GEN-2008-098 & GEN-2010-003 Impact Restudy for Generator Modification (Turbine Change)

March 2014
Generator Interconnection

SPP Southwest Power Pool

Executive Summary

This document reports on the findings of a third restudy for the GEN-2008-098 & GEN-2010-003 interconnection request. The Interconnection Customer has requested this restudy to determine the effects of changing wind turbine generators from the previously studied Vestas V100-1.8MW wind turbine generators to Gamesa G114-2.0MW wind turbine generators. Both projects are owned by the same customer and each project will generate up to 100.0MW using fifty (50) Gamesa G114-2.0MW wind turbine generators. The two projects are collocated in Coffee County, Kansas for an aggregate of 200.0MW and share the same 34.5/345kV substation transformer that will connect the Customer's 345kV transmission line to the Point of Interconnection (POI), a new switching station on the Westar Energy (WERE) Wolf Creek to LaCygne 345kV transmission line. The interconnection customer has provided documentation that shows the Gamesa G114-2.0MW wind turbine generators have a reactive capability of 0.95 lagging (providing VARS) and 0.95 leading (absorbing VARS) power factor.

The GEN-2008-098 & GEN-2010-003 interconnection request, using Vestas V90-1.8MW wind turbine generators, was initially studied in the DISIS-2010-001 Definitive Impact Study which was posted in July 2010. The Transmission Owner requested an additional analysis which was posted in January 2012 to determine operating limits for the Generating Facility for prior outage conditions of 345kV lines in the local area. The Customer requested a second restudy which was posted in April 2012 to determine the effects of changing from the Vestas V90-1.8MW wind turbine generators to the Vestas V100-1.8MW wind turbine generators.

At present the Transmission Owner has a Transmission Operations Directive (TOD) that adjusts the Wolf Creek generation following an outage of any one of the three 345kV transmission lines that terminate at the Wolf Creek 345kV bus. The Wolf Creek plant output is reduced to 800MW for these prior outage conditions in order to be able to withstand a second 345kV line outage. If this condition occurs, the GEN-2008-098/GEN-2010-003 facility must reduce to 0MW. This study shows that with the addition of GEN-2008-098 & GEN-2010-003 projects, the maximum allowable Wolf Creek generation output during periods when a 345kV line is out of service remains at 800MW. The results of this study show that during the conditions for which the TOD applies (i.e. the outage of the lines listed below) the output of GEN-2008-098 & GEN-2010-003 must be reduced to 0MW. The lines whose outage triggers this directive are:

- Wolf Creek – LaCygne 345kV line
    - After the interconnection of the study projects, the line segment between the study projects and LaCygne
- Wolf Creek – Benton 345kV line
- Wolf Creek – Rose Hill 345kV line

With the assumptions and operation requirements described above, study projects GEN-2008-098 & GEN-2010-003 utilizing the Gamesa G114-2.0MW wind turbine generator should be able to interconnect without causing any stability problems on the SPP transmission grid. In addition,

consistent with Order #661A, the facilities will be required to maintain a 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection.

A power factor analysis was performed in this study. The facility will be required to maintain a 95% lagging (providing VARs) and 95% leading (absorbing VARs) power factor at the point of interconnection. The Customer is responsible for maintaining a 95% power factor at the point of interconnection. Additional capacitor banks or other reactive equipment may be required to meet this requirement depending on the design of the Generating Facility and its collector system.

With the assumptions outlined in this report and with all the required network upgrades from the GEN-2008-098 & GEN-2010-003 Generator Interconnection Agreement (GIA) in place, the GEN-2008-098 & GEN-2010-003 requests should be able to reliably interconnect to the SPP transmission grid.

Nothing within this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service rights. Should the Customer require transmission service, those rights should be requested through SPP's Open Access Same-Time Information System (OASIS).

This study did not analyze powerflow situations. For powerflow constraints, please refer to the latest version of DISIS-2010-001. At times, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, it is likely that the Customer may be required to reduce its generation output to **0 MW** under certain system conditions (in addition to the ones mentioned earlier) to allow system operators to maintain the reliability of the transmission network.

I. Introduction

GEN-2008-098 & GEN-2010-003 Impact Restudy is a generation interconnection study performed to study the impacts of interconnecting the project shown in Table I-1. The in-service date assumed for the generation addition was October 2014. This restudy is for a change from Vestas V100-1.8MW wind turbine generators to Gamesa G114-2.0MW wind turbine generators.

Table I-1: Interconnection Requests

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2008-098	100.0	Gamesa G114 2.0MW (572094) (50 turbines)	Tap on the Wolf Creek (532797) – LaCygne (542981) 345kV (560004)
GEN-2010-003	100.0	Gamesa G114 2.0MW (577200) (50 turbines)	Tap on the Wolf Creek (532797) – LaCygne (542981) 345kV (560004)

The prior-queued and equally-queued requests shown in Table I-2 were included in this study and the wind and solar farms were dispatched to 100% of rated capacity.

Table I-2: Prior Queued Interconnection Requests

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2002-004	199.5	GE 1.5MW (532605, 532606)	Latham 345kV (532800)
GEN-2005-013	199.8	Vestas V90 VCSS 1.8MW (532720)	Caney River 345kV (532780)
GEN-2007-025	299.2	GE 1.6MW (533123, 533124)	Viola 345kV (532798)
GEN-2008-013	299.0	GE XLE 1.68MW (515479, 515484)	Hunter 345kV (515476)
GEN-2008-021	1283	GENROU (532751)	Wolf Creek 345kV (532797)
GEN-2009-025	59.8	Siemens 93m 2.3MW (531005)	Tap on the Deer creek – Sinclair Blackwell 69KV line (515528)
GEN-2010-005	299.2	GE 1.6MW (533125, 533126)	Viola 345kV (532798)
ASGI-2010-006	150	GE 1.5MW (301382)	Remington 138kV (301369)
GEN-2010-055	4.8	GENROU (560391)	Wekiwa 138kV (509757)
GEN-2011-057	150.4	GE 1.6MW (583170)	Creswell 138kV (532981)
GEN-2012-023	115	Siemens 101m 2.3MW (583363)	Viola 345kV (532798)
GEN-2012-027	150.7	GE 1.62MW (583393)	Shidler 138kV (510403)
GEN-2012-032	298.3	Vestas V112 3.075MW (583433, 583436)	Tap Rose Hill-Sooner 345kV (562318)

Table I-2: Prior Queued Interconnection Requests

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2012-033	98.8	GE 1.62MW (583443)	Tap Bunch Creek-South 4th 138kV(562303)
GEN-2012-040	76.5	GE 1.7MW (583483)	Chilocco 138kV (521198)
GEN-2012-041	85.3 Summer 121.5 Winter	GENROU (583493)	Tap Rose Hill-Sooner 345kV (562318)
GEN-2013-009	100.0	Vestas V100 VCSS 2MW (583593)	Tap Alluwe Tap-Vinita Junction 138kV (560742)
GEN-2013-012	4 x 168.0MW Summer 4 x 215MW Winter	GENROU (514910, 514911, 514912, 514942)	Redbud 345kV (514909)
GEN-2013-028	516.4 Summer 559.5 Winter	GENROU (583743, 583746)	Tap on Tulsa N to GRDA1 345kV (562423)
GEN-2013-029	300	Vestas V100 VCSS 2MW (583753, 583756)	Renfrow 345kV(515543)

The study included a stability analysis of the interconnection request. Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping relays disabled. Also, a power factor analysis was performed on this project since it is a wind farm. The stability analysis was performed on four seasonal models, the modified versions of the 2014 winter peak, the 2015 summer peak, the 2019 light load, and the 2024 summer peak cases.

The stability analysis determines the impacts of the new interconnecting project on the stability and voltage recovery of the nearby systems and the ability of the interconnecting project to meet FERC Order 661A. If problems with stability or voltage recovery are identified, the need for reactive compensation or system upgrades is investigated. The three-phase faults and the single line-to-ground faults listed in Table III-1 were used in the stability analysis.

The power factor analysis determines the power factor at the point of interconnection for the wind interconnection project for pre-contingency and post-contingency conditions. The contingencies used in the power factor analysis were a subset of the stability analysis contingencies shown in Table III-1.

Nothing in this System Impact Study constitutes a request for transmission service or grants the Interconnection Customer any rights to transmission service.

II. Facilities

The GEN-2008-098 & GEN-2010-003 projects are to be collocated in Coffee County, Kansas and are each comprised of fifty (50) Gamesa G114-2.0MW wind turbine generators for a maximum nameplate capacity of 100.0MW and an aggregate of 200.0MW for both projects. Each turbine will be connected to a 34.5kV collector system that feeds a single shared 34.5/345kV substation transformer. This transformer will connect the Customer's 345kV transmission line to the Point of Interconnection (POI), a new switching station on the Westar Energy (WERE) Wolf Creek to LaCygne 345kV transmission line. A one-line drawing for the GEN-2008-098 & GEN-2010-003 generation interconnection requests are shown in Figure II-1.

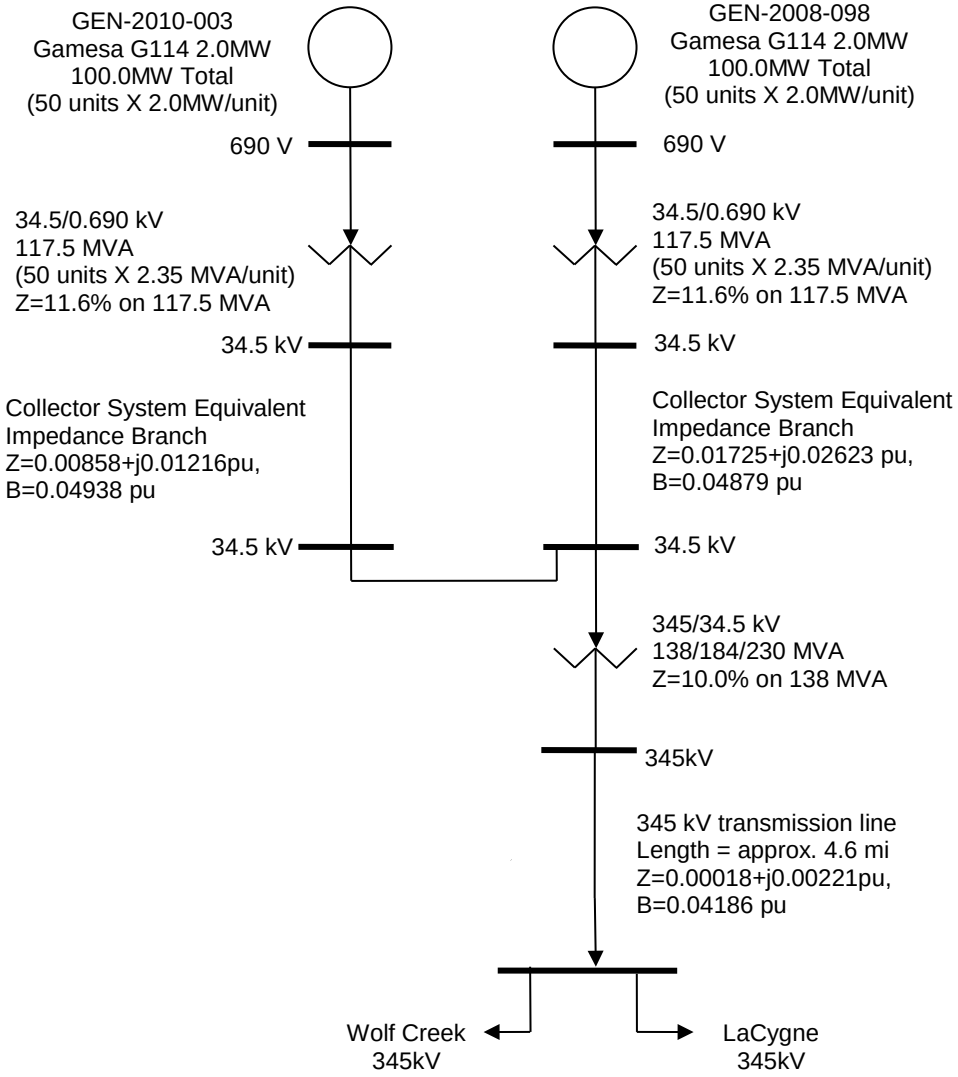

Figure II-1: GEN-2008-098 & GEN-2010-003 One-line Diagram

III. Stability Analysis

Transient stability analysis is used to determine if the transmission system can maintain angular stability and ensure bus voltages stay within planning criteria bandwidth during and after a disturbance while considering the addition of a generator interconnection request.

Model Preparation

Transient stability analysis was performed using modified versions of the 2013 series of Model Development Working Group (MDWG) dynamic study models including the 2014 winter peak, 2015 summer peak, 2019 light load, and the 2024 summer peak seasonal models. The cases are then loaded with prior queued interconnection requests and network upgrades assigned to those interconnection requests. Finally the prior queued and study generation are dispatched into the SPP footprint. Initial simulations are then carried out for a no-disturbance run of twenty (20) seconds to verify the numerical stability of the model.

Disturbances

One-hundred twenty-one (121) contingencies were identified for use in this study and are listed in Table III-1. These contingencies included three-phase faults and single-phase line faults at locations defined by SPP. Single-phase line faults were simulated by applying fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice.

Except for transformer faults, the typical sequence of events for a three-phase and a single-phase fault is as follows:

1. apply fault at particular location
2. continue fault for five (5) cycles, clear the fault by tripping the faulted facility
3. after an additional twenty (20) cycles, re-close the previous facility back into the fault
4. continue fault for five (5) additional cycles
5. trip the faulted facility and remove the fault

Transformer faults are typically modeled as three-phase faults, unless otherwise noted. The sequence of events for a transformer fault is as follows:

1. apply fault for five (5) cycles
2. clear the fault by tripping the affected transformer facility (unless otherwise noted there will be no re-closing into a transformer fault)

The control areas monitored are 520, 523, 524, 525, 536, 540, 541, and 544.

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
1	FLT_01_G08098TAP_WOLFCRK7_345kV_3PH_NR	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
2	FLT_02_G08098TAP_WOLFCRK7_345kV_1PH	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
3	FLT_03_G08098TAP_LACYGNE7_345kV_3PH_NR	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
4	FLT_04_G08098TAP_LACYGNE7_345kV_1PH	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
5	FLT_05_WOLFCRK7_ROSEHIL7_345kV_3PH	3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT_06_WOLFCRK7_ROSEHIL7_345kV_1PH	*Single phase fault and sequence like previous*
7	FLT_07_WOLFCRK7_BENTON7_345kV_3PH	3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT_08_WOLFCRK7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*
9	FLT_09_ROSEHIL7_BENTON7_345kV_3PH	3 phase fault on the Benton 345kV (Bus 532791) to Rose Hill 345kV (Bus 532794) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT_10_ROSEHIL7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*
11	FLT_11_ROSEHIL7_LATHAMS7_345kV_3PH	3 phase fault on the Lathams 345kV (Bus 532800) to Rose Hill 345kV (Bus 532794) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
12	FLT_12_ROSEHIL7_LATHAMS7_345kV_1PH	*Single phase fault and sequence like previous*
13	FLT_13_ROSEHIL7_G12032TAP_345kV_3PH	3 phase fault on the GEN-2012-032 Tap 345kV (Bus 562299) to Rose Hill 345kV (Bus 532794) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT_14_ROSEHIL7_G12032TAP_345kV_1PH	*Single phase fault and sequence like previous*
15	FLT_15_BENTON7_WICHITA7_345kV_3PH	3 phase fault on the Benton 345kV (Bus 532791) to Wichita 345KV (Bus 532796) CKT 1, near Benton. a. Apply fault at the Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT_16_BENTON7_WICHITA7_345kV_1PH	*Single phase fault and sequence like previous*
17	FLT_17_CANEYRV7_NEOSHO7_345kV_3PH	3 phase fault on the Caney River 345kV (Bus 532780) to Neosho 345V (Bus 532793) CKT 1, near Caney River. a. Apply fault at the Caney River 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT_18_CANEYRV7_NEOSHO7_345kV_1PH	*Single phase fault and sequence like previous*
19	FLT_19_G12041TAP_SOONER7_345kV_3PH	3 phase fault on the GEN-2012-041 Tap 345kV (Bus 562318) to Sooner 345kV (Bus 514803) CKT 1, near GEN-2012-041 Tap. a. Apply fault at the GEN-2012-041 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT_20_G12041TAP_SOONER7_345kV_1PH	*Single phase fault and sequence like previous*
21	FLT_21_LACYGNE7_WGRDNR7_345kV_3PH	3 phase fault on the LaCygne 345kV (Bus 542981) to West Gardner 345kV (Bus 542965) CKT 1, near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT_22_LACYGNE7_WGRDNR7_345kV_1PH	*Single phase fault and sequence like previous*
23	FLT_23_LACYGNE7_NEOSHO7_345kV_3PH	3 phase fault on the LaCygne 345kV (Bus 542981) to Neosho 345kV (Bus 532793) CKT 1, near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT_24_LACYGNE7_NEOSHO7_345kV_1PH	*Single phase fault and sequence like previous*

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
25	FLT_25_LACYGNE7_STILWEL7_345kV_3PH	3 phase fault on the LaCygne 345kV (Bus 542981) to Stilwell 345kV (Bus 542968) CKT 1, near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
26	FLT_26_LACYGNE7_STILWEL7_345kV_1PH	*Single phase fault and sequence like previous*
27	FLT_27_WGRDNR7_SWISVAL7_345kV_3PH	3 phase fault on the Swissvale 345kV (Bus 532774) to West Gardner 345kV (Bus 542965) CKT 1, near West Gardner. a. Apply fault at the West Gardner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT_28_WGRDNR7_SWISVAL7_345kV_1PH	*Single phase fault and sequence like previous*
29	FLT_29_WGRDNR7_STILWEL7_345kV_3PH	3 phase fault on the Stilwell 345kV (Bus 542968) to West Gardner 345kV (Bus 542965) CKT 1, near West Gardner. a. Apply fault at the West Gardner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT_30_WGRDNR7_STILWEL7_345kV_1PH	*Single phase fault and sequence like previous*
31	FLT_31_WGRDNR7_CRAIG7_345kV_3PH	3 phase fault on the Craig 345kV (Bus 542977) to West Gardner 345kV (Bus 542965) CKT 1, near West Gardner. a. Apply fault at the West Gardner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT_32_WGRDNR7_CRAIG7_345kV_1PH	*Single phase fault and sequence like previous*
33	FLT_33_SOONER7_WOODRNG7_345kV_3PH	3 phase fault on the Sooner 345kV (Bus 514803) to Woodring 345kV (Bus 514715) CKT 1, near Sooner. a. Apply fault at the Sooner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT_34_SOONER7_WOODRNG7_345kV_1PH	*Single phase fault and sequence like previous*
35	FLT_35_SOONER7_CLEVLND7_345kV_3PH	3 phase fault on the Cleveland 345kV (Bus 512694) to Sooner 345kV (Bus 514803) CKT 1, near Sooner. a. Apply fault at the Sooner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
36	FLT_36_SOONER7_CLEVLND7_345kV_1PH	*Single phase fault and sequence like previous*

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
37	FLT_37_WICHITA7_EMPEC7_345 kV_3PH	3 phase fault on the Emporia Energy Center 345kV (Bus 532768) to Wichita 345KV (Bus 532796) CKT 1, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
38	FLT_38_WICHITA7_EMPEC7_345 kV_1PH	*Single phase fault and sequence like previous*
39	FLT_39_WICHITA7_RENO7_345k V_3PH	3 phase fault on the Reno 345kV (Bus 532771) to Wichita 345KV (Bus 532796) CKT 1, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40	FLT_40_WICHITA7_RENO7_345k V_1PH	*Single phase fault and sequence like previous*
41	FLT_41_WICHITA7_VIOLA7_345k V_3PH	3 phase fault on the Viola 345kV (Bus 532798) to Wichita 345KV (Bus 532796) CKT 1, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
42	FLT_42_WICHITA7_VIOLA7_345k V_1PH	*Single phase fault and sequence like previous*
43	FLT_43_WICHITA7_THISTLE7_345 kV_3PH	3 phase fault on the Thistle 345kV (Bus 539801) to Wichita 345KV (Bus 532796) CKT 1, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
44	FLT_44_WICHITA7_THISTLE7_345 kV_1PH	*Single phase fault and sequence like previous*
45	FLT_45_NEOSHO7_7BLACKBERRY _345kV_3PH	3 phase fault on the Blackberry 345kV (Bus 300739) to Neosho 345kV (Bus 532793) CKT 1, near Neosho. a. Apply fault at the Neosho 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
46	FLT_46_NEOSHO7_7BLACKBERRY _345kV_1PH	*Single phase fault and sequence like previous*
47	FLT_47_NEOSHO7_DELWARE7_3 45kV_3PH	3 phase fault on the Delaware 345kV (Bus 510380) to Neosho 345kV (Bus 532793) CKT 1, near Neosho. a. Apply fault at the Neosho 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
48	FLT_48_NEOSHO7_DELWARE7_3 45kV_1PH	*Single phase fault and sequence like previous*

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
49	FLT_49_STILWEL7_PECULR7_345 kV_3PH	3 phase fault on the Peciliar 345kV (Bus 541198) to Stilwell 345kV (Bus 542968) CKT 1, near West Gardner. a. Apply fault at the West Gardner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
50	FLT_50_STILWEL7_PECULR7_345 kV_1PH	*Single phase fault and sequence like previous*
51	FLT_51_SWISVAL7_EMPEC7_345 kV_3PH	3 phase fault on the Emporia Energy Center 345kV (Bus 532768) to Swissvale 345kV (Bus 532774) CKT 1, near Swissvale. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
52	FLT_52_SWISVAL7_EMPEC7_345 kV_1PH	*Single phase fault and sequence like previous*
53	FLT_53_EMPEC7_MORRIS7_345k V_3PH	3 phase fault on the Emporia Energy Center 345kV (Bus 532768) to Morris County 345KV (Bus 532770) CKT 1, near Emporia Energy Center. a. Apply fault at the Emporia Energy Center 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
54	FLT_54_EMPEC7_MORRIS7_345k V_1PH	*Single phase fault and sequence like previous*
55	FLT_55_STILWEL7_STILWEL5_345 _161kV_3PH	3 phase fault on the Stilwell 345kV (Bus 542968) to Stilwell 161kV (Bus 542969) to Stilwell Tertiary 13.8kV (Bus 543647) CKT 11, near Stilwell 345kV. a. Apply fault at the Stilwell 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
56	FLT_56_WGRDNR7_WGARDNR5_ 345_161kV_3PH	3 phase fault on the West Gardner 345kV (Bus 542965) to West Gardner 161kV (Bus 542966) to West Gardner Tertiary 13.8kV (Bus 543649) CKT 11, near West Gardner 345kV. a. Apply fault at the West Gardner 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
57	FLT_57_SWISVAL7_SWISVAL6_34 5_230kV_3PH	3 phase fault on the Swissvale 345kV (Bus 532774) to Swissvale 230kV (Bus 532856) to Swissvale Tertiary 14.4kV (Bus 532815) CKT 1, near Swissvale 345kV. a. Apply fault at the Swissvale 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
58	FLT_58_NEOSHO7_NEOSHOS4_3 45_138kV_3PH	3 phase fault on the Neosho 345kV (Bus 532793) to Neosho 138kV (Bus 533020) to Neosho Tertiary 13.8kV (Bus 532824) CKT 1, near Neosho 345kV. a. Apply fault at the Neosho 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
59	FLT_59_ROSEHIL7_ROSEHIL4_34 5_138kV_3PH	3 phase fault on the Rose Hill 345kV (Bus 532794) to Rose Hill 138kV (Bus 533062) to Rose Hill Tertiary 13.8kV (Bus 532831) CKT 11, near Rose Hill 345kV. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
60	FLT_60_BENTON7_BENTON4_345_138kV_3PH	3 phase fault on the Benton 345kV (Bus 532791) to Benton 138kV (Bus 532986) to Benton Tertiary 13.8kV (Bus 532821) CKT 1, near Benton 345kV. a. Apply fault at the Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
61	FLT_61_WICHITA7_EVANSN4_345_138kV_3PH	3 phase fault on the Wichita 345kV (Bus 532796) to Gordon Evans 138kV (Bus 533040) to Wichita Tertiary 13.8kV (Bus 532829) CKT 1, near Wichita 345kV. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
62	FLT_62_WOLFCRK7_G08098TAP_345kV_3PH_NR_475CC	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 4.75 cycles by tripping the faulted line.
63	FLT_63_WOLFCRK7_G08098TAP_345kV_1PH	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
64	FLT_64_WOLFCRK7_BENTON7_345kV_3PH	3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
65	FLT_65_WOLFCRK7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*
66	FLT_66_WOLFCRK7_ROSEHIL7_345kV_3PH	3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
67	FLT_67_WOLFCRK7_ROSEHIL7_345kV_1PH	*Single phase fault and sequence like previous*
68	FLT_68_G08098TAP_WOLFCRK7_345kV_3PH_NR	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
69	FLT_69_G08098TAP_WOLFCRK7_345kV_1PH	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
70	FLT_70_G08098TAP_LACYGNE7_345kV_3PH_NR	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
71	FLT_71_G08098TAP_LACYGNE7_345kV_1PH	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
72	FLT_72_LACYGNE7_G08098TAP_345kV_3PH	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
73	FLT_73_LACYGNE7_G08098TAP_345kV_1PH	*Single phase fault and sequence like previous*
74	FLT_74_BENTON7_WOLFCRK7_345kV_3PH	3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton. a. Apply fault at the Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
75	FLT_75_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
76	FLT_76_ROSEHIL7_WOLFCRK7_345kV_3PH	3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
77	FLT_77_ROSEHIL7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
78	FLT_78_POC1_WOLFCRK7_BENTON7_345kV_3PH_NR	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
79	FLT_79_POC1_WOLFCRK7_BENTON7_345kV_1PH	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
80	FLT_80_POC1_WOLFCRK7_ROSEHIL7_345kV_3PH_NR	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
81	FLT_81_POC1_WOLFCRK7_ROSEHIL7_345kV_1PH	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
82	FLT_82_POC1_BENTON7_WOLFCRK7_345kV_3PH	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton. a. Apply fault at the Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
83	FLT_83_POC1_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
84	FLT_84_POC1_ROSEHIL7_WOLFCRK7_345kV_3PH_NR	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
85	FLT_85_POC1_ROSEHIL7_WOLFCRK7_345kV_1PH	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
86	FLT_86_POC2_WOLFCRK7_G08098TAP_345kV_3PH	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault. e. Trip generation projects GEN-2008-098 & GEN-2010-003.
87	FLT_87_POC2_WOLFCRK7_G08098TAP_345kV_1PH	*Single phase fault and sequence like previous*
88	FLT_88_POC2_WOLFCRK7_BENTON7_345kV_3PH_NR	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
89	FLT_89_POC2_WOLFCRK7_BENTON7_345kV_1PH	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
90	FLT_90_POC2_WOLFCRK7_ROSEHIL7_345kV_3PH_NR	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
91	FLT_91_POC2_WOLFCRK7_ROSEHIL7_345kV_1PH	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
92	FLT_92_POC2_G08098TAP_WOLFCRK7_345kV_3PH	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault. e. Trip generation projects GEN-2008-098 & GEN-2010-003.
93	FLT_93_POC2_G08098TAP_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
94	FLT_94_POC2_BENTON7_WOLFCRK7_345kV_3PH	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton. a. Apply fault at the Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
95	FLT_95_POC2_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
96	FLT_96_POC2_ROSEHIL7_WOLFCRK7_345kV_3PH	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
97	FLT_97_POC2_ROSEHIL7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
98	FLT_98_POC3_WOLFCRK7_G08098TAP_345kV_3PH_NR	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
99	FLT_99_POC3_WOLFCRK7_G08098TAP_345kV_1PH	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
100	FLT_100_POC3_WOLFCRK7_BENTON7_345kV_3PH	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
101	FLT_101_POC3_WOLFCRK7_BENTON7_345kV_1PH	*Single phase fault and sequence like previous*
102	FLT_102_POC3_G08098TAP_WOLFCRK7_345kV_3PH_NR	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
103	FLT_103_POC3_G08098TAP_WOLFCRK7_345kV_1PH	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
104	FLT_104_POC3_BENTON7_WOLFCRK7_345kV_3PH	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton. a. Apply fault at the Benton 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
105	FLT_105_POC3_BENTON7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
106	FLT_106_POC3_G08098TAP_LACYGNE7_345kV_3PH_NR	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
107	FLT_107_POC3_G08098TAP_LACYGNE7_345kV_1PH	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
108	FLT_108_POC3_LACYGNE7_G08098TAP_345kV_3PH_NR	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
109	FLT_109_POC3_LACYGNE7_G08098TAP_345kV_1PH	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
110	FLT_110_POC4_WOLFCRK7_G08098TAP_345kV_3PH_NR	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
111	FLT_111_POC4_WOLFCRK7_G08098TAP_345kV_1PH	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
112	FLT_112_POC4_WOLFCRK7_ROSEHIL7_345kV_3PH	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek. a. Apply fault at the Wolf Creek 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
113	FLT_113_POC4_WOLFCRK7_ROSEHIL7_345kV_1PH	*Single phase fault and sequence like previous*

Table III-1: Contingencies Evaluated

Cont. No.	Contingency Name	Description
114	FLT_114_POC4_G08098TAP_WOLFCRK7_345kV_3PH_NR	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
115	FLT_115_POC4_G08098TAP_WOLFCRK7_345kV_1PH	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
116	FLT_116_POC4_ROSEHIL7_WOLFCRK7_345kV_3PH	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill. a. Apply fault at the Rose Hill 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
117	FLT_117_POC4_ROSEHIL7_WOLFCRK7_345kV_1PH	*Single phase fault and sequence like previous*
118	FLT_118_POC4_G08098TAP_LACYGNE7_345kV_3PH_NR	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line.
119	FLT_119_POC4_G08098TAP_LACYGNE7_345kV_1PH	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap. a. Apply fault at the GEN-2008-098 Tap 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
120	FLT_120_POC4_LACYGNE7_G08098TAP_345kV_3PH	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne. a. Apply fault at the LaCygne 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
121	FLT_121_POC4_LACYGNE7_G08098TAP_345kV_1PH	*Single phase fault and sequence like previous*

Results

The stability analysis was performed and the results are summarized in Table III-2.

Based on the dynamic results and with all project and network upgrades in service, there were no stability problems found during any of the simulations. No generators tripped or went unstable, and voltages recovered to acceptable levels.

Table III-2: Stability Analysis Results

	Contingency Number and Summary	2014WP	2015SP	2019LL	2024SP
1	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK[1]	OK[1]	OK[1]	OK[1]
2	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
3	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK[1]	OK[1]	OK[1]	OK[1]
4	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
5	3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
6	*Single phase fault and sequence like previous*	OK	OK	OK	OK
7	3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
8	*Single phase fault and sequence like previous*	OK	OK	OK	OK
9	3 phase fault on the Benton 345kV (Bus 532791) to Rose Hill 345kV (Bus 532794) CKT 1, near Rose Hill.	OK	OK	OK	OK
10	*Single phase fault and sequence like previous*	OK	OK	OK	OK
11	3 phase fault on the Lathams 345kV (Bus 532800) to Rose Hill 345kV (Bus 532794) CKT 1, near Rose Hill.	OK	OK	OK	OK
12	*Single phase fault and sequence like previous*	OK	OK	OK	OK
13	3 phase fault on the GEN-2012-032 Tap 345kV (Bus 562299) to Rose Hill 345kV (Bus 532794) CKT 1, near Rose Hill.	OK	OK	OK	OK
14	*Single phase fault and sequence like previous*	OK	OK	OK	OK
15	3 phase fault on the Benton 345kV (Bus 532791) to Wichita 345KV (Bus 532796) CKT 1, near Benton.	OK	OK	OK	OK
16	*Single phase fault and sequence like previous*	OK	OK	OK	OK
17	3 phase fault on the Caney River 345kV (Bus 532780) to Neosho 345V (Bus 532793) CKT 1, near Caney River.	OK	OK	OK	OK
18	*Single phase fault and sequence like previous*	OK	OK	OK	OK
19	3 phase fault on the GEN-2012-041 Tap 345kV (Bus 562318) to Sooner 345kV (Bus 514803) CKT 1, near GEN-2012-041 Tap.	OK	OK	OK	OK
20	*Single phase fault and sequence like previous*	OK	OK	OK	OK
21	3 phase fault on the LaCygne 345kV (Bus 542981) to West Gardner 345kV (Bus 542965) CKT 1, near LaCygne.	OK	OK	OK	OK
22	*Single phase fault and sequence like previous*	OK	OK	OK	OK
23	3 phase fault on the LaCygne 345kV (Bus 542981) to Neosho 345kV (Bus 532793) CKT 1, near LaCygne.	OK	OK	OK	OK
24	*Single phase fault and sequence like previous*	OK	OK	OK	OK
25	3 phase fault on the LaCygne 345kV (Bus 542981) to Stilwell 345kV (Bus 542968) CKT 1, near LaCygne.	OK	OK	OK	OK
26	*Single phase fault and sequence like previous*	OK	OK	OK	OK

Table III-2: Stability Analysis Results

	Contingency Number and Summary	2014WP	2015SP	2019LL	2024SP
27	3 phase fault on the Swissvale 345kV (Bus 532774) to West Gardner 345kV (Bus 542965) CKT 1, near West Gardner.	OK	OK	OK	OK
28	*Single phase fault and sequence like previous*	OK	OK	OK	OK
29	3 phase fault on the Stilwell 345kV (Bus 542968) to West Gardner 345kV (Bus 542965) CKT 1, near West Gardner.	OK	OK	OK	OK
30	*Single phase fault and sequence like previous*	OK	OK	OK	OK
31	3 phase fault on the Craig 345kV (Bus 542977) to West Gardner 345kV (Bus 542965) CKT 1, near West Gardner.	OK	OK	OK	OK
32	*Single phase fault and sequence like previous*	OK	OK	OK	OK
33	3 phase fault on the Sooner 345kV (Bus 514803) to Woodring 345kV (Bus 514715) CKT 1, near Sooner.	OK	OK	OK	OK
34	*Single phase fault and sequence like previous*	OK	OK	OK	OK
35	3 phase fault on the Cleveland 345kV (Bus 512694) to Sooner 345kV (Bus 514803) CKT 1, near Sooner.	OK	OK	OK	OK
36	*Single phase fault and sequence like previous*	OK	OK	OK	OK
37	3 phase fault on the Emporia Energy Center 345kV (Bus 532768) to Wichita 345KV (Bus 532796) CKT 1, near Wichita.	OK	OK	OK	OK
38	*Single phase fault and sequence like previous*	OK	OK	OK	OK
39	3 phase fault on the Reno 345kV (Bus 532771) to Wichita 345KV (Bus 532796) CKT 1, near Wichita.	OK	OK	OK	OK
40	*Single phase fault and sequence like previous*	OK	OK	OK	OK
41	3 phase fault on the Viola 345kV (Bus 532798) to Wichita 345KV (Bus 532796) CKT 1, near Wichita.	OK	OK	OK	OK
42	*Single phase fault and sequence like previous*	OK	OK	OK	OK
43	3 phase fault on the Thistle 345kV (Bus 539801) to Wichita 345KV (Bus 532796) CKT 1, near Wichita.	OK	OK	OK	OK
44	*Single phase fault and sequence like previous*	OK	OK	OK	OK
45	3 phase fault on the Blackberry 345kV (Bus 300739) to Neosho 345kV (Bus 532793) CKT 1, near Neosho.	OK	OK	OK	OK
46	*Single phase fault and sequence like previous*	OK	OK	OK	OK
47	3 phase fault on the Delaware 345kV (Bus 510380) to Neosho 345kV (Bus 532793) CKT 1, near Neosho.	OK	OK	OK	OK
48	*Single phase fault and sequence like previous*	OK	OK	OK	OK
49	3 phase fault on the Peciliar 345kV (Bus 541198) to Stilwell 345kV (Bus 542968) CKT 1, near West Gardner.	OK	OK	OK	OK
50	*Single phase fault and sequence like previous*	OK	OK	OK	OK
51	3 phase fault on the Emporia Energy Center 345kV (Bus 532768) to Swissvale 345kV (Bus 532774) CKT 1, near Swissvale.	OK	OK	OK	OK
52	*Single phase fault and sequence like previous*	OK	OK	OK	OK
53	3 phase fault on the Emporia Energy Center 345kV (Bus 532768) to Morris County 345KV (Bus 532770) CKT 1, near Emporia Energy Center.	OK	OK	OK	OK
54	*Single phase fault and sequence like previous*	OK	OK	OK	OK
55	3 phase fault on the Stilwell 345kV (Bus 542968) to Stilwell 161kV (Bus 542969) to Stilwell Tertiary 13.8kV (Bus 543647) CKT 11, near Stilwell 345kV.	OK	OK	OK	OK
56	3 phase fault on the West Gardner 345kV (Bus 542965) to West Gardner 161kV (Bus 542966) to West Gardner Tertiary 13.8kV (Bus 543649) CKT 11, near West Gardner 345kV.	OK	OK	OK	OK

Table III-2: Stability Analysis Results

	Contingency Number and Summary	2014WP	2015SP	2019LL	2024SP
57	3 phase fault on the Swissvale 345kV (Bus 532774) to Swissvale 230kV (Bus 532856) to Swissvale Tertiary 14.4kV (Bus 532815) CKT 1, near Swissvale 345kV.	OK	OK	OK	OK
58	3 phase fault on the Neosho 345kV (Bus 532793) to Neosho 138kV (Bus 533020) to Neosho Tertiary 13.8kV (Bus 532824) CKT 1, near Neosho 345kV.	OK	OK	OK	OK
59	3 phase fault on the Rose Hill 345kV (Bus 532794) to Rose Hill 138kV (Bus 533062) to Rose Hill Tertiary 13.8kV (Bus 532831) CKT 11, near Rose Hill 345kV.	OK	OK	OK	OK
60	3 phase fault on the Benton 345kV (Bus 532791) to Benton 138kV (Bus 532986) to Benton Tertiary 13.8kV (Bus 532821) CKT 1, near Benton 345kV.	OK	OK	OK	OK
61	3 phase fault on the Wichita 345kV (Bus 532796) to Gordon Evans 138kV (Bus 533040) to Wichita Tertiary 13.8kV (Bus 532829) CKT 1, near Wichita 345kV.	OK	OK	OK	OK
62	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK[1]	OK[2]	OK[1]	OK[1]
63	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
64	3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
65	*Single phase fault and sequence like previous*	OK	OK	OK	OK
66	3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
67	*Single phase fault and sequence like previous*	OK	OK	OK	OK
68	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK[1]	OK[1]	OK[1]	OK[1]
69	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
70	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK[1]	OK[1]	OK[1]	OK[1]
71	Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
72	3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne.	OK	OK	OK	OK
73	*Single phase fault and sequence like previous*	OK	OK	OK	OK
74	3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton.	OK	OK	OK	OK
75	*Single phase fault and sequence like previous*	OK	OK	OK	OK
76	3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill.	OK	OK	OK	OK
77	*Single phase fault and sequence like previous*	OK	OK	OK	OK
78	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK[1]	OK[1]	OK[1]	OK[1]
79	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK

Table III-2: Stability Analysis Results

	Contingency Number and Summary	2014WP	2015SP	2019LL	2024SP
80	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK[1]	OK[1]	OK[1]	OK[1]
81	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
82	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton.	OK	OK	OK	OK
83	*Single phase fault and sequence like previous*	OK	OK	OK	OK
84	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill.	OK	OK[1]	OK	OK
85	**Prior Outage of Wolf Creek to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill.	OK	OK	OK	OK
86	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
87	*Single phase fault and sequence like previous*	OK	OK	OK	OK
88	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK[1]	OK[1]	OK[1]	OK[1]
89	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
90	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK[1]	OK[1]	OK[1]	OK[1]
91	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
92	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
93	*Single phase fault and sequence like previous*	OK	OK	OK	OK
94	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton.	OK	OK	OK	OK
95	*Single phase fault and sequence like previous*	OK	OK	OK	OK

Table III-2: Stability Analysis Results

	Contingency Number and Summary	2014WP	2015SP	2019LL	2024SP
96	**Prior Outage of LaCygne to GEN-2008-098 Tap Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill.	OK	OK	OK	OK
97	*Single phase fault and sequence like previous*	OK	OK	OK	OK
98	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK[1]	OK[1]	OK[1]	OK[1]
99	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
100	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
101	*Single phase fault and sequence like previous*	OK	OK	OK	OK
102	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK[1]	OK[1]	OK[1]	OK[1]
103	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
104	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Benton 345kV (Bus 532791) to Wolf Creek 345KV (Bus 532797) CKT 1, near Benton.	OK	OK	OK	OK
105	*Single phase fault and sequence like previous*	OK	OK	OK	OK
106	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK[1]	OK[1]	OK[1]	OK[1]
107	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
108	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne.	OK[1]	OK[1]	OK	OK
109	**Prior Outage of Wolf Creek to Rose Hill Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne.	OK	OK	OK	OK
110	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK[1]	OK[1]	OK[1]	OK[1]

Table III-2: Stability Analysis Results

	Contingency Number and Summary	2014WP	2015SP	2019LL	2024SP
111	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
112	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Wolf Creek.	OK	OK	OK	OK
113	*Single phase fault and sequence like previous*	OK	OK	OK	OK
114	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK	OK[1]	OK	OK
115	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to Wolf Creek 345KV (Bus 532797) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
116	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on the Rose Hill 345kV (Bus 532794) to Wolf Creek 345KV (Bus 532797) CKT 1, near Rose Hill.	OK	OK	OK	OK
117	*Single phase fault and sequence like previous*	OK	OK	OK	OK
118	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK[1]	OK[1]	OK[1]	OK
119	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** Single phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near GEN-2008-098 Tap.	OK	OK	OK	OK
120	**Prior Outage of Wolf Creek to Benton Ckt 1 & Wolf Creek output reduced to 800MW net.** 3 phase fault on GEN-2008-098 Tap 345kV (Bus 560004) to LaCygne 345KV (Bus 542981) CKT 1, near LaCygne.	OK	OK	OK	OK
121	*Single phase fault and sequence like previous*	OK	OK	OK	OK

[1]The typical sequence of events for these three phase faults resulted in violations of the transient voltage recovery requirement. A three-phase fault with duration of five (5) cycles was simulated without a reclose of the faulted equipment.

[2]The typical sequence of events for this three phase fault resulted in violations of the transient voltage recovery requirement. A three-phase fault with a duration of four and three-quarter (4.75) cycles was simulated without a reclose of the faulted equipment.

The stability results exhibited large, lightly damped, oscillations for disturbances near Wolf Creek Generating Station. For the system intact conditions, the oscillations with the largest signal amplitudes were observed with the contingency FLT_03_G08098TAP_LACYGNE7_345kV_3PH_NR. For the prior outage conditions with Wolf Creek reduced to 800MW (net output), the oscillations with the largest signal amplitudes were observed with the contingency FLT_108_POC3_LACYGNE7-_G08098TAP_345kV_3PH_NR. The plots of Wolf Creek Generating Station substation voltage, rotor angle, and power output for these disturbances are provided in appendix A.

The Southwest Power Pool Disturbance Performance Requirements, approved by the Transmission Working Group at the August 2013 meeting, established minimum requirements for machine rotor angle damping and transient voltage recovery. These requirements specify that Machine Rotor Angles shall exhibit well damped angular oscillations and acceptable power swings following a disturbance on the Bulk Electric System for all NERC Category A, B and C events. The machine rotor angle damping ratio may be determined by appropriate modal analysis (i.e. Prony Analysis) where the following equivalent requirement must be met: Damping Ratio ≥ 0.0081633 (0.81633%).

A modal analysis was performed for these two disturbances (FLT_03 & FLT_108) to ensure adequate damping to meet the SPP disturbance performance requirements. The modes were calculated using the Siemens PTI PSS/E auxiliary program PSSPLT on the time interval from 1 to 20 Seconds with the Fit by Least Squares calculation method. The modes that have a magnitude relative to the oscillation amplitude and exhibit a small damping ratio are the modes which result in a lightly damped response. The modal eigenvalues and eigenvectors of Wolf Creek Generation Station substation voltage, rotor angle and power output are shown in Table III-3. The modes shown include those with larger magnitudes (cutoff of 0.01) and exhibit the smaller damping ratios (cutoff of 5%).

These results indicate that SPP disturbance performance requirement, Damping Ratio ≥ 0.81633%, is met with the smallest Damping Ratio calculated at 1.059%.

The Damping Ratio (ζ) is calculated by the following equation:

$$\zeta = \frac{-\sigma}{\sqrt{\sigma^2 + \omega^2}}$$

Where:

$$\sigma = real\ part\ of\ the\ eigenvalue$$
$$\omega = imaginary\ part\ of\ the\ eigenvalue$$

Table III-3: Modal Analysis Results

Cont. Num.	Channel	Season	Eigenvalue Real	Imaginary	Magnitude	Angle	Damping Ratio	Freq. (HZ)
3	ANGL532751[WCGS U1 25.000]1	2014WP	-0.137529	5.34716	13.638	163.34	2.571%	0.851
3	ANGL532751[WCGS U1 25.000]1	2014WP	-0.132788	6.37378	0.027505	-129.24	2.083%	1.014
108	ANGL532751[WCGS U1 25.000]1	2014WP	-0.11361	4.33464	24.067	51.66	2.620%	0.69
108	ANGL532751[WCGS U1 25.000]1	2014WP	-0.131062	7.28362	0.26303	-33.51	1.799%	1.159
3	ANGL532751[WCGS U1 25.000]1	2015SP	-0.13414	5.35126	18.719	148.41	2.506%	0.852
108	ANGL532751[WCGS U1 25.000]1	2015SP	-0.141423	4.59025	21.707	34.91	3.079%	0.731
3	ANGL532751[WCGS U1 25.000]1	2019LL	-0.0749848	5.13114	13.524	143.23	1.461%	0.817
108	ANGL532751[WCGS U1 25.000]1	2019LL	-0.10634	4.37686	22.579	35.89	2.429%	0.697
3	ANGL532751[WCGS U1 25.000]1	2024SP	-0.185896	5.38939	25.532	142.76	3.447%	0.858
3	ANGL532751[WCGS U1 25.000]1	2024SP	-0.154298	5.60284	3.5215	33.06	2.753%	0.892
3	ANGL532751[WCGS U1 25.000]1	2024SP	-0.103844	8.00192	0.042959	58.74	1.298%	1.274
108	ANGL532751[WCGS U1 25.000]1	2024SP	-0.185019	4.54165	30.992	29.68	4.070%	0.723
108	ANGL532751[WCGS U1 25.000]1	2024SP	-0.275369	8.33121	1.3201	85.61	3.303%	1.326
108	ANGL532751[WCGS U1 25.000]1	2024SP	-0.101727	4.22913	0.77469	-22.07	2.405%	0.673
03	POWR532751[WCGS U1 25.000]1	2014WP	-0.138225	5.35164	2.2072	161	2.582%	0.852

Table III-3: Modal Analysis Results

Cont. Num.	Channel	Season	Real	Imaginary	Eigenvalue Magnitude	Angle	Damping Ratio	Freq. (HZ)
108	POWR532751[WCGS U1 25.000]1	2014WP	-0.113	4.34177	2.4571	42.87	2.602%	0.691
03	POWR532751[WCGS U1 25.000]1	2015SP	-0.136356	5.34572	2.8107	156.56	2.550%	0.851
03	POWR532751[WCGS U1 25.000]1	2015SP	-0.072385	6.83218	0.027965	62.97	1.059%	1.087
108	POWR532751[WCGS U1 25.000]1	2015SP	-0.145772	4.59211	2.3575	34.69	3.173%	0.731
03	POWR532751[WCGS U1 25.000]1	2019LL	-0.0731931	5.13314	2.0404	141.7	1.426%	0.817
03	POWR532751[WCGS U1 25.000]1	2019LL	-0.10948	7.83205	0.021008	28.7	1.398%	1.247
108	POWR532751[WCGS U1 25.000]1	2019LL	-0.105996	4.37707	2.2452	36.15	2.421%	0.697
03	POWR532751[WCGS U1 25.000]1	2024SP	-0.201583	5.37587	4.4007	158.55	3.747%	0.856
108	POWR532751[WCGS U1 25.000]1	2024SP	-0.178447	4.54283	2.9716	28.69	3.925%	0.723
108	POWR532751[WCGS U1 25.000]1	2024SP	-0.251842	8.27279	0.50802	30.51	3.043%	1.317
3	VOLT 532797 [WOLFCRK7 345.00]	2014WP	-0.140559	5.35026	0.058203	-10.35	2.626%	0.852
108	VOLT 532797 [WOLFCRK7 345.00]	2014WP	-0.114678	4.33546	0.0885	-118.96	2.644%	0.69
3	VOLT 532797 [WOLFCRK7 345.00]	2015SP	-0.134029	5.34894	0.072805	-21.93	2.505%	0.851
108	VOLT 532797 [WOLFCRK7 345.00]	2015SP	-0.147852	4.59062	0.083921	-135.31	3.219%	0.731
3	VOLT 532797 [WOLFCRK7 345.00]	2019LL	-0.0761415	5.13221	0.05956	-29.02	1.483%	0.817
108	VOLT 532797 [WOLFCRK7 345.00]	2019LL	-0.106275	4.37693	0.084798	-132.08	2.427%	0.697
3	VOLT 532797 [WOLFCRK7 345.00]	2024SP	-0.189673	5.38372	0.097577	-23.63	3.521%	0.857
3	VOLT 532797 [WOLFCRK7 345.00]	2024SP	-0.178919	5.60539	0.020218	-148.1	3.190%	0.892
108	VOLT 532797 [WOLFCRK7 345.00]	2024SP	-0.207638	4.54758	0.12002	-158.72	4.561%	0.724
108	VOLT 532797 [WOLFCRK7 345.00]	2024SP	-0.150661	4.43835	0.024772	-12.44	3.393%	0.706

FERC LVRT Compliance

FERC Order #661A places specific requirements on wind farms through its Low Voltage Ride Through (LVRT) provisions. For Interconnection Agreements signed after December 31, 2006, wind farms shall stay on line for faults at the POI that draw the voltage down at the POI to 0.0 pu.

Contingencies 1, 3, 68, 70, 102, 106, 114, and 118 in Table III-2 simulated the LVRT contingencies. GEN-2008-098 & GEN-2010-003 met the LVRT requirements by staying on line and the transmission system remained stable.

IV. Power Factor Analysis

A power factor analysis was performed in this study and the facility will be required to maintain a 95% lagging (providing VARs) and 95% leading (absorbing VARs) power factor at the point of interconnection. The Customer is responsible for maintaining a 95% power factor at the point of interconnection. Additional capacitor banks or other reactive equipment may be required to meet this requirement depending on the design of the Generating Facility and its collector system.

Per FERC and SPP Tariff requirements, if the power factor needed to maintain scheduled voltage is less than 0.95 lagging, then the requirement is limited to 0.95 lagging. The lower limit for leading power factor requirement is also 0.95. If a project never operated leading under any contingency, then the leading requirement is set to 1.0. The same applies on the lagging side.

The final power factor requirements are shown in Table IV-1 below. These are only the minimum power factor ranges based on steady-state analysis.

Table IV-1: Power Factor Requirements [a]

Request	Size (MW)	Generator Model	Point of Interconnection	Final PF Requirement	
				Lagging [b]	Leading [c]
GEN-2008-098	100.0	Gamesa G114 2.0MW	Wolf Creek – LaCygne 345kV	0.950 [d]	0.950 [d]
GEN-2010-003	100.0	Gamesa G114 2.0MW	Wolf Creek – LaCygne 345kV	0.950 [d]	0.950 [d]

Notes:

a. For each plant, the table shows the minimum required power factor capability at the point of interconnection that must be designed and installed with the plant. The power factor capability at the POI includes the net effect of the generators, transformers, line impedances, and any reactive compensation devices installed on the plant side of the meter. Installing more capability than the minimum requirement is acceptable.

b. Lagging is when the generating plant is supplying reactive power to the transmission grid, like a shunt capacitor. In this situation, the alternating current sinusoid "lags" behind the alternating voltage sinusoid, meaning that the current peaks shortly after the voltage.

c. Leading is when the generating plant is taking reactive power from the transmission grid, like a shunt reactor. In this situation, the alternating current sinusoid "leads" the alternating voltage sinusoid, meaning that the current peaks shortly before the voltage.

d. Electrical need is lower, but PF requirement limited to 0.95 by FERC order.

V. Conclusion

The SPP GEN-2008-098 & GEN-2010-003 Impact Restudy evaluated the impact of interconnecting the projects shown below.

Table V-1: Interconnection Requests

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2008-098	100.0	Gamesa G114 2.0MW (572094) (50 turbines)	Tap on the Wolf Creek (532797) – LaCygne (542981) 345kV (560004)
GEN-2010-003	100.0	Gamesa G114 2.0MW (577200) (50 turbines)	Tap on the Wolf Creek (532797) – LaCygne (542981) 345kV (560004)

With all Base Case Network Upgrades in service and previously assigned Network Upgrades in service, the GEN-2008-098 & GEN-2010-003 projects were found to remain on line, and the transmission system was found to remain stable for all conditions studied.

The power factor analysis showed that the GEN-2008-098 & GEN-2010-003 projects are required to maintain a power factor requirement of the pro-forma standard 0.95 leading (absorbing) to 0.95 lagging (supplying) at the Point of Interconnection.

Low Voltage Ride Through (LVRT) analysis showed the study generators did not trip offline due to low voltage when all Network Upgrades are in service.

All generators in the monitored areas remained stable for all of the modeled disturbances.

Any changes to the assumptions made in this study, for example, one or more of the previously queued requests withdraw, may require a re-study at the expense of the Customer.

Nothing in this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service.

APPENDIX A

PLOTS
(Additional Plots Available upon request)

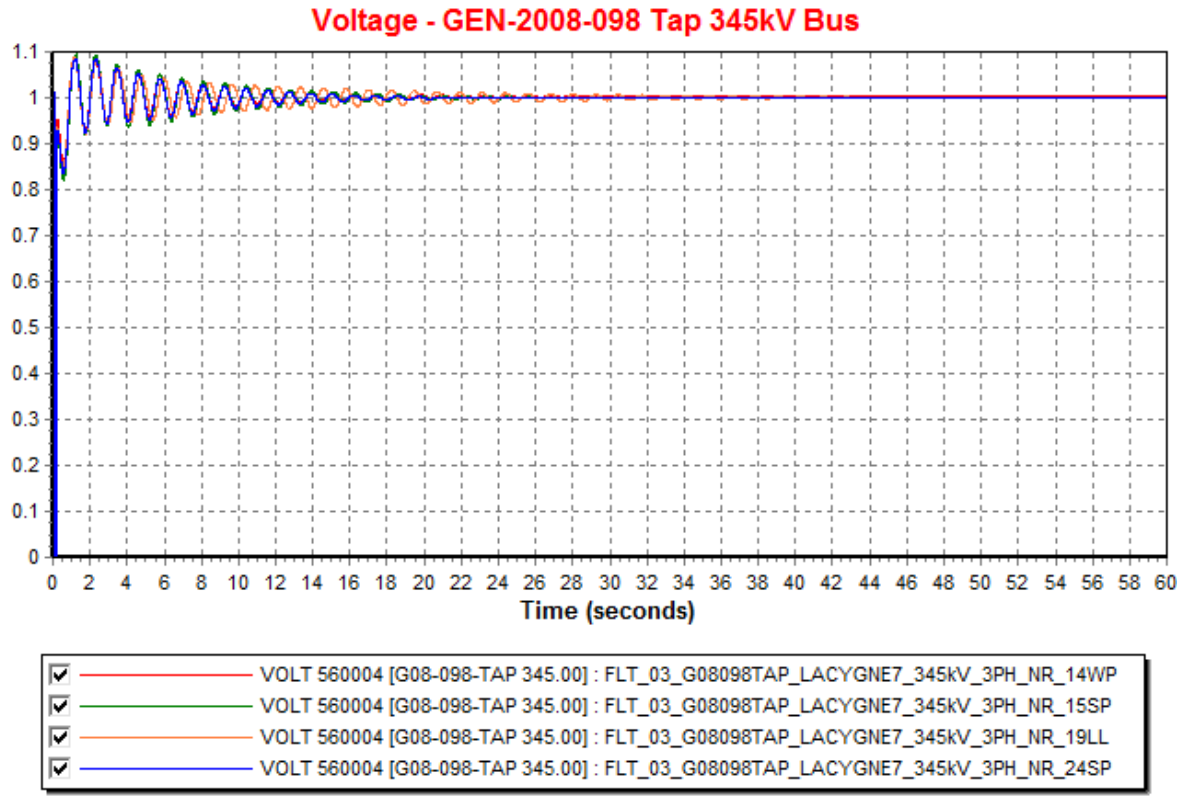

Figure A-1: GEN-2008-098 & GEN-2010-003 345kV POI Voltage with Outage of GEN-2008-098 to LaCygne 345kV Circuit

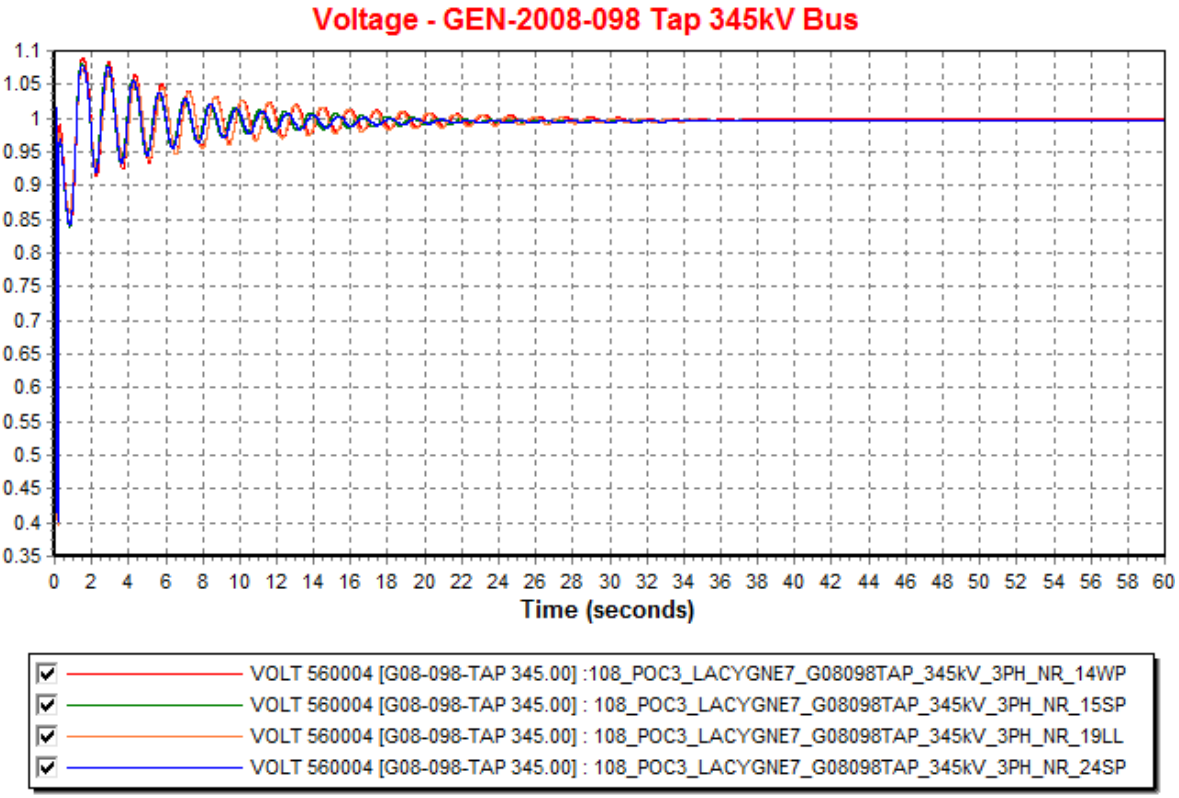

Figure A-2: GEN-2008-098 & GEN-2010-003 345kV POI Voltage with Prior Outage of Wolf Creek to Rose Hill Circuit & Wolf Creek output reduced to 800MW net for Outage of GEN-2008-098 to LaCygne 345kV Circuit

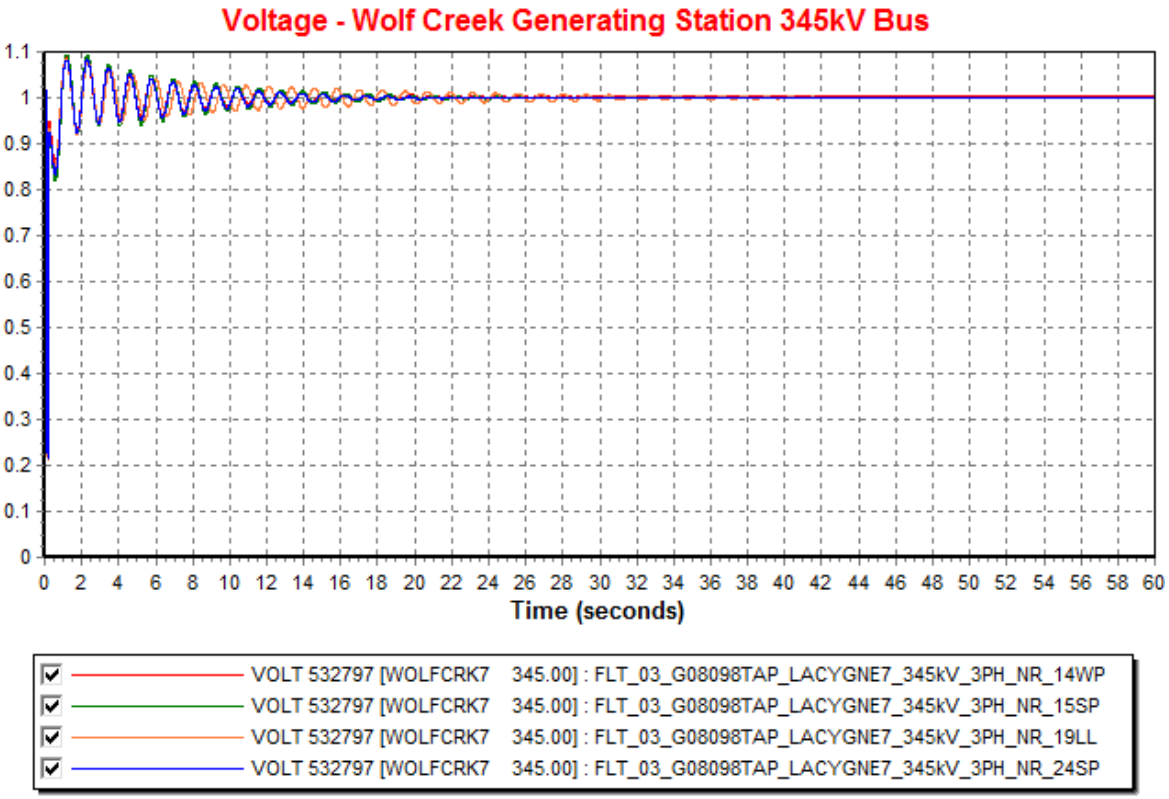

Figure A-3: Wolf Creek 345kV Bus Voltage with Outage of GEN-2008-098 to LaCygne 345kV Circuit

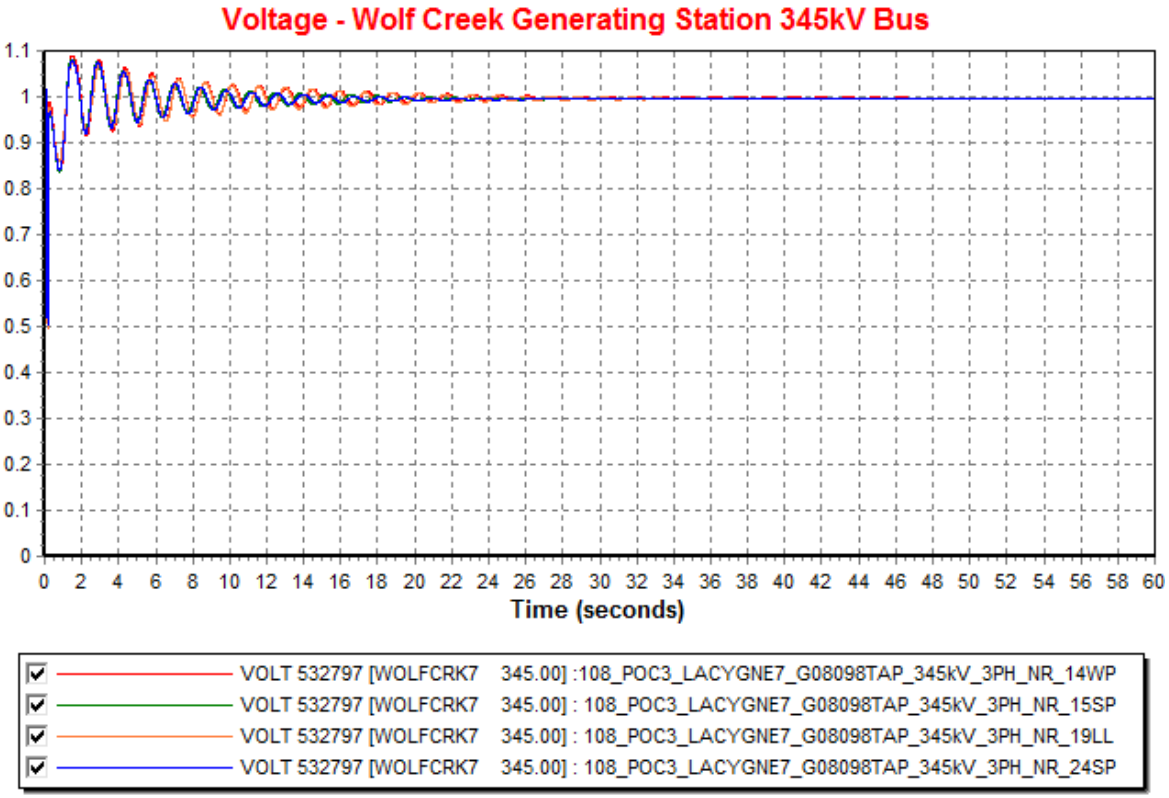

Figure A-4: Wolf Creek 345kV Bus Voltage with Prior Outage of Wolf Creek to Rose Hill Circuit & Wolf Creek output reduced to 800MW net for Outage of GEN-2008-098 to LaCygne 345kV Circuit

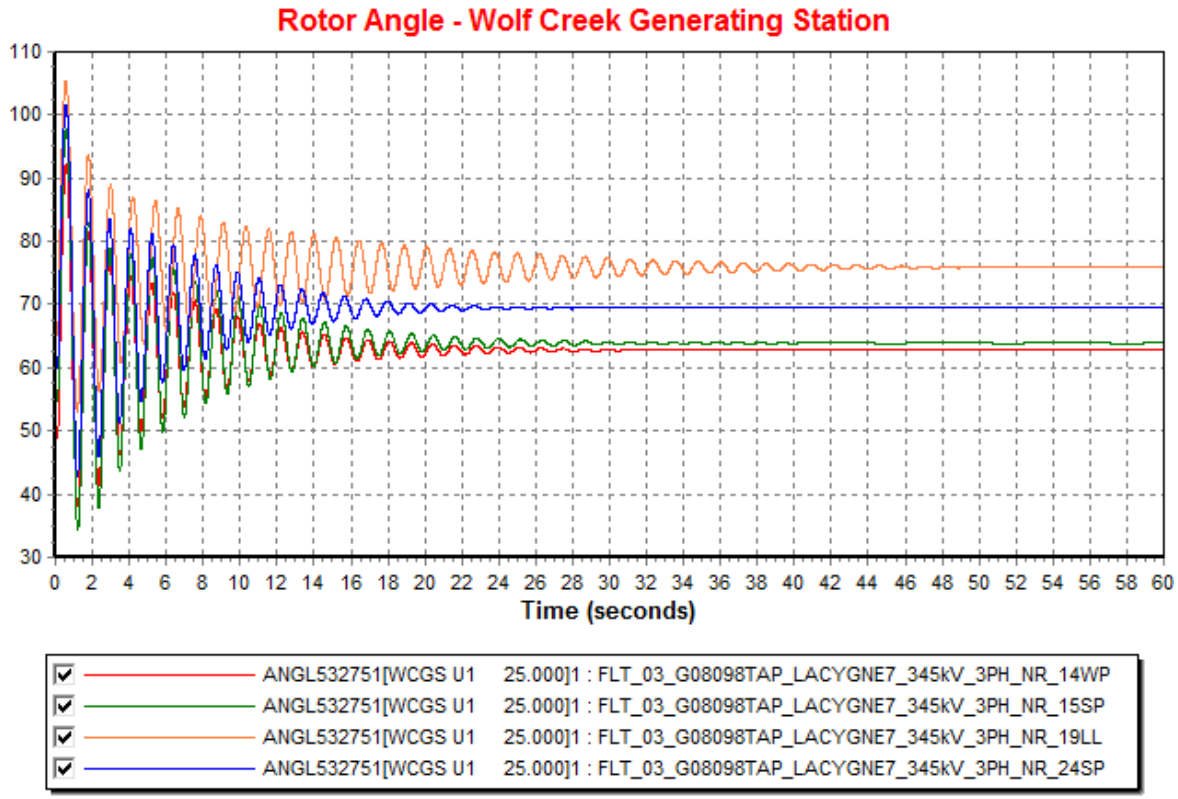

Figure A-5: Wolf Creek Generating Station Rotor Angle with Outage of GEN-2008-098 to LaCygne 345kV Circuit

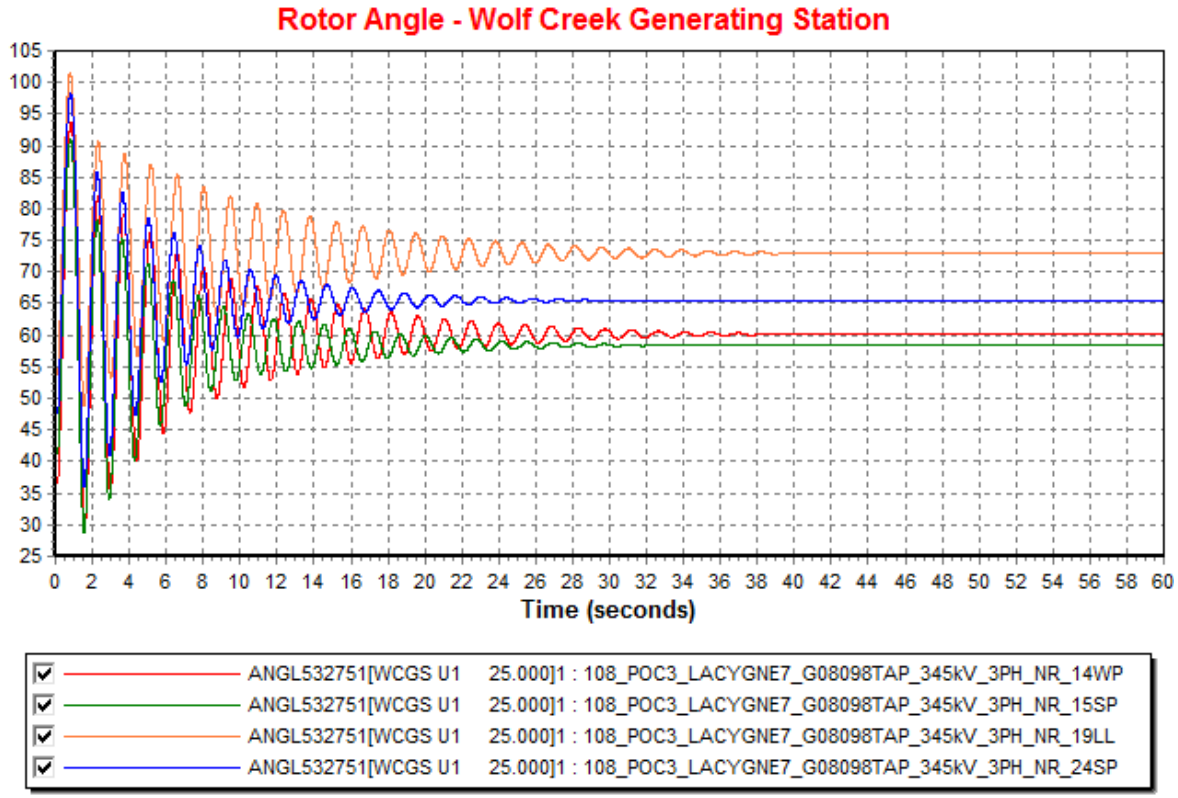

Figure A-6: Wolf Creek Generating Station Rotor Angle with Prior Outage of Wolf Creek to Rose Hill Circuit & Wolf Creek output reduced to 800MW net for Outage of GEN-2008-098 to LaCygne 345kV Circuit

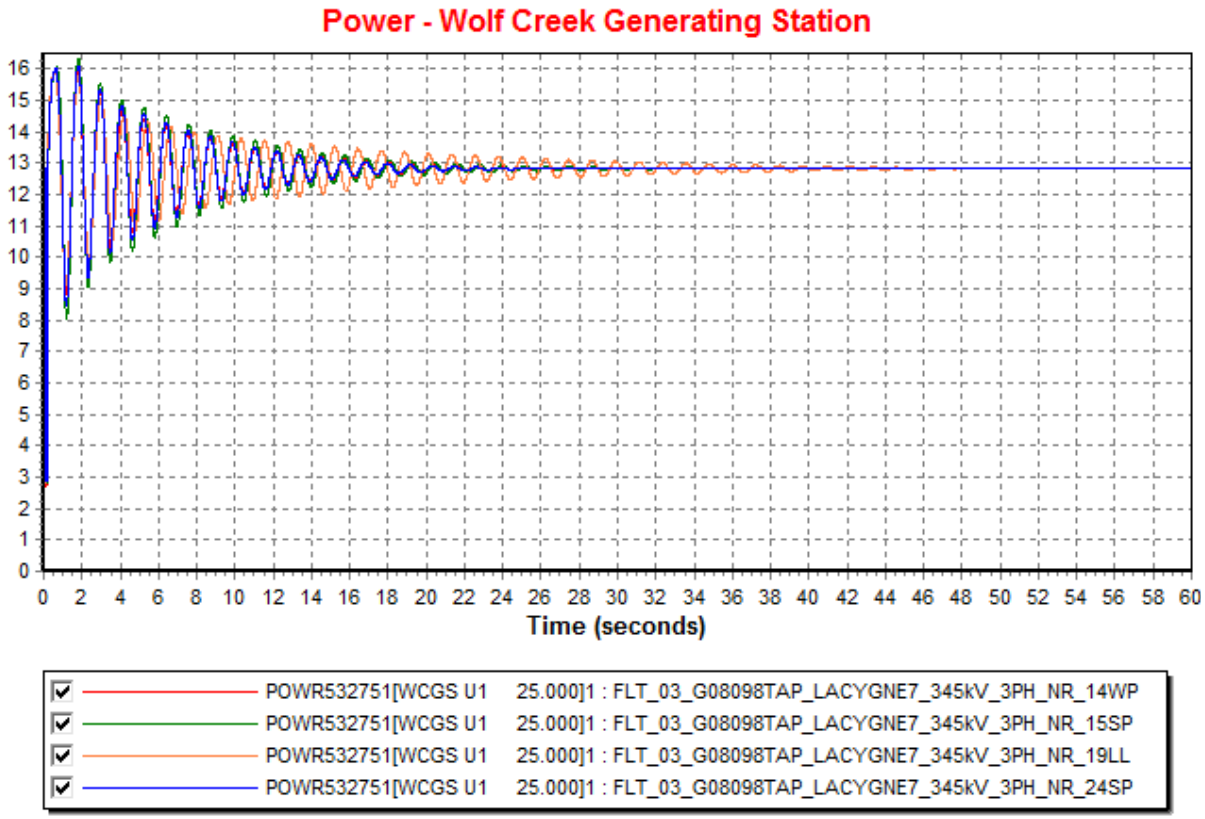

Figure A-7: Wolf Creek Generating Station Power with Outage of GEN-2008-098 to LaCygne 345kV Circuit

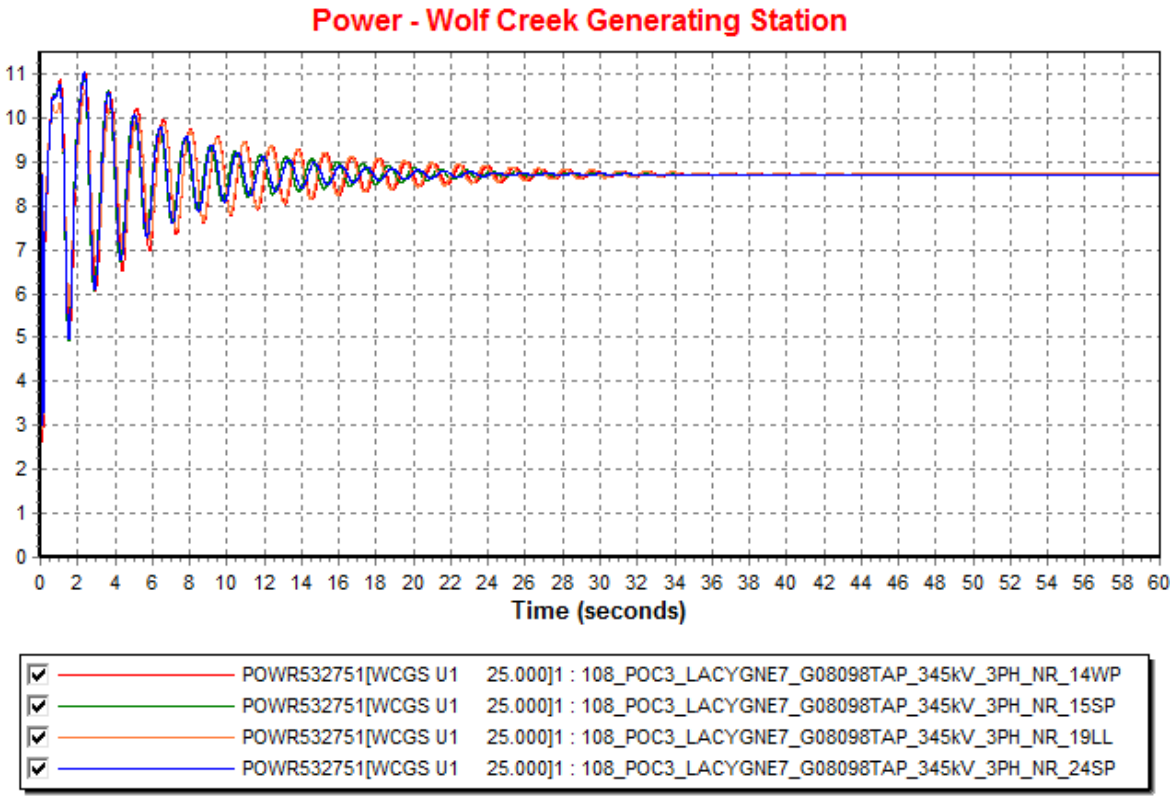

Figure A-8: Wolf Creek Generating Station Power with Prior Outage of Wolf Creek to Rose Hill Circuit & Wolf Creek output reduced to 800MW net for Outage of GEN-2008-098 to LaCygne 345kV Circuit

APPENDIX B

TRANSIENT VOLTAGE DETAILS
(Available upon request)

APPENDIX C

POWER FACTOR ANALYSIS
(Available upon request)

APPENDIX D

PROJECT MODELS

GEN-2008-098 & GEN-2010-003 (Gamesa G114 2.3MW Wind Turbine Generator)

PSS/E 32 Power Flow Data

```
@! GEN-2008-098 Tap on Lacygne-Wolf Creek (Anderson County) 345kV
BAT_LTAP,532797,542981,'1', 0.20,560004,'G08-098-TAP', 345.0,;
@! ********** GEN-2008-098 100% **********
@! POI @ Tap Lacygne-Wolf Creek (Anderson County) 345kV 560004 (532797-542981)
@! Gamesa V114 2.0MW
@! Pmax = 100.0MW
@! 0.95PF Range (Qgen=Qmax=Qmin +/-32.8684|6.5736)
@! ---------- Bus Data ----------
BAT_BUS_DATA_2,572091,1,,,, 345.00,,,'GEN-2008-098',;
BAT_BUS_DATA_2,572092,1,,,,  34.50,,,'G08-098XFMR1',;
BAT_BUS_DATA_2,572093,1,,,,  34.50,,,'G08-098-GSU1',;
BAT_BUS_DATA_2,572094,2,,,,   0.69,,,'G08-098-GEN1',;
@! ---------- Generator Data ----------
BAT_PLANT_DATA,572094,, 1.000,,;
@! 100%
 BAT_MACHINE_DATA_2,572094,'1',1,,,,,0, 100.00,10.0, 10.0000, 10.0000, 100.00,15.00, 100.000, 0.0063, 0.1507,,,,,,,, 1.00,;
@! ---------- Unit Transformers ----------
BAT_TWO_WINDING_DATA_3,572091,572092,'1',1,,,,,,33,,,,1,0,1,2,1, 0.00499, 0.09988, 138.00,,,,,, 230.00, 230.00, 230.00,,,,,,,,,,,,,,;
BAT_TWO_WINDING_DATA_3,572093,572094,'1',1,,,,,, 5,,,,1,0,1,2,1, 0.01023, 0.11555, 117.50,,,,,, 117.50, 117.50, 117.50,,,,,,,,,,,,,,;
@! ---------- Collector Cables ----------
BAT_BRANCH_DATA,572092,572093,'1',1,,,,,,  0.01725, 0.02623, 0.04879,,,,,,,,     ,,,,,;
@! ---------- Transmission Line from Substation to POI ----------
BAT_BRANCH_DATA,560004,572091,'1',1,,,,,,  0.00018, 0.00221, 0.04186,,,,,,,,  4.60,,,,,;
@! ********** GEN-2010-003 100% **********
@! POI @ Tap Tap Lacygne-Wolf Creek (Anderson County) 345kV 560004 (532797-542981)
@! Gamesa V114 2.0MW
@! Pmax = 100.0MW
@! 0.95PF Range (Qgen=Qmax=Qmin +/-32.8684|6.5736)
@! ---------- Bus Data ----------
BAT_BUS_DATA_2,577198,1,,,,  34.50,,,'GEN-2010-003',;
BAT_BUS_DATA_2,577199,1,,,,  34.50,,,'G10-003-GSU1',;
BAT_BUS_DATA_2,577200,2,,,,   0.69,,,'G10-003-GEN1',;
@! ---------- Generator Data ----------
BAT_PLANT_DATA,577200,, 1.000,,;
@! 100%
 BAT_MACHINE_DATA_2,577200,'1',1,,,,,0, 100.00,10.0, 10.0000, 10.0000, 100.00,15.00, 100.000, 0.0063, 0.1507,,,,,,,, 1.00,;
@! ---------- Unit Transformers ----------
BAT_TWO_WINDING_DATA_3,577199,577200,'1',1,,,,,, 5,,,,1,0,1,2,1, 0.01023, 0.11555, 117.50,,,,,, 117.50, 117.50, 117.50,,,,,,,,,,,,,,;
@! ---------- Collector Cables ----------
BAT_BRANCH_DATA,577198,577199,'1',1,,,,,,  0.00858, 0.01216, 0.04938,,,,,,,,     ,,,,,;
@! ---------- Collector Cables from Substation to Shared Transformer ----------
BAT_BRANCH_DATA,572092,577198,'1',1,,,,,,  0.00000, 0.00001, 0.00000,,,,,,,,     ,,,,,;
@END
```

PSS/E 32 Dynamics Data

```
/ ***** GEN-2008-098 *****
/ Gamesa 2.0 MW G114 v4.7 (GXX047_v32.lib)
/ G114 v4.7 Release - Gamesa
572094 'USRMDL' '1' 'GXX047' 1  1  8  45  0  94
 43  1  50  0  8  1  1  1
 0.00 0.00 15.00
 0.00 0.90 0.90 0.90 0.90 0.90 0.90
 0.150 1.750 1.750 1.750 1.750 1.750 16.000
 1.10 1.10 1.20 1.20 2.00
 16.000 15.000 1.500 0.017 0.017
 0.950 0.950 0.950 0.950 0.950
 0.500 0.500 0.500 0.500
 1.050 1.050 1.050 1.050 1.050
 0.500 0.500 0.500 0.500 /
/ ***** GEN-2010-003 *****
/ Gamesa 2.0 MW G114 v4.7 (GXX047_v32.lib)
/ G114 v4.7 Release - Gamesa
577200 'USRMDL' '1' 'GXX047' 1  1  8  45  0  94
 43  1  50  0  8  1  1  1
 0.00 0.00 15.00
 0.00 0.90 0.90 0.90 0.90 0.90 0.90
 0.150 1.750 1.750 1.750 1.750 1.750 16.000
 1.10 1.10 1.20 1.20 2.00
 16.000 15.000 1.500 0.017 0.017
 0.950 0.950 0.950 0.950 0.950
 0.500 0.500 0.500 0.500
 1.050 1.050 1.050 1.050 1.050
 0.500 0.500 0.500 0.500 /
```

APPENDIX E

TRANSMISSION ONE-LINES
(Available upon request)