



# **SPP** *Southwest Power Pool*

*System Impact Study  
SPP-2003-250-2  
For Transmission Service  
Requested By  
Southwestern Public Service  
Company*

*From SPS To EDDY*

*For a Redirected Amount Of 67 MW  
From 1/1/2004 To 1/1/2005*

*SPP Engineering, Tariff Studies*

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**ATTACHMENT: *SPP-2003-250-2 Tables***

## **1. Executive Summary**

Southwestern Public Service Company has requested a system impact study for long-term Firm Point-to-Point transmission service from SPS to EDDY for 67 MW. The period of the service requested is from 1/1/2004 to 1/1/2005. The OASIS reservation numbers are 613905 and 613906. This is a request to redirect the previously confirmed OASIS reservations 297069 and 297076. Oasis Reservations 297069 and 297076 are both 50 MW transfers from SPS to AMRN.

The principal objective of this study is to identify current system limitations using AC analyses and to determine the system upgrades necessary to provide the requested service.

Table 1 lists the SPP Facility Overloads caused or impacted by the requested service and includes solutions with engineering and construction costs to alleviate the limiting facilities. Table 2 includes Non - SPP Facility Overloads caused or impacted by the requested service.

Due to the inability to upgrade the limiting constraints identified within the reservation period, the ATC for the SPS to EDDY redirect is zero. Curtailment of previously confirmed service from AMRN to SPS (Oasis Reservation 381168) and SPS redispatch were evaluated as an option for relieving the additional impacts on the SPP facilities caused by the SPS to EDDY redirect. The amount and time period of curtailment required is documented in Table 3. Applicable SPS redispatch is documented in Table 4. The curtailment and redispatch requirements would be called upon prior to implementing NERC TLR Level 5a. If the customer agrees to curtail previously confirmed service and redispatch SPS units to relieve the impacts on the limiting constraints identified, the request for the redirect of service will be accepted.

## **2. Introduction**

Southwestern Public Service Company has requested a system impact study for Point-to-Point Service from SPS to EDDY for 67 MW. The principal objective of this study is to identify the restraints on the SPP Regional Tariff System that may limit the requested service and determine the least cost solutions required to alleviate the limiting facilities.

This study includes steady-state contingency analyses (PSS/E function ACCC) and Available Transfer Capability (ATC) analyses. The steady-state analyses consider the impact of the 67 MW transfer and the impact of the required upgrades for service on transmission line loading and transmission bus voltages for outages of single and selected multiple transmission lines and transformers on the SPP systems and first tier Non - SPP systems.

### **3. Study Methodology**

#### **A. Description**

The system impact analysis was conducted to determine the steady-state impact of the 67 MW transfer on the SPP and first tier Non - SPP systems. The steady-state analysis was done to ensure current SPP Criteria and NERC Planning Standards requirements are fulfilled. The Southwest Power Pool conforms to the NERC Planning Standards, which provide the strictest requirements, related to voltage violations and thermal overloads during normal conditions and during a contingency. It requires that all facilities be within normal operating ratings for normal system conditions and within emergency ratings after a contingency.

#### **B. Model Updates**

SPP used six seasonal models to study the SPS to EDDY 67 MW transfer for the requested service period. The SPP 2003 Series Cases 2003/2004 Winter Peak (03WP), 2004 April Minimum (04AP), 2004 Spring Peak (04G), 2004 Summer Peak (04SP), 2004 Fall Peak (04FA), and 2004 Winter Peak (04WP) were used to study the impact of the 67 MW transfer on the SPP system during the requested service period of 01/01/2004 to 01/01/2005. The Spring Peak models apply to April and May, the Summer Peak models apply to June through September, the Fall Peak models apply to October and November, and the Winter Peak models apply to December through March.

The chosen base case models were modified to reflect the most current modeling information. The cases were modified to reflect future firm transfers during the requested service period that were not already included in the January 2003 base case series models.

#### **C. Transfer Analysis**

Using the selected cases both with and without the requested transfer modeled, the PSS/E Activity ACCC was run on the cases and compared to determine the facility overloads caused or impacted by the transfer. The PSS/E options chosen to conduct the analysis can be found in Appendix A.

#### **D. Upgrade Analysis**

This system impact study does not include analysis with the assigned upgrades modeled. To determine the final cost and possible start date of the requested service, additional analysis will be performed to determine the impact of modeling the assigned upgrades for the 67 MW SPS to EDDY transfer.

## **4. Study Results**

### **A. Study Analysis Results**

Tables 1 and 2 contain the steady-state analysis results of the System Impact Study. The Tables are in the attached workbook *SPP-2003-250-2 Tables*. The tables identify the seasonal case in which the event occurred, the facility control area location, applicable ratings of the overloaded facility, the loading percentage with and without the studied transfer, and the estimated ATC value using interpolation if calculated. Comments are provided in the tables to document any SPP or Non - SPP identification or assignment of the event, existing mitigations plans or criteria to disregard the event as a limiting constraint, upgrades and costs to mitigate a limiting constraint, or any specific study procedures associated with modeling an event.

Table 1 lists the SPP Facility Overloads caused or impacted by the 67 MW transfer. Solutions with engineering and construction costs are provided in the tables.

Table 2 lists overloads on first tier Non - SPP Regional Tariff participants' transmission systems caused or impacted by the 67 MW transfer. No Non – SPP facilities were identified.

Table 3 documents the amount of AMRN to SPS curtailment required for the time period needed for each limiting constraint.

Table 4 lists SPS Generation Shift Factors for the OSAGE SWITCHING STATION - CANYON EAST 115KV line for the outage of BUSHLAND INTERCHANGE - DEAF SMITH INTERCHANGE 230KV CKT 1. These factors are provided for SPS redispatch to relieve the facility loading by 2 MW from 6/1/2004 to 10/1/2004. Example relief pairs and redispatch amounts required to relieve facility by 2 MW are provided.

Table 1a documents the modeling representation of the events identified in Table 1 to include bus numbers and bus names.

## **5. Conclusion**

Due to the inability to upgrade the limiting constraints identified within the reservation period, the ATC for the SPS to EDDY redirect is zero. Curtailment of previously confirmed service from AMRN to SPS (Oasis Reservation 381168) and SPS redispatch were evaluated as an option for relieving the additional impacts on the SPP facilities caused by the SPS to EDDY redirect. The amount and time period of curtailment required is documented in Table 3. Applicable SPS redispatch is documented in Table 4. The curtailment and redispatch requirements would be called upon prior to implementing NERC TLR Level 5a. If the customer agrees to curtail previously confirmed service and redispatch SPS units to relieve the impacts on the limiting constraints identified, the request for the redirect of service will be accepted.

## Appendix A

### PSS/E CHOICES IN RUNNING LOAD FLOW PROGRAM AND ACCC

#### BASE CASES:

Solutions - Fixed slope decoupled Newton-Raphson solution (FDNS)

1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits – Apply immediately
4. Solution options -  Phase shift adjustment
  - Flat start
  - Lock DC taps
  - Lock switched shunts

#### ACCC CASES:

Solutions – AC contingency checking (ACCC)

1. MW mismatch tolerance – 0.5
2. Contingency case rating – Rate B
3. Percent of rating – 100
4. Output code – Summary
5. Min flow change in overload report – 1mw
6. Excl'd cases w/ no overloads form report – YES
7. Exclude interfaces from report – NO
8. Perform voltage limit check – YES
9. Elements in available capacity table – 60000
10. Cutoff threshold for available capacity table – 99999.0
11. Min. contng. case Vltg chng for report – 0.02
12. Sorted output – None

Newton Solution:

1. Tap adjustment – Stepping
2. Area interchange control – Tie lines only
3. Var limits - Apply automatically
4. Solution options -  Phase shift adjustment
  - Flat start
  - Lock DC taps
  - Lock switched shunts



SPP-2003-250  
 Table 1 SPP Facility Overloads  
 Caused or Impacted by Redirected Path  
 with Impact of Original Path Provided

Southwest Power Pool  
 System Impact Study

Study Case	From Area	To Area	Monitored Branch Overload	Rate <MVA>	SPS to EDDY BC % Loading	SPS to EDDY TC % Loading	SPS to AMRN BC % Loading	SPS to AMRN TC % Loading	Outaged Branch Causing Overload	ATC <MW>	Solution	Estimated Cost
03WP	SWPA	SWPA	EUFULA 161/138/13.8KV TRANSFORMER	105	100.9	101.0	100.9	99.8	GORE - WELEETKA 161KV CKT 1	0	Replace Eufula Transformer	\$ 2,000,000
03WP	SWPA	SWPA	EUFULA 161/138/13.8KV TRANSFORMER	105	100.9	101.0	100.9	99.7	WELEETKA 161/138KV TRANSFORMER CKT 1	0	See Previous Upgrade Specified	
04SP	SPS	SPS	CANYON EAST - OSAGE SWITCHING STATION 115KV	99	95.7	104.2	95.7	98.4	BUSHLAND INTERCHANGE - DEAF SMITH INTERCHANGE 230KV CKT 1	34	Rebuild 13 miles of 115 kV circuit with 397 ACSR on T-0-102 structures.	\$ 1,910,000
04SP	AEPW	AEPW	EAST CENTRAL HENRYETTA - OKMULGEE 138KV	105	110.4	110.5	110.4	109.4	KELCO - OKMULGEE 138KV CKT 1	0	Replace Okmulgee Wavetrap	\$ 40,000
04SP	AEPW	AEPW	EAST CENTRAL HENRYETTA - OKMULGEE 138KV	105	103.1	103.2	103.1	102.1	HENRYETTA - KELCO 138KV CKT 1	0	See Previous Upgrade Specified	
04SP	AEPW	AEPW	EAST CENTRAL HENRYETTA - WELEETKA 138KV	105	106.1	106.2	106.1	105.1	KELCO - OKMULGEE 138KV CKT 1	0	Replace Weleetka Wavetrap	\$ 40,000
04SP	GRRD	AEPW	CATOOSA 161/138KV TRANSFORMER CKT 1	150	106.2	106.3	106.2	105.4	CATOOSA 161/138KV TRANSFORMER CKT 2	67	GRDA has mitigation plan for outage of Catoosa 161/138kV Ckts 1 or 2: 3rd Transformer in place if needed	
04SP	GRRD	AEPW	CATOOSA 161/138KV TRANSFORMER CKT 2	150	106.5	106.6	106.5	105.7	CATOOSA 161/138KV TRANSFORMER CKT 1	67	GRDA has mitigation plan for outage of Catoosa 161/138kV Ckts 1 or 2: 3rd Transformer in place if needed	
04SP	WERE	WERE	ROSE HILL JUNCTION - WEAVER 69KV	43	102.3	102.4	102.3	101.5	EL PASO - FARBER 138KV CKT 1	0	Move Rose Hill Jct. 69 kV load to Rose Hill 345/138 kV substation. Requires new transformer bay and a new 25 MVA 138-12 kV transformer.	\$ 1,400,000
04WP	SWPA	SWPA	EUFULA 161/138/13.8KV TRANSFORMER	105	111.6	111.7	111.6	110.4	GORE - WELEETKA 161KV CKT 1	0	See Previous Upgrade Specified	
04WP	SWPA	SWPA	EUFULA 161/138/13.8KV TRANSFORMER	105	112.1	112.2	112.1	110.9	WELEETKA 161/138KV TRANSFORMER CKT 1	0	See Previous Upgrade Specified	
04WP	SWPA	SWPA	EUFULA 161/138/13.8KV TRANSFORMER	105	102.2	102.3	102.2	101.1	PITTSBURG - MUSKOGEE 345KV CKT 1	0	See Previous Upgrade Specified	
Total Estimated Cost											\$5,390,000	

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 Table 2 Non-SPP Facility Overloads  
 Caused or Impacted by Redirected Path

Southwest Power Pool  
 System Impact Study

Study Case	From Area	To Area	Monitored Branch Overload	Rate <MVA>	BC % Loading	TC % Loading	Outaged Branch Causing Overload	Comment
03WP			NONE IDENTIFIED					
04AP			NONE IDENTIFIED					
04G			NONE IDENTIFIED					
04SP			NONE IDENTIFIED					
04FA			NONE IDENTIFIED					
04WP	CELE	CELE	50113 MANSFLD4 138 to 50090 IPAPER 4 138 CKT 1	232	111.0	111.1	50045 DOLHILL7 345 to 53454 SW SHV 7 345 CKT 1	Dolet Hills Operating Guide

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 Table 3 Amount of Confirmed  
 Reservation 381170 Needed  
 for Curtailment

Southwest Power Pool  
 System Impact Study

Overloaded Facility	Contingency Causing Overload	Date Curtailment Needed	SPS to EDDY %Response	AMRN to SPS %Response	*ATC (MW) Needed	**Amount of AMRN to SPS 50 MW transfer (Oasis Reservation 381168) Needed for Curtailment (MW)
EUFAULA 161/138/13.8KV TRANSFORMER	GORE - WELEETKA 161KV CKT 1	1/1/04-4/1/04	0.113	1.943	67	4
EUFAULA 161/138/13.8KV TRANSFORMER	WELEETKA 161/138KV TRANSFORMER CKT 1	1/1/04-4/1/04	0.110	1.969	67	4
CANYON EAST - OSAGE SWITCHING STATION 115KV	BUSHLAND INTERCHANGE - DEAF SMITH INTERCHANGE 230KV CKT 1	6/1/04-10/1/04	12.574	8.250	12	19 (1)
EAST CENTRAL HENRYETTA - OKMULGEE 138KV	KELCO - OKMULGEE 138KV CKT 1	6/1/04-10/1/04	0.145	1.649	67	6
EAST CENTRAL HENRYETTA - OKMULGEE 138KV	HENRYET4 - KELCO 138KV CKT 1	6/1/04-10/1/04	0.145	1.685	67	6
EAST CENTRAL HENRYETTA - WELEETKA 138KV	KELCO - OKMULGEE 138KV CKT 1	6/1/04-10/1/04	0.146	1.646	67	6
ROSE HILL JUNCTION - WEAVER 69KV	EL PASO - FARBER 138KV CKT 1	6/1/04-10/1/04	0.064	0.618	67	7
EUFAULA 161/138/13.8KV TRANSFORMER	GORE - WELEETKA 161KV CKT 1	12/1/04-1/1/05	0.111	1.971	67	4
EUFAULA 161/138/13.8KV TRANSFORMER	WELEETKA 161/138KV TRANSFORMER CKT 1	12/1/04-1/1/05	0.118	2.008	67	4
EUFAULA 161/138/13.8KV TRANSFORMER	PITTSBURG - MUSKOGEE 345KV CKT 1	12/1/04-1/1/05	0.110	1.888	67	4

\* ATC (MW) Needed = 67 MW - ATC (MW) from Table 1 + ATC (MW) Credit Given to the Redirected Path for Positive Impact Removed by the Original Path

ATC (MW) Credit = Redirect Amount (MW) \* %Response of Redirect Path / %Response Original Path

\*\* Amount (MW) Needed for Curtailment = ATC (MW) Needed \* SPS to EDDY %Response / AMRN to SPS %Response

(1) SPS Unit Redispatch is better option to remove 2 MW additional impact of Redirect Path

Limiting Facility: OSAGE SWITCHING STATION - CANYON EAST 115KV

Line Outage: BUSHLAND INTERCHANGE - DEAF SMITH INTERCHANGE 230KV CKT 1

Date Redispatch Needed: 6/1/04-10/1/04

Relief Amount: 2 MW

Source	Sink	GSF
SPS_HARRNG1 24.0	System Swing	0.04169
SPS_HARRNG2 24.0	System Swing	0.04169
SPS_HARRNG3 24.0	System Swing	0.04169
SPS_NICHOL1 13.8	System Swing	0.0514
SPS_NICHOL2 13.8	System Swing	0.0514
SPS_NICHOL3 22.0	System Swing	0.04171
SPS_PLANTX1 13.8	System Swing	-0.09998
SPS_PLANTX2 13.8	System Swing	-0.09998
SPS_PLANTX3 13.8	System Swing	-0.09998
SPS_PLANTX4 20.0	System Swing	-0.09595
SPS_TOLK1 24.0	System Swing	-0.09368
SPS_TOLK21 24.0	System Swing	-0.09376
SPS_JONES11 22.0	System Swing	-0.06284
SPS_JONES21 21.0	System Swing	-0.06284
SPS_CUNN11 13.8	System Swing	-0.0854
SPS_CUNN21 20.0	System Swing	-0.08677
SPS_CUNN41 22.0	System Swing	-0.08677
SPS_CUNN31 22.0	System Swing	-0.0854
SPS_MADDX11 13.8	System Swing	-0.08512
SPS_MADDX21 13.8	System Swing	-0.08512

Example relief pairs with redispatch amounts required to relieve facility by 2 MW

Source	Sink	Factor	Redispatch Amount (MW)
SPS_PLANTX1 13.8	SPS_NICHOL1 13.8	-0.15138	13
SPS_PLANTX4 20.0	SPS_NICHOL1 13.8	-0.14735	14
SPS_CUNN11 13.8	SPS_NICHOL1 13.8	-0.1368	15
SPS_MADDX11 13.8	SPS_NICHOL1 13.8	-0.13652	15
SPS_JONES11 22.0	SPS_NICHOL1 13.8	-0.11424	18

Factor = Source GSF Referenced to System Swing - Sink GSF Referenced to System Swing

Transaction = Relief Amount / Factor

Study Case	From Area	To Area	Monitored Branch Overload	Rate <MVA>	SPS to EDDY BC % Loading	SPS to EDDY TC % Loading	SPS to AMRN BC % Loading	SPS to AMRN TC % Loading	Outaged Branch Causing Overload	ATC <MW>	Solution	Estimated Cost
03WP	SWPA	SWPA	52774*EUFAULA4 138 WND 2 EUFAULA1 1	105	100.9	101.0	100.9	99.8	52752 GORE 5 161 to 52790 WELEETK5 161 CKT 1	0	Replace Eufaula Transformer	\$ 2,000,000
03WP	SWPA	SWPA	52774*EUFAULA4 138 WND 2 EUFAULA1 1	105	100.9	101.0	100.9	99.7	52790 WELEETK5 161 to 52792 WELEETK4 138 CKT 1	0	See Previous Upgrade Specified	
04SP	SPS	SPS	51014 OSAGE--3 115 to 51080 CANYNE3 115 CKT 1	99	95.7	104.2	95.7	98.4	50993 BUSHLND6 230 to 51111 DFSMTH6 230 CKT 1	34	Rebuild 13 miles of 115 kV circuit with 397 ACSR on T-0-102 structures.	\$ 1,910,000
04SP	AEPW	AEPW	54023 OKMULGE4 138 to 54049 EC.HEN-4 138 CKT 1	105	110.4	110.5	110.4	109.4	54023 OKMULGE4 138 to 54057 KELCO 4 138 CKT 1	0	Replace Okmulgee Wavetrap	\$ 40,000
04SP	AEPW	AEPW	54023 OKMULGE4 138 to 54049 EC.HEN-4 138 CKT 1	105	103.1	103.2	103.1	102.1	54017 HENRYET4 138 to 54057 KELCO 4 138 CKT 1	0	See Previous Upgrade Specified	
04SP	AEPW	AEPW	54049 EC.HEN-4 138 to 54028 WELETK4 138 CKT 1	105	106.1	106.2	106.1	105.1	54023 OKMULGE4 138 to 54057 KELCO 4 138 CKT 1	0	Replace Weleetka Wavetrap	\$ 40,000
04SP	GRRD	AEPW	54438 CATSAGR5 161 to 53802 CATOOSA4 138 CKT 1	150	106.2	106.3	106.2	105.4	53802 CATOOSA4 138 to 54438 CATSAGR5 161 CKT 2	67	GRDA has mitigation plan for outage of Catoosa 161/138kV Ckts 1 or 2; 3rd Transformer in place if needed	
04SP	GRRD	AEPW	54438 CATSAGR5 161 to 53802 CATOOSA4 138 CKT 2	150	106.5	106.6	106.5	105.7	53802 CATOOSA4 138 to 54438 CATSAGR5 161 CKT 1	67	GRDA has mitigation plan for outage of Catoosa 161/138kV Ckts 1 or 2; 3rd Transformer in place if needed	
04SP	WERE	WERE	57604 WEAVER 2 69 to 57837 RH JCT 2 69 CKT 1	43	102.3	102.4	102.3	101.5	57039 ELPASO 4 138 to 57042 FARBER 4 138 CKT 1	0	Move Rose Hill Jct. 69 kV load to Rose Hill 345/138 kV substation. Requires new transformer bay and a new 25 MVA 138-12 kV transformer.	\$ 1,400,000
04WP	SWPA	SWPA	52774*EUFAULA4 138 WND 2 EUFAULA1 1	105	111.6	111.7	111.6	110.4	52752 GORE 5 161 to 52790 WELEETK5 161 CKT 1	0	See Previous Upgrade Specified	
04WP	SWPA	SWPA	52774*EUFAULA4 138 WND 2 EUFAULA1 1	105	112.1	112.2	112.1	110.9	52790 WELEETK5 161 to 52792 WELEETK4 138 CKT 1	0	See Previous Upgrade Specified	
04WP	SWPA	SWPA	52774*EUFAULA4 138 WND 2 EUFAULA1 1	105	102.2	102.3	102.2	101.1	54033 PITTSB-7 345 to 55224 MUSKOGEE7 345 CKT 1	0	See Previous Upgrade Specified	
Total Estimated Cost											\$5,390,000	