG Fault, with Delayed Clearing <sup>c</sup> (stuck breaker or protection system failure):<br>6. Generator  | Yes   | Planned/<br>Controlled <sup>c</sup>                                      | No                             |
| 7. Transformer   | Yes  | Planned/<br>Controlled <sup>c</sup>   | No   |                                |
| 8. Transmission Circuit  | Yes  | Planned/<br>Controlled <sup>c</sup>   | No   |                                |
| 9. Bus Section   | Yes  | Planned/<br>Controlled <sup>c</sup>   | No   |                                |

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|---|--|--|
| <p><b>D<sup>d</sup></b></p> <p>Extreme event resulting in two or more (multiple) elements removed or Cascading out of service</p> | <p>3Ø Fault, with Delayed Clearing<sup>e</sup> (stuck breaker or protection system failure):</p> <ol style="list-style-type: none"> <li>1. Generator</li> <li>2. Transmission Circuit</li> <li>3. Transformer</li> <li>4. Bus Section</li> </ol> <hr/> <p>3Ø Fault, with Normal Clearing<sup>e</sup>:</p> <ol style="list-style-type: none"> <li>5. Breaker (failure or internal Fault)</li> </ol> <hr/> <ol style="list-style-type: none"> <li>6. Loss of towerline with three or more circuits</li> <li>7. All transmission lines on a common right-of way</li> <li>8. Loss of a substation (one voltage level plus transformers)</li> <li>9. Loss of a switching station (one voltage level plus transformers)</li> <li>10. Loss of all generating units at a station</li> <li>11. Loss of a large Load or major Load center</li> <li>12. Failure of a fully redundant Special Protection System (or remedial action scheme) to operate when required</li> <li>13. Operation, partial operation, or misoperation of a fully redundant Special Protection System (or Remedial Action Scheme) in response to an event or abnormal system condition for which it was not intended to operate</li> <li>14. Impact of severe power swings or oscillations from Disturbances in another Regional Reliability Organization.</li> </ol> | <p>Evaluate for risks and consequences.</p> <ul style="list-style-type: none"> <li>▪ May involve substantial loss of customer Demand and generation in a widespread area or areas.</li> <li>▪ Portions or all of the interconnected systems may or may not achieve a new, stable operating point.</li> <li>▪ Evaluation of these events may require joint studies with neighboring systems.</li> </ul> |
|---|--|--|

- a) Applicable rating refers to the applicable Normal and Emergency facility thermal Rating or system voltage limit as determined and consistently applied by the system or facility owner. Applicable Ratings may include Emergency Ratings applicable for short durations as required to permit operating steps necessary to maintain system control. All Ratings must be established consistent with applicable NERC Reliability Standards addressing Facility Ratings.
- b) Planned or controlled interruption of electric supply to radial customers or some local Network customers, connected to or supplied by the Faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted Firm (non-recallable reserved) electric power Transfers.
- c) Depending on system design and expected system impacts, the controlled interruption of electric supply to customers (load shedding), the planned removal from service of certain generators, and/or the curtailment of contracted Firm (non-recallable reserved) electric power transfers may be necessary to maintain the overall reliability of the interconnected transmission systems.
- d) A number of extreme contingencies that are listed under Category D and judged to be critical by the transmission planning entity(ies) will be selected for evaluation. It is not expected that all possible facility outages under each listed contingency of Category D will be evaluated.
- e) Normal clearing is when the protection system operates as designed and the Fault is cleared in the time normally expected with proper functioning of the installed protection systems. Delayed clearing of a Fault is due to failure of any protection system component such as a relay, circuit breaker, or current transformer, and not because of an intentional design delay.
- f) System assessments may exclude these events where multiple circuit towers are used over short distances (e.g., station entrance, river crossings) in accordance with Regional exemption criteria.

## **Appendix 1**

### **Interpretation of TPL-002-0 Requirements R1.3.2 and R1.3.12 and TPL-003-0 Requirements R1.3.2 and R1.3.12 for Ameren and MISO**

NERC received two requests for interpretation of identical requirements (Requirements R1.3.2 and R1.3.12) in TPL-002-0 and TPL-003-0 from the Midwest ISO and Ameren. These requirements state:

#### **TPL-002-0:**

[To be valid, the Planning Authority and Transmission Planner assessments shall:]

- R1.3** Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category B of Table 1 (single contingencies). The specific elements selected (from each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).
- R1.3.2** Cover critical system conditions and study years as deemed appropriate by the responsible entity.
- R1.3.12** Include the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) at those demand levels for which planned (including maintenance) outages are performed.

#### **TPL-003-0:**

[To be valid, the Planning Authority and Transmission Planner assessments shall:]

- R1.3** Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category C of Table 1 (multiple contingencies). The specific elements selected (from each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).
- R1.3.2** Cover critical system conditions and study years as deemed appropriate by the responsible entity.
- R1.3.12** Include the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) at those demand levels for which planned (including maintenance) outages are performed.

### **Requirement R1.3.2**

#### **Request for Interpretation of TPL-002-0 and TPL-003-0 Requirement R1.3.2 Received from Ameren on July 25, 2007:**

*Ameren specifically requests clarification on the phrase, 'critical system conditions' in R1.3.2. Ameren asks if compliance with R1.3.2 requires multiple contingent generating unit Outages as part of possible generation dispatch scenarios describing critical system conditions for which the system shall be planned and modeled in accordance with the contingency definitions included in Table 1.*

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### **Request for Interpretation of TPL-002-0 and TPL-003-0 Requirement R1.3.2 Received from MISO on August 9, 2007:**

*MISO asks if the TPL standards require that any specific dispatch be applied, other than one that is representative of supply of firm demand and transmission service commitments, in the modeling of system contingencies specified in Table 1 in the TPL standards.*

*MISO then asks if a variety of possible dispatch patterns should be included in planning analyses including a probabilistically based dispatch that is representative of generation deficiency scenarios, would it be an appropriate application of the TPL standard to apply the transmission contingency conditions in Category B of Table 1 to these possible dispatch pattern.*

### **The following interpretation of TPL-002-0 and TPL-003-0 Requirement R1.3.2 was developed by the NERC Planning Committee on March 13, 2008:**

The selection of a credible generation dispatch for the modeling of critical system conditions is within the discretion of the Planning Authority. The Planning Authority was renamed “Planning Coordinator” (PC) in the Functional Model dated February 13, 2007. (TPL -002 and -003 use the former “Planning Authority” name, and the Functional Model terminology was a change in name only and did not affect responsibilities.)

- Under the Functional Model, the Planning Coordinator “Provides and informs Resource Planners, Transmission Planners, and adjacent Planning Coordinators of the methodologies and tools for the simulation of the transmission system” while the Transmission Planner “Receives from the Planning Coordinator methodologies and tools for the analysis and development of transmission expansion plans.” A PC’s selection of “critical system conditions” and its associated generation dispatch falls within the purview of “methodology.”

Furthermore, consistent with this interpretation, a Planning Coordinator would formulate critical system conditions that may involve a range of critical generator unit outages as part of the possible generator dispatch scenarios.

Both TPL-002-0 and TPL-003-0 have a similar measure M1:

- M1.** The Planning Authority and Transmission Planner shall have a valid assessment and corrective plans as specified in Reliability Standard TPL-002-0\_R1 [or TPL-003-0\_R1] and TPL-002-0\_R2 [or TPL-003-0\_R2].”

The Regional Reliability Organization (RRO) is named as the Compliance Monitor in both standards. Pursuant to Federal Energy Regulatory Commission (FERC) Order 693, FERC eliminated the RRO as the appropriate Compliance Monitor for standards and replaced it with the Regional Entity (RE). See paragraph 157 of Order 693. Although the referenced TPL standards still include the reference to the RRO, to be consistent with Order 693, the RRO is replaced by the RE as the Compliance Monitor for this interpretation. As the Compliance Monitor, the RE determines what a “valid assessment” means when evaluating studies based upon specific sub-requirements in R1.3 selected by the Planning Coordinator and the Transmission Planner. If a PC has Transmission Planners in more than one region, the REs must coordinate among themselves on compliance matters.

**Requirement R1.3.12**

**Request for Interpretation of TPL-002-0 and TPL-003-0 Requirement R1.3.12 Received from Ameren on July 25, 2007:**

*Ameren also asks how the inclusion of planned outages should be interpreted with respect to the contingency definitions specified in Table 1 for Categories B and C. Specifically, Ameren asks if R1.3.12 requires that the system be planned to be operated during those conditions associated with planned outages consistent with the performance requirements described in Table 1 plus any unidentified outage.*

**Request for Interpretation of TPL-002-0 and TPL-003-0 Requirement R1.3.12 Received from MISO on August 9, 2007:**

*MISO asks if the term “planned outages” means only already known/scheduled planned outages that may continue into the planning horizon, or does it include potential planned outages not yet scheduled that may occur at those demand levels for which planned (including maintenance) outages are performed?*

*If the requirement does include not yet scheduled but potential planned outages that could occur in the planning horizon, is the following a proper interpretation of this provision?*

*The system is adequately planned and in accordance with the standard if, in order for a system operator to potentially schedule such a planned outage on the future planned system, planning studies show that a system adjustment (load shed, re-dispatch of generating units in the interconnection, or system reconfiguration) would be required concurrent with taking such a planned outage in order to prepare for a Category B contingency (single element forced out of service)? In other words, should the system in effect be planned to be operated as for a Category C3 n-2 event, even though the first event is a planned base condition?*

*If the requirement is intended to mean only known and scheduled planned outages that will occur or may continue into the planning horizon, is this interpretation consistent with the original interpretation by NERC of the standard as provided by NERC in response to industry questions in the Phase I development of this standard?*

**The following interpretation of TPL-002-0 and TPL-003-0 Requirement R1.3.12 was developed by the NERC Planning Committee on March 13, 2008:**

This provision was not previously interpreted by NERC since its approval by FERC and other regulatory authorities. TPL-002-0 and TPL-003-0 explicitly provide that the inclusion of planned (including maintenance) outages of any bulk electric equipment at demand levels for which the planned outages are required. For studies that include planned outages, compliance with the contingency assessment for TPL-002-0 and TPL-003-0 as outlined in Table 1 would include any necessary system adjustments which might be required to accommodate planned outages since a planned outage is not a “contingency” as defined in the *NERC Glossary of Terms Used in Standards*.