

ATTACHMENT I
DYNAMIC STABILITY STUDY RESULTS
ALTERNATIVE AC 1, PEAK CONDITIONS

ALTERNATIVE AC-1

Second Paloverde-Devers 500 kV line (Harquahala-Devers),
 Ramona 500 kV Substation, Imperial Valley-Ramona 500 kV line
 Reactive Support (added for dynamic stability in bold font):

Shunts (static support):

2X43 MVAR SOUTH BAY 138 KV
 2X79 MVAR BARRE 230 KV
 1X79 MVAR MIRA LOMA 230 KV
 3X79MVAR DEVERS 230 KV

1X79 MVAR SAN BERNARDINO 230 KV
 2X79 MVAR VISTA 230 KV
 1X79 MVAR COACHELLA VALLEY 230 KV

Dynamic Support:

400 MVAR STATCON or SVC (SYNCHR.COND) ON DEVERS 500 KV
 200 MVAR SVC (SYNCHR.COND) ON VALLEY 500 KV
300 MVAR STATCON on Devers 115 kV
100 MVAR SVC on Wiltmonhr 161 kV

1. Devers-Valley 500 kV outage, fault on Devers

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | VALLEY-S | 115 | vbul | | 1.031 | 0.937 | 9.1 | 0.221 |
| 24 | ESRP MWD | 115 | vbus | | 1.038 | 0.951 | 8.3 | 0.221 |
| 24 | VALLEYSC | 115 | vbug | | 1.04 | 0.948 | 8.9 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | INDIAN W | 115 | fbul | | 59.495 | 0.042 |
| 24 | TAP805 | 115 | fbus | | 59.499 | 0.042 |
| 24 | ESRP P1 | 6.9 | fbug | | 59.57 | 0.067 |

2. Eldorado-McCullough 500 kV outage, fault on Eldorado

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 18 | NEEDLES | 69 | vbul | | 0.982 | 0.912 | 7.1 | 0.213 |
| 26 | SYLMAR3 | 230 | vbus | | 0.998 | 0.924 | 7.4 | 0.213 |
| 26 | ADELSVC | 500 | vbug | | 1.041 | 0.972 | 6.6 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
|------|----------|--------|------|--|--------|-------|

| | | | | | | |
|----|---------|----|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.623 | 0.067 |
| 24 | ETI MWD | 66 | fbus | | 59.804 | 0.067 |
| 24 | VSTA | 66 | fbug | | 59.768 | 0.067 |

3. Eldorado-Mohave 500 kV, fault on Eldorado

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|-------|--|---------|--------|------|-------|
| 18 | NEEDLES | 69 | vbul | | 0.982 | 0.893 | 9.0 | 0.213 |
| 18 | DAVISTP | 69 | vbush | | 1.003 | 0.915 | 8.7 | 0.213 |
| 26 | ADELSVC | 500 | vbug | | 1.041 | 0.968 | 7.0 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.623 | 0.067 |
| 24 | ETI MWD | 66 | fbus | | 59.804 | 0.067 |
| 24 | VSTA | 66 | fbug | | 59.768 | 0.067 |

4. Eldorado-Moenkopi 500 kV, fault on Eldorado

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|-------|--|---------|--------|------|-------|
| 18 | NEEDLES | 69 | vbul | | 0.982 | 0.902 | 8.1 | 0.213 |
| 26 | SYLMAR3 | 230 | vbush | | 0.998 | 0.921 | 7.7 | 0.213 |
| 26 | ADELSVC | 500 | vbug | | 1.041 | 0.967 | 7.1 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.623 | 0.067 |
| 24 | ETI MWD | 66 | fbus | | 59.804 | 0.067 |
| 24 | VSTA | 66 | fbug | | 59.768 | 0.067 |

5. Imperial Valley-North Gila 500 kV, fault on N.Gila

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|-------|--|---------|--------|------|-------|
| 24 | VALLEY-S | 115 | vbul | | 1.031 | 0.917 | 11.1 | 1.046 |
| 24 | TAP805 | 115 | vbush | | 0.981 | 0.875 | 10.8 | 1.046 |
| 24 | VALLEYSC | 500 | vbug | | 1.055 | 0.941 | 10.8 | 1.046 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 20 | CPU-161 | 161 | fbul | | 59.66 | 0.558 |

| | | | | | | |
|----|---------|------|------|--|--------|-------|
| 20 | CPT-161 | 161 | fbus | | 59.659 | 0.558 |
| 20 | CPU-U5 | 13.8 | fbug | | 59.615 | 0.558 |

6. Imperial Valley-Miguel 500 kV, fault on Imperial Valley, trip Imperial Valley generation as RAS

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 20 | RUM-69 | 69 | vbul | | 0.994 | 0.938 | 5.6 | 0.325 |
| 22 | RAMONA 5 | 500 | vbus | | 1.057 | 0.978 | 7.4 | 0.625 |
| 22 | SYCAMORE | 230 | vbug | | 1.003 | 0.937 | 6.6 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 20 | CPU-161 | 161 | fbul | | 59.785 | 0.525 |
| 20 | CPT-161 | 161 | fbus | | 59.784 | 0.525 |
| 20 | CPU-U5 | 13.8 | fbug | | 59.739 | 0.55 |

7. Imperial Valley-Ramona 500 kV, fault on Imperial Valley

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 22 | BORDER | 69 | vbul | | 1.005 | 0.944 | 6 | 0.221 |
| 22 | RAMONA 2 | 230 | vbus | | 1.008 | 0.945 | 6.3 | 0.221 |
| 22 | OTAY | 69 | vbug | | 0.996 | 0.937 | 5.9 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 22 | BORREGO | 69 | fbul | | 59.826 | 0.042 |
| 22 | NARROWS | 69 | fbus | | 59.836 | 0.042 |
| 22 | CALPK_EC | 13.8 | fbug | | 59.841 | 0.042 |

8. Intermountain-Adelanto DC line, no fault

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 65 | AMPS | 69 | vbul | | 1.022 | 0.981 | 4 | 0.963 |
| 65 | AMPS | 230 | vbus | | 1.01 | 0.97 | 3.9 | 0.963 |
| 65 | TWCITIES | 69 | vbug | | 0.959 | 0.927 | 3.4 | 0.4 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
|------|----------|--------|------|--|--------|-------|

| | | | | | | |
|----|----------|------|------|--|--------|-------|
| 65 | MILFORD | 46 | fbul | | 59.843 | 1.863 |
| 65 | BLUNDELL | 46 | fbus | | 59.821 | 1.863 |
| 65 | BLNDL G1 | 12.5 | fbug | | 59.795 | 1.863 |

9. Lugo-Eldorado, Lugo-Mohave 500 kV double outage, fault on Lugo

No violations, listed violations are not violations for double outages. Voltage dip is actually delayed voltage recovery after the fault.

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.711 | 30.3 | 0.21 |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.711 | 30.3 | 0.213 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.74 | 23.3 | 0.213 |
| 24 | VSTA | 66 | vbug | | 0.99 | 0.799 | 19.3 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.048 | 0.042 |
| 24 | HUNTGBCH | 66 | fbus | | 59.596 | 0.054 |
| 24 | KERRGEN | 12.5 | fbug | | 59.431 | 0.963 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|----------|--------|------|--|--------|-------|-------|
| 24 | KERRGEN | 12.5 | fbug | | 15.8 | 0.85 | 1.113 |
| 24 | KERRGEN | 12.5 | fbug | | 11.3 | 1.9 | 2.088 |
| 24 | KERRMGEE | 13.8 | fbug | | 11.3 | 0.888 | 1.075 |

10. Lugo-Eldorado 500 kV, fault at Lugo

Frequency criteria violations possibly caused by wrong models. Voltage violation shown is delayed voltage recovery after the fault

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.739 | 27.7 | 0.21 |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.739 | 27.7 | 0.213 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.762 | 21 | 0.213 |
| 24 | VSTA | 66 | vbug | | 0.99 | 0.82 | 17.2 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.048 | 0.042 |
| 24 | HUNTGBCH | 66 | fbus | | 59.596 | 0.054 |
| 24 | KERRGEN | 12.5 | fbug | | 59.443 | 0.963 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|-----------------|-------------|------|--|-------------|-------|-------|
| 24 | KERRGEN | 12.5 | fbug | | 15.8 | 0.85 | 1.113 |
| 24 | KERRGEN | 12.5 | fbug | | 11.3 | 1.863 | 2.05 |
| 24 | KERRMGEE | 13.8 | fbug | | 9 | 0.888 | 1.038 |

11. Lugo-Mohave 500 kV, fault at Lugo

Frequency criteria violations possibly caused by wrong models. Voltage violation shown is delayed voltage recovery after the fault.

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.755 | 26.1 | 0.21 |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.755 | 26.1 | 0.213 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.777 | 19.5 | 0.213 |
| 24 | OLINDA | 66 | vbug | | 1.023 | 0.859 | 16 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.067 | 0.038 |
| 24 | HUNTGBCH | 66 | fbus | | 59.595 | 0.05 |
| 24 | KERRGEN | 12.5 | fbug | | 59.445 | 0.963 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|-----------------|-------------|------|--|-------------|-------|-------|
| 24 | KERRGEN | 12.5 | fbug | | 15.8 | 0.85 | 1.113 |
| 24 | KERRGEN | 12.5 | fbug | | 11.3 | 1.863 | 2.05 |
| 24 | KERRMGEE | 13.8 | fbug | | 11.3 | 0.85 | 1.038 |

12. Lugo-Miraloma 500 kV # 2, fault on Lugo

Frequency criteria violations possibly caused by wrong models. Voltage violation shown is delayed voltage recovery after the fault.

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
|------|----------|--------|------|--|---------|--------|------|-------|

| | | | | | | | | |
|----|-------|----|------|--|-------|-------|------|------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.734 | 28.1 | 0.21 |
|----|-------|----|------|--|-------|-------|------|------|

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.734 | 28.1 | 0.213 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.759 | 21.3 | 0.213 |
| 24 | VSTA | 66 | vbug | | 0.99 | 0.816 | 17.6 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.048 | 0.042 |
| 24 | HUNTGBCH | 66 | fbus | | 59.596 | 0.054 |
| 24 | KERRGEN | 12.5 | fbug | | 59.449 | 0.963 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|-----------------|-------------|------|--|-------------|-------|-------|
| 24 | KERRGEN | 12.5 | fbug | | 15.8 | 0.85 | 1.113 |
| 24 | KERRGEN | 12.5 | fbug | | 11.3 | 1.863 | 2.05 |
| 24 | KERRMGEE | 13.8 | fbug | | 9 | 0.888 | 1.038 |

13. Lugo-Miraloma 500 kV # 3, fault on Lugo

Frequency criteria violations possibly caused by wrong models. Voltage violation shown is delayed voltage recovery after the fault.

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.736 | 27.9 | 0.21 |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.736 | 27.9 | 0.213 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.761 | 21.2 | 0.213 |
| 24 | VSTA | 66 | vbug | | 0.99 | 0.817 | 17.4 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.048 | 0.042 |
| 24 | HUNTGBCH | 66 | fbus | | 59.596 | 0.054 |
| 24 | KERRGEN | 12.5 | fbug | | 59.449 | 0.963 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|-----------------|-------------|------|--|-------------|-------|-------|
| 24 | KERRGEN | 12.5 | fbug | | 15.8 | 0.85 | 1.113 |
| 24 | KERRGEN | 12.5 | fbug | | 11.3 | 1.863 | 2.05 |
| 24 | KERRMGEE | 13.8 | fbug | | 9 | 0.888 | 1.038 |

14. Lugo-Miraloma 500 kV # 1 and 2 double outage, fault on Lugo

No violations. Voltage violations shown in the table is delayed voltage recovery. Frequency violations, which may be a result of wrong modeling are not violations for a double outage.

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | AMERON | 66 | vbul | | 0.994 | 0.715 | 28.1 | 0.21 |
| 24 | ETIWANDA | 66 | vbul | | 1.006 | 0.735 | 26.9 | 0.21 |
| 24 | PADUA | 66 | vbul | | 1.021 | 0.628 | 38.5 | 0.21 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.669 | 30.7 | 0.21 |
| 24 | WALNUT | 66 | vbul | | 1.029 | 0.768 | 25.3 | 0.21 |
| 24 | VALLEYSC | 115 | vbug | | 1.04 | 0.778 | 25.2 | 0.21 |
| 24 | BARRE | 66 | vbul | | 1.007 | 0.741 | 26.4 | 0.21 |
| 24 | MIRALOMA | 66 | vbul | | 1.04 | 0.717 | 31.1 | 0.21 |
| 24 | SANBRDNO | 66 | vbul | | 1.006 | 0.686 | 31.8 | 0.21 |
| 24 | VILLA PK | 66 | vbul | | 1.006 | 0.723 | 28.1 | 0.21 |
| 24 | VALLEY-S | 115 | vbul | | 1.031 | 0.767 | 25.6 | 0.21 |
| 24 | TAP817 | 115 | vbus | | 0.992 | 0.695 | 30 | 0.21 |
| 24 | TAP801 | 115 | vbus | | 0.973 | 0.669 | 31.2 | 0.21 |
| 24 | YUCCA | 115 | vbul | | 0.973 | 0.669 | 31.2 | 0.21 |
| 24 | HI DESER | 115 | vbul | | 0.954 | 0.638 | 33.1 | 0.21 |
| 24 | TAP802 | 115 | vbus | | 0.97 | 0.665 | 31.5 | 0.21 |
| 24 | TAP803 | 115 | vbus | | 0.963 | 0.652 | 32.3 | 0.21 |
| 24 | BANNING | 115 | vbul | | 0.958 | 0.652 | 32 | 0.21 |
| 24 | GARNET | 115 | vbug | | 0.991 | 0.693 | 30.1 | 0.21 |
| 24 | SANTA RO | 115 | vbul | | 0.985 | 0.669 | 32.1 | 0.21 |
| 24 | EISENHOW | 115 | vbul | | 0.983 | 0.677 | 31.1 | 0.21 |
| 24 | FARREL | 115 | vbul | | 0.983 | 0.679 | 30.9 | 0.21 |
| 24 | CONCHO | 115 | vbul | | 0.981 | 0.664 | 32.4 | 0.21 |
| 24 | THORNHIL | 115 | vbul | | 0.984 | 0.678 | 31.1 | 0.21 |
| 24 | TAMARISK | 115 | vbul | | 0.991 | 0.688 | 30.6 | 0.21 |
| 24 | INDIAN W | 115 | vbul | | 0.981 | 0.663 | 32.4 | 0.21 |
| 24 | TAP805 | 115 | vbus | | 0.981 | 0.664 | 32.4 | 0.21 |
| 24 | CARODEAN | 115 | vbul | | 0.97 | 0.665 | 31.5 | 0.21 |
| 24 | INDIGO | 115 | vbug | | 0.992 | 0.695 | 30 | 0.21 |
| 24 | TAP820 | 115 | vbus | | 0.989 | 0.689 | 30.3 | 0.21 |
| 24 | MARASCHI | 115 | vbus | | 0.993 | 0.694 | 30.1 | 0.21 |
| 24 | VSTA | 230 | vbus | | 0.977 | 0.712 | 27.1 | 0.21 |
| 24 | VSTA | 66 | vbug | | 0.99 | 0.716 | 27.6 | 0.21 |
| 24 | VSTA | 115 | vbul | | 1.009 | 0.734 | 27.2 | 0.21 |
| 24 | LEWIS | 66 | vbul | | 1.016 | 0.715 | 29.6 | 0.21 |
| 24 | TAP806 | 115 | vbus | | 0.987 | 0.682 | 30.9 | 0.21 |
| 24 | TAP808 | 115 | vbus | | 0.971 | 0.664 | 31.6 | 0.21 |
| 24 | TAP811 | 115 | vbus | | 0.993 | 0.694 | 30.1 | 0.21 |
| 24 | TAP813 | 115 | vbus | | 0.992 | 0.694 | 30.1 | 0.21 |
| 24 | TAP814 | 115 | vbus | | 0.992 | 0.694 | 30.1 | 0.21 |
| 24 | TAP815 | 115 | vbus | | 0.991 | 0.693 | 30.1 | 0.21 |
| 24 | TERAWND | 115 | vbug | | 0.992 | 0.696 | 29.8 | 0.21 |

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | CAPWIND | 115 | vbug | | 0.987 | 0.682 | 30.9 | 0.21 |
| 24 | BUCKWIND | 115 | vbug | | 0.992 | 0.695 | 29.9 | 0.21 |
| 24 | ALTWIND | 115 | vbug | | 0.989 | 0.689 | 30.3 | 0.21 |
| 24 | RENWIND | 115 | vbug | | 0.992 | 0.694 | 30.1 | 0.21 |
| 24 | TRANWIND | 115 | vbug | | 0.992 | 0.694 | 30.1 | 0.21 |
| 24 | SEAWIND | 115 | vbug | | 0.986 | 0.687 | 30.4 | 0.21 |
| 24 | PANAERO | 115 | vbug | | 0.986 | 0.687 | 30.4 | 0.21 |
| 24 | TAP816 | 115 | vbus | | 0.986 | 0.687 | 30.4 | 0.21 |
| 24 | TAP819 | 115 | vbus | | 0.989 | 0.689 | 30.3 | 0.21 |
| 24 | TAP818 | 115 | vbus | | 0.991 | 0.694 | 30 | 0.21 |
| 24 | VENWIND | 115 | vbug | | 0.991 | 0.694 | 30 | 0.21 |
| 24 | SANWIND | 115 | vbug | | 0.991 | 0.694 | 30 | 0.21 |
| 24 | WINTEC6 | 115 | vbug | | 0.992 | 0.695 | 29.9 | 0.21 |
| 24 | SEAWEST | 115 | vbug | | 0.989 | 0.689 | 30.3 | 0.21 |
| 24 | ALTAMSA4 | 115 | vbug | | 0.986 | 0.687 | 30.4 | 0.21 |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.628 | 38.5 | 0.213 |
| 24 | TAP805 | 115 | vbus | | 0.981 | 0.664 | 32.4 | 0.213 |
| 24 | CAPWIND | 115 | vbug | | 0.987 | 0.682 | 30.9 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.048 | 0.042 |
| 24 | HUNTGBCH | 66 | fbus | | 59.596 | 0.054 |
| 24 | KERRGEN | 12.5 | fbug | | 59.466 | 1 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|----------|--------|------|--|--------|-------|-------|
| 24 | KERRGEN | 12.5 | fbug | | 15.8 | 0.888 | 1.15 |
| 24 | KERRMGEE | 13.8 | fbug | | 9 | 0.925 | 1.075 |

15. Lugo-Victorville 500 kV, fault at Victorville

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.897 | 12.2 | 0.213 |
| 26 | SYLMAR1 | 230 | vbus | | 0.978 | 0.869 | 11.1 | 0.213 |
| 24 | PALMDALE | 66 | vbug | | 0.989 | 0.896 | 9.5 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.341 | 0.054 |
| 24 | TAP 62 | 66 | fbus | | 59.692 | 0.067 |

| | | | | | | |
|----|--------|----|------|--|-------|-------|
| 24 | OLINDA | 66 | fbug | | 59.63 | 0.067 |
|----|--------|----|------|--|-------|-------|

16. Lugo-Vincent # 1 and 2 500 kV double outage, fault at Lugo

No violations. Voltage violations shown in the table is delayed voltage recovery. Frequency violations, which may be a result of wrong modeling are not violations for a double outage.

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.733 | 28.2 | 0.21 |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.733 | 28.2 | 0.213 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.757 | 21.5 | 0.213 |
| 24 | VSTA | 66 | vbug | | 0.99 | 0.816 | 17.6 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.039 | 0.042 |
| 24 | TAP 62 | 66 | fbus | | 59.572 | 0.042 |
| 24 | KERRGEN | 12.5 | fbug | | 59.447 | 0.963 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|----------|--------|------|--|--------|-------|-------|
| 24 | KERRGEN | 12.5 | fbug | | 15.8 | 0.85 | 1.113 |
| 24 | KERRGEN | 12.5 | fbug | | 9 | 1.9 | 2.05 |
| 24 | KERRMGEE | 13.8 | fbug | | 11.3 | 0.888 | 1.075 |

17. Adelanto-Victorville 500 kV, fault on Adelanto

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 26 | OLYMPCLD | 138 | vbul | | 0.993 | 0.899 | 9.5 | 0.221 |
| 26 | SYLMAR3 | 230 | vbus | | 0.998 | 0.9 | 9.8 | 0.221 |
| 26 | ADELSVC | 500 | vbug | | 1.041 | 0.96 | 7.8 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.428 | 0.067 |
| 24 | TAP 62 | 66 | fbus | | 59.731 | 0.067 |
| 24 | OLINDA | 66 | fbug | | 59.677 | 0.067 |

18. Adelanto-Toluca 500 kV, fault on Adelanto

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 26 | HOLYWDLD | 138 | vbul | | 0.987 | 0.873 | 11.5 | 0.221 |
| 26 | TOLUCA | 500 | vbus | | 1.005 | 0.88 | 12.4 | 0.221 |
| 24 | PALMDALE | 66 | vbug | | 0.989 | 0.914 | 7.6 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.428 | 0.067 |
| 24 | TAP 62 | 66 | fbus | | 59.731 | 0.067 |
| 24 | OLINDA | 66 | fbug | | 59.677 | 0.067 |

19. Adelanto-Rinaldi # 2 500 kV, fault on Adelanto

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 26 | RINALDI | 230 | vbul | | 1 | 0.891 | 10.9 | 0.221 |
| 26 | RINALDI2 | 500 | vbus | | 1.012 | 0.891 | 12 | 0.221 |
| 24 | PALMDALE | 66 | vbug | | 0.989 | 0.914 | 7.6 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.428 | 0.067 |
| 24 | TAP 62 | 66 | fbus | | 59.731 | 0.067 |
| 24 | OLINDA | 66 | fbug | | 59.677 | 0.067 |

20. Adelanto-Market Place 500 kV, fault on Adelanto

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.918 | 10.1 | 0.213 |
| 26 | SYLMAR3 | 230 | vbus | | 0.998 | 0.894 | 10.4 | 0.213 |
| 26 | ADELSVC | 500 | vbug | | 1.041 | 0.952 | 8.5 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.427 | 0.067 |
| 24 | TAP 62 | 66 | fbus | | 59.729 | 0.067 |
| 24 | OLINDA | 66 | fbug | | 59.677 | 0.067 |

21. Midway-Vincent 500 kV double-line outage, fault on Vincent

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | WILSONA | 66 | vbul | | 0.978 | 0.824 | 15.7 | 0.221 |
| 24 | TAP 72 | 66 | vbus | | 0.991 | 0.84 | 15.3 | 0.221 |
| 24 | SEAWEST | 230 | vbug | | 1 | 0.797 | 20.3 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.375 | 0.067 |
| 24 | TAP 62 | 66 | fbus | | 59.483 | 0.042 |
| 24 | PEARBMAP | 13.2 | fbug | | 59.369 | 0.042 |

22. Mc Cullough-Victorville 500 kV, fault on Mc Cullough

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 18 | NEEDLES | 69 | vbul | | 0.982 | 0.898 | 8.5 | 0.213 |
| 26 | SYLMAR3 | 230 | vbus | | 0.998 | 0.914 | 8.3 | 0.213 |
| 26 | ADELSVC | 500 | vbug | | 1.041 | 0.957 | 8 | 0.213 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.605 | 0.067 |
| 24 | ETI MWD | 66 | fbus | | 59.778 | 0.067 |
| 24 | VSTA | 66 | fbug | | 59.749 | 0.067 |

23. Loss of two Palo Verde generators, no fault

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 40 | NEWELL | 69 | vbul | | 0.993 | 0.896 | 9.7 | 1.617 |
| 40 | BURNS | 500 | vbus | | 1.064 | 0.951 | 10.6 | 1.617 |
| 40 | KLAFALLS | 230 | vbug | | 1.048 | 0.96 | 8.4 | 1.617 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
|------|----------|--------|------|--|--------|-------|

| | | | | | | |
|----|----------|------|------|--|--------|-------|
| 54 | AURORA 8 | 69 | fbul | | 59.744 | 3.642 |
| 54 | AURORA 4 | 240 | fbus | | 59.747 | 3.642 |
| 54 | AUR_GTG1 | 13.8 | fbug | | 59.741 | 3.642 |

24. Loss of PDCI, no fault

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 40 | NEWELL | 69 | vbul | | 0.993 | 0.938 | 5.5 | 1.604 |
| 40 | MALIN | 500 | vbus | | 1.084 | 1.025 | 5.4 | 1.592 |
| 40 | KLAFALLS | 230 | vbug | | 1.048 | 0.998 | 4.7 | 1.604 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 54 | AURORA 8 | 69 | fbul | | 59.838 | 3.129 |
| 24 | EASTWOOD | 230 | fbus | | 59.822 | 3.242 |
| 24 | B CRK2-3 | 6.6 | fbug | | 59.809 | 3.204 |

25. Paloverde-Devers 500 kV single line outage, fault on Palo Verde

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 14 | SCHRADER | 69 | vbul | | 1.012 | 0.847 | 16.3 | 0.213 |
| 14 | HARQUAHA | 500 | vbus | | 1.046 | 0.882 | 15.7 | 0.288 |
| 24 | DEVERS | 500 | vbug | | 1.06 | 0.938 | 11.5 | 0.363 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | INDIAN W | 115 | fbul | | 59.591 | 0.054 |
| 24 | TAP805 | 115 | fbus | | 59.594 | 0.054 |
| 24 | ESRP P1 | 6.9 | fbug | | 59.631 | 0.067 |

26. Serrano-Miraloma 500 kV single line outage, fault on Serrano

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.895 | 12.4 | 0.221 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.874 | 9.5 | 0.221 |
| 24 | VALLEYSC | 500 | vbug | | 1.055 | 0.962 | 8.8 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.401 | 0.042 |
| 24 | HUNTGBCH | 66 | fbus | | 59.702 | 0.042 |
| 24 | HUNT5 G | 16 | fbug | | 59.702 | 0.042 |

27. Serrano-Valley 500 kV single line outage, fault on Valley

Frequency violations on Valley, unacceptable frequency dip with the fault

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | VALLEY-S | 115 | vbul | | 1.031 | 0.932 | 9.6 | 0.221 |
| 24 | ESRP MWD | 115 | vbus | | 1.038 | 0.953 | 8.1 | 0.221 |
| 24 | VALLEYSC | 500 | vbug | | 1.055 | 0.959 | 9.1 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | VALLEY-S | 115 | fbul | | 57.804 | 0.067 |
| 24 | VALLEY4T | 13.8 | fbus | | 57.804 | 0.067 |
| 24 | ESRP P2 | 6.9 | fbug | | 59.493 | 0.067 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|----------|--------|------|--|--------|-------|-------|
| 24 | VALLEY-S | 115 | fbul | | 10 | 0.017 | 0.183 |

28. Lugo-Serrano 500 kV single line outage, fault on Serrano

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | PADUA | 66 | vbul | | 1.021 | 0.883 | 13.5 | 0.221 |
| 24 | PADUA | 230 | vbus | | 0.965 | 0.865 | 10.4 | 0.221 |
| 24 | VALLEYSC | 115 | vbug | | 1.04 | 0.948 | 8.9 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | PADUA | 66 | fbul | | 59.401 | 0.042 |
| 24 | HUNTGBCH | 66 | fbus | | 59.702 | 0.042 |
| 24 | HUNT5 G | 16 | fbug | | 59.702 | 0.042 |

29. Loss of two San Onofre generators, no fault

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | VIEJO66 | 66 | vbul | | 1.012 | 0.914 | 9.7 | 0.379 |
| 24 | S.ONOFRE | 230 | vbus | | 1.021 | 0.911 | 10.8 | 0.342 |
| 22 | RINCON | 69 | vbug | | 0.984 | 0.893 | 9.2 | 0.304 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 22 | LAGNA NL | 138 | fbul | | 59.855 | 0.042 |
| 22 | MNSRATTP | 69 | fbus | | 59.864 | 0.042 |
| 22 | TALEGA | 138 | vbug | | 59.874 | 0.042 |

30. Hassyampa-North Gila 500 kV outage, fault on Hassyampa.

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | Initial | MaxDip | Prct | @time | Cycles | From | To |
|------|----------|--------|------|---------|--------|------|-------|--------|-------|-------|
| 14 | GILA | 161 | vbul | 0.987 | | | | 24.7 | 0.55 | 0.963 |
| 14 | GILA | 161 | vbul | 0.987 | 0.738 | 25.2 | 0.74 | | | |
| 14 | WLTNMOHK | 161 | vbul | 0.983 | | | | 24.7 | 0.55 | 0.963 |
| 14 | WLTNMOHK | 161 | vbul | 0.983 | 0.728 | 25.9 | 0.74 | | | |
| 24 | YUCCA | 115 | vbul | 0.976 | | | | 29.2 | 0.363 | 0.85 |
| 24 | YUCCA | 115 | vbul | 0.976 | 0.731 | 25.1 | 0.59 | | | |
| 24 | HI DESER | 115 | vbul | 0.956 | | | | 29.2 | 0.363 | 0.85 |
| 24 | HI DESER | 115 | vbul | 0.956 | 0.706 | 26.2 | 0.59 | | | |
| 24 | BANNING | 115 | vbul | 0.96 | | | | 29.2 | 0.363 | 0.85 |
| 24 | BANNING | 115 | vbul | 0.96 | 0.715 | 25.6 | 0.59 | | | |
| 24 | GARNET | 115 | vbug | 0.994 | | | | 24.7 | 0.4 | 0.813 |
| 24 | SANTA RO | 115 | vbul | 0.985 | | | | 29.2 | 0.363 | 0.85 |
| 24 | SANTA RO | 115 | vbul | 0.985 | 0.734 | 25.4 | 0.59 | | | |
| 24 | EISENHOW | 115 | vbul | 0.983 | | | | 27 | 0.4 | 0.85 |
| 24 | FARREL | 115 | vbul | 0.984 | | | | 27 | 0.4 | 0.85 |
| 24 | CONCHO | 115 | vbul | 0.982 | | | | 29.2 | 0.363 | 0.85 |
| 24 | CONCHO | 115 | vbul | 0.982 | 0.73 | 25.6 | 0.59 | | | |
| 24 | THORNHIL | 115 | vbul | 0.984 | | | | 27 | 0.4 | 0.85 |
| 24 | TAMARISK | 115 | vbul | 0.99 | | | | 27 | 0.4 | 0.85 |
| 24 | INDIAN W | 115 | vbul | 0.981 | | | | 29.2 | 0.363 | 0.85 |
| 24 | INDIAN W | 115 | vbul | 0.981 | 0.73 | 25.6 | 0.59 | | | |
| 24 | CARODEAN | 115 | vbul | 0.973 | | | | 29.2 | 0.363 | 0.85 |
| 24 | CARODEAN | 115 | vbul | 0.973 | 0.727 | 25.2 | 0.59 | | | |
| 24 | INDIGO | 115 | vbug | 0.994 | | | | 24.7 | 0.4 | 0.813 |
| 24 | TERAWND | 115 | vbug | 0.995 | | | | 24.7 | 0.4 | 0.813 |
| 24 | CAPWIND | 115 | vbug | 0.989 | | | | 27 | 0.4 | 0.85 |
| 24 | BUCKWND | 115 | vbug | 0.994 | | | | 24.7 | 0.4 | 0.813 |
| 24 | ALTWIND | 115 | vbug | 0.991 | | | | 24.7 | 0.4 | 0.813 |

VOLTAGE CRITERIA VIOLATIONS

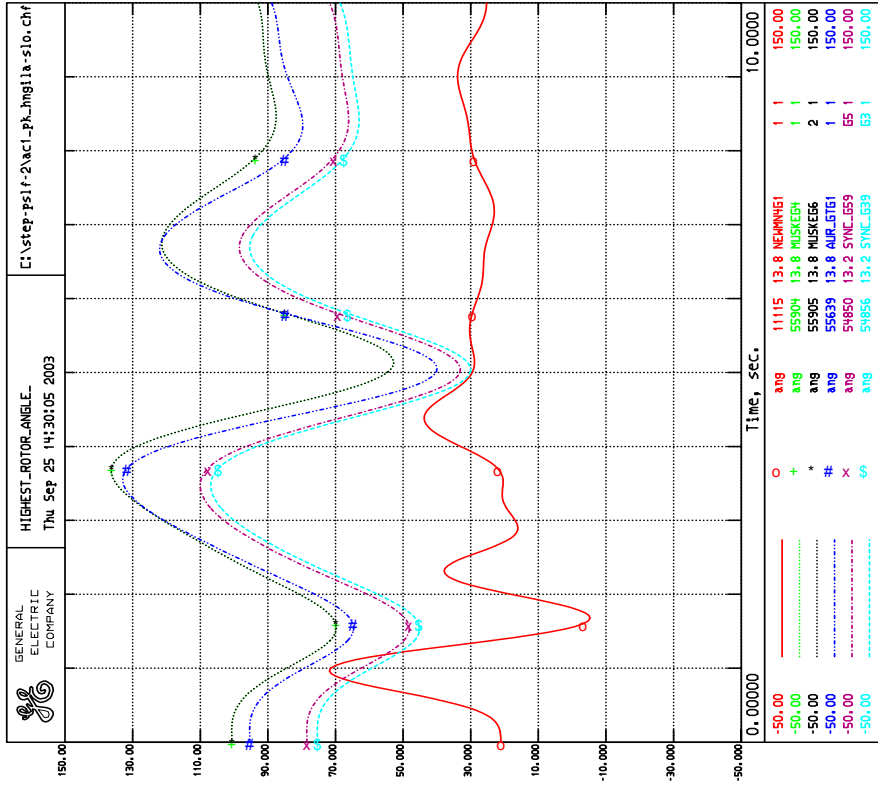
| AREA | BUS NAME | BUS KV | TYPE | Initial | MaxDip | Prct | @time | Cycles | From | To |
|------|----------|--------|------|---------|--------|------|-------|--------|------|-------|
| 24 | RENWIND | 115 | vbug | 0.994 | | | | 24.7 | 0.4 | 0.813 |
| 24 | TRANWND | 115 | vbug | 0.995 | | | | 24.7 | 0.4 | 0.813 |
| 24 | SEAWIND | 115 | vbug | 0.988 | | | | 24.7 | 0.4 | 0.813 |
| 24 | PANAERO | 115 | vbug | 0.988 | | | | 24.7 | 0.4 | 0.813 |
| 24 | VENWIND | 115 | vbug | 0.994 | | | | 24.7 | 0.4 | 0.813 |
| 24 | SANWIND | 115 | vbug | 0.994 | | | | 24.7 | 0.4 | 0.813 |
| 24 | WINTEC6 | 115 | vbug | 0.994 | | | | 24.7 | 0.4 | 0.813 |
| 24 | SEAWEST | 115 | vbug | 0.991 | | | | 24.7 | 0.4 | 0.813 |
| 24 | ALTAMSA4 | 115 | vbug | 0.988 | | | | 24.7 | 0.4 | 0.813 |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|---------|--------|------|-------|
| 24 | HI DESER | 115 | vbul | 0.956 | 0.706 | 26.2 | 0.588 |
| 14 | DOME TAP | 161 | vbus | 0.988 | 0.73 | 26.2 | 0.738 |
| 24 | CAPWIND | 115 | vbug | 0.989 | 0.743 | 24.8 | 0.588 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | MaxDip | @time |
|------|----------|--------|------|--------|-------|
| 24 | TAP805 | 115 | fbus | 59.574 | 0.054 |
| 24 | INDIAN W | 115 | fbul | 59.572 | 0.054 |



2007 HEAVY SUMMER PEAK CASE
 STEP STUDY WORK - DETAILED STUDIES ALTERNATIVE AC-1:
 HARDWALLA-DEVERS AND IMPERIAL VALLEY-RANOMA 500 KV LINES
 SECOND 500/230 KV BANK AT FIGUEL AND DEVERS
 UPGRADE OF THERMAL CAPACITY ON SERIES CAPACITORS ON SMLP NOT MODELED

Additional voltage support: 400 MVAR STATCON ON DEVERS 500 KV
 200 MVAR SVC ON VALLEY 500 KV 300 MVAR STATCON on Devers 115 kV
 100 MVAR SVC on Wiltmonhr 161 kV

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 24 | HI DESER | 115 | vbul | | 0.966 | 0.764 | 20.9 | 0.588 |
| 24 | TAP805 | 115 | vbus | | 0.992 | 0.787 | 20.7 | 0.588 |
| 24 | DEVERS | 500 | vbug | | 1.059 | 0.82 | 22.5 | 0.513 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | INDIAN W | 115 | fbul | | 59.613 | 0.054 |
| 24 | TAP805 | 115 | fbus | | 59.614 | 0.054 |
| 20 | CCBC-U1 | 21 | fbug | | 59.65 | 1.9 |

- 31. Paloverde-Devers, Harquahala-Devers 500 kV double line outage, fault on Palo Verde

No violations. Frequency violations shown are not violations for a double line outage

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|--|---------|--------|------|-------|
| 14 | SCHRADER | 69 | vbul | | 1.012 | 0.849 | 16.1 | 0.213 |
| 22 | N.GILA | 500 | vbus | | 1.04 | 0.854 | 17.9 | 0.4 |
| 22 | SYCAMORE | 230 | vbug | | 1.003 | 0.876 | 12.6 | 0.513 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | INDIAN W | 115 | fbul | | 59.591 | 0.054 |
| 24 | TAP805 | 115 | fbus | | 59.594 | 0.054 |
| 21 | JJELMORE | 14.4 | fbug | | 59.564 | 1.75 |

FREQUENCY LESS THAN 59.6

| AREA | BUS NAME | BUS KV | TYPE | | Cycles | From | To |
|------|-----------|--------|------|--|--------|-------|-------|
| 21 | DEL RANCH | 14.4 | fbug | | 6.8 | 1.675 | 1.788 |
| 21 | JJELMORE | 14.4 | fbug | | 9 | 1.675 | 1.825 |
| 21 | LEATHERS | 14.4 | fbug | | 9 | 1.675 | 1.825 |

- 32. Perkins-Westwing double line outage, fault on Westwing

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|---------|--------|------|-------|
| 14 | THUNDRST | 69 | vbul | 0.995 | 0.919 | 7.6 | 0.221 |
| 14 | KYRENEST | 69 | vbus | 1.048 | 0.981 | 6.4 | 0.221 |
| 24 | DEVERS | 500 | vbug | 1.06 | 0.994 | 6.2 | 0.221 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | MaxDip | @time |
|------|----------|--------|------|--------|-------|
| 14 | WARD | 69 | fbul | 59.759 | 0.042 |
| 24 | TAP805 | 115 | fbus | 59.824 | 0.054 |
| 24 | ESRP P1 | 6.9 | fbug | 59.811 | 0.067 |

33. Paloverde-Westwing double line outage, fault on Paloverde

No violations, voltage violation is not a violation for a double outage

VOLTAGE CRITERIA VIOLATIONS

| AREA | BUS NAME | BUS KV | TYPE | Initial | MaxDip | Prct | @time | Cycles | From | To |
|------|----------|--------|------|---------|--------|------|-------|--------|-------|-----|
| 24 | DEVERS | 500 | vbug | 1.06 | | | | 24.7 | 0.288 | 0.7 |
| 24 | DEVERS | 500 | vbug | 1.06 | 0.79 | 25.4 | 0.51 | | | |

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|---------|--------|------|-------|
| 24 | HI DESER | 115 | vbul | 0.954 | 0.741 | 22.3 | 0.513 |
| 24 | TAP803 | 115 | vbus | 0.963 | 0.752 | 22 | 0.513 |
| 24 | DEVERS | 500 | vbug | 1.06 | 0.79 | 25.4 | 0.513 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | MaxDip | @time |
|------|----------|--------|------|--------|-------|
| 24 | INDIAN W | 115 | fbul | 59.601 | 0.054 |
| 24 | TAP805 | 115 | fbus | 59.603 | 0.054 |
| 24 | ESRP P1 | 6.9 | fbug | 59.642 | 0.067 |

34. Paloverde-Westwing single line outage, fault on Paloverde

No violations

HIGHEST VOLTAGE DIP

| AREA | BUS NAME | BUS KV | TYPE | Initial | MaxDip | Prct | @time |
|------|----------|--------|------|---------|--------|------|-------|
| 14 | SCHRADER | 69 | vbul | 1.012 | 0.839 | 17.1 | 0.213 |
| 14 | HARQUAHA | 500 | vbus | 1.046 | 0.887 | 15.2 | 0.25 |
| 24 | DEVERS | 500 | vbug | 1.06 | 0.898 | 15.3 | 0.325 |

LOWEST FREQUENCY

| AREA | BUS NAME | BUS KV | TYPE | | MaxDip | @time |
|------|----------|--------|------|--|--------|-------|
| 24 | INDIAN W | 115 | fbul | | 59.601 | 0.054 |
| 24 | TAP805 | 115 | fbus | | 59.603 | 0.054 |
| 24 | ESRP P1 | 6.9 | fbug | | 59.642 | 0.067 |