

**A. Introduction**

- 1. Title:** System Performance Following Loss of Two or More Bulk Electric System Elements (Category C)
- 2. Number:** TPL-003-0
- 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 1, 2005

**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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- R1.3.6.** Be performed and evaluated for selected demand levels over the range of forecast system demands.
- R1.3.7.** Demonstrate that System performance meets Table 1 for Category C contingencies.
- R1.3.8.** Include existing and planned facilities.
- R1.3.9.** Include Reactive Power resources to ensure that adequate reactive resources are available to meet System performance.
- R1.3.10.** Include the effects of existing and planned protection systems, including any backup or redundant systems.
- R1.3.11.** Include the effects of existing and planned control devices.
- 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.
- R1.4.** Address any planned upgrades needed to meet the performance requirements of Category C.
- R1.5.** Consider all contingencies applicable to Category C.
- R2.** When system simulations indicate an inability of the systems to respond as prescribed in Reliability Standard TPL-003-0\_R1, the Planning Authority and Transmission Planner shall each:
  - R2.1.** Provide a written summary of its plans to achieve the required system performance as described above throughout the planning horizon:
    - R2.1.1.** Including a schedule for implementation.
    - R2.1.2.** Including a discussion of expected required in-service dates of facilities.
    - R2.1.3.** Consider lead times necessary to implement plans.
  - R2.2.** Review, in subsequent annual assessments, (where sufficient lead time exists), the continuing need for identified system facilities. Detailed implementation plans are not needed.
- R3.** The Planning Authority and Transmission Planner shall each document the results of these Reliability Assessments and corrective plans and shall annually provide these to its respective NERC Regional Reliability Organization(s), as required by the Regional Reliability Organization.

### **C. Measures**

- M1.** The Planning Authority and Transmission Planner shall have a valid assessment and corrective plans as specified in Reliability Standard TPL-003-0\_R1 and TPL-003-0\_R2.
- M2.** The Planning Authority and Transmission Planner shall have evidence it reported documentation of results of its reliability assessments and corrective plans per Reliability Standard TPL-003-0\_R3.

### **D. Compliance**

#### **1. Compliance Monitoring Process**

##### **1.1. Compliance Monitoring Responsibility**

Compliance Monitor: Regional Reliability Organizations.

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### 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          |

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

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> <hr/> <ol style="list-style-type: none"> <li>5. Breaker (failure or internal Fault)</li> <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> |
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- 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.