Report on the Study
For the Springerville unit 3

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Report on the Study for the Springerville Unit 3 Project

Executive Summary

The Springerville Unit 3 Project is a 21kV 430MW generator owned by Tri State G & T. SRP and TEP each have a power purchase agreement for 100MW of the output. Springerville unit 3 will be interconnected to the Springerville switchyard. TEP (as the transmission provider) and Tri State (as the owner) have contracted with SRP to determine the impact of the new Springerville Unit 3 (SP3) Generator on the path rating and flows of the Four Corners West (Path 22) and Cholla/Pinnacle Peak (Path 50) Paths. This Study Report documents the results of the study.

SRP prepared and submitted the "Study Plan for the Springerville #3 & #4 System Impact Study" to the Four Corners Technical Studies Task Force participants and the SWAT participants. This study plan outlined the study methodology, assumptions, and study criteria to be used in the performance of the studies for the Springerville unit 3 Project.

SRP used a 2008 Reliability Must Run base case updated in early 2004. Reliability Must Run (RMR) is a study to determine the minimum required generation in a load pocket to reliably serve load during a critical outage. This was a good case to use since APS, SRP, and TEP had previously reviewed the case. Also, the 2008 timeframe fits the needs for Springerville 3, which will be in service by July 2006 and Springerville 4, which may go in service by June 2009. The Springerville unit 3 Study effort included power flow and transient stability analysis.

In general, the study objective of the Springerville unit 3 Project study was to evaluate the powerflow and stability impact on Path 22, Four Corners-Moenkopi 500kV line and Four Corners-Cholla circuit #1 and #2 345kV lines and the powerflow impact on Path 50, Cholla-Pinnacle Peak 34kV line and Cholla-Preacher Canyon 345kV line. No attempt was made in this analysis to determine a new post SP3 rating for these two paths. Instead the focus was to verify that SP3 did not diminish the current rating of these paths.

The results of the study are summarized below:

A. The addition of the Springerville Unit 3 Project resulted in no violations of the WECC reliability criteria. This is true for both power flow and stability results.

B. The addition of the Springerville Unit 3 Project did not diminish the path rating of neighboring paths Path 22 and Path 50.

C. Inadvertent flows occur on near by lines due to Springerville 3 generation. If reducing inadvertent flow caused by Springerville 3 is required, flow can be

reduced more effectively by reducing Springerville unit 3 generation than by changing Springerville unit 3 schedules.

APS as the path operator for path 22 & 50 has indicated that assuming a satisfactory operating procedure for Springerville plant curtailment or effective re-scheduling can be implemented to mitigate any incremental flow on the Cholla-Pinnacle Peak 345kV lines caused by Springerville 3 during periods of heavy loading problems on the Cholla-Pinnacle Peak 345kV lines, APS would accept such a procedure as sufficient long-term mitigation assuming no further development of additional generation at Springerville (i.e. unit 4). If Springerville 4 is built in the future, APS would expect series compensation to be installed in the Coronado-Silver king 500kV line per the original study work.

I. <u>Introduction</u>

The Springerville Unit 3 Project is a 430MW generator owned by Tri State G & T. It is being developed to serve load in Arizona, New Mexico, and Colorado. SRP and TEP each have a power purchase agreement for 100MW of the output. Tri State intends to serve their load in New Mexico and Colorado with the remaining 230MW produced by Springerville Unit 3. Springerville unit 3 will be interconnected to the Springerville switchyard.

TEP (as the transmission provider) and Tri State (as the owner of the plant) contracted with SRP to determine the impact of the new Springerville Unit 3 (SP3) Generator on the path rating and flows of the Four Corners West (Path 22) and Cholla/PinnaclePeak (Path 50) Paths. This Study Report documents the results of the study.

Consistent with the WECC Reliability Guidelines and the FERC Large Generator Interconnection Procedure, studies were run to determine the impact of this new generator on the existing system. Of particular concern was the impact of this new generator on existing paths in the area including Path 22 and Path 50 (see figure 1). The study plan for this study was reviewed and approved by all interested stakeholders. This was accomplished by circulating the study plan to members of the Four Corners Technical Studies Task Force and the SouthWest Area Transmission (SWAT) regional study group for comment. Once completed this report will be circulated to the same groups for final approval.

SRP used a 2008 RMR base case approved by the Four Corners Technical Studies Task Force on September 11, 2004.

The Springerville Unit 3 Study effort included power flow and stability analysis.

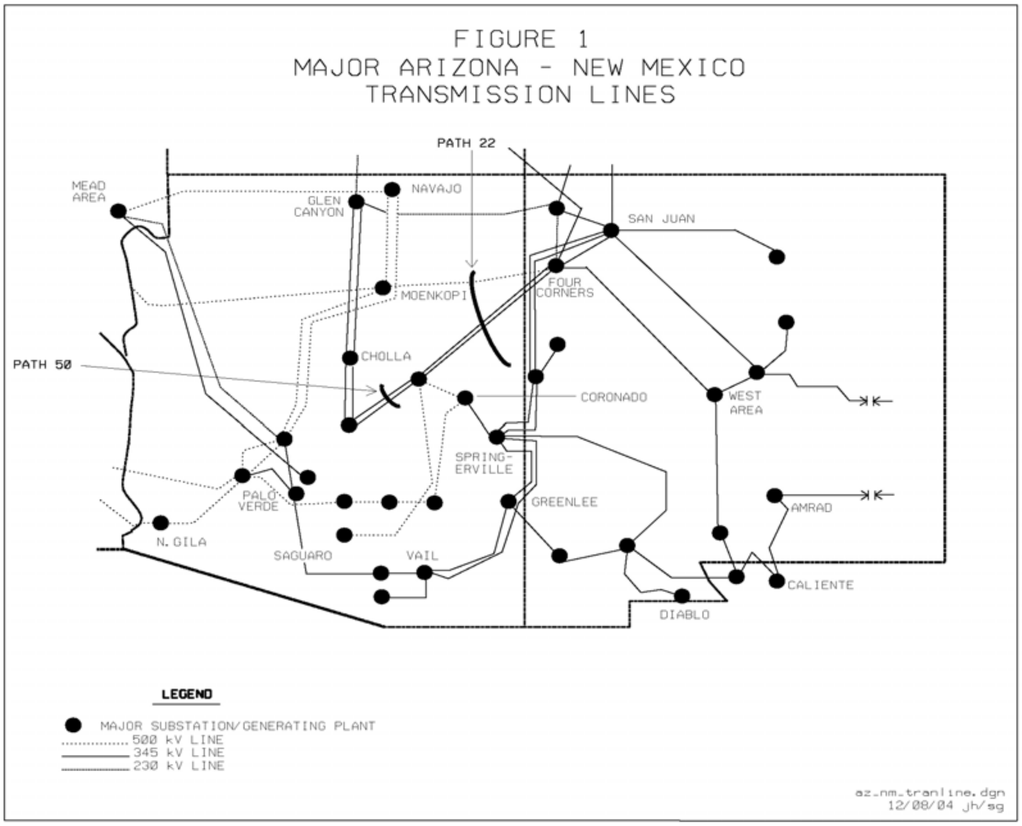

FIGURE 1
MAJOR ARIZONA - NEW MEXICO
TRANSMISSION LINES

II. ***<u>Objective</u>***

The objective of the Springerville Unit 3 Project study was to evaluate the powerflow and stability impact of this project on the WECC interconnected system, specifically path 22 and path 50. To accomplish the objective of determining the impact of SP3 on the system from a <u>stressed</u> powerflow and transient stability standpoint, 6 base cases were created as described below. The seed case for these six new base cases was the RMR 2008 heavy summer base case. It was updated, circulated for comment and approved by members of the Four Corners Technical Studies Task Force and the SWAT group.

SPR08_PREA

This case represents the system prior to the interconnection of SP3. Generation and load have been manipulated in this case to achieve a high flow on the Four Corners West path. The purpose of this case was to establish power flow and stability benchmarks (limits) for the existing Four Corners West transmission system prior to SP3. This case was used to establish **Point 5A** on the FCW operating nomogram on page 7. Four Corners-Moenkopi series compensation was represented.

SPR08_POSTA

This power flow case was developed from the SPR08_PREA base case by adding the SP3 Project with associated generation redispatch. This case was used to establish **Point 5B** on the FCW operating nomogram on page 7. Changes made to the PREA case to create Point 5B were generation redispatch and adjusting the stress on the Four Corners West Path.

SPR08_PRE0A
This power flow case was developed from the SPR08_PREA base case (pre SP3) by by-passing the Four Corners-Moenkopi series capacitors and adjusting the stress on the Four Corners West Path until the operating point was on the nomogram limit line. This case was used to establish **Point 5C** on the FCW operating nomogram on page 7.

SPR08_POST0A
This power flow case was developed from the SPR08_PRE0A base case (Four Corners-Moenkopi series capacitors bypassed) by adding the SP3 Project with associated generation redispatch and adjusting the stress on the Four Corners West Path until the operating point was on the nomogram limit line. This case was used to establish **Point 5E** on the FCW operating nomogram on page 7.

SPR08_PRE_CHOPRE1
This case represents the stressed Cholla system prior to the interconnection of SP3. Generation and load have been manipulated in this case to achieve a flow equal to its rating on the Cholla- Pinnacle Peak system. The purpose of this case was to establish power flow benchmarks (limits) for the existing Cholla-Pinnacle Peak transmission system.

SPR08_POST_CHOPRE1
This power flow case was developed from the SPR08_PRE_CHOPRE1 base case by adding the SP3 Project with associated generation redispatch and adjusting the stress on the Cholla- Pinnacle Peak Path until a limit was reached. This base case was used to determine the path rating of Cholla-Pinnacle Peak system.

III. <u>STUDY METHODOLOGY, ASSUMPTIONS, AND STUDY CRITERIA</u>

The “Study Plan for the Springerville #3 & #4 System Impact Study” outlines in detail, the study methodology, assumptions, and study criteria to be used in the studies for the Springerville Unit 3 Project. A copy of the study plan is included as Appendix 2.

For all “post project” cases Springerville unit 3 generation was scheduled by displacing the output of the following units: 60MW of New Mexico’s PEGS generation, 170MW of Tri-State’s Craig generation and 200MW of Hassayampa generation (100MW for SRP and 100MW for TEP).

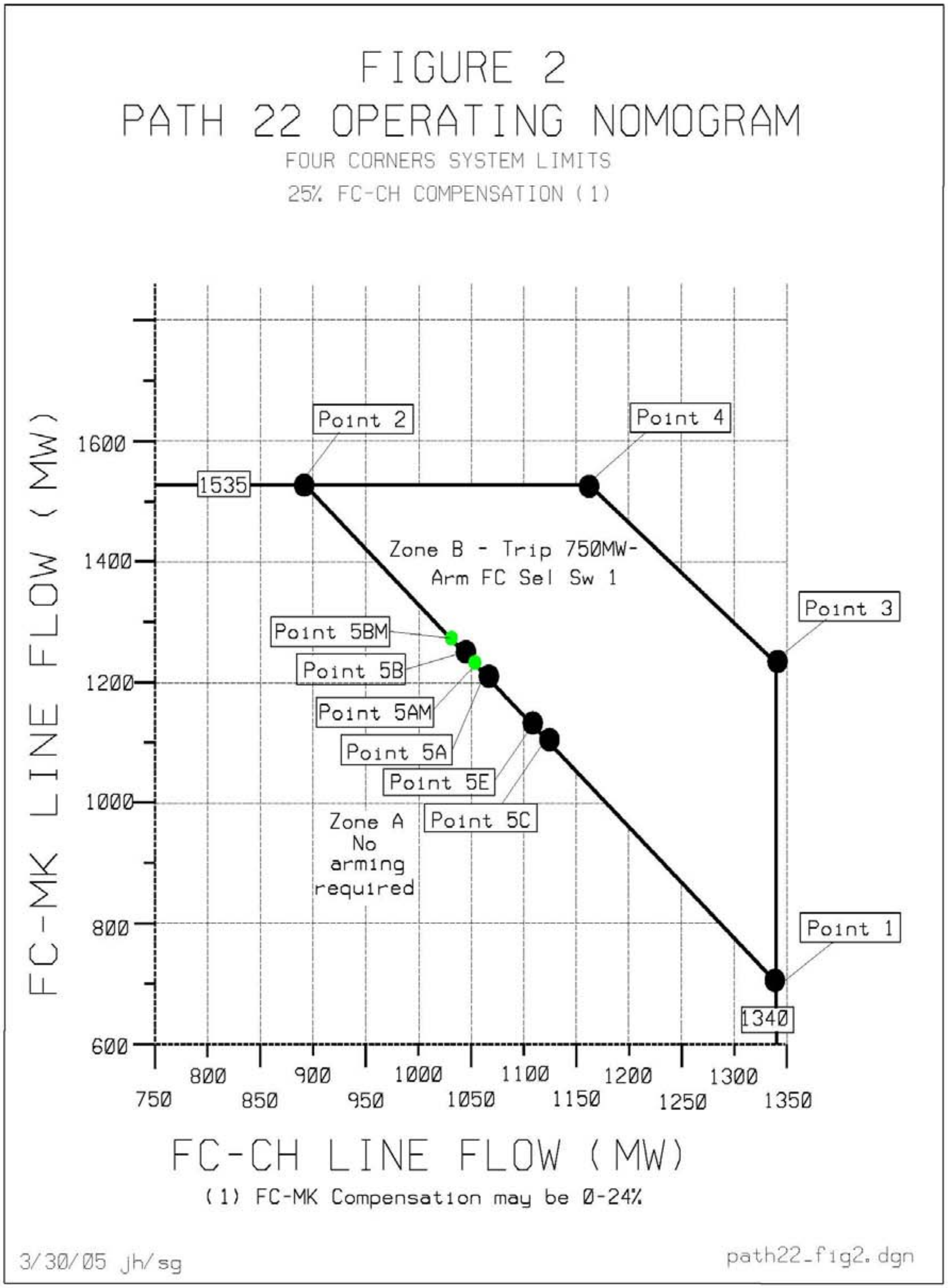
FIGURE 2
PATH 22 OPERATING NOMOGRAM
FOUR CORNERS SYSTEM LIMITS
25% FC-CH COMPENSATION (1)
FC-MK LINE FLOW (MW)
1600
1400
1200
1000
800
600
1535
Point 2
Point 4
Zone B - Trip 750MW-
Arm FC Sel Sw 1
Point 3
Point 5BM
Point 5B
Point 5AM
Point 5A
Point 5E
Point 5C
Zone A
No
arming
required
Point 1
1340
800
900
1000
1100
1200
1300
750
850
950
1050
1150
1250
1350
FC-CH LINE FLOW (MW)
(1) FC-MK Compensation may be 0-24%
3/30/05 jh/sg
path22_fig2.dgn

IV. DISCUSSION OF STUDY RESULTS

Power flow and stability studies were performed to assess the impact of Springerville unit 3 Project on Path 22, Four Corners-Moenkopi 500kV line and Four Corners-Cholla circuit #1 and #2 345kV lines and on Path 50, Cholla-Pinnacle Peak 34kV line and Cholla-Preacher Canyon 345kV line. In the cases where the SP3 project is in-service no attempt was made to determine a new limit line for the Four Corners West Nomogram. Instead the focus was to verify that the SP3 project does not diminish the existing operating limit. Thus instead of increasing the stress on the FCW Path until a new limit was reached the stress on the FCW Path was raised to a level commensurate to the existing nomogram limit line and then the case was checked to see no limits were exceeded. The critical outage of Four Corners-Moenkopi 500kV line determines the Path 22 Nomogram. It is necessary during this outage to bypass Kayenta-Shiprock series compensation at high FCW flows to avoid overloading Shiprock 230/345kV transformer for all points determined in this study.

A. IMPACT ON THE FOUR CORNERS WEST SYSTEM WITH 24% FOUR CORNERS-MOENKOPI SERIES COMPENSATION

Pre-Project Benchmark System:

(1) Power Flow Results (See PF-Table 1)

In the pre-project benchmark case at the operating limit, for the contingency of the Four Corners-Moenkopi line, the worst loading was on the Four Corners-Cholla lines, at 89% of the emergency rating. The FCW flow was 2296MW, which is point 5A on nomogram on page 7 (Figure 2). No low system voltages were detected.

(2) Transient Stability Results (See TS-Table 1)

All single contingencies simulated in the pre-project stability studies were stable and well damped. The most severe N-1 contingency was a three-phase fault at the Four Corners 500 kV end of the Four Corners-Moenkopi line. This resulted in a voltage dip of 5.2% at the Four Corners 500 kV bus, which is well below the 25% WECC reliability criteria limit. This bus had the greatest voltage dip.

Post-Project Benchmark System:

(1) Power Flow Results (See PF-Table 1)

In the post-project case, for the contingency of the Four Corners-Moenkopi line, the worst loading was on the Four Corners-Cholla lines, at 87.9% of the emergency rating. No severe voltage deviations were found in this operating scenario. The FCW flow was 2299MW; this is point 5B on nomogram on page 7 (Figure 2). A comparison of the pre-and post-project systems showed no adverse impact on the power flow performance.

(2) Transient Stability Results (See TS-Table 1)
All contingencies simulated for the pre-project cases were also simulated for the post-project system.

All stability cases studied proved to be stable and well damped.

A comparison of the transient stability performance for the pre and the post-project system indicated no appreciable difference between the two.

B. IMPACT ON THE FOUR CORNERS WEST SYSTEM WITH ZERO FOUR CORNERS-MOENKOPI SERIES COMPENSATION

Pre-Project Benchmark System:

(1) Power Flow Results (See PF-Table 1)
In the pre-project benchmark case at the operating limit, for the contingency of the Four Corners-Moenkopi line, the worst loading was on the Four Corners-Cholla lines, at 89.2% of the emergency rating. The pre-contingency FCW flow was 2238MW, which is point 5C on FCW nomogram on page 7 (Figure 2). No low system voltages were encountered.

(2) Transient Stability Results (See TS-Table 2)
All single contingencies simulated in the pre-project stability studies were stable and well damped. The most severe N-1 contingency was a three-phase fault at the Four Corners end of the Four Corners-Moenkopi line. This resulted in a voltage dip of 6.5% at the Four Corners 500 kV bus, which is well below the 25% WECC reliability criteria limit. This was the worst case.

Post-Project Benchmark System:

(1) Power Flow Results (See PF-Table 1)
In the post-project case, for the contingency of the Four Corners-Moenkopi line, the worst loading was on the Four Corners-Cholla lines, at 89.1% of the emergency rating. No severe voltage deviations were found in this operating scenario. The FCW flow was 2255MW; this is point 5E on nomogram on page 7 (Figure 2). A comparison of the pre-and post-project systems showed no adverse impact on the power flow performance.

(2) Transient Stability Results (See TS-Table 2)
All contingencies simulated for the pre-project cases were repeated for the post-project system.

All stability cases studied proved to be stable and well damped.

A comparison of the pre and the post-project system indicated that the project has no adverse impact on the system from a transient stability performance standpoint. In general the overall post-project performance was similar to the pre-project system performance.

C. IMPACT ON CHOLLA-PINNACLE PEAK SYSTEM (PATH 50)

Pre-Project Benchmark System:

(1) Power Flow Results (See PF-Table 2)
In the pre-project benchmark case, the N-0 loading of the Cholla-Preacher Canyon 345 kV line was 100% of its continuous rating. An N-1 contingency of the Cholla-Pinnacle Peak 345 kV line resulted in the Cholla-Preacher Canyon 345 kV line loading to 99.4% of its emergency rating.

Path 50 had a flow of 1196MVA. No low system voltages were encountered.

Post-Project Benchmark System:

(1) Power Flow Results (See PF-Table 2)
For the post-project case, the N-0 loading of the Cholla-Preacher Canyon 345 kV line was 99.99% of its continuous rating. An N-1 contingency of the Cholla-Pinnacle Peak 345kV line resulted in the Cholla-Preacher Canyon 345kV line loading to 99.3% of its emergency rating.

Path 50 was at 1198MVA. No low system voltages were detected.

A comparison of the pre-and post-project systems showed no adverse impact from the SP3 Project on the 1200MVA rating of path 50.

D. SENSITIVITY: ZERO MOHAVE GENERATION IMPACT ON THE FOUR CORNERS WEST SYSTEM WITH 24% FOUR CORNERS-MOENKOPI SERIES COMPENSATION

The nomogram on page 7 (Figure 2) shows pre and post points with Mohave units off-line (**point 5AM** is the pre project point and **point 5BM** is the post project point). Generation was rescheduled in corresponding Mohave owner's area. For SRP, generation was rescheduled at Hassayampa units.

Only the Four Corners-Moenkopi stability cases were studied for this sensitivity and proved to be stable and well damped.

A comparison of the transient stability performance for the pre and the post-project system indicated no appreciable difference between the two. (See TS-Table 1)

E. DIFFERENCE TABLES: WITH AND WITHOUT SPRINGERVILLE UNIT 3

To illustrate the incremental impact the addition of SP3 has on the n-0 flows on lines in the area, difference tables were generated for an unstressed base case (see Appendix 5). Table 1 in Appendix 5 is a difference table assuming that the Four Corners/Moenkopi Series Compensation is in service. Table 2 in Appendix 5 is a difference table assuming that the Four Corners/Series Compensation is by-passed. In both Tables 1 & 2 the "original case" represents the system before SP3 is in service and the "changed" case represents the system after SP3 is placed in service.

For Tables 1 & 2, the Four Corners-Cholla line flows decrease about 13MW each, while the Four Corners-Moenkopi flow increases about 30MW and the Cholla-PNPKAPS and Preacher Canyon-PNPKAPS circuits increase about 21MW each. This means that SP3 has a negative impact on the Cholla-PNPKAPS path of about 42MW and on the Four Corners-Moenkopi line of 30MW. However it has a positive impact on the Four Corners-Cholla lines of 26MW.

Table 3 shows the effect of reducing Springerville 3 generation by 200MW and replacing with Hassayampa generation. Path 50 decreases about 33MW from the post Springerville 3 case while Path 22 decreases about 42MW. This illustrates that in the event that the flow on Path 50 becomes congested or approaches an overload condition, curtailing SRP's plus TEP's SP3 200MW schedule to the valley should reduce the congestion on Path 50 by about 33MW. (i.e. 930 – 963MW).

Table 4 shows the effect of redirecting SRP' plus TEP's SP3 200MW schedule from the valley to the Colorado area by increasing Hassayampa generation 196MW and reducing Colorado generation by 200MW. Path 50 decreases about 20MW from the post SP3 case while Path 22 decreases about 70MW. This illustrates that in the event that the flow on Path 50 becomes congested or approaches an overload condition, redirecting SRP' plus TEP's SP3 200MW schedule from the valley to the Colorado area should reduce the congestion on Path 50 by about 20MW (943 – 963MW).

Comparing Table 3 with Table 4 we see that in the event that Path 50 becomes congested, redirecting SRP's & TEP's 200MW schedule out of SP3 from the valley to Colorado could reduce the congestion by about 20MW. If additional relief is needed, curtailing 200MW of SP3 schedules to SRP and TEP could reduce the congestion by an additional 13MW.

Table 5 shows historical flow on path 50 for calendar year 2004. It shows that path 50 flows were infrequently above 1000MVA and almost never near the1200MVA limit. This shows that the need to reduce Springerville unit 3 generation to mitigate Path 50 congestion should be a low probability event.

V. CONCLUSION:

The addition of the Springerville Unit 3 Project resulted in no violations of the WECC reliability criteria and does not diminish the capability of paths 22 and 50. Inadvertent flow can be reduced more effectively by reducing Springerville unit 3 generation than by changing Springerville unit 3 schedules.

APS as the path operator for path 22 & 50 has indicated that assuming a satisfactory operating procedure for Springerville plant curtailment or effective re-scheduling can be implemented to mitigate any incremental flow on the Cholla-Pinnacle Peak 345kV lines caused by Springerville 3 during periods of heavy loading problems on the Cholla-Pinnacle Peak 345kV lines, APS would accept such a procedure as sufficient long-term mitigation assuming no further development of additional generation at Springerville (i.e. unit 4). If Springerville 4 is built in the future, APS would expect series compensation to be installed in the Coronado-Silver king 500kV line per the original study work.

Appendix 1

Power Flow and Transient Stability
Summary Tables of Study Results

Remainder of Power Flow Tables of Results will be provided upon request
Media Type: PDF
Approximate # of Pages: 152
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PF-TABLE 1

POWER FLOW IMPACT ON THE FCW TRANSFER CAPABILITY
PF-TABLE 1 (Pre and Post-with Springerville #3)

CASE NO.	CASE DESCRIPTION BASE (SPR08_PREA.SAV) MAJOR LIMITING ELEMENT	FC-MKP %COMP	FC-CHO %COMP	(MW) FCW FLOW	(AMP) FC-MKP	(AMP) FC-CHO #1	(AMP) FC-CHO #2	(AMP) CHO-SAG	(AMP) CO-SI	PPK 230 KV	(PU) SI 230KV	(PU) SAG 115KV	(PU) COCO 230KV	(PU) COMMENTS
	CONTINUOUS RATING				1810	1150	1150	1026	2000					
	EMERGENCY RATING				2520	1520	1520	1538	2000	5% MAX	6% MAX	5% MAX	6% MAX	
	PRE-PROJECT BENCHMARK													
PREA	BASE CASE (SPR08_PREA.SAV)	24	25	**2296**	**1347**	**880**	**880**	**779**	**973**	**1.03**	**1.03**	**1.02**	**1.04**	No Problems
	% OF CONTINUOUS RATING				74.4%	76.6%	76.6%	75.9%	48.7%					
	MW				1221	538	538	697	907					
PRE-1A	FC-MKP OUTAGE				**OUT**	1347	1347	928	1237	1.01	1.02	1.01	1.01	No Problems
	% OF EMERGENCY RATING					88.6%	88.6%	60.3%	61.9%					
	MW			1557		779	779	790	1096					
	POST-CASE SYSTEM													
	CONTINUOUS RATING				1810	1150	1150	1026	2000					
	EMERGENCY RATING				2520	1520	1520	1538	2000	5% MAX	5% MAX	5% MAX	5% MAX	
POSTA	POST CASE (SPR08_POSTA.SAV)	24	25	**2299**	**1382.5**	**857.3**	**857.3**	**790**	**1055**	**1.02**	**1.03**	**1.02**	**1.03**	No Problems
	% OF CONTINUOUS RATING				76.38%	74.55%	74.55%	76.95%	52.75%					
	MW				1252	524	524	705	978					
POST-1A	FC-MKP OUTAGE				**OUT**	1336	1336	951	1337	1.00	1.01	1.01	1.01	No Problems
	% OF EMERGENCY RATING					87.9%	87.9%	61.8%	66.9%					
	MW			1612		806	806	820	1192					
	CONTINUOUS RATING				1810	1150	1150	1026	2000					
	EMERGENCY RATING				2520	1520	1520	1538	2000	5% MAX	6% MAX	5% MAX	6% MAX	
	PRE-PROJECT BENCHMARK													
PRE0A	BASE CASE (SPR08_PRE0A.SAV)	0	25	**2238**	**1218**	**924**	**924**	**792**	**1003**	**1.03**	**1.03**	**1.02**	**1.04**	No Problems
	% OF CONTINUOUS RATING				67.3%	80.4%	80.4%	77.2%	50.1%					
	MW				1107	566	566	708	933					
PRE0-1A	FC-MKP OUTAGE				**OUT**	1356	1356	931	1249	1.01	1.01	1.01	1.01	No Problems
	% OF EMERGENCY RATING					89.2%	89.2%	60.6%	62.4%					
	MW			1638		819	819	809	1129					
	POST-CASE SYSTEM													
	CONTINUOUS RATING				1810	1150	1150	1026	2000					
	EMERGENCY RATING				2520	1520	1520	1538	2000	5% MAX	5% MAX	5% MAX	5% MAX	
POST0A	POST CASE (SPR08_POST0A.SAV)	0	25	**2255**	**1257.3**	**907**	**907**	**806**	**1094**	**1.02**	**1.03**	**1.02**	**1.03**	No Problems
	% OF CONTINUOUS RATING				69.46%	78.89%	78.89%	78.53%	54.68%					
	MW				1144	556	556	718	1011					
POST0-1A	FC-MKP OUTAGE				**OUT**	1354	1354	957	1360	1.00	1.01	1.01	1.00	No Problems
	% OF EMERGENCY RATING					89.1%	89.1%	62.2%	68.0%					
	MW			1556		778	778	811	1180					

PF-TABLE 2

POWER FLOW IMPACT ON PATH 50 RATING
PF-TABLE 2 (Pre and Post-with Springerville #3)

CASE NO.	CASE DESCRIPTION BASE (SPR08_PRE_CHOPRE1.SAV) MAJOR LIMITING ELEMENT	FC-MKP %COMP	FC-CHO %COMP	(MVA) PATH 50 FLOW	(AMP) CHO-PPK	(AMP) CHO-PREACH	(AMP) CHO-SAG	(AMP) CO-SI	PPK 230 KV	(PU) SI 230KV	(PU) SAG 115KV	(PU) COCO 230KV	(PU) COMMENTS
	CONTINUOUS RATING				1000	1000	1026	2000					
	EMERGENCY RATING				1310	1310	1538	2000	5% MAX	6% MAX	5% MAX	6% MAX	
	PRE-PROJECT BENCHMARK												
PREA	BASE CASE (SPR08_PRE_CHOPRE1.SAV)	0	25	**1196**	**941**	**1000**	**804**	**1032**	**1.02**	**1.03**	**1.02**	**1.03**	N-0 LOADING LIMIT
	% OF CONTINUOUS RATING				94.1%	100.0%	78.4%	51.6%					
	MW				579	613	717	959					
PRE-2A	CHO-PPK OUTAGE				**OUT**	1302	895	1147	1.02	1.02	1.02	1.05	N-1 LOADING LIMIT
	% OF EMERGENCY RATING					99.4%	58.2%	57.3%					
	MW					791	803	1062					
	POST-CASE SYSTEM												
	CONTINUOUS RATING				1000	1000	1026	2000					
	EMERGENCY RATING				1310	1310	1538	2000	5% MAX	5% MAX	5% MAX	5% MAX	
POSTA	POST CASE (SPR08_POST_CHOPRE1.SAV)	0	25	**1198**	**940**	**999.9**	**801**	**1063**	**1.02**	**1.03**	**1.02**	**1.03**	N-0 LOADING LIMIT
	% OF CONTINUOUS RATING				94.04%	99.99%	78.10%	53.14%					
	MW				575	614	715	984					
POST-2A	CHO-PPK OUTAGE				**OUT**	1301	893	1178	1.02	1.02	1.02	1.05	N-1 LOADING LIMIT
	% OF EMERGENCY RATING					99.3%	58.0%	58.9%					
	MW					792	801	1087					

TS-TABLE 1

STABILITY IMPACT ON FOUR CORNERS WEST TRANSFER CAPABILITY

CASE NO.	CONTINGENCY CASE DESCRIPTION	FC-MKP %COMP	FC-CHO %COMP	POWER FLOW (MW) FCW FLOW	FC-MKP (1645)	FC-CHO (908ea)	CHO-SAG (1399)	CO-SI (2509)	STABILITY RESULTS PPK 230kV 5% MAX	SI 230kV 6% MAX	SAG 115kV 5%	COCO 230kV 6% MAX	COMMENTS
2008HS PRE-	**BASE CASE (SPR08_PREA)**	**24**	**25**	**2296**	**1221**	**1075**	**697**	**907**	**1.03**	**1.03**	**1.02**	**1.04**	
ST-1	3 PH FLT FC-MKP												Stable and well damped
ST-2	3 PH FLTFC-CHO												Stable and well damped
ST-3	3 PH FLT CHO-PPK												Stable and well damped
ST-4	3 PH FLT CHO-SAG												Stable and well damped
ST-5	3 PH FLT CO-SI												Stable and well damped

CASE NO.	CONTINGENCY CASE DESCRIPTION	SCIT FLOW	EOR FLOW	POWER FLOW (MW) FCW FLOW	FC-MKP (1645)	FC-CHO (908ea)	CHO-SAG (1399)	CO-SI (2509)	STABILITY RESULTS PPK 230kV 5% MAX	SI 230kV 6% MAX	SAG 115kV 5%	COCO 230kV 6% MAX	COMMENTS
2008HS POST-	**BASE CASE (SPR08_POSTA)**	**24**	**25**	**2299**	**1252**	**1047**	**705**	**978**	**1.02**	**1.03**	**1.02**	**1.03**	
ST-1	3 PH FLT FC-MKP												Stable and well damped
ST-2	3 PH FLTFC-CHO												Stable and well damped
ST-3	3 PH FLT CHO-PPK												Stable and well damped
ST-4	3 PH FLT CHO-SAG												Stable and well damped
ST-5	3 PH FLT CO-SI												Stable and well damped
2008HS POST-	**BASE CASE (SPR08_PRE5BM)**	**24**	**25**	**2288**	**1237**	**1051**	**691**	**884**	**1.03**	**1.03**	**1.02**	**1.04**	
ST-1	3 PH FLT FC-MKP												Stable and well damped
2008HS POST-	**BASE CASE (SPR08_POST5BM)**	**24**	**25**	**2311**	**1280**	**1031**	**700**	**965**	**1.03**	**1.03**	**1.02**	**1.03**	
ST-1	3 PH FLT FC-MKP												Stable and well damped

TS-TABLE 2

STABILITY IMPACT ON FOUR CORNERS WEST TRANSFER CAPABILITY

CASE NO.	CONTINGENCY CASE DESCRIPTION	FC-MKP %COMP	FC-CHO %COMP	POWER FLOW (MW) FCW FLOW	FC-MKP (1645)	FC-CHO (908ea)	CHO-SAG (1399)	CO-SI (2509)	STABILITY RESULTS PPK 230kV 5% MAX	SI 230kV 6% MAX	SAG 115kV 5%	COCO 230kV 6% MAX	COMMENTS
2008HS PRE-	**BASE CASE (SPR08_PRE0A)**	**0**	**25**	**2238**	**1107**	**1131**	**708**	**933**	**1.03**	**1.03**	**1.02**	**1.04**	
ST-1	3 PH FLT FC-MKP												Stable and well damped
ST-2	3 PH FLT FC-CHO												Stable and well damped
ST-3	3 PH FLT CHO-PPK												Stable and well damped
ST-4	3 PH FLT CHO-SAG												Stable and well damped
ST-5	3 PH FLT CO-SI												Stable and well damped

CASE

CASE NO.	CONTINGENCY CASE DESCRIPTION	SCIT FLOW	EOR FLOW	POWER FLOW (MW) FCW FLOW	FC-MKP (1645)	FC-CHO (908ea)	CHO-SAG (1399)	CO-SI (2509)	STABILITY RESULTS PPK 230kV 5% MAX	SI 230kV 6% MAX	SAG 115kV 5%	COCO 230kV 6% MAX	COMMENTS
2008HS POST-	**BASE CASE (SPR08_POST0A)**	**0**	**25**	**2255**	**1143**	**1112**	**718**	**1011**	**1.02**	**1.03**	**1.02**	**1.03**	
ST-1	3 PH FLT FC-MKP												Stable and well damped
ST-2	3 PH FLT FC-CHO												Stable and well damped
ST-3	3 PH FLT CHO-PPK												Stable and well damped
ST-4	3 PH FLT CHO-SAG												Stable and well damped
ST-5	3 PH FLT CO-SI												Stable and well damped

Appendix 2

Springerville Unit 3 Project Study Plan

SPRINGERVILLE #3 & #4
System Impact Study
Study Plan
9/16/2004
v10

OBJECTIVE:

Determine the impact of the new Springerville Unit 3 (SP3) and Unit 4 (SP4) Generators on the path rating and flows of the Four Corners West (Path 22) and Cholla/PinnaclePeak (Path 50) Paths. Develop recommendations for mitigating any adverse impact on these paths. For information only monitor the flow on Path 31(Tot 2A), Path 54 (Coronado West) and the Arizona Triangle both before and after the SpringerVille upgrades. Technical study work will be limited to powerflow and transient stability studies. Short circuit studies, Sub Synchronous Resonance studies and Post transient voltage stability study work will not be a part of this study effort.

ASSUMPTIONS:

Springerville in-service dates of 2007 (Unit #3) and 2009 (Unit #4)

Output (each unit) = 430MW Net
220 MVAR (0.90 p.f. lagging)
150 MVAR (0.95 p.f. leading)

Springerville #3 unit output scheduled as follows –

TriState –	230MW to Colorado & Northern New Mexico
TEP -	100MW to Tucson
SRP -	100MW to Phoenix

Springerville #4 unit output scheduled as follows –

Scenario A

SRP -	430MW to Phoenix

Scenario B

TEP -	430MW to Tucson

Scenario C

SRP -	215MW to Phoenix
TEP -	215MW to Tucson

NOTE1: When Springerville #4 goes into service SRP's 100MW share of Springerville #3 will potentially be returned to TriState. As a sensitivity, examine the impact of SRP's 100MW share of Springville #3 being returned to TriState and displacing PEGS generation in Northern New Mexico versus being retained by SRP and continuing to be displaced by Hassayampa generation in Arizona.

NOTE 2: Scenarios A, B & C for the Springerville #4 part of the study (above) will each produce the same result because in each case Hassayampa generation will be used to displace both SRP and TEP generation (see "Benchmark" paragraph below).

Springerville #3 transmission upgrades: To be determined by this study

Springerville #4 transmission upgrades: To be determined by this study

Benchmark –

Springerville #3 generation will displace the following units for the "with" vs the "without SP3" cases:

TriState- 170MW @ Craig
60MW @ Plains Escalante Gen Station (PEGS)

TEP - 100MW @ Hassayampa

SRP - 100MW @ Hassaymapa

Springerville #4 generation will displace Hassayampa generation for the "with" vs the "without SP4" cases:

NOTE As a sensitivity all of the output of Springerville #3 will displace Hassayampa generation only. This will be studied for the Springerville #3 case and the Springerville #3 plus #4 case.

Major Generation Stations Output:

	# Units	Gen Level
Four Corners	5	2060
Cholla	4	995
Coronado	2	773
Springerville	2	840 (with station load modeled)
San Juan	4	1798
Navajo	3	2244
Palo Verde	3	4137
Hassayampa	12	variable
Desert Basin	3	600
Saguaro	5	398
Craig	3	1264
Glen Canyon	8	1000 scheduled to Phoenix
PEGS	1	230

Series compensation at the following levels:

FourCorners to Moenkopi	0.0%
Four Corners to Cholla 1&2	25% each
Cholla to Pinnacle Pk 1&2	0.0% each
SanJuan to Mckinley 1&2	30% each
Cholla to Saguaro	35%
FourCorners to West Mesa	34%
SanJuan to BA	34%
Springerville to Greenlee	37%
Springerville to Luna	26%
Springerville to Vail	38%
Winchester to Vail	90%
Navajo to Crystal	70%
Navajo to Moenkopi	70%
Navajo to Westwing	40%
Moenkopi to Yavapai	43%
Yavapai to Westwing	28%
Moenkopi to Eldorado	70%
McCullough to Victorville	35% each
Eldorado to Lugo	35%
Mohave to Lugo	26%
Mead to Peacock to Liberty	54%
Eldorado to McCullough	0.0%
Palo Verde to Devers	50%
Palo Verde to N. Gila	50%
Perkins to Mead	70%
Glen to Pinnacle Pk	70%

Critical Contingencies

Coronado to Silverking 500
Coronado to Springerville 345
Cholla to Coronado 500
Cholla to Pinnacle Pk 345
Cholla to Preacher Cyn 345
Cholla to Saguaro 500
Flagstaff to Pinnacle Pk 345
Fourcorn to San Juan 345
Fourcorn to Pinto 345
Fourcorn to Westmesa 345
Fourcorn to Shiprock 345
Fourcorn to Pillar 230
Fourcorn 500/345
Four Corners to Cholla 345
Four Corners to Moenkopi 500
San Juan to B-A 345

Springerville to Greenlee 345
Springerville to Luna 345
Springerville to Vail 345
Shiprock to Kayenta 230
Shiprock to San Juan 345
Shiprock 345/230
Greenlee to Winchester 345
Winchester to Vail 345
Vail 345/138
South 345/138
Greenlee-Greenlee-AE 345
Greenlee to Hidalgo 345
Hesperus to SanJuan 345
Hesperus to Montrose 345
YaTaHey 345/115

Monitored/Reported Paths/Elements –

Path 22 Four Corners West (FourCorners to Moenkopi & FourCorners to Cholla)
Path 50 Cholla to Pinnacle Pk & Cholla to Preacher Canyon
Path 54 Coronado West (Coronado to SilverKing & Coronado to Cholla)
Path 31 TOT 2A (Hesperus-SanJuan, Durango-Glade Tap,LostCanyon-Shiprock)
Arizona Triangle
- Shiprock to Glen Canyon 230
- Glen Canyon to Flagstaff 345
- Flagstaff to Pinnacle Peak 345
- Four Corners to Cholla to Pinnacle Pk (Paths 22 & 50 above)

EPE Arroyo PST (hold at 201MW flow north to south)

NOTE: All other elements will also be monitored but only overloaded lines/xfmrs will be reported.

Base Case –

2008 Heavy Summer Case used in the 2003 RMR studies.

This case was jointly built by APS, SRP, TEP, SWTC and WAPA. The case was built from a WECC 2008 heavy summer case, with the Transmission Providers above having included their most accurate sub-transmission models and load forecasts.

Note, the assumed close proximity of in-service dates for SP#3 (2007) vs SP#4 (2009) justifies use of a single base case to analyze the addition of both units.

METHODOLOGY:

Circulate the Study Plan to members of the Four Corners Technical Studies Task Force and the SWAT regional planning group for review and approval.

Circulate the 2008 heavy summer case used in the 2003 RMR studies to members of the Four Corners Technical Studies Task Force and the SWAT regional planning group for review and approval.

Benchmark the path limits for the Cholla/Pinnacle Peak Path (1200MW) and the Four Corners West Path without Springerville #3. The latter will require simulating a point on the Four Corners West nomogram (Nomogram graph 414 in the 2004 Arizona Security Manual ATTACHMENT #1). As a sensitivity, increase the series compensation on the Four Corners to Moenkopi Line from 0% to 24% and observe the movement of the limit point on the nomogram. Stressing these paths will be accomplished by raising generation in the Four Corners area and lowering generation at Hassayampa. If additional stressing is required TOT2A and Pinto PSTs will be used up to their rating. If additional stressing is required, load will be reduced in the New Mexico area and New Mexico area generation scheduled to Hassayampa. The "Four Corners, Cholla, Coronado Transmission Operating/Study Criteria" (ATTACHMENT #2) will serve as a guideline for conducting the analysis. This criteria requires that for faults applied at the Four Corners 500kV bus, ten-percent machine fault damping is applied at Four Corners Unit #5. And, stability will be tested for all determined Four Corners West operating points established by either thermal or voltage limitations.

Add the Springerville #3 generator and associated transmission upgrades and re-establish the path limits and flows for the Cholla/Pinnacle Peak and Four Corners West Paths. With Springerville #3 in service, document the path flow change compared to the base case both before and after stressing the case to the new path limits. Again, as a sensitivity, increase the series compensation on the Four Corners to Moenkopi Line from 0% to 24% and observe the movement of the limit point on the nomogram. (Nomogram graph 414 in the 2004 Arizona Security Manual is still applicable per note #2 on pg 87.) For information, monitor the flow on Path 31(Tot 2A), Path 54 (Coronado West) and the Arizona Triangle both before and after the addition of Springerville #3.

Propose and test solutions to mitigate any adverse impacts Springerville #3 has on the aforementioned paths.

Review the recommended solution with the Four Corners Technical Studies Task Force and the SWAT regional planning group for approval.

Repeat the process for Springerville #4 with upgrades required for Springerville #3 in-service if any are required. Note, to reduce the number of alternatives to analyze for the SP#4 part of the study an acceptable solution for SP#3 problems, if any, will be agreed upon by interested parties before study work begins on the SP#4 part of the analysis.

SENSITIVITY SUMMARY

Benchmark (No SP3 or SP4)

Increase compensation of Four Corners to Moenkopi from 0% to 24% and observe the movement of the limit point on the Four Corners West Nomogram

SP3 Only In Service

> Increase compensation of Four Corners to Moenkopi from 0% to 24% and observe the movement of the limit point on the Four Corners West Nomogram
>
> Displace 100% of the output of SP 3 with Hassayampa generation
>
> Examine the impact of Mohave Generator out of service

SP3 & SP4 In Service

> Increase compensation of Four Corners to Moenkopi from 0% to 24% and observe the movement of the limit point on the Four Corners West Nomogram.
>
> SRP's 100MW share of SP3 is returned to TriState and displaced by PEGS (i.e. PEGS displacement of SP3 increases from 60MW to 160MW).
>
> Displace 100% of the output of SP3 & SP4 with Hassayampa generation.
>
> Examine the impact of Mohave Generator out of service

V4 Add comments by Tom Isham (APS)
V5 Add comments by Frank McKelvin from 7/19 Memo
V6 Add comments by Nohan Kondragunta (SCE) & Nick Saber (WAPA)
V7 Add comments by Nick Saber (WAPA),David Tovar (EPE),& David Eubanks (PNM)
V8 Add comments received in SWAT-AZNM 8/16/04 mtg plus Sensitivity Summary
V9 Add comments from base case review – Change output of Craig & Coronado Gen, Change comp level of Liberty-Peacock-Mead line.
V10 Add sensitivity – Mohave gen on vs off line

Appendix 3

Power Flow Maps

Power flow maps will be provided upon request
Media Type: PDF
Approximate # of Pages: 156

Please contact: John Hernandez
Salt River Project
Mail Station POB100
P O Box 52025
Phoenix, AZ 85072-2025
602-236-0968
jxhernan@srpnet.com

Appendix 4

Stability Plots

Stability plots will be provided upon request
Media Type: PDF
Approximate # of Pages: 192
Please contact: John Hernandez
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Phoenix, AZ 85072-2025
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Appendix 5

Difference Tables

DIFFERENCE OUTPUT TABLE 1
FC/MKP series comp NOT By PASSED (In Service)

Oringinal Base Case: ./stab/spr08_pre_ps0.sav-----pre SP3
Changed Base Case: ./stab/spr08_post_ps0.sav-----post SP3
Tolerence = 0.1 Units = MW

EQ	FROM	BUS	KV	TO BUS	KV	ORIGINAL VALUE	CHANGED VALUE	DELTA VALUE
L	15051	BROWNING	500	15041 SILVERKG	500	-340.26	-405.44	65.18
L	14000	CHOLLA	500	15001 CORONADO	500	-89.3	-177.06	87.77
T	15001	CORONADO	500	16100 CORONADO	345	-13.95	-176.4	162.45
L	16100	CORONADO	345	16104 SPRINGR	345	-14.13	-176.63	162.51
L	14101	FOURCORN	345	14100 CHOLLA	345	376.47	362.3	14.17
L	14101	FOURCORN	345	14100 CHOLLA	345	376.47	362.3	14.17
L	14101	FOURCORN	345	10292 SAN_JUAN	345	-140.07	-169.13	29.06
L	14101	FOURCORN	345	79064 SHIPROCK	345	-114.62	-138.75	24.13
L	16101	GREENLEE	345	16104 SPRINGR	345	-417.85	-453.52	35.67
L	15090	HASSYAMP	500	14008 JOJOBA	500	328.69	327.69	1
L	14008	JOJOBA	500	15011 KYRENE	500	1536.61	1474.82	61.79
L	15011	KYRENE	500	15051 BROWNING	500	169.98	108.99	60.98
L	11093	LUNA	345	16104 SPRINGR	345	-302.4	-319.11	16.71
L	16102	MCKINLEY	345	16104 SPRINGR	345	221.2	135.49	85.71
L	16102	MCKINLEY	345	16104 SPRINGR	345	223.79	137.08	86.71
L	14002	MOENKOPI	500	14001 FOURCORN	500	-789.48	-819.2	29.72
L	66235	PINTO PS	345	14101 FOURCORN	345	60.87	34.15	26.72
L	14102	PNPKAPS	345	14100 CHOLLA	345	-425.71	-446.95	21.25
L	14102	PNPKAPS	345	14103 PRECHCYN	345	-396.72	-417.24	20.53
L	14103	PRECHCYN	345	14100 CHOLLA	345	-461.05	-482.88	21.84
L	14004	SAGUARO	500	14000 CHOLLA	500	-630.88	-637.13	6.25
L	14004	SAGUARO	500	16000 TORTOLIT	500	314.15	304.13	10.02
L	14004	SAGUARO	500	16001 TORTLIT2	500	314.15	304.13	10.02
L	15041	SILVERKG	500	15001 CORONADO	500	-686.33	-759.14	72.82
L	16106	VAIL2	345	16104 SPRINGR	345	-427.21	-464.75	37.54
L	10369	WESTMESA	345	14101 FOURCORN	345	-622.68	-629.69	7

DIFFERENCE OUTPUT TABLE 2
FC/MKP series comp By Passed (Out of Service)

Original Base Case: \stab\spr08_pre_ps0_fm0.sav-----pre SP3
Changed Base Case: \stab\spr08_post_ps0_fm0.sav--post SP3
Tolerence = 1 Units = MW

EQ	FROM	BUS	KV	TO BUS		KV	ORIGINAL	CHANGED	DELTA
L	15051	BROWNING	500	15041	SILVERKG	500	-351.55	-416.83	65.28
L	14000	CHOLLA	500	15001	CORONADO	500	-87.14	-174.18	87.04
T	15001	CORONADO	500	16100	CORONADO	345	-24.61	-186.46	161.86
L	16100	CORONADO	345	16104	SPRINGR	345	-24.78	-186.7	161.92
L	14101	FOURCORN	345	14100	CHOLLA	345	392.68	379.63	13.05
L	14101	FOURCORN	345	14100	CHOLLA	345	392.68	379.63	13.05
L	14101	FOURCORN	345	79064	SHIPROCK	345	-96.85	-119.85	23
L	14101	FOURCORN	345	10292	SAN_JUAN	345	-124.15	-152.27	28.11
L	16101	GREENLEE	345	16104	SPRINGR	345	-420.63	-457.23	36.6
L	15090	HASSYAMP	500	14008	JOJOBA	500	318.16	316.95	1.21
L	14008	JOJOBA	500	15011	KYRENE	500	1525.95	1463.95	62
L	15011	KYRENE	500	15051	BROWNING	500	159.28	98.19	61.09
L	11093	LUNA	345	16104	SPRINGR	345	-301.95	-320.38	18.44
L	16102	MCKINLEY	345	16104	SPRINGR	345	230.02	145.51	84.51
L	16102	MCKINLEY	345	16104	SPRINGR	345	232.72	147.21	85.51
L	14002	MOENKOPI	500	14001	FOURCORN	500	-713.92	-741.24	27.32
L	66235	PINTO PS	345	14101	FOURCORN	345	54.37	27.55	26.82
L	14102	PNPKAPS	345	14103	PRECHCYN	345	-404.82	-425.61	20.79
L	14102	PNPKAPS	345	14100	CHOLLA	345	-434.12	-455.65	21.53
L	14103	PRECHCYN	345	14100	CHOLLA	345	-469.68	-491.82	22.14
L	14004	SAGUARO	500	14000	CHOLLA	500	-636.72	-643.53	6.81
L	14004	SAGUARO	500	16000	TORTOLIT	500	313.73	303.9	9.83
L	14004	SAGUARO	500	16001	TORTLIT2	500	313.73	303.9	9.83
L	15041	SILVERKG	500	15001	CORONADO	500	-698.86	-771.77	72.91
L	16106	VAIL2	345	16104	SPRINGR	345	-431.08	-468.78	37.7
L	10369	WESTMESA	345	14101	FOURCORN	345	-626.01	-631.52	5.51

DIFFERENCE OUTPUT TABLE 3
FC/MKP series comp BY PASSED (Out of Service)

Oringinal Base Case: ./stab/spr08_post_ps0_fm0.sav-----post SP3
Changed Base Case: ./stab/spr08_post_ps0_fm0_1.sav-----post SP3@230MW, HAA inc 195MW
Tolerence = 0.1 Units = MW

EQ	FROM BUS		KV	TO BUS		KV	ORIGINAL VALUE	CHANGED VALUE	DELTA VALUE
L	15051	BROWNING	500	15011	KYRENE	500	-98.13	-142.81	44.68
L	14000	CHOLLA	500	14004	SAGUARO	500	652.09	644.63	7.46
L	14100	CHOLLA	345	14102	PNPKAPS	345	463.03	446.8	16.22
L	14100	CHOLLA	345	14103	PRECHCYN	345	500.14	483.49	16.65
L	15001	CORONADO	500	14000	CHOLLA	500	174.55	137.75	36.79
L	15001	CORONADO	500	15041	SILVERKG	500	781.14	733.57	47.57
T	16100	CORONADO	345	15001	CORONADO	500	186.7	102.29	84.41
L	14001	FOURCORN	500	14002	MOENKOPI	500	750.34	718.84	31.5
L	14101	FOURCORN	345	14100	CHOLLA	345	379.63	374.27	5.36
L	14101	FOURCORN	345	14100	CHOLLA	345	379.63	374.27	5.36
L	14101	FOURCORN	345	66235	PINTO PS	345	-27.43	-32.81	5.38
L	15090	HASSYAMP	500	14008	JOJOBA	500	316.95	201.24	115.71
L	15011	KYRENE	500	14008	JOJOBA	500	-1456.33	-1522.1	65.77
L	14103	PRECHCYN	345	14102	PNPKAPS	345	431.66	416	15.67
L	10292	SAN_JUAN	345	14101	FOURCORN	345	152.44	130.43	22.01
L	79064	SHIPROCK	345	14101	FOURCORN	345	119.91	99.78	20.14
L	15041	SILVERKG	500	15051	BROWNING	500	417.56	373.77	43.79
L	16104	SPRINGR	345	16102	MCKINLEY	345	-144.52	-173.83	29.31
L	16104	SPRINGR	345	16102	MCKINLEY	345	-146.22	-175.87	29.65
L	16104	SPRINGR	345	16100	CORONADO	345	187.15	102.51	84.64
L	16104	SPRINGR	345	16101	GREENLEE	345	467.76	446.25	21.51
L	16104	SPRINGR	345	16106	VAIL2	345	493.32	469.51	23.81
L	16104	SPRINGR	345	11093	LUNA	345	331.1	320.28	10.82
L	16001	TORTLIT2	500	14004	SAGUARO	500	-303.87	-309.15	5.28
L	16000	TORTOLIT	500	14004	SAGUARO	500	-303.87	-309.15	5.28
L	10369	WESTMESA	345	14101	FOURCORN	345	-631.52	-635.15	3.63

Salt River Project

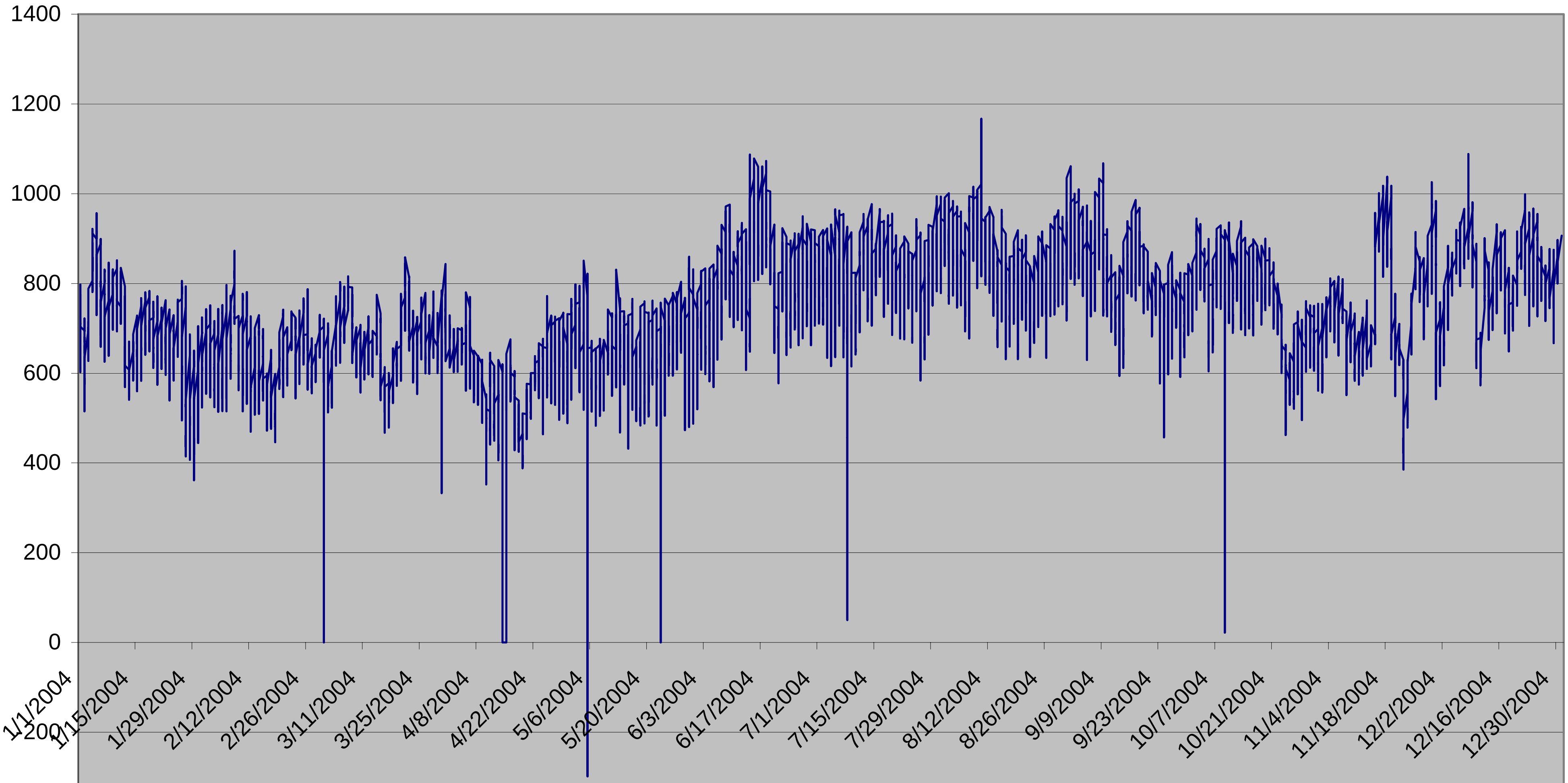
DIFFERENCE OUTPUT TABLE 4
FC/MKP series comp BY PASSED (Out of Service)

Oringinal Base Case: ./stab/spr08_post_ps0_fm0.sav-----post SP3
Changed Base Case: ./stab/spr08_post_ps0_fm0_2.sav-----post SP3@430MW, HAA +196MW, COLO -200MW
Tolerence = 0.1 Units = MW

EQ	FROM BUS		KV	TO BUS		KV	ORIGINAL VALUE	CHANGED VALUE	DELTA VALUE
L	15051	BROWNING	500	15011	KYRENE	500	-98.13	-120.8	22.67
L	14000	CHOLLA	500	14004	SAGUARO	500	652.09	643.62	8.48
L	14000	CHOLLA	500	15001	CORONADO	500	-174.18	-179.41	5.23
L	14100	CHOLLA	345	14102	PNPKAPS	345	463.03	453.26	9.77
L	14100	CHOLLA	345	14103	PRECHCYN	345	500.14	490.19	9.95
L	15001	CORONADO	500	15041	SILVERKG	500	781.14	761.65	19.49
T	16100	CORONADO	345	15001	CORONADO	500	186.7	172.44	14.26
L	14001	FOURCORN	500	14002	MOENKOPI	500	750.34	718.98	31.36
L	14101	FOURCORN	345	14100	CHOLLA	345	379.63	360.38	19.24
L	14101	FOURCORN	345	14100	CHOLLA	345	379.63	360.38	19.24
L	15090	HASSYAMP	500	14008	JOJOBA	500	316.95	229.03	87.91
L	15011	KYRENE	500	14008	JOJOBA	500	-1456.33	-1502.2	45.88
L	16102	MCKINLEY	345	16104	SPRINGR	345	145.51	131.53	13.98
L	16102	MCKINLEY	345	16104	SPRINGR	345	147.21	133.07	14.14
L	66235	PINTO PS	345	14101	FOURCORN	345	27.55	6.35	21.2
L	14103	PRECHCYN	345	14102	PNPKAPS	345	431.66	422.19	9.47
L	10292	SAN_JUAN	345	14101	FOURCORN	345	152.44	131.43	21.01
L	79064	SHIPROCK	345	14101	FOURCORN	345	119.91	96.66	23.25
L	15041	SILVERKG	500	15051	BROWNING	500	417.56	397.98	19.58
L	16104	SPRINGR	345	16100	CORONADO	345	187.15	172.85	14.3
L	16104	SPRINGR	345	16101	GREENLEE	345	467.76	462.46	5.3
L	16104	SPRINGR	345	16106	VAIL2	345	493.32	487.4	5.92
L	16104	SPRINGR	345	11093	LUNA	345	331.1	328.86	2.23
L	16001	TORTLIT2	500	14004	SAGUARO	500	-303.87	-304.28	0.4
L	16000	TORTOLIT	500	14004	SAGUARO	500	-303.87	-304.28	0.4
L	10369	WESTMESA	345	14101	FOURCORN	345	-631.52	-633.89	2.38

Salt River Project

TABLE 5
PATH 50
INTEGRATED HOURLY
2004



July 27,2005