Existing System Contingency Analysis Summary

Load Level = 144 MW
Power Factor = 1.00

Tot 5 Transfers = 1678 MW
SLV Generation = 0 MW

PSCo/UC Losses = 152/172 MW
Load Model = Constant I

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 194 MW	Fort Garland 69 kV = 0.93 p.u.	San Luis 230-115 kV xfmr = 109%(100) 12 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.11 p.u. Ft Garland 69 kV Deviation = 0.11 p.u.	Mosca-San Luis 69 kV Line= 105% (29) San Luis 230-115 kV xfmr = 109% (100)
Alamosa Term 115-69 kV xfmr Outage	None	San Luis 230-115 kV xfmr = 109% (100)
Alamosa Term-San Luis 115 kV Outage SLV Load @ Pt. of Collapse = 161 MW	Alamosa Steam 69 kV Dev. = 0.11 p.u. Alamosa Terminal 69 kV Dev= 0.12 p.u. Antonito 69 kV Deviation = 0.12 p.u. Ft Garland 69 kV Deviation = 0.12 p.u. Home Lake 69 kV Deviation = 0.05 p.u. Romeo 69 kV Deviation = 0.12 p.u.	Mosca-San Luis 69 kV Line= 109% (29) San Luis 115-69 kV xfmr = 109% (42) San Luis 230-115 kV xfmr = 109% (100)
Curecanti-Poncha 230 kV Line Outage	Poncha 115 kV Deviation = 0.05 p.u. Sargent 115 kV Deviation = 0.05 p.u.	Blue Mesa-Skito 115 kV = 120% (100) Gunnison-Skito 115 kV = 107% (100)
Gunnison-Poncha 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 126% (100) Blue Mesa-Curecanti 115 = 110% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 132% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage SLV Load @ Pt. of Collapse = 68 MW	**Failed (Voltage Collapse)**	**Failed**
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 142% (100)
Rio Grande Tap-Sargent 115 kV Outage	Alamosa Steam 69 kV Dev = 0.06 p.u. Alamosa Term 69 kV Dev = 0.06 p.u. Antonito 69 kV Deviation = 0.06 p.u. Del Norte 69 kV Deviation = 0.11 p.u. Ft Garland 69 kV Deviation = 0.06 p.u. Rio Grande 69 kV Deviation = 0.11 p.u. Romeo 69 kV Deviation = 0.06 p.u.	Alamosa Term 115-69 xfmr = 134% (25) Mosca-San Luis 69 kV Line= 111% (29) San Luis 230-115 kV xfmr = 114% (100)
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 120% (29) San Luis 230-115 kV xfmr = 108% (100)
Sargent 115-69 kV Transformer Outage	None	San Luis 115-69 kV xfmr = 143% (42) San Luis 230-115 kV xfmr = 110% (100)
Stuck Poncha CB 386 Curecanti-Poncha 230 kV Line & Midway-Poncha 230 kV Line Outage	**Failed (Voltage Collapse)**	**Failed**
Stuck Poncha CB 686 Curecanti-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	**Failed (Voltage Collapse)**	**Failed**
Stuck Poncha CB 1186 Midway-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	**Failed (Voltage Collapse)**	**Failed**

Existing System Contingency Analysis
Actual Load Model (LOADSYN)

Load Level = 144 MW Tot 5 Transfers = 1678 MW SLV Generation = 0 MW

This case document the effects of modeling the San Luis Valley loads with detailed voltage dependent characteristics. This improves the accuracy of voltage stability analyses. These cases model the existing system, with the San Luis Valley at its projected peak load in 2006 (144 MW), Tot 5 at its maximum west-to-east power flow capability (1,680 MW), and no local San Luis Valley generation on-line.

The results of the variation of power factors are consistent with previously stated intuition. The lower the power factor of the loads, the worse the San Luis Valley regional voltage profile becomes. However, a major difference of the cases which model the actual load model from all the other load models, is that the cases with the actual load model behaved in a manner which allowed a contingency analysis to be completed for each of the load power factors simulated. Detailed plots are in Appendices I (1.00 power factor), J (0.95 power factor), K (0.90 power factor), L (0.85 power factor), and M (0.80 power factor).

The actual load model results in points-of-collapse that are more optimistic than any other load model investigated in this study. Furthermore, as the load power factor becomes worse, the difference of the points of collapse between the actual load model cases, and all the other cases, becomes greater. Table 9, below summarizes the differences between constant MVA and the actual synthesized load model:

Table 9

Comparison of Points-of-Collapse between Constant MVA and LOADSYN Synthesized Loads

Case	Constant MVA	Actual (LOADSYN)
System Normal 1.00 Power Factor	190 MW	194 MW
System Normal 0.95 Power Factor	143 MW	163 MW
System Normal 0.90 Power Factor	126 MW	153 MW
System Normal 0.85 Power Factor	113 MW	145 MW
System Normal 0.80 Power Factor	102 MW	138 MW
Poncha-San Luis Outage 1.00 Power Factor	68 MW	68 MW
Alamosa Term-San Luis Outage 1.00 Power Factor	142 MW	159 MW

Existing System Contingency Analysis Summary

Load Level = 144 MW
Power Factor = 1.00

Tot 5 Transfers = 1678 MW
SLV Generation = 0 MW

PSCo/UC Losses = 152/172 MW
Load Model = Actual

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 194 MW	Fort Garland 69 kV = 0.93 p.u.	San Luis 230-115 kV xfmr = 109%(100) 12 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.10 p.u. Ft Garland 69 kV Deviation = 0.11 p.u.	Mosca-San Luis 69 kV Line= 104% (29) San Luis 230-115 kV xfmr = 109% (100)
Alamosa Term 115-69 kV xfmr Outage	None	San Luis 230-115 kV xfmr = 108% (100)
Alamosa Term-San Luis 115 kV Outage SLV Load @ Pt. of Collapse = 159 MW	Alamosa Steam 69 kV Dev. = 0.11 p.u. Alamosa Term. 69 kV Dev. = 0.11 p.u. Antonito 69 kV Deviation = 0.11 p.u. Ft. Garland 69 kV Deviation = 0.11 p.u. Home Lake 69 kV Deviation = 0.05 p.u. Romeo 69 kV Deviation = 0.11 p.u.	Mosca-San Luis 69 kV Line= 107% (29) San Luis 115-69 kV xfmr = 107% (42) San Luis 230-115 kV xfmr = 107% (100)
Curecanti-Poncha 230 kV Line Outage	Poncha 115 kV Deviation = 0.05 p.u.	Blue Mesa-Skito 115 kV = 120% (100) Gunnison-Skito 115 kV = 107% (100)
Gunnison-Poncha 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 126% (100) Blue Mesa-Curecanti 115 = 110% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 133% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage SLV Load @ Pt. of Collapse = 68 MW	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 142% (100)
Rio Grande Tap-Sargent 115 kV Outage	Alamosa Steam 69 kV Dev = 0.05 p.u. Alamosa Term 69 kV Dev = 0.05 p.u. Antonito 69 kV Deviation = 0.05 p.u. Del Norte 69 kV Deviation = 0.10 p.u. Ft Garland 69 kV Deviation = 0.06 p.u. Home Lake 59 kV Deviation = 0.09 p.u. Rio Grande 69 kV Deviation = 0.10 p.u. Romeo 69 kV Deviation = 0.05 p.u.	Alamosa Term 115-69 xfmr = 134% (25) Mosca-San Luis 69 kV Line= 111% (29) San Luis 230-115 kV xfmr = 113% (100)
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 120% (29) San Luis 230-115 kV xfmr = 107% (100)
Sargent 115-69 kV Transformer Outage	None	San Luis 115-69 kV xfmr = 143% (42) San Luis 230-115 kV xfmr = 110% (100)
Stuck Poncha CB 386 Curecanti-Poncha & Midway-Poncha	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 585 Curecanti-Poncha & Poncha-San Luis	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 1186 Midway-Poncha & Poncha-San Luis	Failed (Voltage Collapse)	Failed

Existing System Contingency Analysis Summary

Load Level = 144 MW
Power Factor = 0.95

Tot 5 Transfers = 1681 MW
SLV Generation = 0 MW

PSCo/UC Losses = 153/172 MW
Load Model = Actual

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 163 MW	Fort Garland 69 kV = 0.93 p.u. Mirage Junction 69 kV = 0.94 p.u. Moffat 69 kV = 0.94 p.u. Saguache 69 kV = 0.93 p.u. Zinzer 69 kV = 0.95 p.u.	San Luis 230-115 kV xfmr = 111%(100) 13 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.11 p.u. Ft Garland 69 kV Deviation = 0.10 p.u.	Mosca-San Luis 69 kV Line= 100% (29) San Luis 230-115 kV xfmr = 111% (100)
Alamosa Term 115-69 kV xfmr Outage	None	San Luis 230-115 kV xfmr = 111% (100)
Alamosa Term-San Luis 115 kV Outage	5 - 69 kV Bus Voltage Deviations = 0.11 p.u.	Mosca-San Luis 69 kV Line= 101% (29) San Luis 115-69 kV xfmr = 105% (42) San Luis 230-115 kV xfmr = 109% (100) Sargent 115-69 kV xfmr = 104% (63)
Curecanti-Poncha 230 kV Line Outage	8 - 69 kV Bus Voltage Deviations = 0.05 p.u.	Blue Mesa-Skito 115 kV = 118% (100) Gunnison-Skito 115 kV = 105% (100)
Gunnison-Poncha 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 127% (100) Blue Mesa-Curecanti 115 = 109% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 133% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 148% (100)
Rio Grande Tap-Sargent 115 kV Outage	8 - 69 kV Bus Voltage Deviations ranging between 0.07 and 0.14 p.u.	Alamosa Term 115-69 xfmr = 122% (25) Ansel-San Luis 69 kV Line = 101% (29) Mosca-San Luis 69 kV Line= 103% (29) San Luis 230-115 kV xfmr = 113% (100)
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 122% (29) San Luis 230-115 kV xfmr = 111% (100) Sargent 115-69 kV xfmr = 106% (63)
Sargent 115-69 kV Transformer Outage	City of Center 69 kV Dev. = 0.05 p.u. Del Norte 69 kV Deviation = 0.05 p.u. Rio Grande 69 kV Deviation = 0.05 p.u. Sargent 69 kV Deviation = 0.05 p.u.	San Luis 115-69 kV xfmr = 143% (42) San Luis 230-115 kV xfmr = 111% (100)
Stuck Poncha CB 386 Curecanti-Poncha 230 kV Line & Midway-Poncha 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 586 Curecanti-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 1186 Midway-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed

Existing System Contingency Analysis Summary

Load Level = 144 MW | Tot 5 Transfers = 1681 MW | PSCo/UC Losses = 153/173 MW
Power Factor = 0.90 | SLV Generation = 0 MW | Load Model = Actual

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 153 MW	19 - 69 kV Bus Voltages below 0.95 p.u.	San Luis 230-115 kV xfmr = 113%(100) 15 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.11 p.u. Ft Garland 69 kV Deviation = 0.10 p.u.	Ansel-San Luis 69 kV Line= 104% (29) San Luis 230-115 kV xfmr = 112% (100)
Alamosa Term 115-69 kV xfmr Outage	Alamosa Steam 69 kV Dev. = 0.05 p.u. Alamosa Term. 69 kV Dev. = 0.05 p.u. Antonito 69 kV Deviation = 0.05 p.u. Romeo 69 kV Deviation = 0.05 p.u.	San Luis 230-115 kV xfmr = 112% (100)
Alamosa Term-San Luis 115 kV Outage	10 - 69 kV Bus Voltage Deviations > 0.05 p.u.	San Luis 115-69 kV xfmr = 101% (42) San Luis 230-115 kV xfmr = 109% (100) Sargent 115-69 kV xfmr = 105% (63)
Curecanti-Poncha 230 kV Line Outage	27 - 69 kV Bus Voltage Deviations > 0.05 p.u.	Blue Mesa-Skito 115 kV = 118% (100) Gunnison-Skito 115 kV = 105% (100)
Gunnison-Poncha 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 128% (100) Blue Mesa-Curecanti 115 = 109% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 134% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 147% (100)
Rio Grande Tap-Sargent 115 kV Outage	Alamosa Steam 69 kV Dev = 0.09 p.u. Alamosa Term 69 kV Dev = 0.09 p.u. Antonito 69 kV Deviation = 0.09 p.u. Del Norte 69 kV Deviation = 0.17 p.u. Ft Garland 69 kV Deviation = 0.09 p.u. Home Lake 69 kV Deviation = 0.14 p.u. Rio Grande 69 kV Deviation = 0.17 p.u. Romeo 69 kV Deviation = 0.09 p.u.	Alamosa Term 115-69 xfmr = 117% (25) Ansel-San Luis 69 kV Line = 110% (29) Mosca-San Luis 69 kV Line= 100% (29) San Luis 230-115 kV xfmr = 113% (100)
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 125% (29) San Luis 230-115 kV xfmr = 115% (100) Sargent 115-69 kV xfmr = 113% (63)
Sargent 115-69 kV Transformer Outage	20 - 69 kV Bus Voltage Deviations > 0.05 p.u.	San Luis 115-69 kV xfmr = 144% (42) San Luis 230-115 kV xfmr = 113% (100)
Stuck Poncha CB 386 Curecanti-Poncha & Midway-Poncha	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 586 Curecanti-Poncha & Poncha-San Luis	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 1186 Midway-Poncha & Poncha-San Luis	Failed (Voltage Collapse)	Failed

Existing System Contingency Analysis Summary

Load Level = 144 MW
Power Factor = 0.85

Tot 5 Transfers = 1679 MW
SLV Generation = 0 MW

PSCo/UC Losses = 154/171 MW
Load Model = Actual

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 145 MW	23 - 69 kV Bus Voltages below 0.95 p.u.	San Luis 230-115 kV xfmr = 112%(100) 14 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.11 p.u. Ft Garland 69 kV Deviation = 0.11 p.u.	Ansel-San Luis 69 kV Line= 105% (29) San Luis 230-115 kV xfmr = 113% (100)
Alamosa Term 115-69 kV xfmr Outage	Alamosa Steam 69 kV Dev. = 0.05 p.u. Alamosa Term. 69 kV Dev. = 0.05 p.u. Antonito 69 kV Deviation = 0.05 p.u. Ft Garland 69 kV Deviation = 0.05 p.u. Romeo 69 kV Deviation = 0.05 p.u.	San Luis 230-115 kV xfmr = 113% (100)
Alamosa Term-San Luis 115 kV Outage	10 - 69 kV Bus Voltage Deviations > 0.05 p.u.	San Luis 230-115 kV xfmr = 109% (100) Sargent 115-69 kV xfmr = 107% (63)
Curecanti-Poncha 230 kV Line Outage	29 - 69 kV Bus Voltage Deviations > 0.05 p.u.	Blue Mesa-Skito 115 kV = 117% (100) Gunnison-Skito 115 kV = 104% (100)
Gunnison-Poncha 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 128% (100) Blue Mesa-Curecanti 115 = 109% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 134% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 148% (100)
Rio Grande Tap-Sargent 115 kV Outage	Alamosa Steam 69 kV Dev = 0.09 p.u. Alamosa Term 69 kV Dev = 0.09 p.u. Antonito 69 kV Deviation = 0.09 p.u. Del Norte 69 kV Deviation = 0.17 p.u. Ft Garland 69 kV Deviation = 0.09 p.u. Home Lake 59 kV Deviation = 0.15 p.u. Rio Grande 69 kV Deviation = 0.17 p.u. Romeo 69 kV Deviation = 0.09 p.u.	Alamosa Term 115-69 xfmr = 116% (25) Ansel-San Luis 69 kV Line = 113% (29) San Luis 230-115 kV xfmr = 113% (100)
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 126% (29) San Luis 230-115 kV xfmr = 115% (100) Sargent 115-69 kV xfmr = 113% (63)
Sargent 115-69 kV Transformer Outage	20 - 69 kV Bus Voltage Deviations > 0.05 p.u.	San Luis 115-69 kV xfmr = 142% (42) San Luis 230-115 kV xfmr = 113% (100)
Stuck Poncha CB 386 Curecanti-Poncha & Midway-Poncha	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 586 Curecanti-Poncha & Poncha-San Luis	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 1186 Midway-Poncha & Poncha-San Luis	Failed (Voltage Collapse)	Failed

Existing System Contingency Analysis Summary

Load Level = 144 MW
Power Factor = 0.80

Tot 5 Transfers = 1679 MW
SLV Generation = 0 MW

PSCo/UC Losses = 155/171 MW
Load Model = Actual

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 138 MW	28 - 69 kV Bus Voltages below 0.95 p.u.	San Luis 230-115 kV xfmr = 115%(100) 15 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.10 p.u. Ft Garland 69 kV Deviation = 0.10 p.u.	Ansel-San Luis 69 kV Line= 106% (29) San Luis 230-116 kV xfmr = 114% (100)
Alamosa Term 115-69 kV xfmr Outage	Alamosa Steam 69 kV Dev. = 0.05 p.u. Alamosa Term. 69 kV Dev. = 0.05 p.u. Antonito 69 kV Deviation = 0.05 p.u. Romeo 69 kV Deviation = 0.05 p.u.	San Luis 230-115 kV xfmr = 114% (100)
Alamosa Term-San Luis 115 kV Outage	10 - 69 kV Bus Voltage Deviations > 0.05 p.u.	San Luis 230-115 kV xfmr = 110% (100)
Curecanti-Poncha 230 kV Line Outage	29 - 69 kV Bus Voltage Deviations > 0.05 p.u.	Blue Mesa-Skito 115 kV = 116% (100) Gunnison-Skito 115 kV = 103% (100)
Gunnison-Poncha 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 128% (100) Blue Mesa-Curecanti 115 = 109% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 133% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	20 - 69 kV Bus Voltage Deviations > 0.05 p.u.	San Luis 230-115 kV xfmr = 148% (100)
Rio Grande Tap-Sargent 115 kV Outage	Alamosa Steam 69 kV Dev = 0.09 p.u. Alamosa Term 69 kV Dev = 0.10 p.u. Antonito 69 kV Deviation = 0.09 p.u. Del Norte 69 kV Deviation = 0.18 p.u. Ft Garland 69 kV Deviation = 0.09 p.u. Home Lake 59 kV Deviation = 0.16 p.u. Rio Grande 69 kV Deviation = 0.18 p.u. Romeo 69 kV Deviation = 0.09 p.u.	Alamosa Term 115-69 xfmr = 115% (25) Ansel-San Luis 69 kV Line = 115% (29) San Luis 230-115 kV xfmr = 114% (100)
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 126% (29) San Luis 230-115 kV xfmr = 115% (100) Sargent 115-69 kV xfmr = 113% (63)
Sargent 115-69 kV Transformer Outage	21 - 69 kV Bus Voltage Deviations > 0.05 p.u.	San Luis 115-69 kV xfmr = 141% (42) San Luis 230-115 kV xfmr = 113% (100)
Each Multiple Contingency at Poncha 230 kV	Failed (Voltage Collapse)	Failed
Clear Poncha 115 kV Bus	15 - 69 kV Bus Voltages < 0.90 p.u.	San Luis 230-115 kV xfmr = 115% (100)
Clear San Luis 115 kV Bus	10 - 69 kV Bus Voltages < 0.90 p.u.	None

Existing System Contingency Analysis
Constant MVA & Local Generation On

Load Level = 144 MW Tot 5 Transfers = 1678 MW SLV Generation = 36 MW

The following set of power flow and voltage stability summaries are for the existing system, with the San Luis Valley at its projected peak load in 2006 (144 MW), Tot 5 at its maximum west-to-east power flow capability (1,680 MW), and all local San Luis Valley generation on-line (36 MW, at Alamosa Terminal).

Contingency cases were not run for the cases which modeled San Luis Valley load power factors of 0.95, 0.90, 0.85, and 0.80. The voltage profiles of the system normal cases were simply too poor, and, since the voltage profiles of the contingency cases would be even worse, added insight into the system behavior would not be gained by running these contingencies. In fact, the system normal case at a load power factor of 0.80 did not converge to a solution. Voltage stability simulations confirm that the 144 MW load in the San Luis Valley is beyond the point-of-collapse at a load power factor of 0.80. Detailed power flow and voltage stability plots are in Appendix O.

The Alamosa Generation offsets San Luis Valley load, and provides some local VAr support. The expectation is that, with the additional 36 MW of local generation, the points-of-collapse will be approximately 40 MW higher than the cases without the local Alamosa generation on-line. The summary which follows demonstrates that the expected increase in the points-of-collapse do occur with the local Alamosa Terminal Generation modeled on-line. Table 10, below, compares the points-of-collapse of cases without the Alamosa Generators on-line with the corresponding cases that do model the Alamosa Generators on-line.

Table 10

Comparison of Points-of-Collapse with and without the Alamosa Terminal Generators (Constant MVA Loads)

Case	SLV Generation = 0 MW	SLV Generation = 36 MW
System Normal 1.00 Power Factor	190 MW	228 MW
System Normal 0.95 Power Factor	143 MW	171 MW
System Normal 0.90 Power Factor	126 MW	150 MW
System Normal 0.85 Power Factor	113 MW	135 MW
System Normal 0.80 Power Factor	102 MW	121 MW
Poncha-San Luis Outage 1.00 Power Factor	68 MW	111 MW
Alamosa Term-San Luis Outage 1.00 Power Factor	142 MW	206 MW

Existing System Contingency Analysis Summary

Load Level = 144 MW
Power Factor = 1.00

Tot 5 Transfers = 1677 MW
SLV Generation = 36 MW

PSCo/UC Losses = 151/171 MW
Load Model = Constant MVA

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 228 MW	None	12 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.13 p.u. Ft Garland 69 kV Deviation = 0.14 p.u.	None
Alamosa Term 115-69 kV xfmr Outage	None	None
Alamosa Term-San Luis 115 kV Outage SLV Load @ Pt. of Collapse = 206 MW	None	None
Curecanti-Poncha 230 kV Line Outage	None	Blue Mesa-Skito 115 kV = 116% (100) Gunnison-Skito 115 kV = 104% (100)
Gunnison-Poncha 115 kV Line Outage	None	Blue Mesa-Curecanti 115 = 111% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 107% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage SLV Load @ Pt. of Collapse = 111 MW	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 100% (100)
Rio Grande Tap-Sargent 115 kV Outage	Del Norte 69 kV Deviation = 0.06 p.u. Rio Grande 69 kV Deviation = 0.06 p.u.	None
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 105% (29)
Sargent 115-69 kV Transformer Outage	None	San Luis 115-69 kV xfmr = 113% (42)
Stuck Poncha CB 386 Curecanti-Poncha 230 kV Line & Midway-Poncha 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 586 Curecanti-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 1186 Midway-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed

Existing System Contingency Analysis
Actual Load Model (LOADSYN) & Local Generation On

Load Level = 144 MW Tot 5 Transfers = 1678 MW SLV Generation = 36 MW

This set of cases model the existing system, with the San Luis Valley at its projected peak load in 2006 (144 MW), Tot 5 at its maximum west-to-east power flow capability (1,680 MW), and all local San Luis Valley generation on-line (36 MW, at Alamosa Terminal). In addition, these cases model the San Luis Valley loads with voltage characteristics synthesized by the LOADSYN program. The results of these cases are expected to be slightly better than the results of the cases which model constant MVA loads. Table 11, below, compares the Points-of-Collapse of cases with and without the Alamosa Terminal Generation on-line, with LOADSYN load models. Power flow and voltage stability plots are in Appendix P.

Table 11

Comparison of Points-of-Collapse with and without the Alamosa Terminal Generators (LOADSYN Synthesized Loads)

Case	SLV Generation = 0 MW	SLV Generation = 36 MW
System Normal 1.00 Power Factor	194 MW	232 MW
System Normal 0.95 Power Factor	163 MW	193 MW
System Normal 0.90 Power Factor	153 MW	180 MW
System Normal 0.85 Power Factor	145 MW	170 MW
System Normal 0.80 Power Factor	138 MW	161 MW
Poncha-San Luis Outage 1.00 Power Factor	68 MW	111 MW
Alamosa Term-San Luis Outage 1.00 Power Factor	159 MW	216 MW

Existing System Contingency Analysis Summary

Load Level = 144 MW
Power Factor = 1.00

Tot 5 Transfers = 1678 MW
SLV Generation = 36 MW

PSCo/UC Losses = 151/171 MW
Load Model = Actual

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 232 MW	None	10 Load transformers > 80% of rating
Alamosa Terminal Unit 1	None	None
Alamosa Terminal Unit 2	None	None
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.11 p.u. Ft Garland 69 kV Deviation = 0.11 p.u.	None
Alamosa Term 115-69 kV xfmr Outage	None	None
Alamosa Term-San Luis 115 kV Outage SLV Load @ Pt. of Collapse = 216 MW	None	None
Curecanti-Poncha 230 kV Line Outage	None	Blue Mesa-Skito 115 kV = 117% (100) Gunnison-Skito 115 kV = 104% (100)
Gunnison-Poncha 115 kV Line Outage	None	Blue Mesa-Curecanti 115 = 111% (72)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 107% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage SLV Load @ Pt. of Collapse = 111 MW	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 100% (100)
Rio Grande Tap-Sargent 115 kV Outage	Del Norte 69 kV Deviation = 0.05 p.u. Rio Grande 69 kV Deviation = 0.05 p.u.	None
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 103% (29)
Sargent 115-69 kV Transformer Outage	None	San Luis 115-69 kV xfmr = 112% (42)
Stuck Poncha CB 386 Curecanti-Poncha 230 kV Line & Midway-Poncha 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 586 Curecanti-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 1186 Midway-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed

Existing System Contingency Analysis
Constant MVA & Reduced Tot 5

Load Level = 144 MW Tot 5 Transfers = 1089 MW SLV Generation = 0 MW

The following set of power flow and voltage stability summaries are for the existing system, with the San Luis Valley at its projected peak load in 2006 (144 MW), Tot 5 at a typical west-to-east power flow (1,089 MW), and no local San Luis Valley generation on-line. The load power factor is 1.00.

These cases were run to determine if the level of Tot 5 power transfers had an effect on the performance of the San Luis Valley high-voltage transmission system. The power flow results indicate that very little, if any, such influence exists. Due to the high degree of similarity of the power flow results of cases with Tot 5 at its maximum power transfers, and the cases with Tot 5 at a lower power transfer, voltage stability comparison cases were not run.

The level of Tot 5 power transfers will not be considered an issue with regard to the performance of the San Luis Valley High Voltage System, for the rest of this report. Power flow plots are in Appendix Q.

Existing System Contingency Analysis Summary

Load Level = 144 MW | Tot 5 Transfers = 1089 MW | PSCo/UC Losses = 124/125 MW
Power Factor = 1.00 | SLV Generation = 0 MW | Load Model = Constant MVA

System State	High & Low Voltages	Overloads
System Normal	None	San Luis 230-115 kV xfmr = 105%(100) 9 Load transformers > 80% of rating
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	Alamosa St 69 kV Deviation = 0.12 p.u. Ft Garland 69 kV Deviation = 0.13 p.u.	San Luis 230-115 kV xfmr = 107% (100)
Alamosa Term 115-69 kV xfmr Outage	Antonito 69 kV Deviation = 0.05 p.u. Ft. Garland 69 kV Deviation = 0.05 p.u. Romeo 69 kV Deviation = 0.05 p.u.	San Luis 230-115 kV xfmr = 106% (100)
Alamosa Term-San Luis 115 kV Outage	Failed (Voltage Collapse)	Failed
Curecanti-Poncha 230 kV Line Outage	None	None
Gunnison-Poncha 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 115% (100)
Midway-Poncha 230 kV Line Outage	None	San Luis 230-115 kV xfmr = 111% (100)
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage	Failed (Voltage Collapse)	Failed
Poncha-Sargent 115 kV Line Outage	None	San Luis 230-115 kV xfmr = 136% (100)
Rio Grande Tap-Sargent 115 kV Outage	Del Norte 69 kV Deviation = 0.09 p.u. Ft Garland 69 kV Deviation = 0.05 p.u. Home Lake 69 kV Deviation = 0.08 p.u. Rio Grande 69 kV Deviation = 0.09 p.u.	Alamosa Term 115-69 xfmr = 136% (25) San Luis 230-115 kV xfmr = 112% (100)
San Luis 115-69 kV xfmr Outage	None	Ansel-San Luis 69 kV Line = 121% (29) San Luis 230-115 kV xfmr = 105% (100)
Sargent 115-69 kV Transformer Outage	None	San Luis 115-69 kV xfmr = 140% (42) San Luis 230-115 kV xfmr = 107% (100)
Stuck Poncha CB 386 Curecanti-Poncha 230 kV Line & Midway-Poncha 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 586 Curecanti-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed
Stuck Poncha CB 1186 Midway-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	Failed (Voltage Collapse)	Failed

Existing System Contingency Analysis
Constant MVA at Low Regional Load

Load Level = 20 MW SLV Generation = 0 MW

The following set of power flow and voltage stability summaries are for the existing system, with the San Luis Valley at its lowest load in 1995 (20 MW) and no local San Luis Valley generation on-line. These cases were prepared to assess the need for reactors during periods of low loads.

The results of these cases indicate that some provision to reduce voltages during periods of low load in the San Luis Valley is required. Voltage collapse is not a concern during periods of low load, and the cases would results in the same point-of-collapse as noted on the cases with San Luis Valley loads at 144 MW. Therefore, the points of collapse ~~of collapse~~ noted on the summary sheets are identical to those noted on the corresponding peak load cases.

Power flow plots are in Appendix R.

Existing System Contingency Analysis Summary

Load Level = 20 MW
Power Factor = 1.00

Tot 5 Transfers = 1668 MW
SLV Generation = 0 MW

PSCo/UC Losses = 150/168 MW
Load Model = Constant MVA

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 190 MW	Carmel 69 kV Bus Voltage = 1.07 p.u. Creede 69 kV Bus Voltage = 1.08 p.u. Highland 69 kV Bus Voltage = 1.08 p.u. Ramon 69 kV Bus Voltage = 1.08 p.u. San Acacio 69 kV Voltage = 1.08 p.u. South Fork 69 kV Voltage = 1.08 p.u. Stockade 69 kV Bus Voltage = 1.08 p.u. Waverly 69 kV Bus Voltage = 1.07 p.u. Zinzer 69 kV Bus Voltage = 1.07 p.u.	None
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	None	None
Alamosa Term 115-69 kV xfmr Outage	None	None
Alamosa Term-San Luis 115 kV Outage SLV Load @ Pt. of Collapse = 142 MW	None	None
Curecanti-Poncha 230 kV Line Outage	None	Blue Mesa-Skito 115 kV = 107% (100)
Gunnison-Poncha 115 kV Line Outage	None	Blue Mesa-Curecanti 115 = 112% (72)
Midway-Poncha 230 kV Line Outage	Carmel 69 kV Bus Voltage = 1.11 p.u. Creede 69 kV Bus Voltage = 1.11 p.u. Highland 69 kV Bus Voltage = 1.11 p.u. Ramon 69 kV Bus Voltage = 1.11 p.u. San Acacio 69 kV Voltage = 1.11 p.u. South Fork 69 kV Voltage = 1.11 p.u. Stockade 69 kV Bus Voltage = 1.11 p.u. Waverly 69 kV Bus Voltage = 1.11 p.u. Zinzer 69 kV Bus Voltage = 1.11 p.u.	None
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage SLV Load @ Pt. of Collapse = 68 MW	30 - 69 kV Bus Voltage Deviations > 0.05 p.u.	None
Poncha-Sargent 115 kV Line Outage	None	None
Rio Grande Tap-Sargent 115 kV Outage	None	None
San Luis 115-69 kV xfmr Outage	None	None
Sargent 115-69 kV Transformer Outage	None	None
Stuck Poncha CB 386 Curecanti-Poncha & Midway-Poncha	18 - 69 kV Bus Voltages > 1.10 p.u.	Blue Mesa-Skito 115 kV = 105% (100)
Stuck Poncha CB 586 Curecanti-Poncha & Poncha-San Luis	None	Blue Mesa-Skito 115 kV = 102% (100)
Stuck Poncha CB 1186 Midway-Poncha & Poncha-San Luis	None	Blue Mesa-Skito 115 kV = 102% (100)

Existing System Contingency Analysis
Actual Load Model (LOADSYN)

Load Level = 20 MW SLV Generation = 0 MW

This set of cases assesses the need for reactive support in the San Luis Valley during light load periods, with LOADSYN synthesized load models. These cases model the existing system, with the San Luis Valley at its lowest load in 1995 (20 MW) and no local San Luis Valley generation on-line. Power flow plots are in Appendix S.

The results of these cases are not significantly different from the constant MVA cases, and these cases also indicate that some provision to reduce voltages during periods of low load in the San Luis Valley is required.

Existing System Contingency Analysis Summary

Load Level = 20 MW
Power Factor = 1.00

Tot 5 Transfers = 1668 MW
SLV Generation = 0 MW

PSCo/UC Losses = 150/168 MW
Load Model = Actual

System State	High & Low Voltages	Overloads
System Normal SLV Load @ Pt. of Collapse = 194 MW	Carmel 69 kV Bus Voltage = 1.07 p.u. Creede 69 kV Bus Voltage = 1.08 p.u. Highland 69 kV Bus Voltage = 1.08 p.u. Ramon 69 kV Bus Voltage = 1.08 p.u. San Acacio 69 kV Voltage = 1.08 p.u. South Fork 69 kV Voltage = 1.08 p.u. Stockade 69 kV Bus Voltage = 1.08 p.u. Waverly 69 kV Bus Voltage = 1.07 p.u. Zinzer 69 kV Bus Voltage = 1.07 p.u.	None
Alamosa Steam-Alamosa Terminal 69 kV Line Outage	None	None
Alamosa Term 115-69 kV xfmr Outage	None	None
Alamosa Term-San Luis 115 kV Outage SLV Load @ Pt. of Collapse = 159 MW	None	None
Curecanti-Poncha 230 kV Line Outage	None	Blue Mesa-Skito 115 kV = 107% (100)
Gunnison-Poncha 115 kV Line Outage	None	Blue Mesa-Curecanti 115 = 112% (72)
Midway-Poncha 230 kV Line Outage	Carmel, Creede, Highland, Ramon, San Acacio, South Fork, Stockade, Waverly, & Zinzer 69 kV Bus Voltages =1.11 p.u.	None
Poncha-San Luis 230 kV Line or San Luis 230-115 kV xfmr Outage SLV Load @ Pt. of Collapse = 68 MW	Carmel, Creede, Highland, Ramon, San Acacio, South Fork, Stockade, Waverly, & Zinzer 69 kV Deviation = 0.05 p.u.	None
Poncha-Sargent 115 kV Line Outage	None	None
Rio Grande Tap-Sargent 115 kV Outage	None	None
San Luis 115-69 kV xfmr Outage	None	None
Sargent 115-69 kV Transformer Outage	None	None
Stuck Poncha CB 386 Curecanti-Poncha 230 kV Line & Midway-Poncha 230 kV Line Outage	Carmel, Creede, Highland, Ramon, San Acacio, South Fork, Stockade, Waverly, & Zinzer 69 kV Bus Voltages =1.15 p.u.	Blue Mesa-Skito 115 kV = 105% (100)
Stuck Poncha CB 586 Curecanti-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	None	Blue Mesa-Skito 115 kV = 103% (100)
Stuck Poncha CB 1186 Midway-Poncha 230 kV Line & Poncha-San Luis 230 kV Line Outage	None	Blue Mesa-Skito 115 kV = 103% (100)

System Alternative Summary
San Luis Valley High Voltage System

This portion of the study report begins an evaluation of alternatives to improve the electrical performance of the San Luis Valley High Voltage System. The summaries which follow indicate that the voltage collapse concerns of the San Luis Valley High Voltage System cannot be mitigated with the addition of a 115 kV line into the region. A San Luis Valley-Walsenburg 230 kV line addition is technically feasible, and a Burro Canyon-San Luis 230 kV line is also technically feasible, as long as at least 60 MW of generation is running at Burro Canyon. Any new 230 kV connection to San Luis Substation also requires a second 230-115 kV autotransformer at San Luis Substation. In addition, several new 69 kV capacitors and 69 kV line uprates are required on the San Luis Valley High Voltage System, to fully satisfy reliability criteria.

The process of identifying technically acceptable alternatives progressed by first identifying alternatives to improve the voltage collapse associated with the Poncha-San Luis 230 kV line outage. The system additions that improved the performance of the San Luis Valley High Voltage System for that critical outage were utilized in progressive alternatives, to address voltage collapse associated with the Alamosa Terminal-San Luis 115 kV line outage, and then addressing the overloads and low voltages of lesser impact. For this reason, some of the alternatives appear similar, because the higher numbered alternatives build on the lower numbered alternatives.

Note that lower numbered alternatives were studied with constant MVA loads, and a unity (1.0) power factor. This is an optimistic power factor, and the loads of the San Luis Valley cannot be expected to have a 1.0 power factor during peak loads. However, this was done because the existing system performed very poorly with power factors below 1.0. As system improvements were identified, and the system was better able to support lower power factors, the analysis was switched to the actual load characteristic model, with actual peak load power factors. In addition, more information on the actual power factors in the region were obtained, as the study progressed.

Also, since the Alamosa Terminal generators do not typically run, all alternatives to investigate system improvements were completed with these generators off-line. A summary of all of the study alternatives is below.

Alternative 1: This includes a Pagosa-Ramon 115 kV Line Addition. The results of this alternative are unsatisfactory, since the Poncha-San Luis 230 kV line outage created a voltage collapse condition in the San Luis Valley. Overall, a comparison of the summary sheet of this alternative to the existing system alternative indicates that a Pagosa-Ramon 115 kV line addition does not significantly improve the region's system performance. These cases were completed with constant MVA loads, and an optimistic power factor of 1.0.

Alternative 2: This includes a Lake City-Ramon 115 kV Line Addition. All of the comments for Alternative 1 apply to Alternative 2.

Alternative 3: This includes a Burro Canyon-San Luis 230 kV Line Addition, a second San Luis 230-115 kV autotransformer, and no generation at Burro Canyon. The results of this alternative are unsatisfactory, since the Poncha-San Luis 230 kV line outage created a voltage collapse condition in the San Luis Valley.

The combined results of Alternatives 1 through 3 indicate that another 115 kV line into the San Luis Valley is not sufficient to mitigate the voltage collapse concerns of the San Luis Valley High Voltage System. Alternative 3 is a 230 kV addition, however it depends on the 115 kV system between Burro Canyon and Walsenburg Substations to support the San Luis Valley during a Poncha-San Luis 230 kV line outage.

The possibility still exists that the Burro Canyon-San Luis 230 kV line addition will be successful in improving the performance of the San Luis Valley system, if generation is on-line at Burro Canyon. This is investigated in another alternative. Alternative 3 was investigated with constant MVA loads, and an optimistic power factor of 1.0.

Alternative 4: This includes a San Luis-Walsenburg 230 kV Line Addition and a second San Luis 230-115 kV autotransformer. This case displays satisfactory results to support the San Luis Valley region during the loss of the Poncha-San Luis 230 kV line. This alternative must be further developed to address the 69 kV overloads of the region, and the less severe low voltages in the region. These cases were completed with constant MVA loads, and an optimistic power factor of 1.0.

Alternative 5: This includes the addition of several dispersed Static VAr Compensators (SVCs) throughout the San Luis Valley region. Seven 100 MVAr SVCs, holding 1.02 p.u. voltages at 69 kV busses, are added at Antonito, Fort Garland, Mosca, Ramon, San Luis, Sargent, and Waverly. The results of this alternative are unsatisfactory, since the Poncha-San Luis 230 kV line outage created a voltage collapse condition on the region's system.

This alternative eliminates the possibility of mitigating the voltage collapse concerns of the San Luis Valley High Voltage System with VAr support devices instead of a new transmission line. These cases were also completed with constant MVA loads, and an optimistic power factor of 1.0.

Alternative 6: This includes a Burro Canyon-San Luis 230 kV Line Addition, a second San Luis 230-115 kV transformer, and 90-120 MW of generation at Burro Canyon. This alternative also demonstrated acceptable performance by improving system performance for the Poncha-San Luis 230 kV Line outage. Alternative 6 also requires further development to fully satisfy reliability criteria. These cases were completed with constant MVA loads, and an optimistic unity power factor.

Alternative 7: This alternative builds on Alternative 4, by adding SVCs at Alamosa Steam and Rio Grande Tap 69 kV. The results of this alternative are satisfactory, and improve the electrical performance of Alternative 4. The Poncha-San Luis 230 kV line outage is acceptable, and the regional voltage profile is adequately supported. Further development of this alternative is required to mitigate overloading on several 69 kV lines and 115-69 kV autotransformers in the region. These cases were completed with constant MVA loads and an optimistic unity power factor.

Alternative 8: This builds on Alternative 4, by adding an Alamosa Terminal-Waverly 115 kV line, to support the Alamosa Terminal-San Luis 115 kV line outage. An SVC is also modeled at Rio Grande Tap 69 kV. This case was investigated to determine the feasibility of adding a 115 kV transmission line in lieu of an Alamosa Steam Capacitor.

The results of this alternative are not satisfactory. The Alamosa Terminal-Waverly 115 kV line does not eliminate the need to add a capacitor at Alamosa Steam, because high post-transient voltage deviations are noted for loss of the Alamosa Steam-Alamosa Terminal 69 kV line. These cases were completed with constant MVA loads and an optimistic power factor of 1.0.

Alternative 9: This alternative builds on Alternative 6, by adding SVCs at Alamosa Steam and Rio Grande Tap 69 kV. The results of this alternative are acceptable, and improve the results obtained with Alternative 6. Further development of this alternative is required to mitigate overloading on several 69 kV line and 115-69 kV autotransformers in the region. These cases were completed with constant MVA loads and an optimistic power factor.

Alternative 10: This alternative is identical to Alternative 9, except that the proposed generation at Burro Canyon is 60 MW, instead of 90-120 MW. The results of previous alternatives indicate that a Burro Canyon-San Luis 230 kV line is acceptable with 90-120 MW of generation at Burro Canyon, but unacceptable with no generation at Burro Canyon. Alternative 10 investigates the performance of an intermediate Burro Canyon generation capability.

The results of this alternative are also acceptable. Further development of this alternative is required to fully comply with the reliability criteria. These cases were completed with constant MVA loads and an optimistic unity power factor.

Alternative 11: This alternative is identical to Alternative 10, except that the proposed generation at Burro Canyon is 30 MW. This is investigated because, the addition of a Burro Canyon-San Luis 230 kV line demonstrated acceptable system performance with 90-120 MW and 60 MW of Burro Canyon generation. Previous results also indicate that the Burro Canyon-San Luis 230 kV line addition is insufficient, with no generation added at Burro Canyon.

The results of Alternative 11 are satisfactory. Further development of this alternative is required to mitigate overloading on several 69 kV lines and 115-69 kV autotransformers in the region. These cases were completed with constant MVA loads and an optimistic unity power factor.

Alternative 12: This alternative builds on Alternative 7 by adding a second Alamosa Terminal 115-69 kV transformer, a second San Luis 115-69 kV transformer, and uprates for the Ansel-San Luis, Alamosa Steam-Mosca, and Rio Grande Tap-Sargent 69 kV lines. Previous results, completed with constant MVA loads and with a unity power factor, indicate that this alternative should be sufficient for all system contingencies in the San Luis Valley region.

With the transition from constant MVA loads at unity power factor, to the actual load model and actual power factors, causes unsatisfactory results. Further development is still required to fully comply with the reliability criteria.

Alternative 13: This alternative is identical to Alternative 12, except the proposed San Luis-Walsenburg 230 kV line is replaced with the proposed Burro Canyon-San Luis 230 kV line, and 90-120 MW of generation at Burro Canyon. The results of Alternative 13, also utilizing the actual load model and actual power factors, are similar to Alternative 12, and further development is required to fully satisfy the reliability criteria.

Alternative 14: This alternative is identical to Alternative 13, except the generation at Burro Canyon is 60 MW rather than 90-120 MW. The results of Alternative 14 are identical to Alternative 13, and additional alternative development is required.

Alternative 15: This alternative is identical to Alternative 14, except the generation at Burro Canyon is 30 MW rather than 60 MW. The results of Alternative 15 are identical to Alternative 14, and additional alternative development is required.

Alternative 16: This alternative modifies Alternative 12, by adding more 69 kV capacitors to the San Luis Valley High Voltage System. Alternative 16 models the addition of a San Luis-Walsenburg 230 kV line, a second San Luis 230-115 kV autotransformer, a second Alamosa Terminal 115-69 kV autotransformer, and a second San Luis 115-69 kV autotransformer. Furthermore, capacitor additions are modeled at Alamosa Steam, Antonito, Del Norte, Fort Garland, and Home Lake 69 kV. Uprates of the Ansel-San Luis, Alamosa Steam-Mosca, and Rio Grande Tap-Sargent 69 kV lines are also modeled.

This alternative was investigated with the actual load characteristics and actual power factors modeled, and the results of this alternative are acceptable. Slight modifications to this alternative are that capacitors at Home Lake are not necessary, and an additional uprate, of the Home Lake-Rio Grande Tap 69 kV line, is necessary. All other credible contingencies demonstrate acceptable performance of the San Luis Valley High Voltage System.

Alternative 17: This alternative is identical to Alternative 16, except that the proposed San Luis-Walsenburg 230 kV line is replaced with the proposed Burro Canyon-Walsenburg 230 kV line, with 90-120 MW of generation at Burro Canyon. The results of this alternative, also utilizing the actual load characteristics and power factors, are acceptable. Slight modifications to this alternative are that capacitors at Home Lake are not necessary, and an additional uprate, of the Home Lake-Rio Grande Tap 69 kV line, is necessary. All other credible contingencies demonstrate acceptable performance of the San Luis Valley High Voltage System.

Alternative 18: This alternative is identical to Alternative 17, except that the proposed 90-120 MW generator at Burro Canyon is replaced with a 60 MW generator. The results of this alternative, modeling the actual load characteristics and power factors, are acceptable. Slight modifications to this alternative are that capacitors at Home Lake are not necessary, and an additional uprate, of the Home Lake-Rio Grande Tap 69 kV line, is necessary. All other credible contingencies demonstrate acceptable performance of the San Luis Valley High Voltage System.

Alternative 19: This alternative is also identical to Alternative 18, except that the proposed 60 MW generator at Burro Canyon is replaced with a 30 MW generator. The results of this alternative, modeling the actual load characteristics and power factors, are acceptable. Slight modifications to this alternative are that capacitors at Home Lake are not necessary, and an additional uprate, of the Home Lake-Rio Grande Tap 69 kV line, is necessary. All other credible contingencies demonstrate acceptable performance of the San Luis Valley High Voltage System.

Alternative 1 Contingency Analysis
Pagosa-Ramon 115 kV Line Addition

Load Level = 154 MW SLV Generation = 0 MW

The following power flow summary is for Alternative 1, which adds a Pagosa-Wolf Creek-Ramon 115 kV line to the high-voltage transmission. An additional 10 MW of load is modeled at Wolf Creek Substation. The possibility of upgrading the existing Ramon-South Fork-Highland 69 kV line to complete the Pagosa-Wolf Creek-Ramon 115 kV line exists, however, to assess the effectiveness of this option in improving the voltage stability of the San Luis Valley High Voltage Transmission System, a new line was simply added to the system representation. Alternative 1 was studied with no local San Luis Valley generation on-line. The following summary notes the results of these cases, which modeled constant MVA loads, at a power factor of 1.00. Power flow cases are in Appendix 1.

The results of the these cases indicate that this alternative does not effectively mitigate the voltage collapse concerns of the San Luis Valley High Voltage Transmission System, even though the power factor is an 1.00. Since this alternative fails at an optimistic power factor of 1.00, it can be eliminated from further consideration.