SPP RTO EXPANSION INTEGRATION STUDY

Study Report

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REVISION HISTORY

Date or version number	Author	Change Description
3/21/2025 v1.0	SPP Staff	

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1 EXECUTIVE SUMMARY

This report documents the analysis conducted as part of the Integration Study (the "Study"), which examined the integration of entities within the proposed RTO Expansion footprint (RTO Expansion members). The Study assessed RTO Expansion members' transmission facilities in the Western Interconnection (WI), as well as a limited set of transmission facilities in the Eastern Interconnection (EI) owned by WAPA-RMR, expected to transfer to SPP's functional control upon integration with SPP. The RTO Expansion member facilities analyzed in this study are as follows:

- Basin Electric Power Cooperative (BEPC)
- Colorado Springs Utilities (CSU)
- Deseret Power Electric Cooperative (DPEC)
- Municipal Energy Agency of Nebraska (MEAN)
- Platte River Power Authority (PRPA)
- Tri-State Generation and Transmission Association (TSGT)
- Western Area Power Administration (WAPA)
    - Upper Great Plains Regions (WAUW)
    - Rocky Mountain Region (RMR)
    - Colorado River Storage Project (CRSP)

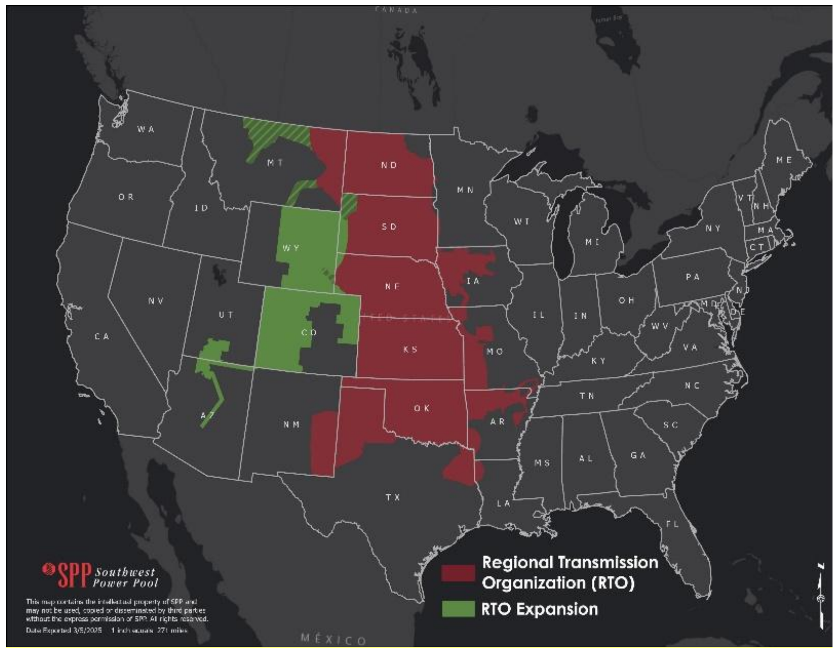

Figure 1: RTO Expansion Footprint[1]

The Study process evaluated the RTO Expansion member facilities[2] based on SPP and NERC criteria as shown in the study scope and identified required projects necessary to ensure the reliability of the RTO expansion members prior to the integration date (April 1^{st}, 2026). Any reliability issue that exists before integration into SPP remains the sole responsibility of the RTO expansion members. Reliability issues identified after the integration date will be addressed under the SPP Tariff.

Results from the Study reported several initial thermal and voltage violations on select RTO expansion members' facilities, specifically on the TSGT, WAPA-RMR, and WAPA-UGP systems. RTO expansion members provided model corrections, planned projects, Remedial Action Schemes (RAS), Op Guides, and system

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[1] Map is a general representation and may not be drawn to exact scale for the SPP and the expansion areas.
[2] Areas and owners included within the RTO Expansion system for the Study were as defined within the final approved RTO Expansion Assessment scope document. Facilities to be included within the Tariff and under SPP jurisdiction were still under review internally at SPP during the execution of the Study.

adjustments as mitigations through coordination with SPP. SPP validated these mitigations to relieve the initial violation and not cause adverse impacts to the system. The planned projects provided as part of the mitigation coordination effort are as follows:

- Burlington-Lamar 230 kV Project with an ISD of Feb 2025 (TSGT)
- Fort Morgan Capacitor Project with an ISD prior to the integration date (WAPA-RMR)

The Study did not identify any new projects as needed to address reported violations. Further, all fault currents determined through the short circuit analysis were found to be within the minimum fault interrupting capability of the RTO expansion member substations.

The following sections of this report provide additional detail on the Study approach and results.

2 OBJECTIVE

The primary objective of the Study was to evaluate the reliability of the RTO expansion members' transmission systems at the time of the assumed integration date. The study assessed reliability performance using the planning criteria outlined in SPP's OATT Attachment O, Section III.6, which includes:

- NERC Reliability Standards
- SPP Planning Criteria
- ITP Manual

The Study followed the assessment performed by SPP for the Integrated Transmission Planning (ITP) process. Similar to the ITP study (ITP Manual 4.2), SPP assessed the performance of the RTO expansion members' transmission systems under system intact and contingency conditions. SPP utilized Table 1 from the NERC Standard TPL-001-5 as the basis for the contingencies that were assessed during the Study. The Study analyzed contingencies that do not allow for non-consequential load loss (NCLL) or the interruption of firm transmission service (IFTS). The Study does not replace or serve as a substitute for all analyses required for a TPL-001-5.1 Annual Planning Assessment.

The Study evaluated the RTO expansion members' transmission systems using the following principles:

- Identify potential reliability-based issues
- Coordinate needs and existing/planned mitigations with RTO expansion members
- Validate existing/planned mitigations to identified needs
- Develop additional mitigation plans, including transmission upgrades, to address remaining needs or adverse impacts from existing/planned mitigations

3 STUDY INPUTS AND ASSUMPTIONS

The assessment for the Study evaluated multiple years and seasons for both the WI and EI as detailed in the sections that follow.

3.1 WESTERN INTERCONNECTION

The WI models were constructed by the Western Electricity Coordinating Council (WECC) in accordance with the data requirements and reporting procedures outlined in the WECC Data Preparation Manual (DPM). Planning Coordinators (PCs) within the WI utilized the DPM to support the creation of interconnection-wide cases for various planning studies.

SPP staff developed the Study models using several data sources and methodology guides, including:

- WECC models
- Colorado Coordinated Planning Group (CCPG) models
- RTO expansion member data submission
- Topology updates provided by the RTO expansion members
- Load Forecast updates provided by the RTO expansion members
- First-tier entities to the modeling areas of interest
- First-tier data request in the West (refer to ITP Manual)
- SPP Modeling Development Advisory Group (MDAG) Manual
- SPP ITP Manual

3.1.1 MODELS

The WECC 2023-24 model series served as the basis for the WI model set. SPP coordinated with each of the RTO expansion members for any model updates needed prior to conducting the assessment.

- 24HS3ap - 2024 Heavy Summer
- 25HW3ap - 2025 Heavy Winter
- 25LW1ap - 2025 Light Winter

3.1.2 AREAS OF INTEREST

In the WI model set, not all the RTO expansion members have their own designated area. In fact, many of the RTO expansion members own facilities modeled under separate areas. As a result, the Owner Number defined the majority of the areas of interest as opposed to the Area Number. Table 3.1 reflects the Owner and Area details for each of the RTO expansion members that was applied for the Study.

WECC PLANNING CASE DATA				
RTO expansion Member	**Owner Name**	**Owner Number**	**Area Name**	**Area Number**
Basin Electric Cooperative	Basin Electric	94	WAPA R.M.	73
Colorado Springs Utilities	CSU	95	WAPA R.M.	73
Deseret	DG&T	175	PACE	65
	DG&T	175	WAPA R.M.	73
Platte River	PLATTE RIVER	93	PSCOLORADO	70
	PLATTE RIVER	93	WAPA R.M.	73
Tri-State G&T	TRI-STATE G&T	73	PSCOLORADO	70
	TRI-STATE G&T	73	WAPA R.M.	73
Western Area Power Administration (RM, UGP, CRSP)	WAPA L.M.	26	WAPA R.M.	73
	WAPA U.C.	27	PSCOLORADO	70
	WAPA U.C.	27	WAPA R.M.	73
	WAPA UGP	77	MONTANA	62
	WAPA UGP	77	WAPA U.W.	63
	WAPA-DSW	191	WAPA L.C.	19
Municipal Energy Agency of Nebraska	WAPA L.M.	26	WAPA R.M.	73
	ATL	67	WAPA R.M.	73
	TRI-STATE G&T	73	WAPA R.M.	73

Table 3.1: Areas of Interest (West)

3.1.3 LOAD

The WECC base case model provided the load density and distribution for the steady state analysis. Additional load data, if supplied by the RTO expansion members, was incorporated into the models prior to conducting the analysis. Table 3.2 summarizes the seasonal load totals for each of the WI RTO expansion members.

		Heavy Summer		Heavy Winter		Light Winter	
Owner Name	Owner Number	P (MW)	Q (MVAR)	P (MW)	Q (MVAR)	P (MW)	Q (MVAR)
BASIN ELECTR	94	337	172	377	185	268	150
CSU	95	1,112	290	886	240	475	144
DG&T	175	403	77	300	75	240	70
PLATTE RIVER	93	759	335	499	160	310	98
TRI-STATE G&T	73	2,083	366	1,821	86	1,344	96
WAPA L.M.	26	70	23	75	25	40	13
WAPA UGP	77	196	94	193	81	154	77

Table 3.2: Load by Area

3.1.4 GENERATION

The RTO expansion members provided input for the Study's existing, retired, and new generation resources prior to conducting the analysis. The models were solved with area interchange enabled, which required re-dispatching of generation in RTO expansion member areas to balance the generation with load and area interchange. SPP coordinated with RTO expansion members to confirm which generators could be adjusted as part of this re-dispatching. Appendix A provides the resulting generation unit dispatch in each of the seasonal models for the RTO expansion members. The seasonal generation totals for each of the WI RTO expansion members is summarized below in Table 3.3.

		Heavy Summer	Heavy Winter	Light Winter
Area Number	Area Name	P (MW)	P (MW)	P (MW)
19	WAPA L.C.	4,463	2,831	2,441
62	MONTANA	3,157	2,925	3,034
63	WAPA U.W.	101	105	61
65	PACE	12,688	10,011	7,874
70	PSCOLORADO	9,241	7,461	4,233
73	WAPA R.M.	6,788	6,366	4,721

Table 3.3: Generation by Area

3.1.5 TOPOLOGY

The Study's transmission system topology, excluding generation, was based on the planned transmission infrastructure as of the integration date. RTO expansion members provided input for the topology assumptions specific to their regions, ensuring the models reflected the expected state of the transmission system over the long-term horizon. Temporary facilities were excluded from the models, and transmission lines operated in real-time as normally open were modeled accordingly. Additionally, radial transmission lines serving two or more unaffiliated Eligible Customers[3] were clearly labeled to determine their applicability to the analysis. The Direct Current (DC) ties were not modified from the initial settings in the WECC base case model.

3.1.6 PHASE-SHIFTING TRANSFORMERS

By default, SPP configures phase-shifting transformers (PSTs) with auto-adjust enabled, allowing adjustments across their full angular range during steady-state analysis. However, WECC's base case modeling often restricted the full tap angular range of PSTs to specific angles. For PSTs with auto-adjust disabled, SPP modeled them at their associated fixed angle. In all instances, SPP utilized WECC's base case modeling without adjustments or modifications, unless otherwise determined in consultation with the respective RTO expansion member.

Table 3.4 reflects each of the RTO expansion members PSTs, their associated initial angle, and control mode.

				Heavy Summer	Heavy Winter	Light Winter
RTO expansion Member	Name	Id	Control Mode	Angle	Angle	Angle
WAPA	BILLINGS RIMROCK PHASE SHIFTER	PS	MW	-6.56	-26.3	-21.54
WAPA	BILLINGS STEAMPLANT PHASE SHIFTER	PS	MW	-5.56	-24.11	-21.54
Tri-State	GLADSTON_PST	1	MW	24.76	32.63	6.43
WAPA	XOVER KV8A	PS	MW	-4.68	0	0
WAPA	GLENCANY PS	1	None	0	0	0
WAPA	SANJUAN KU1A	1	None	0	0	0
WAPA	SANJUAN KU1B	2	None	0	0	0
WAPA	SHPROCK KU3A	1	None	0	0	0
WAPA	SHPROCK KU3B	2	None	0	0	0

Table 3.4: RTOE Phase Shifting Transformers

3.1.7 TRANSMISSION SERVICE

[3] https://sppviewer.etariff.biz/tariff

SPP maintained area interchanges at the initial amounts in the WECC base case model. Adjustments were made with input from RTO expansion members while ensuring compliance with existing Long-term Point-To-Point and Network Integration Transmission Service obligations. The Study did not consider non-firm or economic interchanges.

Table 3.5 reflects the area interchange in the associated seasonal model for each of the areas in which the RTO expansion members reside.

		Heavy Summer	Heavy Winter	Light Winter
Area Number	Area Name	Interchange (MW)	Interchange (MW)	Interchange (MW)
19	WAPA L.C.	30,532	18,490	16,515
62	MONTANA	2,993	2,347	5,740
63	WAPA U.W.	-211	-196	-183
65	PACE	9,829	7,866	7,085
70	PSCOLORADO	-1,646	-1,522	-1,338
73	WAPA R.M.	6,720	9,631	8,524

Table 3.5: Area Interchange

3.1.8 SHORT CIRCUIT

SPP modified WECC 24HS3ap – 2024 Heavy Summer model to create a short-circuit model. WECC base case models typically lack the sequence data necessary for unbalanced fault calculations in short-circuit analyses. To address this, the participants in the Study provided sequence data in PSS®E format (.seq), Aspen equivalent .seq format, or used the Non-PSSE User template, in order to represent their equipment. The submitted .seq data was mapped as needed from Aspen case data to the WECC 24HS3ap – 2024 Heavy Summer model in order to accommodate the different data submission types.

After the mapping was completed, any discrepancies remaining between the WECC powerflow case and the submitted data was provided to the RTO expansion entities for verification and update. Once all of the updates were provided, the short-circuit model was developed. This short-circuit model differs from power flow models because it activates all generation and transmission equipment, except for normally open lines or retired generation, to simulate maximum fault current.

3.2 EASTERN INTERCONNECTION

For RTO expansion members proposing to place facilities in the EI under SPP's functional control, additional models were evaluated. These facilities were assessed using the applicable seasons and cases from the latest approved SPP Integrated Transmission Planning (ITP) Base Reliability (BR) Models. Specifically, the 2025 ITP BR models included the 2025 Summer, 2026 Winter, and 2026 Light Load models. SPP built each of these models through the existing SPP model development process. As a result, load, generation, topology, phase-shifting transformers, or transmission service assumptions are not summarized in the sections below.

3.2.1 STUDY MODELS

The 2025 ITP Base Reliability (BR) Models served as the basis for the EI model set. SPP coordinated with the lone RTO expansion member for any model updates needed prior to conducting the analysis. The sections below detail the modeling assumptions that guide modifications to the models.

- 2025 ITP IF-25S
- 2025 ITP IF-26W
- 2025 ITP IF-26L
- 2025ITPIF-26S_SC (short circuit only)

3.2.2 MODELING AREAS OF INTEREST

In the EI, there were only a handful of facilities from a single entity that are proposing to be integrated under SPP's functional control. The specific Owner and list of facilities are captured in Table *3.6* and Table *3.7* respectively.

MEMBERS	ITP CASE DATA			
	Owner Name	Owner Number	Area Name	Area Number
Western Area Power Administration	WAPA-RMR	653	WAPA R.M.	640

Table 3.6: Area of Interest (East)

From Bus Name	To Bus Name
Big Springs 115 kV	Brule 115 kV
Big Springs 115 kV	Julesburg Tap 115 kV
Brule 115 kV	TSGT-Ogallala 115 kV
Chadron 115 kV	Dunlap 115 kV
Julesburg Tap 115 kV	Chappel 115 kV
Julesburg Tap 115 kV	Highline 115 kV
Chappel 115 kV	TSGT-Colton 115 kV
Julesburg Tap 115 kV	Highline 115 kV
Dunlap 115 kV	TSGT-Box Butte 115 kV
Morrill 115 kV	Gering Tap 115 kV
Morrill 115 kV	TSGT-Snake Creek 115 kV
Gering Tap 115 kV	TSGT-Gering Tap 115 kV
Alliance 115 kV	TSGT-Snake Creek 115 kV
Alliance 115 kV	TSGT-Box Butte 115 kV
Sidney 115 kV	TSGT-Colton 115 kV

Table 3.7: Facilities of Interest (East)

3.3 DC TIE SENSITIVITY MODELS

Starting from the WI and EI models described above, additional models were built with the Miles City, Sidney, and Stegall DC ties modeled at their maximum import and export capabilities. According to Section 3.1.7 of the RTOE scope, we were required to assess the DC ties set at firm service levels. However, the Terms and Conditions of the RTOE service agreement call for an assessment of the DC ties at their maximum import and export limits. We fulfilled both requirements through this sensitivity by evaluating the ties simultaneously at their maximum import and export capabilities. No unmitigable issues were identified as a result of the analysis.

3.3.1 IMPORT MODELS

To create the Import cases, the DC ties were modeled as generators with no reactive capability and dispatched at the amount specified in Table 3.8. A reactive load was also added at the DC tie terminal bus at 50% of the maximum capability of the tie in MVAR. To offset the additional generation added at the DC ties, generators furthest from the ties were scaled down and area interchange was adjusted accordingly. For the WI models, only RTO expansion member owned generators were scaled.

3.3.2 EXPORT MODELS

To create the Export cases, the DC ties were modeled as loads at the amount specified in Table 3.8. The load was given a reactive component at 50% of the maximum capability of the tie in MVAR. To offset the load added at the DC ties, generators closest to the ties were scaled up and area interchange was adjusted accordingly. For the WI models, only RTO expansion member owned generators were scaled.

	Maximum Output (MW)	
DC Tie	**East to West**	**West to East**
Miles City	200	150
Stegall	110	110
Sidney	200	200

Table 3.8: DC Tie Maximum Capability

3.3.1 MODELS

The following models were created for the West based on the methodology outlined above:

- 24HS_RTOE_Initial_Final_E-W
- 24HS_RTOE_Initial_Final_W-E
- 25LW_RTOE_Initial_Final_E-W
- 25LW_RTOE_Initial_Final_W-E

- 25HW_RTOE_Initial_Final_E-W
- 25HW_RTOE_Initial_Final_W-E

The following models were created for the East based on the methodology outlined above:

- 2025 ITP IF-25S_W-E
- 2025 ITP IF-25S_E-W
- 2025 ITP IF-26W_W-E
- 2025 ITP IF-26W_E-W
- 2025 ITP IF-26L_W-E
- 2025 ITP IF-26L_E-W

3.4 PLANNING CRITERIA

Consistent with SPP Planning Criteria, for normal and contingency conditions:

- Line and equipment loading shall be within applicable thermal limits
- Voltage levels shall be maintained within applicable limits
- All customer demands shall be supplied (except as noted), and
- Stability of the network shall be maintained

Applicable steady state limits for system intact conditions were defined as follows for the Study:

- Thermal Limits Within Applicable Rating – Applicable Rating shall be defined as the Normal Rating per SPP Planning Criteria 7, Section 7.2. The thermal limit shall be 100% of Rating A.
- Voltage Limits Within Applicable Rating – Applicable Rating shall have the meaning of Nominal Voltage per SPP Planning Criteria 5. Voltage limits shall be set at plus or minus five percent (+/- 5%), 0.95 p.u. - 1.05 p.u..

Applicable steady state limits for contingency conditions evaluated for the assessment were defined as follows for the Study:

- Thermal Limits within Applicable Rating - Applicable Rating shall be defined as the Emergency Rating per SPP Planning Criteria 7, Section 7.2. The thermal limit shall be 100% of Rating B.
- Voltage Limits Within Applicable Rating – Applicable Rating shall have the meaning of Nominal Voltage per SPP Planning Criteria 5. Voltage limits shall be set at plus five percent to minus ten percent (+5%/-10%), 0.90 p.u. – 1.05 p.u. for systems operating at 60 kV or above on load serving buses.

4 STUDY METHODOLOGY

The Study's analysis identified projects necessary to address exceedances of applicable planning criteria within the RTO expansion members' transmission systems. SPP staff were responsible for determining the transmission system's needs and ensuring these needs were mitigated through transmission solutions or other measures, such as implementing operating guides.

4.1 WI STEADY STATE ANALYSIS

Needs (i.e., violations) were identified by assessing the performance of the RTO expansion members' transmission system under system-intact and limited contingency conditions. The following sections outline the details of the steady state analysis.

4.1.1 CONTINGENCIES

The contingency set evaluated for the Study includes a combination of auto generated events and RTO expansion member submitted events as follows:

- Auto N-1: All branches, ties, shunts, and generators within the following areas:
    - Internal Areas for 65 kV – 999 kV facilities:
        - 19, 62, 63, 65, 70, 73
    - External Areas for 65 kV – 999 kV facilities:
        - 10, 11 14-18, 20-22, 24, 26, 30, 40, 50, 52, 54, 60, 64
- RTO expansion member submitted events
- Planning Event P3 (N-1,G-1)
    - SPP performed a screening analysis for the entire WI to determine which P3 events reported an impact on an RTO expansion members facility or Tier 1 facility. SPP identified system redispatch mitigations for any initial P3 violations. Any remaining P3 events that produced violations or non-convergence that could not be resolved with redispatch, were analyzed within the Study.

Any non-converged event was mitigated through different solution settings or RTO expansion member feedback.

4.1.2 MONITORED FACILITIES

All RTO expansion members facilities and Tier 1 facilities with a voltage level greater than 60 kV were monitored for the Study against the SPP Planning Criteria as defined in Section 3.3. Facilities less than 100 kV are not within the scope of the Study and were monitored for informational purposes only. Each of the monitored areas are shown below:

- Internal Areas
    - 19, 62, 63, 65, 70, 73

4.1.3 SOLUTION SETTINGS

The following solution parameters were applied in performing the Study:

- Fixed slope decoupled Newton-Raphson
- Tap Adjustment – stepping
- Switch shunt adjustments – enable all
- Area interchange disabled
- Adjust phase shift
- Adjust DC taps
- VAR limits – apply immediately

4.2 EI STEADY STATE ANALYSIS

SPP identified needs (i.e., violations) by assessing the performance of the RTO expansion member's transmission system under system-intact and limited contingency conditions. The following sections outline the details of the steady state analysis.

4.2.1 CONTINGENCIES

The contingency set evaluated for the Study includes a combination of auto generated events and RTO expansion member submitted events as follows:

- Auto N-1: All branches, ties, shunts, and generators within the following areas:
    - Internal Areas for 65 kV – 999 kV facilities:
        - Owner Number 653 (WAPA RMR)
    - External Areas for 100 kV – 999 kV facilities:
        - 327, 330, 351, 356, 502, 515 – 546, 600, 615, 620, 627, 635, 640, 641, 642, 645, 650, 652, 659, 661, 672, 680, 997, 998, 999
- RTO expansion member submitted events
- Planning Event P3 (N-G-1)
    - SPP performed a screening analysis for the entire EI to determine which P3 events reported an impact on an RTO expansion members facility or Tier 1 facility. The screening analysis

included a re-dispatch step that allowed generation to re-dispatch around identified thermal and voltage violations. This screened list of events were then simulated as the P3 events for the Study.

Any non-converged event was mitigated through different solution settings or RTO expansion member feedback. Non-converged events in SPS were ignored due to their proximity to the RTO expansion area.

4.2.2 MONITORED FACILITIES

All RTO expansion members facilities with a voltage level greater than 60 kV and Tier 1 facilities with a voltage level greater than 100 kV were monitored for the Study against the SPP Planning Criteria as defined in Section 3.3. RTO expansion members facilities less than 100 kV are not within the scope of the Study and were monitored for informational purposes only. Each of the monitored areas are shown below:

- Internal Areas
  - Owner 653 (WAPA-RMR)
- External Areas
  - 506-546, 641, 642, 645, 650, 652, 659, 327, 330, 351, 356, 502, 600, 615, 620, 627, 635, 661, 672, 680

4.2.3 SOLUTION SETTINGS

The following solution parameters were applied in performing the Study:

- Fixed slope decoupled Newton-Raphson
- Tap Adjustment – stepping
- Switch shunt adjustments – enable all
- Area interchange disabled
- Adjust phase shift
- Adjust DC taps
- VAR limits – apply immediately

4.3 SHORT CIRCUIT ASSESSMENT

SPP simulated three-phase faults and single line-to-ground faults for both the WI and EI short circuit models for both of the following methods:

- Full bus-fault current and line-out results using an automatic sequencing fault calculation
- Full bus-fault current and line-out results using an American National Standards Institute fault calculation

RTO expansion members were required to evaluate the results and inform SPP if any fault-interrupting equipment would have its duty ratings exceeded by the maximum available fault current (potential violation). For equipment identified with exceeded duty ratings, RTO expansion members provided SPP with the applicable duty rating of the equipment or indicated it was within the minimum interrupt capability at the applicable substation.

4.4 MITIGATION DEVELOPMENT

SPP provided information about exceedances considered as reliability needs to the RTO expansion members in a format consistent with the SPP ITP needs posting. Facilities below 100 kV were flagged as informational only and did not require mitigation. Further, facilities that were not owned by an RTO expansion member or would not be under SPP functional control were flagged as non-tariff facilities. For those facilities expected to be placed under function control of the tariff, RTO expansion members provided mitigations for each of their respective facilities in the needs list. SPP staff evaluated the solutions provided to determine whether they sufficiently addressed reliability needs and did not cause adverse impacts to the system.

Since Transmission Operating Guides (TOGs)[4] are tools used to mitigate violations in the daily management of the transmission grid, operating guides were considered as alternatives to transmission solutions and tested for their effectiveness in mitigating violations. For the purposes of the Study, SPP staff identified all solutions where the use of operating guides was deemed ineffective. SPP utilized TOGs submitted by the respective RTO expansion members for consideration in the assessment. An effective TOG will remain under consideration in future assessments unless and until the facility-owning entity or transmission operator withdraws the TOG.

[4] Refer to the finalized and approved RTO Expansion Study Scope for more details on TOG applicability and requirements

5 STUDY RESULTS

5.1 RELIABILITY ASSESSMENT

The Study included the 2024 Heavy Summer, 2025 Heavy Winter, and 2025 Light Winter models for the Western Interconnect and the 2025 Summer, 2026 Winter, and 2026 Light Load models for the Eastern Interconnect. Contingencies ran on these models included N-1, RTO expansion member Submitted Events (Member Submitted), and P3 Planning Events. Appropriate facilities were monitored against the thermal and voltage criteria defined in Section 3. Table 5.1 and Table 5.2 provide a summary of unique instances of a facility being reported as a potential violation for each model and contingency set analyzed.

	Total Thermal Violations			Total Voltage Violations		
Model	**N-1**	**Member Submitted**	**P3**	**N-1**	**Member Submitted**	**P3**
2024 Heavy Summer	8	5	9	5	9	5
2025 Heavy Winter	8	7	16	36	37	30
2025 Light Winter	4	3	6	3	8	4

Table 5.1: Total Violations (West)

	Total Thermal Violations			Total Voltage Violations		
Model	**N-1**	**Member Submitted**	**P3**	**N-1**	**Member Submitted**	**P3**
2025 Summer	0	0	0	0	0	0
2026 Light Load	0	0	0	0	0	0
2026 Winter	0	0	0	2	2	0

Table 5.2: Total Violations (East)

Several RTO expansion members confirmed that their post contingent high voltage criteria is 1.10 p.u. which voided many initial high voltage violations reported above 1.05 p.u. These specific instances were not captured in the result summary present above. Further, many potential P3 violations were able to be re-dispatched around using POM, resulting in a limited set of P3 events being analyzed for the Study.

SPP provided the potential violations to RTO expansion members for review and comments. Mitigations were provided for the results and, as appropriate, were confirmed to be effective mitigations by SPP staff. All potential violations with their associated mitigations and comments are provided in Appendix B & C.

5.2 RESULTS BY RTO EXPANSION MEMBER

5.2.1 BASIN ELECTRIC POWER COOPERATIVE

BEPC reviewed the results of the Study and confirmed that no violations were identified for facilities on its system.

5.2.2 COLORADO SPRINGS UTILITIES

CSU reviewed the results of the Study and confirmed that no violations were identified for facilities on its system. For the Short Circuit Analysis, CSU staff provided feedback that all breakers on CSU's system have an interrupting capability of at least 40 kA.

5.2.3 DESERET POWER ELECTRIC COOPERATIVE

DPEC reviewed the results of the Study and confirmed that no violations were identified for facilities on its system. DPEC provided feedback that the only facilities integrating into the SPP footprint are the Calamity Ridge Tap and Deserado Mine 138 kV buses which showed no violations within the Study.

5.2.4 PLATTE RIVER POWER AUTHORITY

PRPA reviewed the results of the Study and confirmed that no violations were identified for facilities on its system. For the Short Circuit Analysis, PRPA provided feedback that all circuit breakers on its system are rated at 40 kA except for the Valley substation where the circuit breakers are rated at 25 kA.

5.2.5 TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION

TSGT staff reviewed the results of the Study and supplied mitigations for violations identified as summarized in Table 5.3. To resolve thermal violations, TSGT supplied 3 model correction mitigations: 1 project coming into service before the Integration Date, 1 remedial action scheme (RAS), and 2 system adjustments. To resolve voltage violations, TSGT supplied 1 project coming into service before the Integration Date and 3 system adjustments. SPP staff applied the mitigations provided by TSGT to the models and verified that the violations identified were resolved and that no additional violations were identified as a result of the mitigations.

Member	Type	Name
TSGT	Model Correction	Axial - Hayden Ratings Update
TSGT	Model Correction	Henry Lake & Reunion Load Update
TSGT	Model Correction	Update Henry Lake 230/115kV XFMR Ratings
TSGT	Planned Project	Burlington-Lamar 230 kV Project (ISD Feb 2025)
TSGT	RAS	Comanche / Walsenburg RAS
TSGT	System Adjustment	Craig Redispatch

Member	Type	Name
TSGT	System Adjustment	Hesperus Reactor On
TSGT	System Adjustment	Open Waanibe Tap Cap 1 & 2
TSGT	Redispatch	Spring Canyon Redispatch

Table 5.3: TSGT Provided Mitigations

As part of the feedback for the Study, TSGT confirmed that its post contingent voltage criteria is 1.10 p.u. which voided many initial voltage violations reported above 1.05 p.u. These specific instances were not captured in the result summary present in Table 5.1.

5.2.6 WESTERN AREA POWER ADMINISTRATION – ROCKY MOUNTAIN REGION

WAPA-RMR reviewed the results of the Study and supplied mitigations for violations identified as summarized in Table 5.4. To resolve thermal violations: WAPA-RMR supplied 2 model corrections, 1 Op Guide, 1 RAS scheme, and 1 system adjustment. To resolve voltage violations, WAPA-RMR supplied: 1 contingency correction, 1 model correction, 1 project coming into service before the Integration Date, 1 RAS, and 3 system adjustments. SPP staff applied the mitigations provided by WAPA-RMR to the models and verified that the violations identified were resolved and that no additional violations were identified as a result of the mitigations.

Member	Type	Name
WAPA-RMR	Model Correction	San Juan 230/115 Hogback Transformer Correction
WAPA-RMR	Model Correction	West Canon 115/230 kV Ratings Update
WAPA-RMR	Op Guide	Path 30/31 Op Guide
WAPA-RMR	Planned Project	Fort Morgan Cap Project
WAPA-RMR	RAS	Glen Canyon RAS
WAPA-RMR	System Adjustment	Gering Cap On
WAPA-RMR	System Adjustment	Rimrock/Billings PST Adjustment
WAPA-RMR	System Adjustment	Spence Inductor On
WAPA-RMR	Redispatch	Weld Redispatch
WAPA-RMR	System Adjustment	Sidney Reactive Support

Table 5.4: WAPA-RMR Provided Mitigations

As part of the feedback for the Study, WAPA-RMR confirmed that its post contingent voltage criteria is 1.10 p.u. which voided many initial voltage violations reported above 1.05 p.u. These specific instances were not captured in the result summary present in Table 5.1.

5.2.7 WESTERN AREA POWER ADMINISTRATION – UPPER GREAT PLAINS

WAPA-UGP reviewed the results of the Study and supplied mitigations for violations identified as summarized in Table 5.5. To resolve thermal violations, WAPA-UGP supplied 2 system adjustment mitigations. To resolve voltage violations, WAPA-UGP supplied 2 contingency corrections and 2 system adjustments. SPP staff applied the mitigations provided by WAPA-UGP to the models and verified that the violations identified were resolved and that no additional violations were identified as a result of the mitigations.

Member	Type	Name
WAPA-UGP	System Adjustment	Crossover PST Adjustment
WAPA-UGP	System Adjustment	Great Falls Reactor On
WAPA-UGP	System Adjustment	Havre Overvoltage Mitigation
WAPA-UGP	System Adjustment	Rimrock / Steamplant PST Adjustment

Table 5.5: WAPA-UGP Provided Mitigations

5.2.8 WESTERN AREA POWER ADMINISTRATION – COLORADO RIVER STORAGE PROJECT

TO responsibilities for WAPA-CRSP are handled by other WAPA entities.

5.2.9 MUNICIPAL ENERGY AGENCY OF NEBRASKA

Due to the MEAN being a Resource Planner (RP) only and not a TO/TOP, no feedback on the study results was requested for its system.

5.3 DC TIE SENSITIVITY RESULTS

The models developed for the DC Tie Sensitivity analysis as described in Section 3.3 were utilized to run contingency analysis to determine the impacts of the ties on the RTO expansion member facilities. Contingencies ran on these models included N-1, RTO expansion member Submitted Events (Member Submitted), and P3 Planning Events. Appropriate facilities were monitored against the thermal and voltage criteria defined in Section 3. Table 5.6 and Table 5.7 below provide a summary of unique instances of a facility being reported as a potential violation for each model and contingency set analyzed.

		Total Thermal Violations			Total Voltage Violations		
Model	**Direction**	**N-1**	**Member Submitted**	**P3**	**N-1**	**Member Submitted**	**P3**
2024 Heavy Summer	E-W	6	6	7	1	6	0
2024 Heavy Summer	W-E	7	7	4	3	5	0
2025 Heavy Winter	E-W	3	5	4	2	36	1
2025 Heavy Winter	W-E	9	10	12	4	36	0
2025 Light Winter	E-W	2	2	3	1	1	2
2025 Light Winter	W-E	5	4	8	3	1	1

Table 5.6: Total Violations (West)

		Total Thermal Violations			Total Voltage Violations		
Model	**Direction**	**N-1**	**Member Submitted**	**P3**	**N-1**	**Member Submitted**	**P3**
2025 Summer	E-W	0	0	0	0	0	0
2025 Summer	W-E	0	0	0	0	0	0
2026 Light Load	E-W	0	0	0	0	0	0
2026 Light Load	W-E	0	0	0	0	0	0
2026 Winter	E-W	0	0	0	0	0	0
2026 Winter	W-E	0	0	0	0	0	0

Table 5.7: Total Violations (East)

Several RTO expansion members confirmed that their post contingent high voltage criteria is 1.10 p.u. which voided many initial high voltage violations reported above 1.05 p.u. These specific instances were not captured in the result summary present above. Further, many potential P3 violations were able to be re-dispatched around using POM, resulting in a limited set of P3 events being analyzed for the Study.

SPP provided the potential violations to RTO expansion members for review and comments. Mitigations were provided for the results and, as appropriate, were confirmed to be effective mitigations by SPP staff. All potential violations with their associated mitigations and comments will be provided in an upcoming report for the DC Tie Sensitivity Analysis.

6 CONCLUSION

This informational report outlines the evaluation of the RTO Expansion system[5] by the SPP Engineering department. The purpose of this report is to aid in the decision-making process of both the RTO Expansion and SPP members in the event that the RTO Expansion membership decides to join the SPP RTO. The main goal of this report is to:

- Evaluate the RTO Expansion transmission system to determine whether it satisfies SPP's Planning Criteria, NERC Reliability Standards, and ITP Manual criteria

The violations identified during the Study were resolved by mitigations or existing projects provided by members. No new projects were identified as needed to address reported violations through the Study process.

[5] Areas and owners included within the RTO Expansion system for the Study were as defined within the final approved RTO Expansion Assessment scope document. Facilities to be included within the Tariff and under SPP jurisdiction were still under review internally at SPP during the execution of the Study.

7 RESERVED SECTION

Reserved section for additional information as needed.

APPENDICES

APPENDIX A – THERMAL RESULTS

Thermal_Results.pdf

APPENDIX B – VOLTAGE RESULTS

Voltage_Results.pd
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APPENDIX C – SHORT CIRCUIT RESULTS

Short_Circuit_Resul
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APPENDIX D – DC TIE SENSITIVITY THERMAL RESULTS

DC_Tie_Sensitivity_Thermal_Results.pdf

APPENDIX E – DC TIE SENSITIVITY VOLTAGE RESULTS

DC_Tie_Sensitivity_Voltage_Results.pdf