PURPOSE

This document defines criteria that shall be used when performing studies for the Southwestern Public Service Company (SPS) Transmission system. The document also provides guidance for acceptable forms of mitigation plans and provides guidance when assessing the SPS transmission system for the best reliability solutions.

This document addresses various aspects of the SPS local planning process and does not address allocation of cost for each of the subparts. The cost for implementing any of the subparts shall be addressed outside of this local planning criteria.

APPLICABILITY AND RESPONSIBILITIES

- Transmission Owner (TO) represented by the Transmission Planning, South (SPS) Manager is responsible for ensuring the criteria is carried out as identified in this document as well as informing the Southwest Power Pool (SPP) and neighboring entities of changes to this document.

- Transmission Planning Engineers – are responsible for following the criteria in this document for performing transmission related planning studies and assisting the Manager in assuring the criteria is followed as noted in this document.

- Other Entities – when performing studies, interconnecting facilities, or making changes to existing facilities in the SPS transmission system shall adhere to the criteria set in this document.

APPROVERS

Name	Title
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VERSION HISTORY

Date	Version Number	Supersedes	Change
12/16/2015	1.0	N/A	Initial version.
12/20/2016	1.1	1.0	Revised Version
03/23/2021	2.0	1.1	Redraft of last version
03/10/2022	2.1	2.0	Clarified language in Section 5 and Approvers
03/17/2023	2.2	2.1	Added-Load Power Factor, Bus Configurations, Updated Hyperlinks

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1. Thermal and Voltage Criteria

The following criterion applies to the planning of existing and new transmission system facilities. This criterion will also apply to planning assessments performed for the purpose of meeting reliability requirements specific to NERC Standards (e.g. TPL-001, TPL-007, FAC-008). Specifically, the criterion applies to the SPS transmission facilities of the Southwest Power Pool Balancing Authority (BA), commonly known as Area 526.

1.1 Thermal Loading Criteria

The thermal loading on new and existing transmission lines and transformers shall not exceed 100% of the normal rating during steady-state system intact conditions. During the forced outage of transmission facilities, thermal loading shall not exceed 100% of the emergency rating. See section 7.

1.2 Voltage Criteria

Bus voltages shall remain within the per-unit range [0.95 – 1.05] of the nominal bus voltage value, for system-intact conditions. During the forced outage of transmission facilities, bus voltages shall remain within the per-unit range [0.90 – 1.05] of the nominal bus voltage value.

In some instances, the voltage criteria may deviate (higher/lower bound) slightly on select buses, as a result of transient stability limits. Any new voltage limits must be supported by applicable planning studies.

2. Transient stability criteria

2.1 Simulation Run Time

At a minimum, transient simulation runs shall be run for 20 seconds. The time may be extended based on the outcome of the 20 second run.

2.2 Angular stability criteria

2.2.1 For a NERC TPL-001 P1 planning event, no generating unit shall pull out of synchronism. A generator being disconnected from the System by fault clearing actions or by a temporary Remedial Action Scheme (RAS) is not considered pulling out of synchronism.

2.2.2 For a NERC TPL-001 P2 through P7 planning events; a generator pulling out of synchronism in the simulations shall not result in the tripping of any Transmission system elements other than the generating unit, and its directly connected Facilities.

2.2.3 Generator rotor angles, Transient bus voltages, bus frequencies and transmission line flows shall show positive damping.

2.3 Transient Voltage criteria

2.3.1 SPS adopts the Transient Voltage Recovery Requirement as described in the SPP Disturbance Performance Requirements[1].

3. Cascading

Applicable to BES facilities within the purview of SPP OATT and NERC reliability standards where the criteria is further defined in the scope of work specific reliability standard. As a general definition, cascading as defined in this document is:

3.1 Cascading in Steady State analysis

3.1.1 A true divergent power flow or singular Jacobian solution not due to mathematical instability, or

3.1.2 Contingencies that yielded monitored elements with thermal loadings over 120% of the emergency rating and/or per-unit voltages below .90 per-unit at three (3) or more buses (tripping threshold), are analyzed with POM-PCM (Potential Cascading Modes) module, PSSE, or some other software. After simulating the initial contingency any monitored element that exceeds the tripping threshold will be taken out of service. The power flow is then solved again and the system is scanned for elements meeting the tripping threshold again. This tripping and solving is continued until the system becomes stable or continues to result in elements exceeding the tripping threshold (i.e., Cascading).

3.2 Cascading in Transient Stability analysis

3.2.1 Cascading: The Cascading analysis is performed by tripping generators offline that pulled out of synchronism (generator angle >180 degrees) while the simulation continues to monitor whether additional generation would pull out of synchronism. The criteria for an event resulting in potential cascading is the loss of more than 3,000 MW of generation based on SPP's largest plant output plus 50 percent of the largest unit. Those events violating these criteria were identified as a possible cascading event for further analysis to determine any necessary Corrective Action Plans (CAP).

3.2.2 Transient voltage is described in the SPP Disturbance Performance Requirements[2]. Transient bus voltages that do not recover by the end of the simulation run time, as noted in section 2.1, will be marked as voltage unstable.

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[2] Bus voltages on the Bulk Electric System shall recover above 0.70 per unit, 2.5 seconds after the fault is cleared. Bus voltages shall not swing above 1.20 per unit after the fault is cleared, unless affected Transmission system elements are designed to handle the rise above 1.2 per unit.

4. Short Circuit Criteria

The short circuit fault-interrupting capability rating of all equipment (circuit breakers, circuit switchers, etc.) shall exceed the maximum available fault current that the interrupting device will experience, as determined by short circuit analysis. Any violation of this criterion shall be mitigated appropriately, respective of equipment lead times.

5. Network Transmission upgrades to existing Radial Transmission

This section applies to substations served with radial transmission lines (single source), serving electrical load, that might want to be considered as candidates for networked transmission lines (not radial transmission lines). For consideration as a possible candidate, the radial lines shall be in the SPP Model Development Working Group (MDWG) models and are SPP Tariff Facilities. In addition, one or more of the following must apply,

5.1 The radial transmission line requires networking as part of a Corrective Action Plan (CAP) needed to meet reliability requirements identified as part of a NERC TPL-001 planning assessment, or

5.2 The total load served by a radial transmission line is greater than 75 MW and would be outaged under a single contingency where the load cannot be restored by transmission switching, or

5.3 The radial transmission line loading is in excess of 450 MW-Mile, or

5.4 A customer may request networking of radial facilities.

5.5 Entities requesting a permanent change to the operation of a N.O. switch to a Normal Closed (N.C.) switch will have to justify that no material impacts related to thermal, or voltage limit exceedances are introduced. This will require a separate System Impact Study and a validation that the change does not introduce violations during the next cycle of the SPP ITP and NERC TPL-001 annual assessment. Any Corrective Action Plans addressing violations observed during these studies will be applicable to the requesting entity, unless the change is necessary to address NERC reliability requirements.

All facilities identified under section 5.2 – 5.5, may be subject to a FERC Seven Factor Test to confirm that the conversion to a network transmission line provides network flows (flow through). All proposed projects to network radial transmission lines are subject to the SPP material modification process. In addition, historical outage information on identified radial line may be considered, as well as good utility practice.

6. Radial Transmission connected using Normally Open Switches

This section applies to a radial transmission line with the capability of being served from another transmission line connecting via a Normal Open (N.O.) switch. When load is served via the other

radial line that can connect through a shared N.O. switch, a CAP to correct thermal overloads and voltage violations could be identified. This CAP would only address violations when the primary source to the radial line is out of service and the N.O. switch is closed so load is served from the alternative single sourced radial line, without loop flow. The intent is to allow backup service to the radial load served by each of the radial lines sharing the N.O. switch temporarily.

CAPs to radial transmission lines shall coordinate with applicable parties connecting to the radial transmission lines. Additionally, concerns with the daily operations of these lines will also be considered.

7. Facility Ratings

SPS BES facility ratings are reviewed for use in the planning and operation of the SPS transmission network. Facility ratings are consistent with the NERC FAC-008 reliability standard and applicable Facility Ratings Methodology. Facility ratings shall be in accordance with the requirements of the NERC FAC-008, the SPP Tariff or in accordance with the requirements of the MDWG Model Procedure Manual if non-BES facilities are modeled.

8. Transmission Studies

8.1 Generation, Transmission Service and Transmission Interconnection Study Requests

All new interconnection requesters will be required to work with SPP, and SPS, if SPS facilities are being impacted. SPS reserves the right to redirect the generation POI to existing substations to maintain or increase the reliability of the transmission network.

Any new generation interconnection connecting to the SPS transmission system within 6 miles from an existing non-tapped substation will require the addition of fiber, if not already installed, for communication and protection as part of the interconnection.

Entities requesting the interconnection of generation facilities, or transmission service to the SPS transmission network need to apply for these types of requests via the Southwest Power Pool (SPP) Tariff approved process. These types of studies are administered by the SPP and details can be found on the SPP website at https://www.spp.org/.

SPP Generation Interconnection Guidelines (*GuidelinesAndBusinessPracticesForGIP.pdf*) can be found at the following location: https://opsportal.spp.org/Studies/Gen

SPS Transmission Interconnection Guidelines:
https://www.transmission.xcelenergy.com/Interconnections

8.2 Load Interconnection Studies (SPP Tariff, Attachment AQ requests)

Studies for new load or modifications to existing transmission facilities (>60kV) serving load via the SPS transmission system will be submitted to SPP and SPS as required by Attachment AQ of

the SPP Tariff. Upgrades to the existing transmission network identified by SPP via the Attachment AQ process will result in SPP issuing a Notification to Construct (NTC).

In addition to any network related upgrades identified through the Attachment AQ process, the following considerations shall be taken into account as part of the interconnection request for new interconnections on the 100 kV and above facilities.

8.2.1 New load or modifications to existing load in excess of, or through load growth, exceeding 75 MW may be subject to service from line terminal(s), with breaker(s).

8.2.2 The number of load taps on a transmission line that exceed 3 load taps between breakers on a transmission circuit could result in a transmission system reconfiguration to minimize the impact to consequential load outages.

8.2.3 Substations tapped off an existing transmission line with a combined load in excess of 75 MW could results in a transmission system reconfiguration to minimize the impact to consequential load outages.

Requester will coordinate with SPS to determine if temporary service can be provided while permanent facilities identified in the study process are being designed/constructed in order to meet the agreed upon in-service date. Finally, temporary service and redundant service to a facility identified for serving load under Attachment AQ are not requirements.

Xcel Energy *Transmission to Load Interconnecting Guidelines (PDF)* can be found at the following location: https://www.transmission.xcelenergy.com/Interconnections

8.3 NERC Reliability Standards

As a result of NERC mandated reliability standards, SPS will consider CAPs for any project that is necessary for reliability resulting from a NERC Reliability Standard associated with the BES.

8.4 Other Studies

Additional technical studies can be performed as required to maintain system reliability on the BES and to follow good utility practice. These studies include, but are not limited to generation retirements, Harmonics, Transmission Outages, Operational studies, etc.. SPS may address issues related to reliability concerns from these studies and develop projects to address violations.

9. Remedial Action Schemes

SPS does not allow the installation, ownership or administration of permanent (or Extended Use) Remedial Action Schemes (RAS), or to expand any existing temporary RAS for the purpose of mitigating reliability concerns on the SPS transmission system or the transmission system of an interconnected neighboring utility's transmission system. These reliability concerns include, but are not limited to thermal overloads, voltage violations, and system stability violations.

9.1.1 the RAS is a temporary measure required to maintain system reliability during the construction of a transmission solution, where the RAS will be removed and retired upon the energization of the transmission solution, or,

9.1.2 the RAS is a temporary measure to grant limited transmission service until the energization of transmission projects identified as required for transmission service, where the RAS will be removed and retired upon the energization of the transmission projects or,

9.1.3 the RAS is a temporary measure required to allow generator or load interconnection during the construction of transmission upgrades identified through studies, where the RAS will be removed and retired upon the energization of the transmission upgrades,

9.1.4 the entity owning and administering the RAS agrees to obtain all necessary approvals from the applicable regional entity (e.g., the Southwest Power Pool),

9.1.5 The entity owning the RAS agrees to be responsible for complying with the mis-operation reporting requirements as required by the applicable NERC standards for RASs and will be responsible for coordinating any corrective actions with the SPS transmission system.

9.1.6 The entity identified as the Transmission Operator of the RAS, for the RAS owner, would be solely responsible for monitoring the status of the RAS and notifying affected entities of changes in the status of the RAS, including any degradation or potential failure to operate as expected, as required by NERC reliability standard PRC-012.

9.1.7 the entity owning and administering the RAS agrees with the implementation and removal of work required for the RAS.

9.1.8 the RAS is approved by the SPP stakeholder process.

And, the RAS will only be allowed if the applicable RAS owner has a committed in-service date for the transmission solution(s)/upgrade(s)/project(s), within a period no longer than 2 years following the RAS installation, that eliminates the need for the RAS. If the transmission solution(s)/upgrade(s)/project(s) required for removing and retiring the RAS are not in-service by the agreed upon date, this will result in the removal of the RAS. The generator or load will lose its ability to stay interconnected to the transmission system, and/or losing its transmission service until the transmission solution(s)/upgrade(s)/project(s) are completed and impact facilities will comply with orders requesting they disconnect.

10. Other

10.1 Multi-Terminal Transmission Circuits

SPS will not allow the addition of new, or the reconfiguration of existing, transmission facilities that will cause the creation of a multi-terminal (>2 terminals) transmission circuit, meaning the transmission circuit is protected by circuit breakers from multiple separate sources, where current injection is possible from these multiple sources.

10.2 Additions to Existing Substations

Any addition to an existing SPS substation will be required to comply with existing company design standards related to bus configurations.

10.3 Voltage Conversion or System Reconfiguration Projects

For solutions that may result in a change of high-side voltage to customer facilities or a reconfiguration of the existing Transmission facilities, SPS can consider total project cost, system reliability, operational flexibility, and the radial line study impacts.

10.4 Load Power Factor

Load interconnection guidelines have a minimum power factor, see *Minimum Power Factor Requirements* in the Xcel Energy *Transmission to Load Interconnecting Guidelines (PDF)* found at the following location:
https://www.transmission.xcelenergy.com/Interconnections

Loads interconnecting to the Transmission System may require the addition of capacitor banks at the Point Of Interconnection (POI), specifically to alleviate the reactive power burden on the transmission system.

10.5 Bus Configurations, 230kV and 345kV

Bus configurations for interconnections at 230kV and 345kV voltages levels will consist of a ring bus, breaker-and-a-half or double-bus double-breaker substation arrangement. These types of interconnections are needed to minimize the impact to the 230kV or 345kV transmission paths.