

Zonal Planning Criteria

SPP Zone 1



BOUNDLESS ENERGY⁵⁴

Mar 6, 2024

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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-driven 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

This document establishes SPP Zone 1 Planning Criteria that must be approved by the two-step ZPC voting criteria as defined in SPP OATT Attachment O Section II, 5b in order to become active. Once finalized, approved ZPC must be submitted to SPP by April 1st, annually. 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 Revision Request 452 (RR452), retroactively effective as of 2/6/2023, establishes the process by which TO projects intended to mitigate approved Zone 1 Planning Criteria violations are submitted to SPP for evaluation. The Transmission Owner Project Evaluation process that has been established by RR452, which includes TO project submissions to mitigate approved Zone 1 ZPC, is an annually timebound process that must be synchronized with ITP power flow case availability, ITP needs assessment, and annual ITP DPP project submission window. Additionally, significant collaboration will be required amongst Zone 1 stakeholders to identify system needs based on approved Zone 1 ZPC, develop solutions to mitigate ZPC criteria violations, validate that proposed projects effectively mitigate ZPC-based needs, and prepare and submit RMS tickets and Non-DPP project forms. In order to facilitate coordination activities and add annual ZPC process clarity, this document will additionally establish a Zone 1 ZPC Implementation Plan for review and adoption by Zone 1 stakeholders.

Application of the Zone 1 ZPC shall not result in the replacement, withdrawal, or deferment of any current reliability projects already approved by SPP.



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-001-5 or successor standard.

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-001-5 or successor standard.

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

- 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 Spring² load case from 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.

¹ NERC TPL-001-5 category P0 is the pre-contingency normal operating state of the system.

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. A Spring power flow case has been targeted for this analysis because it represents system conditions under which maintenance outages are most likely to occur.



- 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. AEP 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.

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 <u>ONE</u> of the following criteria:

(a) Non-transferrable³ peak demand that meets or exceeds 130 MW-mile.

- Or -

(b) A single radial substation feeding 35 MW or greater of non-transferrable peak demand.

- Or -

(c) Facility upgrades needed to serve new customer demand within 2 miles of a transmission source, given the construction design utilizes hairpin construction methodology.

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,

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.



including radials from tap locations, are modeled⁴ 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 a cost-effective solution that mitigates MW-mile exposure to acceptable⁵ levels.
- 5) Mitigations for looping criteria violations should consider utilization of Non-Wires Alternatives (NWAs).

Zone 1 Looping Criteria Calculation (Example 1-1)

Example Looping Calculations



MW-mile = 4 MW*(6 miles + 3 miles) + 15 MW*(6 miles + 5 miles) = 201 MW-mile

⁴ It is envisioned that SPP will evaluate all modeled Zone 1 radial facilities against defined looping criteria and the examples provided to determine Zone 1 needs for looping solutions.

⁵ 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 facility.





Radial 1 MW-mile = 4 MW*(6 miles + 3 miles) + 4 MW*(6 miles + 2 miles + 4 miles) = 84 MW-mile Radial 2 MW-mile = 3 MW*(11 miles + 5 miles) = 48 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 Zonal Planning Criteria (SPP Zone 1)





Radial 1 MW-mile = 15 MW*(2 miles + 3 miles) + 20 MW*(2 miles + 4 miles) = 195 MW-mile Radial 2 MW-mile = 20 MW*(3 miles) = 60 MW-mile

Section 5: Zonal Planning Criteria Beyond Power Flow Analysis Boundaries

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 ⁶ calculations for MOABs (FOI)	Consideration regarding feasibility of maintenance
MPOI ⁷ calculations for CBs (MPOI)	Area outage statistics

The FOI and MPOI calculations are structured as follows:

Equation 1 $FOI = L_f \times Miles \ of \ Exposure \ \times P_f$

Equation 2

$MPOI = L_f \times Miles \ of \ Exposure \ x \ (P_f + M_f)$

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 Permanent⁸ Forced Outage Rate (Outages per Year⁹, per Mile) associated with the breaker-tobreaker transmission circuit under evaluation, and
- *M_f* is the Momentary¹⁰ Forced Outage Rate (Outages per Year, per Mile) associated with the breaker-to-breaker transmission circuit under evaluation.

Minimum Thresholds:

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

⁶ FOI = Forced Outage Index

⁷ MPOI = Momentary Permanent Outage Index

⁸ Permanent forced outages are comprised of outages lasting 1 minute or more.

⁹ 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.

¹⁰ 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.

Submission and Application for Section 5 ZPC Projects:

The evaluation of need for additional circuit breaker or auto-sectionalizing capabilities resulting from the addition of new, or modification of existing, load will be based on TO submitted *FOI* or *MPOI* calculations or other submitted justification as described above. Zone 1 TOs may submit, as needed, RMS ticket(s) to SPP that contain the *FOI* or *MPOI* calculations as justification for the addition of circuit breakers or auto-sectionalizing capabilities needed as a result of load amount, line mileage exposure, and outage performance associated with subject transmission facilities. Alternately, Zone 1 TOs may submit their rationale for the addition of circuit breakers or auto-sectionalizing capabilities to existing transmission circuits that are needed due to the criticality of the load served by the applicable transmission facilities or other factors as described above. Zone 1 TOs may also submit RMS tickets to SPP, as needed, for the elimination of hard tap connections or three terminal lines.

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 Case For the purpose of the N-1-1 maintenance outage criteria, the off-peak case 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 model series of:
 - o Spring
- 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-ofservice according to TPL-001-5 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 facilities that emanates from a single point of connection to the transmission system at 69 kV or higher.

Zone 1 ZPC Implementation Plan

SPP Revision Request 452 (RR452), retroactively effective as of 2/6/2023, establishes the process by which TO projects intended to mitigate approved Zone 1 Planning Criteria are submitted to SPP for evaluation. The two-stage process requires a preliminary SPP RMS ticket submission that includes, amongst other information, specific proposed project information, description of need (*as supported by Zone 1 ZPC*), and associated project modeling information. The Transmission Owner Project Evaluation Process Request form located on the <u>MODELING</u> page on the <u>SPP Website</u> must accompany the RMS ticket submission. The RMS ticket enables SPP to determine the appropriate study process by which the project will be evaluated. Upon receiving SPP direction resulting from the preliminary RMS ticket, the secondary step of the two-stage process requires that the TO submit a completed "Non-DPP" form to SPP. DPP and Non-DPP submission forms are located on the <u>DETAILED PROJECT PROPOSALS</u> page on the SPP website. Most valid ZPC-driven project submissions will result in evaluation of the project within the annual Integrated Transmission Plan (ITP) or an ITP Supplemental Study. Please reference the TO Project Evaluation Process flowchart located in <u>SPP OATT Business Practice 7400</u>.

The following Implementation Plan details aim to define the requirements, collaborative stakeholder activities, task ownership, and an approximate annual timeline for completion of the activities and tasks associated with the transmission system evaluation of approved Zone 1 ZPC.

ZPC Mitigation Project Runway

The application of new and more stringent [zonal] planning criteria may result in a number of newly identified transmission system deficiencies. Projects to mitigate newly identified violations take time to develop, plan, scope, fund, and execute. Project interdependencies, budgetary constraints, outage planning, and regulatory processing are examples of other project scheduling challenges that must be considered when establishing a timeline for implementation of projects associated with new planning criteria. With these factors in mind, the portfolio of Zonal Planning Criteria projects identified as needed based on the initial, first year, implementation of Zone 1 Planning Criteria will be granted a 10-year grace period for project execution and in-servicing.

Commencement of the initial implementation of Zonal Planning Criteria analysis within the SPP Transmission Expansion Plan (STEP) will coincide with the 2025 ITP. Given that the proposed ZPC for Zone 1 are approved by April

Zonal Planning Criteria (SPP Zone 1)



1st, 2024, Zone 1 stakeholders can expect to have received ZPC-based NTCs between July [Annual SPP Planning Summit] and December of 2025. Based on the initial 2025 ITP timeline for project portfolio development and the 10-year implementation grace period, projects that address violations in the first Zone 1 ZPC assessment will need to be planned for in-servicing by December 2035.

Project 'Need Dates' for subsequent ZPC windows within the SPP ITP process will be addressed in future updates to this Zone 1 ZPC document and will consider and include lessons learned from the initial implementation of ZPC.

Annual Zone 1 Coordination Activities & Task Ownership

The following ZPC Implementation Plan table outlines key coordination activities and ownership responsibilities for associated tasks.

Task	Task Description	Task Owner	Date
ITP-BR Model Development	Develop ITP Base Reliability Models.	SPP	March (2024)
ZPC Case Selection	Choose power flow cases from 2025 ITP-BR models to be utilized for application of Zone 1 ZPC.	Zone 1 Stakeholders	Apr – May (2024)
ZPC Needs Assessment ¹¹	Identify and post Zone 1 transmission system needs list from ITP-BR model based on Sections 3 & 4 of Zone 1 ZPC criteria.	AEP	By Jun 1 (2024)
Project Dev / Needs Mitigation	Develop projects aimed at mitigating Zone 1 transmission system needs.	Zone 1 Stakeholders	Jun – Aug (2024)
Project Presentations	Summarize and present Zone 1 ZPC-driven projects planned for SPP submission.	Zone 1 Stakeholders (Project Sponsors)	Sept (2024)
RMS Ticket Submissions	Complete SPP's TO Project Evaluation Process Request form and submit associated SPP RMS tickets.	Zone 1 Stakeholders (Project Sponsors)	Sept – Mid Oct (2024)
Study Process Determination	Determine the SPP study process by which the ZPC- driven project will be evaluated.	SPP	Oct – Mid Nov (2024)
ITP-BR Model Updates	Update ITP-BR models based on previous year's ITP planned portfolio of projects.	SPP	November (2024)
ZPC Project Validations	Validate proposed Zone 1 ZPC-driven project proposals are still needed and resolve associated ZPC violation(s). Post results for Stakeholder review.	AEP	By Jan 15 (2025)
Non-DPP Submission	Prepare Non-DPP submission form and submit to SPP during the applicable ITP DPP response window (i.e. 2025 ITP DPP window for initial ZPC year).	Zone 1 Stakeholders (Project Sponsors)	Feb – Mar (2025)

¹¹ Zone 1 TOs with System Modeling responsibilities will need to provide a power flow case means of filtering to their specific transmission facilities to be monitored within Zone 1.

Zonal Planning Criteria (SPP Zone 1)



Task	Task Description	Task Owner	Date
Project Portfolio Development	Review submitted DPPs and develop a set of proposed projects to address system needs from ITP.	SPP	Mar – Aug (2025)
Receive NTC & Implement	Develop and execute project once an associated NTC has been received from SPP.	Zone 1 TOs (Project Sponsors)	December (2025)

Table 1: ZPC Coordination Activities



Annual ZPC Timeline

The following figure outlines an approximate timeline of meetings, events, and milestones associated with the annual Zone 1 ZPC assessment process. The proposed timeline is specific to integration of Zone 1 ZPC assessment activities into the introductory year 2025 ITP. Future ZPC updates are intended to convert the timeline to an approximate annual schedule of events and tasks.

2024/25 ITP & ZONE 1 ZPC ASSESSMENT - TIMELINE



Figure 1: ZPC & ITP Integration Timeline

Revision History

Revision#	Description of Change(s)	Requested By	Revision Date
0	AEP Draft ZPC Proposal	SPP OATT Attachment O	5/31/2023
1	Final Draft ZPC Proposal (with Zone 1 Stakeholder comments considered)	SPP OATT Attachment O	7/31/2023
2	Edits based on Stakeholder feedback and 10/24/2023 Open Meeting #1 discussion. Updates address "FOW" correction, elimination of footnotes 6, 12, & 13, and updated definition of "Radial Systems"	Zone 1 Stakeholders	12/6/2023
3	Updated to include a ZPC Implementation Plan. Other updates included to more accurately reflect ZPC processing within SPP's Transmission Owner Project Evaluation Process per RR-452 and Business Practice 7400.	Zone 1 Stakeholders	2/26/2024
4	Stakeholder request for a single modification reducing looping criteria threshold to 130 MW-mi	Zone 1 Stakeholder	3/6/2024

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Review and Retention

Review Frequency	Annual
Retention Period	1-Year
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