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Midcontinent ISO
Affected System Impact Study

Prepared for: **Midcontinent ISO**

Prepared by: **Quanta Technology, LLC**

Contacts: **Ed Pfeiffer**
epfeiffer@quanta-technology.com
919 334 3054

Xiaohuan Tan
xtan@quanta-technology.com
919 334 3073

Table of Contents

List of Tables

1 Executive Summary

This report documents the system thermal impacts of thirty-four (34) projects in the PJM generator interconnection queue on the Midcontinent Independent System Operator ("MISO") transmission system, with a proposed combined maximum output of 7,477.2 MW.

The linear transfer analysis (DC analysis) did not identify any steady state thermal violations with the interconnection of the thirty-four PJM projects on the monitored MISO transmission system based on a standard FCITC calculation using a 3% TDF cutoff.

2 Study Methodology & Assumptions

2.1 Study Criteria

All interconnection requirements are based on the applicable MISO Transmission Planning Criteria and NERC Reliability Standards. The criteria used in this study are shown in Table 2-1.

Table 2-1 Planning Criteria Requirements

System Event	Steady State Thermal
Category A Intact System	All transmission facilities <100% of Normal Seasonal Rating (Rate A)
Category B Single Contingency	All transmission facilities <100% of Emergency Seasonal Rating (Rate B)
Category B Single Contingency	At 100% of the combined capacity of the all queue entries, no overloads for which MW impact of the queue injection exceeds 20% of the Emergency Seasonal Rating (Rate B)
Category C / D Selected Multiple Contingencies & Extreme Events	Violations of Category B Criteria will be noted.

2.2 Base Case Development

All steady state analysis performed in this study was based on the following 2016 and 2023 summer peak ("SPK") and shoulder peak ("SH") base cases provided by MISO:

- BaseCase-DPP-Feb13_2016SH_050813_v33.sav
- BaseCase-DPP-Feb13_2016spk_050813_v33.sav
- BaseCase-DPP-Feb13_2023SH_050813_v33.sav
- BaseCase-DPP-Feb13_2023SPK_050813_v33.sav

The detail of each PJM interconnection request is listed in Table 2-2. Wind-based generation was dispatched at 20% of requested maximum MW output in the SPK condition and 100% of nameplate in the SH condition. Generations of other fuel types were modeled at 100% of their nameplate capacity. All PJM interconnection requests were dispatched to the PJM system.

Table 2-2 PJM Generation Interconnection Projects Studied

PJM Queue Entry	PJM Substation	State	Max-Output (MW)	Fuel Type
S73	Lincoln – North Delphos 138kV	IN	200.0	wind
T130	Convoy – East Lima 345kV	OH	300.0	wind
T131	Lincoln – Sterling 138kV	OH	150.0	wind
T142	Southwest Lima – Marysville 345kV	OH	300.0	wind
T143	Hennepin 138kV	IL	250.0	wind
T148	Caledonia Wind II 100 MW	IL	100.0	wind
T94	Cook – Palesades 345kV	MI	1035.0	natural gas
T99	Caledonia Wind 100 MW	IL	100.0	wind
U1-049	Kankakee #4 138kV	IL	100.0	wind
U2-028A_AT1	Ironville 138kV	OH	135.0	other
U2-072	East Lima – Marysville 345kV	OH	300.0	wind
U3-021	Silver Lake – Cherry Valley 345kV	IL	100.0	natural gas
U4-027	Normandy-Kewanee 138kV	IL	100.0	natural gas
V1-011	Haviland 138kV	OH	100.0	wind
V1-012	Haviland 138kV	OH	150.0	wind
V2-006	East Leipsic 138kV	OH	150.0	wind
V2-042A_AT2	Galion 138kV	OH	200.0	wind
V3-007	Desoto-Tanners Creek #1 345kV	IN	200.0	wind
V3-008	Desoto-Tanners Creek #1 345kV	IN	200.0	wind
V3-009	Desoto-Tanners Creek #1 345kV	IN	200.0	wind
V3-053	Desoto 138kV	IN	150.0	wind
V4-010	Tiffin Center 138kV	OH	200.0	wind
V4-015	Fostoria Central 138kV	OH	66.6	wind
V4-016	Valley 138kV	MI	200.0	wind
W1-070A_AT4	Ashtabula 138kV	OH	50.0	wind
W1-072A_AT5	Lemoyne 345kV	OH	40.0	natural gas
W2-001	Fostoria Central 138kV	OH	66.6	wind
W3-059A_At6	Avery – Greenfield 138kV	OH	99.0	wind
W3-088	South West Lima 345kV	OH	200.0	wind
W3-128	Sporn – Waterford 345kV	OH	652.0	natural gas
W3-170	Buckskin 69kV	OH	12.0	solar
X1-027A_AT12	Davis Besse – Beaver 345kV	OH	500.0	wind
Y1-006	Jubal Early – Austinville 138kV	VA	72.0	wind
Y1-069	Bay Shore – Fostoria Central 345kV	OH	799.0	natural gas
Total			**7,477.2**	

2.3 Study Methodology

The steady state analysis was performed to identify the thermal violations on the MISO system caused by the PJM interconnection projects. Linear transfer analysis was performed using the Linear Transfer Analysis modules of the version 11.0.1 of the Managing and Utilizing System Transmission (MUST, Version 11.0.1) program from Siemens Power Technologies, Inc (PTI). AC power flow solutions to verify constraints identified in the linear analysis were performed using the Power Flow module of the Power System Simulation/Engineering-33 (PSS/E, Version 33) program from PTI. These programs are accepted industry-wide for power flow analysis.

The study region defined in the monitoring file that MISO provided includes:

Table 2-3 Study Region

Area #	Area ID	Area Name	Subsystem
208	DEI	Duke Energy Indiana	STUDY_CENTRAL
210	SIGE	Southern Indiana Gas & Electric Company	
216	IPL	Indianapolis Power & Light Company	
217	NIPS	Northern Indiana Public Service Company	
333	CWLD	Columbia, MO Water and Light	
356	AMMO	Ameren Missouri	
357	AMIL	Ameren Illinois	
360	CWLP	City of Springfield (IL) Water Light & Power	
361	SIPC	Southern Illinois Power Cooperative	
222	CE	Commonwealth Edison	STUDY_SEAMS
330	AECI	Associated Electric Cooperative Inc.	
540	GMO	Greater Missouri Operations Company	
541	KCPL	Kansas City Power and Light Company	
542	KACY	Board of Public Utilities	
545	INDN	City of Independence	
640	NPPD	Nebraska Public Power District	
645	OPPD	Omaha Public Power District	
650	LES	Lincoln Electric System, NE	
652	WAPA	Western Area Power Administration	
295	WEC	Wisconsin Electric Power Company (ATC)	STUDY_WEST
600	XEL	Xcel Energy North	
608	MP	Minnesota Power & Light	
613	SMMPA	Southern Minnesota Municipal Power Association	
615	GRE	Great River Energy	
620	OTP	Otter Tail Power Company	
627	ALTW	Alliant Energy West	
633	MPW	Muscatine Power & Water	

Area #	Area ID	Area Name	Subsystem
635	MEC	MidAmerican Energy	
661	MDU	Montana-Dakota Utilities Co.	
667	MHEB	Manitoba Hydro	
680	DPC	Dairyland Power Cooperative	
694	ALTE	Alliant Energy East (ATC)	
696	WPC	Wisconsin Public Service Corporation (ATC)	
697	MGE	Madison Gas and Electric Company (ATC)	
698	UPPC	Upper Peninsula Power Company (ATC)	

All facilities in the study region with a voltage of 69kV and above were monitored. The MISO provided contingencies include single branch, single unit, and selected multi-element contingencies on facilities in the study region and part of the surrounding control areas.

Thermal overloads were identified using linear transfer with DC power flow solutions to evaluate the intact system, N-1 contingency and certain multiple contingency conditions. Transmission reserve margin ("TRM") is not used (i.e., 0% TRM) in the analysis.

The MISO Business Practices Manual states that for NERC Category B contingencies, all study region facilities with powers flows above the rated limits and TDFs (Transfer Distribution Factors) of greater than 5% were flagged as violations for both system intact conditions and under contingencies. The MISO criteria used to determine constraints refer to all thermal overloads with DF $\geq$ 5 % under system intact conditions, or DF $\geq$ 20% under Category B contingency, an overload of a generator outlet or an overload caused by the outage of a generator outlet, or the MW impact due to the study generation is $\geq$ 20% of the overloaded facility ratings.

For NERC category C contingencies, all study region facilities with powers flows 25% above the rated limits, or TDFs $\geq$ 3%, or the MW impact $\geq$ 20% of the overloaded facility applicable rating were flagged as potential constraints for further review.

The system impact analysis performed in this group study was a traditional FCITC calculation using a source consisting of all of the queued projects and a sink modeled as the whole of PJM. The full nameplate capacity of the PJM queue projects was modeled as the source in the SH cases and the rated deliverable capacity was modeled as the source in the SPK cases. The MUST runs used a 3% TDF cutoff.

2.4 Study Assumptions

This affected system impact study was conducted with all the PJM participating generators operating together as a group. Analysis was not performed on individual generating units or subsets of the generating units unless specifically noted otherwise. The results obtained in this analysis will change if any of the data or assumptions which were made during the development of the study models is revised.

3 Power Flow Analysis Results

3.1 Thermal Results by DC Analysis

3.1.1 2016 Results

No thermal violations attributed to the PJM interconnection requests were identified in MISO system under the 2016 SPK nor SH condition by the DC transfer analysis using the DF cutoff criterion.

3.1.2 2023 Results

No thermal violations attributed to the PJM interconnection requests were identified in MISO system under the 2023 SPK nor SH condition by the DC transfer analysis using the DF cutoff criterion.

3.2 Thermal Results by AC Analysis

As there was no FCITC binding contingency and thermal violation pairs identified in the study region by the DC analysis, no AC analysis was performed to verify the contingency/monitor pairs.

4 Conclusions

The linear transfer analysis (DC analysis) did not identify any steady state thermal violations with the interconnection of the thirty-four PJM projects on the monitored MISO transmission system using a 3% TDF cutoff criterion.

Appendix A Steady State Analysis Input Files

A.1 Subsystem File

Following subsystem definitions were used in the MUST linear transfer analysis.

```
/ For DPP August Cycle study
/ updated U3-021 and U2-072 on 7/8/2013

SUBSYSTEM 'STUDY_CENTRAL'
   AREA 333 / cwld
   AREA 356 / AMMO
   AREA 357 / AMIL
   AREA 217 / NIPS
   AREA 208 / DEM
   AREA 210 / SIGE
   AREA 216 / IPL
   AREA 360 / CWLP
   AREA 361 / SIPC
END

SUBSYSTEM 'STUDY_WEST'
   AREA 295 / WEC
   AREA 600 / XEL
   AREA 608 / MP
   AREA 613 / SMMPA
   AREA 615 / GRE
   AREA 620 / OTP
   AREA 627 / ALTW
   AREA 633 / MPW
   AREA 635 / MEC
       AREA 661   / mdu
   AREA 680 / DPC
   AREA 694 / ALTE
   AREA 696 / WPS
   AREA 697 / MGE
   AREA 698 / UPPC
END

Subsystem 'STUDY_SEAMS'
/   AREA 222 / CE
   AREA 330 / AECI
   AREA 640 / NPPD
   AREA 645 / OPPD
   AREA 650 / LES
   AREA 652 / WAPA
   AREA 540 / MIPU
   AREA 541 / KCPL
   AREA 542 / KACY
   AREA 545 / INDN
```


```
end

Subsystem 'CENTRAL_SEAMS'
      AREA 333    / CWLD
   AREA 356 / AMMO
   AREA 357 / AMIL
   AREA 222 / CE
   AREA 330 / AECI
   AREA 640 / NPPD
   AREA 645 / OPPD
   AREA 650 / LES
   AREA 652 / WAPA
end

SUBSYSTEM PJM_im
      AREAS 201 209
      AREAS 222 235
      scale ALL for import
END

subsystem   s-073
      participate include offline
      bus   884501      160
      bus   884502      40
      end
end
subsystem   t-094
      participate include offline
      bus   885601      1035
      end
end
subsystem   t-099
      participate include offline
      bus   885611      20
      bus   885612      80
      end
end
subsystem   t-130
      participate include offline
      bus   885621      60
      bus   885622      240
      end
end
subsystem   t-131
      participate include offline
      bus   885631      30
      bus   885632      120
      end
end
subsystem   t-142
      participate include offline
      bus   885641      60
```


```
      bus   885642      240
      end
end
subsystem   t-143
      participate include offline
      bus   885651      50
      bus   885652      200
      end
end
subsystem   t-148
      participate include offline
      bus   885661      20
      bus   885662      80
      end
end
subsystem   u1-049
      participate include offline
      bus   887601      13
      bus   887602      87
      end
end
subsystem   u2-028a
      participate include offline
      bus   889001      135
      end
end

/* Withdrew 07/08/2013
subsystem   u2-062
      participate include offline
      bus   889031      12.2
      bus   889032      81.8
      bus   889041      12.2
      bus   889042      81.8
      end
end

subsystem   u2-072
      participate include offline
      bus   889031      39
      bus   889032      261
      end
end
subsystem   u3-021
      participate include offline
      bus   890511      50
      bus   890501      50
      end
end
subsystem   u4-027
      participate include offline
      bus   891001      100
```

```
      end
end
subsystem   v1-011
      participate include offline
      bus   892001      13
      bus   892002      87
      end
end
subsystem   v1-012
      participate include offline
      bus   892011      19.5
      bus   892012      130.5
      end
end
subsystem   v2-006
      participate include offline
      bus   893011      19.5
      bus   893012      130.5
      end
end
subsystem   v2-042a
      participate include offline
      bus   893000      26
      bus   893001      174
      end
end
subsystem   v3-007
      participate include offline
      bus   894501      26
      bus   894502      174
      end
end
subsystem   v3-008
      participate include offline
      bus   894511      26
      bus   894512      174
      end
end
subsystem   v3-009
      participate include offline
      bus   894521      26
      bus   894522      174
      end
end
subsystem   v3-053
      participate include offline
      bus   894540      19.5
      bus   894541      130.5
      end
end
subsystem   v4-010
      participate include offline
```

```
      bus   900001      26
      bus   900002      174
      end
end
subsystem   v4-015
      participate include offline
      bus   900011      8.6
      bus   900012      58
      end
end
subsystem   v4-016
      participate include offline
      bus   900021      26
      bus   900022      174
      end
end
subsystem   w1-070a-at4
      participate include offline
      bus   901001      6.5
      bus   901002      43.5
      end
end
subsystem   w1-072a_at5
      participate include offline
      bus   901011      40
      end
end
subsystem   w2-001
      participate include offline
      bus   902141      8.6
      bus   902142      58
      end
end
subsystem   w3-059a_at6
      participate include offline
      bus   903201      12.9
      bus   903202      86.1
      end
end
subsystem   w3-088
      participate include offline
      bus   903211      26
      bus   903212      174
      end
end
subsystem   w3-128
      participate include offline
      bus   903221      652
      end
end
subsystem   w3-170
      participate include offline
```

```
      bus   903232      12
      end
end
subsystem   x1-027a
      participate include offline
      bus   907001      65
      bus   907002      435
      end
end
subsystem   y1-006
      participate include offline
      bus   913001      9.36
      bus   913002      62.64
      end
end
subsystem   y1-069
      participate include offline
      bus   913011      799
      end
end
subsystem ICQ_Total_SH
      participate include offline
      subsystem   s-073       200
      subsystem   t-094       1035
      subsystem   t-099       100
      subsystem   t-130       300
      subsystem   t-131       150
      subsystem   t-142       300
      subsystem   t-143       250
      subsystem   t-148       100
      subsystem   u1-049      100
      subsystem   u2-028a     135
      subsystem   u2-072      300
      subsystem   u3-021      100
      subsystem   u4-027      100
      subsystem   v1-011      100
      subsystem   v1-012      150
      subsystem   v2-006      150
      subsystem   v2-042a     200
      subsystem   v3-007      200
      subsystem   v3-008      200
      subsystem   v3-009      200
      subsystem   v3-053      150
      subsystem   v4-010      200
      subsystem   v4-015      66.6
      subsystem   v4-016      200
      subsystem   w1-070a-at4 50
      subsystem   w1-072a_at5 40
      subsystem   w2-001      66.6
      subsystem   w3-059a_at6 99
      subsystem   w3-088      200
      subsystem   w3-128      652
```


```
      subsystem   w3-170      12
      subsystem   x1-027a     500
      subsystem   y1-006      72
      subsystem   y1-069      799
      end
end
/
/subsystems for on peak studies
/
subsystem   s-073_op
      participate include offline
      bus   884502      40
      end
end
subsystem   t-094_op
      participate include offline
      bus   885601      1035
      end
end
subsystem   t-099_op
      participate include offline
      bus   885611      20
      end
end
subsystem   t-130_op
      participate include offline
      bus   885621      60
      end
end
subsystem   t-131_op
      participate include offline
      bus   885631      30
      end
end
subsystem   t-142_op
      participate include offline
      bus   885641      60
      end
end
subsystem   t-143_op
      participate include offline
      bus   885651      50
      end
end
subsystem   t-148_op
      participate include offline
      bus   885661      20
      end
end
subsystem   u1-049_op
      participate include offline
      bus   887601      13
```

```
      end
end
subsystem   u2-028a_op
      participate include offline
      bus   889001      135
      end
end
subsystem   u2-072_op
      participate include offline
      bus   889031      39
      end
end
subsystem   u3-021_op
      participate include offline
      bus   890511      50
      bus   890501      50
      end
end
subsystem   u4-027_op
      participate include offline
      bus   891001      100
      end
end
subsystem   v1-011_op
      participate include offline
      bus   892001      13
      end
end
subsystem   v1-012_op
      participate include offline
      bus   892011      19.5
      end
end
subsystem   v2-006_op
      participate include offline
      bus   893011      19.5
      end
end
subsystem   v2-042a_op
      participate include offline
      bus   893000      26
      end
end
subsystem   v3-007_op
      participate include offline
      bus   894501      26
      end
end
subsystem   v3-008_op
      participate include offline
      bus   894511      26
      end
```


```
end
subsystem   v3-009_op
      participate include offline
      bus   894521      26
      end
end
subsystem   v3-053_op
      participate include offline
      bus   894540      19.5
      end
end
subsystem   v4-010_op
      participate include offline
      bus   900001      26
      end
end
subsystem   v4-015_op
      participate include offline
      bus   900011      8.6
      end
end
subsystem   v4-016_op
      participate include offline
      bus   900021      26
      end
end
subsystem   w1-070a-at4_op
      participate include offline
      bus   901001      6.5
      end
end
subsystem   w1-072a_at5_op
      participate include offline
      bus   901011      40
      end
end
subsystem   w2-001_op
      participate include offline
      bus   902141      8.6
      end
end
subsystem   w3-059a_at6_op
      participate include offline
      bus   903201      12.9
      end
end
subsystem   w3-088_op
      participate include offline
      bus   903211      26
      end
end
subsystem   w3-128_op
```

```
      participate include offline
      bus   903221      652
      end
end
subsystem   w3-170_op
      participate include offline
      bus   903232      12
      end
end
subsystem   x1-027a_op
      participate include offline
      bus   907001      65
      end
end
subsystem   y1-006_op
      participate include offline
      bus   913001      9.36
      end
end
subsystem   y1-069_op
      participate include offline
      bus   913011      799
      end
end
subsystem ICQ_Total_SPK
      participate include offline
      subsystem   s-073_op    40
      subsystem   t-094_op    1035
      subsystem   t-099_op    20
      subsystem   t-130_op    60
      subsystem   t-131_op    30
      subsystem   t-142_op    60
      subsystem   t-143_op    50
      subsystem   t-148_op    20
      subsystem   u1-049_op   13
      subsystem   u2-028a_op  135
      subsystem   u2-072_op   39
      subsystem   u3-021_op   100
      subsystem   u4-027_op   100
      subsystem   v1-011_op   13
      subsystem   v1-012_op   19.5
      subsystem   v2-006_op   19.5
      subsystem   v2-042a_op  26
      subsystem   v3-007_op   26
      subsystem   v3-008_op   26
      subsystem   v3-009_op   26
      subsystem   v3-053_op   19.5
      subsystem   v4-010_op   26
      subsystem   v4-015_op   8.6
      subsystem   v4-016_op   26
      subsystem   w1-070a-at4_op    6.5
      subsystem   w1-072a_at5_op    40
```

```
      subsystem   w2-001_op   8.6
      subsystem   w3-059a_at6_op    12.9
      subsystem   w3-088_op   26
      subsystem   w3-128_op   652
      subsystem   w3-170_op   12
      subsystem   x1-027a_op  65
      subsystem   y1-006_op   9.36
      subsystem   y1-069_op   799
      end
end
END
```

A.2 Monitored Element File

Following monitored element definitions were used in the MUST linear transfer analysis.

```
monitor branches in subsystem 'STUDY_CENTRAL' in kvrange 60 800
monitor ties   from subsystem 'STUDY_CENTRAL' in kvrange 60 800
com ========ATC 69kV above============
monitor branches in area 295 in kvrange 60 800
monitor ties   from area 295 in kvrange 60 800
monitor branches in area 694 in kvrange 60 800
monitor ties   from area 694 in kvrange 60 800
monitor branches in area 696 in kvrange 60 800
monitor ties   from area 696 in kvrange 60 800
monitor branches in area 697 in kvrange 60 800
monitor ties   from area 697 in kvrange 60 800
monitor branches in area 698 in kvrange 60 800
monitor ties   from area 698 in kvrange 60 800
/==================================
monitor branches in area 600 in kvrange 60 800
monitor ties   from area 600 in kvrange 60 800
monitor branches in area 608 in kvrange 60 800
monitor ties   from area 608 in kvrange 60 800
monitor branches in area 613 in kvrange 60 800
monitor ties   from area 613 in kvrange 60 800
monitor branches in area 615 in kvrange 60 800
monitor ties   from area 615 in kvrange 60 800
monitor branches in area 620 in kvrange 40 800
monitor ties   from area 620 in kvrange 40 800
monitor branches in area 627 in kvrange 60 800
monitor ties   from area 627 in kvrange 60 800
monitor branches in area 633 in kvrange 60 800
monitor ties   from area 633 in kvrange 60 800
```

```
monitor branches in area 635 in kvrange 60 800
monitor ties   from area 635 in kvrange 60 800
monitor branches in area 661 in kvrange 57 800
monitor ties   from area 661 in kvrange 57 800
monitor branches in area 667 in kvrange 60 800
monitor ties   from area 667 in kvrange 60 800
monitor branches in area 680 in kvrange 60 800
monitor ties   from area 680 in kvrange 60 800

com subsystem seams
monitor branches in subsystem 'STUDY_SEAMS' in kvrange 60 800
monitor ties   from subsystem 'STUDY_SEAMS' in kvrange 60 800
```

A.3 Contingency Files

The following three master contingency files were supplied by MISO and applied to the 2016 SPK and SH conditions without any modification.

- 2015-DPP_Aug-Cycle_Master-B_Central_rev0.con

```
SINGLE BRANCH IN SUBSYSTEM 'STUDY_CENTRAL'
SINGLE UNIT OUTAGE IN SUBSYSTEM 'STUDY_CENTRAL'
SINGLE BRANCH IN SUBSYSTEM 'STUDY_SEAMS'
SINGLE TIE FROM SUBSYSTEM 'CENTRAL_SEAMS'
SINGLE UNIT OUTAGE IN SUBSYSTEM 'STUDY_SEAMS'
include '.\2015\2015-CatB\BREC_2014S_Cat-B_06122012_Explicit.con'
include '.\2015\2015-CatB\DEI_2014S_CatB_06122012_Explicit.con'
INCLUDE '.\2015\2015-CatB\HE_2014S_Cat-B_06122012_Explicit.con'
INCLUDE '.\2015\2015-CatB\IPL_2014_Cat-B_06122012_Explicit.con'
INCLUDE '.\2015\2015-CatB\SIGE_2014_Cat-B_06122012.con'
INCLUDE '.\2015\2015-CatB\NIPS_2015_CatB.con'
INCLUDE '.\2015\2015-CatB\B_explicit_AMRN_2015.con'
INCLUDE '.\2015\2015-CatB\B_explicit_AMRN_2017S_fixed.con'
INCLUDE '.\2015\2015-CatB\B_Explicit_SIPC_2017_MISO.con'
INCLUDE '.\2015\2015-CatB\CWLP_MTEP12_CatB.con'
INCLUDE '.\PJM\21S_RFC-PJM_Study_Cat-B1-B2-B3_R1.con'
INCLUDE '.\PJM\ComEd_RTEP_Cat_B.con'
```

- 2015-DPP_Aug-Cycle_Master-B_West_rev0.con

```
SINGLE BRANCH IN SUBSYSTEM 'STUDY_WEST'
SINGLE TIE FROM SUBSYSTEM 'STUDY_WEST'
SINGLE UNIT OUTAGE IN SUBSYSTEM 'STUDY_WEST'
INCLUDE '.\2015\2015west\2015_ATC_DPP_August_2012_B1_fixed.con'
INCLUDE '.\2015\2015west\2015_ATC_DPP_August_2012_B2_B3_fixed.con'
include '.\2015\2015west\GRE_CONS_B.con'
include '.\2015\2015west\MDU-CON-CAT-B_fixed.con'
```

```
include '.\2015\2015west\MP_CONS_B.con'
include '.\2015\2015west\MRES_MTEP12_Cat-B_edits.con'
include '.\2015\2015west\MTEP12_2017_DPC_Cat_B.con'
include '.\2015\2015west\MTEP12_2017_ITCM_Cat_B_fixed.con'
include '.\2015\2015west\MTEP12_2017_MEC_Cat_B.con'
include '.\2015\2015west\MTEP12_2017_MPW_Cat_B.con'
include '.\2015\2015west\MTEP12_2017_Xcel_Cat_B_fixed.con'
include '.\2015\2015west\OTP_CONS_B_Updated.con'
include '.\2015\2015west\Selected_MDU_CONS_B.con'
include '.\2015\2015west\SMPA_CONS_B.con'
```

- 2015-DPP_Aug-Cycle_Master-C-Single_rev0.con

```
INCLUDE '.\2015\2015west\ATC_MTEP12_2017_C1_C2_fixed.con'
INCLUDE '.\2015\2015west\ATC_MTEP12_2017_C5_fixed.con'
include '.\2015\2015west\ATC_MTEP12_2017_C9_fixed.con'
include '.\2015\2015west\ATC_MTEP12_auto_C3_for_cat_C1_C2_fixed.con'
include '.\2015\2015west\GRE_CONS_C_fixed.con'
include '.\2015\2015west\IS_2017_CAT_C_fixed.con'
include '.\2015\2015west\MDU_CONS_C1.con'
include '.\2015\2015west\MDU-CON-CAT-C_fixed.con'
include '.\2015\2015west\MP_CONS_C_fixed.con'
include '.\2015\2015west\MRES_CONS_C_Updated_fixed.con'
include '.\2015\2015west\MTEP12_2017_DPC_Cat_C.con'
include '.\2015\2015west\MTEP12_2017_ITCM_Cat_C_fixed.con'
include '.\2015\2015west\MTEP12_2017_MEC_Cat_C1_C2_C5_fixed.con'
include '.\2015\2015west\MTEP12_2017_MPW_Cat_C.con'
include '.\2015\2015west\MTEP12_2017_Xcel_Cat_C_fixed.con'
include '.\2015\2015west\OTP_CONS_C_fixed.con'
include '.\2015\2015west\Selected_WAPA_CONS_C_fixed.con'
include '.\2015\2015west\SMPA_CONS_C_fixed.con'
include '.\2015\2015-CatC\C1_Explicit_AMRN_2017.con'
include '.\2015\2015-CatC\C1_Explicit_CWLD_2017_MISO.con'
include '.\2015\2015-CatC\C1_Explicit_SIPC_2017_MISO.con'
include '.\2015\2015-CatC\C2_Explicit_AMRN_2017_fixed.con'
include '.\2015\2015-CatC\C2_Explicit_CWLD_2017_MISO.con'
include '.\2015\2015-CatC\C2_Explicit_SIPC_2017_MISO.con'
include '.\2015\2015-CatC\C5_Explicit_AMRN_2017_fixed.con'
include '.\2015\2015-CatC\C5_Explicit_CWLD_2017_MISO_fixed.con'
include '.\2015\2015-CatC\CWLP_MTEP12_CatC1.con'
include '.\2015\2015-CatC\CWLP_MTEP12_CatC2.con'
include '.\2015\2015-CatC\CWLP_MTEP12_CatC5.con'
include '.\2015\2015-CatC\BREC_2014S_Cat-C12_06122012_Explicit.con'
include                                  '.\2015\2015-CatC\BREC_2014S_Cat-
C125_06122012_BusDoubleAuto.con'
include '.\2015\2015-CatC\DEI_2014S_CatC1_C2_06122012_Explicit.con'
include '.\2015\2015-CatC\DEI_2014S_CatC5_06122012_Explicit.conn'
include '.\2015\2015-CatC\HE_2014S_Cat-C_06122012_BusDouble-auto.con'
include '.\2015\2015-CatC\IPL_2014S_Cat-C125_06122012_Explicit.con'
include '.\2015\2015-CatC\NIPS_2015_CatC.con'
```

```
include'.\2015\2015-CatC\SIGE_2014S_Cat-
C125_06122012_BusDoubleAuto.con'
INCLUDE '.\PJM\21S_RFC-PJM_Study_Cat-C1-C2-C3-C5_R1.con'
INCLUDE '.\PJM\ComEd_RTEP_Cat_C.con'
```

The following three master contingency files were supplied by MISO and applied to the 2023 SPK and SH conditions without any modification.

- 2022-DPP_Aug-Cycle_Master-B_Central_rev0.con

```
SINGLE BRANCH IN SUBSYSTEM 'STUDY_CENTRAL'
SINGLE UNIT OUTAGE IN SUBSYSTEM 'STUDY_CENTRAL'
SINGLE BRANCH IN SUBSYSTEM 'STUDY_SEAMS'
SINGLE TIE FROM SUBSYSTEM 'CENTRAL_SEAMS'
SINGLE UNIT OUTAGE IN SUBSYSTEM 'STUDY_SEAMS'
INCLUDE '.\2022\2022-CatB\B_explicit_AMRN_2022.con'
INCLUDE '.\2022\2022-CatB\B_Explicit_SIPC_2022_MISO.con'
INCLUDE '.\2022\2022-CatB\CWLP_MTEP12_CatB.con'
INCLUDE '.\2022\2022-CatB\BREC_2022S_Cat-B_06122012_Explicit.con'
INCLUDE '.\2022\2022-CatB\DEI_2022S_CatB_06122012_Explicit.con'
INCLUDE '.\2022\2022-CatB\HE_2022S_Cat-B_06122012_Explicit.con'
INCLUDE '.\2022\2022-CatB\IPL_2022_Cat-B_06122012_Explicit.con'
INCLUDE '.\2022\2022-CatB\NIPS_2022_CatB.con'
INCLUDE '.\2022\2022-CatB\SIGE_2022S_Cat-B_06122012.con'
INCLUDE '.\PJM\21S_RFC-PJM_Study_Cat-B1-B2-B3_R1.con'
INCLUDE '.\PJM\ComEd_RTEP_Cat_B.con'
```

- 2022-DPP_Aug-Cycle_Master-B_West_rev0.con

```
SINGLE BRANCH IN SUBSYSTEM 'STUDY_WEST'
SINGLE TIE FROM SUBSYSTEM 'STUDY_WEST'
SINGLE UNIT OUTAGE IN SUBSYSTEM 'STUDY_WEST'
INCLUDE '.\2022\2022west\2022_ATC_DPP_August_2012_B1_fixed.con'
INCLUDE '.\2022\2022west\2022_ATC_DPP_August_2012_B2_B3_fixed.con'
include '.\2022\2022west\GRE_CONS_B.con'
include '.\2022\2022west\MDU-CON-CAT-B_fixed.con'
include '.\2022\2022west\MP_CONS_B.con'
include '.\2022\2022west\MRES_MTEP12_Cat-B_edits.con'
include '.\2022\2022west\MTEP12_2022_DPC_Cat_B.con'
include '.\2022\2022west\MTEP12_2022_ITCM_Cat_B_fixed.CON'
include '.\2022\2022west\MTEP12_2022_MEC_Cat_B.con'
include '.\2022\2022west\MTEP12_2022_MPW_Cat_B.con'
include '.\2022\2022west\MTEP12_2022_Xcel_Cat_B_fixed.con'
include '.\2022\2022west\OTP_CONS_B_Updated.con'
include '.\2022\2022west\Selected_MDU_CONS_B.con'
include '.\2022\2022west\SMPA_CONS_B.con'
```

- 2022-DPP_Aug-Cycle_Master-C-Single_rev0.con

```
INCLUDE '.\2022\2022west\ATC_MTEP12_2022_C1_C2_fixed.con'
INCLUDE '.\2022\2022west\ATC_MTEP12_2022_C5_fixed.con'
```

```
include '.\2022\2022west\ATC_MTEP12_2022_C9_fixed.con'
include '.\2022\2022west\ATC_MTEP12_auto_C3_for_cat_C1_C2_fixed.con'
include '.\2022\2022west\GRE_CONS_C_fixed.con'
include '.\2022\2022west\IS_2022_CAT_C_fixed.con'
include '.\2022\2022west\MDU_CONS_C1.con'
include '.\2022\2022west\MDU-CON-CAT-C_fixed.con'
include '.\2022\2022west\MP_CONS_C_fixed.con'
include '.\2022\2022west\MRES_CONS_C_Updated.con'
include '.\2022\2022west\MTEP12_2022_DPC_Cat_C.con'
include '.\2022\2022west\MTEP12_2022_ITCM_Cat_C_fixed.CON'
include '.\2022\2022west\MTEP12_2022_MEC_Cat_C1_C2_C5_fixed.con'
include '.\2022\2022west\MTEP12_2022_MPW_Cat_C.con'
include '.\2022\2022west\MTEP12_2022_Xcel_Cat_C_fixed.con'
include '.\2022\2022west\OTP_CONS_C_fixed.con'
include '.\2022\2022west\Selected_WAPA_CONS_C_fixed.con'
include '.\2022\2022west\SMPA_CONS_C_fixed.con'
include '.\2022\2022-CatC\C1_Explicit_AMRN_2022.con'
include '.\2022\2022-CatC\C1_Explicit_CWLD_2022_MISO.con'
include '.\2022\2022-CatC\C1_Explicit_SIPC_2022_MISO.con'
include '.\2022\2022-CatC\C2_Explicit_AMRN_2022_fixed.con'
include '.\2022\2022-CatC\C2_Explicit_CWLD_2022_MISO.con'
include '.\2022\2022-CatC\C2_Explicit_SIPC_2022_MISO.con'
include '.\2022\2022-CatC\C5_Explicit_AMRN_2022_fixed.con'
include '.\2022\2022-CatC\C5_Explicit_CWLD_2022_MISO_fixed.con'
include '.\2022\2022-CatC\CWLP_MTEP12_CatC1.con'
include '.\2022\2022-CatC\CWLP_MTEP12_CatC2.con'
include '.\2022\2022-CatC\CWLP_MTEP12_CatC5.con'
include '.\2022\2022-CatC\SIPCautoCdub.con'
include '.\2022\2022-CatC\BREC_2022S_Cat-C12_06122012_Explicit.con'
include                                  '.\2022\2022-CatC\BREC_2022S_Cat-
C125_06122012_BusDoubleAuto.con'
include '.\2022\2022-CatC\DEI_2022S_CatC5_06122012_Explicit.con'
include '.\2022\2022-CatC\DEI_2022S_CatC1_C2_06122012_Explicit.con'
include '.\2022\2022-CatC\HE_2022S_Cat-C_06122012_BusDoubleAuto.con'
include '.\2022\2022-CatC\IPL_2022S_Cat-C125_06122012_Explicit.con'
include '.\2022\2022-CatC\NIPS_2022_CatC.con'
include                                  '.\2022\2022-CatC\SIGE_2022S_Cat-
C125_06122012_BusDoubleAuto.con'
INCLUDE '.\PJM\21S_RFC-PJM_Study_Cat-C1-C2-C3-C5_R1.con'
INCLUDE '.\PJM\ComEd_RTEP_Cat_C.con'
```