COLORADO COORDINATED PLANNING GROUP (CCPG)
NERC/WECC COMPLIANCE REPORT
AND REACTIVE MARGIN ANALYSIS
December 28, 2009

1. INTRODUCTION

The purpose of this study is to help CCPG Transmission Planners meet selected Standards and Criteria set forth by the North American Electric Reliability Corporation (NERC) and the Western Electricity Coordinating Council (WECC) via a coordinated planning process. The transmission system performance assessment studies documented in this report specifically address NERC Standards TPL-001, TPL-002, TPL-003, and TPL-004. It is the responsibility of each Transmission Planner or Planning Authority to ensure that they are in compliance with NERC Standards. This report may not completely fulfill compliance requirements, and parties may have to supplement this information with other system analyses. It is recommended that entities document the results of these studies in a separate annual "Compliance Assessment" document to use for auditing purposes.

This study consists of load flow, transient stability, and voltage stability analyses. The study area consists of the CCPG footprint, including the states of Wyoming and Colorado, and can be electrically described as the area bounded by Yellowtail to the north, the DC ties at Rapid City, Stegall, Sidney and Lamar to the east, TOT1A and Jim Bridger to the west, and TOT2A to the south. This study is generally completed annually, or as system conditions warrant.

The study was performed using PTI PSS/E version 30.3.3.

2. SYSTEM MODELS

The transmission system models were developed from models prepared by the Western Electricity Coordinating Council (WECC) to conduct assessments for the near-term (years one through five) and the long-term (years six through ten) planning horizons. The three base cases included in this study originated from the WECC 2012-13 light winter loading case (13lw1sa), 2013-14 heavy winter loading case (14hw1a), and the 2018-19 heavy winter loading case (19hw1a). The cases include both existing and planned facilities. CCPG study participants reviewed these cases to ensure accurate load, generation, and topology modeling.

In the steady state analysis, all Bulk Electric System (BES) high voltage (>= 115kV) bus voltages and non-radial branch flows in the CCPG area are monitored for criteria violations.

The transient stability cases include the detailed Sidney DC tie, Stegall DC tie, and Rapid City DC tie models. All BES buses in the study area are monitored for voltage and major generating units in the area are monitored for stability.

3. CRITERIA

System performance was measured against criteria set forth by NERC, WECC, and CCPG. Regional voltage criteria are documented in the CCPG Rocky Mountain Voltage Coordination Guidelines (VCG).

a) Steady State - System Intact

Based on the VCG, voltages are maintained between 1.05 p.u. and 0.95 p.u. Transmission line and transformer loadings were flagged if they exceeded 100% of continuous rating. Shunt reactive device switching and transformer tap adjustments are enabled. Phase shifters are locked.

b) Steady State - Contingency

Category B – Based on the VCG, voltages are generally maintained between 1.10 p.u. and 0.90 p.u. Platte River Power Authority minimum bus voltage is 0.92 p.u. at load busses. Transmission line and transformer loadings were flagged if they exceeded 100% of continuous rating or an established emergency rating. Automatic shunt reactive device switching is enabled. Transformer tap adjustments are locked. Phase shifters are locked.

Category C – Allowable emergency limits will be considered as determined by the affected parties and the available emergency mitigation plan. Curtailment of firm transfers, generation redispatch, and load shedding will be considered if necessary.

Category D – Evaluate for risks and consequences. If applicable, use allowable emergency limits as determined by available emergency mitigation plans. Curtailment of firm transfers, generation redispatch, and load shedding will be considered if necessary.

c) Transient Stability

NERC Standards require that the system remain stable for Category A, B, and C disturbances.

The *WECC Disturbance – Performance Table of Allowable Effects on Other Systems,* included in Appendix A, has the following requirements:

Category B: Any transient voltage dip must not exceed 25% at load buses or 30% at nonload buses. The dip also must not exceed 20% for more than 20 cycles at load buses. Frequency must not drop below 59.6 Hz for 6 or more cycles at a load bus.

Category C: Any transient voltage dip must not exceed 30% at load buses or 30% at nonload buses. The dip also must not exceed 20% for more than 40 cycles at load buses. Frequency must not drop below 59.0 Hz for 6 or more cycles at a load bus.

d) Voltage Stability

The established WECC voltage stability criteria for acceptable real power (MW) margins are as follows: 5% for Category A and B outages, 2.5% for Category C, and 0% for Category D outages.

4. PLANNING STANDARDS AND MEASUREMENTS

The following procedures were used for both the near term 2014 light and heavy winter loading base cases, and the long term 2020 heavy winter loading base case. The NERC/WECC Table 1, which contains the Category A, B, C, and D outage definitions, is provided in Appendix A.

All normal operating procedures and the effects of all control devices and protection systems are modeled. The effects of any BES equipment planned to be out-of-service during the critical demand levels are modeled. All projected firm transfers are modeled per the WECC base case detail. Reactive power resources are included in the model to ensure adequate reactive resources are available to meet system performance.

Category C and Category D contingencies are those that would produce more severe system results or impacts based on Transmission Planners knowledge of the system and engineering judgment. The rationale for selected disturbances considers the following: large bulk transfer paths, significant substations, large generation stations, transmission using common right-of-way (ROW), common structure, and breaker configuration/line location in selected substations.

The Category D contingencies selected on Western's system include all buses identified per their Critical Asset Methodology document which states that Western will test for cascading on all busses that have a maximum fault duty greater than 5000 MVA within the WACM BA, which account for 12 of the 22 Category D contingencies. Criteria violations are evaluated based on resulting consequences and are assessed whether any additional projects should be added to Western-RMR's Capital Investment Plan.

Planned upgrades, additions, or corrective actions needed to meet the performance requirements for each Category of contingency (outage) conditions are identified in the Appendices along with the system performance results.

TPL-001 N-0 System Performance (NERC Category A Outages)

Steady State: The case is checked for system intact criteria violations.

Transient Stability: A non-disturbance case is run.

TPL-002 N-1 System Performance (NERC Category B Outages)

Steady State: The NERC Category B outage list consists of all single branches in the CCPG study area operated at 115 kV or greater, plus all major generating units in the CCPG area, including Cherokee4, Comanche3, Pawnee, Rawhide, MBPP1, Nixon, Craig1, DJ4, and Wyodak.

Transient Stability: A list of Category B faults was created by the CCPG study participants to meet the requirements of the WECC/NERC standard. This Category B fault list for the 2014 and 2020 cases is provided in Appendix B.

TPL-003 N-2 System Performance (NERC Category C Outages)

Steady State: A list of Category C outages was created by the CCPG study participants to meet the requirements of the WECC/NERC standard. This Category C outage list for the 2014 and 2020 cases is provided in Appendix C.

Transient Stability: A list of Category C faults was created by the CCPG study participants to meet the requirements of the WECC/NERC standard. This Category C fault list for the 2014 and 2020 cases is provided in Appendix B.

TPL-004 Extreme Contingency (NERC Category D Outages)

Steady State: A list of Category D outages was created by the CCPG study participants to meet the requirements of the WECC/NERC standard. This Category D outage list for the 2014 and 2020 cases is provided in Appendix C.

Transient Stability: A list of Category D faults was created by the CCPG study participants to meet the requirements of the WECC/NERC standard. This Category D fault list for the 2014 and 2020 cases is provided in Appendix B.

5. VOLTAGE STABILITY

The voltage stability study consists of a PV analysis of the system contained within the TOT3/TOT5 area. The TOT3/TOT5 area is considered to be south of TOT3, north of the Colorado/New Mexico border, east of TOT5, and west of the east/west interconnect boundary. Load within the TOT3/TOT5 area is scaled up, area generation is held constant, and power is imported into the area in order to determine the collapse point. The voltage stability margin is calculated by comparing the TOT3/TOT5 area load in the initial base case to the scaled area load determined at the collapse point. The NERC Category A, B, C and D forced outages, as described in Section 4, are analyzed. The prior outages of major TOT3/TOT5 area generation facilities are also considered. Separate results for the prior outages of Comanche #3, Cherokee #4, and Pawnee #1 generation units are provided. For each generator prior outage other TOT3/TOT5 area generation is redispatched to make up for the lost generation. The established WECC voltage stability criteria for acceptable real power (MW) margins are as follows: 5% for Category A and B outages, 2.5% for Category C, and 0% for Category D outages. Both the 2014 winter cases and the 2020 winter case are studied.

6. RESULTS

NEAR TERM BASE CASE – 2014 LIGHT WINTER

AREA PATH FLOW; TOT3 = 660, TOT7 = 246, TOT5 = 371, TOT4A = 283

TPL-001 N-0 System Performance (NERC Category A Outages)

Steady State: The results of the N-0 Steady State Analysis indicate NO criteria violations. The results of the N-0 Steady State Analysis are listed in Appendix D.

Transient Stability: The results of the N-0 Transient Stability Analysis indicate NO criteria violations. The results of the N-0 Transient Stability Analysis are listed in Appendix E.

TPL-002 N-1 System Performance (NERC Category B Outages)

Steady State: The results of the N-1 Steady State Analysis indicate numerous voltage and loading violations that appear to exceed the criteria stated in Section 3 of this report. The detailed results of the N-1 analysis are shown in Appendix D. In some instances, the simplified analysis showed violations that wouldn't occur under actual system operation. For other violations there are plans to achieve the required system performance. These plans include planned system upgrades or established operating procedures. The violations and comments for the N-1 Steady State Analysis are listed in Appendix D.

Transient Stability: The results of the N-1 Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few N-1 disturbances. The results of the N-1 Transient Stability Analysis and comments are listed in Appendix E.

TPL-003 N-2 System Performance (NERC Category C Outages)

Steady State: The results of the N-2 Steady State Analysis indicate numerous voltage and loading violations that appear to exceed the criteria stated in Section 3 of this report. The detailed results of the N-1 analysis are shown in Appendix D. In some instances, the simplified analysis showed violations that wouldn't occur under actual system operation. For other violations there are plans to achieve the required system performance. These plans include planned system upgrades or established operating procedures. The violations and comments for the N-2 Steady State Analysis are listed in Appendix D.

Transient Stability: The results of the N-2 Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few N-2 disturbances. The results of the N-2 Transient Stability Analysis and comments are listed in Appendix E.

TPL-004 Extreme Contingency (NERC Category D Outages)

Steady State: The results of the "Extreme Contingency" Steady State Analysis indicate several loading and voltage violations which exceeded the criteria stated in Section 3 of this report. The violations and comments for the "Extreme Contingency" Steady State Analysis are listed in Appendix D.

Transient Stability: The results of the "Extreme Contingency" Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few disturbances. The results of the N-2 Transient Stability Analysis and comments are listed in Appendix E.

NEAR TERM BASE CASE – 2014 HEAVY WINTER

AREA PATH FLOW; TOT3 = 861, TOT7 = -75, TOT5 = 227, TOT4A = 290

TPL-001 N-0 System Performance (NERC Category A Outages)

Steady State: The results of the N-0 Steady State Analysis indicate NO criteria violations. The results of the N-0 Steady State Analysis are listed in Appendix F.

Transient Stability: The results of the N-0 Transient Stability Analysis indicate NO criteria violations. The results of the N-0 Transient Stability Analysis are listed in Appendix G.

TPL-002 N-1 System Performance (NERC Category B Outages)

Steady State: The results of the N-1 Steady State Analysis indicate numerous voltage and loading violations that appear to exceed the criteria stated in Section 3 of this report. The detailed results of the N-1 analysis are shown in Appendix F. In some instances, the simplified analysis showed violations that wouldn't occur under actual system operation. For other violations there are plans to achieve the required system performance. These plans include planned system upgrades or established operating procedures. The violations and comments for the N-1 Steady State Analysis are listed in Appendix F.

Transient Stability: The results of the N-1 Transient Stability Analysis indicate NO criteria violations. The results of the N-1 Transient Stability Analysis are listed in Appendix G.

TPL-003 N-2 System Performance (NERC Category C Outages)

Steady State: The results of the N-2 Steady State Analysis indicate numerous voltage and loading violations that appear to exceed the criteria stated in Section 3 of this report. The detailed results of the N-1 analysis are shown in Appendix F. In some instances, the simplified analysis showed violations that wouldn't occur under actual system operation. For other violations there are plans to achieve the required system performance. These plans include planned system upgrades or established operating procedures. The violations and comments for the N-2 Steady State Analysis are listed in Appendix F.

Transient Stability: The results of the N-2 Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few N-2 disturbances. The results of the N-2 Transient Stability Analysis and comments are listed in Appendix G.

TPL-004 Extreme Contingency (NERC Category D Outages)

Steady State: The results of the "Extreme Contingency" Steady State Analysis indicate several loading and voltage violations which exceeded the criteria stated in Section 3 of this report. The violations and comments for the "Extreme Contingency" Steady State Analysis are listed in Appendix F.

Transient Stability: The results of the "Extreme Contingency" Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few disturbances. The results of the N-2 Transient Stability Analysis and comments are listed in Appendix G.

LONG TERM BASE CASE – 2020 HEAVY WINTER

AREA PATH FLOW; TOT3 = 932, TOT7x = 206, TOT5 = 411, TOT4A = 282

TPL-001 N-0 System Performance (NERC Category A Outages)

Steady State: The results of the N-0 Steady State Analysis indicated voltage and overload violations. The results of the N-0 Steady State Analysis are listed in Appendix I.

Transient Stability: The results of the N-0 Transient Stability Analysis indicate NO criteria violations. The results of the N-0 Transient Stability Analysis are listed in Appendix J.

TPL-002 N-1 System Performance (NERC Category B Outages)

Steady State: The results of the N-1 Steady State Analysis indicate numerous voltage and loading violations that appear to exceed the criteria stated in Section 3 of this report. The detailed results of the N-1 analysis are shown in Appendix I. In some instances, the simplified analysis showed violations that wouldn't occur under actual system operation. For other violations there are plans to achieve required system performance. These plans include planned system upgrades or established operating procedures. The violations and comments for the N-1 Steady State Analysis are listed in Appendix I.

Transient Stability: The results of the N-1 Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few N-1 disturbances. The results of the N-1 Transient Stability Analysis and comments are listed in Appendix J.

TPL-003 N-2 System Performance (NERC Category C Outages)

Steady State: The results of the N-2 Steady State Analysis indicate numerous voltage and loading violations that appear to exceed the criteria stated in Section 3 of this report. The violations and comments for the N-2 Steady State Analysis are listed in Appendix I.

Transient Stability: The results of the N-2 Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few N-2 disturbances. The results of the N-2 Transient Stability Analysis and comments are listed in Appendix J.

TPL-004 Extreme Contingency (NERC Category D Outages)

Steady State: The results of the "Extreme Contingency" Steady State Analysis indicate several loading and voltage violations that exceeded the criteria stated in Section 3 of this report. The violations and comments for the "Extreme Contingency" Steady State Analysis are listed in Appendix I.

Transient Stability: The results of the "Extreme Contingency" Transient Stability Analysis indicate NO voltage criteria violations. Frequency deviations are noted for a few disturbances. The results of the "Extreme Contingency" Transient Stability Analysis and comments are listed in Appendix J.

7. VOLTAGE STABILITY RESULTS

The established WECC voltage stability criteria for acceptable real power (MW) margins are as follows: 5% for Category A and B outages, 2.5% for Category C, and 0% for Category D outages. PV analysis results are provided for the Category A, B, C, and D outages described in Section 3. The following is a summary of the study results. The 2014 results are provided in Appendix H and 2020 results in Appendix K.

2014 LIGHT WINTER - NO PRIOR OUTAGE

The Voltage Stability Analysis indicated the following voltage stability margins for the 2014 LW system intact base case. The system intact margin was determined to be 34.6%. The outage of Comanche #4 provided the least margin, 27.3%, of the Category B outages. The Front Range-Nixon 230 and Midway-Nixon 230 outage provided the least margin,19.1%, of the Category C outages, and the San Luis 115 kV bus outage provided the least margin, 15.1%, of the Category D outages. All are within the established voltage stability criteria.

2014 LIGHT WINTER - CHEROKEE UNIT 4 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Cherokee #4 generation in the 2014 LW base case. The Cherokee #4 prior outage margin was determined to be 31.3%. The outage of Comanche #3 provided the least margin, 23.5%, of the Category B outages. The Front Range-Nixon 230 and Midway-Nixon 230 outage provided the least margin,17.2%, of the Category C outages, and the San Luis 115 kV bus outage provided the least margin, 14.9%, of the Category D outages. All are within the established voltage stability criteria.

2014 LIGHT WINTER – COMANCHE UNIT 3 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Comanche #3 generation in the 2014 LW base case. The Comanche #3 prior outage margin was determined to be 33.6%. The outage of Cherokee #4 GSU provided the least margin, 26%, of the Category B outages. The Front Range-Nixon 230 and Midway-Nixon 230 outage provided the least margin,18.9%, of the Category C outages, and the San Luis 115 kV bus outage provided the least margin, 14.9%, of the Category D outages. All are within the established voltage stability criteria.

2014 LIGHT WINTER - PAWNEE UNIT 1 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Pawnee #1 generation in the 2014 LW base case. The Pawnee #1 prior outage margin was determined to be 32.9%. The outage of Comanche #3 provided the least margin, 24.4%, of the Category B outages. The Front Range-Nixon 230 and Midway-Nixon 230 outage provided the least margin,18.3%, of the Category C outages, and the Sidney 230 and 115 bus outage provided the least margin, 11.0%, of the Category D outages. All are within the established voltage stability criteria.

2014 HEAVY WINTER - NO PRIOR OUTAGE

The Voltage Stability Analysis indicated the following voltage stability margins for the 2014 HW system intact base case. The system intact margin was determined to be 28.8%. The outage of Comanche #3 provided the least margin, 21.9%, of the Category B outages.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer has a margin of -2.0% in the 2014 HW base case. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2014 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2014 HEAVY WINTER - CHEROKEE UNIT 4 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Cherokee #4 generation in the 2014 HW base case. The Cherokee #4 prior outage margin was determined to be 27.9%. The outage of Comanche #3 provided the least margin, 21.0%, of the Category B outages.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer has a margin of 0.9%. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2014 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2014 HEAVY WINTER – COMANCHE UNIT 3 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Comanche #3 generation in the 2014 HW base case. The Comanche #3 prior outage margin was determined to be 28.8%. The outage of Cherokee #4 provided the least margin, 24.2%, of the Category B outages.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer has a margin of 1.3%. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2014 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2014 HEAVY WINTER - PAWNEE UNIT 1 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Pawnee #1 generation in the 2014 HW base case. The Pawnee #1 prior outage margin was determined to be 29.6%. The outage of Comanche #3 provided the least margin, 22.1%, of the Category B outages.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer has a margin of 0.9%. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2014 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2020 HEAVY WINTER - NO PRIOR OUTAGE

The Voltage Stability Analysis indicated the following voltage stability margins for the 2020 HW system intact base case. The system intact margin was determined to be 23.3%.

The Category B outage of the Gladstone-Walsenburg 230 kV line did not solve in the 2020 HW case. Tri-State has agreements in place to mitigate this violation by shedding the motor load at Hess and Rosebud for this outage scenario. Of the remaining Category B outages the loss of the Comanche #3 GSU (17.4%) provided the least margin. It is within the established WECC Voltage Stability Criteria.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer did not solve in the 2020 HW base case and therefore has no voltage stability margin. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2020 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2020 HEAVY WINTER - CHEROKEE UNIT 4 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Cherokee #4 generation in the 2020 HW base case. The Cherokee #4 prior outage margin was determined to be 21.6%.

The Category B outage of the Gladstone-Walsenburg 230 kV line did not solve in the 2020 HW case. Tri-State has agreements in place to mitigate this violation by shedding the motor load at Hess and Rosebud for this outage scenario. Of the remaining Category B outages the loss of the Comanche #3 GSU (16.0%) provided the least margin. It is within the established WECC Voltage Stability Criteria.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer did not solve in the 2020 HW base case and therefore has no voltage stability margin. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2020 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2020 HEAVY WINTER – COMANCHE UNIT 3 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Comanche #3 generation in the 2020 HW base case. The Comanche #3 prior outage margin was determined to be 23.2%.

The Category B outage of the Gladstone-Walsenburg 230 kV line did not solve in the 2020 HW case. Tri-State has agreements in place to mitigate this violation by shedding the motor load at Hess and Rosebud for this outage scenario. Of the remaining Category B outages the loss of the LRS-Ault 345 kV line (13.2%) provided the least margin. It is within the established WECC Voltage Stability Criteria.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer did not solve in the 2020 HW base case and therefore has no voltage stability margin. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2020 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2020 HEAVY WINTER - PAWNEE UNIT 1 PRIOR OUTAGE WITH REDISPATCH

The Voltage Stability Analysis indicated the following voltage stability margins for the prior outage of the Pawnee #1 generation in the 2020 HW base case. The Pawnee #1 prior outage margin was determined to be 22.9%.

The Category B outage of the Gladstone-Walsenburg 230 kV line did not solve in the 2020 HW case. Tri-State has agreements in place to mitigate this violation by shedding the motor load at Hess and Rosebud for this outage scenario. Of the remaining Category B outages the loss of the Comanche #3 GSU (16.6%) provided the least margin. This is within the established WECC Voltage Stability Criteria.

The Category C outage of the Portland-West Station 115 kV line and West Canon 115/230 transformer did not solve in the 2020 HW base case and therefore has no voltage stability margin. Black Hills Energy is in the process of studying an additional 115 kV tie into the Portland area to mitigate this violation.

The Category D San Luis 115 kV bus outage did not solve in the 2020 HW base case and therefore has no voltage stability margin. This Category D disturbance will be further evaluated for risk and consequence.

All other outages meet the established WECC Voltage Stability Criteria.

2014 Light Winter TOT Flows

TOT3

FLOW FROM LAR.RIVR	345.00 TO AULT	345.00 1	=	409 MW
FLOW FROM LAR.RIVR	345.00 TO STORY	345.00 1	=	213 MW
FLOW FROM ARCHER	230.00 TO AULT	230.00 1	=	42 MW
FLOW FROM CHEYENNE	115.00 TO PONNEQUI	115.00 1	=	30 MW
FLOW FROM SIDNEY	230.00 TO SPRNGCAN	230.00 1	=	-49 MW
FLOW FROM SIDNEY	115.00 TO PEETZ	115.00 1	=	7 MW
FLOW FROM CHEYENNE	230.00 TO AULT	230.00 1	=	9 MW
			TOT3 =	**660 MW**

TOT7

FLOW FROM AULT	230.00 TO WINDSOR	230.00 1	=	142 MW
FLOW FROM WELD_PS	230.00 TO ST.VRAIN	230.00 1	=	141 MW
FLOW FROM LONGPEAK	230.00 TO ST.VRAIN	230.00 1	=	5 MW
FLOW FROM FORDHAM	230.00 TO ST.VRAIN	230.00 1	=	-42 MW
			TOT7 =	**246 MW**

TOT5

FLOW FROM NRTHPARK	230.00 TO ARCHER	230.00 1	=	36 MW
FLOW FROM CRAIG	345.00 TO AULT	345.00 1	=	94 MW
FLOW FROM GOREPASS	230.00 TO BLUERIVR	230.00 1	=	149 MW
FLOW FROM HAYDEN	138.00 TO GOREPASS	138.00 1	=	35 MW
FLOW FROM GOREPASS	230.00 TO GOREPASS	138.00 1	=	14 MW
FLOW FROM N.GUNNSN	115.00 TO PONCHA	115.00 1	=	4 MW
FLOW FROM CURECANT	230.00 TO PARLIN	230.00 1	=	17 MW
FLOW FROM BASALT	230.00 TO MALTA	230.00 1	=	-6 MW
FLOW FROM BASALT	115.00 TO HOPKINS	115.00 1	=	-17 MW
FLOW FROM RIFLE_PS	230.00 TO HOPKINS	230.00 1	=	45 MW
			TOT5 =	**371 MW**

TOT4A

FLOW FROM RIVERTON	230.00 TO WYOPO	230.00 1	=	123 MW
FLOW FROM DAVEJOHN	230.00 TO DIFICULT	230.00 1	=	45 MW
FLOW FROM SPENCE	230.00 TO MUSTANG	230.00 1	=	115 MW
			TOT4A =	**283 MW**

TOT4B

FLOW FROM CARR DRA	230.00 TO BUFFALO	230.00 1	=	129 MW
FLOW FROM SPENCE	230.00 TO BADWATER	230.00 1	=	59 MW
FLOW FROM ALCOVA	115.00 TO RADERVIL	115.00 1	=	33 MW
FLOW FROM CASPERPP	230.00 TO CLAIMJPR	230.00 1	=	-9 MW
FLOW FROM RIVERTON	230.00 TO THERMOPL	230.00 1	=	-7 MW
FLOW FROM RIVERTON	230.00 TO RIVERTON	115.00 1	=	27 MW
FLOW FROM TONGRIV	230.00 TO SHERIDAN	230.00 1	=	79 MW
			TOT4B =	**311 MW**

2014 Heavy Winter TOT Flows

TOT3

FLOW FROM LAR.RIVR 345.00 TO AULT 345.00 1 = 514 MW
FLOW FROM LAR.RIVR 345.00 TO STORY 345.00 1 = 240 MW
FLOW FROM ARCHER 230.00 TO AULT 230.00 1 = 31 MW
FLOW FROM CHEYENNE 115.00 TO PONNEQUI 115.00 1 = 15 MW
FLOW FROM SIDNEY 230.00 TO SPRNGCAN 230.00 1 = 67 MW
FLOW FROM SIDNEY 115.00 TO PEETZ 115.00 1 = 47 MW
FLOW FROM CHEYENNE 230.00 TO AULT 230.00 1 = -54 MW

TOT3 = 861 MW

TOT7

FLOW FROM AULT 230.00 TO WINDSOR 230.00 1 = 68 MW
FLOW FROM WELD_PS 230.00 TO ST.VRAIN 230.00 1 = 96 MW
FLOW FROM LONGPEAK 230.00 TO ST.VRAIN 230.00 1 = -136 MW
FLOW FROM FORDHAM 230.00 TO ST.VRAIN 230.00 1 = -102 MW

TOT7 = -75 MW

TOT5

FLOW FROM NRTHPARK 230.00 TO ARCHER 230.00 1 = 23 MW
FLOW FROM CRAIG 345.00 TO AULT 345.00 1 = 81 MW
FLOW FROM GOREPASS 230.00 TO BLUERIVR 230.00 1 = 170 MW
FLOW FROM HAYDEN 138.00 TO GOREPASS 138.00 1 = 43 MW
FLOW FROM GOREPASS 230.00 TO GOREPASS 138.00 1 = 24 MW
FLOW FROM N.GUNNSN 115.00 TO PONCHA 115.00 1 = -16 MW
FLOW FROM CURECANT 230.00 TO PARLIN 230.00 1 = -71 MW
FLOW FROM BASALT 230.00 TO MALTA 230.00 1 = -36 MW
FLOW FROM BASALT 115.00 TO HOPKINS 115.00 1 = -26 MW
FLOW FROM RIFLE_PS 230.00 TO HOPKINS 230.00 1 = 35 MW

TOT5 = 227 MW

TOT4A

FLOW FROM RIVERTON 230.00 TO WYOPO 230.00 1 = 67 MW
FLOW FROM DAVEJOHN 230.00 TO DIFICULT 230.00 1 = 146 MW
FLOW FROM SPENCE 230.00 TO MUSTANG 230.00 1 = 76 MW

TOT4A = 290 MW

TOT4B

FLOW FROM CARR DRA 230.00 TO BUFFALO 230.00 1 = 167 MW
FLOW FROM SPENCE 230.00 TO BADWATER 230.00 1 = 94 MW
FLOW FROM ALCOVA 115.00 TO RADERVIL 115.00 1 = 41 MW
FLOW FROM CASPERPP 230.00 TO CLAIMJMP 230.00 1 = 25 MW
FLOW FROM RIVERTON 230.00 TO THERMOPL 230.00 1 = 39 MW
FLOW FROM RIVERTON 230.00 TO RIVERTON 115.00 1 = 44 MW
FLOW FROM TONGRIV 230.00 TO SHERIDAN 230.00 1 = 105 MW

TOT4B = 515 MW

2020 Heavy Winter TOT Flows

TOT3

FLOW FROM LAR.RIVR	345.00 TO AULT	345.00 1	=	469 MW
FLOW FROM ARROWTS	345.00 TO STORY	345.00 1	=	103 MW
FLOW FROM ARCHER	230.00 TO AULT	230.00 1	=	116 MW
FLOW FROM CHEYENNE	115.00 TO PONNEQUI	115.00 1	=	27 MW
FLOW FROM SIDNEY	230.00 TO SPRNGCAN	230.00 1	=	67 MW
FLOW FROM SIDNEY	115.00 TO PEETZ	115.00 1	=	49 MW
FLOW FROM CHEYENNE	230.00 TO AULT	230.00 1	=	100 MW
			TOT3 =	**932 MW**

TOT7x

FLOW FROM AULT	230.00 TO WINDSOR	230.00 1	=	117 MW
FLOW FROM WELD_PS	230.00 TO ST.VRAIN	230.00 1	=	55 MW
FLOW FROM LONGPEAK	230.00 TO ST.VRAIN	230.00 1	=	-75 MW
FLOW FROM FORDHAM	230.00 TO ST.VRAIN	230.00 1	=	-96 MW
FLOW FROM AULT	230.00 TO CHEROKEE	230.00 1	=	205 MW
			TOT7x =	**206 MW**

TOT5

FLOW FROM NRTHPARK	230.00 TO ARCHER	230.00 1	=	36 MW
FLOW FROM CRAIG	345.00 TO AULT	345.00 1	=	186 MW
FLOW FROM GOREPASS	230.00 TO BLUERIVR	230.00 1	=	211 MW
FLOW FROM HAYDEN	138.00 TO GOREPASS	138.00 1	=	54 MW
FLOW FROM GOREPASS	230.00 TO GOREPASS	138.00 1	=	24 MW
FLOW FROM N.GUNNSN	115.00 TO PONCHA	115.00 1	=	-9 MW
FLOW FROM CURECANT	230.00 TO PARLIN	230.00 1	=	-95 MW
FLOW FROM BASALT	230.00 TO MALTA	230.00 1	=	-30 MW
FLOW FROM BASALT	115.00 TO HOPKINS	115.00 1	=	-31 MW
FLOW FROM RIFLE_PS	230.00 TO HOPKINS	230.00 1	=	64 MW
			TOT5 =	**411 MW**

TOT4A

FLOW FROM RIVERTON	230.00 TO WYOPO	230.00 1	=	6 MW
FLOW FROM DAVEJOHN	230.00 TO DIFICULT	230.00 1	=	120 MW
FLOW FROM SPENCE	230.00 TO MUSTANG	230.00 1	=	156 MW
			TOT4A =	**281 MW**

TOT4B

FLOW FROM CARR DRA	230.00 TO BUFFALO	230.00 1	=	135 MW
FLOW FROM SPENCE	230.00 TO BADWATER	230.00 1	=	192 MW
FLOW FROM ALCOVA	115.00 TO RADERVIL	115.00 1	=	25 MW
FLOW FROM CASPERPP	230.00 TO CLAIMJMP	230.00 1	=	-23 MW
FLOW FROM RIVERTON	230.00 TO THERMOPL	230.00 1	=	17 MW
FLOW FROM RIVERTON	230.00 TO RIVERTON	115.00 1	=	47 MW
FLOW FROM TONGRIV	230.00 TO SHERIDAN	230.00 1	=	51 MW
			TOT4B =	**444 MW**

List of Study Participants

1. Basin Electric Power Cooperative
2. Black Hills Energy
3. Black Hills Power
4. Colorado Springs Utilities
5. Platte River Power Authority
6. Public Service Company of Colorado
7. Tri-State Generation and Transmission Association
8. Western Area Power Administration

LIST OF APPENDICES

APPENDIX A

NERC / WECC TABLES

Table I. Transmission Systems Standards — Normal and Contingency Conditions

Category	Contingencies		System Limits or Impacts				
	Initiating Event(s) and Contingency Component(s)	Components Out of Service	Thermal Limits	Voltage Limits	System Stable	Loss of Demand or Curtailed Firm Transfers	Cascading[c] Outages
A - No Contingencies	All Facilities in Service	None	Normal	Normal	Yes	No	No
B - Event resulting in the loss of a single component.	Single Line Ground (SLG) or 3-Phase (3Ø) Fault, with Normal Clearing: 1. Generator 2. Transmission Circuit 3. Transformer Loss of a Component without a Fault.	 Single Single Single Single	 Applicable Rating[a] (A/R) A/R A/R A/R	 Applicable Rating[a] (A/R) A/R A/R A/R	 Yes Yes Yes Yes	 No[b] No[b] No[b] No[b]	 No No No No
	Single Pole Block, Normal Clearing: 4. Single Pole (dc) Line	 Single	 A/R	 A/R	 Yes	 No[b]	 No
C - Event(s) resulting in the loss of two or more (multiple) components.	SLG Fault, with Normal Clearing: 1. Bus Section 2. Breaker (failure or internal fault)	 Multiple Multiple	 A/R A/R	 A/R A/R	 Yes Yes	 Planned[d] Planned[d]	 No No
	SLG or 3Ø Fault, with Normal Clearing, Manual System Adjustments, followed by another SLG or 3Ø Fault, with Normal Clearing: 3. Category B (B1, B2, B3, or B4) contingency, manual system adjustments, followed by another Category B (B1, B2, B3, or B4) contingency	Multiple	A/R	A/R	Yes	Planned[d]	No
	Bipolar Block, with Normal Clearing: 4. Bipolar (dc) Line Fault (non 3Ø), with Normal Clearing: 5. Double Circuit Towerline	 Multiple Multiple	 A/R A/R	 A/R A/R	 Yes Yes	 Planned[d] Planned[d]	 No No
	SLG Fault, with Delayed Clearing: 6. Generator 8. Transformer 7. Transmission Circuit 9. Bus Section	 Multiple Multiple	 A/R A/R	 A/R A/R	 Yes Yes	 Planned[d] Planned[d]	 No No

Table I. Transmission Systems Standards — Normal and Contingency Conditions

D [e] – Extreme event resulting in two or more (multiple) components removed or cascading out of service	3Ø Fault, with Delayed Clearing (stuck breaker or protection system failure): 1. Generator 3. Transformer 2. Transmission Circuit 4. Bus Section 3Ø Fault, with Normal Clearing: 5. Breaker (failure or internal fault) Other: 6. Loss of towerline with three or more circuits 7. All transmission lines on a common right-of-way 8. Loss of a substation (one voltage level plus transformers) 9. Loss of a switching station (one voltage level plus transformers) 10. Loss of all generating units at a station 11. Loss of a large load or major load center 12. Failure of a fully redundant special protection system (or remedial action scheme) to operate when required 13. Operation, partial operation, or misoperation of a fully redundant special protection system (or remedial action scheme) for an event or condition for which it was not intended to operate 14. Impact of severe power swings or oscillations from disturbances in another Regional Council.	Evaluate for risks and consequences. • May involve substantial loss of customer demand and generation in a widespread area or areas. • Portions or all of the interconnected systems may or may not achieve a new, stable operating point. • Evaluation of these events may require joint studies with neighboring systems. • Document measures or procedures to mitigate the extent and effects of such events. • Mitigation or elimination of the risks and consequences of these events shall be at the discretion of the entities responsible for the reliability of the interconnected transmission systems.

Footnotes to Table I.

a) Applicable rating (A/R) refers to the applicable normal and emergency facility thermal rating or system voltage limit as determined and consistently applied by the system or facility owner.

b) Planned or controlled interruption of generators or electric supply to radial customers or some local network customers, connected to or supplied by the faulted component or by the affected area, may occur in certain areas without impacting the overall security of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) electric power transfers.

c) Cascading is the uncontrolled successive loss of system elements triggered by an incident at any location. Cascading results in widespread service interruption which cannot be restrained from sequentially spreading beyond an area predetermined by appropriate studies.

d) Depending on system design and expected system impacts, the controlled interruption of electric supply to customers (load shedding), the planned removal from service of certain generators, or the curtailment of contracted firm (non-recallable reserved) electric power transfers may be necessary to maintain the overall security of the interconnected transmission systems.

e) A number of extreme contingencies that are listed under Category D and judged to be critical by the transmission planning entity(ies) will be selected for evaluation. It is not expected that all possible facility outages under each listed contingency of Category D will be evaluated.

Table 2. WECC DISTURBANCE-PERFORMANCE TABLE OF ALLOWABLE EFFECTS ON OTHER SYSTEMS

WECC DISTURBANCE-PERFORMANCE TABLE OF ALLOWABLE EFFECTS ON OTHER SYSTEMS

NERC and WECC Categories	Outage Frequency Associated with the Performance Category (outage/year)	Transient Voltage Dip Standard	Minimum Transient Frequency Standard	Post Transient Voltage Deviation Standard (See Note 2)
A	Not Applicable	Nothing in addition to NERC		
B	≥ 0.33	Not to exceed **25%** at load buses or **30%** at non-load buses. Not to exceed **20% for more than 20 cycles** at load buses.	Not below **59.6** Hz for 6 cycles or more at a load bus.	Not to exceed **5%** at any bus.
C	0.033 – 0.33	Not to exceed **30%** at any bus. Not to exceed **20% for more than 40 cycles** at load buses.	Not below **59.0** Hz for 6 cycles or more at a load bus.	Not to exceed **10%** at any bus.
D	< 0.033	Nothing in addition to NERC		

Notes to Table 2:

1. The WECC Disturbance-Performance Table applies equally to either a system with all elements in service, or a system with one element removed and the system adjusted.

2. As an example in applying the WECC Disturbance-Performance Table, a Category B disturbance in one system shall not cause a transient voltage dip in another system that is greater than 20% for more than 20 cycles at load buses, or exceed 25% at load buses or 30% at non-load buses at any time other than during the fault.

3. If it can be demonstrated that post transient voltage deviations that are less than the values in the table will result in voltage instability, the system in which the disturbance originated and the affected system(s) shall cooperate in mutually resolving the problem.

4. Refer to Figure W-1 for voltage performance parameters.

5. Load buses include generating unit auxiliary loads.

6. To reach the frequency categories shown in the WECC Disturbance-Performance Table for Category C disturbances, it is presumed that some planned and controlled islanding has occurred. Underfrequency load shedding is expected to arrest this frequency decline and assure continued operation within the resulting islands.

7. For simulation test cases, the interconnected transmission system steady state loading conditions prior to a disturbance shall be appropriate to the case. Disturbances shall be simulated at locations on the system that result in maximum stress on other systems. Relay action, fault clearing time, and reclosing practice shall be represented in simulations according to the planning and operation of the actual or planned systems. When simulating post transient conditions, actions are limited to automatic devices and no manual action is to be assumed.

APPENDIX B

TRANSIENT DISTURBANCE DESCRIPTION LISTING

NERC CATEGORY A, B, C, & D

NERC CATEGORY A			
FAULTED BUS	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
*** NO FAULT ***	*****	*****	*****

NERC CATEGORY B			
FAULTED BUS	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
ARCHER 230	3 PHASE	5 CYCLES	ARCHER - AULT 230
ARCHER 230	3 PHASE	5 CYCLES	ARCHER - STEGALL 230
ARCHER 230	3 PHASE	5 CYCLES	ARCHER - HAYDEN 230
AULT 230	3 PHASE	5 CYCLES	AULT - ARCHER 230
AULT 230	3 PHASE	5 CYCLES	AULT - WELD 230 NO. 1
BADWTR 230	3 PHASE	5 CYCLES	BADWTR - SPENCE 230
BADWTR 230	3 PHASE	5 CYCLES	BADWTR - THERM 230
CARRDRAW 230	3 PHASE	5 CYCLES	CARRDRAW - BUFFALO 230
CARRDRAW 230	3 PHASE	5 CYCLES	CARRDRAW - HARTZOG 230
CARRDRAW 230	3 PHASE	5 CYCLES	CARRDRAW - WYODAK 230
CHEROKEE 230	3 PHASE	5 CYCLES	CHEROKEE - DENVER TERM 230
COMANCHE 345	3 PHASE	4 CYCLES	COMANCHE – DANIEL PARK 345
COMANCHE 230	3 PHASE	5 CYCLES	COMANCHE - MIDWAY 230
COMANCHE 230	3 PHASE	5 CYCLES	COMANCHE - FULLER 230
CRAIG 230	3 PHASE	5 CYCLES	CRAIG - HAYDEN 230 NO.1
CRAIG 230	3 PHASE	5 CYCLES	CRAIG - RIFLE 230
CRAIG 230	3 PHASE	5 CYCLES	CRAIG UNIT #2
CURECANT 230	3 PHASE	5 CYCLES	CURECANTI - LOSTCAN 230
CURECANT 230	3 PHASE	5 CYCLES	CURECANTI – MORROWPT 230
CURECANT 230	3 PHASE	5 CYCLES	CURECANTI - NORTHFORK 230
CURECANT 230	3 PHASE	5 CYCLES	CURECANTI - PARLIN 230
DONKEYCRK 230	3 PHASE	4.25 CYCLES	DONKEYCRK-PUMPKIN BUTTE 230
DONKEYCRK 230	3 PHASE	4.25 CYCLES	DONKEYCRK-RENO 230
DRAKE 115KV	3 PHASE	6 CYCLES	DRAKE – ATMEL 115KV
DRYFORK 230	3 PHASE	4.25 CYCLES	DRY FORK-CARR DRAW 230
DRYFORK 230	3 PHASE	4.25 CYCLES	DRY FORK-HUGHES 230
DRYFORK 230	3 PHASE	4.25 CYCLES	DRY FORK-TONGUE RIVER 230
HAYDEN 230	3 PHASE	5 CYCLES	HAYDEN – ARCHER 230

NERC CATEGORY B – (CONTINUED)			
FAULTED BUS	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
HAYDEN 230	3 PHASE	5 CYCLES	HAYDEN – CRAIG 230
HAYDEN 230	3 PHASE	5 CYCLES	HAYDEN – GOREPASS 230
LANGE 230	3 PHASE	5 CYCLES	LANGE – LOOKOUT 230
LANGE 230	3 PHASE	5 CYCLES	LANGE – RCSOUTH 230
LRS 345	3 PHASE	4 CYCLES	LRS – AULT 345
LRS 345	3 PHASE	4 CYCLES	LRS – STORY 345
LRS 345	3 PHASE	4 CYCLE	LRS UNIT #2
MALTA 230	3 PHASE	5 CYCLES	MALTA – MTE 230
MIDWAY 230	3 PHASE	5 CYCLES	MIDWAY – WCANON 230
PAWNEE 230	3 PHASE	5 CYCLES	PAWNEE – BRICKCTR 230
PAWNEE 230	3 PHASE	5 CYCLES	PAWNEE – DAN PARK 230
RAWHIDE 230	3 PHASE	5 CYCLES	RAWHIDE – AULT 230
RAWHIDE 230	3 PHASE	5 CYCLES	RAWHIDE – TIMBERLINE 230
RAWHIDE 230	3 PHASE	5 CYCLES	RAWHIDE UNIT #1
RD NIXON 230	3 PHASE	6 CYCLES	RD NIXON – FULLER 230kV
ST.VRAIN 230	3 PHASE	5 CYCLES	ST.VRAIN – SPNDLE 230
STEGALL 230	3 PHASE	5 CYCLES	STEGALL – ARCHER 230
STEGALL 230	3 PHASE	5 CYCLES	STEGALL – DJ 230
STEGALL 230	3 PHASE	5 CYCLES	STEGALL – WESTHILL 230
STEGALL 230	3 PHASE	5 CYCLES	STEGALL – SIDNEY 230
VALMONT 230	3 PHASE	5 CYCLES	VALMONT – SPNDLE230
WYODAK 230	3 PHASE	4.25 CYCLES	WYODAK – CARRDRAW 230
WYODAK 230	3 PHASE	4.25 CYCLES	WYODAK – DONKEYCRK 230
WYODAK 230	3 PHASE	4.25 CYCLES	WYGEN UNIT
WYODAK 230	3 PHASE	4.25 CYCLES	WYODAK – HUGHES 230
WYODAK 230	3 PHASE	4.25 CYCLES	WYODAK – OSAGE 230
YELOWTLP 230	3 PHASE	5 CYCLES	YELOWTLP – FRANNIE 230

NERC CATEGORY B – (CONTINUED)			
FAULTED BUS	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
YELOWTLP 230	3 PHASE	5 CYCLES	YELOWTLP – YELLOWBR 230

NERC CATEGORY C			
FAULTED BUS	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
ARCHER 230	SLG	5 CYCLES	ALL ARCHER 230 BRANCHES
AULT 230	SLG	5 CYCLES	AULT – WELD 230 #1
		15 CYCLES	AULT – WELD 230 #2
BADWATER230	SLG	5 CYCLES	BADWTR – SPENCE 230
		15 CYCLES	BADWTR – THERM 230
CASPER 230	SLG	5 CYCLES	CASPER – CLAIMJPR 230
		15 CYCLES	CASPER – RIVERTON 230
CASPER 230	SLG	5 CYCLES	CASPER – CLAIMJPR 230
		15 CYCLES	CASPER – DJ 230
CHEROKEE 230	SLG	5 CYCLES	CHEROKEE – RIVERDALE 230
		15 CYCLES	CHEROKEE – GLENN 230
CHEYENNE 230	3 Phase	5 CYCLES	CHEY-AULT 230 & CHEY- OWL CRK 115
COMANCHE 230	SLG	5 CYCLES	COMANCHE – MIDWAY 230
		15 CYCLES	COMANCHE – FULLER 230
CRAIG 230	SLG	5 CYCLES	CRAIG – HAYDEN 230
		15 CYCLES	CRAIG – RIFLE 230
CRAIG 230	SLG	5 CYCLES	CRAIG – HAYDEN 230
		15 CYCLES	CRAIG 345/230
CRAIG 345	SLG	4 CYCLES	CRAIG – AULT 345
		12 CYCLES	CRAIG – CBTAP 345
CURCANTI 230	SLG	5 CYCLES	CURE – MORROW 230
		15 CYCLES	CURE – LOSTCAN 230
CURCANTI 230	SLG	5 CYCLES	CURE – MORROW 230
		15 CYCLES	CURE – NORTHFORK 230
CURCANTI 230	SLG	5 CYCLES	CURE – PARLIN 230
		15 CYCLES	CURE – NORTHFORK 230

NERC CATEGORY C – (CONTINUED)			
FAULTED BUS	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
CURCANTI 230	SLG	5 CYCLES	CURE – PARLIN 230
		15 CYCLES	CURE 230/115
CURCANTI 230	SLG	5 CYCLES	CURE – LOSTCAN 230
		15 CYCLES	CURE 230/115
DONKEY CRK 230	SLG	4.25 CYCLES	DONKEY CRK-RENO 230
		12 CYCLES	WYGEN 2
DONKEY CRK 230	SLG	4.25 CYCLES	DONKEY CRK-PUMPKIN BUTTE 230
		12 CYCLES	WYGEN 3
DRAKE 115	SLG	6 CYCLE	DRAKE UNIT 7
		17 CYCLE	DRAKE-ATMELDSUB 115
DRY FORK 230	SLG	4.25 CYCLES	DRY FORK-TONGUE RVR 230
		12 CYCLES	DRY FORK-CARR DRAW 230
FULLER 230	SLG	6 CYCLES	FULLER – CTTNWD 230
		17 CYCLES	NIXON – FULLER230
HAYDEN 230 EAST BUS	SLG	5 CYCLES	EAST BUS 230 LINES
HAYDEN 230 WEST BUS	SLG	5 CYCLES	WEST BUS 230 LINES
LRS 345	SLG	4 CYCLES	LRS – AULT 345
		12 CYCLES	LRS UNIT 2
MIDWAY 230	SLG	5 CYCLES	ALL MIDWAY WAPA 230 LINES
PAWNEE 230	SLG	5 CYCLES	PAWNEE – BRICKCTR 230
		15 CYCLES	PAWNEE – DAN PARK 230
RAWHIDE 230	SLG	5 CYCLES	RAWHIDE – AULT 230
		5 CYCLES	RAWHIDE – TIMBERLINE 230
RAWHIDE 230	SLG	5 CYCLES	RAWHIDE – LAPORTE 230 #1
		5 CYCLES	RAWHIDE – LAPORTE 230 #2
RDNIXON 230	SLG	6 CYCLES	NIXON – FULLER 230
		17 CYCLES	NIXON – ARIES 230
FRONTRANGE 230	SLG	6 CYCLES	FRONTRANGE-NIXON 230
		17 CYCLES	NIXON – MIDWAY 230

NERC CATEGORY C – (CONTINUED)				
FAULTED BUS		**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
RDNIXON 230		SLG	6 CYCLES	FRPP UNITS
			17 CYCLES	NIXON CT UNITS
RIVERTON 230		SLG	5 CYCLES	RIV – THERM 230
			15 CYCLES	RIV – WYOPO 230
STEGALL 230 BUS		SLG	5 CYCLES	STEGALL 230 LINES
ST.VRAIN 230		SLG	5 CYCLES	ST.VRAIN – FT.LUPTON 230
			15 CYCLES	ST.VRAIN – SPNDLE 230
THERMOP 230		SLG	5 CYCLES	THERM – RIVERTON 230
			15 CYCLES	THERM – BADWATER 230
WYODAK 230		SLG	4.25 CYCLES	WYGEN UNIT
			12 CYCLES	WYODAK – DONKYCRK 230
WYODAK 230		SLG	4.25 CYCLES	WYODAK – DONKYCRK 230
			12 CYCLES	WYGEN UNIT
WYODAK 230		SLG	4.25 CYCLES	WYODAK – HUGHES 230
			12 CYCLES	WYODAK – CARRDRAW 230
WYODAK 230		SLG	4.25 CYCLES	WYODAK – HUGHES 230
			12 CYCLES	WYODAK 230/69 XFMRS
WYODAK 230		SLG	4.25 CYCLES	WYODAK – OSAGE 230
			12 CYCLES	WYODAK UNIT
Y.TAIL PP230 BUS		SLG	5 CYCLES	Y.TAIL PP – Y.TAIL BR 230
			15 CYCLES	Y.TAIL PP – GOOSECRK-SHERD230
Prior Outage	**Faulted Bus**	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
CRAIG #2	CRAIG 230	3 PHASE	5 CYCLES	CRAIG UNIT #1
LRS #2	LRS 345	3 PHASE	4 CYCLE	LRS UNIT #3
RAWHIDE #1	RAWHIDE 230	3 PHASE	5 CYCLES	RAWHIDE UNIT #F

NERC CATEGORY D			
FAULTED BUS	**FAULT TYPE**	**CLEARING TIME**	**CLEARED BRANCH**
AULT 345	3 PHASE	4 CYCLES	ALL AULT 345
AULT 230	3 PHASE	5 CYCLES	ALL AULT 230
BEARS EARS 345	3 PHASE	4 CYCLES	ALL BEARS EARS 345
COMANCHE 345	3 PHASE	4 CYCLES	COMANCHE-DANIELS PARK 1 & 2, MIDWAY-WATERTON 345, & MIDWAY-FULLER 230
CRAIG 345	3 PHASE	4 CYCLES	ALL CRAIG 345
CRAIG 345	3 PHASE	4 CYCLES	CRAIG-AULT 345 & HAYDEN-ARCH 230
CRAIG 230	3 PHASE	5 CYCLES	ALL CRAIG 230
DANIEL PARK 230	3 PHASE	5 CYCLES	ALL DANIEL PARK 230
DJ 230	3 PHASE	5 CYCLES	ALL DJ 230
DONKEY CRK 230	3 PHASE	5 CYCLES	ALL DONKEY CRK 230
DRY FORK 230	3 PHASE	5 CYCLES	ALL DRY FORK 230
HAYDEN 230	3 PHASE	5 CYCLES	ALL HAYDEN 230
LRS 345	3 PHASE	4 CYCLES	ALL LRS 345
LRS 230	3 PHASE	5 CYCLES	ALL LRS 230
MIDWAY 230	3 PHASE	5 CYCLES	ALL MIDWAY 230
PAWNEE 230	3 PHASE	5 CYCLES	ALL PAWNEE 230
RAWHIDE 230	3 PHASE	5 CYCLES	ALL RAWHIDE 230
RD NIXON 230	3 PHASE	6 CYCLES	ALL RD NIXON 230
RIFLE 345	3 PHASE	4 CYCLES	ALL RIFLE 345
ST.VRAIN 230	3 PHASE	5 CYCLES	ALL ST.VRAIN 230
WATERFLOW (SANJN PS) 345	3 PHASE	4 CYCLES	ALL WATERFLOW 345
WELD LM 230	3 PHASE	5 CYCLES	ALL WELD LM 230
WYODAK 230	3 PHASE	5 CYCLES	ALL WYODAK 230

APPENDIX C

STEADY STATE OUTAGE LISTING

NERC CATEGORY A, B, C, & D

NERC CATEGORY A – OUTAGE DESCRIPTION

- SYSTEM INTACT

NERC CATEGORY B – OUTAGE DESCRIPTION

- ALL BRANCHES OPERATED AT 115KV OR GREATER IN CCPG AREA

NERC CATEGORY C – OUTAGE DESCRIPTION

1. WYODAK – HUGHES 230KV & WYODAK-CARRDRAW 230KV OUTAGE; WYODAK 1H326 FAILURE
2. WYODAK – HUGHES 230KV & HUGHES – LOOKOUT 230KV OUTAGE
3. LOOKOUT – HUGHES 230KV & LOOKOUT – YELLOWCREEK 230KV OUTAGE
4. WESTHILL – SOUTHRC 230KV & WESTHILL – OSAGE 230KV OUTAGE
5. WESTHILL – STEGALL 230KV & WESTHILL – OSAGE 230KV OUTAGE
6. WYODAK – DONKEY CREEK 230KV & WYGEN UNIT OUTAGE
7. WYODAK – OSAGE 230KV & WYODAK UNIT OUTAGE; WYODAK 1H334 FAILURE
8. DRY FORK – CARR DRAW & DRY FORK-TONGUE RIVER 230 KV OUTAGE
9. LOSS OF ARCHER 230KV MAIN BUS – BREAKER FAILURE SLG
10. CRAIG – CBTAP 345KV & CRAIG-AULT 345KV OUTAGE; CRAIG 896 FAILURE
11. LRS – AULT 345KV & LRS UNIT 3 OUTAGE; LRS 2996 FAILURE
12. RAWHIDE – AULT 230KV & RAWHIDE – TIMBERLINE 230KV OUTAGE; DOUBLE CIRCUIT TOWER
13. NIXON – FULLER 230KV & NIXON-CLAREMONT 230KV OUTAGE (SAME BUS NEW NAME)
14. FULLER – CTTNWD 230KV & NIXON – FULLER 230KV OUTAGE
15. AULT – WELD 230KV #1 & #2 DOUBLE CIRCUIT OUTAGE
16. BADWATER – SPENCE 230KV & BADWATER – THERM 230KV OUTAGE; BADWATER 1184 FAILURE
17. CRAIG – HAYDEN 230KV & CRAIG – RIFLE 230KV OUTAGE; CRAIG 886 FAILURE
18. CRAIG – HAYDEN 230KV #2 & CRAIG 345/230KV OUTAGE; CRAIG 286 FAILURE
19. CURCANTI - MORROW 230KV & CURECANTI-LOSTCAN 230KV OUTAGE; CURECANTI 1082 FAILURE
20. CURCANTI - MORROW 230KV & CURECANTI – NORTHFORK 230KV OUTAGE; CURECANTI 682 FAILURE
21. CURCANTI - PARLIN 230KV & CURECANTI – NORTHFORK 230KV OUTAGE; CURECANTI 786 FAILURE
22. CURCANTI – PARLIN 230KV & CURECANTI 230/115KV OUTAGE; CURECANTI 882 FAILURE
23 CURCANTI – LOSTCAN 230KV & CURECANTI 230/115KV OUTAGE; CURECANTI 1282 FAILURE
24. HAYDEN 230KV EAST MAIN BUS – BREAKER FAILURE SLG
25. HAYDEN 230KV WEST MAIN BUS – BREAKER FAILURE SLG
26. STEGALL 230KV MAIN BUS – BREAKER FAILURE SLG
27. Y.TAILBR - Y.TAILPP 230KV & Y.TAIL – GOOSE 230KV OUTAGE; Y.TAILPP 1H296 FAILURE

NERC CATEGORY C – OUTAGE DESCRIPTION - CONTINUED

28. DJ – SPENCE 230KV & DJ – CASPER 230KV DOUBLE CIRCUIT OUTAGE
29. DJ – SPENCE 230KV & DJ – YELLOW 230KV OUTAGE; DJ 1H212 FAILURE
30. CASPER – CLAIMJPR 230KV & CASPER – RIVERTON 230KV OUTAGE
31. CASPER – CLAIMJPR 230KV & CASPER – DJ 230KV OUTAGE
32. RIVERTON – THERM 230KV & RIVERTON – WYOPO 230KV OUTAGE; RIVERTON 1H112 FAILURE
33. THERM – RIVERTON 230KV & THERM – BADWATER 230KV OUTAGE; THERM 1H224 FAILURE
34. AULT – LRS 345KV & AULT345/230KV OUTAGE
35. CRAIG – AULT 345KV & AULT345/230KV OUTAGE
36. AULT – ARCHER 230KV & AULT345/230KV OUTAGE
37. AULT – WELD 230KV & AULT 345/230KV OUTAGE
38. AULT – WELD 230KV & AULT-RAWHIDE 230KV OUTAGE
39. AULT - ST.VRAIN 230KV & AULT – TIMBERLINE 230KV OUTAGE
40. AULT – RAWHIDE 230KV & AULT - TIMBERLINE 230KV OUTAGE
41. TIMBERLINE – RAWHIDE 230KV & TIMBERLINE – AULT 230KV OUTAGE
42. ST.VRAIN - FT.LUPTON CKTS #1 & #2 230KV OUTAGE
43. LONGPEAK – BOYD230 KV & LONGPEAK 230/115KV OUTAGE
44. LONGPEAK 230/115KV & LONGPEAK – COUNTY LINE115KV OUTAGE
45. LONGPEAK 230/115KV & LONGPEAK – DELCAM – MEADOW 115KV OUTAGE
46. ST.VRAIN – LONGPEAK 230KV & STVRAIN – ISABELLE 230KV OUTAGE
47. CHEROKEE – RIVERDALE, RIVERDALE – HENRY LAKE, & CHEROKEE – SILVER SADDLE 230KV OUTAGE
48. COMANCHE – MIDWAY 230KV & MIDWAY – FULLER 230KV OUTAGE
49. FULLER – DANIELS PARK & FULLER 230/115KV TRANSFORMER
50. PAWNEE – BRICKCTR, QUINCY – SMOKY HILL, & PAWNEE - DANPARK 230KV OUTAGE
51. ST.VRAIN – NIWOT, & ST.VRAIN – SPNDLE 230KV OUTAGE
52. CABIN CREEK – LOOKOUT & CABIN CREEK– IDAHO SPRINGS- LOOKOUT 230KV OUTAGE
53. COMANCHE – MIDWAY CKTS #1 & #2 230KV OUTAGE
54. SMOKY HILL – SPRUCE CKTS #1 & #2 230KV OUTAGE
55. BOONE – DOT TAP & MIDWAY – NORTHRIDGE 115KV
56. CANON CITY – WEST CANON & COMANCHE – READER 115KV OUTAGE
57. PORTLAND – WEST STATION 115KV & WEST CANON XFMR OUTAGE
58. BOONE – DOT TAP & COMANCHE – READER 115 KV OUTAGE
59. LOSS OF LRS UNIT #2, SYSTEM READJUSTED FOLLOWED BY LOSS OF LRS UNIT #3
60. LOSS OF CRAIG UNIT G2, SYSTEM READJUSTED FOLLOWED BY LOSS OF CRAIG UNIT G3
61. CHEYENNE – AULT 230-KV, CHEYENNE – OWL CREEK 115-KV DOUBLE CIRCUIT OUTAGE
62. NIXON # 1 & ALL FRPP UNITS OUTAGE
63. COTTONWOOD TRANSFORMERS #1 & #2 OUTAGE
64. KELKER TRANSFORMERS #1 & #2 OUTAGE
65. FRONTRANGE (73559) – NIXON (73419) & MIDWAY – NIXON 230 KV
66. RMEC – GREENVAL 230 KV & RMEC – KEENSBG 230 KV OUTAGE

NERC CATEGORY C – OUTAGE DESCRIPTION – CONTINUED

67. FTLUPTON – HENRYLAKE 230 & FTLUPTON – GREENVAL 230 KV OUTAGE
68. GREENVAL – FTLUPTON 230 & GREENVAL – BARRLAKE 230 KV OUTAGE
69. PLAINS END – NIWOT 230 & PLAINS END – VALMONT 230 OUTAGE
70. LOOKOUT- PLAINS END #1 & #2 230 KV OUTAGE
71. DANIELPK - COMANCHE #1 & #2 345 KV OUTAGE
72. MIDWAYPS – WATERTON 345 & DANIELPK-FULLER 230 KV OUTAGE
73. DANIELPK – SANTEFE 230 & DANIELPK – MARCY 230 KV OUTAGE
74. ARCHER-HAYDEN & GORE-HAYDEN 230 OUTAGE
75 ARCHER-HAYDEN & GORE-HAYDEN 138 OUTAGE
76 ARCHER-HAYDEN & AXIAL-HAYDEN OUTAGE
77 ARCHER-HAYDEN & ARTESIA-HAYDEN OUTAGE
78 AULT-CRAIG, AX-HAYDN & CRAIG-HAYDEN OUTAGE
79 ARCHER-HAYDN, AULT-CRAIG & CRAIG-HAYDEN OUTAGE
80 AULT-CRAIG, CRAIG-HAYDN & HAYDEN-WOLC OUTAGE
81 AULT-CRAIG,GORE-HAYDEN 230 & HAYDEN-WOLC OUTAGE
82 AULT-CRAIG,GORE-HAYDEN 138 & HAYDENDN-STEAMBOAT OUTAGE
83 AULT-ST VRAIN & WELD-WINDSOR OUTAGE
84 BEARS-BONANZA & BONANZA XFMR OUTAGE (BONANZA CB B-3438 FAILURE)
85 N/A
86 BEARS-CRAIG & CRAIG XFMR 1 OUTAGE (CRAIG CB 311K FAILURE)
87 STORY-PAWNEE & STORY XFMR OUTAGE (STORY CB 286 FAILURE)
88 TWO STORY TRANSFORMERS OUTAGE (STORY CB 586 FAILURE)
89 BIG SANDY-BURLINGTON & BIG SANDY XFMR OUTAGE (BIG SANDY CB 286 FAILURE)
90 BIG SANDY-MIDWAY & BIG SANDY XFMR OUTAGE (BIG SANDY CB 586 FAILURE)
91 MIDWAY-BIG SANDY-BURLINGTON 230 OUTAGE (BIG SANDY CB 382 FAILURE)
92 BLUE R-GORE PASS & GORE XFMR OUTAGE (GORE PASS CB 1186 FAILURE)
93 BLUE R-GORE PASS-HAYDEN 230 OUTAGE (GORE PASS CB 1282 FAILURE)
94 BODO-HESPERUS, CASCSDE-HESPERUS, DURANGO-GLADE OUTAGE
95 BONANZA-MONA & BONANZA XFMR OUTAGE (BONANZA CB B-3219 FAILURE)
96 BONNY-BURLINGTON-BURLKC 115 OUTAGE (BURLINGTON CB 766 FAILURE)
97 BOONE-COMANCHE & BOONE XFMR OUTAGE (BOONE CB 5415 FAILURE)
98 BOONE-MIDWAY & BOONE XFMR OUTAGE (BOONE CB 5335 FAILURE)
99 COMANCHE-BOONE-LAMAR 230 OUTAGE (BOONE CB 5337 FAILURE)
100 BOONE-LAMAR & BOONE-LAJUNTA (TS) OUTAGE
101 MIDWAY-BOONE-LAMAR 230 OUTAGE (BOONE CB 5336 FAILURE)
102 BOONE-LAJUNTA (TS & WPE) 115 OUTAGE
103 BOYD-LONE TREE & BOYD-LONGS PEAK OUTAGE
104 BOTH BURLINGTON GENERATORS OUTAGE (BURLINGTON CB 466 FAILURE)

NERC CATEGORY C – OUTAGE DESCRIPTION - CONTINUED

105 CASPER-DJ & DJ UNIT 4 OUTAGE (DAVE JOHNSTON CB IH238 FAILURE)
106 COMAN UNIT 1 & COMAN XFMR 1 OUTAGE (COMANCHE CB 5406 FAILURE)
107 COMAN-WALSENB & COMAN XFMR 2 OUTAGE
108 COMANCHE-MIDWAY-DANIELS PARK OUTAGE (MIDWAY CB 5124 FAILURE)
109 CRAIG UNIT 3 & CRAIG XFMR 1 OUTAGE (CRAIG CB 321K FAILURE)
110 CRAIG UNIT 2 & CRAIG XFMR 2 OUTAGE (CRAIG CB 221K FAILURE)
111 CRAIG-HAYDEN & HAYDEN-WOLCOTT 230 OUTAGE
112 CRAIG-RIFLE-GRAND JUNCTION 345 OUTAGE (RIFLE CB 321K FAILURE)
113 CURECANTI-LOST CANYON-SHIP OUTAGE (LOST CANYON CB 5321 FAILURE)
114 CURECANTI-PONCHA-MIDWAY 230 OUTAGE (PONCHA CB 386 FAILURE)
115 CURECANTI-PONCHA-SAN LUIS 230 OUTAGE (PONCHA CB 586 FAILURE)
116 CURECANTI-LOST CANYON & HESPERUS-MONTROSE OUTAGE
117 DJ-STEGALL & DJ XFMR OUTAGE (DAVE JOHNSTON CB IH204 FAILURE)
118 DJ-LRS & DJ UNIT 3 OUTAGE (DAVE JOHNSTON CB IH268 FAILURE)
119 DJ-LRS & LRS XFMR OUTAGE (LARAMIE RIVER CB 386 FAILURE)
120 DJ-LRS-STEGALL 230 OUTAGE (LARAMIE RIVER CB 382 FAILURE)
121 NORTH YUMA-WAUNETA & NORTH YUMA XFMR OUTAGE (NORTH YUMA CB 1266 FAILURE)
122 DEERING L-NORTH YUMA-RED WILLOW OUTAGE (NORTH YUMA CB 1362 FAILURE)
123 FRASER-WINDY GAP-KREMMLING 138 OUTAGE (WINDY GAP CB 972 FAILURE)
124 FRASER-WINDY GAP & WINDY GAP XFMR OUTAGE (WINDY GAP CB 876 FAILURE)
125 BLUE R-GORE PASS & GORE PASS XFMR OUTAGE (GORE PASS CB 1186 FAILURE)
126 GORE PASS XFMRS OUTAGE (GORE PASS CB 172 FAILURE)
127 GORE PASS-HAYDEN 138 & GORE PASS XFMR OUTAGE (GORE PASS CB 472 FAILURE)
128 GORE PASS-WINDY GAP & GORE PASS XFMR OUTAGE (GORE PASS CB 276 FAILURE)
129 HAYDEN-GORE PASS-KREMMLING OUTAGE (GORE PASS CB 576 FAILURE)
130 WINDY GAP-GORE PASS-KREMMLING OUTAGE (GORE PASS CB 372 FAILURE)
131 GORE PASS-WINDY GAP & KREMMLING-WINDY GAP OUTAGE
132 GORE PASS-WINDY GAP-NCWCD 138 OUTAGE (WINDY GAP CB 576 FAILURE)
133 GORE PASS-WINDY GAP & WINDY GAP XFMR OUTAGE (WINDY GAP CB 772 FAILURE)
134 GRAND JUNCTION-MONTROSE & GRAND JUNCTION XFMR OUTAGE (GRAND JUNCTION CB 331K FAILURE)
135 GRAND JUNCTION -RIFLE & GRAND JUNCTION XFMR OUTAGE (GRAND JUNCTION CB 331K FAILURE)
136 GRAND JUNCTION-MONTROSE 345 & 115 OUTAGE
137 GRAND JUNCTION -RIFLE & RIFLE XFMR OUTAGE (RIFLE CB 311K FAILURE)
138 MONTROSE- GRAND JUNCTION -RIFLE 345 OUTAGE (GRAND JUNCTION CB 331S FAILURE)
139 GRAND JUNCTION-MONTROSE-HESPERUS 345 OUTAGE
140 GRAND JUNCTION-MONTROSE & MONTROSE XFMR OUTAGE (MONTROSE CB M311 FAILURE)
141 HESPERUS-MONTROSE & HESPERUS XFMR OUTAGE (HESPERUS CB 321N FAILURE)
142 HESPERUS-MONTROSE & DURANGO-LOST CANYON OUTAGE
143 HESPERUS-MONTROSE & MONTROSE XFMR OUTAGE (MONTROSE CB M321 FAILURE)

NERC CATEGORY C – OUTAGE DESCRIPTION - CONTINUED

144 HESPERUS-MONTROSE & MONTROSE-NUCLA OUTAGE
145 HESPERUS-WATERFLOW & HESPERUS XFMR OUTAGE (HESPERUS CB 321K FAILURE)
146 KREMMLING-WINDY GAP-NCWCD 138 OUTAGE (WINDY GAP CB 672 FAILURE)
147 LAMAR-VILAS & LAMAR-WILLOW CREEK 115 OUTAGE
148 LRS UNIT 1 & LRS XFMR OUTAGE (LARAMIE RIVER CB 2992 FAILURE)
149 LRS UNIT 2 & LRS XFMR OUTAGE (LARAMIE RIVER CB 2992 FAILURE)
150 LRS UNIT 1 & LRS-STORY OUTAGE (LARAMIE RIVER CB 2796 FAILURE)
151 LOST CANYON-SHIPROCK & LOST CANYON XFMR OUTAGE (LOST CANYON CB 3331 FAILURE)
152 MIDWAY-PONCHA-SAN LUIS 230 OUTAGE (PONCHA CB 1186 FAILURE)
153 NORTH YUMA -SIDNEY & NORTH YUMA XFMR OUTAGE (NORTH YUMA CB 582 FAILURE)
154 NORTH YUMA -STORY & NORTH YUMA XFMR OUTAGE (NORTH YUMA CB 882 FAILURE)
155 DEER LAKE- NORTH YUMA & NORTH YUMA XFMR OUTAGE (NORTH YUMA CB 1566 FAILURE)
156 SIDNEY- NORTH YUMA -WRAY 230 OUTAGE (NORTH YUMA CB 686 FAILURE)
157 STORY- NORTH YUMA -WRAY 230 OUTAGE (NORTH YUMA CB 782 FAILURE)
158 STORY-NORTH YUMA & STORY XFMR 1 OUTAGE (STORY CB 886 FAILURE)
159 LRS-STEGALL-SIDNEY 230 BUS OUTAGE (STEGALL CB 7092 FAILURE)
160 LRS-STEGALL & STEGALL XFMR OUTAGE (STEGALL CB 7196 FAILURE)
161 SIDNEY-STEGAL & STEGAL XFMR OUTAGE (STEGALL CB 7292 FAILURE)
162 LONGPEAK- COUNTYLINE & LONGPEAK – DELCAM – MEADOW 115 OUTAGE
163 CHEYENNE – AULT 230-KV, CHEYENNE – OWL CREEK 115-KV DOUBLE CIRCUIT OUTAGE
164 RIFLE-NORTH FORK-CURECANTI 230-KV (NORTH FORK CB 882 FAILURE)
165 STORY-HENRY LAKE 230-KV AND BEAVER CREEK-HOYT 115-KV DOUBLE CIRCUIT OUTAGE
166 LOSS OF STEGALL 115 KV MAIN BUS
167 LOSS OF RANGELY 138 KV MAIN BUS
168 LOSS OF MONTROSE 115 KV MAIN BUS
169 LOSS OF HAYDEN 138 KV MAIN BUS
170 LOSS OF CHEYENNE 115 KV MAIN BUS
171 LOSS OF AXIAL BASIN 138 KV MAIN BUS
172 LOSS OF ARCHER 115 KV MAIN BUS
173 LOSS OF MIDWAY 230 KV MAIN BUS
174 N/A
175 LOSS OF BEAVER CREEK 115 KV MAIN BUS

NERC CATEGORY D – OUTAGE DESCRIPTION

1. CRAIG-AULT 345KV & HAYDEN-ARCHER 230KV OUTAGE- COMMON CORRIDOR
2. SOUTHRC – LANGE 230KV & SOUTHRC – WESTHILL 230KV OUTAGE & SOUTHRC XFRM OUTAGE
3. LANGE – LOOKOUT 230KV & LANGE – SOUTHRC 230KV OUTAGE & LANGE XFMR OUTAGE
4. AULT-RAWHIDE,AULT-TIMBERLINE & RAWHIDE-TIMBERLINE OUTAGE
5. MIDWAY-WATERTON 345; COMANCHE-DANIELS PARK 345 CRK 1 & 2; MIDWAY – FULLER 230 KV
6. COMMON CORRIDORLRS 345KV BUS OUTAGE
   LOSS OF STATION
7. PAWNEE 230KV BUS OUTAGE
   LOSS OF STATION
8. DANIEL PARK 230KV BUS OUTAGE
   LOSS OF STATION
9. CRAIG 345KV BUS OUTAGE
   LOSS OF STATION
10. AULT 345KV BUS OUTAGE
    LOSS OF STATION
11. RIFLE 345KV BUS OUTAGE
    LOSS OF STATION
12. DJ 230KV BUS OUTAGE
    LOSS OF STATION
13. WYODAK 230KV BUS OUTAGE
    LOSS OF STATION
14. CHEROKEE
    LOSS OF ALL 115KV & GENERATION
15. LOOKOUT 230KV BUS OUTAGE
    LOSS OF STATION
16. BOONE 115kV BUS OUTAGE
    LOSS OF STATION
17 LRS 230-KV BUS OUTAGE
    LOSS OF STATION
18 BEARS EARS 345-KV BUS OUTAGE
    LOSS OF STATION
19 CRAIG 230-KV BUS OUTAGE
    LOSS OF STATION
20 AULT 230-KV BUS OUTAGE
    LOSS OF STATION
21 HAYDEN 230-KV BUS OUTAGE
    LOSS OF STATION

NERC CATEGORY D – OUTAGE DESCRIPTION - CONTINUED

22 WATERFLOW 345-KV BUS OUTAGE (SAN JUAN PS)
LOSS OF STATION
23 WELD 230 KV (LM&PS) BUS OUTAGE
LOSS OF STATION
24 NIXON 230 KV BUS OUTAGE
LOSS OF STATION
25 RAWHIDE 230KV BUS OUTAGE
LOSS OF STATION
26 ST.VRAIN 230KV BUS OUTAGE
LOSS OF STATION
27 BAYFIELD 115 BUS OUTAGE
LOSS OF STATION
28 BIG SANDY 115 BUS OUTAGE
LOSS OF STATION
29 CAHONE 115 BUS OUTAGE
LOSS OF STATION
30 EMPIRE 115 BUS OUTAGE
LOSS OF STATION
31 GRAND JUNCTION 230 BUS OUTAGE
LOSS OF STATION
32 GRAND JUNCTION 138 BUS OUTAGE
LOSS OF STATION
33 LAJUNTA(TS) 115 BUS OUTAGE
LOSS OF STATION
34 LOST CANYON 115 BUS OUTAGE
LOSS OF STATION
35 MEEKER 138 BUS OUTAGE
LOSS OF STATION
36 MIDWAYPS 115 BUS OUTAGE
LOSS OF STATION
37 NUCLA 115 BUS OUTAGE
LOSS OF STATION
38 PONCHA 115 BUS OUTAGE
LOSS OF STATION
39 RIFLE 230 BUS OUTAGE
LOSS OF STATION
40 RIFLE 138 BUS OUTAGE
LOSS OF STATION

NERC CATEGORY D – OUTAGE DESCRIPTION - CONTINUED

41 SAN LUIS 115 BUS OUTAGE
LOSS OF STATION
42 SIDNEY 230 and 115 BUS OUTAGE
LOSS OF STATION
43 STEM BEACH 115 BUS OUTAGE
LOSS OF STATION
44 WALSENBURG 115 BUS OUTAGE
LOSS OF STATION
45 WILLOW CREEK(TS) 115 BUS OUTAGE
LOSS OF STATION
46 WRAY 115 BUS OUTAGE
LOSS OF STATION
47 FORDHAM 115 BUS OUTAGE
LOSS OF STATION
48 LONGS PEAK 115 BUS OUTAGE
LOSS OF STATION
49 LONGS PEAK 230 BUS OUTAGE
LOSS OF STATION
50 BOYD 115 BUS OUTAGE
LOSS OF STATION
51 BOYD 230 BUS OUTAGE
LOSS OF STATION
52 TIMBERLINE 115 BUS OUTAGE
LOSS OF STATION
53 TIMBERLINE 230 BUS OUTAGE
LOSS OF STATION
54 LAPORTE 230 BUS OUTAGE
LOSS OF STATION

Additional appendices are available upon request from Shawn Carlson.
SCarlson@bepc.com