

Mapping Document

Project 2015-10 Single Points of Failure TPL-001

Standard: TPL-001-5		
Requirement in Approved Standard	Translation to New Standard or Other Action	Description and Change Justification
<p>TPL-001-4, Requirement R1</p> <p>R1. Each Transmission Planner and Planning Coordinator shall maintain System models within its respective area for performing the studies needed to complete its Planning Assessment. The models shall use data consistent with that provided in accordance with the MOD-010 and MOD-012 standards, supplemented by other sources as needed, including items represented in the Corrective Action Plan, and shall represent projected System conditions. This establishes Category P0 as the normal System condition in Table 1.</p> <p>1.1 System models shall represent: 1.1.1. Existing Facilities</p>	<p>TPL-001-5, Requirement R1</p> <p>R1. Each Transmission Planner and Planning Coordinator shall maintain System models within its respective area for performing the studies needed to complete its Planning Assessment. The models shall use data consistent with that provided in accordance with the MOD-032 standard, supplemented by other sources as needed, including items represented in the Corrective Action Plan, and shall represent projected System conditions. This establishes Category P0 as the normal System condition in Table 1. <i>[Violation Risk Factor: High] [Time Horizon: Long-term Planning]</i></p> <p>1.1. System models shall represent: 1.1.1. Existing Facilities.</p>	<p><u>Requirement R1 body.</u> Updated referenced standard number in body of requirement.</p> <p><u>Requirement R1 Part 1.1.2</u> Consistent with FERC Order 786 Para 40, the six-month threshold that could exclude planned maintenance outages is eliminated. Additionally, the addition of Near-term Planning Horizon aligns this requirement with IRO-017-1 Requirement R4 which requires the Planning Coordinator and Transmission Planner to jointly develop solutions with its respective Reliability Coordinator(s) for identified issues or conflicts with planned outages in its Planning</p>

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<p>1.1.2. Known outage(s) of generation or Transmission Facility(ies) with a duration of at least six months.</p> <p>1.1.3. New planned Facilities and changes to existing Facilities</p> <p>1.1.4. Real and reactive Load forecasts</p> <p>1.1.5. Known commitments for Firm Transmission Service and Interchange</p> <p>1.1.6. Resources (supply or demand side) required for Load</p>	<p>1.1.2. Known <u>outage(s)</u> of generation or Transmission Facility(ies) <u>scheduled in as selected in consultation with the Reliability Coordinator for the Near-Term Transmission Planning Horizon selected for analyses pursuant to Requirement R2, Parts 2.1.3 and 2.4.3 only. Known outage(s) shall be selected according to an established procedure or technical rationale that, at a minimum:</u></p> <p><u>1.1.2.1. for analyses pursuant to Requirement R2, parts 2.1.3 and 2.4.3 Includes known outage(s) that are expected to result in Non-Consequential Load Loss for P1 events</u></p>	<p>Assessment for the Near-Term Transmission Planning Horizon.</p> <p><u>Requirement R1 Parts 1.1.2.1, 1.1.2.2, and 1.1.2.3</u></p> <p>Substantial regional differences exist for outage coordination methods and procedures, making it difficult to define specific known outage selection criteria pertinent to all. Therefore, considering the NERC SAMS recommendations, selection of known outages in the Near-Term Planning Horizon were limited to three primary considerations.</p> <p><u>Requirement R1 Part 1.1.2.1</u></p> <p>A properly planned Transmission system should facilitate maintenance outages without Non-Consequential Load Loss (FERC Order 786, Paragraph 41).</p>

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	<p><u>in Table 1 when concurrent with the selected known outage(s); and</u></p> <p><u>1.1.2.2. Does not exclude known outage(s) solely based upon the outage duration.</u></p> <p><u>1.1.2.1.1.3.</u> New planned Facilities and changes to existing Facilities.</p> <p><u>1.1.3.1.1.4.</u> Real and reactive Load forecasts.</p> <p><u>1.1.4.1.1.5.</u> Known commitments for Firm Transmission Service and Interchange.</p> <p><u>1.1.5.1.1.6.</u> Resources (supply or demand side) required for Load.</p>	<p>Therefore, System models shall represent known outages in the Near-Term Transmission Planning Horizon that are expected to result in Non-Consequential Load Loss following a Table 1 P1 Event. It is noted that the performance requirements for all Table 1 Events include that the System shall remain stable, as well as Cascading and uncontrolled islanding shall not occur.</p> <p><u>Requirement R1 Part 1.1.2.2</u></p> <p>Planned outages lasting less than six months could be overlooked when the Transmission Planner and Planning Coordinator formulate System models (FERC Order 786, Paragraph 42). Further, there is no correlation between the System impact of an outage and its duration. Therefore, while duration is an</p>

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		<p>acceptable factor to consider when selecting a known outage for representation in System models, the duration shall not be the sole factor for omission.</p> <p><u>Requirement R1 Part 1.1.2.3</u></p> <p>A technical rationale is necessary to establish a rules-based approach to the selection of known outages for representation in System models. Similarly, regional operational approaches and outage coordination procedures vary, but the selection of known outages should incorporate input from operational experience. Therefore, known outages shall be selected according to an established procedure or a technical rationale.</p>
TPL-001-4, Requirement R2	TPL-001-5, Requirement R2	No modifications made.

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<p>Parts 2.1, 2.1.1, 2.1.2, 2.1.4 and 2.1.5 Parts 2..2, 2.2.1 Part 2.3 Parts 2.4, 2.4.1, 2.4.2 Part 2.5 Parts 2.6, 2.6.1, 2.6.2 Parts 2.7, 2.7.1, 2.7.2, 2.7.3, 2.7.4 Parts 2.8, 2.8.1, 2.8.2</p>	<p>Parts 2.1, 2.1.1, 2.1.2, 2.1.4 and 2.1.5 Parts 2..2, 2.2.1 Part 2.3 Parts 2.4, 2.4.1, 2.4.2 Part 2.5 Parts 2.6, 2.6.1, 2.6.2 Parts 2.7, 2.7.1, 2.7.2, 2.7.3, 2.7.4 Parts 2.8, 2.8.1, 2.8.2</p>	
<p>TPL-001-4, Requirement R2</p> <p>2.1.3. P1 events in Table 1, with known outages modeled as in Requirement R1, Part 1.1.2, under those System peak or Off-Peak conditions when known outages are scheduled.</p>	<p>TPL-001-5, Requirement R2</p> <p>2.1.3. P1 events in Table 1 <u>expected to produce more severe System impacts on its portion of the BES</u>, with known outages modeled as in Requirement R1, Part 1.1.2, under those System peak or Off-Peak conditions when known outages are scheduled.</p>	<p><u>Requirement R2 Part 2.1.3</u></p> <p>A properly planned Transmission system should facilitate maintenance outages without Non-Consequential Load Loss, maintain a stable System without Cascading and uncontrolled islanding. (FERC Order 786, Paragraph 41). Therefore, consistent with the principle of TPL-001-5 Requirement R3, Part 3.4 which requires the Transmission Planner and Planning Coordinator to identify those planning events in Table 1 that are</p>

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		expected to produce more severe System impacts on its portion of the BES, only those P1 events in Table 1 expected to produce more severe System impacts on its portion of the BES are to be assessed for System models that include known outages pursuant to Requirement R1 Part 1.1.2.
<p>TPL-001-4, Requirement R2</p> <p>2.4.3. For each of the studies described in Requirement R2, Parts 2.4.1 and 2.4.2, sensitivity case(s) shall be utilized to demonstrate the impact of changes to the basic assumptions used in the model. To accomplish this, the sensitivity analysis in the Planning Assessment must vary one or more of the following conditions by a sufficient amount to stress the System within a range of credible conditions that demonstrate a measurable change in performance:</p> <ul style="list-style-type: none"> • Load level, Load forecast, or dynamic Load model assumptions. 	<p>TPL-001-4, Requirement R2</p> <p>2.4.4. For each of the studies described in Requirement R2, Parts 2.4.1 and 2.4.2, sensitivity case(s) shall be utilized to demonstrate the impact of changes to the basic assumptions used in the model. To accomplish this, the sensitivity analysis in the Planning Assessment must vary one or more of the following conditions by a sufficient amount to stress the System within a range of credible conditions that demonstrate a measurable change in performance:</p> <ul style="list-style-type: none"> • Load level, Load forecast, or dynamic Load model assumptions. • Expected transfers. 	<p><u>TPL-001-5, Requirement R2, Part 2.4.4</u></p> <p>TPL-001-4, Part 2.4.3 moved to TPL-001-5, Part 2.4.4</p>

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<ul style="list-style-type: none"> • Expected transfers. • Expected in service dates of new or modified Transmission Facilities. • Reactive resource capability. • Generation additions, retirements, or other dispatch scenarios. 	<ul style="list-style-type: none"> • Expected in service dates of new or modified Transmission Facilities. • Reactive resource capability. • Generation additions, retirements, or other dispatch scenarios. 	
	<p>TPL-001-5, Requirement R2</p> <p>2.4.3. P1 events in Table 1 <u>expected to produce more severe System impacts on its portion of the BES</u>, with known outages modeled as in Requirement R1, Part 1.1.2, under those System peak or Off-Peak conditions when known outages are scheduled.</p>	<p><u>TPL-001-5, Requirement R2, Part 2.4.3</u></p> <p>Modified the standard to add a Stability analysis requirement for P1 events in Table 1, with known outages under appropriate System conditions, that includes similar language to that used for the steady state analysis stated in Requirement R2, Part 2.1.3. For reasons similar to those justifying changes to Requirement R2 Part 2.1.3, the Transmission Planner and Planning Coordinator shall identify those P1 events in Table 1 expected to produce more severe System impacts on its portion of</p>

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		the BES to be assessed for System models that include known outages pursuant to Requirement R1 Part 1.1.2.
	<p>TPL-001-5, Requirement R2</p> <p>2.4.5. When an entity’s spare equipment strategy could result in the unavailability of major Transmission equipment that has a lead time of one year or more (such as a transformer), the impact of this possible unavailability on System performance shall be assessed. Based upon this assessment, an analysis shall be performed for the selected P1 and P2 category events identified in Table 1 for which the unavailability is expected to produce more severe System impacts on its portion of the BES. The analysis shall simulate the conditions that the System is expected to experience during the possible unavailability of the long lead time equipment.</p>	<p><u>TPL-001-5, Requirement R2, Part 2.4.5</u></p> <p>Consistent with FERC Order 786 Para 89, modified the standard to add Requirement R2, Part 2.4.5, which includes similar language to that used for the steady-state analysis stated in Requirement R2, Part 2.1.5 to address stability analysis for spare equipment strategy.</p>
<p>TPL-001-4, Requirement R3</p> <p>R3. For the steady state portion of the Planning Assessment, each Transmission Planner and Planning Coordinator shall perform studies for</p>	<p>TPL-001-5, Requirement R3</p> <p>R3. For the steady state portion of the Planning Assessment, each Transmission Planner and Planning Coordinator shall perform studies for the Near-Term and Long-Term</p>	No Modification Made

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<p>the Near-Term and Long-Term Transmission Planning Horizons in Requirement R2, Parts 2.1, and 2.2. The studies shall be based on computer simulation models using data provided in Requirement R1. <i>[Violation Risk Factor: Medium]</i> <i>[Time Horizon: Long-term Planning]</i></p> <p>3.1. Studies shall be performed for planning events to determine whether the BES meets the performance requirements in Table 1 based on the Contingency list created in Requirement R3, Part 3.4.</p> <p>3.2. Studies shall be performed to assess the impact of the extreme events which are identified by the list created in Requirement R3, Part 3.5.</p> <p>3.3. Contingency analyses for Requirement R3, Parts 3.1 & 3.2 shall:</p>	<p>Transmission Planning Horizons in Requirement R2, Parts 2.1, and 2.2. The studies shall be based on computer simulation models using data provided in Requirement R1. <i>[Violation Risk Factor: Medium]</i> <i>[Time Horizon: Long-term Planning]</i></p> <p>3.1. Studies shall be performed for planning events to determine whether the BES meets the performance requirements in Table 1 based on the Contingency list created in Requirement R3, Part 3.4.</p> <p>3.2. Studies shall be performed to assess the impact of the extreme events which are identified by the list created in Requirement R3, Part 3.5.</p> <p>3.3. Contingency analyses for Requirement R3, Parts 3.1 & 3.2 shall:</p> <p>3.3.1. Simulate the removal of all elements that the Protection System and other automatic controls are expected to</p>	

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<p>3.3.1. Simulate the removal of all elements that the Protection System and other automatic controls are expected to disconnect for each Contingency without operator intervention. The analyses shall include the impact of subsequent:</p> <p>3.3.1.1. Tripping of generators where simulations show generator bus voltages or high side of the generation</p>	<p>disconnect for each Contingency without operator intervention. The analyses shall include the impact of subsequent:</p> <p>3.3.1.1. Tripping of generators where simulations show generator bus voltages or high side of the generation step up (GSU) voltages are less than known or assumed minimum generator steady state or ride through voltage limitations. Include in the assessment any assumptions made.</p> <p>3.3.1.2. Tripping of Transmission</p>	

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<p>step up (GSU) voltages are less than known or assumed minimum generator steady state or ride through voltage limitations. Include in the assessment any assumptions made.</p> <p>3.3.1.2. Tripping of Transmission elements where relay loadability</p>	<p>elements where relay loadability limits are exceeded.</p> <p>3.3.2. Simulate the expected automatic operation of existing and planned devices designed to provide steady state control of electrical system quantities when such devices impact the study area. These devices may include equipment such as phase-shifting transformers, load tap changing transformers, and switched capacitors and inductors.</p> <p>3.4. Those planning events in Table 1, that are expected to produce more severe System impacts on its portion of the BES, shall be identified and a list of those Contingencies to be evaluated for System performance in Requirement R3, Part 3.1 created. The rationale for those</p>	

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<p>limits are exceeded.</p> <p>3.3.2. Simulate the expected automatic operation of existing and planned devices designed to provide steady state control of electrical system quantities when such devices impact the study area. These devices may include equipment such as phase-shifting transformers, load tap changing transformers, and switched capacitors and inductors.</p> <p>3.4. Those planning events in Table 1, that are expected to produce more severe</p>	<p>Contingencies selected for evaluation shall be available as supporting information.</p> <p>3.4.1. The Planning Coordinator and Transmission Planner shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on adjacent Systems which may impact their Systems are included in the Contingency list.</p> <p>Those extreme events in Table 1 that are expected to produce more severe System impacts shall be identified and a list created of those events to be evaluated in Requirement R3, Part 3.2. The rationale for those Contingencies selected for evaluation shall be available as supporting information. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or</p>	

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<p>System impacts on its portion of the BES, shall be identified and a list of those Contingencies to be evaluated for System performance in Requirement R3, Part 3.1 created. The rationale for those Contingencies selected for evaluation shall be available as supporting information.</p> <p>3.4.1. The Planning Coordinator and Transmission Planner shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on adjacent Systems which may impact their Systems are</p>	<p>mitigate the consequences and adverse impacts of the event(s) shall be conducted.</p>	

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<p>included in the Contingency list.</p> <p>Those extreme events in Table 1 that are expected to produce more severe System impacts shall be identified and a list created of those events to be evaluated in Requirement R3, Part 3.2. The rationale for those Contingencies selected for evaluation shall be available as supporting information. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences and adverse impacts of the event(s) shall be conducted.</p>		
<p>TPL-001-4, Requirement R4</p> <p>Parts 4.1, 4.1.1, 4.1.2, 4.1.3</p> <p>Parts 4.3, 4.3.1, 4.3.1.1, 4.3.1.2, 4.3.1.3, 4.3.2</p> <p>Parts 4.4, 4.4.1</p> <p>Part 4.5</p>	<p>TPL-001-5, Requirement R4</p> <p>Parts 4.1, 4.1.1, 4.1.2, 4.1.3</p> <p>Parts 4.3, 4.3.1, 4.3.1.1, 4.3.1.2, 4.3.1.3, 4.3.2</p> <p>Parts 4.4, 4.4.1</p> <p>Part 4.5</p>	<p>No modifications made.</p>

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<p>TPL-001-4, Requirement R4</p> <p>4.2. Studies shall be performed to assess the impact of the extreme events which are identified by the list created in Requirement R4, Part 4.5.</p>	<p>TPL-001-5, Requirement R4,</p> <p>R4. For the Stability portion of the Planning Assessment, as described in Requirement R2, Parts 2.4 and 2.5, each Transmission Planner and Planning Coordinator shall perform the Contingency analyses listed in Table 1. The studies shall be based on computer simulation models using data provided in Requirement R1. <i>[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]</i></p> <p>4.1. Studies shall be performed for planning events to determine whether the BES meets the performance requirements in Table 1 based on the Contingency list created in Requirement R4, Part 4.4.</p> <p>4.1.1. For planning event P1: No generating unit shall pull out of synchronism. A generator being disconnected from the System by fault clearing action or by a Remedial Action Scheme is not</p>	<p><u>TPL-001-5, Requirement R4, Part 4.2</u></p> <p>Prior to this change, TPL-001-4 Requirement R4, Part 4.5 discussed analysis performed during studies referenced in TPL-001-4 Requirement R4, Part 4.2. To eliminate confusion and better separate the discussion of studies and analysis from the discussion of the necessary pre-conditional selection of extreme events in Table 1 that are expected to produce more severe System impacts, identical language from Requirement R4, Part 4.5 was moved to Requirement R4, Part 4.2.</p>

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	<p>considered pulling out of synchronism.</p> <p>4.1.2. For planning events P2 through P7: When a generator pulls out of synchronism in the simulations, the resulting apparent impedance swings shall not result in the tripping of any Transmission system elements other than the generating unit and its directly connected Facilities.</p> <p>4.1.3. For planning events P1 through P7: Power oscillations shall exhibit acceptable damping as established by the Planning Coordinator and Transmission Planner.</p> <p>4.2. Studies shall be performed to assess the impact of the extreme events which are identified by the list created in Requirement R4, Part 4.5. <u>If the analysis concludes there</u></p>	

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	<p><u>is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event (s) shall be conducted.</u></p> <p>4.2.1. — If the analysis concludes there is Cascading caused by the occurrence of extreme events, excluding extreme events 2e-2h in the stability column, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event(s) shall be conducted.</p> <p>4.2.2. — If the analysis concludes there is Cascading caused by the occurrence of extreme events 2e-2h in the stability column, an evaluation of possible</p>	

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	<p>actions designed to prevent the System from Cascading shall:</p> <p>4.2.2.1. List System deficiencies, the associated actions needed to prevent the System from Cascading, and the associated timetable for implementation.</p> <p>4.2.2.2. Be reviewed in subsequent annual Planning Assessments for continued validity and implementation status.</p> <p>4.3. Contingency analyses for Requirement R4, Parts 4.1 and 4.2 shall:</p>	

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	<p>4.3.1. Simulate the removal of all elements that the Protection System and other automatic controls are expected to disconnect for each Contingency without operator intervention. The analyses shall include the impact of subsequent:</p> <p>4.3.1.1. Successful high speed (less than one second) reclosing and unsuccessful high speed reclosing into a Fault where high speed reclosing is utilized.</p> <p>4.3.1.2. Tripping of generators where simulations show generator bus voltages or high side of the GSU</p>	

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	<p>voltages are less than known or assumed generator low voltage ride through capability. Include in the assessment any assumptions made.</p> <p>4.3.1.3. Tripping of Transmission lines and transformers where transient swings cause Protection System operation based on generic or actual relay models.</p> <p>4.3.2. Simulate the expected automatic operation of existing and planned devices designed to provide dynamic control of electrical system quantities when such devices impact the study area. These</p>	

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	<p>devices may include equipment such as generation exciter control and power system stabilizers, static var compensators, power flow controllers, and DC Transmission controllers.</p> <p>4.4. Those planning events in Table 1 that are expected to produce more severe System impacts on its portion of the BES, shall be identified, and a list created of those Contingencies to be evaluated in Requirement R4, Part 4.1. The rationale for those Contingencies selected for evaluation shall be available as supporting information.</p> <p>4.4.1. Each Planning Coordinator and Transmission Planner shall coordinate with adjacent Planning Coordinators and Transmission Planners to ensure that Contingencies on</p>	

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	<p>adjacent Systems which may impact their Systems are included in the Contingency list.</p> <p>4.5. Those extreme events in Table 1 that are expected to produce more severe System impacts shall be identified and a list created of those events to be evaluated in Requirement R4, Part 4.2. The rationale for those Contingencies selected for evaluation shall be available as supporting information. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event(s) shall be conducted.</p>	
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TPL-001-4, Requirement R6	TPL-001-5, Requirement R6	No modifications made.

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TPL-001-4, Requirement R8	TPL-001-5, Requirement R8	No modifications made.