



Southwest Power Pool
TRANSMISSION WORKING GROUP MEETING
February 12, 2016
SPP Corporate Campus – Little Rock, AR

• Summary of Action Items •

1. Approved the 2015 TPL-001-4 Stability Assessment Report

Southwest Power Pool
TRANSMISSION WORKING GROUP MEETING
February 12, 2016
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• M I N U T E S •

Agenda Item 1 – Administrative Items

TWG Chair Travis Hyde called the meeting to order at 2:02 pm. The following members were in attendance or represented by proxy (Attendance 1a – Attendance, 1b – Proxies):

John Allen, City Utilities of Springfield, proxy for John Boshears, City Utilities of Springfield
Richard Dahl – Missouri River Energy Services
John Fulton, Southwestern Public Service Company
Jody Holland, South Central MCN, proxy for Noman Williams, South Central MCN
Travis Hyde, Oklahoma Gas & Electric
Kalun Kelley, Western Farmers' Electric Cooperative
John Knofczynski, East River Electric Power Cooperative
Dan Lenihan, Omaha Public Power District
Randy Lindstrom, Nebraska Public Power District
Jim McAvoy, Oklahoma Municipal Power Authority
Matt McGee, American Electric Power
Nathan McNeil, Westar Energy, Inc.
Marcus Moor, Kansas City Power & Light, proxy for Harold Wyble, Kansas City Power & Light
Michael Mueller, Arkansas Electric Cooperative Corporation
Alan Myers, ITC Great Plains
Gayle Nansel, Western Area Power Authority
Jason Shook, GDS Associates, representing ETEC

Kirk noted that a quorum was achieved and the group could conduct regular business.

Agenda Item 2 – SPP 2015 TPL-001-4 Stability Assessment

Doug Bowman, SPP staff, began review of SPP's 2015 TPL-001-4 Stability Report. Doug reviewed the updated results with the members requesting a final approval of the report and its results (Attachment 2 – 2015 TPL-001-4 Stability Report). Members requested the location of the channel plots from the study results. Staff informed them that data was available on TrueShare already for each entity.

Motion: Alan Myers made a motion to approve the 2015 TPL-001-4 Stability Assessment. Jody Holland seconded the motion. The motion was approved unanimously.

Jody asked staff for a response at the February TWG/ESWG Face-to-Face meetings for the stakeholders on the recent stay of the Clean Power Plan and what effects that would have on the 2017 ITP10. Kirk responded that staff would try to come prepared with some discussion points, but with the limited time prior to the meeting there not be enough time prior to the meeting for a full internal discussion and planned direction.

Respectfully Submitted,

Kirk Hall

Secretary

All sessions in Central Standard Time (Chicago, GMT-06:00)

Session detail for 'TWG Net Conference':

Participant Name	Email	Date	Start time
1 Chenal WebEx	awhite@spp.org	2/12/2016	2:00 PM
2 Ryan Yokley	ryokley@sunflower.net	2/12/2016	2:00 PM
3 Nathan McNeil	nathan.mcneil@westarenergy.com	2/12/2016	2:01 PM
4 Sherri Maxey	smaxey@spp.org	2/12/2016	2:01 PM
5 Gimod Olapurayil	golapurayil@itctransco.com	2/12/2016	2:01 PM
6 Greg Sorenson, SPP RE	gsorenson.re@spp.org	2/12/2016	2:01 PM
7 Kim Van Brimer	kvanbrimer@spp.org	2/12/2016	2:01 PM
8 John Allen (SPRM)	john.allen@cityutilities.net	2/12/2016	2:01 PM
9 Josie Daggett (WAPA)	daggett@wapa.gov	2/12/2016	2:01 PM
10 Kalun Kelley - WFEC	k_kelley@wfec.com	2/12/2016	2:01 PM
11 Matt McGee	mcmcgee@aep.com	2/12/2016	2:01 PM
12 Dan Lenihan	djlenihan@oppd.com	2/12/2016	2:01 PM
13 Randy Lindstrom	rrlinds@nppd.com	2/12/2016	2:01 PM
14 Richard Dahl (MRES)	richard.dahl@mrenergy.com	2/12/2016	2:01 PM
15 Joseph Nichols	jbnichols@burnsmcd.com	2/12/2016	2:01 PM
16 Doug Bowman	dbowman@spp.org	2/12/2016	2:02 PM
17 Jason Shook (GDS/ETEC)	jason.shook@gdsassociates.com	2/12/2016	2:02 PM
18 Marcus Moor (KCP&L)	marcus.moor@kcpl.com	2/12/2016	2:02 PM
19 Thomas Burns [SPP]	tburns@spp.org	2/12/2016	2:02 PM
20 Alan Myers	amyers@itctransco.com	2/12/2016	2:02 PM
21 Michael Odom (SPP)	modom@spp.org	2/12/2016	2:02 PM
22 John Fulton	john.fulton@xcelenergy.com	2/12/2016	2:02 PM
23 Brian Rounds (AESL)	brian.rounds@aeslconsulting.com	2/12/2016	2:02 PM
24 Michael Wegner (ITC)	mwegner@itctransco.com	2/12/2016	2:03 PM
25 Jody Holland	jholland@gridliance.com	2/12/2016	2:03 PM
26 Moses Rotich	mrotich@spp.org	2/12/2016	2:03 PM
27 Jonathan Abebe	jabebe@cleanlineenergy.com	2/12/2016	2:04 PM
28 Travis Hyde	hydets@oge.com	2/12/2016	2:04 PM
29 Gayle Nansel (WAPA)	nansel@wapa.gov	2/12/2016	2:04 PM
30 Michael Mueller	michael.mueller@aecc.com	2/12/2016	2:06 PM
31 John Knofczynski	jknofczynski@eastriver.coop	2/12/2016	2:06 PM
32 Reynaldo	rey.rodriquez@wfec.com	2/12/2016	2:07 PM
33 Jim McAvoy	jmcavoy@ompa.com	2/12/2016	2:10 PM
34 ed pfeiffer (quanta)	epfeiffer@quanta-technology.com	2/12/2016	2:11 PM
35 Bruce Cude	bruce.cude@xcelenergy.com	2/12/2016	2:17 PM
36 David Spargo (OPPD)	dpspargo@oppd.com	2/12/2016	2:25 PM
37 Jody Holland	jholland@gridliance.com	2/12/2016	2:36 PM

Kirk Hall

From: Wyble Harold <Harold.Wyble@kcpl.com>
Sent: Wednesday, February 03, 2016 7:33 AM
To: Kirk Hall; Hyde, Travis; McNeil, Nathan (nmcneil@mwenergy.com)
Cc: Moor, Marcus
Subject: TWG 2/12/16 webex proxy

Marcus Moor will have my proxy for the TWG webex on 2/12/16.

Harold Wyble
Manager Transmission Planning
Kansas City Power & Light
816-654-1213

Kirk Hall

From: John Boshears <John.Boshears@cityutilities.net>
Sent: Friday, February 12, 2016 12:47 PM
To: Kirk Hall
Cc: Allen, John; Knottek, Jeff
Subject: RE: TWG 2-12-16 Meeting

Kirk,
John Allen will be available for the meeting this afternoon so I give him my proxy for todays meeting.
Thank you,
John Boshears

From: Kirk Hall [khall@spp.org]
Sent: Friday, February 12, 2016 11:49 AM
To: John Boshears
Subject: RE: TWG 2-12-16 Meeting

John,

Feel free to give your proxy to someone outside of City Utilities. They will cast a vote on your behalf. You will want to make sure they planned to vote 'Yes'

Kirk Hall
Sr. Engineer
Steady State Planning
501.688.8230



From: John Boshears [mailto:John.Boshears@cityutilities.net]
Sent: Friday, February 12, 2016 7:52 AM
To: Kirk Hall <khall@spp.org>
Cc: Knottek, Jeff <Jeff.Knottek@cityutilities.net>
Subject: TWG 2-12-16 Meeting

Kirk,
Myself and the individuals that would be my proxy are tied up in a meeting this afternoon and will not be able to attend the TWG Meeting. This came up after the TWG Meeting was set up.

I have not been able to find an agenda for todays meeting. If the TPL Stability Report Approval is the subject of the meeting, CU has no objections to the Report and would vote to approve it. I do not know if early voting is approved for this occasion.
Thank you,
John Boshears

Are you connected? Follow us!   

Kirk Hall

From: Noman Williams <Nwilliams@gridliance.com>
Sent: Friday, February 12, 2016 12:57 PM
To: Kirk Hall
Subject: RE: Proxy

Thanks

Noman Williams
Sr. VP/COO
785.259.5110

Sent from my Verizon Wireless 4G LTE Droid
On Feb 12, 2016 12:21 PM, Kirk Hall <khall@spp.org> wrote:
Noted sir.

Kirk Hall
Sr. Engineer
Steady State Planning
501.688.8230

Sent from my Galaxy S6 using TouchDown

-----Original Message-----

From: Noman Williams [Nwilliams@gridliance.com]
Received: Friday, 12 Feb 2016, 12:00PM
To: Kirk Hall [khall@spp.or]; Jody Holland [JHolland@gridliance.com]; Kirk Hall [khall@spp.org]
Subject: Re: Proxy

Noman Williams
Sr. VP/COO
785.259.5110

Sent from my Verizon Wireless 4G LTE Droid
On Feb 12, 2016 11:47 AM, Noman Williams <Nwilliams@gridliance.com> wrote:
Kirk
I will be in the air during the call I provide my proxy to Jody Holland

Thanks

Noman Williams
Sr. VP/COO
785.259.5110

Sent from my Verizon Wireless 4G LTE Droid



Southwest Power Pool, Inc.
TRANSMISSION WORKING GROUP MEETING
February 12, 2016
Net Conference – SPP Corporate Campus

• A G E N D A •

2:00 pm – 3:00 pm

1. Administrative ItemsTravis Hyde (5 min.)
 - a. Call to Order
 - b. Proxies

2. SPP 2015 TPL-001-4 Stability Assessment (Action Item) Doug Bowman (55 min.)



SPP 2015 TPL-001-4 STABILITY ASSESSMENT

February ~~1126~~, 2016 |
Engineering
Research Development and Special Studies

Revision History

Date	Author	Change Description
11/4/2015	J. McDiarmid	Initial Draft
2/01/2016	D. Bowman	Report Complete
<u>2/126/2016</u>	<u>D. Bowman</u>	<u>Revisions for TWG 2/23/16</u>

Table of Contents

REVISION HISTORY.....	2
TABLE OF CONTENTS.....	3
LIST OF TABLES.....	4
SECTION 1: INTRODUCTION.....	5
SECTION 2: STUDY SCOPE AND METHOD.....	6
2.1: Fast Fault Screening and Dynamic Assessment.....	8
2.2: Dynamic Assessment of Member Specified Events.....	8
2.3: Dynamic Assessment of Coordinated Events with Tier 1 Entities.....	89
2.4: Dynamic Assessment of Breaker to Breaker Contingencies.....	9
2.5: Assessment of Possible Cascading Due to Transient Instability.....	9
2.6: Mitigation of Unstable/Cascading Events.....	9
SECTION 3: RESULTS.....	10
3.1: Fast Fault Screening (FFS) and Dynamic Analysis.....	10
3.2: Transient Stability Analysis of Member Submitted Events.....	10
3.3: Dynamic Assessment of Coordinated Events with Tier 1 Entities.....	11
3.4: Transient Stability Analysis of Breaker-to-Breaker Contingencies.....	11
3.5: Assessment of Possible Cascading Due to Transient Instability.....	11
SECTION 4: CONCLUSION.....	12
APPENDIX A – DATA.....	13

List of Tables

Table 2.1: Study Models	6
Table 2.2: SPP Assessment Areas.....	7
Table 3.1: Events by Category	10
Table 3.2: Stability Results for Member-Submitted Events	1110

Section 1: Introduction

The objective of this study is to report findings from the 2015 Dynamic Stability Compliance Assessment to support compliance with NERC TPL-001-4 Reliability Standards for future years 2016 and 2025. This report, along with the Near-Term and Long-Term Load Flow Assessments, fulfills requirements of applicable TPL Standards. This report summarizes the potential stability violations anticipated by SPP and the applicable Corrective Action Plans (CAPS) developed by SPP Member Entities and SPP Engineering Staff.

A separate comprehensive report will be issued detailing the 2015 Transmission Planning Compliance Statement for each TPL Standard. This report will address how each requirement defined in the TPL Standards is fulfilled by one or more mechanism in the TPL Near-Term or Longer-Term Compliance Assessments.

The following terms are used in this report and are defined as follows:

Rotor Angle Stability – refers to the ability of synchronous machines of an interconnected power system to remain in synchronism after being subjected to a disturbance (also known as transient stability). It depends on the ability to maintain/restore equilibrium between electromagnetic torque and mechanical torque of each synchronous machine in the system. Instability that may result occurs in the form of increasing angular swings of some generators leading to their loss of synchronism with other generators.¹

Oscillation Damping – is an influence within or upon an oscillating system that has the effect of reducing, restricting or preventing its oscillations. In the context of the present study, damping is the decay of disturbance induced rotor oscillations and is caused by mechanical energy loss in the generator rotor.

Transient Voltage Stability (Short-term voltage stability) – involves dynamics of fast-acting power system components such as induction motors, electronically controlled loads and HVDC converters. The study period of interest is in the order of several seconds, and analysis requires solutions of appropriate system differential equations; that is similar to the analysis of rotor angle stability. Dynamic modeling of loads is often essential. In contrast to rotor angle stability, short circuits near loads are important.¹

Cascading - The uncontrolled successive loss of system elements triggered by an incident at any location. Cascading results in widespread electric service interruption that cannot be restrained from sequentially spreading beyond an area predetermined by studies.²

¹ IEEE/CIGRE Joint Task Force on Stability Terms and Definitions, *Definition and Classification of Power System Stability*, IEEE PES Trans. on Power Systems, Vol. 19, No. 2, May 2004.

² Glossary of Terms Used in NERC Reliability Standards. [Online], Updated Jan. 25, 2016, Available: http://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf

Section 2: Study Scope and Method

This section summarizes the scope of work performed by SPP, as Planning Coordinator (PC), for the 2015 NERC TPL-001-4 Stability Assessment. The full Scope of Work for the study was approved by the Transmission Planning Task Force (TPLTF) on May 11, 2015.

The model set in Table 2.1 below establishes category P0 as the normal System condition in TPL-001-4 Table 1, and defines the models that are used for the 2015 TPL Stability analysis.

Description	Base Cases	Sensitivity Cases
Year 1 peak	MDWG 2016S	ITPNT 2016S5
Year 1 off-peak	MDWG 2016L	ITPNT 2016L5
Year 10 peak	MDWG 2025S	N/A

Table 2.1: Study Models

The generation dispatch in the base case models is derived from a member submitted merit order block dispatch. The ITPNT Scenario 5 models, which were chosen for the sensitivity cases, have as much of the firm transmission rights protected as load allows. The wind machines are dispatched considerably higher in the ITPNT Scenario 5 models.

TPL-001-4, Requirement 2.4.1, states that dynamic cases take into account the behavior of induction motors. SPP and their Member companies performed a sensitivity analysis using a generic PSSE load model in a summer peak case. The results from this sensitivity analysis indicated the need for additional research regarding the use of a dynamic load model and its effects on the bulk electric system. The research will include partnering with Electric Power Research Institute (EPRI), leveraging their research on the subject matter, and the formation of an SPP Dynamic Load Task Force (DLTF). The SPP DLTF has been tasked to develop and execute a load survey, a set of dynamic load models for different load types, and a methodology to maintain and update them as the electric utility industry moves forward with improvements and new dynamic load models.

The SPP areas included in this assessment are shown below in Table 2.2:

Area Number	Entity Name
520	American Electric Power (AEPW)
542	Board of Public Utilities (BPU)
546	City Utilities of Springfield, MO (SPRM)
523	Grand River Dam Authority (GRDA)
545	Independence Power & Light (INDN)
NA	ITC Great Plains, LLC (ITCGP)
541	Kansas City Power & Light Company (KCPL)
540	KCPL - Greater Missouri Operations (KCPL-GMO)
650	Lincoln Electric System (LES)
531	Midwest Energy, Inc (MIDW)

Area Number	Entity Name
640	Nebraska Public Power District (NPPD)
524	Oklahoma Gas & Electric Company (OKGE)
527	Oklahoma Municipal Power Authority (OMPA)
645	Omaha Public Power District (OPPD)
515	Southwestern Power Administration (SWPA)
526	Southwestern Public Service Company (SPS)
534	Sunflower Electric Power Corporation (SECI)
544	The Empire District Electric Company (EDE)
64052	Western Area Power Administration – RMR (WAPA RMR)
536	Westar Energy, Inc. (WR)
525	Western Farmers Electric Cooperative (WFEC)

Table 2.2: SPP Assessment Areas

Twenty (20) second time domain simulations are performed for all events described in later sections of this report using Siemens' PTI's PSS/E Rev 32 and the PSSPLT plotting package and PowerTech Labs' DSATools TSAT (breaker-to-breaker events). As the simulations occur, the following are monitored and recorded to determine stability:

Rotor angle stability is monitored for generators up to ten (10) buses away from the disturbance (fault) location. It is assumed that the absence of instability up to 10 buses away from the disturbance implies that generators located beyond this point will remain stable. Should any event cause instability, the event will be re-simulated and monitored to capture all possible unstable generators beyond the ten (10) buses. Those units that exhibit signs of instability are marked for further analysis, and should CAPS be necessary, the member entity is engaged to determine the necessary CAP.

Rotor angle oscillation damping is monitored for those generators monitored for rotor angle stability. The damping curves are judged against the SPPR5 criteria as described in the *SPP Disturbance Performance Requirements*. Those units that violate the criteria were identified for further analysis and, should CAPS be necessary, the member entity was engaged to determine the necessary CAP.

Transient voltage stability is monitored for BES buses up to ten (10) buses away from the disturbance (fault) location. The voltage responses are judged against the $.7 < V_{\text{transient}} < 1.2$ p.u. criteria, as described in the *SPP Disturbance Performance Requirements*. Those units that violate the transient voltage criteria are marked for further analysis and should CAPS be necessary, the member entity is engaged to determine the necessary CAP.

Potential cascading due to a fault event and subsequent rotor angle instability is determined for NERC category P1-P7 and Extreme events. The criteria for an event resulting in *potential* cascading are the loss of more than 1768 MW of generation based on SPP operating reserve. Those events violating these criteria were identified as a possible cascading event for further analysis and, should CAPS be necessary, the member entity is engaged to determine the necessary CAP.

With respect to system stability, compliance with the new TPL-001-4 Standard is required. Paragraphs 2.1 through 2.5 of this document describe the events required for study and the method by which they are studied.

2.1: Fast Fault Screening and Dynamic Assessment

A Fast Fault Screening analysis of the SPP Transmission System was performed on all cases shown in Table 2.1. V&R Energy's Fast Fault Scan (FFS) tool was used to determine category P1 and P6 events above 100 kV. A list of potential severe fault locations, their ranking, and fault sequences for potential category P1 and P6 contingencies was determined. The screening identified 88 severe fault locations for the study cases.

V&R Energy's FFS tool screens potential transmission fault locations for grid stability analysis and quickly identifies the most severe fault locations and ranks them in the order of severity. The tool begins by identifying the most severe fault locations, above 100 kV, which are considered the weaker points in the network. Faults at each of the identified locations are then ranked according to severity using a Ranking Index (RI) for the loss of lines, transformers, or generators according to TPL-001-4 at each ranked bus. SPP classifies fault severity according to the Ranking Index (RI) and the Critical Clearing Time (CCT).

Once the RI is known, the CCT is computed. The CCT is the maximum time during which a disturbance can be applied without generator units losing transient stability. The RI and CCT are used as metrics to determine fault locations that merit further examination.

Transient stability analysis was performed on ranked contingencies having a critical clearing time of less than nine (9) cycles using the ranked bus, CCT and the "outaged branch" identified in the FFS. The FFS identified the fault bus and associated "outaged branches;" however, the fault sequence was determined by SPP, as follows:

- Category P1: Apply a three-phase fault at the ranked bus for a time span of CCT cycles, open the "outaged branch," and clear the fault.
- Category P6: Open the first "outaged branch" and allow steady state system adjustments. Apply a three-phase fault at the ranked bus for a time span of CCT cycles, open the second "outaged branch," and clear the fault.

Prior to executing the analysis, discussions with members of actual clearing times to be used during the simulations are coordinated.

2.2: Dynamic Assessment of Member Specified Events

SPP members provided SPP Staff with 4,582 reliability events for transient stability performance analysis. A transient stability analysis was performed for all member submitting events for all Table 2.1 cases.

Some events required a change in generation differing from that amount in the powerflow models based on the member submitted contingency. In such cases, an offset amount was included within the member modeling area to balance generation prior to or during the event simulation.

2.3: Dynamic Assessment of Coordinated Events with Tier 1 Entities

Contingencies on systems adjacent to SPP may impact the SPP system and vice versa. Coordination with adjacent PCs must, therefore, be accomplished. SPP Staff performed a fast fault screening and provided

adjacent entities with twenty-one (21) severe fault locations as indicated by the FFS screening for their review and further study. SPP also requested the adjacent systems provide events for the SPP study. SPP received a total of 1,459 events for study. A transient stability analysis was performed for all received events for all Table 2.1 cases.

2.4: Dynamic Assessment of Breaker to Breaker Contingencies

SPP Staff gathered system breaker-to-breaker data to formulate contingencies that emulate actual field responses to faults. Since faults on line segments between breakers normally cause the line-end terminal breakers to open all line sections, end-to-end de-energization is required during the simulation. A total of 1,565 breaker-to-breaker contingencies were produced. A transient stability analysis was performed for all cases shown in Table 2.1 for the formulated breaker-to-breaker contingencies. Powertech Labs, Inc.'s DSATools TSAT was used for the analysis.

2.5: Assessment of Possible Cascading Due to Transient Instability

Category P1 through P7 and Extreme contingency events that produced the more severe system impacts were evaluated for cascading. A loss of synchronism as a result of an outaged element is the initiating mechanism for purposes of this assessment. A cascading analysis was performed on all cases shown in Table 2.1 using V&R Energy's Fast Fault Scan (FFS) and Potential Cascading Modes (PCM) tools. This analysis determined possible cascading due to transient instability within the SPP System.

The FFS tool was first used to determine the most severe category P1 fault locations (fault is placed near the bus on each branch to be outaged) within the system. The identified fault locations were ranked in order of decreasing severity (1 being the most severe) using a ranking index. The bus fault and associated outaged branch were then used as the initiating event in the PCM tool to determine possible cascading, meaning a criteria violation (loss of 1,768 MW) had occurred. A criteria violation would merit further analysis.

Second, Category P2 through P7 and Extreme events were evaluated for potential cascading, as well. Any loss of MW due to generator instabilities for these events was evaluated against the 1,768 MW criteria. A criteria violation would merit further analysis.

2.6: Mitigation of Unstable/Cascading Events

SPP Staff worked with SPP Members and adjacent entities to determine Corrective Action Plans (CAPS) for events found to be unstable or that resulted in cascading to ensure the proposed CAPS would, by implementation, provide system stability.

Section 3: Results

3.1: Fast Fault Screening (FFS) and Dynamic Analysis

The 88 severe fault locations (buses) were ranked according to their Ranking Index (RI) and Critical Clearing Time (CCT) for NERC P1 and P6 contingencies. Those ranked locations with a CCT less than 9 cycles were identified for time domain analysis in PSS/E. There was no resulting system instability for Fast Fault Screened events.

3.2: Transient Stability Analysis of Member Submitted Events

Members provided a total of 4,582 events for study according to the following categories:

Category	Number of Events
P1	1,221
P2	682
P3	69
P4	705
P5	292
P6	443
P7	162
Extreme	1,008

Table 3.1: Events by Category

Transient stability analysis was performed on the above events using PSS/E’s dynamics package. There were ~~three~~^{four} (43) events resulting in transient voltage instability as shown below in Table 3.1. The Corrective Action Plans are also shown.

Event	Owner	Model	Instability	Corrective Action Plan
FAULT__OKGE-2015-All-1-P5_1-HSL4__16S-Pass_2	OGE	16S-Pass 2	Transient Voltage Violations below 0.7 p.u.	Install backup distance relaying on Horseshoe Lake—Forest Hill-Inglewood 138kV Line. Complete by June 1, 2016
FAULT__SPS-2015-All-91-P4-DEAFSMITH6_2K25	SPS	16S-Pass 2	Transient Voltage Violation	Curtail load to alleviate low bus voltage conditions until Deaf Smith Interchange is converted to a Double-Bus-Double-Breaker configuration in 2017.
FAULT__SPS-2015-All-346-P2-DEAFSMITH6_5H65	SPS	25S	Transient Voltage Violation	Rebuild Deaf Smith Interchange to a Double-Bus-Double-Breaker configuration. Complete by June 1, 2025.
FAULT__SPS-2015-All-77-P4-WHEELER3_1H135	SPS	16L and 16L Pass 2 and 25S	Transient Voltage Violation	Convert Wheeler Bus Configuration to Ring Bus. Complete by April 1, 2016.

Table 3.2: Stability Results for Member-Submitted Events

3.3: Dynamic Assessment of Coordinated Events with Tier 1 Entities

The 21 FFS Screened Events were provided to adjacent Planning Coordinators for their review and further study.

3.4: Transient Stability Analysis of Breaker-to-Breaker Contingencies

A transient stability analysis was performed using TSAT for all cases shown in Table 2.1 for the 1,565 breaker-to-breaker contingencies.

There was no resulting system instability for the breaker-to-breaker events.

3.5: Assessment of Possible Cascading Due to Transient Instability

All P1 through P7 and Extreme events were evaluated against criteria for potential cascading.

There was no resulting cascading for the evaluated events.

Section 4: Conclusion

The new TPL-001-4 Standard significantly increased the work performed by SPP Staff and its Members. The volume and complexity of events studied expanded beyond the previous TPL stability assessments. For example, the number of contingencies evaluated by SPP staff increased to 6,235 in this assessment compared to the 2014 and 2013 assessments which evaluated 163 and 61 contingencies respectively. New processes and tools were required and developed to automate the processing of contingencies and the post-processing of results, allowing for the completion of the project.

The following results demonstrate how the TPL-001-4 requirements are satisfied:

Table 2.1 cases were tested and found to be stable during normal conditions prior to this study, satisfying NERC TPL Category P0 requirements.

All NERC TPL Category P1, P3, P5, P6, and P7 events were found to be stable when the clearing times were tested, satisfying NERC TPL Category P1, P3, P5, P6, and P7 requirements.

All Category P2 FFS events were found to be stable, with the exception of **FAULT__SPS-2015-AII-346-P2-DEAFSMITH6_5H65**, which will require the rebuild of the DEAF SMITH 230kV bus configuration to double bus – double breaker by June 1, 2025. The specified CAP, together with all tested stable events, ensures that NERC TPL Category P2 requirements are satisfied.

All Category P4 FFS events were found to be stable, with the exception of **FAULT__SPS-2015-AII-91-P4-DEAFSMITH6_2K25** and **FAULT_SPS-2015-AII-77-P4-WHEELER3_1H135**. The former will require load curtailment to alleviate low bus voltage conditions until Deaf Smith Interchange is converted to a Double-Bus-Double-Breaker configuration in 2017, while the latter will require the conversion of the WHEELER bus configuration to a ring bus by April 1, 2016. The specified CAPs, together with all tested stable events, ensured that NERC TPL Category P4 requirements are satisfied.

All ~~Category P5 FFS~~submitted extreme events were ~~found to be stable, with tested without~~ the ~~exception occurrence~~ of **FAULT__OKGE-2015-AII-1-P5_1-HSL4**, which will require the installation of ~~backup distance relaying on the Horseshoe Lake – Forest Hill – Inglewood 138kV line by June 1, 2016.~~ The ~~specified CAP, together with all tested stable events,~~ ensures that NERC TPL Category ~~P5~~ requirements are satisfied.

All ~~NERC TPL Extreme events were found to be stable when the clearing times were tested and no potential cascading was found,~~ satisfying NERC TPL ~~Extreme~~ Category “Extreme” event requirements.

Appendix A – Data

All data, including rotor angle, damping, and transient voltage responses are made available on TrueShare at:

[TWG—Confidential and Protected Material and or CEII-Do Not Release >> TPL Compliance Rpts >> 2015 TPL Assessment >> 4. Stability Results >> Results by Member](#)

~~[TWG → TPL Compliance Reports → 2015 TPL Assessment → Stability Results](#)~~

In order to obtain access to these documents in TrueShare, stakeholders must provide SPP with a signed [confidentiality agreement](#). Instructions can be obtained by clicking on the link. Please submit these forms via **RMS** through the “Request TrueShare Access” Quick Pick. After the executed confidentiality agreement is received, an account will be created for the requester on TrueShare. An email with instructions for logging on will be sent to requester. For those that already have a TrueShare account, no additional action is necessary.