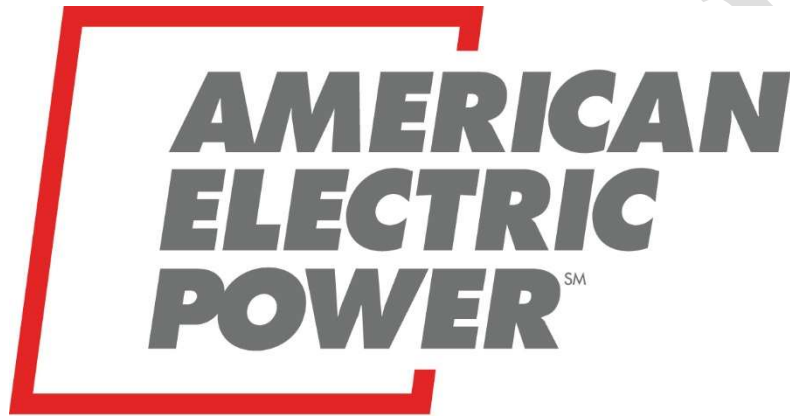


Zonal Planning Criteria

SPP Zone 1



BOUNDLESS ENERGYSM

May 31, 2023

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Purpose

The Transmission Planning system analysis and performance criteria defined herein will be effective for SPP Zone 1 of the SPP Regional Transmission Organization (RTO). Approved Zonal Planning Criteria (ZPC) will be applied by SPP during SPP Transmission Expansion Plan (STEP) studies on an annual basis commencing with the 2025 SPP Integrated Transmission Plan (ITP). These criteria measures will be utilized to determine Notifications to Construct (NTCs) for transmission system improvements issued by SPP. The cost associated with ZPC-based NTC projects will be eligible for zonal cost recovery. The Zone 1 criteria described herein supplements the: 1) North American Electric Reliability Corporation (NERC) Reliability Standards; 2) SPP Planning Criteria Section 5, Regional Transmission Planning.

Scope

Create SPP Zone 1 Planning Criteria that is approved by the two-step ZPC voting criteria as defined in SPP OATT Attachment O Section II, 5b. Once reviewed and complete, approved ZPC will be submitted to SPP for implementation and analysis of SPP Zone 1 facilities, as a part of the Planning Criteria evaluated by SPP on an annual basis. Application of the Zone 1 ZPC shall not result in the replacement, withdrawal, or deferral of any current reliability projects already approved by SPP. Per the Zonal Planning Criteria process defined in Attachment O, prior year approved ZPC will be reviewed on an annual basis for any necessary revisions.

SPP Zone 1 Planning Criteria

Section 1: Loading Criteria

Evaluated in accordance with NERC Reliability Standards and SPP Planning Criteria.

Section 2: Voltage Criteria

Normal Conditions (Pre-contingency)

All transmission level busses shall maintain a voltage of 0.95 p.u. - 1.05 p.u. following the occurrence of any operating condition in category P0¹ of the NERC Reliability Standard TPL-001.

Emergency Conditions (Post-contingency)

All transmission level busses shall maintain a voltage of 0.92 p.u. - 1.05 p.u. following the occurrence of any operating condition in categories P1 through P7 of the NERC Reliability Standard TPL-001.

¹ NERC TPL-001 category P0 is the pre-contingency normal operating state of the system.

Section 3: N-1-1 Evaluation

N-1-1 Criteria

The system design for Zone 1 of the SPP transmission network shall avoid thermal or voltage criteria violations under NERC P6 (N-1-1) conditions for power flow cases designed to represent off-peak load periods.

Neither Non-Consequential Load Loss (load-shedding) nor Interruption of Firm Transmission Service will be permitted to maintain facilities within thermal and voltage limits.

N-1-1 Criteria Study

1. To study the SPP Zone 1 transmission system for N-1-1 compliance, a full N-1-1 ACCC analysis will be performed for the zone. The N-1-1 ZPC criteria will be evaluated using the furthest out Spring and Fall² load cases of the ITP Base Reliability Models.
2. The contingency file will be comprised of all single branch outages within or connected to Load Zone 1 facilities to simulate the worst-case scenario and post contingency switching scenarios.
3. The monitor file will be comprised of a subsystem designed to assess bus voltage and branch, including transformer branch, loadings for all transmission level voltage facilities according to the Loading and Voltage Criteria defined in Sections 1 and 2, above. The monitored subsystem will include all transmission level facilities within Zone 1.
4. This study will assume switches are currently installed at all tap locations.
5. Generation re-dispatch should be used first to alleviate violations. If dispatchable generation cannot alleviate the violation, a project should be developed.

N-1-1 Project Development

Solutions for N-1-1 issues shall be the most cost-effective projects based on factors such as solution cost, current facility age, and effectiveness of the project to improve bus voltages and reduce monitored branch loading. The process for N-1-1 solution development will mirror existing processes for development of SPP's Integrated Transmission Plan (ITP) solutions. SPP will post Zone 1 N-1-1 based system needs for review by Zone 1 stakeholders. Zone 1 stakeholders will be provided an opportunity to submit N-1-1 solutions and the opportunity to comment upon proposed N-1-1 solutions. SPP will have final authority for inclusion of N-1-1 solutions in the annual ITP project portfolio. Zone 1 system improvements that resolve the N-1-1 violations but are upgrades to system facilities owned by or tied to facilities owned by other Transmission Owners in Zone 1 shall be considered.

² The primary purpose for inclusion of N-1-1 criteria in ZPC is better alignment between system planning conditions and system operating conditions. As such, the N-1-1 ZPC criteria will require analysis of the impact that maintenance outages have on the transmission system ensuring that planning processes enable support and approval of future maintenance outages. Spring and Fall power flow cases have been targeted for this analysis because they represent system conditions under which maintenance outages are most likely to occur.

Section 4: Looping Radial Lines

Looping Criteria

A facility operated at 69 kV nominal voltage or above will qualify for looping with zonal cost recovery within SPP Zone 1 if it meets at least ONE of the following criteria:

- (a) Non-transferrable³ peak demand that meets or exceeds 150 MW-mile.
- Or -
- (b) A single radial substation feeding 35 MW or greater of non-transferrable peak load.

Looping Project Development

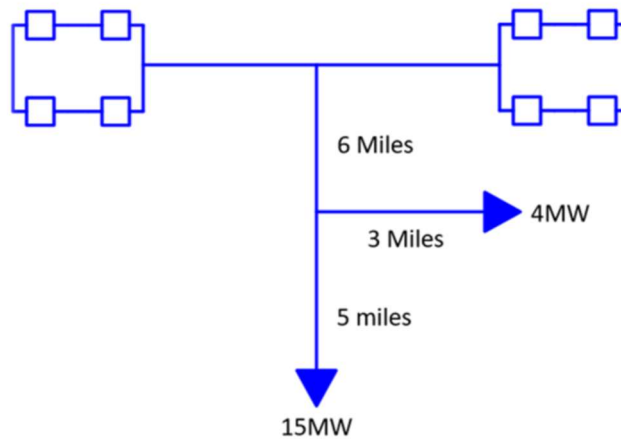
- 1) All looping projects will be developed through SPP ITP Base Reliability Model cases using the Summer Peak or Winter Peak 5-year Models.
- 2) The modeled transmission system topology for SPP ITP Base Reliability models is sourced from Model Development Advisory Group (MDAG) steady-state cases. It is important that all transmission facilities, including radials from tap locations, are modeled with accurate radial line mileage and forecasted radial load values during the MDAG case build process.
- 3) Projects developed from data not included in the ITP Base Reliability Model 5-year cases will not be eligible for zonal cost recovery.
- 4) Project selection and development shall be based on the most cost-effective solution that mitigates MW-mile exposure to acceptable⁴ levels.

³ Normally Open (N.O.) internal or tie connections to serve radial load under emergency conditions shall not be considered when calculating the MW-mile value associated to the radial, as depicted in Examples 1-2 and 1-3 of Example Looping Calculations.

⁴ Reducing the MW-mile or single radial load below the Looping Criteria thresholds is an acceptable solution. In other words, it is not necessarily required to loop the entire radial load.

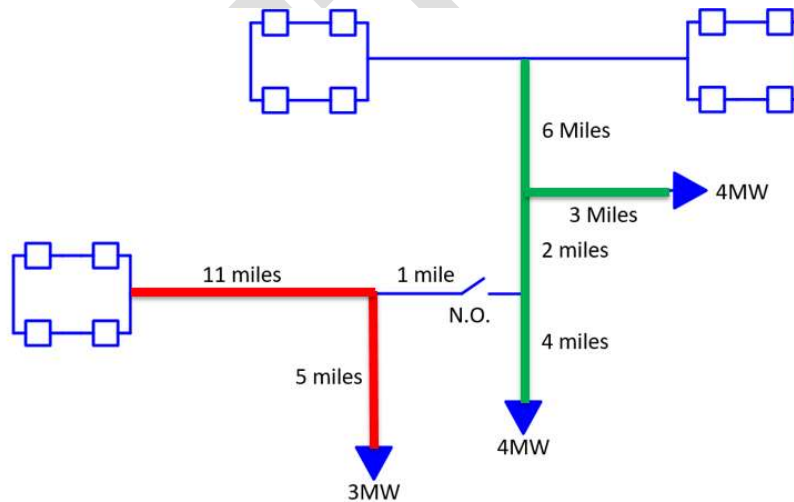
Example Looping Calculations

Zone 1 Looping Criteria Calculation (Example 1-1)



$$\text{MW-mile} = 4 \text{ MW} * (6 \text{ miles} + 3 \text{ miles}) + 15 \text{ MW} * (6 \text{ miles} + 5 \text{ miles}) = 201 \text{ MW-mile}$$

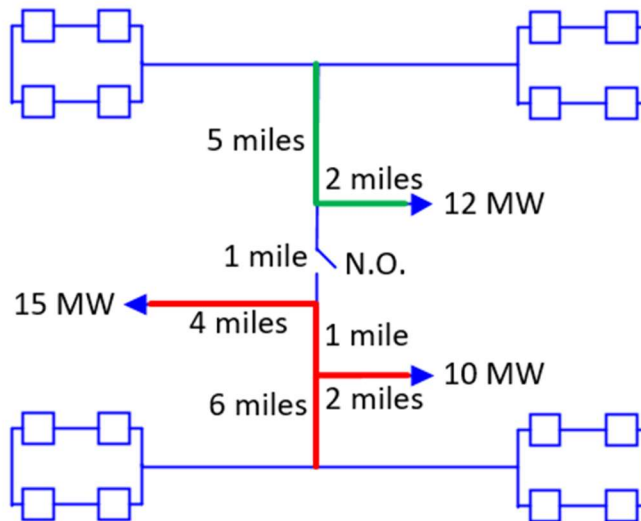
Zone 1 Looping Criteria Calculation (Example 1-2)



$$\text{Radial 1 MW-mile} = 4 \text{ MW} * (6 \text{ miles} + 3 \text{ miles}) + 4 \text{ MW} * (6 \text{ miles} + 2 \text{ miles} + 4 \text{ miles}) = 84 \text{ MW-mile}$$

$$\text{Radial 2 MW-mile} = 3 \text{ MW} * (11 \text{ miles} + 5 \text{ miles}) = 48 \text{ MW-mile}$$

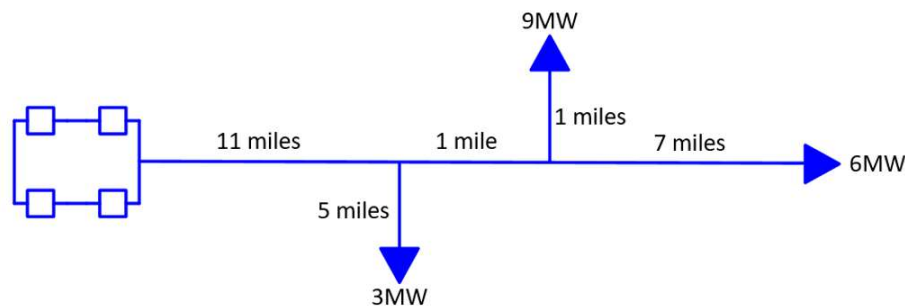
Zone 1 Looping Criteria Calculation (Example 1-3)



Radial 1 MW-mile = 12 MW*(5 miles + 2 miles) = 84 MW-mile

Radial 2 MW-mile = 10 MW*(6 miles + 2 miles) + 15 MW*(6 miles + 1 mile + 4 miles) = 245 MW-mile

Zone 1 Looping Criteria Calculation (Example 1-4)



MW-mile = 3 MW*(5 miles + 11 miles) + 9 MW*(11 miles + 1 mile + 1 mile) + 6 MW*(11 miles + 1 mile + 7 miles) = 279 MW-mile

Section 5: Circuit Breaker and Auto-Sectionalizing for Closed-Loop Transmission Lines

Any new or changing connection to SPP Zone 1 facilities will require, at a minimum, motor operated, Supervisory Control and Data Acquisition (SCADA) controlled line disconnect switches, commonly referred to as motor operated air-break (MOAB) switches. Exceptions to this minimum switching requirement exist for the following situations:

- The connection established to serve load is considered temporary (24 months or less).
- The topography of the tap location is such that the tap is not accessible by road, in which case the in-line switches can be placed elsewhere in a more accessible location.
- The tapped in-line connection is required temporarily under emergency system conditions.

SCADA control and monitoring is required for all in-line sectionalizing unless acceptable justification for manual control exists. Automatic motor operated controls can be added to in-line switches, when justified, to minimize the time required for restoration following a failure of the transmission supply line.

The factors considered when determining whether a load connection is switched with MOAB or circuit breaker (CB) application for in-line switching include, but are not limited to:

Safety & Health	SAIDI performance
Total load magnitude	Criticality of load and customer/community impact
Restoration time	Operational flexibility
MVA-mile calculations	Existing system configurations
FOI ⁵ calculations for MOABs (FOI)	Consideration regarding feasibility of maintenance
MPOI ⁶ calculations for CBs (MPOI)	Area outage statistics

The FOI and MPOI calculations are structured as follows:

Equation 1

$$FOI = L_f \times \text{Miles of Exposure} \times P_f$$

Equation 2

$$MPOI = L_f \times \text{Miles of Exposure} \times (P_f + M_f)$$

Where:

- L_f is the peak load (MW) directly jeopardized by the forced outage of the line
- Miles of Exposure is the number of line miles between two existing automatic sectionalizing devices (including taps)
- P_f is the Permanent⁷ Forced Outage Rate (Outages per Year⁸, per Mile), and
- M_f is the Momentary⁹ Forced Outage Rate (Outages per Year, per Mile).

Minimum Thresholds:

- Installation of circuit breakers will be justified for zonal cost recovery when the MPOI calculation is ≥ 200 .
- Installation of auto-sectionalizing MOAB switches will be justified when the FOI calculation is ≥ 6 .

⁵ FOI = Forced Outage Index

⁶ MPOI = Momentary Permanent Outage Index

⁷ Permanent forced outages are comprised of outages lasting 1 minute or more.

⁸ The standard range of time for outage rate evaluation is the most recent 5-years. Exceptions shall be allowed based upon the availability of circuit specific outage data.

⁹ Momentary forced outages are comprised of outages lasting less than 1 minute.

Hard Tap Connections

- 1) All delivery points and taps off through-path transmission shall have some method for switching.
- 2) Exceptions exist for temporary facilities and existing facilities with switchable devices within a reasonable distance or with alternative switching means.

Three Terminal Lines

- 1) No new three terminal lines shall be installed in the SPP Zone 1 system.
- 2) Projects to eliminate existing three terminal lines shall be allowed.

Definitions

- **Transmission Level (Busses and Facilities)** – Nominal 765 kV, 345 kV, 161 kV, and 138 kV voltage levels will normally be used for most new power transmission lines and are considered Bulk Electric System (BES). Some interconnection lines may be constructed at 500 kV, 230 kV, or 115 kV to match neighboring utilities' voltage. 69 kV lines may be constructed in appropriate situations. Busses and facilities operated at a nominal voltage of 69 kV will be considered Transmission Level for the purposes of Zonal Planning Criteria applicability.
 - **Off-Peak Cases** – For the purpose of the N-1-1 maintenance outage criteria, Off-Peak cases will be defined as those in the near-term evaluation (1 to 5 years) or long-term evaluation (> 5 years) cases, or both, with a "Season" description in the ITP/MDAG model series of:
 - Spring
 - Fall
 - **Normal Conditions** – The Planning model's base case condition with all facilities in-service, other than normally open circuits. The applicable facility rating(s) under Normal Conditions are those defined by the facility owner that specify the level of electrical loading, usually expressed in Megavolt-Amperes (MVA) or Amps (A), that a facility or station element can support or withstand through the daily demand cycles without abnormal loss of equipment life.
 - **Emergency Conditions** – The Planning model's single or multiple contingency condition with facilities out-of-service according to TPL-001 contingency categories P1 through P7. The applicable facility rating(s) under Emergency Conditions are those defined by the equipment owner that specify the level of electrical loading, usually expressed in Megavolt-Amperes (MVA) or Amps (A), that a facility or station element can support or withstand for a finite period of time. Emergency facility rating(s) assume some acceptable loss of equipment life or strength but establish a thermal limit that occurs before the facility sustains permanent overheating damage and before it violates public safety requirements.
 - **Radial Systems:** A group of contiguous transmission Elements that emanates from a single point of connection at 69 kV or higher and:
-

- a) Only serves Load.
 - Or -
 - b) Only includes generation resources, not identified in Inclusions I2, I3, or I4, with an aggregate capacity less than or equal to 75 MVA (gross nameplate rating).
 - Or -
 - c) Where the radial system serves load and includes generation resources, not identified in Inclusions I2, I3, or I4, with an aggregate capacity of non-retail generation less than or equal to 75 MVA (gross nameplate rating).
- Inclusions:
 - a) I2 – Generating resource(s) with gross individual generator unit nameplate rating greater than 20 MVA or gross plant/facility aggregate nameplate rating greater than 75 MVA including the generator terminals through the high side of the step-up transformer(s) connected at a voltage of 60 kV or above
 - b) I3 – Blackstart Resources identified in the Transmission Operator’s restoration plan.
 - c) I4 – Dispersed power producing resources that aggregate to a total capacity greater than 75 MVA (gross nameplate rating) and are connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage of 60 kV or higher.

Glossary

Follow link for [NERC Glossary of Terms](#)

Revision History

Revision#	Description of Change(s)	Requested By	Revision Date
0	AEP Draft ZPC Proposal	SPP OATT Attachment O	5/31/2023

Review

Reviewed By	Title	Signature	Date
Matthew McGee	Engineer Principal – West Transmission Planning		5/31/2023

Reviewed By	Title	Signature	Date
Bradley Myers	Planning Manager – West Transmission Planning		5/31/2023

Approval

Approved By	Title	Signature	Date
Wayman Smith	Planning Director – West Transmission Planning		

Review and Retention

Review Frequency	Annual
Retention Period	3-Years