Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AD2-194

Elwood

June 14, 2019

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement.

For Local and Network Upgrades which are required due to overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost less than $5,000,000, the cost of the Local and Network Upgrades will be shared by all proposed projects which have been assigned a Queue Position in the New Services Queue in which the need for the Local and Network Upgrades was identified. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects.

For Local and Network Upgrades which are required due to the overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost of $5,000,000 or greater, the cost of the Local and Network Upgrades will be allocated according to the order of the New Service Requests in the New Services Queue and the MW contribution of each individual Interconnection Request for those projects which cause or contribute to the need for the Local or Network Upgrades. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects.

Cost allocation rules can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.

An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is

contained in Attachment G-2 of Manual 14A. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a $10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 2.2.2. of Manual 14A for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment G-1 of Manual 14A) in order to document the request for the study.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

Queue Position AD2-194 is an uprate to Queue AC1-204 for an additional 60 MW to the Maximum Facility Output (combined is 1260.9 MW) and 120 MW of CIRs (1235.9 MW total) to the proposed combined cycle to be located in Will County, IL, consisting of two 1x1 CCGT (single shaft).

The IC has proposed a service date for this project of March 1, 2022.

Impacts on the MISO member transmission systems are not included in this analysis, but will be included in the System Impact Study Phase. Winter peak analysis will be performed in the System Impact Study phase.

This Generation Interconnection Feasibility Study provides analysis results to aid the IC in assessing the practicality and cost of incorporating the facility into the PJM system. This study was limited to load flow analyses of probable contingencies. If the IC elects to pursue a System Impact Study, a more comprehensive analysis will be performed.

Point of Interconnection

AD2-194 proposes an uprate of 60 MW to an earlier queue position AC1-204, interconnected to 345kV bus at TSS 900 Elwood. The combined output of both AC1-204 and AD2-194 would become 1260.9 MW.

Attachment Facilities

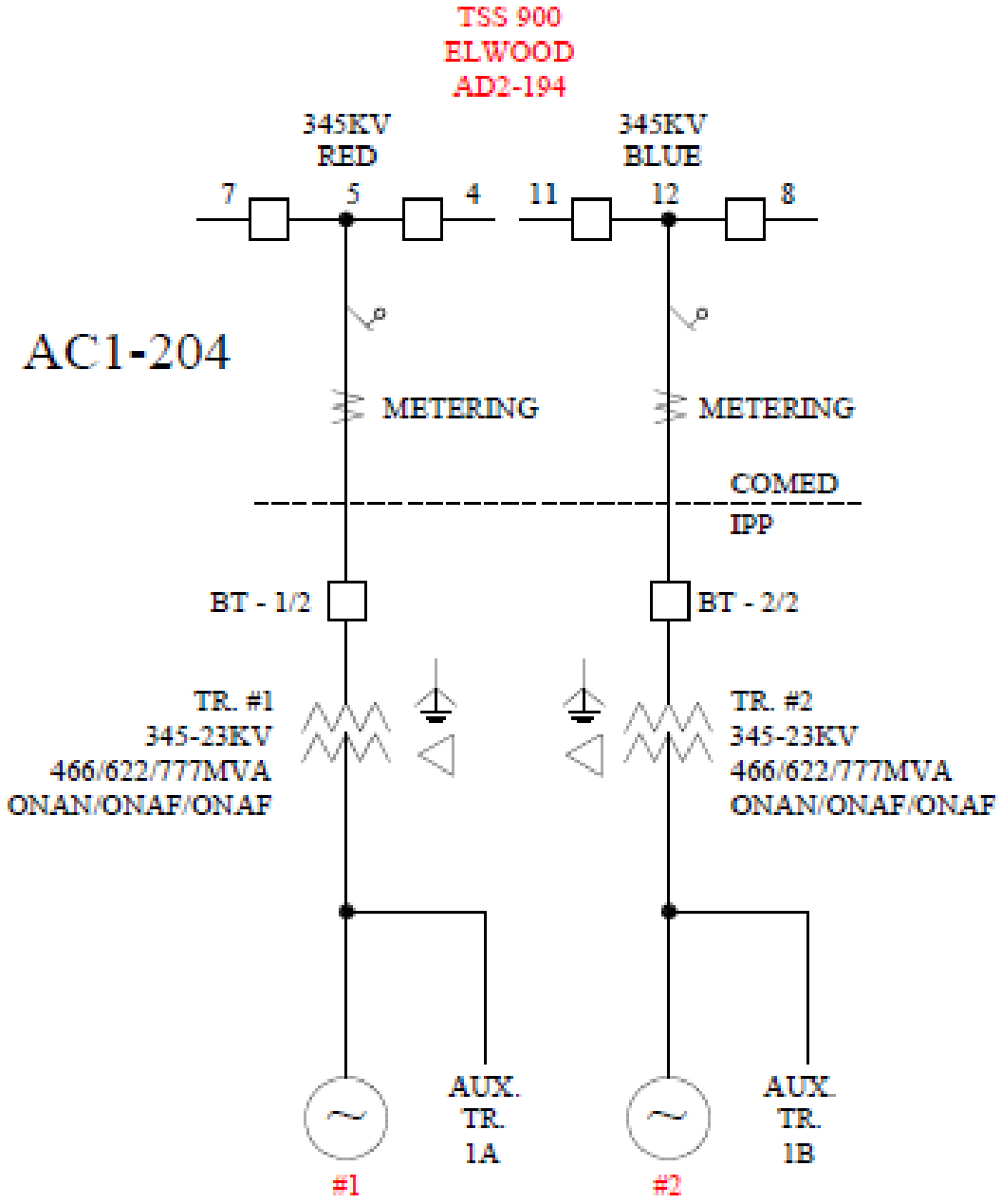
None

Direct Connection Network Upgrades

In order to accommodate interconnection of AD2-194, there will be no electrical changes to the generators, transformers, etc., as shown in the one-line diagram below. Therefore, no Direct Connection Network Upgrade cost is anticipated.

Non-Direct Connection Cost Estimate

None



Network Impacts

The Queue Project AD2-194 was evaluated as a 120.0 MW (Capacity 120.0 MW) uprate to AC1-204 which is an injection split evenly between Elwood; B & Elwood; R 345kV substations in the ComEd area. Project AD2-194 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-194 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2021

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 112.51% to 112.57% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 11.85 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

2. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 111.68% to 111.74% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 11.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_023-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1          / COLLI; 765 PLANO; 765
```

```
END
```

3. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 111.65% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 11.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

4. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 111.64% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 11.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

5. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 168.87% to 168.98% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 18.09 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

6. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 124.77% to 125.37% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 18.62 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

7. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 134.22% to 134.33% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of

'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 15.13 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

8. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 129.58% to 130.97% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 22.64 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

9. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 110.8% to 111.57% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L1221__B-S_+_345-L1223_TR-S'. This project contributes approximately 12.64 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L1221__B-S_+_345-L1223_TR-S'
 TRIP BRANCH FROM BUS 270716 TO BUS 270928 CKT 1          / DRESD; B 345 WOLFS; B 345
 TRIP BRANCH FROM BUS 270717 TO BUS 270731 CKT 1          / DRESD; R 345 ELECT;4R 345
 TRIP BRANCH FROM BUS 275180 TO BUS 270717 CKT 1          / DRESD;3M 138 DRESD; R 345
 TRIP BRANCH FROM BUS 275180 TO BUS 271336 CKT 1          / DRESD;3M 138 DRESD; B 138
 TRIP BRANCH FROM BUS 275180 TO BUS 275280 CKT 1          / DRESD;3M 138 DRESD;3C 34.5
 END
```

10. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 104.02% to 105.02% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1221__B-S'. This project contributes approximately 12.0 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L1221__B-S'
 TRIP BRANCH FROM BUS 270716 TO BUS 270928 CKT 1          / DRESD; B 345 WOLFS; B 345
 END
```

11. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 103.7% to 104.71% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 12.01 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L14321TB-N'
 TRIP BRANCH FROM BUS 270928 TO BUS 270730 CKT 1          / WOLFS; B 345 ELECT; B 345
```

```
 TRIP BRANCH FROM BUS 270928 TO BUS 272794 TO BUS 275334 CKT 1    / WOLFS; B 345 WOLFS; B 138 WOLFS;1C 34.5
 END
```

12. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.74% to 111.8% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 16.91 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

13. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.2% to 111.26% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 16.99 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_023-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1          / COLLI; 765 PLANO; 765
 END
```

14. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.18% to 111.23% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 17.01 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

15. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.16% to 111.22% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 17.01 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

16. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 134.85% to 137.49% (**DC power flow**) of its emergency rating (1479 MVA)

for the single line contingency outage of 'COMED_P1-2_345-L11622_R-S'. This project contributes approximately 39.05 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1              / ELWOO; R 345 GOODI;1R 345
 END
```

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

17. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 124.7% to 126.63% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11614_'. This project contributes approximately 39.07 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L11614_'
 TRIP BRANCH FROM BUS 270667 TO BUS 270665 CKT 1              / B ISL;RT 345 B ISL; R 345
 TRIP BRANCH FROM BUS 270667 TO BUS 270927 CKT 1              / B ISL;RT 345 WILTO; R 345
 TRIP BRANCH FROM BUS 270769 TO BUS 270667 CKT 1              / GOODI;2R 345 B ISL;RT 345
 DISCONNECT BUS 270769                          / GOODI;2R 345
 END
```

18. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 123.85% to 125.78% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L0303__'. This project contributes approximately 39.08 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L0303__'
 TRIP BRANCH FROM BUS 270855 TO BUS 936290 CKT 1              / POWERTON ; R 345 AD2-038 TAP 345
 DISCONNECT BUS 270769                          / GOODI;2R 345
 END
```

19. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 123.85% to 125.77% (**DC power flow**) of its load dump rating (1479 MVA) for the bus fault outage of 'COMED_P2-2_116_GG-345R__2'. This project contributes approximately 39.08 MW to the thermal violation.

```
CONTINGENCY 'COMED_P2-2_116_GG-345R__2'
 DISCONNECT BUS 270769                          / GOODI;2R 345
 END
```

20. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 122.96% to 125.04% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 30.78 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L10805_B-S'
 TRIP BRANCH FROM BUS 270810 TO BUS 274702 CKT 1              / LOCKP; B 345 KENDA;BU 345
 END
```

21. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 121.23% to 123.63% (**DC power flow**) of its normal rating (1201 MVA) for

non-contingency condition. This project contributes approximately 28.84 MW to the thermal violation.

22. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 134.57% to 137.22% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11620_B-S'. This project contributes approximately 39.24 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11620_B-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1             / ELWOO; B 345 GOODI;3B 345
 END
```

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

23. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 125.5% to 127.47% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11613_'. This project contributes approximately 40.06 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L11613_'
 TRIP BRANCH FROM BUS 270666 TO BUS 270664 CKT 1             / B ISL;BT 345 B ISL; B 345
 TRIP BRANCH FROM BUS 270666 TO BUS 270926 CKT 1             / B ISL;BT 345 WILTO; B 345
 TRIP BRANCH FROM BUS 270770 TO BUS 270666 CKT 1             / GOODI;4B 345 B ISL;BT 345
 DISCONNECT BUS 270770                          / GOODI;4B 345
 END
```

24. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 124.71% to 126.69% (**DC power flow**) of its load dump rating (1479 MVA) for the bus fault outage of 'COMED_P2-2_116_GG-345B__4'. This project contributes approximately 40.07 MW to the thermal violation.

```
CONTINGENCY 'COMED_P2-2_116_GG-345B__4'
 DISCONNECT BUS 270770                          / GOODI;4B 345
 END
```

25. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 124.71% to 126.69% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11617_'. This project contributes approximately 40.07 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_116-45-L11617_'
 TRIP BRANCH FROM BUS 270770 TO BUS 270810 CKT 1             / GOODI;4B 345 LOCKP; B 345
 DISCONNECT BUS 270770                          / GOODI;4B 345
 END
```

26. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 118.18% to 120.62% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 29.25 MW to the thermal violation.

27. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 112.09% to 114.15% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 30.57 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L10805_B-S'
 TRIP BRANCH FROM BUS 270810 TO BUS 274702 CKT 1          / LOCKP; B 345 KENDA;BU 345
 END
```

28. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 112.51% to 112.57% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 11.85 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

29. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 111.67% to 111.73% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 11.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_023-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1          / COLLI; 765 PLANO; 765
 END
```

30. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 111.65% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 11.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

31. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 111.64% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 11.94 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
```

```
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

32. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 155.56% to 155.79% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 19.14 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT5-6__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

33. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 155.32% to 155.52% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 19.55 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

34. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 117.04% to 117.62% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 22.25 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

35. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 129.53% to 129.59% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 16.72 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 12 for a table containing the generators having contribution to this flowgate.

36. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 128.99% to 129.05% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 16.8 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_023-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1          / COLLI; 765 PLANO; 765
 END
```

37. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 128.96% to 129.02% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 16.82 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

38. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 128.95% to 129.01% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 16.82 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

39. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 103.18% to 104.09% (**DC power flow**) of its emergency rating (1399 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 16.81 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

40. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 137.46% to 137.75% (**DC power flow**) of its emergency rating (971 MVA) for the

line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 12.82 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Please refer to Appendix 13 for a table containing the generators having contribution to this flowgate.

41. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.28% to 136.57% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 12.93 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_023-65-BT4-5__'
 TRIP BRANCH FROM BUS 275168 TO BUS 270607 CKT 1          / COLLI;2M 345 COLLI; 765
 TRIP BRANCH FROM BUS 275168 TO BUS 270697 CKT 1          / COLLI;2M 345 COLLI; R 345
 TRIP BRANCH FROM BUS 275168 TO BUS 275268 CKT 1          / COLLI;2M 345 COLLI;2C 33
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 END
```

42. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.28% to 136.57% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 12.93 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT4-5__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

43. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.28% to 136.56% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 12.93 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT3-4__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

44. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.26% to 136.55% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 12.92 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_023-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 243206 CKT 1          / WILTO; 765 05DUMONT 765
 TRIP BRANCH FROM BUS 270607 TO BUS 270630 CKT 1          / COLLI; 765 PLANO; 765
```

```
END
```

45. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 113.07% to 113.69% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 12.92 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_695_B2'
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1              / 243206 05DUMONT 765 270644 WILTO; 765 1
 END
```

46. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 155.56% to 155.79% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 19.14 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT5-6__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

Please refer to Appendix 14 for a table containing the generators having contribution to this flowgate.

47. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 155.31% to 155.51% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 19.55 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

Please refer to Appendix 15 for a table containing the generators having contribution to this flowgate.

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

To be determined

Short Circuit

(Summary of impacted circuit breakers)

No issues identified

Affected System Analysis & Mitigation

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Delivery of Energy Portion of Interconnection Request
PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.
Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

Not Applicable

Light Load Analysis - 2021

Light Load Studies to be conducted during the System Impact Study phase (as required by PJM Manual 14B).

Short Circuit
(Summary form of Cost allocation for breakers will be inserted here if any)

None

Stability and Reactive Power Requirement
(Results of the dynamic studies should be inserted here)

To be determined

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements
(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

1. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 112.51% to 112.57% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 11.85 MW to the thermal violation.

COMED:
SSTE rating is 1134 MVA. The post contingency load exceeds the SSTE rating therefore an upgrade is required. The upgrade will be to mitigate the sag on the line. A preliminary estimate for the upgrade is $2.8 million with a construction estimated timeline of 30 months. Upon completion of this work the new line ratings will be 1091/1399/1483/1674 MVA (SN/SLTE/SSTE/SLD).

MISO:
The external (i.e. Non-PJM) Transmission Owner, MISO, will not evaluate this violation until the impact study phase.

2. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 111.68% to 111.74% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 11.94 MW to the thermal violation.

Same as Contribution to Previously Identified #1

3. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 111.65% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 11.94 MW to the thermal violation.

Same as Contribution to Previously Identified #1

4. (MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 111.64% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 11.94 MW to the thermal violation.

Same as Contribution to Previously Identified #1

5. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 168.87% to 168.98% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 18.09 MW to the thermal violation.

AEP / MISO:

1) **(N4058) Sag study results: Stillwell - Dumont 345 kV line work will include the replacement of tower 20 with a custom steel pole, replacement of tower 24 with a custom H-frame and the removal of swing angle brackets on 2 structures. Cost estimate is $1.613 million. New SE rating will be 1718 MVA limited by a Dumont wavetrap and possibly the conductor. This upgrade is driven by a prior queue. Per PJM cost allocation rules, AC1-002 LTF presently does not receive cost allocation for this upgrade. Note: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, AC1-002 LTF could receive cost allocation.**

2) **Additional AEP-end upgrade: Rebuild 8.6 miles of the AEP owned line and upgrade necessary Dumont terminal equipment (wavetrap) at a cost of $20 million. PJM Network Upgrade N4790. New AEP-end ratings to be 1409/2045 MVA (SN/SE). Limited by Dumont risers.**

3) **Additional AEP-end upgrade: In addition to upgrading the Dumont risers, a different conductor (compared to the prior upgrade) will need to be selected to achieve the desired rating. The new conductor would be 1272 dual ACSR conductor. The additional cost for this work scope is $2 million. The new AEP-end ratings to be 1690/2278 MVA SN/SE (limited by the conductor). PJM Network Upgrade N5064.**

4) **Additional AEP-end upgrade: AEP said it would cost $4.8 million to string a second Stillwell- Dumont 345 kV line on the existing tower. The $4.8 million is for 8.5 miles of the AEP portion. Would need a NIPSCO portion (2.87 miles) cost estimate.**

5) **MISO end – ratings are 1409/1779 MVA. MISO end upgrade: Rebuild NIPSCO portion of line (2.87 miles) at a cost of $6.5 million and upgrade Stillwell substation equipment at a cost of $1.5 million. Total cost is $8.0 million. New expected MISO end ratings will be 1582/1898 MVA SN/SE.**

6) **Additional MISO-end upgrade: Reconductor 2.87 miles of transmission conductor to bundled 954 ACSS, replace substation conductor to bundled 2500 AL, and replace wavetrap. $12 million. New MISO-end ratings to be 2550/2923 MVA SN/SE.**

6. (MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 124.77% to 125.37% (**DC power flow**) of its normal rating (1409 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 18.62 MW to the thermal violation.

Same as Contribution to Previously Identified #5

7. (CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 134.22% to 134.33% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 15.13 MW to the thermal violation.

COMED:
ComEd L17703 SSTE rating is 1251 MVA. The post contingency flow exceeds the rating therefore an upgrade is required. Upgrades include line reconductoring and station conductor work at Burnham. A preliminary estimate for the upgrades is $8.1 million with a preliminary construction timeline of 30 months. Upon completion the new ratings will be 1248/1441/1667/1982 MVA (SN/SLTE/SSTE/SLD)

MISO:
The external (i.e. Non-PJM) Transmission Owner, MISO, will not evaluate this violation until the impact study phase.

8. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 129.58% to 130.97% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 22.64 MW to the thermal violation.

COMED:
ComEd 345kV L93505 SLD rating is 1284 MVA with an ALDR rating of 1477 MVA. The post contingency flow for this event exceeds the ALDR rating therefore an upgrade is required. Sag mitigation of the line will increase the SLD rating to 1768 MVA. The ALDR rating will increase to 2033 MVA. A preliminary estimate for this upgrade is $2.5 million with an estimated construction timeline of 24-30 months.

9. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 110.8% to 111.57% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L1221__B-S_+_345-L1223_TR-S'. This project contributes approximately 12.64 MW to the thermal violation.

Same as Contribution to Previously Identified #8

10. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 104.02% to 105.02% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L1221__B-S'. This project contributes approximately 12.0 MW to the thermal violation.

Same as Contribution to Previously Identified #8

11. (CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 103.7% to 104.71% (**DC power flow**) of its emergency rating (1195 MVA) for the single line contingency outage of 'COMED_P1-2_345-L14321TB-N'. This project contributes approximately 12.01 MW to the thermal violation.

Same as Contribution to Previously Identified #8

12. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.74% to 111.8% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 16.91 MW to the thermal violation.

COMED:
ComEd 345kV L6607 SSTE rating is 1483 MVA. The post contingency flow for this event exceeds the rating therefore an upgrade is required. The upgrade will be to reconductor the line. A preliminary estimate for this upgrade is $11.2 million with a preliminary construction timeline of 30-36 months. Upon completion of this upgrade the new ratings will be 1334/1726/1837/2084 MVA (SN/SLTE/SSTE/SLD)

13. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.2% to 111.26% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 16.99 MW to the thermal violation.

Same as Contribution to Previously Identified #12

14. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.18% to 111.23% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 17.01 MW to the thermal violation.

Same as Contribution to Previously Identified #12

15. (CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.16% to 111.22% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 17.01 MW to the thermal violation.

Same as Contribution to Previously Identified #12

16. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 134.85% to 137.49% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11622_R-S'. This project contributes approximately 39.05 MW to the thermal violation.

COMED:
ComEd 345kV L11620 SSTE rating is 1568 MVA. Upgrade is required. The upgrade will be to re-conductor the line, station conductor upgrades at bot terminals and 345kV line circuit breaker upgrade at Goodings Grove. A preliminary estimate for the upgrade is $19.3 million with a preliminary construction timeline of 30-36 months. Upon completion the new SSTE rating will be 2083 MVA.

17. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 124.7% to 126.63% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11614_'. This project contributes approximately 39.07 MW to the thermal violation.

Same as Contribution to Previously Identified #16

18. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 123.85% to 125.78% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L0303__'. This project contributes approximately 39.08 MW to the thermal violation.

Same as Contribution to Previously Identified #16

19. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 123.85% to 125.77% (**DC power flow**) of its load dump rating (1479 MVA) for the bus fault outage of 'COMED_P2-2_116_GG-345R__2'. This project contributes approximately 39.08 MW to the thermal violation.

Same as Contribution to Previously Identified #16

20. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 122.96% to 125.04% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 30.78 MW to the thermal violation.

Same as Contribution to Previously Identified #16

21. (CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 121.23% to 123.63% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 28.84 MW to the thermal violation.

Same as Contribution to Previously Identified #16

22. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 134.57% to 137.22% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11620_B-S'. This project contributes approximately 39.24 MW to the thermal violation.

COMED:
ComEd 345kV L11622 SSTE rating is 1568 MVA. The post contingency flow for this event exceeds the SSTE rating therefore an upgrade is required. Reconductoring of the line, station conductor upgrades and a upgrade of a 345kV Circuit Breaker will increase the SSTE rating to 2083 MVA. A preliminary estimate for this upgrade is $14.5 million with an estimated construction timeline of 30-36 months.

23. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 125.5% to 127.47% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11613_'. This project contributes approximately 40.06 MW to the thermal violation.

Same as Contribution to Previously Identified #22

24. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 124.71% to 126.69% (**DC power flow**) of its load dump rating (1479 MVA) for the bus fault outage of 'COMED_P2-2_116_GG-345B__4'. This project contributes approximately 40.07 MW to the thermal violation.

Same as Contribution to Previously Identified #22

25. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 124.71% to 126.69% (**DC power flow**) of its load dump rating (1479 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_116-45-L11617_'. This project contributes approximately 40.07 MW to the thermal violation.

Same as Contribution to Previously Identified #22

26. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 118.18% to 120.62% (**DC power flow**) of its normal rating (1201 MVA) for non-contingency condition. This project contributes approximately 29.25 MW to the thermal violation.

Same as Contribution to Previously Identified #22

27. (CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 112.09% to 114.15% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L10805_B-S'. This project contributes approximately 30.57 MW to the thermal violation.

Same as Contribution to Previously Identified #22

28. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 112.51% to 112.57% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of

'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 11.85 MW to the thermal violation.

Same as Contribution to Previously Identified #1

29. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 111.67% to 111.73% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 11.94 MW to the thermal violation.

Same as Contribution to Previously Identified #1

30. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 111.65% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 11.94 MW to the thermal violation.

Same as Contribution to Previously Identified #1

31. (CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 111.64% to 111.71% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 11.94 MW to the thermal violation.

Same as Contribution to Previously Identified #1

32. (CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 155.56% to 155.79% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 19.14 MW to the thermal violation.

COMED:
ComEd post contingency facility overloaded by this event is Tr. 93 @ Station 112 Wilton Center. The upgrade will be to build out the 765kV ring bus at Wilton Center, installation of two 765 kV Bus Tie Circuit Breakers (BT 6-8 & 8-2) along with a relocation of 765kV L11216 from bus 6 to bus 8. Preliminary estimate for upgrade is $12 million with an estimated construction time line of 30 months. Note, the rating for Tr. 93 at Wilton Center will remain current however with this upgrade the 112-65-BT5-6 contingency file will no longer include the Wilton Center Tr. 94 and will allow both transformers to remain in service eliminating the overload.

33. (CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 155.32% to 155.52% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 19.55 MW to the thermal violation.

Same as Contribution to Previously Identified #32

34. (CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 117.04% to 117.62% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 22.25 MW to the thermal violation.

COMED:
ComEd 345kV L10805 SLD rating is 1768 MVA with an ALDR rating of 2033 MVA. The post contingency flow for this event exceeds the ALDR rating therefore an upgrade is required. Reconductoring of the line along with station conductor upgrades will increase the SLD & rating to 2084 MVA & 2397 MVA respectively. A preliminary estimate for this upgrade is $15.2 million with an estimated construction timeline of 24-30 months.

35. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 129.53% to 129.59% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 16.72 MW to the thermal violation.

Same as Contribution to Previously Identified #12

36. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 128.99% to 129.05% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 16.8 MW to the thermal violation.

Same as Contribution to Previously Identified #12

37. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 128.96% to 129.02% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 16.82 MW to the thermal violation.

Same as Contribution to Previously Identified #12

38. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 128.95% to 129.01% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 16.82 MW to the thermal violation.

Same as Contribution to Previously Identified #12

39. (CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 103.18% to 104.09% (**DC power flow**) of its emergency rating (1399 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 16.81 MW to the thermal violation.

Same as Contribution to Previously Identified #12

40. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 137.46% to 137.75% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 12.82 MW to the thermal violation.

AEP:
A sag study will be required on the 40.64 mile section line to mitigate the overload. Depending on the sag study results, cost for the upgrade is expected to be between $1,62,560 (no remediations required just sag study) and $81.28 million (complete line reconductor/rebuild required).

(A) Sag study: 6 to 12 months.
(B) Rebuild. The standard time required for construction differs from state to state. An Approximate construction would be 36 to 48 months after signing an interconnection agreement.

COMED:
ComEd 345kV L97008 SSTE rating is 1134 MVA. The post contingency flow exceeds the rating therefore an upgrade is required. The upgrade will be to mitigate the sag on the line. A preliminary estimate for this upgrade is $ 22.6 million with a construction timeline of 30 months. Upon completion of the upgrade the ratings will be 1334/1334/1391/1523 MVA (SN/SLTE/SSTE/SLD).

41. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.28% to 136.57% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT4-5__'. This project contributes approximately 12.93 MW to the thermal violation.

Same as Contribution to Previously Identified #40

42. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.28% to 136.57% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT4-5__'. This project contributes approximately 12.93 MW to the thermal violation.

Same as Contribution to Previously Identified #40

43. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.28% to 136.56% (**DC power flow**) of its emergency rating (971 MVA) for the

line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT3-4__'. This project contributes approximately 12.93 MW to the thermal violation.

Same as Contribution to Previously Identified #40

44. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 136.26% to 136.55% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_023-65-BT2-3__'. This project contributes approximately 12.92 MW to the thermal violation.

Same as Contribution to Previously Identified #40

45. (CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 113.07% to 113.69% (**DC power flow**) of its normal rating (971 MVA) for the single line contingency outage of 'COMED_P1-2_695_B2'. This project contributes approximately 12.92 MW to the thermal violation.

Same as Contribution to Previously Identified #40

46. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 155.56% to 155.79% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 19.14 MW to the thermal violation.

Same as Contribution to Previously Identified #32

47. (CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 155.31% to 155.51% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 19.55 MW to the thermal violation.

Same as Contribution to Previously Identified #32

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the Appendices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the Appendices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators.

It should be noted the project/generator MW contributions presented in the body of the report and appendices sections are full contributions, whereas the loading percentages reported in the body of the report, take into consideration the commercial probability of each project as well as the ramping impact of "Adder" contributions.

Appendix 1

(MISO NIPS - CE) The 17STJOHN-ST JOHN ; T 345 kV line (from bus 255112 to bus 270886 ckt 1) loads from 112.51% to 112.57% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 11.85 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.63*
932012	*AC2-007 E*	*1.16*
932881	*AC2-115 1*	*1.77*
932891	*AC2-115 2*	*1.77*
932921	*AC2-116*	*0.62*
933341	*AC2-147 C*	*0.65*
933342	*AC2-147 E*	*1.06*
933361	*AC2-149 C*	*0.69*
933362	*AC2-149 E*	*1.13*
933381	*AC2-151 C*	*0.72*
933382	*AC2-151 E*	*1.18*
933411	*AC2-154 C*	*1.73*
933412	*AC2-154 E*	*2.83*
933431	*AC2-156 C*	*0.71*
933432	*AC2-156 E*	*1.16*
933511	*AC2-166 C*	*1.73*
933512	*AC2-166 E*	*1.91*
933911	*AD1-013 C O1*	*1.36*
933912	*AD1-013 E O1*	*2.18*
933931	*AD1-016 C*	*0.69*
933932	*AD1-016 E*	*1.13*
934101	*AD1-039 1*	*5.71*
934111	*AD1-039 2*	*6.12*
934401	*AD1-064 C O1*	*2.39*
934402	*AD1-064 E O1*	*11.18*
934431	*AD1-067 C*	*0.1*
934432	*AD1-067 E*	*0.41*
LTF	*AD1-092*	*8.26*
LTF	*AD1-093*	*14.32*
LTF	*AD1-094*	*2.75*
934651	*AD1-096 C*	*0.66*
934652	*AD1-096 E*	*1.08*
934701	*AD1-098 C O1*	*5.1*

934702	*AD1-098 E O1*	*3.72*
934721	*AD1-100 C*	*16.29*
934722	*AD1-100 E*	*76.28*
934871	*AD1-116 C*	*0.67*
934872	*AD1-116 E*	*1.1*
934881	*AD1-117 C*	*3.98*
934882	*AD1-117 E*	*2.66*
934941	*AD1-126 C*	*4.34*
934942	*AD1-126 E*	*2.89*
934971	*AD1-129 C*	*0.67*
934972	*AD1-129 E*	*0.45*
935001	*AD1-133 C O1*	*15.12*
935002	*AD1-133 E O1*	*10.08*
936181	*AD2-024 C O1*	*0.69*
936182	*AD2-024 E O1*	*1.13*
936291	*AD2-038 C O1*	*1.71*
936292	*AD2-038 E O1*	*11.42*
936371	*AD2-047 C O1*	*1.55*
936372	*AD2-047 E O1*	*16.69*
936461	*AD2-060*	*1.82*
936511	*AD2-066 C O1*	*6.19*
936512	*AD2-066 E O1*	*4.13*
936781	*AD2-101 C*	*3.07*
936782	*AD2-101 E*	*14.37*
936791	*AD2-102 C*	*8.95*
936792	*AD2-102 E*	*8.6*
936961	*AD2-130 C*	*1.18*
936962	*AD2-130 E*	*0.16*
937001	*AD2-134 C*	*2.03*
937002	*AD2-134 E*	*8.37*
937031	*AD2-137 C O1*	*2.42*
937032	*AD2-137 E O1*	*11.33*
937051	*AD2-140 C O1*	*2.43*
937052	*AD2-140 E O1*	*11.36*
937061	*AD2-141 C O1*	*2.41*
937062	*AD2-141 E O1*	*11.37*
937071	*AD2-142 C O1*	*4.85*
937072	*AD2-142 E O1*	*22.72*
937121	*AD2-148 C O1*	*2.41*
937122	*AD2-148 E O1*	*11.28*
937131	*AD2-149 C O1*	*2.41*
937132	*AD2-149 E O1*	*11.28*
937141	*AD2-150 C O1*	*2.41*
937142	*AD2-150 E O1*	*11.28*
937181	*AD2-155 C O1*	*2.41*

937182	*AD2-155 E O1*	*11.28*
937311	*AD2-172 C*	*1.83*
937312	*AD2-172 E*	*2.53*
937321	*AD2-175 C*	*11.23*
937322	*AD2-175 E*	*7.49*
937331	*AD2-176 C O1*	*5.46*
937332	*AD2-176 E O1*	*3.64*
937401	*AD2-194 C1*	*5.93*
937411	*AD2-194 C2*	*5.92*
LTF	*BLUEG*	*1.44*
274654	*BRAIDWOOD;1U*	*21.6*
274655	*BRAIDWOOD;2U*	*21.03*
LTF	*CALDERWOOD*	*0.04*
LTF	*CANNELTON*	*0.08*
LTF	*CARR*	*0.57*
LTF	*CATAWBA*	*0.2*
LTF	*CBM-S1*	*1.06*
LTF	*CBM-W1*	*39.58*
LTF	*CBM-W2*	*28.59*
LTF	*CELEVELAND*	*0.56*
LTF	*CHEOAH*	*0.04*
LTF	*CHILHOWEE*	*0.01*
LTF	*CLIFTY*	*8.62*
274751	*CRETE EC ;1U*	*3.84*
274752	*CRETE EC ;2U*	*3.84*
274753	*CRETE EC ;3U*	*3.84*
274754	*CRETE EC ;4U*	*3.84*
LTF	*DEARBORN*	*2.32*
274859	*EASYR;U1 E*	*8.15*
274860	*EASYR;U2 E*	*8.15*
LTF	*ELMERSMITH*	*0.17*
LTF	*G-007*	*1.52*
LTF	*GIBSON*	*0.09*
290051	*GSG-6; E*	*7.75*
LTF	*HAMLET*	*0.77*
275149	*KEMPTON ;1E*	*12.77*
274704	*KENDALL ;1C*	*3.21*
274705	*KENDALL ;1S*	*2.14*
274706	*KENDALL ;2C*	*3.21*
274707	*KENDALL ;2S*	*2.14*
274660	*LASCO STA;1U*	*20.12*
274661	*LASCO STA;2U*	*20.16*
290108	*LEEDK;1U E*	*18.02*
LTF	*MEC*	*27.78*
274850	*MENDOTA H;RU*	*4.*

293061	*N-015 E*	*11.65*
293715	*O-029 E*	*1.28*
293716	*O-029 E*	*0.7*
293717	*O-029 E*	*0.64*
LTF	*O-066*	*9.77*
293644	*O22 E1*	*8.55*
293645	*O22 E2*	*16.6*
290021	*O50 E*	*14.66*
294392	*P-010 E*	*14.8*
294763	*P-046 E*	*6.97*
274888	*PILOT HIL;1E*	*12.77*
274830	*PWR VTREC;1U*	*4.54*
274831	*PWR VTREC;2U*	*4.54*
LTF	*RENSSELAER*	*0.45*
LTF	*ROSETON*	*3.27*
LTF	*ROWAN*	*0.47*
LTF	*SANTEETLA*	*0.01*
295111	*SUBLETTE E*	*2.02*
274861	*TOP CROP ;1U*	*0.37*
274862	*TOP CROP ;2U*	*0.73*
LTF	*TRIMBLE*	*0.29*
299993	*U3-031C*	*3.67*
903433	*W3-046*	*17.95*
905471	*W4-084*	*0.33*
274874	*WALNR;2U*	*1.77*
294502	*WALNR;2U E*	*7.08*
LTF	*WEC*	*5.97*
295109	*WESTBROOK E*	*4.15*
274687	*WILL CNTY;4U*	*52.45*
914641	*Y2-103*	*33.74*
915011	*Y3-013 1*	*2.81*
915021	*Y3-013 2*	*2.81*
915031	*Y3-013 3*	*2.81*
LTF	*Z1-043*	*21.06*
916502	*Z1-106 E1*	*0.94*
916504	*Z1-106 E2*	*0.94*
916512	*Z1-107 E*	*1.84*
916522	*Z1-108 E*	*1.86*
918051	*AA1-018 C*	*1.73*
918052	*AA1-018 E*	*11.56*
918972	*AA1-116 E*	*1.82*
918982	*AA1-117 E*	*1.82*
919221	*AA1-146*	*13.02*
919581	*AA2-030*	*13.02*
919591	*AA2-035*	*94.84*

920112	*AA2-107 E*	*1.82*
920272	*AA2-123 E*	*1.82*
930481	*AB1-089*	*48.94*
930491	*AB1-090*	*48.94*
930501	*AB1-091*	*50.64*
930761	*AB1-122 1*	*52.53*
930771	*AB1-122 2*	*56.31*
931221	*AB1-172*	*0.57*
LTF	*AB2-013*	*11.93*
924471	*AB2-096*	*31.56*
925161	*AB2-173*	*2.32*
925301	*AB2-191 C*	*0.94*
925302	*AB2-191 E*	*0.83*
926311	*AC1-109 1*	*1.42*
926321	*AC1-109 2*	*1.42*
926331	*AC1-110 1*	*1.42*
926341	*AC1-110 2*	*1.42*
926351	*AC1-111 1*	*0.57*
926361	*AC1-111 2*	*0.57*
926371	*AC1-111 3*	*0.57*
926381	*AC1-111 4*	*0.57*
926391	*AC1-111 5*	*0.57*
926401	*AC1-111 6*	*0.57*
927511	*AC1-113 1*	*0.89*
927522	*AC1-113 2*	*0.89*
926431	*AC1-114*	*1.77*
927451	*AC1-142A 1*	*3.19*
927461	*AC1-142A 2*	*3.2*
926701	*AC1-153 C1*	*57.1*
926711	*AC1-153 C2*	*61.21*
926702	*AC1-153 E1*	*2.28*
926712	*AC1-153 E2*	*2.45*
926821	*AC1-168 C*	*0.86*
926822	*AC1-168 E*	*5.74*
927531	*AC1-185 1*	*0.51*
927541	*AC1-185 2*	*0.51*
927551	*AC1-185 3*	*0.51*
927561	*AC1-185 4*	*0.51*
927571	*AC1-185 5*	*0.51*
927581	*AC1-185 6*	*0.51*
927591	*AC1-185 7*	*0.51*
927601	*AC1-185 8*	*0.51*
927091	*AC1-204 1*	*55.14*
927101	*AC1-204 2*	*55.06*

Appendix 2

(MISO NIPS - AEP) The 17STILLWELL-05DUMONT 345 kV line (from bus 255113 to bus 243219 ckt 1) loads from 168.87% to 168.98% (**DC power flow**) of its emergency rating (1409 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 18.09 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.98*
932012	*AC2-007 E*	*1.82*
932881	*AC2-115 1*	*2.77*
932891	*AC2-115 2*	*2.77*
932921	*AC2-116*	*0.97*
932931	*AC2-117*	*3.84*
933341	*AC2-147 C*	*1.02*
933342	*AC2-147 E*	*1.66*
933361	*AC2-149 C*	*1.08*
933362	*AC2-149 E*	*1.76*
933381	*AC2-151 C*	*1.12*
933382	*AC2-151 E*	*1.83*
933411	*AC2-154 C*	*3.04*
933412	*AC2-154 E*	*4.96*
933431	*AC2-156 C*	*1.11*
933432	*AC2-156 E*	*1.81*
933511	*AC2-166 C*	*2.71*
933512	*AC2-166 E*	*2.99*
933911	*AD1-013 C O1*	*2.14*
933912	*AD1-013 E O1*	*3.42*
933931	*AD1-016 C*	*1.08*
933932	*AD1-016 E*	*1.76*
934101	*AD1-039 1*	*8.99*
934111	*AD1-039 2*	*9.33*
934401	*AD1-064 C O1*	*3.73*
934402	*AD1-064 E O1*	*17.44*
934431	*AD1-067 C*	*0.15*
934432	*AD1-067 E*	*0.64*
LTF	*AD1-092*	*13.08*
LTF	*AD1-093*	*22.62*
LTF	*AD1-094*	*4.36*
934651	*AD1-096 C*	*1.04*

934652	*AD1-096 E*	*1.69*
934701	*AD1-098 C O1*	*7.99*
934702	*AD1-098 E O1*	*5.84*
934721	*AD1-100 C*	*26.62*
934722	*AD1-100 E*	*124.62*
934871	*AD1-116 C*	*1.1*
934872	*AD1-116 E*	*1.8*
934881	*AD1-117 C*	*6.25*
934882	*AD1-117 E*	*4.17*
934941	*AD1-126 C*	*6.79*
934942	*AD1-126 E*	*4.53*
934971	*AD1-129 C*	*1.05*
934972	*AD1-129 E*	*0.7*
935001	*AD1-133 C O1*	*24.36*
935002	*AD1-133 E O1*	*16.24*
936181	*AD2-024 C O1*	*1.08*
936182	*AD2-024 E O1*	*1.76*
936291	*AD2-038 C O1*	*2.72*
936292	*AD2-038 E O1*	*18.22*
936371	*AD2-047 C O1*	*2.72*
936372	*AD2-047 E O1*	*29.31*
936461	*AD2-060*	*3.2*
936511	*AD2-066 C O1*	*9.78*
936512	*AD2-066 E O1*	*6.52*
936781	*AD2-101 C*	*5.89*
936782	*AD2-101 E*	*27.59*
936791	*AD2-102 C*	*14.*
936792	*AD2-102 E*	*13.45*
936961	*AD2-130 C*	*1.85*
936962	*AD2-130 E*	*0.25*
937001	*AD2-134 C*	*3.18*
937002	*AD2-134 E*	*13.12*
937031	*AD2-137 C O1*	*4.12*
937032	*AD2-137 E O1*	*19.29*
937051	*AD2-140 C O1*	*4.16*
937052	*AD2-140 E O1*	*19.46*
937061	*AD2-141 C O1*	*4.13*
937062	*AD2-141 E O1*	*19.49*
937071	*AD2-142 C O1*	*8.31*
937072	*AD2-142 E O1*	*38.93*
937121	*AD2-148 C O1*	*4.21*
937122	*AD2-148 E O1*	*19.7*
937131	*AD2-149 C O1*	*4.21*
937132	*AD2-149 E O1*	*19.7*
937141	*AD2-150 C O1*	*4.21*

937142	*AD2-150 E O1*	*19.7*
937181	*AD2-155 C O1*	*4.21*
937182	*AD2-155 E O1*	*19.7*
937311	*AD2-172 C*	*2.87*
937312	*AD2-172 E*	*3.96*
937321	*AD2-175 C*	*19.61*
937322	*AD2-175 E*	*13.07*
937331	*AD2-176 C O1*	*8.52*
937332	*AD2-176 E O1*	*5.68*
937401	*AD2-194 C1*	*9.05*
937411	*AD2-194 C2*	*9.05*
LTF	*BLUEG*	*0.22*
LTF	*CARR*	*0.92*
LTF	*CATAWBA*	*0.19*
274890	*CAYUG;1U E*	*16.*
274891	*CAYUG;2U E*	*16.*
LTF	*CBM-S1*	*4.01*
LTF	*CBM-W1*	*72.75*
LTF	*CBM-W2*	*62.04*
LTF	*CELEVELAND*	*0.5*
LTF	*CIN*	*2.99*
LTF	*CLIFTY*	*8.31*
LTF	*DEARBORN*	*3.87*
274859	*EASYR;U1 E*	*12.8*
274860	*EASYR;U2 E*	*12.8*
LTF	*G-007*	*2.41*
290051	*GSG-6; E*	*12.15*
LTF	*HAMLET*	*0.84*
LTF	*IPL*	*1.27*
940531	*J351*	*434.36*
951131	*J643*	*25.84*
981291	*J740 C*	*5.51*
981292	*J740 E*	*22.06*
938961	*J847*	*13.15*
275149	*KEMPTON ;1E*	*22.42*
290108	*LEEDK;1U E*	*28.2*
LTF	*MEC*	*45.34*
274850	*MENDOTA H;RU*	*6.27*
293061	*N-015 E*	*17.73*
293516	*O-009 E1*	*10.61*
293517	*O-009 E2*	*5.39*
293518	*O-009 E3*	*5.94*
293715	*O-029 E*	*11.35*
293716	*O-029 E*	*6.22*
293717	*O-029 E*	*5.72*

LTF	*O-066*	*15.45*
293644	*O22 E1*	*12.09*
293645	*O22 E2*	*23.47*
290021	*O50 E*	*22.56*
294392	*P-010 E*	*22.52*
294763	*P-046 E*	*10.92*
274888	*PILOT HIL;1E*	*22.42*
274830	*PWR VTREC;1U*	*7.09*
274831	*PWR VTREC;2U*	*7.09*
LTF	*RENSSELAER*	*0.73*
LTF	*ROSETON*	*5.25*
LTF	*ROWAN*	*0.5*
274789	*SE CHICAG;6U*	*1.31*
274790	*SE CHICAG;7U*	*1.31*
274791	*SE CHICAG;8U*	*1.31*
295111	*SUBLETTE E*	*3.16*
LTF	*TRIMBLE*	*0.07*
299993	*U3-031C*	*6.3*
903433	*W3-046*	*27.87*
905471	*W4-084*	*0.52*
274874	*WALNR;2U*	*2.78*
294502	*WALNR;2U E*	*11.11*
LTF	*WEC*	*9.31*
295109	*WESTBROOK E*	*6.5*
274687	*WILL CNTY;4U*	*79.57*
910542	*X3-005 E*	*1.01*
914641	*Y2-103*	*52.37*
915011	*Y3-013 1*	*4.36*
915021	*Y3-013 2*	*4.36*
915031	*Y3-013 3*	*4.36*
LTF	*Z1-043*	*33.35*
916502	*Z1-106 E1*	*1.47*
916504	*Z1-106 E2*	*1.47*
916512	*Z1-107 E*	*3.05*
916522	*Z1-108 E*	*2.89*
918051	*AA1-018 C*	*2.83*
918052	*AA1-018 E*	*18.92*
918972	*AA1-116 E*	*3.2*
918982	*AA1-117 E*	*3.2*
919221	*AA1-146*	*20.49*
919581	*AA2-030*	*20.49*
919591	*AA2-035*	*151.1*
920112	*AA2-107 E*	*2.85*
920272	*AA2-123 E*	*2.84*
930481	*AB1-089*	*76.49*

930491	*AB1-090*	*76.49*
930501	*AB1-091*	*89.27*
930761	*AB1-122 1*	*82.68*
930771	*AB1-122 2*	*85.86*
931221	*AB1-172*	*0.95*
LTF	*AB2-013*	*18.85*
924471	*AB2-096*	*49.26*
925161	*AB2-173*	*3.65*
925301	*AB2-191 C*	*1.47*
925302	*AB2-191 E*	*1.3*
925881	*AC1-067*	*200.38*
926311	*AC1-109 1*	*2.21*
926321	*AC1-109 2*	*2.21*
926331	*AC1-110 1*	*2.21*
926341	*AC1-110 2*	*2.21*
926351	*AC1-111 1*	*0.89*
926361	*AC1-111 2*	*0.89*
926371	*AC1-111 3*	*0.89*
926381	*AC1-111 4*	*0.89*
926391	*AC1-111 5*	*0.89*
926401	*AC1-111 6*	*0.89*
927511	*AC1-113 1*	*1.38*
927522	*AC1-113 2*	*1.38*
926431	*AC1-114*	*2.77*
927451	*AC1-142A 1*	*4.89*
927461	*AC1-142A 2*	*4.89*
926701	*AC1-153 C1*	*89.87*
926711	*AC1-153 C2*	*93.33*
926702	*AC1-153 E1*	*3.59*
926712	*AC1-153 E2*	*3.73*
926821	*AC1-168 C*	*1.35*
926822	*AC1-168 E*	*9.04*
927531	*AC1-185 1*	*0.8*
927541	*AC1-185 2*	*0.8*
927551	*AC1-185 3*	*0.8*
927561	*AC1-185 4*	*0.8*
927571	*AC1-185 5*	*0.8*
927581	*AC1-185 6*	*0.8*
927591	*AC1-185 7*	*0.8*
927601	*AC1-185 8*	*0.8*
927091	*AC1-204 1*	*84.14*
927101	*AC1-204 2*	*84.11*

Appendix 3

(CE - MISO NIPS) The BURNHAM ;0R-17MUNSTER 345 kV line (from bus 270677 to bus 255109 ckt 1) loads from 134.22% to 134.33% (**DC power flow**) of its emergency rating (1195 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 15.13 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.82*
932012	*AC2-007 E*	*1.52*
932881	*AC2-115 1*	*2.31*
932891	*AC2-115 2*	*2.31*
932921	*AC2-116*	*0.81*
932931	*AC2-117*	*5.37*
933341	*AC2-147 C*	*0.84*
933342	*AC2-147 E*	*1.38*
933361	*AC2-149 C*	*0.91*
933362	*AC2-149 E*	*1.48*
933381	*AC2-151 C*	*0.95*
933382	*AC2-151 E*	*1.55*
933411	*AC2-154 C*	*2.88*
933412	*AC2-154 E*	*4.69*
933431	*AC2-156 C*	*0.94*
933432	*AC2-156 E*	*1.53*
933511	*AC2-166 C*	*2.27*
933512	*AC2-166 E*	*2.51*
933911	*AD1-013 C O1*	*1.79*
933912	*AD1-013 E O1*	*2.86*
933931	*AD1-016 C*	*0.9*
933932	*AD1-016 E*	*1.48*
934101	*AD1-039 1*	*7.56*
934111	*AD1-039 2*	*7.74*
934401	*AD1-064 C O1*	*3.12*
934402	*AD1-064 E O1*	*14.61*
934431	*AD1-067 C*	*0.13*
934432	*AD1-067 E*	*0.54*
LTF	*AD1-092*	*10.67*
LTF	*AD1-093*	*18.49*
LTF	*AD1-094*	*3.59*
934651	*AD1-096 C*	*0.87*

934652	*AD1-096 E*	*1.41*
934701	*AD1-098 C O1*	*6.68*
934702	*AD1-098 E O1*	*4.88*
934721	*AD1-100 C*	*22.43*
934722	*AD1-100 E*	*105.04*
934871	*AD1-116 C*	*0.99*
934872	*AD1-116 E*	*1.61*
934881	*AD1-117 C*	*5.2*
934882	*AD1-117 E*	*3.47*
934941	*AD1-126 C*	*5.7*
934942	*AD1-126 E*	*3.8*
934971	*AD1-129 C*	*0.88*
934972	*AD1-129 E*	*0.59*
935001	*AD1-133 C O1*	*20.29*
935002	*AD1-133 E O1*	*13.53*
936181	*AD2-024 C O1*	*0.9*
936182	*AD2-024 E O1*	*1.48*
936291	*AD2-038 C O1*	*2.34*
936292	*AD2-038 E O1*	*15.68*
936371	*AD2-047 C O1*	*2.57*
936372	*AD2-047 E O1*	*27.71*
936461	*AD2-060*	*3.03*
936511	*AD2-066 C O1*	*8.19*
936512	*AD2-066 E O1*	*5.46*
936781	*AD2-101 C*	*4.27*
936782	*AD2-101 E*	*19.99*
936791	*AD2-102 C*	*11.69*
936792	*AD2-102 E*	*11.23*
936961	*AD2-130 C*	*1.56*
936962	*AD2-130 E*	*0.21*
937001	*AD2-134 C*	*2.65*
937002	*AD2-134 E*	*10.97*
937031	*AD2-137 C O1*	*3.65*
937032	*AD2-137 E O1*	*17.08*
937051	*AD2-140 C O1*	*3.71*
937052	*AD2-140 E O1*	*17.37*
937061	*AD2-141 C O1*	*3.69*
937062	*AD2-141 E O1*	*17.4*
937071	*AD2-142 C O1*	*7.42*
937072	*AD2-142 E O1*	*34.75*
937121	*AD2-148 C O1*	*3.42*
937122	*AD2-148 E O1*	*16.02*
937131	*AD2-149 C O1*	*3.42*
937132	*AD2-149 E O1*	*16.02*
937141	*AD2-150 C O1*	*3.42*

937142	*AD2-150 E O1*	*16.02*
937181	*AD2-155 C O1*	*3.42*
937182	*AD2-155 E O1*	*16.02*
937311	*AD2-172 C*	*2.39*
937312	*AD2-172 E*	*3.3*
937321	*AD2-175 C*	*15.94*
937322	*AD2-175 E*	*10.63*
937331	*AD2-176 C O1*	*7.14*
937332	*AD2-176 E O1*	*4.76*
937401	*AD2-194 C1*	*7.56*
937411	*AD2-194 C2*	*7.57*
LTF	*BLUEG*	*1.86*
LTF	*CALDERWOOD*	*0.03*
LTF	*CANNELTON*	*0.1*
LTF	*CARR*	*0.74*
LTF	*CATAWBA*	*0.25*
274890	*CAYUG;1U E*	*13.3*
274891	*CAYUG;2U E*	*13.3*
LTF	*CBM-S1*	*1.46*
LTF	*CBM-W1*	*48.06*
LTF	*CBM-W2*	*37.99*
LTF	*CELEVELAND*	*0.7*
LTF	*CHEOAH*	*0.04*
LTF	*CHILHOWEE*	*< 0.01*
LTF	*CLIFTY*	*11.17*
LTF	*DEARBORN*	*2.87*
274859	*EASYR;U1 E*	*10.64*
274860	*EASYR;U2 E*	*10.64*
LTF	*ELMERSMITH*	*0.2*
LTF	*G-007*	*1.96*
LTF	*GIBSON*	*0.1*
290051	*GSG-6; E*	*10.15*
LTF	*HAMLET*	*0.98*
275149	*KEMPTON ;1E*	*21.19*
290108	*LEEDK;1U E*	*23.64*
LTF	*MEC*	*36.29*
274850	*MENDOTA H;RU*	*5.24*
293061	*N-015 E*	*14.92*
293715	*O-029 E*	*0.32*
293716	*O-029 E*	*0.18*
293717	*O-029 E*	*0.16*
LTF	*O-066*	*12.56*
293644	*O22 E1*	*9.24*
293645	*O22 E2*	*17.94*
290021	*O50 E*	*18.63*

294392	*P-010 E*	*18.95*
294763	*P-046 E*	*9.1*
274888	*PILOT HIL;1E*	*21.19*
274830	*PWR VTREC;1U*	*5.94*
274831	*PWR VTREC;2U*	*5.94*
LTF	*RENSSELAER*	*0.58*
274723	*RIVER EC ;12*	*4.89*
LTF	*ROSETON*	*4.2*
LTF	*ROWAN*	*0.59*
LTF	*SANTEETLA*	*0.01*
274794	*SE CHICAG;1U*	*1.08*
274795	*SE CHICAG;2U*	*1.08*
295111	*SUBLETTE E*	*2.64*
LTF	*TRIMBLE*	*0.38*
299993	*U3-031C*	*5.64*
903433	*W3-046*	*22.91*
905471	*W4-084*	*0.43*
274874	*WALNR;2U*	*2.31*
294502	*WALNR;2U E*	*9.22*
LTF	*WEC*	*7.79*
295109	*WESTBROOK E*	*5.44*
274687	*WILL CNTY;4U*	*64.35*
910541	*X3-005 C*	*0.1*
910542	*X3-005 E*	*0.91*
914641	*Y2-103*	*44.*
915011	*Y3-013 1*	*3.67*
915021	*Y3-013 2*	*3.67*
915031	*Y3-013 3*	*3.67*
LTF	*Z1-043*	*27.44*
916502	*Z1-106 E1*	*1.24*
916504	*Z1-106 E2*	*1.24*
916512	*Z1-107 E*	*2.6*
916522	*Z1-108 E*	*2.43*
918051	*AA1-018 C*	*2.53*
918052	*AA1-018 E*	*16.95*
918972	*AA1-116 E*	*3.03*
918982	*AA1-117 E*	*3.03*
919221	*AA1-146*	*16.97*
919581	*AA2-030*	*16.97*
919591	*AA2-035*	*129.49*
920112	*AA2-107 E*	*2.39*
920272	*AA2-123 E*	*2.38*
930481	*AB1-089*	*63.95*
930491	*AB1-090*	*63.95*
930501	*AB1-091*	*93.35*

930761	*AB1-122 1*	*69.55*
930771	*AB1-122 2*	*71.24*
931221	*AB1-172*	*0.81*
LTF	*AB2-013*	*15.41*
924471	*AB2-096*	*41.26*
925161	*AB2-173*	*3.03*
925301	*AB2-191 C*	*1.23*
925302	*AB2-191 E*	*1.09*
925881	*AC1-067*	*307.46*
926311	*AC1-109 1*	*1.87*
926321	*AC1-109 2*	*1.87*
926331	*AC1-110 1*	*1.86*
926341	*AC1-110 2*	*1.86*
926351	*AC1-111 1*	*0.75*
926361	*AC1-111 2*	*0.75*
926371	*AC1-111 3*	*0.75*
926381	*AC1-111 4*	*0.75*
926391	*AC1-111 5*	*0.75*
926401	*AC1-111 6*	*0.75*
927511	*AC1-113 1*	*1.16*
927522	*AC1-113 2*	*1.16*
926431	*AC1-114*	*2.31*
927451	*AC1-142A 1*	*4.11*
927461	*AC1-142A 2*	*4.1*
926701	*AC1-153 C1*	*75.59*
926711	*AC1-153 C2*	*77.43*
926702	*AC1-153 E1*	*3.02*
926712	*AC1-153 E2*	*3.1*
926821	*AC1-168 C*	*1.11*
926822	*AC1-168 E*	*7.46*
927531	*AC1-185 1*	*0.66*
927541	*AC1-185 2*	*0.66*
927551	*AC1-185 3*	*0.66*
927561	*AC1-185 4*	*0.66*
927571	*AC1-185 5*	*0.66*
927581	*AC1-185 6*	*0.66*
927591	*AC1-185 7*	*0.66*
927601	*AC1-185 8*	*0.66*
927091	*AC1-204 1*	*70.31*
927101	*AC1-204 2*	*70.37*

Appendix 4

(CE - CE) The DRESDEN ; B-KENDALL ;BU 345 kV line (from bus 270716 to bus 274702 ckt 1) loads from 129.58% to 130.97% (**DC power flow**) of its load dump rating (1195 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 22.64 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934101	*AD1-039 1*	*4.99*
934111	*AD1-039 2*	*18.42*
LTF	*AD1-092*	*5.37*
LTF	*AD1-093*	*9.36*
LTF	*AD1-094*	*1.77*
936511	*AD2-066 C O1*	*9.21*
936512	*AD2-066 E O1*	*6.14*
937401	*AD2-194 C1*	*11.36*
937411	*AD2-194 C2*	*11.28*
LTF	*BLUEG*	*0.1*
LTF	*CARR*	*0.1*
LTF	*CBM-S1*	*1.02*
LTF	*CBM-S2*	*0.13*
LTF	*CBM-W1*	*1.25*
LTF	*CBM-W2*	*14.06*
LTF	*CIN*	*0.35*
LTF	*CLIFTY*	*1.24*
LTF	*DEARBORN*	*0.53*
274658	*DRESDEN ;2U*	*47.28*
274735	*ELWOOD EC;4P*	*4.93*
274728	*ELWOOD EC;5P*	*4.97*
274730	*ELWOOD EC;6P*	*4.97*
274732	*ELWOOD EC;7P*	*4.97*
274734	*ELWOOD EC;8P*	*4.97*
274736	*ELWOOD EC;9P*	*4.97*
LTF	*G-007*	*0.24*
LTF	*IPL*	*0.16*
LTF	*MEC*	*7.9*
LTF	*O-066*	*1.53*
290021	*O50 E*	*26.68*
LTF	*RENSSELAER*	*0.08*
LTF	*ROSETON*	*0.54*
LTF	*TRIMBLE*	*0.02*

LTF	*Z1-043*	*13.51*
930761	*AB1-122 1*	*45.95*
930771	*AB1-122 2*	*169.5*
LTF	*AB2-013*	*7.8*
926701	*AC1-153 C1*	*49.95*
926711	*AC1-153 C2*	*184.24*
926702	*AC1-153 E1*	*2.*
926712	*AC1-153 E2*	*7.37*
927091	*AC1-204 1*	*105.63*
927101	*AC1-204 2*	*104.91*

Appendix 5

(CE - CE) The E FRANKFO; B-CRETE EC ;BP 345 kV line (from bus 270728 to bus 274750 ckt 1) loads from 111.74% to 111.8% (**DC power flow**) of its load dump rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 16.91 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.89*
932012	*AC2-007 E*	*1.65*
932881	*AC2-115 1*	*2.51*
932891	*AC2-115 2*	*2.51*
932921	*AC2-116*	*0.88*
933341	*AC2-147 C*	*0.92*
933342	*AC2-147 E*	*1.5*
933361	*AC2-149 C*	*0.98*
933362	*AC2-149 E*	*1.6*
933381	*AC2-151 C*	*1.02*
933382	*AC2-151 E*	*1.67*
933411	*AC2-154 C*	*2.33*
933412	*AC2-154 E*	*3.81*
933431	*AC2-156 C*	*1.*
933432	*AC2-156 E*	*1.64*
933511	*AC2-166 C*	*2.46*
933512	*AC2-166 E*	*2.72*
933911	*AD1-013 C O1*	*1.94*
933912	*AD1-013 E O1*	*3.09*
933931	*AD1-016 C*	*0.98*
933932	*AD1-016 E*	*1.6*
934101	*AD1-039 1*	*8.08*
934111	*AD1-039 2*	*8.74*
934401	*AD1-064 C O1*	*3.39*
934402	*AD1-064 E O1*	*15.87*
934431	*AD1-067 C*	*0.14*
934432	*AD1-067 E*	*0.58*
LTF	*AD1-092*	*11.74*
LTF	*AD1-093*	*20.37*
LTF	*AD1-094*	*3.91*
934651	*AD1-096 C*	*0.94*
934652	*AD1-096 E*	*1.53*
934701	*AD1-098 C O1*	*7.24*

934702	*AD1-098 E O1*	*5.29*
934721	*AD1-100 C*	*22.71*
934722	*AD1-100 E*	*106.3*
934871	*AD1-116 C*	*0.94*
934872	*AD1-116 E*	*1.53*
934881	*AD1-117 C*	*5.66*
934882	*AD1-117 E*	*3.77*
934941	*AD1-126 C*	*6.16*
934942	*AD1-126 E*	*4.1*
934971	*AD1-129 C*	*0.95*
934972	*AD1-129 E*	*0.64*
935001	*AD1-133 C O1*	*21.3*
935002	*AD1-133 E O1*	*14.2*
936181	*AD2-024 C O1*	*0.98*
936182	*AD2-024 E O1*	*1.6*
936291	*AD2-038 C O1*	*2.41*
936292	*AD2-038 E O1*	*16.12*
936371	*AD2-047 C O1*	*2.09*
936372	*AD2-047 E O1*	*22.47*
936461	*AD2-060*	*2.46*
936511	*AD2-066 C O1*	*8.77*
936512	*AD2-066 E O1*	*5.85*
936791	*AD2-102 C*	*12.71*
936792	*AD2-102 E*	*12.21*
936961	*AD2-130 C*	*1.67*
936962	*AD2-130 E*	*0.22*
937001	*AD2-134 C*	*2.88*
937002	*AD2-134 E*	*11.88*
937031	*AD2-137 C O1*	*3.31*
937032	*AD2-137 E O1*	*15.49*
937051	*AD2-140 C O1*	*3.3*
937052	*AD2-140 E O1*	*15.47*
937061	*AD2-141 C O1*	*3.29*
937062	*AD2-141 E O1*	*15.49*
937071	*AD2-142 C O1*	*6.61*
937072	*AD2-142 E O1*	*30.94*
937121	*AD2-148 C O1*	*3.27*
937122	*AD2-148 E O1*	*15.32*
937131	*AD2-149 C O1*	*3.27*
937132	*AD2-149 E O1*	*15.32*
937141	*AD2-150 C O1*	*3.27*
937142	*AD2-150 E O1*	*15.32*
937181	*AD2-155 C O1*	*3.27*
937182	*AD2-155 E O1*	*15.32*
937311	*AD2-172 C*	*2.6*

937312	*AD2-172 E*	*3.59*
937321	*AD2-175 C*	*15.24*
937322	*AD2-175 E*	*10.16*
937331	*AD2-176 C O1*	*7.75*
937332	*AD2-176 E O1*	*5.17*
937401	*AD2-194 C1*	*8.46*
937411	*AD2-194 C2*	*8.45*
LTF	*BLUEG*	*2.01*
274654	*BRAIDWOOD;1U*	*31.26*
274655	*BRAIDWOOD;2U*	*30.4*
LTF	*CALDERWOOD*	*0.01*
LTF	*CANNELTON*	*0.12*
LTF	*CARR*	*0.75*
LTF	*CATAWBA*	*0.25*
LTF	*CBM-S1*	*1.63*
LTF	*CBM-W1*	*53.33*
LTF	*CBM-W2*	*40.73*
LTF	*CELEVELAND*	*0.69*
LTF	*CHEOAH*	*0.02*
LTF	*CHILHOWEE*	*< 0.01*
LTF	*CLIFTY*	*11.72*
LTF	*DEARBORN*	*2.97*
274859	*EASYR;U1 E*	*11.58*
274860	*EASYR;U2 E*	*11.58*
LTF	*ELMERSMITH*	*0.24*
LTF	*G-007*	*1.99*
LTF	*GIBSON*	*0.15*
290051	*GSG-6; E*	*11.*
LTF	*HAMLET*	*0.97*
274676	*JOLIET 29;8U*	*12.91*
275149	*KEMPTON ;1E*	*17.19*
274704	*KENDALL ;1C*	*4.6*
274705	*KENDALL ;1S*	*3.07*
274706	*KENDALL ;2C*	*4.6*
274707	*KENDALL ;2S*	*3.07*
274660	*LASCO STA;1U*	*28.87*
274661	*LASCO STA;2U*	*28.92*
290108	*LEEDK;1U E*	*25.57*
LTF	*MEC*	*39.46*
274850	*MENDOTA H;RU*	*5.68*
293061	*N-015 E*	*16.67*
293715	*O-029 E*	*4.02*
293716	*O-029 E*	*2.2*
293717	*O-029 E*	*2.02*
LTF	*O-066*	*12.77*

293644	*O22 E1*	*12.5*
293645	*O22 E2*	*24.26*
290021	*O50 E*	*20.92*
294392	*P-010 E*	*21.17*
294763	*P-046 E*	*9.9*
274888	*PILOT HIL;1E*	*17.19*
274830	*PWR VTREC;1U*	*6.45*
274831	*PWR VTREC;2U*	*6.45*
LTF	*RENSSELAER*	*0.59*
LTF	*ROSETON*	*4.27*
LTF	*ROWAN*	*0.59*
LTF	*SANTEETLA*	*< 0.01*
295111	*SUBLETTE E*	*2.86*
274861	*TOP CROP ;1U*	*0.55*
274862	*TOP CROP ;2U*	*1.06*
LTF	*TRIMBLE*	*0.41*
299993	*U3-031C*	*5.*
903433	*W3-046*	*25.61*
905471	*W4-084*	*0.47*
274874	*WALNR;2U*	*2.51*
294502	*WALNR;2U E*	*10.05*
LTF	*WEC*	*8.49*
295109	*WESTBROOK E*	*5.89*
274687	*WILL CNTY;4U*	*74.86*
914641	*Y2-103*	*47.93*
915011	*Y3-013 1*	*3.99*
915021	*Y3-013 2*	*3.99*
915031	*Y3-013 3*	*3.99*
LTF	*Z1-043*	*29.92*
916502	*Z1-106 E1*	*1.34*
916504	*Z1-106 E2*	*1.34*
916512	*Z1-107 E*	*2.56*
916522	*Z1-108 E*	*2.64*
918051	*AA1-018 C*	*2.41*
918052	*AA1-018 E*	*16.15*
918972	*AA1-116 E*	*2.46*
918982	*AA1-117 E*	*2.46*
919221	*AA1-146*	*18.49*
919581	*AA2-030*	*18.49*
919591	*AA2-035*	*133.48*
920112	*AA2-107 E*	*2.59*
920272	*AA2-123 E*	*2.58*
930481	*AB1-089*	*69.49*
930491	*AB1-090*	*69.49*
930501	*AB1-091*	*67.56*

930761	*AB1-122 1*	*74.37*
930771	*AB1-122 2*	*80.41*
931221	*AB1-172*	*0.79*
LTF	*AB2-013*	*16.97*
924471	*AB2-096*	*44.81*
925161	*AB2-173*	*3.3*
925301	*AB2-191 C*	*1.33*
925302	*AB2-191 E*	*1.18*
926311	*AC1-109 1*	*2.01*
926321	*AC1-109 2*	*2.01*
926331	*AC1-110 1*	*2.01*
926341	*AC1-110 2*	*2.01*
926351	*AC1-111 1*	*0.8*
926361	*AC1-111 2*	*0.8*
926371	*AC1-111 3*	*0.8*
926381	*AC1-111 4*	*0.8*
926391	*AC1-111 5*	*0.8*
926401	*AC1-111 6*	*0.8*
927511	*AC1-113 1*	*1.26*
927522	*AC1-113 2*	*1.26*
926431	*AC1-114*	*2.51*
927451	*AC1-142A 1*	*4.56*
927461	*AC1-142A 2*	*4.56*
926701	*AC1-153 C1*	*80.84*
926711	*AC1-153 C2*	*87.4*
926702	*AC1-153 E1*	*3.23*
926712	*AC1-153 E2*	*3.5*
926821	*AC1-168 C*	*1.22*
926822	*AC1-168 E*	*8.17*
927531	*AC1-185 1*	*0.72*
927541	*AC1-185 2*	*0.72*
927551	*AC1-185 3*	*0.72*
927561	*AC1-185 4*	*0.72*
927571	*AC1-185 5*	*0.72*
927581	*AC1-185 6*	*0.72*
927591	*AC1-185 7*	*0.72*
927601	*AC1-185 8*	*0.72*
927091	*AC1-204 1*	*78.72*
927101	*AC1-204 2*	*78.58*

Appendix 6

(CE - CE) The ELWOOD ; B-GOODINGS ;4B 345 kV line (from bus 270736 to bus 270770 ckt 1) loads from 134.85% to 137.49% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11622_R-S'. This project contributes approximately 39.05 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933381	*AC2-151 C*	*0.43*
934101	*AD1-039 1*	*8.24*
934111	*AD1-039 2*	*8.89*
LTF	*AD1-092*	*3.99*
LTF	*AD1-093*	*6.89*
LTF	*AD1-094*	*1.27*
935001	*AD1-133 C O1*	*17.24*
936511	*AD2-066 C O1*	*5.1*
937401	*AD2-194 C1*	*19.59*
937411	*AD2-194 C2*	*19.46*
LTF	*BLUEG*	*0.63*
LTF	*CALDERWOOD*	*0.02*
LTF	*CANNELTON*	*0.04*
LTF	*CARR*	*0.23*
LTF	*CATAWBA*	*0.08*
LTF	*CBM-S1*	*0.41*
LTF	*CBM-W1*	*6.93*
LTF	*CBM-W2*	*12.19*
LTF	*CELEVELAND*	*0.23*
LTF	*CHEOAH*	*0.02*
LTF	*CHILHOWEE*	*< 0.01*
LTF	*CLIFTY*	*3.67*
LTF	*DEARBORN*	*0.94*
274658	*DRESDEN ;2U*	*22.81*
274659	*DRESDEN ;3U*	*22.22*
LTF	*ELMERSMITH*	*0.07*
274729	*ELWOOD EC;1P*	*8.51*
274731	*ELWOOD EC;2P*	*8.51*
274733	*ELWOOD EC;3P*	*8.51*
274735	*ELWOOD EC;4P*	*8.51*
274728	*ELWOOD EC;5P*	*8.57*
274730	*ELWOOD EC;6P*	*8.57*
274732	*ELWOOD EC;7P*	*8.57*
274734	*ELWOOD EC;8P*	*8.57*

274736	*ELWOOD EC;9P*	*8.57*
274837	*EQUISTAR ; B*	*0.69*
274836	*EQUISTAR ; R*	*1.22*
LTF	*GIBSON*	*0.03*
LTF	*HAMLET*	*0.31*
274704	*KENDALL ;1C*	*2.8*
274705	*KENDALL ;1S*	*1.87*
274706	*KENDALL ;2C*	*2.8*
274707	*KENDALL ;2S*	*1.87*
LTF	*MEC*	*9.61*
274879	*MINONK ;1U*	*0.58*
LTF	*RENSSELAER*	*0.18*
LTF	*ROSETON*	*1.31*
LTF	*ROWAN*	*0.19*
LTF	*SANTEETLA*	*< 0.01*
LTF	*TRIMBLE*	*0.13*
904211	*W3-135*	*0.2*
905493	*W4-086*	*0.03*
LTF	*WEC*	*1.*
LTF	*Z1-043*	*9.71*
918111	*AA1-040 1*	*0.17*
918121	*AA1-040 2*	*0.15*
919591	*AA2-035*	*82.54*
930761	*AB1-122 1*	*75.79*
930771	*AB1-122 2*	*81.8*
LTF	*AB2-013*	*5.74*
926701	*AC1-153 C1*	*82.38*
926711	*AC1-153 C2*	*88.91*
927091	*AC1-204 1*	*182.19*
927101	*AC1-204 2*	*180.95*

Appendix 7

(CE - CE) The ELWOOD ; R-GOODINGS ;2R 345 kV line (from bus 270737 to bus 270769 ckt 1) loads from 134.57% to 137.22% (**DC power flow**) of its emergency rating (1479 MVA) for the single line contingency outage of 'COMED_P1-2_345-L11620_B-S'. This project contributes approximately 39.24 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L11620_B-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
933381	*AC2-151 C*	*0.41*
934101	*AD1-039 1*	*8.08*
934111	*AD1-039 2*	*9.46*
LTF	*AD1-092*	*4.19*
LTF	*AD1-093*	*7.24*
LTF	*AD1-094*	*1.3*
935001	*AD1-133 C O1*	*16.85*
936511	*AD2-066 C O1*	*5.18*
937401	*AD2-194 C1*	*19.56*
937411	*AD2-194 C2*	*19.68*
LTF	*BLUEG*	*0.61*
LTF	*CALDERWOOD*	*< 0.01*
LTF	*CANNELTON*	*0.03*
LTF	*CARR*	*0.22*
LTF	*CATAWBA*	*0.08*
LTF	*CBM-S1*	*0.48*
LTF	*CBM-W1*	*7.89*
LTF	*CBM-W2*	*12.74*
LTF	*CELEVELAND*	*0.21*
LTF	*CHEOAH*	*< 0.01*
LTF	*CHILHOWEE*	*< 0.01*
LTF	*CLIFTY*	*3.58*
LTF	*DEARBORN*	*0.94*
274658	*DRESDEN ;2U*	*24.26*
274659	*DRESDEN ;3U*	*21.75*
LTF	*ELMERSMITH*	*0.06*
274729	*ELWOOD EC;1P*	*8.61*
274731	*ELWOOD EC;2P*	*8.61*
274733	*ELWOOD EC;3P*	*8.61*
274735	*ELWOOD EC;4P*	*8.61*
274728	*ELWOOD EC;5P*	*8.55*
274730	*ELWOOD EC;6P*	*8.55*
274732	*ELWOOD EC;7P*	*8.55*
274734	*ELWOOD EC;8P*	*8.55*

274736	*ELWOOD EC;9P*	*8.55*
274837	*EQUISTAR ; B*	*0.66*
274836	*EQUISTAR ; R*	*1.24*
LTF	*GIBSON*	*0.02*
LTF	*HAMLET*	*0.29*
274704	*KENDALL ;1C*	*3.41*
274705	*KENDALL ;1S*	*2.27*
274706	*KENDALL ;2C*	*3.41*
274707	*KENDALL ;2S*	*2.27*
LTF	*MEC*	*9.98*
274879	*MINONK ;1U*	*0.62*
LTF	*RENSSELAER*	*0.18*
LTF	*ROSETON*	*1.28*
LTF	*ROWAN*	*0.18*
LTF	*SANTEETLA*	*< 0.01*
LTF	*TRIMBLE*	*0.12*
904211	*W3-135*	*0.19*
905493	*W4-086*	*0.03*
LTF	*WEC*	*1.04*
LTF	*Z1-043*	*9.91*
918111	*AA1-040 1*	*0.17*
918121	*AA1-040 2*	*0.14*
919591	*AA2-035*	*72.01*
930761	*AB1-122 1*	*74.34*
930771	*AB1-122 2*	*87.04*
LTF	*AB2-013*	*6.04*
926701	*AC1-153 C1*	*80.81*
926711	*AC1-153 C2*	*94.61*
927091	*AC1-204 1*	*181.89*
927101	*AC1-204 2*	*183.02*

Appendix 8

(CE - MISO NIPS) The ST JOHN ; T-17GREEN_ACRE 345 kV line (from bus 270886 to bus 255104 ckt 1) loads from 112.51% to 112.57% (**DC power flow**) of its emergency rating (1091 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 11.85 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.63*
932012	*AC2-007 E*	*1.16*
932881	*AC2-115 1*	*1.77*
932891	*AC2-115 2*	*1.77*
932921	*AC2-116*	*0.62*
933341	*AC2-147 C*	*0.65*
933342	*AC2-147 E*	*1.06*
933361	*AC2-149 C*	*0.69*
933362	*AC2-149 E*	*1.13*
933381	*AC2-151 C*	*0.72*
933382	*AC2-151 E*	*1.18*
933411	*AC2-154 C*	*1.73*
933412	*AC2-154 E*	*2.83*
933431	*AC2-156 C*	*0.71*
933432	*AC2-156 E*	*1.16*
933511	*AC2-166 C*	*1.73*
933512	*AC2-166 E*	*1.91*
933911	*AD1-013 C O1*	*1.36*
933912	*AD1-013 E O1*	*2.18*
933931	*AD1-016 C*	*0.69*
933932	*AD1-016 E*	*1.13*
934101	*AD1-039 1*	*5.71*
934111	*AD1-039 2*	*6.12*
934401	*AD1-064 C O1*	*2.39*
934402	*AD1-064 E O1*	*11.18*
934431	*AD1-067 C*	*0.1*
934432	*AD1-067 E*	*0.41*
LTF	*AD1-092*	*8.26*
LTF	*AD1-093*	*14.32*
LTF	*AD1-094*	*2.75*
934651	*AD1-096 C*	*0.66*
934652	*AD1-096 E*	*1.08*

934701	*AD1-098 C O1*	*5.1*
934702	*AD1-098 E O1*	*3.72*
934721	*AD1-100 C*	*16.29*
934722	*AD1-100 E*	*76.28*
934871	*AD1-116 C*	*0.67*
934872	*AD1-116 E*	*1.1*
934881	*AD1-117 C*	*3.98*
934882	*AD1-117 E*	*2.66*
934941	*AD1-126 C*	*4.34*
934942	*AD1-126 E*	*2.89*
934971	*AD1-129 C*	*0.67*
934972	*AD1-129 E*	*0.45*
935001	*AD1-133 C O1*	*15.12*
935002	*AD1-133 E O1*	*10.08*
936181	*AD2-024 C O1*	*0.69*
936182	*AD2-024 E O1*	*1.13*
936291	*AD2-038 C O1*	*1.71*
936292	*AD2-038 E O1*	*11.42*
936371	*AD2-047 C O1*	*1.55*
936372	*AD2-047 E O1*	*16.69*
936461	*AD2-060*	*1.82*
936511	*AD2-066 C O1*	*6.19*
936512	*AD2-066 E O1*	*4.13*
936781	*AD2-101 C*	*3.07*
936782	*AD2-101 E*	*14.37*
936791	*AD2-102 C*	*8.95*
936792	*AD2-102 E*	*8.6*
936961	*AD2-130 C*	*1.18*
936962	*AD2-130 E*	*0.16*
937001	*AD2-134 C*	*2.03*
937002	*AD2-134 E*	*8.37*
937031	*AD2-137 C O1*	*2.42*
937032	*AD2-137 E O1*	*11.33*
937051	*AD2-140 C O1*	*2.43*
937052	*AD2-140 E O1*	*11.36*
937061	*AD2-141 C O1*	*2.41*
937062	*AD2-141 E O1*	*11.37*
937071	*AD2-142 C O1*	*4.85*
937072	*AD2-142 E O1*	*22.72*
937121	*AD2-148 C O1*	*2.41*
937122	*AD2-148 E O1*	*11.28*
937131	*AD2-149 C O1*	*2.41*
937132	*AD2-149 E O1*	*11.28*
937141	*AD2-150 C O1*	*2.41*
937142	*AD2-150 E O1*	*11.28*

937181	*AD2-155 C O1*	*2.41*
937182	*AD2-155 E O1*	*11.28*
937311	*AD2-172 C*	*1.83*
937312	*AD2-172 E*	*2.53*
937321	*AD2-175 C*	*11.23*
937322	*AD2-175 E*	*7.49*
937331	*AD2-176 C O1*	*5.46*
937332	*AD2-176 E O1*	*3.64*
937401	*AD2-194 C1*	*5.93*
937411	*AD2-194 C2*	*5.92*
LTF	*BLUEG*	*1.44*
274654	*BRAIDWOOD;1U*	*21.6*
274655	*BRAIDWOOD;2U*	*21.03*
LTF	*CALDERWOOD*	*0.04*
LTF	*CANNELTON*	*0.08*
LTF	*CARR*	*0.57*
LTF	*CATAWBA*	*0.2*
LTF	*CBM-S1*	*1.06*
LTF	*CBM-W1*	*39.58*
LTF	*CBM-W2*	*28.59*
LTF	*CELEVELAND*	*0.56*
LTF	*CHEOAH*	*0.04*
LTF	*CHILHOWEE*	*0.01*
LTF	*CLIFTY*	*8.62*
274751	*CRETE EC ;1U*	*3.84*
274752	*CRETE EC ;2U*	*3.84*
274753	*CRETE EC ;3U*	*3.84*
274754	*CRETE EC ;4U*	*3.84*
LTF	*DEARBORN*	*2.32*
274859	*EASYR;U1 E*	*8.15*
274860	*EASYR;U2 E*	*8.15*
LTF	*ELMERSMITH*	*0.17*
LTF	*G-007*	*1.52*
LTF	*GIBSON*	*0.09*
290051	*GSG-6; E*	*7.75*
LTF	*HAMLET*	*0.77*
275149	*KEMPTON ;1E*	*12.77*
274704	*KENDALL ;1C*	*3.21*
274705	*KENDALL ;1S*	*2.14*
274706	*KENDALL ;2C*	*3.21*
274707	*KENDALL ;2S*	*2.14*
274660	*LASCO STA;1U*	*20.12*
274661	*LASCO STA;2U*	*20.16*
290108	*LEEDK;1U E*	*18.02*
LTF	*MEC*	*27.78*

274850	*MENDOTA H;RU*	*4.*
293061	*N-015 E*	*11.65*
293715	*O-029 E*	*1.28*
293716	*O-029 E*	*0.7*
293717	*O-029 E*	*0.64*
LTF	*O-066*	*9.77*
293644	*O22 E1*	*8.55*
293645	*O22 E2*	*16.6*
290021	*O50 E*	*14.66*
294392	*P-010 E*	*14.8*
294763	*P-046 E*	*6.97*
274888	*PILOT HIL;1E*	*12.77*
274830	*PWR VTREC;1U*	*4.54*
274831	*PWR VTREC;2U*	*4.54*
LTF	*RENSSELAER*	*0.45*
LTF	*ROSETON*	*3.27*
LTF	*ROWAN*	*0.47*
LTF	*SANTEETLA*	*0.01*
295111	*SUBLETTE E*	*2.02*
274861	*TOP CROP ;1U*	*0.37*
274862	*TOP CROP ;2U*	*0.73*
LTF	*TRIMBLE*	*0.29*
299993	*U3-031C*	*3.67*
903433	*W3-046*	*17.95*
905471	*W4-084*	*0.33*
274874	*WALNR;2U*	*1.77*
294502	*WALNR;2U E*	*7.08*
LTF	*WEC*	*5.97*
295109	*WESTBROOK E*	*4.15*
274687	*WILL CNTY;4U*	*52.45*
914641	*Y2-103*	*33.74*
915011	*Y3-013 1*	*2.81*
915021	*Y3-013 2*	*2.81*
915031	*Y3-013 3*	*2.81*
LTF	*Z1-043*	*21.06*
916502	*Z1-106 E1*	*0.94*
916504	*Z1-106 E2*	*0.94*
916512	*Z1-107 E*	*1.84*
916522	*Z1-108 E*	*1.86*
918051	*AA1-018 C*	*1.73*
918052	*AA1-018 E*	*11.56*
918972	*AA1-116 E*	*1.82*
918982	*AA1-117 E*	*1.82*
919221	*AA1-146*	*13.02*
919581	*AA2-030*	*13.02*

919591	*AA2-035*	*94.84*
920112	*AA2-107 E*	*1.82*
920272	*AA2-123 E*	*1.82*
930481	*AB1-089*	*48.94*
930491	*AB1-090*	*48.94*
930501	*AB1-091*	*50.64*
930761	*AB1-122 1*	*52.53*
930771	*AB1-122 2*	*56.31*
931221	*AB1-172*	*0.57*
LTF	*AB2-013*	*11.93*
924471	*AB2-096*	*31.56*
925161	*AB2-173*	*2.32*
925301	*AB2-191 C*	*0.94*
925302	*AB2-191 E*	*0.83*
926311	*AC1-109 1*	*1.42*
926321	*AC1-109 2*	*1.42*
926331	*AC1-110 1*	*1.42*
926341	*AC1-110 2*	*1.42*
926351	*AC1-111 1*	*0.57*
926361	*AC1-111 2*	*0.57*
926371	*AC1-111 3*	*0.57*
926381	*AC1-111 4*	*0.57*
926391	*AC1-111 5*	*0.57*
926401	*AC1-111 6*	*0.57*
927511	*AC1-113 1*	*0.89*
927522	*AC1-113 2*	*0.89*
926431	*AC1-114*	*1.77*
927451	*AC1-142A 1*	*3.19*
927461	*AC1-142A 2*	*3.2*
926701	*AC1-153 C1*	*57.1*
926711	*AC1-153 C2*	*61.21*
926702	*AC1-153 E1*	*2.28*
926712	*AC1-153 E2*	*2.45*
926821	*AC1-168 C*	*0.86*
926822	*AC1-168 E*	*5.74*
927531	*AC1-185 1*	*0.51*
927541	*AC1-185 2*	*0.51*
927551	*AC1-185 3*	*0.51*
927561	*AC1-185 4*	*0.51*
927571	*AC1-185 5*	*0.51*
927581	*AC1-185 6*	*0.51*
927591	*AC1-185 7*	*0.51*
927601	*AC1-185 8*	*0.51*
927091	*AC1-204 1*	*55.14*
927101	*AC1-204 2*	*55.06*

Appendix 9

(CE - CE) The WILTON ; B-WILTON ;3M 345 kV line (from bus 270926 to bus 275232 ckt 1) loads from 155.56% to 155.79% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 19.14 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT5-6__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*1.03*
932012	*AC2-007 E*	*1.91*
932881	*AC2-115 1*	*2.91*
932891	*AC2-115 2*	*2.91*
932921	*AC2-116*	*1.02*
933361	*AC2-149 C*	*1.14*
933362	*AC2-149 E*	*1.85*
933381	*AC2-151 C*	*1.2*
933382	*AC2-151 E*	*1.96*
933411	*AC2-154 C*	*3.2*
933412	*AC2-154 E*	*5.22*
933431	*AC2-156 C*	*1.17*
933432	*AC2-156 E*	*1.9*
933511	*AC2-166 C*	*2.85*
933512	*AC2-166 E*	*3.15*
933911	*AD1-013 C O1*	*2.25*
933912	*AD1-013 E O1*	*3.59*
933931	*AD1-016 C*	*1.13*
933932	*AD1-016 E*	*1.85*
934101	*AD1-039 1*	*9.64*
934111	*AD1-039 2*	*9.82*
934401	*AD1-064 C O1*	*3.92*
934402	*AD1-064 E O1*	*18.33*
934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.67*
LTF	*AD1-092*	*13.85*
LTF	*AD1-093*	*23.92*
LTF	*AD1-094*	*4.64*
934651	*AD1-096 C*	*1.09*
934652	*AD1-096 E*	*1.78*
934701	*AD1-098 C O1*	*8.4*
934702	*AD1-098 E O1*	*6.13*

934721	*AD1-100 C*	*35.14*
934722	*AD1-100 E*	*164.52*
934871	*AD1-116 C*	*1.17*
934872	*AD1-116 E*	*1.92*
934941	*AD1-126 C*	*7.14*
934942	*AD1-126 E*	*4.76*
934971	*AD1-129 C*	*1.1*
934972	*AD1-129 E*	*0.73*
935001	*AD1-133 C O1*	*27.6*
935002	*AD1-133 E O1*	*18.4*
936181	*AD2-024 C O1*	*1.13*
936182	*AD2-024 E O1*	*1.85*
936291	*AD2-038 C O1*	*2.89*
936292	*AD2-038 E O1*	*19.32*
936371	*AD2-047 C O1*	*2.86*
936372	*AD2-047 E O1*	*30.82*
936461	*AD2-060*	*3.37*
936511	*AD2-066 C O1*	*10.35*
936512	*AD2-066 E O1*	*6.9*
936781	*AD2-101 C*	*6.07*
936782	*AD2-101 E*	*28.43*
936791	*AD2-102 C*	*14.69*
936792	*AD2-102 E*	*14.12*
936961	*AD2-130 C*	*1.92*
936962	*AD2-130 E*	*0.25*
937001	*AD2-134 C*	*3.34*
937002	*AD2-134 E*	*13.78*
937031	*AD2-137 C O1*	*7.26*
937032	*AD2-137 E O1*	*33.97*
937051	*AD2-140 C O1*	*7.62*
937052	*AD2-140 E O1*	*35.68*
937061	*AD2-141 C O1*	*7.58*
937062	*AD2-141 E O1*	*35.73*
937071	*AD2-142 C O1*	*15.24*
937072	*AD2-142 E O1*	*71.37*
937121	*AD2-148 C O1*	*4.76*
937122	*AD2-148 E O1*	*22.29*
937131	*AD2-149 C O1*	*4.76*
937132	*AD2-149 E O1*	*22.29*
937141	*AD2-150 C O1*	*4.76*
937142	*AD2-150 E O1*	*22.29*
937181	*AD2-155 C O1*	*4.76*
937182	*AD2-155 E O1*	*22.29*
937311	*AD2-172 C*	*3.01*
937312	*AD2-172 E*	*4.15*

937321	*AD2-175 C*	*22.19*
937322	*AD2-175 E*	*14.79*
937331	*AD2-176 C O1*	*8.95*
937332	*AD2-176 E O1*	*5.97*
937401	*AD2-194 C1*	*9.57*
937411	*AD2-194 C2*	*9.57*
LTF	*BLUEG*	*2.67*
LTF	*CALDERWOOD*	*0.06*
LTF	*CANNELTON*	*0.13*
LTF	*CARR*	*0.95*
LTF	*CATAWBA*	*0.35*
274890	*CAYUG;1U E*	*20.6*
274891	*CAYUG;2U E*	*20.6*
LTF	*CBM-S1*	*1.89*
LTF	*CBM-W1*	*74.34*
LTF	*CBM-W2*	*52.52*
LTF	*CELEVELAND*	*0.98*
LTF	*CHEOAH*	*0.07*
LTF	*CHILHOWEE*	*0.02*
LTF	*CLIFTY*	*15.96*
LTF	*DEARBORN*	*2.8*
LTF	*ELMERSMITH*	*0.25*
LTF	*G-007*	*2.58*
LTF	*GIBSON*	*< 0.01*
290051	*GSG-6; E*	*12.76*
LTF	*HAMLET*	*1.35*
275149	*KEMPTON ;1E*	*23.59*
290108	*LEEDK;1U E*	*29.64*
274770	*LINCOLN ;1U*	*3.88*
274771	*LINCOLN ;2U*	*3.88*
274772	*LINCOLN ;3U*	*3.88*
274773	*LINCOLN ;4U*	*3.88*
274774	*LINCOLN ;5U*	*3.88*
274775	*LINCOLN ;6U*	*3.88*
274776	*LINCOLN ;7U*	*3.88*
274777	*LINCOLN ;8U*	*3.88*
LTF	*MEC*	*46.75*
274850	*MENDOTA H;RU*	*6.59*
293061	*N-015 E*	*19.15*
LTF	*O-066*	*16.54*
293644	*O22 E1*	*12.57*
293645	*O22 E2*	*24.4*
290021	*O50 E*	*23.77*
294392	*P-010 E*	*24.33*
294763	*P-046 E*	*2.75*

274888	*PILOT HIL;1E*	*23.59*
274830	*PWR VTREC;1U*	*7.45*
274831	*PWR VTREC;2U*	*7.45*
296308	*R-030 C1*	*4.99*
296271	*R-030 C2*	*4.99*
296125	*R-030 C3*	*5.05*
296309	*R-030 E1*	*19.97*
296272	*R-030 E2*	*19.97*
296128	*R-030 E3*	*20.21*
LTF	*RENSSELAER*	*0.75*
LTF	*ROSETON*	*5.43*
LTF	*ROWAN*	*0.82*
LTF	*SANTEETLA*	*0.02*
295111	*SUBLETTE E*	*3.32*
LTF	*TRIMBLE*	*0.55*
299993	*U3-031C*	*11.52*
LTF	*WEC*	*9.76*
295109	*WESTBROOK E*	*6.83*
274687	*WILL CNTY;4U*	*81.89*
910542	*X3-005 E*	*0.9*
914641	*Y2-103*	*54.95*
915011	*Y3-013 1*	*4.58*
915021	*Y3-013 2*	*4.58*
915031	*Y3-013 3*	*4.58*
LTF	*Z1-043*	*35.51*
916502	*Z1-106 E1*	*1.54*
916504	*Z1-106 E2*	*1.54*
916512	*Z1-107 E*	*3.17*
916522	*Z1-108 E*	*3.04*
917501	*Z2-087 C*	*3.9*
917502	*Z2-087 E*	*26.11*
918051	*AA1-018 C*	*3.01*
918052	*AA1-018 E*	*20.16*
918972	*AA1-116 E*	*3.37*
918982	*AA1-117 E*	*3.37*
919591	*AA2-035*	*160.3*
920112	*AA2-107 E*	*3.*
920272	*AA2-123 E*	*2.98*
930481	*AB1-089*	*80.34*
930491	*AB1-090*	*80.34*
930501	*AB1-091*	*90.99*
930761	*AB1-122 1*	*88.67*
930771	*AB1-122 2*	*90.31*
931221	*AB1-172*	*0.98*
LTF	*AB2-013*	*19.94*

924041	*AB2-047 C O1*	*4.81*
924042	*AB2-047 E O1*	*32.22*
924471	*AB2-096*	*51.73*
925301	*AB2-191 C*	*1.54*
925302	*AB2-191 E*	*1.37*
925881	*AC1-067*	*167.37*
926311	*AC1-109 1*	*2.34*
926321	*AC1-109 2*	*2.34*
926331	*AC1-110 1*	*2.32*
926341	*AC1-110 2*	*2.32*
926351	*AC1-111 1*	*0.93*
926361	*AC1-111 2*	*0.93*
926371	*AC1-111 3*	*0.93*
926381	*AC1-111 4*	*0.93*
926391	*AC1-111 5*	*0.93*
926401	*AC1-111 6*	*0.93*
927511	*AC1-113 1*	*1.45*
927522	*AC1-113 2*	*1.45*
926431	*AC1-114*	*2.91*
927451	*AC1-142A 1*	*5.12*
927461	*AC1-142A 2*	*5.12*
926701	*AC1-153 C1*	*96.37*
926711	*AC1-153 C2*	*98.16*
926702	*AC1-153 E1*	*3.86*
926712	*AC1-153 E2*	*3.93*
927091	*AC1-204 1*	*88.99*
927101	*AC1-204 2*	*88.99*

Appendix 10

(CE - CE) The WILTON ; R-WILTON ;4M 345 kV line (from bus 270927 to bus 275233 ckt 1) loads from 155.32% to 155.52% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 19.55 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*1.05*
932012	*AC2-007 E*	*1.95*
932881	*AC2-115 1*	*2.97*
932891	*AC2-115 2*	*2.97*
932921	*AC2-116*	*1.04*
932931	*AC2-117*	*6.63*
933341	*AC2-147 C*	*1.09*
933342	*AC2-147 E*	*1.78*
933361	*AC2-149 C*	*1.16*
933362	*AC2-149 E*	*1.89*
933381	*AC2-151 C*	*1.23*
933382	*AC2-151 E*	*2.*
933411	*AC2-154 C*	*3.27*
933412	*AC2-154 E*	*5.33*
933431	*AC2-156 C*	*1.19*
933432	*AC2-156 E*	*1.94*
933511	*AC2-166 C*	*2.91*
933512	*AC2-166 E*	*3.21*
933911	*AD1-013 C O1*	*2.29*
933912	*AD1-013 E O1*	*3.67*
933931	*AD1-016 C*	*1.16*
933932	*AD1-016 E*	*1.89*
934101	*AD1-039 1*	*9.84*
934111	*AD1-039 2*	*10.03*
934401	*AD1-064 C O1*	*4.*
934402	*AD1-064 E O1*	*18.72*
934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.69*
LTF	*AD1-092*	*14.14*
LTF	*AD1-093*	*24.43*
LTF	*AD1-094*	*4.74*
934651	*AD1-096 C*	*1.11*

934652	*AD1-096 E*	*1.82*
934701	*AD1-098 C O1*	*8.58*
934702	*AD1-098 E O1*	*6.26*
934721	*AD1-100 C*	*35.83*
934722	*AD1-100 E*	*167.76*
934871	*AD1-116 C*	*1.2*
934872	*AD1-116 E*	*1.96*
934881	*AD1-117 C*	*6.71*
934882	*AD1-117 E*	*4.47*
934941	*AD1-126 C*	*7.29*
934942	*AD1-126 E*	*4.86*
934971	*AD1-129 C*	*1.13*
934972	*AD1-129 E*	*0.75*
935001	*AD1-133 C O1*	*28.18*
935002	*AD1-133 E O1*	*18.78*
936181	*AD2-024 C O1*	*1.16*
936182	*AD2-024 E O1*	*1.89*
936291	*AD2-038 C O1*	*2.95*
936292	*AD2-038 E O1*	*19.73*
936371	*AD2-047 C O1*	*2.92*
936372	*AD2-047 E O1*	*31.47*
936461	*AD2-060*	*3.44*
936511	*AD2-066 C O1*	*10.57*
936512	*AD2-066 E O1*	*7.04*
936781	*AD2-101 C*	*6.2*
936782	*AD2-101 E*	*29.02*
936791	*AD2-102 C*	*15.01*
936792	*AD2-102 E*	*14.42*
936961	*AD2-130 C*	*1.96*
936962	*AD2-130 E*	*0.26*
937001	*AD2-134 C*	*3.41*
937002	*AD2-134 E*	*14.08*
937031	*AD2-137 C O1*	*7.39*
937032	*AD2-137 E O1*	*34.6*
937051	*AD2-140 C O1*	*7.76*
937052	*AD2-140 E O1*	*36.34*
937061	*AD2-141 C O1*	*7.72*
937062	*AD2-141 E O1*	*36.38*
937071	*AD2-142 C O1*	*15.52*
937072	*AD2-142 E O1*	*72.68*
937121	*AD2-148 C O1*	*4.86*
937122	*AD2-148 E O1*	*22.74*
937131	*AD2-149 C O1*	*4.86*
937132	*AD2-149 E O1*	*22.74*
937141	*AD2-150 C O1*	*4.86*

937142	*AD2-150 E O1*	*22.74*
937181	*AD2-155 C O1*	*4.86*
937182	*AD2-155 E O1*	*22.74*
937311	*AD2-172 C*	*3.07*
937312	*AD2-172 E*	*4.24*
937321	*AD2-175 C*	*22.63*
937322	*AD2-175 E*	*15.09*
937331	*AD2-176 C O1*	*9.14*
937332	*AD2-176 E O1*	*6.09*
937401	*AD2-194 C1*	*9.77*
937411	*AD2-194 C2*	*9.77*
LTF	*BLUEG*	*2.73*
LTF	*CALDERWOOD*	*0.06*
LTF	*CANNELTON*	*0.13*
LTF	*CARR*	*0.97*
LTF	*CATAWBA*	*0.36*
274890	*CAYUG;1U E*	*21.01*
274891	*CAYUG;2U E*	*21.01*
LTF	*CBM-S1*	*1.93*
LTF	*CBM-W1*	*75.93*
LTF	*CBM-W2*	*53.61*
LTF	*CELEVELAND*	*1.*
LTF	*CHEOAH*	*0.07*
LTF	*CHILHOWEE*	*0.02*
LTF	*CLIFTY*	*16.31*
LTF	*DEARBORN*	*2.86*
LTF	*ELMERSMITH*	*0.26*
LTF	*G-007*	*2.63*
LTF	*GIBSON*	*0.01*
290051	*GSG-6; E*	*13.03*
LTF	*HAMLET*	*1.38*
275149	*KEMPTON ;1E*	*24.08*
290108	*LEEDK;1U E*	*30.27*
274770	*LINCOLN ;1U*	*3.98*
274771	*LINCOLN ;2U*	*3.98*
274772	*LINCOLN ;3U*	*3.98*
274773	*LINCOLN ;4U*	*3.98*
274774	*LINCOLN ;5U*	*3.98*
274775	*LINCOLN ;6U*	*3.98*
274776	*LINCOLN ;7U*	*3.98*
274777	*LINCOLN ;8U*	*3.98*
LTF	*MEC*	*47.74*
274850	*MENDOTA H;RU*	*6.73*
293061	*N-015 E*	*19.56*
LTF	*O-066*	*16.89*

293644	*O22 E1*	*12.83*
293645	*O22 E2*	*24.91*
290021	*O50 E*	*24.28*
294392	*P-010 E*	*24.84*
294763	*P-046 E*	*11.7*
274888	*PILOT HIL;1E*	*24.08*
274830	*PWR VTREC;1U*	*7.61*
274831	*PWR VTREC;2U*	*7.61*
296308	*R-030 C1*	*5.09*
296271	*R-030 C2*	*5.09*
296125	*R-030 C3*	*5.15*
296309	*R-030 E1*	*20.37*
296272	*R-030 E2*	*20.37*
296128	*R-030 E3*	*20.61*
LTF	*RENSSELAER*	*0.77*
LTF	*ROSETON*	*5.54*
LTF	*ROWAN*	*0.84*
LTF	*SANTEETLA*	*0.02*
295111	*SUBLETTE E*	*3.39*
LTF	*TRIMBLE*	*0.56*
299993	*U3-031C*	*11.82*
903433	*W3-046*	*30.03*
LTF	*WEC*	*9.97*
295109	*WESTBROOK E*	*6.98*
274687	*WILL CNTY;4U*	*83.63*
910542	*X3-005 E*	*0.92*
914641	*Y2-103*	*56.13*
915011	*Y3-013 1*	*4.68*
915021	*Y3-013 2*	*4.68*
915031	*Y3-013 3*	*4.68*
LTF	*Z1-043*	*36.26*
916502	*Z1-106 E1*	*1.58*
916504	*Z1-106 E2*	*1.58*
916512	*Z1-107 E*	*3.23*
916522	*Z1-108 E*	*3.1*
917501	*Z2-087 C*	*3.98*
917502	*Z2-087 E*	*26.64*
918051	*AA1-018 C*	*3.08*
918052	*AA1-018 E*	*20.6*
918972	*AA1-116 E*	*3.44*
918982	*AA1-117 E*	*3.44*
919591	*AA2-035*	*163.71*
920112	*AA2-107 E*	*3.06*
920272	*AA2-123 E*	*3.05*
930481	*AB1-089*	*82.05*

930491	*AB1-090*	*82.05*
930501	*AB1-091*	*92.91*
930761	*AB1-122 1*	*90.55*
930771	*AB1-122 2*	*92.23*
931221	*AB1-172*	*1.*
LTF	*AB2-013*	*20.36*
924041	*AB2-047 C O1*	*4.91*
924042	*AB2-047 E O1*	*32.87*
924471	*AB2-096*	*52.84*
925301	*AB2-191 C*	*1.58*
925302	*AB2-191 E*	*1.4*
925881	*AC1-067*	*171.09*
926311	*AC1-109 1*	*2.39*
926321	*AC1-109 2*	*2.39*
926331	*AC1-110 1*	*2.37*
926341	*AC1-110 2*	*2.37*
926351	*AC1-111 1*	*0.95*
926361	*AC1-111 2*	*0.95*
926371	*AC1-111 3*	*0.95*
926381	*AC1-111 4*	*0.95*
926391	*AC1-111 5*	*0.95*
926401	*AC1-111 6*	*0.95*
927511	*AC1-113 1*	*1.48*
927522	*AC1-113 2*	*1.48*
926431	*AC1-114*	*2.97*
927451	*AC1-142A 1*	*5.23*
927461	*AC1-142A 2*	*5.23*
926701	*AC1-153 C1*	*98.42*
926711	*AC1-153 C2*	*100.25*
926702	*AC1-153 E1*	*3.94*
926712	*AC1-153 E2*	*4.01*
927531	*AC1-185 1*	*0.22*
927541	*AC1-185 2*	*0.22*
927551	*AC1-185 3*	*0.22*
927561	*AC1-185 4*	*0.22*
927571	*AC1-185 5*	*0.22*
927581	*AC1-185 6*	*0.22*
927591	*AC1-185 7*	*0.22*
927601	*AC1-185 8*	*0.22*
927091	*AC1-204 1*	*90.89*
927101	*AC1-204 2*	*90.89*

Appendix 11

(CE - CE) The KENDALL ;BU-LOCKPORT ; B 345 kV line (from bus 274702 to bus 270810 ckt 1) loads from 117.04% to 117.62% (**DC power flow**) of its load dump rating (1768 MVA) for the tower line contingency outage of 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'. This project contributes approximately 22.25 MW to the thermal violation.

```
CONTINGENCY 'COMED_P7_345-L11620_B-S_+_345-L11622_R-S'
 TRIP BRANCH FROM BUS 270736 TO BUS 270770 CKT 1          / ELWOO; B 345 GOODI;3B 345
 TRIP BRANCH FROM BUS 270737 TO BUS 270769 CKT 1          / ELWOO; R 345 GOODI;1R 345
 END
```

Bus Number	*Bus Name*	*Full Contribution*
934101	*AD1-039 1*	*4.79*
934111	*AD1-039 2*	*18.22*
LTF	*AD1-092*	*5.03*
LTF	*AD1-093*	*8.78*
LTF	*AD1-094*	*1.66*
936511	*AD2-066 C O1*	*8.99*
936512	*AD2-066 E O1*	*5.99*
937401	*AD2-194 C1*	*11.16*
937411	*AD2-194 C2*	*11.09*
LTF	*BLUEG*	*0.66*
LTF	*CALDERWOOD*	*0.06*
LTF	*CANNELTON*	*0.06*
LTF	*CARR*	*0.21*
LTF	*CATAWBA*	*0.1*
LTF	*CBM-S1*	*0.05*
LTF	*CBM-W2*	*8.29*
LTF	*CELEVELAND*	*0.27*
LTF	*CHEOAH*	*0.06*
LTF	*CHILHOWEE*	*0.02*
LTF	*CLIFTY*	*3.56*
LTF	*DEARBORN*	*0.81*
274658	*DRESDEN ;2U*	*46.77*
LTF	*ELMERSMITH*	*0.14*
274728	*ELWOOD EC;5P*	*4.88*
274730	*ELWOOD EC;6P*	*4.88*
274732	*ELWOOD EC;7P*	*4.88*
274734	*ELWOOD EC;8P*	*4.88*
274736	*ELWOOD EC;9P*	*4.88*
LTF	*G-007*	*0.58*
LTF	*GIBSON*	*0.08*
LTF	*HAMLET*	*0.35*
274704	*KENDALL ;1C*	*15.19*
274705	*KENDALL ;1S*	*10.13*

274706	*KENDALL ;2C*	*15.19*
274707	*KENDALL ;2S*	*10.13*
LTF	*MEC*	*6.41*
LTF	*O-066*	*3.7*
290021	*O50 E*	*26.17*
LTF	*RENSSELAER*	*0.17*
LTF	*ROSETON*	*1.22*
LTF	*ROWAN*	*0.21*
LTF	*SANTEETLA*	*0.02*
LTF	*TRIMBLE*	*0.13*
LTF	*UNIONPOWER*	*< 0.01*
903433	*W3-046*	*12.47*
LTF	*Z1-043*	*12.67*
930761	*AB1-122 1*	*44.09*
930771	*AB1-122 2*	*167.64*
LTF	*AB2-013*	*7.32*
926701	*AC1-153 C1*	*47.92*
926711	*AC1-153 C2*	*182.21*
926702	*AC1-153 E1*	*1.92*
926712	*AC1-153 E2*	*7.29*
927091	*AC1-204 1*	*103.82*
927101	*AC1-204 2*	*103.1*

Appendix 12

(CE - MISO NIPS) The CRETE EC ;BP-17STJOHN 345 kV line (from bus 274750 to bus 255112 ckt 1) loads from 129.53% to 129.59% (**DC power flow**) of its emergency rating (1399 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 16.72 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.88*
932012	*AC2-007 E*	*1.63*
932881	*AC2-115 1*	*2.48*
932891	*AC2-115 2*	*2.48*
932921	*AC2-116*	*0.87*
933341	*AC2-147 C*	*0.91*
933342	*AC2-147 E*	*1.48*
933361	*AC2-149 C*	*0.97*
933362	*AC2-149 E*	*1.58*
933381	*AC2-151 C*	*1.01*
933382	*AC2-151 E*	*1.65*
933411	*AC2-154 C*	*2.3*
933412	*AC2-154 E*	*3.76*
933431	*AC2-156 C*	*0.99*
933432	*AC2-156 E*	*1.62*
933511	*AC2-166 C*	*2.43*
933512	*AC2-166 E*	*2.68*
933911	*AD1-013 C O1*	*1.91*
933912	*AD1-013 E O1*	*3.05*
933931	*AD1-016 C*	*0.97*
933932	*AD1-016 E*	*1.58*
934101	*AD1-039 1*	*7.98*
934111	*AD1-039 2*	*8.64*
934401	*AD1-064 C O1*	*3.35*
934402	*AD1-064 E O1*	*15.67*
934431	*AD1-067 C*	*0.14*
934432	*AD1-067 E*	*0.57*
LTF	*AD1-092*	*11.58*
LTF	*AD1-093*	*20.08*
LTF	*AD1-094*	*3.86*
934651	*AD1-096 C*	*0.93*
934652	*AD1-096 E*	*1.51*

934701	*AD1-098 C O1*	*7.15*
934702	*AD1-098 E O1*	*5.22*
934721	*AD1-100 C*	*22.42*
934722	*AD1-100 E*	*104.99*
934871	*AD1-116 C*	*0.93*
934872	*AD1-116 E*	*1.51*
934881	*AD1-117 C*	*5.58*
934882	*AD1-117 E*	*3.72*
934941	*AD1-126 C*	*6.08*
934942	*AD1-126 E*	*4.05*
934971	*AD1-129 C*	*0.94*
934972	*AD1-129 E*	*0.63*
935001	*AD1-133 C O1*	*21.02*
935002	*AD1-133 E O1*	*14.01*
936181	*AD2-024 C O1*	*0.97*
936182	*AD2-024 E O1*	*1.58*
936291	*AD2-038 C O1*	*2.38*
936292	*AD2-038 E O1*	*15.91*
936371	*AD2-047 C O1*	*2.06*
936372	*AD2-047 E O1*	*22.18*
936461	*AD2-060*	*2.42*
936511	*AD2-066 C O1*	*8.66*
936512	*AD2-066 E O1*	*5.77*
936791	*AD2-102 C*	*12.55*
936792	*AD2-102 E*	*12.05*
936961	*AD2-130 C*	*1.65*
936962	*AD2-130 E*	*0.22*
937001	*AD2-134 C*	*2.84*
937002	*AD2-134 E*	*11.73*
937031	*AD2-137 C O1*	*3.27*
937032	*AD2-137 E O1*	*15.29*
937051	*AD2-140 C O1*	*3.26*
937052	*AD2-140 E O1*	*15.27*
937061	*AD2-141 C O1*	*3.24*
937062	*AD2-141 E O1*	*15.29*
937071	*AD2-142 C O1*	*6.52*
937072	*AD2-142 E O1*	*30.54*
937121	*AD2-148 C O1*	*3.23*
937122	*AD2-148 E O1*	*15.12*
937131	*AD2-149 C O1*	*3.23*
937132	*AD2-149 E O1*	*15.12*
937141	*AD2-150 C O1*	*3.23*
937142	*AD2-150 E O1*	*15.12*
937181	*AD2-155 C O1*	*3.23*
937182	*AD2-155 E O1*	*15.12*

937311	*AD2-172 C*	*2.56*
937312	*AD2-172 E*	*3.54*
937321	*AD2-175 C*	*15.05*
937322	*AD2-175 E*	*10.03*
937331	*AD2-176 C O1*	*7.66*
937332	*AD2-176 E O1*	*5.11*
937401	*AD2-194 C1*	*8.37*
937411	*AD2-194 C2*	*8.35*
LTF	*BLUEG*	*2.29*
274654	*BRAIDWOOD;1U*	*30.93*
274655	*BRAIDWOOD;2U*	*30.08*
LTF	*CALDERWOOD*	*0.1*
LTF	*CANNELTON*	*0.17*
LTF	*CARR*	*0.81*
LTF	*CATAWBA*	*0.3*
LTF	*CBM-S1*	*1.15*
LTF	*CBM-W1*	*51.53*
LTF	*CBM-W2*	*37.87*
LTF	*CELEVELAND*	*0.85*
LTF	*CHEOAH*	*0.1*
LTF	*CHILHOWEE*	*0.03*
LTF	*CLIFTY*	*12.87*
274751	*CRETE EC ;1U*	*6.58*
274752	*CRETE EC ;2U*	*6.58*
274753	*CRETE EC ;3U*	*6.58*
274754	*CRETE EC ;4U*	*6.58*
LTF	*DEARBORN*	*3.11*
274859	*EASYR;U1 E*	*11.43*
274860	*EASYR;U2 E*	*11.43*
LTF	*ELMERSMITH*	*0.38*
LTF	*G-007*	*2.16*
LTF	*GIBSON*	*0.24*
290051	*GSG-6; E*	*10.86*
LTF	*HAMLET*	*1.15*
275149	*KEMPTON ;1E*	*16.97*
274704	*KENDALL ;1C*	*4.55*
274705	*KENDALL ;1S*	*3.04*
274706	*KENDALL ;2C*	*4.55*
274707	*KENDALL ;2S*	*3.04*
274660	*LASCO STA;1U*	*28.55*
274661	*LASCO STA;2U*	*28.6*
290108	*LEEDK;1U E*	*25.25*
LTF	*MEC*	*38.72*
274850	*MENDOTA H;RU*	*5.6*
293061	*N-015 E*	*16.47*

293715	*O-029 E*	*7.72*
293716	*O-029 E*	*4.23*
293717	*O-029 E*	*3.89*
LTF	*O-066*	*13.84*
293644	*O22 E1*	*12.37*
293645	*O22 E2*	*24.*
290021	*O50 E*	*20.67*
294392	*P-010 E*	*20.92*
294763	*P-046 E*	*9.77*
274888	*PILOT HIL;1E*	*16.97*
274830	*PWR VTREC;1U*	*6.37*
274831	*PWR VTREC;2U*	*6.37*
LTF	*RENSSELAER*	*0.64*
LTF	*ROSETON*	*4.61*
LTF	*ROWAN*	*0.7*
LTF	*SANTEETLA*	*0.03*
295111	*SUBLETTE E*	*2.83*
274861	*TOP CROP ;1U*	*0.54*
274862	*TOP CROP ;2U*	*1.05*
LTF	*TRIMBLE*	*0.46*
299993	*U3-031C*	*4.94*
903433	*W3-046*	*25.28*
905471	*W4-084*	*0.47*
274874	*WALNR;2U*	*2.48*
294502	*WALNR;2U E*	*9.92*
LTF	*WEC*	*8.38*
295109	*WESTBROOK E*	*5.81*
274687	*WILL CNTY;4U*	*74.05*
914641	*Y2-103*	*47.35*
915011	*Y3-013 1*	*3.95*
915021	*Y3-013 2*	*3.95*
915031	*Y3-013 3*	*3.95*
LTF	*Z1-043*	*29.5*
916502	*Z1-106 E1*	*1.32*
916504	*Z1-106 E2*	*1.32*
916512	*Z1-107 E*	*2.53*
916522	*Z1-108 E*	*2.61*
918051	*AA1-018 C*	*2.38*
918052	*AA1-018 E*	*15.94*
918972	*AA1-116 E*	*2.42*
918982	*AA1-117 E*	*2.42*
919221	*AA1-146*	*18.24*
919581	*AA2-030*	*18.24*
919591	*AA2-035*	*131.85*
920112	*AA2-107 E*	*2.55*

920272	*AA2-123 E*	*2.55*
930481	*AB1-089*	*68.61*
930491	*AB1-090*	*68.61*
930501	*AB1-091*	*66.68*
930761	*AB1-122 1*	*73.45*
930771	*AB1-122 2*	*79.49*
931221	*AB1-172*	*0.78*
LTF	*AB2-013*	*16.73*
924471	*AB2-096*	*44.25*
925161	*AB2-173*	*3.25*
925301	*AB2-191 C*	*1.31*
925302	*AB2-191 E*	*1.17*
926311	*AC1-109 1*	*1.98*
926321	*AC1-109 2*	*1.98*
926331	*AC1-110 1*	*1.99*
926341	*AC1-110 2*	*1.99*
926351	*AC1-111 1*	*0.79*
926361	*AC1-111 2*	*0.79*
926371	*AC1-111 3*	*0.79*
926381	*AC1-111 4*	*0.79*
926391	*AC1-111 5*	*0.79*
926401	*AC1-111 6*	*0.79*
927511	*AC1-113 1*	*1.24*
927522	*AC1-113 2*	*1.24*
926431	*AC1-114*	*2.48*
927451	*AC1-142A 1*	*4.5*
927461	*AC1-142A 2*	*4.51*
926701	*AC1-153 C1*	*79.84*
926711	*AC1-153 C2*	*86.4*
926702	*AC1-153 E1*	*3.19*
926712	*AC1-153 E2*	*3.46*
926821	*AC1-168 C*	*1.2*
926822	*AC1-168 E*	*8.06*
927531	*AC1-185 1*	*0.71*
927541	*AC1-185 2*	*0.71*
927551	*AC1-185 3*	*0.71*
927561	*AC1-185 4*	*0.71*
927571	*AC1-185 5*	*0.71*
927581	*AC1-185 6*	*0.71*
927591	*AC1-185 7*	*0.71*
927601	*AC1-185 8*	*0.71*
927091	*AC1-204 1*	*77.83*
927101	*AC1-204 2*	*77.68*

Appendix 13

(CE - AEP) The UNIV PK N;RP-05OLIVE 345 kV line (from bus 274804 to bus 243229 ckt 1) loads from 137.46% to 137.75% (**DC power flow**) of its emergency rating (971 MVA) for the line fault with failed breaker contingency outage of 'AEP_P4_#2978_05DUMONT 765'. This project contributes approximately 12.82 MW to the thermal violation.

```
CONTINGENCY 'AEP_P4_#2978_05DUMONT 765'
 OPEN BRANCH FROM BUS 243206 TO BUS 907040 CKT 1          / 243206 05DUMONT 765 X1-020
 OPEN BRANCH FROM BUS 243206 TO BUS 270644 CKT 1          / 243206 05DUMONT 765 270644 WILTON ; 765 1
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*0.68*
932012	*AC2-007 E*	*1.27*
932881	*AC2-115 1*	*1.94*
932891	*AC2-115 2*	*1.94*
932921	*AC2-116*	*0.68*
932931	*AC2-117*	*10.46*
933341	*AC2-147 C*	*0.71*
933342	*AC2-147 E*	*1.15*
933361	*AC2-149 C*	*0.76*
933362	*AC2-149 E*	*1.24*
933381	*AC2-151 C*	*0.8*
933382	*AC2-151 E*	*1.31*
933411	*AC2-154 C*	*2.04*
933412	*AC2-154 E*	*3.33*
933431	*AC2-156 C*	*0.78*
933432	*AC2-156 E*	*1.27*
933511	*AC2-166 C*	*1.9*
933512	*AC2-166 E*	*2.1*
933911	*AD1-013 C O1*	*1.49*
933912	*AD1-013 E O1*	*2.39*
933931	*AD1-016 C*	*0.76*
933932	*AD1-016 E*	*1.23*
934101	*AD1-039 1*	*6.31*
934111	*AD1-039 2*	*6.53*
934401	*AD1-064 C O1*	*2.61*
934402	*AD1-064 E O1*	*12.22*
934431	*AD1-067 C*	*0.11*
934432	*AD1-067 E*	*0.45*
LTF	*AD1-092*	*8.97*
LTF	*AD1-093*	*15.55*
LTF	*AD1-094*	*3.02*
934651	*AD1-096 C*	*0.72*
934652	*AD1-096 E*	*1.18*

934701	*AD1-098 C O1*	*5.58*
934702	*AD1-098 E O1*	*4.08*
934721	*AD1-100 C*	*18.02*
934722	*AD1-100 E*	*84.36*
934871	*AD1-116 C*	*0.84*
934872	*AD1-116 E*	*1.37*
934881	*AD1-117 C*	*4.35*
934882	*AD1-117 E*	*2.9*
934941	*AD1-126 C*	*4.75*
934942	*AD1-126 E*	*3.17*
934971	*AD1-129 C*	*0.73*
934972	*AD1-129 E*	*0.49*
935001	*AD1-133 C O1*	*16.74*
935002	*AD1-133 E O1*	*11.16*
936181	*AD2-024 C O1*	*0.76*
936182	*AD2-024 E O1*	*1.23*
936291	*AD2-038 C O1*	*1.99*
936292	*AD2-038 E O1*	*13.32*
936371	*AD2-047 C O1*	*1.83*
936372	*AD2-047 E O1*	*19.67*
936461	*AD2-060*	*2.15*
936511	*AD2-066 C O1*	*6.88*
936512	*AD2-066 E O1*	*4.58*
936781	*AD2-101 C*	*3.49*
936782	*AD2-101 E*	*16.34*
936791	*AD2-102 C*	*9.78*
936792	*AD2-102 E*	*9.4*
936961	*AD2-130 C*	*1.29*
936962	*AD2-130 E*	*0.17*
937001	*AD2-134 C*	*2.22*
937002	*AD2-134 E*	*9.16*
937031	*AD2-137 C O1*	*2.69*
937032	*AD2-137 E O1*	*12.58*
937051	*AD2-140 C O1*	*2.7*
937052	*AD2-140 E O1*	*12.62*
937061	*AD2-141 C O1*	*2.68*
937062	*AD2-141 E O1*	*12.64*
937071	*AD2-142 C O1*	*5.39*
937072	*AD2-142 E O1*	*25.24*
937121	*AD2-148 C O1*	*2.72*
937122	*AD2-148 E O1*	*12.73*
937131	*AD2-149 C O1*	*2.72*
937132	*AD2-149 E O1*	*12.73*
937141	*AD2-150 C O1*	*2.72*
937142	*AD2-150 E O1*	*12.73*

937181	*AD2-155 C O1*	*2.72*
937182	*AD2-155 E O1*	*12.73*
937311	*AD2-172 C*	*2.*
937312	*AD2-172 E*	*2.76*
937321	*AD2-175 C*	*12.67*
937322	*AD2-175 E*	*8.45*
937331	*AD2-176 C O1*	*5.98*
937332	*AD2-176 E O1*	*3.98*
937401	*AD2-194 C1*	*6.41*
937411	*AD2-194 C2*	*6.41*
LTF	*BLUEG*	*1.53*
LTF	*CALDERWOOD*	*0.04*
LTF	*CANNELTON*	*0.08*
LTF	*CARR*	*0.63*
LTF	*CATAWBA*	*0.22*
274890	*CAYUG;1U E*	*6.57*
274891	*CAYUG;2U E*	*6.57*
LTF	*CBM-S1*	*1.19*
LTF	*CBM-W1*	*44.13*
LTF	*CBM-W2*	*31.59*
LTF	*CELEVELAND*	*0.61*
LTF	*CHEOAH*	*0.04*
LTF	*CHILHOWEE*	*0.01*
LTF	*CLIFTY*	*9.34*
LTF	*DEARBORN*	*2.59*
274859	*EASYR;U1 E*	*8.9*
274860	*EASYR;U2 E*	*8.9*
LTF	*ELMERSMITH*	*0.16*
LTF	*G-007*	*1.68*
LTF	*GIBSON*	*0.08*
290051	*GSG-6; E*	*8.48*
LTF	*HAMLET*	*0.85*
275149	*KEMPTON ;1E*	*15.05*
290108	*LEEDK;1U E*	*19.74*
LTF	*MEC*	*30.34*
274850	*MENDOTA H;RU*	*4.38*
293061	*N-015 E*	*12.77*
293516	*O-009 E1*	*7.34*
293517	*O-009 E2*	*3.73*
293518	*O-009 E3*	*4.11*
293715	*O-029 E*	*7.85*
293716	*O-029 E*	*4.31*
293717	*O-029 E*	*3.96*
LTF	*O-066*	*10.76*
293644	*O22 E1*	*7.89*

293645	*O22 E2*	*15.31*
290021	*O50 E*	*15.72*
294392	*P-010 E*	*16.22*
294763	*P-046 E*	*7.62*
274888	*PILOT HIL;1E*	*15.05*
274830	*PWR VTREC;1U*	*4.97*
274831	*PWR VTREC;2U*	*4.97*
LTF	*RENSSELAER*	*0.5*
LTF	*ROSETON*	*3.6*
LTF	*ROWAN*	*0.51*
LTF	*SANTEETLA*	*0.01*
295111	*SUBLETTE E*	*2.21*
LTF	*TRIMBLE*	*0.31*
299993	*U3-031C*	*4.09*
291984	*U4-033*	*1.43*
274814	*UNIV PK N;0U*	*1.07*
274806	*UNIV PK N;2U*	*1.07*
274807	*UNIV PK N;3U*	*1.07*
274808	*UNIV PK N;4U*	*1.07*
274809	*UNIV PK N;5U*	*1.07*
274810	*UNIV PK N;6U*	*1.07*
274811	*UNIV PK N;7U*	*1.07*
274812	*UNIV PK N;8U*	*1.07*
274813	*UNIV PK N;9U*	*1.07*
274815	*UNIV PK N;XU*	*1.07*
274816	*UNIV PK N;YU*	*1.07*
903433	*W3-046*	*19.35*
905471	*W4-084*	*0.36*
274874	*WALNR;2U*	*1.93*
294502	*WALNR;2U E*	*7.71*
LTF	*WEC*	*6.52*
295109	*WESTBROOK E*	*4.54*
274687	*WILL CNTY;4U*	*53.18*
910542	*X3-005 E*	*0.52*
914641	*Y2-103*	*36.87*
915011	*Y3-013 1*	*3.07*
915021	*Y3-013 2*	*3.07*
915031	*Y3-013 3*	*3.07*
LTF	*Z1-043*	*23.08*
916502	*Z1-106 E1*	*1.03*
916504	*Z1-106 E2*	*1.03*
916512	*Z1-107 E*	*2.22*
916522	*Z1-108 E*	*2.03*
918051	*AA1-018 C*	*2.16*
918052	*AA1-018 E*	*14.47*

918972	*AA1-116 E*	*2.15*
918982	*AA1-117 E*	*2.15*
919221	*AA1-146*	*14.2*
919581	*AA2-030*	*14.2*
919591	*AA2-035*	*106.9*
920112	*AA2-107 E*	*2.*
920272	*AA2-123 E*	*1.99*
930481	*AB1-089*	*53.5*
930491	*AB1-090*	*53.5*
930501	*AB1-091*	*58.31*
930761	*AB1-122 1*	*58.06*
930771	*AB1-122 2*	*60.06*
931221	*AB1-172*	*0.69*
LTF	*AB2-013*	*12.96*
924471	*AB2-096*	*34.52*
925161	*AB2-173*	*2.53*
925301	*AB2-191 C*	*1.03*
925302	*AB2-191 E*	*0.91*
925881	*AC1-067*	*98.67*
926311	*AC1-109 1*	*1.56*
926321	*AC1-109 2*	*1.56*
926331	*AC1-110 1*	*1.55*
926341	*AC1-110 2*	*1.55*
926351	*AC1-111 1*	*0.62*
926361	*AC1-111 2*	*0.62*
926371	*AC1-111 3*	*0.62*
926381	*AC1-111 4*	*0.62*
926391	*AC1-111 5*	*0.62*
926401	*AC1-111 6*	*0.62*
927511	*AC1-113 1*	*0.97*
927522	*AC1-113 2*	*0.97*
926431	*AC1-114*	*1.94*
927451	*AC1-142A 1*	*3.48*
927461	*AC1-142A 2*	*3.48*
926701	*AC1-153 C1*	*63.11*
926711	*AC1-153 C2*	*65.28*
926702	*AC1-153 E1*	*2.52*
926712	*AC1-153 E2*	*2.61*
926821	*AC1-168 C*	*0.94*
926822	*AC1-168 E*	*6.29*
927531	*AC1-185 1*	*0.56*
927541	*AC1-185 2*	*0.56*
927551	*AC1-185 3*	*0.56*
927561	*AC1-185 4*	*0.56*
927571	*AC1-185 5*	*0.56*

927581	*AC1-185 6*	*0.56*
927591	*AC1-185 7*	*0.56*
927601	*AC1-185 8*	*0.56*
927091	*AC1-204 1*	*59.56*
927101	*AC1-204 2*	*59.61*

Appendix 14

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275232 to bus 270644 ckt 1) loads from 155.56% to 155.79% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT5-6__'. This project contributes approximately 19.14 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT5-6__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270644 CKT 1          / WILTO;4M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275233 TO BUS 270927 CKT 1          / WILTO;4M 345 WILTO; R 345
 TRIP BRANCH FROM BUS 275233 TO BUS 275333 CKT 1          / WILTO;4M 345 WILTO;4C 33
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*1.03*
932012	*AC2-007 E*	*1.91*
932881	*AC2-115 1*	*2.91*
932891	*AC2-115 2*	*2.91*
932921	*AC2-116*	*1.02*
933361	*AC2-149 C*	*1.14*
933362	*AC2-149 E*	*1.85*
933381	*AC2-151 C*	*1.2*
933382	*AC2-151 E*	*1.96*
933411	*AC2-154 C*	*3.2*
933412	*AC2-154 E*	*5.22*
933431	*AC2-156 C*	*1.17*
933432	*AC2-156 E*	*1.9*
933511	*AC2-166 C*	*2.85*
933512	*AC2-166 E*	*3.15*
933911	*AD1-013 C O1*	*2.25*
933912	*AD1-013 E O1*	*3.59*
933931	*AD1-016 C*	*1.13*
933932	*AD1-016 E*	*1.85*
934101	*AD1-039 1*	*9.64*
934111	*AD1-039 2*	*9.82*
934401	*AD1-064 C O1*	*3.92*
934402	*AD1-064 E O1*	*18.33*
934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.67*
LTF	*AD1-092*	*13.85*
LTF	*AD1-093*	*23.92*
LTF	*AD1-094*	*4.64*
934651	*AD1-096 C*	*1.09*
934652	*AD1-096 E*	*1.78*
934701	*AD1-098 C O1*	*8.4*
934702	*AD1-098 E O1*	*6.13*

934721	*AD1-100 C*	*35.14*
934722	*AD1-100 E*	*164.52*
934871	*AD1-116 C*	*1.17*
934872	*AD1-116 E*	*1.92*
934941	*AD1-126 C*	*7.14*
934942	*AD1-126 E*	*4.76*
934971	*AD1-129 C*	*1.1*
934972	*AD1-129 E*	*0.73*
935001	*AD1-133 C O1*	*27.6*
935002	*AD1-133 E O1*	*18.4*
936181	*AD2-024 C O1*	*1.13*
936182	*AD2-024 E O1*	*1.85*
936291	*AD2-038 C O1*	*2.89*
936292	*AD2-038 E O1*	*19.32*
936371	*AD2-047 C O1*	*2.86*
936372	*AD2-047 E O1*	*30.82*
936461	*AD2-060*	*3.37*
936511	*AD2-066 C O1*	*10.35*
936512	*AD2-066 E O1*	*6.9*
936781	*AD2-101 C*	*6.07*
936782	*AD2-101 E*	*28.43*
936791	*AD2-102 C*	*14.69*
936792	*AD2-102 E*	*14.12*
936961	*AD2-130 C*	*1.92*
936962	*AD2-130 E*	*0.25*
937001	*AD2-134 C*	*3.34*
937002	*AD2-134 E*	*13.78*
937031	*AD2-137 C O1*	*7.26*
937032	*AD2-137 E O1*	*33.97*
937051	*AD2-140 C O1*	*7.62*
937052	*AD2-140 E O1*	*35.68*
937061	*AD2-141 C O1*	*7.58*
937062	*AD2-141 E O1*	*35.73*
937071	*AD2-142 C O1*	*15.24*
937072	*AD2-142 E O1*	*71.37*
937121	*AD2-148 C O1*	*4.76*
937122	*AD2-148 E O1*	*22.29*
937131	*AD2-149 C O1*	*4.76*
937132	*AD2-149 E O1*	*22.29*
937141	*AD2-150 C O1*	*4.76*
937142	*AD2-150 E O1*	*22.29*
937181	*AD2-155 C O1*	*4.76*
937182	*AD2-155 E O1*	*22.29*
937311	*AD2-172 C*	*3.01*
937312	*AD2-172 E*	*4.15*

937321	*AD2-175 C*	*22.19*
937322	*AD2-175 E*	*14.79*
937331	*AD2-176 C O1*	*8.95*
937332	*AD2-176 E O1*	*5.97*
937401	*AD2-194 C1*	*9.57*
937411	*AD2-194 C2*	*9.57*
LTF	*BLUEG*	*2.67*
LTF	*CALDERWOOD*	*0.06*
LTF	*CANNELTON*	*0.13*
LTF	*CARR*	*0.95*
LTF	*CATAWBA*	*0.35*
274890	*CAYUG;1U E*	*20.6*
274891	*CAYUG;2U E*	*20.6*
LTF	*CBM-S1*	*1.89*
LTF	*CBM-W1*	*74.34*
LTF	*CBM-W2*	*52.52*
LTF	*CELEVELAND*	*0.98*
LTF	*CHEOAH*	*0.07*
LTF	*CHILHOWEE*	*0.02*
LTF	*CLIFTY*	*15.96*
LTF	*DEARBORN*	*2.8*
LTF	*ELMERSMITH*	*0.25*
LTF	*G-007*	*2.58*
LTF	*GIBSON*	*< 0.01*
290051	*GSG-6; E*	*12.76*
LTF	*HAMLET*	*1.35*
275149	*KEMPTON ;1E*	*23.59*
290108	*LEEDK;1U E*	*29.64*
274770	*LINCOLN ;1U*	*3.88*
274771	*LINCOLN ;2U*	*3.88*
274772	*LINCOLN ;3U*	*3.88*
274773	*LINCOLN ;4U*	*3.88*
274774	*LINCOLN ;5U*	*3.88*
274775	*LINCOLN ;6U*	*3.88*
274776	*LINCOLN ;7U*	*3.88*
274777	*LINCOLN ;8U*	*3.88*
LTF	*MEC*	*46.75*
274850	*MENDOTA H;RU*	*6.59*
293061	*N-015 E*	*19.15*
LTF	*O-066*	*16.54*
293644	*O22 E1*	*12.57*
293645	*O22 E2*	*24.4*
290021	*O50 E*	*23.77*
294392	*P-010 E*	*24.33*
294763	*P-046 E*	*2.75*

274888	*PILOT HIL;1E*	*23.59*
274830	*PWR VTREC;1U*	*7.45*
274831	*PWR VTREC;2U*	*7.45*
296308	*R-030 C1*	*4.99*
296271	*R-030 C2*	*4.99*
296125	*R-030 C3*	*5.05*
296309	*R-030 E1*	*19.97*
296272	*R-030 E2*	*19.97*
296128	*R-030 E3*	*20.21*
LTF	*RENSSELAER*	*0.75*
LTF	*ROSETON*	*5.43*
LTF	*ROWAN*	*0.82*
LTF	*SANTEETLA*	*0.02*
295111	*SUBLETTE E*	*3.32*
LTF	*TRIMBLE*	*0.55*
299993	*U3-031C*	*11.52*
LTF	*WEC*	*9.76*
295109	*WESTBROOK E*	*6.83*
274687	*WILL CNTY;4U*	*81.89*
910542	*X3-005 E*	*0.9*
914641	*Y2-103*	*54.95*
915011	*Y3-013 1*	*4.58*
915021	*Y3-013 2*	*4.58*
915031	*Y3-013 3*	*4.58*
LTF	*Z1-043*	*35.51*
916502	*Z1-106 E1*	*1.54*
916504	*Z1-106 E2*	*1.54*
916512	*Z1-107 E*	*3.17*
916522	*Z1-108 E*	*3.04*
917501	*Z2-087 C*	*3.9*
917502	*Z2-087 E*	*26.11*
918051	*AA1-018 C*	*3.01*
918052	*AA1-018 E*	*20.16*
918972	*AA1-116 E*	*3.37*
918982	*AA1-117 E*	*3.37*
919591	*AA2-035*	*160.3*
920112	*AA2-107 E*	*3.*
920272	*AA2-123 E*	*2.98*
930481	*AB1-089*	*80.34*
930491	*AB1-090*	*80.34*
930501	*AB1-091*	*90.99*
930761	*AB1-122 1*	*88.67*
930771	*AB1-122 2*	*90.31*
931221	*AB1-172*	*0.98*
LTF	*AB2-013*	*19.94*

924041	*AB2-047 C O1*	*4.81*
924042	*AB2-047 E O1*	*32.22*
924471	*AB2-096*	*51.73*
925301	*AB2-191 C*	*1.54*
925302	*AB2-191 E*	*1.37*
925881	*AC1-067*	*167.37*
926311	*AC1-109 1*	*2.34*
926321	*AC1-109 2*	*2.34*
926331	*AC1-110 1*	*2.32*
926341	*AC1-110 2*	*2.32*
926351	*AC1-111 1*	*0.93*
926361	*AC1-111 2*	*0.93*
926371	*AC1-111 3*	*0.93*
926381	*AC1-111 4*	*0.93*
926391	*AC1-111 5*	*0.93*
926401	*AC1-111 6*	*0.93*
927511	*AC1-113 1*	*1.45*
927522	*AC1-113 2*	*1.45*
926431	*AC1-114*	*2.91*
927451	*AC1-142A 1*	*5.12*
927461	*AC1-142A 2*	*5.12*
926701	*AC1-153 C1*	*96.37*
926711	*AC1-153 C2*	*98.16*
926702	*AC1-153 E1*	*3.86*
926712	*AC1-153 E2*	*3.93*
927091	*AC1-204 1*	*88.99*
927101	*AC1-204 2*	*88.99*

Appendix 15

(CE - CE) The WILTON ; 765/345 kV transformer (from bus 275233 to bus 270644 ckt 1) loads from 155.31% to 155.51% (**DC power flow**) of its load dump rating (1379 MVA) for the line fault with failed breaker contingency outage of 'COMED_P4_112-65-BT2-3__'. This project contributes approximately 19.55 MW to the thermal violation.

```
CONTINGENCY 'COMED_P4_112-65-BT2-3__'
 TRIP BRANCH FROM BUS 270644 TO BUS 270607 CKT 1          / WILTO; 765 COLLI; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270644 CKT 1          / WILTO;3M 345 WILTO; 765
 TRIP BRANCH FROM BUS 275232 TO BUS 270926 CKT 1          / WILTO;3M 345 WILTO; B 345
 TRIP BRANCH FROM BUS 275232 TO BUS 275332 CKT 1          / WILTO;3M 345 WILTO;3C 33
 END
```

Bus Number	*Bus Name*	*Full Contribution*
932011	*AC2-007 C*	*1.05*
932012	*AC2-007 E*	*1.95*
932881	*AC2-115 1*	*2.97*
932891	*AC2-115 2*	*2.97*
932921	*AC2-116*	*1.04*
932931	*AC2-117*	*6.63*
933341	*AC2-147 C*	*1.09*
933342	*AC2-147 E*	*1.78*
933361	*AC2-149 C*	*1.16*
933362	*AC2-149 E*	*1.89*
933381	*AC2-151 C*	*1.23*
933382	*AC2-151 E*	*2.*
933411	*AC2-154 C*	*3.27*
933412	*AC2-154 E*	*5.33*
933431	*AC2-156 C*	*1.19*
933432	*AC2-156 E*	*1.94*
933511	*AC2-166 C*	*2.91*
933512	*AC2-166 E*	*3.21*
933911	*AD1-013 C O1*	*2.29*
933912	*AD1-013 E O1*	*3.67*
933931	*AD1-016 C*	*1.16*
933932	*AD1-016 E*	*1.89*
934101	*AD1-039 1*	*9.84*
934111	*AD1-039 2*	*10.03*
934401	*AD1-064 C O1*	*4.*
934402	*AD1-064 E O1*	*18.72*
934431	*AD1-067 C*	*0.16*
934432	*AD1-067 E*	*0.69*
LTF	*AD1-092*	*14.14*
LTF	*AD1-093*	*24.43*
LTF	*AD1-094*	*4.74*
934651	*AD1-096 C*	*1.11*

934652	*AD1-096 E*	*1.82*
934701	*AD1-098 C O1*	*8.58*
934702	*AD1-098 E O1*	*6.26*
934721	*AD1-100 C*	*35.83*
934722	*AD1-100 E*	*167.76*
934871	*AD1-116 C*	*1.2*
934872	*AD1-116 E*	*1.96*
934881	*AD1-117 C*	*6.71*
934882	*AD1-117 E*	*4.47*
934941	*AD1-126 C*	*7.29*
934942	*AD1-126 E*	*4.86*
934971	*AD1-129 C*	*1.13*
934972	*AD1-129 E*	*0.75*
935001	*AD1-133 C O1*	*28.18*
935002	*AD1-133 E O1*	*18.78*
936181	*AD2-024 C O1*	*1.16*
936182	*AD2-024 E O1*	*1.89*
936291	*AD2-038 C O1*	*2.95*
936292	*AD2-038 E O1*	*19.73*
936371	*AD2-047 C O1*	*2.92*
936372	*AD2-047 E O1*	*31.47*
936461	*AD2-060*	*3.44*
936511	*AD2-066 C O1*	*10.57*
936512	*AD2-066 E O1*	*7.04*
936781	*AD2-101 C*	*6.2*
936782	*AD2-101 E*	*29.02*
936791	*AD2-102 C*	*15.01*
936792	*AD2-102 E*	*14.42*
936961	*AD2-130 C*	*1.96*
936962	*AD2-130 E*	*0.26*
937001	*AD2-134 C*	*3.41*
937002	*AD2-134 E*	*14.08*
937031	*AD2-137 C O1*	*7.39*
937032	*AD2-137 E O1*	*34.6*
937051	*AD2-140 C O1*	*7.76*
937052	*AD2-140 E O1*	*36.34*
937061	*AD2-141 C O1*	*7.72*
937062	*AD2-141 E O1*	*36.38*
937071	*AD2-142 C O1*	*15.52*
937072	*AD2-142 E O1*	*72.68*
937121	*AD2-148 C O1*	*4.86*
937122	*AD2-148 E O1*	*22.74*
937131	*AD2-149 C O1*	*4.86*
937132	*AD2-149 E O1*	*22.74*
937141	*AD2-150 C O1*	*4.86*

937142	*AD2-150 E O1*	*22.74*
937181	*AD2-155 C O1*	*4.86*
937182	*AD2-155 E O1*	*22.74*
937311	*AD2-172 C*	*3.07*
937312	*AD2-172 E*	*4.24*
937321	*AD2-175 C*	*22.63*
937322	*AD2-175 E*	*15.09*
937331	*AD2-176 C O1*	*9.14*
937332	*AD2-176 E O1*	*6.09*
937401	*AD2-194 C1*	*9.77*
937411	*AD2-194 C2*	*9.77*
LTF	*BLUEG*	*2.73*
LTF	*CALDERWOOD*	*0.06*
LTF	*CANNELTON*	*0.13*
LTF	*CARR*	*0.97*
LTF	*CATAWBA*	*0.36*
274890	*CAYUG;1U E*	*21.01*
274891	*CAYUG;2U E*	*21.01*
LTF	*CBM-S1*	*1.93*
LTF	*CBM-W1*	*75.93*
LTF	*CBM-W2*	*53.61*
LTF	*CELEVELAND*	*1.*
LTF	*CHEOAH*	*0.07*
LTF	*CHILHOWEE*	*0.02*
LTF	*CLIFTY*	*16.31*
LTF	*DEARBORN*	*2.86*
LTF	*ELMERSMITH*	*0.26*
LTF	*G-007*	*2.63*
LTF	*GIBSON*	*0.01*
290051	*GSG-6; E*	*13.03*
LTF	*HAMLET*	*1.38*
275149	*KEMPTON ;1E*	*24.08*
290108	*LEEDK;1U E*	*30.27*
274770	*LINCOLN ;1U*	*3.98*
274771	*LINCOLN ;2U*	*3.98*
274772	*LINCOLN ;3U*	*3.98*
274773	*LINCOLN ;4U*	*3.98*
274774	*LINCOLN ;5U*	*3.98*
274775	*LINCOLN ;6U*	*3.98*
274776	*LINCOLN ;7U*	*3.98*
274777	*LINCOLN ;8U*	*3.98*
LTF	*MEC*	*47.74*
274850	*MENDOTA H;RU*	*6.73*
293061	*N-015 E*	*19.56*
LTF	*O-066*	*16.89*

293644	*O22 E1*	*12.83*
293645	*O22 E2*	*24.91*
290021	*O50 E*	*24.28*
294392	*P-010 E*	*24.84*
294763	*P-046 E*	*11.7*
274888	*PILOT HIL;1E*	*24.08*
274830	*PWR VTREC;1U*	*7.61*
274831	*PWR VTREC;2U*	*7.61*
296308	*R-030 C1*	*5.09*
296271	*R-030 C2*	*5.09*
296125	*R-030 C3*	*5.15*
296309	*R-030 E1*	*20.37*
296272	*R-030 E2*	*20.37*
296128	*R-030 E3*	*20.61*
LTF	*RENSSELAER*	*0.77*
LTF	*ROSETON*	*5.54*
LTF	*ROWAN*	*0.84*
LTF	*SANTEETLA*	*0.02*
295111	*SUBLETTE E*	*3.39*
LTF	*TRIMBLE*	*0.56*
299993	*U3-031C*	*11.82*
903433	*W3-046*	*30.03*
LTF	*WEC*	*9.97*
295109	*WESTBROOK E*	*6.98*
274687	*WILL CNTY;4U*	*83.63*
910542	*X3-005 E*	*0.92*
914641	*Y2-103*	*56.13*
915011	*Y3-013 1*	*4.68*
915021	*Y3-013 2*	*4.68*
915031	*Y3-013 3*	*4.68*
LTF	*Z1-043*	*36.26*
916502	*Z1-106 E1*	*1.58*
916504	*Z1-106 E2*	*1.58*
916512	*Z1-107 E*	*3.23*
916522	*Z1-108 E*	*3.1*
917501	*Z2-087 C*	*3.98*
917502	*Z2-087 E*	*26.64*
918051	*AA1-018 C*	*3.08*
918052	*AA1-018 E*	*20.6*
918972	*AA1-116 E*	*3.44*
918982	*AA1-117 E*	*3.44*
919591	*AA2-035*	*163.71*
920112	*AA2-107 E*	*3.06*
920272	*AA2-123 E*	*3.05*
930481	*AB1-089*	*82.05*

930491	*AB1-090*	*82.05*
930501	*AB1-091*	*92.91*
930761	*AB1-122 1*	*90.55*
930771	*AB1-122 2*	*92.23*
931221	*AB1-172*	*1.*
LTF	*AB2-013*	*20.36*
924041	*AB2-047 C O1*	*4.91*
924042	*AB2-047 E O1*	*32.87*
924471	*AB2-096*	*52.84*
925301	*AB2-191 C*	*1.58*
925302	*AB2-191 E*	*1.4*
925881	*AC1-067*	*171.09*
926311	*AC1-109 1*	*2.39*
926321	*AC1-109 2*	*2.39*
926331	*AC1-110 1*	*2.37*
926341	*AC1-110 2*	*2.37*
926351	*AC1-111 1*	*0.95*
926361	*AC1-111 2*	*0.95*
926371	*AC1-111 3*	*0.95*
926381	*AC1-111 4*	*0.95*
926391	*AC1-111 5*	*0.95*
926401	*AC1-111 6*	*0.95*
927511	*AC1-113 1*	*1.48*
927522	*AC1-113 2*	*1.48*
926431	*AC1-114*	*2.97*
927451	*AC1-142A 1*	*5.23*
927461	*AC1-142A 2*	*5.23*
926701	*AC1-153 C1*	*98.42*
926711	*AC1-153 C2*	*100.25*
926702	*AC1-153 E1*	*3.94*
926712	*AC1-153 E2*	*4.01*
927531	*AC1-185 1*	*0.22*
927541	*AC1-185 2*	*0.22*
927551	*AC1-185 3*	*0.22*
927561	*AC1-185 4*	*0.22*
927571	*AC1-185 5*	*0.22*
927581	*AC1-185 6*	*0.22*
927591	*AC1-185 7*	*0.22*
927601	*AC1-185 8*	*0.22*
927091	*AC1-204 1*	*90.89*
927101	*AC1-204 2*	*90.89*