SPP 2011 TPL Compliance Report

12/31/2011

Southwest Power Pool

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Executive Summary

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)

On July 6, 2011 the US Environmental Protection Agency (EPA) finalized the Cross-State Air Pollution Rule (CSAPR), which requires 27 states to significantly improve air quality by reducing power plant emissions that contribute to ozone and/or fine particle pollution in other states. The impact to power plant and bulk electric system operations is still being evaluated by SPP and was not considered as part of this 2011 TPL Compliance Report. SPP staff has conducted some preliminary CSAPR impact assessments independent from the TPL assessment and will be performing additional analysis in 2012.

To support SPP's compliance, as the Planning Coordinator, with the NERC FAC-014-2.1 Reliability Standard, the objective of this document is to ensure that System Operating Limits (SOLs) used in

[1] Local requirements for individual Entity apply in some cases.

the reliable planning and operation of the Bulk Electric System (BES) are determined based on an established methodology in section 12.3.2 of the SPP Criteria.[2]

All System Operating Limits (SOLs) that were identified in the TPL assessment were mitigated by operating procedures or transmission projects developed or approved by SPP entities and staff. Therefore, there were no Interconnection Reliability Operating Limits (IROLs) for the planning horizon.

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

[2] SPP Criteria

Western Farmers Electric Coop (WFEC)	BA,DP,GOP,GO,LSE,PSE,RP,TOP,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.

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

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

Assessments

SPP staff has conducted various analyses to comply with NERC TPL standard requirements and are summarized here.

NERC TPL Standard	Key Requirement	SPP Analysis
TPL-001	Category A	SPP MDWG Models, Regional Reliability Assessment
TPL-002	Category B	Load Flow Mitigation Analysis, Stability Analysis, Regional Reliability Assessment
TPL-003,004	Category C, D	Select N-2 and select N-3 reliability analyses, Stability Analysis

Each of these analyses is discussed below.

Integrated Transmission Planning Near-Term Assessment (TPL-001 through TPL-002)

Two assessments were completed in 2011 that compliment the 2011 TPL Steady State analysis: the 2012 Integrated Transmission Planning Near-Term Assessment (ITPNT) and 2012 Integrated Transmission Planning 10-Year Assessment (ITP10). The 2012 ITPNT analysis was conducted to create a reliable transmission expansion plan for the SPP footprint through year 2017 and protect long-term firm transmission service. This steady-state assessment reviewed normal conditions (no contingency) and single contingency outage (N-1) scenarios using NERC Reliability Standards, SPP Criteria, and local planning criteria. It also coordinated appropriate mitigation plans to meet the SPP region's reliability needs. The powerflow cases used in this analysis were created from the SPP 2011 MDWG Build 1 Model Series. The generation dispatch in these cases was similar to that in the MDWG cases with exception of excluding generation without Transmission Service; the generation was also dispatched to account for all long-term firm transmission service. The 2012 ITP10 study was performed to create a long-term 10-year plan out to 2022 for the SPP region that will allow transmission to become an enabling solution to regional and national issues. As part of the ITP10 study, a steady-state analysis similar to the 2012 ITPNT's analysis was conducted.

The 2012 ITPNT and 2012 ITP10 reports are summarized in the 2012 SPP Transmission Expansion Plan (STEP) report. The planned system upgrades will be tracked to ensure reliability projects are built in time to meet system needs. The timing of the upgrades are individually listed in the spreadsheet below and are discussed as a whole in the 2012 STEP Report[3].

MDWG Models

Power flow models are developed by the Model Development Working Group for an annual series of SPP cases.

In January 2011, SPP created 16 power flow models in coordination with SPP members through the Model Development Working Group (MDWG). This set of models goes through a validation process in several iterations until all models meet requirements as stated in the SPP MDWG Procedure Manual.[4]

The 2011 SPP MDWG power flow models reflect system condition, for selected years between years 2011 and 2022. These models are verified on a quarterly basis to reflect more 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 voltage violations under N-0, or normal system conditions. In order to achieve this, the SPP members listed below have identified, as part of the MDWG model-building process, transmission projects as mitigation plans. These projects are expected to be in service in time to mitigate the issue as determined by SPP's Attachment O Planning process.[5]

Area	No. of Projects
AEPW	7
CELE	6
KCPL	2
MIDW	2
GMO	2
NPPD	9
OKGE	6
OPPD	5
SPS	5
SWPA	1
WERE	18

[3] 2012 STEP Report
[4] SPP MDWG Procedure Manual
[5] SPP's Open Access Transmission Tariff

Load Flow: TPL-001 Assessment (Category A)

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

Load Flow: TPL-002 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, which is a tool used to automatically apply mitigation techniques based on operating measures handled by SPP Operations in real-time, 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

Load Flow: TPL-003/TPL-004 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

Load Flow: 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 or transmission projects developed or approved by SPP entities and staff. This is explained in further detail in the 2011 TPL Steady State Assessment Report.[6]

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

[6] 2011 TPL Steady State Assessment Report

Stability Study (TPL-001 through TPL-004)

The MDWG 2011 Series 2012 Light Load and 2017 Summer Load Cases were tested to be stable during normal system conditions.

The Stability Study is conducted for one seasonal light load (MDWG 2011 Series 2012 Light Load Case) case within the near-term planning window and selected events for one seasonal peak load case (MDWG 2011 Series 2017 Summer Case) for long term planning window. This assessment provides findings on potential events which could lead to instability within the SPP footprint for all categories (A, B, C and D) of events. A list of seventy NERC Category B, C, and D events were simulated in this assessment and are listed below in Table 1. These events were submitted by SPP members and include reliability type contingencies and tower outages (events) to analyze for powerflow and stability performance.

Table 1: NERC Category B, C, and D Events.

Event	Contingency
B1	Rose Hill to Wolf Creek 345 kV 3-phase fault. No reclosing
B2	Benton to Wolf Creek 345 kV 3-phase fault. No reclosing
B3	Wolf Creek to LaCygne 345 kV 3-phase fault. No reclosing.
B4	Jeffrey Energy Center (JEC) to Hoyt 345 kV, No fault. Trip line. No reclosing.
B5	JEC Auburn 230 kV 3-phase fault. No reclosing
B6	Plant X to Tolk 230 kV line 3-phase fault -- no reclosing
B7	Tolk to Eddy 345 kV line outage -- typical reclosing
B8	Yoakum to Sundown 230 kV line outage with typical reclosing.
B9	Tolk to TUCO 230 kV line 3-phase fault, no reclosing
B10	Potter 345/230 kV transformer 3-phase fault, no reclosing
B11	Iatan to Stranger Creek 345 kV 3-phase fault. Reclosing on Stanger Creek breaker only.
B12	Iatan to St. Joseph 345 kV 3-phase fault. Reclosing on St. Joseph breaker only.
B13	3-Ø fault at S3451 on T3 transformer. Normal clearing.
B14	3-Ø fault at S1211 on the S1211-S1220 line. Normal clearing.

B15	3-Ø fault at S1206 on the S1206-S1232 line. Normal clearing.
B16	3-Ø fault at S3458 on the S3458 - Cooper line. Normal clearing.
B17	SERPTA to Longwood 345 kV 3-phase fault
B18	3PH fault at GGS on GGS-Sweetwater 345 kV Circuit #1; Normal clearing; No reclose attempts
B19	3PH fault at GGS on GGS-Red Willow 345 kV; Normal clearing; No reclose attempts
B20	3PH fault at GGS on GGS-North Platte 230 kV Circuit #1; Normal clearing; No reclose attempts
B21	3PH fault at GGS on high side of GGS 345/230 kV T-1 transformer; Normal clearing; No reclose attempts
B22	Brookline to Monett to Flint Creek 345 kV 3-phase fault, reclosing on one terminal only and rotated every year (549984 – 547481 – 506935).
B23	ANO – Ft. Smith 500 kV Line. Normal clearing.
B24	Grimes to Crocket 345 kV Line (Pirkey – Grimes 345 kV Line). Normal clearing.
C1	3-Ø fault on Auburn-JEC 230 kV; followed by 3-Ø fault on Hoyt-JEC 345 kV.
C2	Prior outage of GRDA 1 – Flint Creek 345 kV with a 3-Ø fault near GRDA 1 on GRDA – Tulsa 345 kV.
C3	Prior outage of Fairport-St Joe 345kV with a 3-phase fault near Cooper on Cooper - St Joe 345 kV. No Reclosing.
C4	Prior outage of Holcomb generating unit with an outage of Mingo – Red Willow 345 kV line.
C5	3-Ø fault on Benton - Wolf Creek 345 kV line with no reclosing; Reduce Wolf Creek output to 900 MW (Transmission Operating Directive 300); 3-phase fault on LaCygne - Wolf Creek 345 kV line with no reclosing)
C6	Summit to Smoky Hills 230 kV 3-Ø fault and outage followed by Circle to Mullergren 230 kV 3-Ø fault, no reclosing.
C7	Knoll to Smoky Hills 230 kV 3-Ø fault and outage followed by Circle to Mullergren 230 kV 3-Ø fault, no reclosing.
C8	Prior outage of Tolk to Roosevelt #1 230 kV circuit with a 3-phase fault near Roosevelt on the Tolk to Roosevelt #2 230 kV circuit -- no reclosing.

C9	Iatan to St. Joseph 345 kV 3-Ø fault, reclosing on St. Joseph breaker only, then Iatan to Stranger Creek 345 kV 3-Ø fault, reclosing on Stranger Creek breaker only.
C10	3-Ø fault on Wolf Creek-LaCygne 345 kV line; Reduce Wolf Creek output to 900 MW (Transmission Operating Directive 302); 3-Ø fault on Wolf Creek-Benton 345 kV line, no reclosing.
C11	DLG fault at the S3451 end of the S3451-S3459 and S3451-S3454 lines. Normal clearing. 2246 - 24500 MVA
C12	SLG fault at the S3451 end of the S3451-Raun line, followed by a stuck breaker and the opening of transformer T4 at S3451.
C13	SLG fault at S1206 on the S1206 - S1232 line, followed by a stuck breaker and the opening of the S1206 - S1201 line.
C14	SLG fault at GGS on GGS-Sweetwater 345 kV Circuit #2, Stuck Breaker (GGS 3322), Drop GGS-Red Willow 345 kV line; Delayed clearing; No reclose attempts
C15	Prior Outage of Brookline – Monett - Flint Creek 345 kV with a 3-phase fault near Brookline on Brookline - Morgan 345 kV, with reclosing first at Morgan and then Brookline
C16	3-phase fault and outage of the Brookline – John Twitty Energy Center (JTEC) 161 kV line followed by a 3-phase fault near JTEC on the JETC - Southwest Treatment Plant - Battlefield 161 kV line, no reclosing
C17	SLG fault on HOLCOMB 115kV bus which will trip Holcomb - Holcomb 345/115 kV transformer with breaker stuck which trips Holcomb to Jones 15 kV line (delayed trip).
C18	3-Phase fault on the 230 kV line from Spearville to MULGREN with stuck breaker which trips Spearville 345/230 kV transformer
C19	3-phase fault on the 230 kV line from Holcomb to Finney with stuck breaker which trips the 345 kV line from Holcomb to SETAB with 9 cycle delayed trip
C20	Prior outage of South Hays-Great Bend 230 kV Line followed by three-phase fault on Knoll-Smoky Hill 230 kV Line with reclose once at 90 cycles and trip permanently.
C21	Prior outage of Colby-Mingo 115 kV Line followed by three-phase fault on Colby-Hoxie-Beach 115 kV Line with reclose once at 20 cycles and trip permanently.
C22	Fault on Knoll 230/115 kV transformer with breaker 3010 failure resulting in clearing Knoll-Redline-Beach 115 kV line.
C23	3-Ø fault on Rose Hill - Wolf Creek 345 kV line with no reclosing; Reduce Wolf Creek output to 900 MW (Transmission Operating Directive 300); 3-phase fault on LaCygne - Wolf Creek 345 kV line with no reclosing

D1	3-Ø fault on Holcomb – SETAB 345 kV Line with breaker failure taking out the 345-115 kV auto-transformer.
D2	3-Ø fault on Jeffrey Energy Center (JEC) to Hoyt 345 kV Line, no reclosing, and trip JEC Unit #2
D3	3-Ø fault on Auburn-Jeffery Energy Center (JEC) 230 kV; followed by 3-Ø fault on Hoyt-JEC 345 kV, no reclosing, and trip JEC Unit#2
D4	Run fault on GRDA1 345 kV bus for 5 cycles. Then open Flint Creek end of Flint Creek-GRDA1 345 kV line, but stuck breaker 9580 at GRDA1. Run for 25 cycles and then drop GRDA 345/161 transformer #1 & breaker 9080 (GRDA bkr 500T opens correctly)
D5	Loss of Flint Creek 161 kV bus
D6	Loss of Ft. Smith 500/345/161 kV Substation
D7	Loss of AEP's NW Texarkana 345 kV bus
D8	3-Ø fault at the S3451 on T3 transformer, followed by a stuck breaker and the opening of the S3451-S3459 line.
D9	3-Ø fault at S3458 on the S3458 - Cooper line, followed by a stuck breaker and the opening of the west bus at S3458.
D10	Loss of the entire substation S3456, including the transformer to the 161-kV level.
D11	Valliant to Welsh to NW Texarkana 345 kV 3-phase fault
D12	NE Station to Tulsa North 345/138 kV double circuit 3-phase fault
D13	Simultaneous SLG fault on GGS-Sweetwater 345 kV Circuit #1 and 3PH fault on GGS-Sweetwater 345 kV Circuit #2 at cross point; Normal clearing; Reclose far end
D14	5 cycle SLG fault on the 84th & Bluff end of the 84th & Bluff - Waverly 115 kV line breaker #7502 fails, and the 84th & Bluff - 70th & Bluff 115 kV line is opened to clear the fault. There is no reclosure.
D15	Loss of Summit Substation plus transformers.
D16	Loss of the entire JEC 345 kV substation. This includes loss of JEC-Hoyt 345 kV, JEC-Morris 345 kV, JEC-Summit 345 kV, JEC 345-230 kV transformer #1, JEC 345-230 kV transformer #2, and trip JEC U3 and JEC U2.
D17	3-Ø fault on Hoyt-Stranger at Hoyt 345 kV. After 3.6 cycles, trip the Hoyt-Stranger 345 kV line at Stranger. After 8 cycles (breaker failure at Hoyt), trip Hoyt 345-115 kV transformer and trip JEC-Hoyt 345 kV.

D18	3-Ø fault on JEC-Hoyt 345 kV line near JEC. After 3.6 cycles, trip the JEC-Hoyt 345 kV line at Hoyt end only. After 8 cycles (345-16 breaker failure at JEC), clear the fault, trip the line and trip JEC U2.
D19	3-Ø fault on JEC-Summit 345 kV line near JEC. After 3.6 cycles, trip the JEC-Summit 345 kV line at Summit end only. After 8 cycles (345-25 breaker failure at JEC), clear the fault, trip the line and trip the 345-230 kV transformer #26
D20	3-Ø fault on JEC-Morris 345 kV line near JEC. After 3.6 cycles, trip the JEC-Summit 345 kV line at Morris end only. After 8 cycles (breaker failure at JEC), clear the fault, trip the line at JEC end and trip JEC U3.
D21	Loss of Knoll 115kV Substation.
D22	Loss of Heizer 115 KV Substation
D23	Brookline 345 kV double Circuit 3-phase fault on Brookline161 kV bus

SPP members provided staff with twenty-four category B events that were to be evaluated for transient stability. There were no NERC Category B contingencies that were unstable during this analysis.

SPP Members provided staff with twenty-three category C events that were to be evaluated for transient stability. Twenty-two of the twenty-three events were stable for the specified clearing times (provided by the SPP Members) in the initial evaluation using the MDWG 2011 Series 2012 Light Load Case. The event in question was not unstable based upon past practices. However, it is situation that is not adequately damped and could result in adverse affects to other machines in the SPP footprint. After additional simulations, staff determined that the remaining event, C23, was stable with a modified generator dispatch. To ensure transmission system stability for events C5 and C10, the Transmission Operating Guideline redispatch of 900 MWs should remain the same. To ensure transmission system stability for event C23, the Transmission Operating Guideline redispatch of 900 MWs should be lowered to 800 MWs.

An additional sensitivity simulation was performed to look at adding a fourth 345 kV Line out of the Wolf Creek 345 kV Substation using an SPP Member submitted IDEV. This new 345 kV line is from the Wolf Creek 345 kV Substation to the Emporia Energy Center 345 kV Substation. The addition of the line will result in not having to de-rate the unit at Wolf Creek for any of the NERC Category C event simulations and the output is more than adequately damped.

SPP members provided staff with twenty-three category D events that were to be evaluated for transient stability. Twenty-one of the twenty-three events were stable for an appropriate clearing time as specified by the SPP Member in the initial evaluation using the MDWG 2011 Series 2012 Light Load Case. Due to the severity of the event simulations, the units that were made unstable due to this simulation were tripped offline. Event D1 was shown to be stable when this methodology was applied to this event. Event D4 needed additional case and simulation adjustments in order to reach a stable simulation. The case adjustment is that the KERR units ‘2’ and ‘3’ at bus 512634 must be dispatched to a minimum of 15 MWs each. Additionally, the fault current value for bus 512650 was calculated and used in place of the –j2e9 fault current value.

An angular stability screening was performed on the SPP Transmission System using the MDWG 2011 Series 2012 Light Load Case and 2017 Summer Load Case. The angular stability screen assessed the angular stability of a machine based on the maximum angle difference between two generators belonging to the same powerflow island at a given time. Since it is the difference between two generator angles, a choice of reference is not necessary. This methodology will not indentify unstable situations regarding Wind Turbines or other types of asynchronous connections. The purpose of this assessment was to find areas of potential instability for SPP Member Baseline Generators which are synchronous machines. The future plans are to implement a Transient Voltage Response screening tool that will be able to detect voltage deviations that would cause the asynchronous machines to become unstable/go offline along with other voltage measurements (voltage recovery and stabilization) during transient events.

The transient scan was performed by applying N-1 contingencies on transmission lines above 100 kV. The scan was performed by faulting bus A for a specified period of time. Next, the fault was cleared based on the voltage level of the transmission line. The line was opened from bus A to bus B without re-closing. The simulation was run for 5 seconds. Transient Stability issues should manifest with a few cycles of the fault simulation therefore a 5 second simulation was sufficient to assess basic angular stability. There was one contingency that could potentially cause stability issues and are listed in Table 2.

Table 2: Transient Stability Screening

Event	Contingency
SCR12L-1	Apply fault on bus 500250 and outage branch from Bus 500250 to Bus 507760

Event SCR12L_1 was made stable by adjusting the fault current values from the scan value of –j2e9 MVA to the actual value based on a fault current study from the SPP Short Circuit Models. The original clearing time of 5 cycles showed to be stable for the actual fault current value for the CLECO Dolet Hills bus.

There were three unstable events from the SPP Member Submitted Events that were evaluated using the MDWG 2011 Series 2012 Light Load Case. Events C23, D1 & D4 were unstable for the clearing time as specified by the SPP Member in the initial evaluation using the MDWG 2011 Series 2017 Summer Load Case. Event C25 was made stable by reducing the output of Wolf Creek to 1000 MWs. Even though events C5 and C10 were stable based on the conditions in the event simulation for the 2012L case, these events were also simulated using the 2017S case to test the de-rate of the Wolf Creek Unit and were stable.

Events D1 were made stable using the methodology of tripping the unstable unit and making sure that the rest of the transmission system remained stable. Event D4 needed simulation adjustments in order to reach a stable simulation. The fault current value for bus 512650 was calculated and used in place of the –j2e9 fault current value. The detailed results of the Dynamic Simulations are contained in Appendix A under Table 8: 2017 Summer Review of Member Submitted Unstable Events from 2012 LL Study.

The background material for the 2010 Stability Study and the stability plots will be provided on an as requested basis.

Attachment 1

Appendix A Project List

The Appendix A list can be found in the annual SPP Transmission Expansion Plan (STEP) report:

SPP.org> Engineering>Transmission Planning.

Attachment 2

TPL-001 Compliance Statement

R1. The Planning Authority and Transmission Planner shall each demonstrate through a valid assessment that its portion of the interconnected transmission system is planned such that, with all transmission facilities in service and with normal (pre-contingency) operating procedures in effect, the Network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services at all Demand levels over the range of forecast system demands, under the conditions defined in Category A of Table I. To be considered valid, the Planning Authority and Transmission Planner assessments shall:

The Southwest Power Pool (SPP) MDWG models used for the TPL Compliance Assessment were validated in compliance with current SPP Criteria under Criteria 3.3.3 and were documented in ***Criteria 3.3.3 – 2011 Summer.***[7] *SPP has demonstrated with the* ***2011 TPL Compliance Assessment*** *that its portion of the interconnected transmission system has been planned as documented in the 2011 SPP Transmission Expansion Plan such that, with all transmission facilities in service and with normal (pre-contingency) operating procedures in effect, the Network can be operated to supply projected customer demands and projected Firm (non- recallable reserved) Transmission Services at all Demand levels over the range of forecast system demands, under the conditions defined in Category A.*

R1.1. Be made annually.

The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the ***MDWG 2011 Build releases****. The TPL Compliance Assessment is conducted annually. The previous iteration of the TPL Compliance Assessment was reported in* ***SPP 2010 TPL Compliance Report – Final.***[8]

R1.2. Be conducted for near-term (years one through five) and longer-term (years six through ten) planning horizons.

The MDWG models for seasons ***2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter*** *were used as the basis for the near-term (years one through five) and MDWG models for seasons* ***2017 Winter and 2022 Summer*** *were used as the basis for longer-term (years six through ten) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table below. The timing of needed transmission project upgrades for years in between those explicitly assessed was identified as part of SPP's Attachment O planning process such that the projects will be in service prior to the date needed to resolve the issue.*

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[7] SPP Criteria 3.3.3 – 2011 Summer
[8] SPP 2010 TPL Compliance Report

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
Model Scope	**Seasonal Assessment**	**Model Used**	**Model Released**	**Assessment Completed**
Longer Term	2017 Winter	2011MDWGB1Final-17W	Feb-11	Nov -11
Longer Term	2022 Summer	2011MDWGB1Final-22S	Feb-11	Nov-11

R1.3. Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category A of Table 1 (no contingencies). The specific elements selected (from each of the following categories) shall be acceptable to the associated Regional Reliability Organization(s).

This 2011 TPL Compliance Assessment includes current system simulations that address each of the required categories.

R1.3.1. Cover critical system conditions and study years as deemed appropriate by the entity performing the study.

This assessment uses MDWG models including system conditions for all BA's within the SPP footprint as well as BA's connecting directly to them. These parameters are deemed to be appropriate by SPP engineering staff and members. The MDWG models for seasons ***2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter*** *were used as the basis for the near-term (years one through five) and MDWG models for seasons* ***2017 Winter and 2022 Summer*** *were used as the basis for longer-term (years six through ten) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table in R1.2.*

R1.3.2. Be conducted annually unless changes to system conditions do not warrant such analyses.

The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the MDWG ***2011 Build 1*** *release. The continual change and improvement in system conditions warrant this* ***2011*** *assessment.*

R1.3.3. Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.

It was deemed by SPP engineering staff and members that MDWG models for seasons ***2017 Winter and 2022 Summer*** *were necessary. These models will be sufficient to address and identify longer lead-time solutions for the transmission projects that are examined as mitigation plans to address potential violations.*

R1.3.4. Have established normal (pre-contingency) operating procedures in place.

The MDWG models and POM software used by SPP incorporate established normal, pre-contingency operating procedures (MVAR dispatch, transformer tap-adjustment, phase-shifter angle regulation, capacitor reactor switching, MW dispatch, etc) as parts of the power flow solution.

R1.3.5. Have all projected firm transfers modeled.

*The assessment uses the transfers projected by **SPP-2011-MDWG-Data Submittal Forms Master 2/01/2011** submitted by SPP members **Aug 2010 - Jan 2011**. This data is incorporated in the MDWG models.*

R1.3.6. Be performed for selected demand levels over the range of forecast system demands.

These assessments were performed over the range of seasonal demand levels as reported in the seasonal assessment table in R1.2.

R1.3.7. Demonstrate that system performance meets Table 1 for Category A (no contingencies).

The assessments demonstrate that system performance meets Table 1 for Category A.
The MDWG models used include planned upgrades. No violations occurred in models with no contingencies (N-0), meaning the planned upgrades meet the performance requirements of Category A.

R1.3.8. Include existing and planned facilities.

The MDWG models used include all existing and planned facilities for the term modeled.

R1.3.9. Include Reactive Power resources to ensure that adequate reactive resources are available to meet system performance.

The MDWG models used include reactive power resources. The analysis performed ensures that adequate reactive power is available to meet system performance requirements.

R1.4. Address any planned upgrades needed to meet the performance requirements of Category A.

The MDWG models used include planned upgrades. No violations occurred in models with no contingencies (N-0), meaning the planned upgrades meet the performance requirements of Category A.

R2. When system simulations indicate an inability of the systems to respond as prescribed in Reliability Standard TPL-001-0_R1, the Planning Authority and Transmission Planner shall each:

R2.1. Provide a written summary of its plans to achieve the required system performance as described above throughout the planning horizon.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission

Expansion Plan, includes projects planned from ***January 2012 through December 2022****. These dates cover and exceed the planning horizon.*

R2.1.1. Including a schedule for implementation.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. This document includes the schedule on which the projects are implemented.*

R2.1.2. Including a discussion of expected required in-service dates of facilities.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. This document includes the in-service dates on which the projects are implemented.*

R2.1.3. Consider lead times necessary to implement plans.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. The dates on which the projects are implemented reflect lead-times necessary for members to implement plans.*

R2.2. Review, in subsequent annual assessments, (where sufficient lead time exists), the continuing need for identified system facilities. Detailed implementation plans are not needed.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. The dates on which the projects are implemented reflect lead-times necessary for members to implement plans.*

R3. The Planning Authority and Transmission Planner shall each document the results of these reliability assessments and corrective plans and shall annually provide these to its respective NERC Regional Reliability Organization(s), as required by the Regional Reliability Organization.

SPP has documented the results of this reliability assessment and its corrective plans and the results were provided to its NERC RRO as required.

Attachment 3

TPL-002 Compliance Statement

R1. The Planning Authority and Transmission Planner shall each demonstrate through a valid assessment that its portion of the interconnected transmission system is planned such that the Network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services, at all demand levels over the range of forecast system demands, under the contingency conditions as defined in Category B of Table I. To be valid, the Planning Authority and Transmission Planner assessments shall:

*The Southwest Power Pool (SPP) MDWG models used for the TPL Compliance Assessment were validated in compliance with current SPP Criteria under Criteria 3.3.3 and were documented in **Criteria 3.3.3 – 2011 Summer.**[9] SPP has demonstrated with its **2011** TPL Compliance Assessment that its portion of the interconnected transmission system has been planned as documented in the 2011 SPP Transmission Expansion Plan such that the Network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services, at all demand levels over the range of forecast system demands, under the contingency conditions as defined in Category B.*

R1.1. Be made annually.

*The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the **MDWG 2011 Build releases**. The TPL Compliance Assessment is conducted annually. The previous iteration of the TPL Compliance Assessment was reported in **SPP 2010 TPL Compliance Report – Final.**[10]*

R1.2. Be conducted for near-term (years one through five) and longer-term (years six through ten) planning horizons.

*The MDWG models for seasons **2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter** were used as the basis for the near-term (years one through five) and MDWG models for seasons **2017 Winter and 2022 Summer** were used as the basis for longer-term (years six through ten) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table below. The timing of needed transmission project upgrades for years in between those explicitly assessed was identified as part of SPP's Attachment O planning process such that the projects will be in service prior to the date needed to resolve the issue.*

[9] SPP Criteria 3.3.3 – 2011 Summer
[10] SPP 2010 TPL Compliance Report

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
Model Scope	**Seasonal Assessment**	**Model Used**	**Model Released**	**Assessment Completed**
Longer Term	2017 Winter	2011MDWGB1Final-17W	Feb-11	Nov -11
Longer Term	2022 Summer	2011MDWGB1Final-22S	Feb-11	Nov-11

R1.3. Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category B of Table 1 (single contingencies). The specific elements selected (from each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).

*The **2011** TPL Compliance Assessment is supported by the most up-to-date MDWG models available. The TPL assessment uses **2011 Build 1 MDWG models**. The Complex Elements considered for system evaluation under Category B were developed by SPP-RTO with input from stakeholders and members. Additional (N-1) elements were automatically selected based on base voltage according to the following table.*

Element	Base kV	Source
Complex Elements (Cat. B)	---	SPP & Stakeholders
Branch	69 kV+	Software Selection
Generator	All	Software Selection
Transformer	100 kV+	Software Selection

The Stability Study is conducted for one seasonal light load (MDWG 2011 Series 2012 Light Load Case) case within the near-term planning window and selected events for one seasonal peak load case (MDWG 2011 Series 2017 Summer Case) for long term planning window. This assessment provides findings on potential events which could lead to instability within the SPP footprint for all categories (A, B, C and D) of events. A list of twenty-four NERC Category B events were simulated in this assessment and are listed below in Table 1. These events were submitted by SPP members and include reliability type contingencies and tower outages (events) to analyze for powerflow and stability performance. These simulations follow Category B of Table 3. The Category B contingencies simulated are described in the following table.

Event	Table 3: NERC Category B Events. Contingency
B1	Rose Hill to Wolf Creek 345 kV 3-phase fault. No reclosing
B2	Benton to Wolf Creek 345 kV 3-phase fault. No reclosing
B3	Wolf Creek to LaCygne 345 kV 3-phase fault. No reclosing.
B4	Jeffrey Energy Center (JEC) to Hoyt 345 kV, No fault. Trip line. No reclosing.
B5	JEC Auburn 230 kV 3-phase fault. No reclosing
B6	Plant X to Tolk 230 kV line 3-phase fault -- no reclosing
B7	Tolk to Eddy 345 kV line outage -- typical reclosing
B8	Yoakum to Sundown 230 kV line outage with typical reclosing.
B9	Tolk to TUCO 230 kV line 3-phase fault, no reclosing
B10	Potter 345/230 kV transformer 3-phase fault, no reclosing
B11	Iatan to Stranger Creek 345 kV 3-phase fault. Reclosing on Stanger Creek breaker only.
B12	Iatan to St. Joseph 345 kV 3-phase fault. Reclosing on Stranger Creek breaker only.
B13	3-Ø fault at S3451 on T3 transformer. Normal clearing.
B14	3-Ø fault at S1211 on the S1211-S1220 line. Normal clearing.
B15	3-Ø fault at S1206 on the S1206-S1232 line. Normal clearing.
B16	3-Ø fault at S3458 on the S3458 - Cooper line. Normal clearing.
B17	SERPTA to Longwood 345 kV 3-phase fault
B18	3PH fault at GGS on GGS-Sweetwater 345 kV Circuit #1; Normal clearing; No reclose attempts
B19	3PH fault at GGS on GGS-Red Willow 345 kV; Normal clearing; No reclose attempts
B20	3PH fault at GGS on GGS-North Platte 230 kV Circuit #1; Normal clearing; No reclose attempts
B21	3PH fault at GGS on high side of GGS 345/230 kV T-1 transformer; Normal clearing; No reclose attempts
B22	Brookline to Monett to Flint Creek 345 kV 3-phase fault, reclosing on one terminal only and rotated every year (549984 – 547481 – 506935).
B23	ANO – Ft. Smith 500 kV Line. Normal clearing.
B24	Grimes to Crocket 345 kV Line (Pirkey – Grimes 345 kV Line). Normal clearing.

SPP members provided staff with twenty-four category B events that were to be evaluated for transient stability. There were no NERC Category B contingencies that were unstable during this analysis.

An angular stability screening was performed on the SPP Transmission System using the MDWG 2011 Series 2012 Light Load Case and 2017 Summer Load Case. The angular stability screen assessed the angular stability of a machine based on the maximum angle difference between two generators belonging to the same powerflow island at a given time. Since it is the difference between two generator angles, a choice of reference is not necessary. This methodology will not indentify unstable situations regarding Wind Turbines or other types of asynchronous connections. The purpose of this assessment was to find areas of potential instability for SPP Member Baseline Generators which are synchronous machines. The future plans are to implement a Transient Voltage Response screening tool that will be able to detect voltage deviations that would cause the *asynchronous machines to become unstable/go offline along with other voltage measurements (voltage recovery and stabilization) during transient events.*

The transient scan was performed by applying N-1 contingencies on transmission lines above 100 kV. The scan was performed by faulting bus A for a specified period of time. Next, the fault was cleared based on the voltage level of the transmission line. The line was opened from bus A to bus B without re-closing. The simulation was run for 5 seconds. Transient Stability issues should manifest with a few cycles of the fault simulation therefore a 5 second simulation was sufficient to assess basic angular stability. There was one contingency that could potentially cause stability issues and are listed in Table 2.

Event	Table 2: Transient Stability Screening Contingency
SCR12L-1	Apply fault on bus 500250 and outage branch from Bus 500250 to Bus 507760

Event SCR12L_1 was made stable by adjusting the fault current values from the scan value of –j2e9 MVA to the actual value based on a fault current study from the SPP Short Circuit Models. The original clearing time of 5 cycles showed to be stable for the actual fault current value for the CLECO Dolet Hills bus.

R1.3.1. Be performed and evaluated only for those Category B contingencies that would produce the more severe System results or impacts. The rationale for the contingencies selected for evaluation shall be available as supporting information. An explanation of why the remaining simulations would produce less severe system results shall be available as supporting information.

The Complex Elements considered for system evaluation under Category B were developed by SPP-RTO with input from stakeholders and members. Branch elements with base voltages less than 69kV have less critical roles in system capability than those with higher base voltage and produce less severe system results. Transformer elements with base voltages less than 100kV on all busses have less capacity than those with one or more higher base voltages and produce less severe system results. All generator elements were considered in evaluating system results regardless of base voltage of power capacity. These additional elements were automatically selected based on base voltage as outlined in the following table.

Element	Base kV	Source
Complex B	---	SPP & Stakeholders
Branch (AC and DC)	69 kV+	Software Selection
Generator	All	Software Selection
Transformer	100 kV+	Software Selection

R1.3.2. Cover critical system conditions and study years as deemed appropriate by the responsible entity.

This assessment uses MDWG models including system conditions for all BA's within the SPP footprint as well as BA's connecting directly to them. These parameters are deemed to be appropriate by SPP engineering staff and members. The MDWG models for seasons ***2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter*** *were used as the basis for the near-term (years one through five) and MDWG models for seasons* ***2017 Winter and 2022 Summer*** *were used as the basis for longer-term (years six through ten) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table in R1.2.*

R1.3.3. Be conducted annually unless changes to system conditions do not warrant such analyses.

The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the MDWG ***2011 Build 1*** *release. The continual change and improvement in system conditions warrant this* ***2011*** *assessment.*

R1.3.4. Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.

It was deemed by SPP engineering staff and members that MDWG models for seasons ***2017 Winter and 2022 Summer*** *were necessary. These models will be sufficient to address and identify longer lead-time solutions for the transmission projects that are examined as mitigation plans to address potential thermal violation.*

R1.3.5. Have all projected firm transfers modeled.

The assessment uses the transfers projected by ***SPP-2011-MDWG-Data Submittal Forms Master 2/01/2011*** *submitted by SPP members* ***Aug 2010 - Jan 2011****. This data is incorporated in the MDWG models.*

R1.3.6. Be performed and evaluated for selected demand levels over the range of forecast system Demands.

These assessments were performed over the range of seasonal demand levels as reported in the seasonal assessment table in R1.2.

R1.3.7. Demonstrate that system performance meets Table 1 for Category B contingencies.

The assessments demonstrate that system performance meets Table 1 for Category B. Any violations occurring in models with events resulting in the loss of a single element (N-1) were mitigated by procedures developed by SPP engineering staff and member entities, or were mitigated by procedures produced by software analysis of evaluation models.

R1.3.8. Include existing and planned facilities.

The MDWG models used include all existing and planned facilities for the term modeled.

R1.3.9. Include Reactive Power resources to ensure that adequate reactive resources are available to meet system performance.

The MDWG models used include reactive power resources. The analysis performed ensures that adequate reactive power is available to meet system performance requirements.

R1.3.10. Include the effects of existing and planned protection systems, including any backup or redundant systems.

The Category B contingencies provided by SPP member entities include protection systems including normal clearing of 3-phase breakers for generators, branches, and transformers. The Category B contingencies provided by SPP member entities include backup and redundant systems including load throw-over.

R1.3.11. Include the effects of existing and planned control devices.

The MDWG models and POM software used include existing and planned control devices including MVAR dispatch, transformer tap adjustments, phase-shifter angle regulation, capacitor switching, MW dispatch, line switching, and load curtailment.

R1.3.12. Include the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) at those demand levels for which planned (including maintenance) outages are performed.

The MDWG models used include planned outages of bulk electric equipment at demand levels for which those planned outages are performed.

R1.4. Address any planned upgrades needed to meet the performance requirements of Category B of Table I.

The MDWG models used include planned upgrades. All violations occurring in models with events resulting in the loss of a single element (N-1) were mitigated by operating procedures developed by SPP engineering staff and member entities, or were mitigated by procedures produced by software analysis of evaluation models; meaning the planned upgrades meet the performance requirements of Category B.

R1.5. Consider all contingencies applicable to Category B.

The Complex Elements considered for system evaluation under Category B were developed by SPP-RTO with input from stakeholders and members. Branch elements with base voltages less than 69kV have less critical roles in system capability than those with higher base voltage and produce less severe system results. Transformer elements with base voltages less than 100kV on all busses have less capacity than those with one or more higher base voltages and produce less severe system results. All generator elements were considered in evaluating system results regardless of base voltage of power capacity. These additional elements were automatically selected based on base voltage as outlined in the following table.

Element	Base kV	Source
Complex B	---	SPP & Stakeholders
Branch (AC and DC)	69 kV+	Software Selection

Generator	All	Software Selection
Transformer	100 kV+	Software Selection

R2. When system simulations indicate an inability of the systems to respond as prescribed in Reliability Standard TPL-001-0_R1, the Planning Authority and Transmission Planner shall each:

R2.1. Provide a written summary of its plans to achieve the required system performance as described above throughout the planning horizon.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. These dates cover and exceed the planning horizon.*

R2.1.1. Including a schedule for implementation.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. This document includes the schedule on which the projects are implemented.*

R2.1.2. Including a discussion of expected required in-service dates of facilities.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. This document includes the in-service dates on which the projects are implemented.*

R2.1.3. Consider lead times necessary to implement plans.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. The dates on which the projects are implemented reflect lead-times necessary for members to implement plans.*

R2.2. Review, in subsequent annual assessments, (where sufficient lead time exists), the continuing need for identified system facilities. Detailed implementation plans are not needed.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. The dates on which the projects are implemented reflect lead-times necessary for members to implement plans.*

R3. The Planning Authority and Transmission Planner shall each document the results of its Reliability Assessments and corrective plans and shall annually provide the results to its respective Regional Reliability Organization(s), as required by the Regional Reliability Organization.

SPP has documented the results of this reliability assessment and its corrective plans and the results were provided to its NERC RRO as required.

Attachment 4

TPL-003 Compliance Statement

R1. The Planning Authority and Transmission Planner shall each demonstrate through a valid assessment that its portion of the interconnected transmission systems is planned such that the network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services, at all demand Levels over the range of forecast system demands, under the contingency conditions as defined in Category C of Table I (attached). The controlled interruption of customer Demand, the planned removal of generators, or the Curtailment of firm (non-recallable reserved) power transfers may be necessary to meet this standard. To be valid, the Planning Authority and Transmission Planner assessments shall:

*The Southwest Power Pool (SPP) MDWG models used for the TPL Compliance Assessment were validated in compliance with current SPP Criteria under Criteria 3.3.3 and were documented in **Criteria 3.3.3 – 2011 Summer.**[11] SPP has demonstrated with its **2011 TPL Compliance Assessment** that its portion of the interconnected transmission system has been planned as documented in the 2011 SPP Transmission Expansion Plan such that the network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services, at all demand Levels over the range of forecast system demands, under the contingency conditions as defined in Category C.*

R1.1. Be made annually.

*The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the **MDWG 2011 Build releases**. The TPL Compliance Assessment is conducted annually. The previous iteration of the TPL Compliance Assessment was reported in **SPP 2010 TPL Compliance Report – Final.**[12]*

R1.2. Be conducted for near-term (years one through five) and longer-term (years six through ten) planning horizons.

*The MDWG models for seasons **2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter** were used as the basis for the near-term (years one through five) and MDWG models for seasons **2017 Winter and 2022 Summer** were used as the basis for longer-term (years six through ten) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table below. The timing of needed transmission project upgrades for years in between those explicitly assessed was identified as part of SPP's Attachment O planning process such that the projects will be in service prior to the date needed to resolve the issue.*

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[11] SPP Criteria 3.3.3 – 2011 Summer
[12] SPP 2010 TPL Compliance Report

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
Model Scope	**Seasonal Assessment**	**Model Used**	**Model Released**	**Assessment Completed**
Longer Term	2017 Winter	2011MDWGB1Final-17W	Feb-11	Nov -11
Longer Term	2022 Summer	2011MDWGB1Final-22S	Feb-11	Nov-11

R1.3. Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category C of Table 1 (multiple contingencies). The specific elements selected (from each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).

The ***2011 TPL Compliance Assessment*** *is supported by the most up-to-date MDWG models available. The TPL assessment uses* ***2011 Build 1 MDWG models****. The Complex Elements considered for system evaluation under Category B were developed by SPP-RTO with input from stakeholders and members. Additional (N-1) elements were automatically selected based on base voltage according to the following table.*

Element	Base KV	Source
Complex Elements (Cat. B)	---	SPP & Stakeholders
Branch	69 KV+	Software Selection
Generator	All	Software Selection
Transformer	100 KV+	Software Selection

These (N-1) elements were paired to form (N-2) contingencies. Pairs of (N-1) elements were chosen according to the following table.

(N-2) Category	Selection Rule
Branch-Branch	Same Zone
Branch-Generator	Same Area
Generator-Generator	All Modeled

The Stability Study is conducted for one seasonal light load (MDWG 2011 Series 2012 Light Load Case) case within the near-term planning window and selected events for one seasonal peak load case (MDWG 2011 Series 2017 Summer Case) for long term planning window. This assessment provides findings on potential events which could lead to instability within the SPP footprint for all categories (A, B, C and D) of events. A list of twenty-three NERC Category C events were simulated *in this assessment and are listed below in Table 1. These events were submitted by SPP members and include reliability type contingencies and tower outages (events) to analyze for powerflow and stability performance. These simulations follow Category C of Table 1. The Category C contingencies simulated are described in the following table.*

Table 3: NERC Category C Events.

Event	Contingency
C1	3-Ø fault on Auburn-JEC 230 kV; followed by 3-Ø fault on Hoyt-JEC 345 kV.
C2	Prior outage of GRDA 1 – Flint Creek 345 kV with a 3-Ø fault near GRDA 1 on GRDA – Tulsa 345 kV.
C3	Prior outage of Fairport-St Joe 345kV with a 3-phase fault near Cooper on Cooper - St Joe 345 kV. No Reclosing.
C4	Prior outage of Holcomb generating unit with an outage of Mingo – Red Willow 345 kV line.
C5	3-Ø fault on Benton - Wolf Creek 345 kV line with no reclosing; Reduce Wolf Creek output to 900 MW (Transmission Operating Directive 300); 3-phase fault on LaCygne - Wolf Creek 345 kV line with no reclosing)
C6	Summit to Smoky Hills 230 kV 3-Ø fault and outage followed by Circle to Mullergren 230 kV 3-Ø fault, no reclosing.
C7	Knoll to Smoky Hills 230 kV 3-Ø fault and outage followed by Circle to Mullergren 230 kV 3-Ø fault, no reclosing.
C8	Prior outage of Tolk to Roosevelt #1 230 kV circuit with a 3-phase fault near Roosevelt on the Tolk to Roosevelt #2 230 kV circuit -- no reclosing.
C9	Iatan to St. Joseph 345 kV 3-Ø fault, reclosing on St. Joseph breaker only, then Iatan to Stranger Creek 345 kV 3-Ø fault, reclosing on Stranger Creek breaker only.
C10	3-Ø fault on Wolf Creek-LaCygne 345 kV line; Reduce Wolf Creek output to 900 MW (Transmission Operating Directive 302); 3-Ø fault on Wolf Creek-Benton 345 kV line, no reclosing.
C11	DLG fault at the S3451 end of the S3451-S3459 and S3451-S3454 lines. Normal clearing. 2246 - 24500 MVA
C12	SLG fault at the S3451 end of the S3451-Raun line, followed by a stuck breaker and the opening of transformer T4 at S3451.
C13	SLG fault at S1206 on the S1206 - S1232 line, followed by a stuck breaker and the opening of the S1206 - S1201 line.
C14	SLG fault at GGS on GGS-Sweetwater 345 kV Circuit #2, Stuck Breaker (GGS 3322), Drop GGS-Red Willow 345 kV line; Delayed clearing; No reclose attempts
C15	Prior Outage of Brookline – Monett - Flint Creek 345 kV with a 3-phase fault near Brookline on Brookline - Morgan 345 kV, with reclosing first at Morgan and then Brookline
C16	3-phase fault and outage of the Brookline – John Twitty Energy Center (JTEC) 161 kV line followed by a 3-phase fault near JTEC on the JETC - Southwest Treatment Plant - Battlefield 161 kV line, no reclosing
C17	SLG fault on HOLCOMB 115kV bus which will trip Holcomb - Holcomb 345/115 kV transformer with breaker stuck which trips Holcomb to Jones 15 kV line (delayed trip).
C18	3-Phase fault on the 230 kV line from Spearville to MULGREN with stuck breaker which trips Spearville 345/230 kV transformer
C19	3-phase fault on the 230 kV line from Holcomb to Finney with stuck breaker which trips

	the 345 kV line from Holcomb to SETAB with 9 cycle delayed trip
C20	Prior outage of South Hays-Great Bend 230 kV Line followed by three-phase fault on Knoll-Smoky Hill 230 kV Line with reclose once at 90 cycles and trip permanently.
C21	Prior outage of Colby-Mingo 115 kV Line followed by three-phase fault on Colby-Hoxie-Beach 115 kV Line with reclose once at 20 cycles and trip permanently.
C22	Fault on Knoll 230/115 kV transformer with breaker 3010 failure resulting in clearing Knoll-Redline-Beach 115 kV line.
C23	3-Ø fault on Rose Hill - Wolf Creek 345 kV line with no reclosing; Reduce Wolf Creek output to 900 MW (Transmission Operating Directive 300); 3-phase fault on LaCygne - Wolf Creek 345 kV line with no reclosing

SPP Members provided staff with twenty-three category C events that were to be evaluated for transient stability. Twenty-two of the twenty-three events were stable for the specified clearing times (provided by the SPP Members) in the initial evaluation using the MDWG 2011 Series 2012 Light Load Case. The event in question was not unstable based upon past practices. However, it is situation that is not adequately damped and could result in adverse affects to other machines in the SPP footprint. After additional simulations, staff determined that the remaining event, C23, was stable with a modified generator dispatch. To ensure transmission system stability for events C5 and C10, the Transmission Operating Guideline redispatch of 900 MWs should remain the same. To ensure transmission system stability for event C23, the Transmission Operating Guideline redispatch of 900 MWs should be lowered to 800 MWs.

An additional sensitivity simulation was performed to look at adding a fourth 345 kV Line out of the Wolf Creek 345 kV Substation using an SPP Member submitted IDEV. This new 345 kV line is from the Wolf Creek 345 kV Substation to the Emporia Energy Center 345 kV Substation. The addition of the line will result in not having to de-rate the unit at Wolf Creek for any of the NERC Category C event simulations and the output is more than adequately damped.

R1.3.1. Be performed and evaluated only for those Category C contingencies that would produce the more severe system results or impacts. The rationale for the contingencies selected for evaluation shall be available as supporting information. An explanation of why the remaining simulations would produce less severe system results shall be available as supporting information.

The Complex Elements considered for system evaluation under Category C were developed by SPP-RTO with input from stakeholders and members. Branch elements with base voltages less than 69KV have less critical roles in system capability than those with higher base voltage and therefore produce less severe system results. Transformer elements with base voltages less than 100KV on all busses have less capacity than those with one or more higher base voltages and therefore produce less severe system results. All generator elements were considered in evaluating system results regardless of base voltage of power capacity. Additional elements were selected based on base voltage as outlined in the following table.

Element	Base KV	Source
Complex Elements (Cat. C)	---	SPP & Stakeholders
Branch (AC and DC)	69 KV+	Software Selection
Generator	All	Software Selection

Transformer	100 KV+	Software Selection

These (N-1) elements were paired to form (N-2). Branch-branch contingencies are most likely to produce severe system results when both elements are in the same zone. Branch-generator contingencies are more likely to produce severe system results when both elements are in the same area. All possible pairs of generator contingencies were assessed. Pairs of (N-1) elements were chosen according to the following table.

(N-2) Category	Selection Rule
Branch-Branch	Same Zone
Branch-Generator	Same Area
Generator-Generator	All Modeled

R1.3.2. Cover critical system conditions and study years as deemed appropriate by the responsible entity.

*This assessment uses MDWG models including system conditions for all BA's within the SPP footprint as well as BA's connecting directly to them. These parameters are deemed to be appropriate by SPP engineering staff and members. The MDWG models for seasons **2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter** were used as the basis for the near-term (years one through five) and MDWG models for seasons **2017 Winter and 2022 Summer** were used as the basis for longer-term (years six through ten) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table in R1.2.*

R1.3.3. Be conducted annually unless changes to system conditions do not warrant such analyses.

*The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the MDWG **2011 Build 1** release. The continual change and improvement in system conditions warrant this **2011** assessment.*

R1.3.4. Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.

*It was deemed by SPP engineering staff and members that MDWG models for seasons **2017 Winter and 2022 Summer** were necessary. These models will be sufficient to address and identify longer lead-time solutions for the transmission projects that are examined as mitigation plans to address potential thermal violation.*

R1.3.5. Have all projected firm transfers modeled.

*The assessment uses the transfers projected by **SPP-2011-MDWG-Data Submittal Forms Master 2/01/2011** submitted by SPP members **Aug 2010 - Jan 2011**. This data is incorporated in the MDWG models.*

R1.3.6. Be performed and evaluated for selected demand levels over the range of forecast system demands.

These assessments were performed over the range of seasonal demand levels as reported in the seasonal assessment table in R1.2.

R1.3.7. Demonstrate that System performance meets Table 1 for Category C contingencies.

The assessments demonstrate that system performance meets Table 1 for Category C. Any violations occurring in models with events resulting in the loss of any two or more elements (N-k) likely to produce severe effects on the system were mitigated by procedures developed by SPP engineering staff and member entities, or were mitigated by procedures produced by software analysis of evaluation models.

R1.3.8. Include existing and planned facilities.

The MDWG models used include all existing and planned facilities for the term modeled.

R1.3.9. Include Reactive Power resources to ensure that adequate reactive resources are available to meet System performance.

The MDWG models used include reactive power resources. The analysis performed ensures that adequate reactive power is available to meet system performance requirements.

R1.3.10. Include the effects of existing and planned protection systems, including any backup or redundant systems.

The Category C contingencies provided by SPP member entities include protection systems including normal clearing of 3-phase breakers for generators, branches, and transformers. The Category C contingencies provided by SPP member entities include backup and redundant systems including load throw-over.

R1.3.11. Include the effects of existing and planned control devices.

The MDWG models used and POM software include existing and planned control devices including MVAR dispatch, transformer tap adjustments, phase-shifter angle regulation, capacitor switching, MW dispatch, line switching, and load curtailment.

R1.3.12. Include the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) at those demand levels for which planned (including maintenance) outages are performed.

The MDWG models used include planned outages of bulk electric equipment at demand levels for which those planned outages are performed.

R1.4. Address any planned upgrades needed to meet the performance requirements of Category C.

The MDWG models used include planned upgrades. All violations occurring in models with events resulting in the loss of two or more elements (N-2) were mitigated by operating procedures developed by SPP engineering staff and member entities, or were mitigated by procedures produced *by software analysis of evaluation models; meaning the planned upgrades meet the performance requirements of Category C.*

R1.5. Consider all contingencies applicable to Category C.

The Complex Elements considered for system evaluation under Category C were developed by SPP-RTO with input from stakeholders and members. Branch elements with base voltages less than 69KV have less critical roles in system capability than those with higher base voltage and therefore produce less severe system results. Transformer elements with base voltages less than 100KV on all busses have less capacity than those with one or more higher base voltages and therefore produce less severe system results. All generator elements were considered in evaluating system results regardless of base voltage of power capacity. Additional elements were selected based on base voltage as outlined in the following table.

Element	Base KV	Source
Complex Elements (Cat. C)	---	SPP & Stakeholders
Branch (AC and DC)	69 KV+	Software Selection
Generator	All	Software Selection
Transformer	100 KV+	Software Selection

These (N-1) elements were paired to form (N-2) contingencies. Branch-branch contingencies are most likely to produce severe system results when both elements are in the same zone. Branch-generator contingencies are more likely to produce severe system results when both elements are in the same area. All possible pairs of generator contingencies were assessed. Pairs of (N-1) elements were chosen according to the following table.

(N-2) Category	Selection Rule
Branch-Branch	Same Zone
Branch-Generator	Same Area
Generator-Generator	All Modeled

R2. When system simulations indicate an inability of the systems to respond as prescribed in Reliability Standard TPL-001-0_R1, the Planning Authority and Transmission Planner shall each:

R2.1. Provide a written summary of its plans to achieve the required system performance as described above throughout the planning horizon.

*A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from **January 2012 through December 2022**. These dates cover and exceed the planning horizon.*

R2.1.1. Including a schedule for implementation.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission

Expansion Plan, includes projects planned from ***January 2012 through December 2022****. This document includes the dates on which the projects are implemented.*

R2.1.2. Including a discussion of expected required in-service dates of facilities.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. This document includes the in-service dates on which the projects are implemented.*

R2.1.3. Consider lead times necessary to implement plans.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. The dates on which the projects are implemented reflect lead-times necessary for members to implement plans.*

R2.2. Review, in subsequent annual assessments, (where sufficient lead time exists), the continuing need for identified system facilities. Detailed implementation plans are not needed.

A continually-updated, written summary of SPP's 10-year plans to achieve the required system performance is maintained and provided by SPP. This summary, the 2011 SPP Transmission Expansion Plan, includes projects planned from ***January 2012 through December 2022****. The dates on which the projects are implemented reflect lead-times necessary for members to implement plans.*

R3. The Planning Authority and Transmission Planner shall each document the results of these Reliability Assessments and corrective plans and shall annually provide these to its respective NERC Regional Reliability Organization(s), as required by the Regional Reliability Organization.

SPP has documented the results of this reliability assessment and its corrective plans and the results were provided to its NERC RRO as required.

Attachment 5

TPL-004 Compliance Statement

R1. The Planning Authority and Transmission Planner shall each demonstrate through a valid assessment that its portion of the interconnected transmission system is evaluated for the risks and consequences of a number of each of the extreme contingencies that are listed under Category D of Table I. To be valid, the Planning Authority's and Transmission Planner's assessment shall:

The Southwest Power Pool (SPP) MDWG models used for the TPL Compliance Assessment were validated in compliance with current SPP Criteria under Criteria 3.3.3 and were documented in ***Criteria 3.3.3 – 2011 Summer.***[13] *SPP has demonstrated with the TPL Compliance Assessment that its portion of the interconnected transmission system has been evaluated for risks and consequences for extreme contingencies covered under Category D.*

R1.1. Be made annually.

The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the ***MDWG 2011 Build releases****. The TPL Compliance Assessment is conducted annually. The previous iteration of the TPL Compliance Assessment was reported in* ***SPP 2010 TPL Compliance Report – Final.***[14]

R1.2. Be conducted for near-term (years one through five).

The MDWG models for seasons ***2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter*** *were used as the basis for the near-term (years one through five) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table below. The timing of needed transmission project upgrades for years in between those explicitly assessed was identified as part of SPP's Attachment O planning process such that the projects will be in service prior to the date needed to resolve the issue.*

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

[13] SPP Criteria 3.3.3 – 2011 Summer
[14] SPP 2010 TPL Compliance Report

R1.3. Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category D contingencies of Table I. The specific elements selected (from within each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).

*The **2011 TPL Compliance Assessment** is supported by the most up-to-date MDWG models available. The TPL assessment uses **2011 Build 1 MDWG models**.*

The Stability Study is conducted for one seasonal light load (MDWG 2011 Series 2012 Light Load Case) case within the near-term planning window and selected events for one seasonal peak load case (MDWG 2011 Series 2017 Summer Case) for long term planning window. This assessment provides findings on potential events which could lead to instability within the SPP footprint for all categories (A, B, C and D) of events. A list of twenty-three NERC Category D events were simulated in this assessment and are listed below in Table 1. These events were submitted by SPP members and include reliability type contingencies and tower outages (events) to analyze for powerflow and stability performance. These simulations follow Category D of Table 1. The Category D contingencies simulated are described in the following table.

Table 1: NERC Category D Events.

Event	Contingency
D1	3-Ø fault on Holcomb – SETAB 345 kV Line with breaker failure taking out the 345-115 kV auto-transformer.
D2	3-Ø fault on Jeffrey Energy Center (JEC) to Hoyt 345 kV Line, no reclosing, and trip JEC Unit #2
D3	3-Ø fault on Auburn-Jeffery Energy Center (JEC) 230 kV; followed by 3-Ø fault on Hoyt-JEC 345 kV, no reclosing, and trip JEC Unit#2
D4	Run fault on GRDA1 345 kV bus for 5 cycles. Then open Flint Creek end of Flint Creek-GRDA1 345 kV line, but stuck breaker 9580 at GRDA1. Run for 25 cycles and then drop GRDA 345/161 transformer #1 & breaker 9080 (GRDA bkr 500T opens correctly)
D5	Loss of Flint Creek 161 kV bus
D6	Loss of Ft. Smith 500/345/161 kV Substation
D7	Loss of AEP's NW Texarkana 345 kV bus
D8	3-Ø fault at the S3451 on T3 transformer, followed by a stuck breaker and the opening of the S3451-S3459 line.
D9	3-Ø fault at S3458 on the S3458 - Cooper line, followed by a stuck breaker and the opening of the west bus at S3458.
D10	Loss of the entire substation S3456, including the transformer to the 161-kV level.
D11	Valliant to Welsh to NW Texarkana 345 kV 3-phase fault
D12	NE Station to Tulsa North 345/138 kV double circuit 3-phase fault
D13	Simultaneous SLG fault on GGS-Sweetwater 345 kV Circuit #1 and 3PH fault on GGS-Sweetwater 345 kV Circuit #2 at cross point; Normal clearing; Reclose far end

D14	5 cycle SLG fault on the 84th & Bluff end of the 84th & Bluff - Waverly 115 kV line breaker #7502 fails, and the 84th & Bluff - 70th & Bluff 115 kV line is opened to clear the fault. There is no reclosure.
D15	Loss of Summit Substation plus transformers.
D16	Loss of the entire JEC 345 kV substation. This includes loss of JEC-Hoyt 345 kV, JEC-Morris 345 kV, JEC-Summit 345 kV, JEC 345-230 kV transformer #1, JEC 345-230 kV transformer #2, and trip JEC U3 and JEC U2.
D17	3-Ø fault on Hoyt-Stranger at Hoyt 345 kV. After 3.6 cycles, trip the Hoyt-Stranger 345 kV line at Stranger. After 8 cycles (breaker failure at Hoyt), trip Hoyt 345-115 kV transformer and trip JEC-Hoyt 345 kV.
D18	3-Ø fault on JEC-Hoyt 345 kV line near JEC. After 3.6 cycles, trip the JEC-Hoyt 345 kV line at Hoyt end only. After 8 cycles (345-16 breaker failure at JEC), clear the fault, trip the line and trip JEC U2.
D19	3-Ø fault on JEC-Summit 345 kV line near JEC. After 3.6 cycles, trip the JEC-Summit 345 kV line at Summit end only. After 8 cycles (345-25 breaker failure at JEC), clear the fault, trip the line and trip the 345-230 kV transformer #26
D20	3-Ø fault on JEC-Morris 345 kV line near JEC. After 3.6 cycles, trip the JEC-Summit 345 kV line at Morris end only. After 8 cycles (breaker failure at JEC), clear the fault, trip the line at JEC end and trip JEC U3.
D21	Loss of Knoll 115kV Substation.
D22	Loss of Heizer 115 KV Substation
D23	Brookline 345 kV double Circuit 3-phase fault on Brookline161 kV bus

SPP members provided staff with twenty-three category D events that were to be evaluated for transient stability. Twenty-one of the twenty-three events were stable for an appropriate clearing time as specified by the SPP Member in the initial evaluation using the MDWG 2011 Series 2012 Light Load Case. Due to the severity of the event simulations, the units that were made unstable due to this simulation were tripped offline. Event D1 was shown to be stable when this methodology was applied to this event. Event D4 needed additional case and simulation adjustments in order to reach a stable simulation. The case adjustment is that the KERR units '2' and '3' at bus 512634 must be dispatched to a minimum of 15 MWs each. Additionally, the fault current value for bus 512650 was calculated and used in place of the –j2e9 fault current value.

R1.3.1. Be performed and evaluated only for those Category D contingencies that would produce the more severe system results or impacts. The rationale for the contingencies selected for evaluation shall be available as supporting information. An explanation of why the remaining simulations would produce less severe system results shall be available as supporting information.

The Complex Elements considered for system evaluation under Category D were developed by SPP-RTO with input from stakeholders and members. The Category D Complex Elements only include loss of all generation at a facility, loss of all transformers at a substation, or loss of all transmission circuits on a right-of-way. Any less severe loss of system elements would be considered Category C and is covered by TPL-003-0.

R1.3.2. Cover critical system conditions and study years as deemed appropriate by the responsible entity.

This assessment uses MDWG models including system conditions for all BA's within the SPP footprint as well as BA's connecting directly to them. These parameters are deemed to be appropriate by SPP engineering staff and members. The MDWG models for seasons ***2012 Fall, 2012 Spring, 2012 Summer, 2013 Summer, and 2013 Winter*** *were used as the basis for the near-term (years one through five) for the TPL Compliance Assessment. The assessment uses MDWG models as outlined in the table in R1.2.*

R1.3.3. Be conducted annually unless changes to system conditions do not warrant such analyses.

The MDWG models used for the TPL Compliance Assessment are developed annually. The MDWG models used for this assessment are the MDWG ***2011 Build 1*** *release. The continual change and improvement in system conditions warrant this* ***2011*** *assessment.*

R1.3.4. Have all projected firm transfers modeled.

The assessment uses the transfers projected by ***SPP-2011-MDWG-Data Submittal Forms Master 2/01/2011*** *submitted by SPP members* ***Aug 2010 - Jan 2011****. This data is incorporated in the MDWG models.*

R1.3.5. Include existing and planned facilities.

The MDWG models used include all existing and planned facilities for the term modeled.

R1.3.6. Include Reactive Power resources to ensure that adequate reactive resources are available to meet system performance.

The MDWG models used include reactive power resources. The analysis performed ensures that adequate reactive power is available to meet system performance requirements.

R1.3.7. Include the effects of existing and planned protection systems, including any backup or redundant systems.

The Category D contingencies provided by SPP member entities include protection systems including normal clearing of 3-phase breakers for generators, branches, and transformers. The Category D contingencies provided by SPP member entities include backup and redundant systems including load throw-over.

R1.3.8. Include the effects of existing and planned control devices.

The MDWG models and POM software used include existing and planned control devices including MVAR dispatch, transformer tap adjustments, phase-shifter angle regulation, capacitor switching, MW dispatch, line switching, and load curtailment.

R1.3.9. Include the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) at those demand levels for which planned (including maintenance) outages are performed.

The MDWG models used include reactive power resources. The analysis performed ensures that adequate reactive power is available to meet system performance requirements.

R1.4. Consider all contingencies applicable to Category D.

All violations occurring in models with extreme contingencies were mitigated by procedures developed by member entities or were mitigated by procedures produced by software analysis of evaluation models, meaning the planned upgrades meet the performance requirements of Category D.

R2. The Planning Authority and Transmission Planner shall each document the results of its reliability assessments and shall annually provide the results to its entities' respective NERC Regional Reliability Organization(s), as required by the Regional Reliability Organization.

SPP has documented the results of this reliability assessment and its corrective plans and the results were provided to its NERC RRO as required.