



SPP 2011 Steady State TPL Compliance Report

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Purpose

To support SPP's compliance, as the Planning Coordinator, with NERC TPL-001-0, TPL-002-0, TPL-003-0, and TPL-004-0 Reliability Standards, the objective of this document is to report findings from the 2011 Compliance Assessment process.

The goals of this assessment are:

1. To identify overloaded branches/transformers (>100% of rate A) under normal conditions. (NERC Category A)
2. To identify branch/transformer potential violations (>100% of rate B) due to the loss of a single element. (NERC Category B)
3. To identify branch/transformer potential violations (>100% of rate B) due to the loss of two elements. (NERC Category C)
4. To identify branch/transformer potential violations (>100% of rate B) due to extreme events. (NERC Category D)
5. To identify voltage performance (0.95 pu - 1.05 pu)¹ under normal conditions. (NERC Category A)
6. To identify voltage potential violations (0.9 pu – 1.05 pu)¹ due to the loss of a single element. (NERC Category B)
7. To identify voltage potential violations (0.9 pu – 1.05 pu)¹ due to the loss of two elements. (NERC Category C)
8. To identify voltage potential violations (0.9 pu – 1.05 pu)¹ due to extreme events. NERC Category D)

This report focuses on facilities 100 kV or above and summarizes potential violations anticipated by SPP and the mitigation plans developed by SPP member entities and SPP engineering staff.

¹ Local requirements for individual Entity apply in some cases.

Models

The powerflow cases used in the 2011 TPL Compliance Assessments are the SPP 2011 MDWG B1 Final MOD Base Case series according to the following table.

Model Scope	Seasonal Assessment	Model Used	Model Released	Assessment Completed
Near Term	2012 Fall	2011MDWGB1Final-12F	Feb/11	Nov/11
Near Term	2012 Spring	2011MDWGB1Final-12G	Feb/11	Nov/11
Near Term	2012 Summer	2011MDWGB1Final-12S	Feb/11	Nov/11
Near Term	2013 Summer	2011MDWGB1Final-13S	Feb/11	Nov/11
Near Term	2013 Winter	2011MDWGB1Final-13W	Feb/11	Nov/11
Long Term	2017 Winter	2011MDWGB1Final-17W	Feb/11	Nov/11
Long Term	2022 Summer	2011MDWGB1Final-22S	Feb/11	Nov/11

Assessment

TPL-001-0 Assessment (N-0)

The 2011 SPP MDWG power flow models reflect system conditions for selected years between year 2012 and year 2022. These models are updated to reflect the most up-to-date information using the Model On Demand (MOD) program. The SPP 2011 MDWG B1 Final MOD models used for the compliance assessment have no thermal overloads or potential voltage violations under N-0, or normal system conditions.

TPL-002-0 Assessment (N-1)

The Complex Elements considered for system evaluation under Category B were compiled by SPP-RTO with input from stakeholders and member entities. Additional Automatically Selected (N-1) elements were selected according to base voltage as shown on the following table.

Element	Base KV	Source
Complex Elements (Cat. B)	---	SPP Staff and Member Entities
Branch	69 KV+	Software Selection
Generator	All	Software Selection
Transformer	100 KV+	Software Selection

TPL-003-0 / TPL-004-0 Assessment (N-2 / Extreme Events)

The Complex Elements considered for system evaluation under Category C and D were compiled by SPP-RTO with input from stakeholders and member entities. Additionally, the Automatically Selected (N-1) elements studied for TPL-002-0 were paired to form Automatically Selected (N-2) contingencies for the TPL assessment. Pairs of Automatically Selected (N-1) elements were chosen according to the following table.

(N-2) Category	Selection Rule	(N-2) Pairs per Season
Complex Elements (Cat. C, D)	---	SPP Staff and Member Entities
Branch-Branch	Same Zone	Approximately 300K
Branch-Generator	Same Area	Approximately 200K
Generator-Generator	All Modeled	Approximately 100K

Entities Involved

The following entities registered with the SPP Regional Entity were included in these studies.

Entity Name	Registered Function
Arkansas Electric Cooperative Corporation (AECC)	DP,GOP,GO,LSE,PSE,RP,TO
American Electric Power (AEPW)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
➤ East Texas Electric Cooperative (ETEC)	DP,LSE,PSE,RP,TO,TP
➤ Tex-La Electric Cooperative of Texas, Inc (TEXL)	DP,LSE,PSE,RP,TO,TP
Board of Public Utilities (KACY)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
City Utilities of Springfield, MO (SPRM)	BA, DP,GOP,GO,LSE,RP,TO,TP
Cleco Corporation (CELE)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP
Empire District Electric Company (EMDE)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
Grand River Dam Authority (GRDA)	BA,GOP,GO,LSE,PSE,RP,TO,TP
Independence Power and Light (INDN)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
ITC Great Plains, LLC (ITCGP)	TO
Kansas City Power & Light Company (KCPL)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
KCPL – Greater Missouri Operations (KCPL-GMO)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP
Lafayette Utilities System (LAFA)	BA,DP,GOP,GO,LSE,PSE,TO,TP
Louisiana Energy & Power Authority (LEPA)	BA
Lincoln Electric System (LES)*	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
Mid-Kansas Electric Company, LLC (MKEC)	DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP
Midwest Energy, Inc (MIDW)	DP,LSE,PSE,TO,TP
Nebraska Public Power District (NPPD)*	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP
Oklahoma Gas & Electric Company (OKGE)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
Oklahoma Municipal Power Authority (OMPA)	DP,GOP,GO,LSE,PSE,RP
Omaha Public Power District (OPPD)*	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP
Southwestern Power Administration (SWPA)	BA,PSE,RP,TO,TP,TSP
Southwestern Public Service Company (SWPS)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP
Sunflower Electric Power Corp (SUNC)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP
Westar Energy, Inc (WERE)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP
Western Farmers Electric Coop (WFEC)	BA,DP,GOP,GO,LSE,PSE,RP,TO,TP,TSP

BA : Balancing Authority
DP : Distribution Provider
GOP : Generator Operator
GO : Generation Owner
LSE : Load Serving Entity
PSE : Purchasing-Selling Entity
RP : Resource Planner
TOP : Transmission Operator
TO : Transmission Owner
TP : Transmission Planner
TSP : Transmission Service Provider

*Midwest Reliability Organization (MRO) is the current Regional Entity for these entities.

Simulation

Physical Operational Margins (POM) software was used to screen not only the Category B and C lists developed by SPP engineering staff and by member entities, but to also run Automatically Selected (N-k) contingency analysis based on the selection criteria described above. Power System Simulation for Engineering (PSS/E) was used as a supplementary tool for analysis and verification. All potential violations were presented along with OPM generated mitigation techniques to member entities for review.

Mitigations / Member Review

All of the potential violations were sent to the members for review. Each member was asked to review each of the potential violations and automatically mitigated violations and to provide an alternate mitigation if they did not agree with the automatically selected mitigation.

Results

The actual mitigations have been redacted from the public version.

TPL-001-0 Assessment (N-0)

The SPP 2011 MDWG B1 Final MOD base case models used for the TPL compliance assessment have no thermal overloads or voltage violations under N-0, or normal system conditions.

TPL-002-0 Assessment (N-1)

A summary of potential violations found using the Category B Complex Element assessment list and the automatically selected N-1 list by POM is presented in the table below. These numbers include the violations which were mitigated by SPP members in addition to the violations which were automatically mitigated by OPM and verified by the SPP members.

Season	Vmax	Vmin	Branch Overload	Transformer Overload	Total	Mitigated Findings	Remaining
2012 Fall	293	78	0	0	371	371	0
2012 Spring	309	56	4	3	372	372	0
2012 Summer	155	216	14	15	400	400	0
2013 Summer	144	113	28	13	298	298	0
2013 Winter	330	121	9	0	460	460	0
2017 Winter	295	231	37	13	576	576	0
2022 Summer	113	421	97	64	695	695	0

TPL-003-0 / TPL-004-0 Assessment (N-2 / Extreme Events)

A summary of potential violations found using the Category C&D Complex Element assessment list and the automatically selected N-2 list by POM is presented in the table below. These numbers include the violations which were mitigated by SPP members in addition to the violations which were automatically mitigated by OPM and verified by the SPP members.

Season	Vmax	Vmin	Branch Overload	Transformer Overload	Total	Mitigated Findings	Remaining
2012 Fall	2020	2354	275	126	4775	4775	0
2012 Spring	4371	2405	318	147	7241	7241	0
2012 Summer	1294	5013	1408	561	8276	8276	0
2013 Summer	627	4861	1372	430	7290	7290	0
2013 Winter	2589	4302	678	131	7700	7700	0
2017 Winter	2595	3324	1922	141	7982	7982	0
2022 Summer	753	5977	2682	999	10411	10411	0

Totals by Model Area

A summary of potential violations organized by Model Area is presented in the table below.

Member	Area Number	Automatic Selected	Cat B	Cat C&D	Total	Mitigated Findings	Remaining
Cleco Corporation	502	1029	12	7	1048	1048	0
Lafayette Utilities System	503	153	12	0	165	165	0
Louisiana Energy & Power Authority	504	1	3	0	4	4	0
Southwestern Power Administration	515	1885	22	20	1927	1927	0
American Electric Power	520	14402	95	102	14599	14599	0
Grand River Dam Authority	523	102	3	9	114	114	0
Oklahoma Gas & Electric Company	524	3188	24	99	3311	3311	0
Western Farmers Electric Coop	525	715	5	6	726	626	0
Southwestern Public Service Co	526	10493	164	33	10690	10690	0
Oklahoma Municipal Power Authority	527	147	1	0	148	148	0
Midwest Energy, Inc	531	1074	0	39	1113	1113	0
Sunflower Electric Power Corp	534	7535	30	33	7598	7598	0
Westar Energy, Inc	536	5851	46	219	6116	6116	0
KCPL – Greater Missouri Operations	540	476	1	55	532	532	0
Kansas City Power & Light Company	541	597	0	18	615	615	0
Board of Public Utilities Kansas City	542	3	0	0	3	3	0
Empire District Electric Company	544	171	0	8	179	179	0
Independence Power and Light	545	0	0	0	0	0	0
City Utilities of Springfield, MO	546	49	0	6	55	55	0
Nebraska Public Power District	640	7101	171	150	7422	7422	0
Omaha Public Power District	645	403	1	69	473	473	0
Lincoln Electric System	650	9	0	0	9	9	0

Summary

The MDWG models developed by SPP and member entities represent the power system for the SPP footprint. These models have no voltage or thermal potential violations for normal (N-0) operation under Category A. Complex element lists were developed by SPP and entities to simulate selected Category B, C, and D events. These events were simulated by SPP along with Automatically Selected (N-k) contingency lists. All potential violations found by SPP assessments were mitigated by operating procedures developed or approved by SPP entities and staff.

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