Midcontinent Independent System Operator

Regional Transmission Organization (RTO)

Reliability Plan

June 1, 2020

Document Change History

Issue	Reason for Issue	Date
Version 0	Reformatted and updated MISO RTO Reliability Plan to meet the terms of NERC Operating Standards as approved by NERC.	11/3/05
Version 1	Removed LGEE and DEVI from Reliability Coordination Area. Added Southern Minnesota Municipal Power Agency to MISO tariff.	9/20/06
Version 2	Reflected Ameren's reconfiguration of their Balancing Areas from three into two.	2/2/07
Version 3	Reflects the de-certification of the Western Plains East Kansas (WPEK) Balancing Area	4/1/07
Version 4	Reflects the conception of the MISO Balancing Authority. To be effective with the start of MISO Balancing Authority operations.	11/14/07
Version 5	Reflects the addition of Duquesne Light Company (DLCO) local Balancing Authority into the MISO Balancing Authority. To be effective with the start of DLCO into MISO Balancing Authority and MISO Market.	05/07/08
Version 6	Reflects moving Missouri Public Service -Aquila Networks (MPS) Balancing Authority from MISO to SPP RC. To be effective with the move of MPS to SPP RC.	11/19/08
Version 7	Reflects Duquesne Light Company's (DLCO) decision to not become a Local Balancing Authority in MISO Balancing Authority Area. Reflects moving LES, NPPD, and OPPD from MISO RC Area to SPP RC Area. To be effective with the move of LES, NPPD, and OPPD to SPP RC. Reflects starting to provide Cleveland Public Power Reliability Coordination services to be effective with the start of the service.	01/31/09
Version 8	Reflects MidAmerican Energy Company (MEC) and Muscatine Power and Water (MPW) changing from Balancing Authorities (BAs) to Local Balancing Authorities (LBAs) and being incorporated into Midwest ISO Balancing Authority Area. Midwest ISO Reliability Coordination Area boundaries are not changing with this version. This version becomes effective with the incorporation of MEC and MPW LBAs into Midwest ISO BA.	06/23/09
Version 9	Reflects the addition of Cedar Falls Utilities (CFU) and other miscellaneous updates	9/23/09
Version 10	Reflects Dairyland Power Cooperative (DPC) changing from	1/8/10

	Balancing Authority (BA) to Local Balancing Authority (LBA) and being incorporated into Midwest ISO Balancing Authority Area. Midwest ISO Reliability Coordination Area boundaries are not changing with this version. This version becomes effective with the incorporation of DPC LBA into Midwest ISO BA.	
Version 11	Reflects Big Rivers Electric Corporation (BREC) Balancing Area moving from TVA RC to Midwest ISO RC. Also reflects BREC changing from Balancing Authority (BA) to Local Balancing Authority (LBA) and being incorporated into Midwest ISO BA Area. Note that depending on state regulatory approval, BREC BA integration into Midwest ISO BA may occur subsequent to Midwest ISO becoming BREC's RC. This version becomes effective with the BREC BA moving into Midwest ISO RC Area.	5/10/10
Version 12	Reflects First Energy LBA exiting the Midwest ISO BA and the Midwest ISO Reliability Footprint, scheduled for June 1, 2011 and Cleveland Public Power exiting its Reliability Coordination Services Agreement with the Midwest ISO, scheduled for June 1, 2011	2/9/11
Version 13	Reflects Missouri River Energy Services becoming a Transmission Owning member of the Midwest ISO and Ohio Valley Electric Corporation and Department of Energy taking Reliability Coordination Services from Midwest ISO scheduled for June 1, 2011.	5/4/11
Version 14	Reflects Lansing Board of Water and Light taking Reliability Coordination Services from MISO. This version becomes effective when LBWL begins RC Services with MISO (currently scheduled for September 1, 2011).	8/11/2011
Version 15	Reflects Duke Energy Ohio and Kentucky LBA exiting the MISO BA and the MISO Reliability Footprint, scheduled for January 1, 2012. Duke Energy Indiana remains in the MISO BA and MISO Reliability Footprint	11/15/2011
Version 16	Reflects Entergy taking Reliability Coordination Services from MISO. This version becomes effective when Entergy begins RC services with MISO (currently scheduled for November 19, 2012).	3/2/12
Version 17	Reflects Entergy (EES) Balancing Area changing from a Balancing Authority (BA) to Local Balancing Authority (LBA) and being incorporated into MISO BA Area (currently scheduled for December 19, 2013). Also included in this revision are multiple Balancing Authorities that are expected to join the MISO RC area on June 1, 2013 and subsequently the MISO BA area on December 19.2013. The BAs included are City of Conway (CWAY), Brazos Electric Corporation (BRAZ), CLECO, Lafayette Utility System (LAFA), Louisiana Energy and Power Authority (LEPA), Louisiana Generating (LAGN), Plum Point Energy Associates (PLUM), City of Osceola (OMLP), City of West Memphis (WMU), City of	1/1/13

	North Little Rock (NLR), City of Benton (BUBA), Union Power Partners (PUPP), City of Ruston (DERS), South Mississippi Electric (SME), The listing of BAs above is based on BAs defined on 1/1/13. The BAs are also evaluating the BA boundaries and may determine to change their BA boundaries. This version becomes effective with the BAs listed, pending regulatory approvals, Regional Entity/NERC certifications) moving into MISO RC Area and subsequently the MISO BA Area.	
Version 18	Reflects the Eagan Control Center move from St. Paul, scheduled for December, 2013 and the Midwest ISO name change to Midcontinent ISO, already completed.	11/20/2013
Version 19	Reflects a clean-up from December 19, 2013 South Region Integration (removing dissolved BAs, removing footnotes, etc.), adding AECC and City of Ames as a Transmission Owners, MIUP as a new LBA, and adding City of Alexandria and Consumers Energy as Reliability Services Customers.	5/8/2014
Version 20	Reflects the move of the Integrated System (WAPA, Basin Electric, and Heartland Consumers Power District) and Corn Belt Power Cooperative to the SPP Reliability Coordination Footprint scheduled for June 1, 2015. Also reflects additional Transmission Owners in MISO of Rochester Public Utilities, City of Alexandria (LA), City of Marshall (MN), already completed or scheduled in 2015, and the addition of Entergy Mississippi as a Local Balancing Area in the MISO Balancing Authority Area. Added Little Rock, AR as a MISO Control Center scheduled for June, 2015.	3/20/2015
Version 21	Local Balancing Area Entergy Mississippi Abbreviation change from EMI to EMBA, Pioneer Transmission becoming a Transmission Owner, and AEP becoming a MISO TOP	5/8/2018
Version 22	Ohio Valley Electric Corp transferring from the MISO Reliability Footprint to PJM on 12/1/2018 and updating the South Mississippi Electric Power Association to Cooperative Energy. Clean up of directives to operating instructions and SOL/IROL violations to exceedances.	12/1/2018
Version 23	Henderson Municipal Power & Light entering MISO as an LBA and Transmission Owner and AEP Indiana Michigan Transmission Company, Inc. entering as a Transmission Owner.	3/1/2019
Version 24	GridLiance Heartland BA and LBA transition to MISO RC from TVA RC. GridLiance Heartland LBA transitions into MISO BA.	3/1/2020
Version 25	Update to Current Day analysis language	9/1/2019
Version 26	Updated GridLiance transition to March 1, 2020	3/1/2020
Version 27	Updated Republic Transmission as MISO TO on June 1,2020	6/1/2020

Table of Contents

Introduction

The North American Electric Reliability Corporation (NERC) requires every Region, sub-region, or interregional coordinating group to establish a Reliability Coordinator (RC) to provide the reliability assessment and emergency operations coordination for the Balancing Authorities (BAs) and Transmission Operators (TOPs) within the Regions and across the Regional boundaries.

The Midcontinent Independent System Operator (MISO) serves as the RC for its members, under coordination agreements, and under RC agreements. The MISO RC has certain defined responsibilities and directs the reliable operation of Bulk Power System which is, in general, 100 kV facilities and higher. The MISO RC functions associated with the reliability of the Bulk Power System include review and approval of planned facility transmission line outages[1] & generation outages[2] based upon current and projected system conditions, monitoring of real time loading information and calculating post-contingent loadings on the transmission system, administering loading relief procedures, re-dispatch of generation, and ordering curtailment of transactions and/or load. The MISO RC functions associated with power supply reliability entails monitoring BA performance and ordering the BAs to take actions, including load curtailment and increasing/decreasing generation in situations where an imbalance between generation and load places the system in jeopardy. The MISO reliability procedures and policies are consistent with NERC Standards.[3] MISO operates in multiple NERC Regions and recognizes each Region's policies and standards. Where there are conflicts in the Regional policies and standards, MISO works with the Regions and members on resolving those conflicts. MISO also provides RC Services for non-market members via Module F.

This document is the Reliability Plan for the MISO RC and is posted at https://www.nerc.com/comm/OC/Pages/ORS/Reliability-Plans.aspx. This version supersedes the previous version.

[1] For those Non-market members within MRO, MISO reviews all planned facility transmission line outages for these entities, notifies the entities of possible conflicts or system conditions that would warrant reconsideration of these planned outages, and works with the entities – along with MISO members - to resolve any issues. Further revisions of NERC Standards may render this distinction obsolete.

[2] MISO discusses and coordinates pending generation maintenance outages to the extent possible, as MISO has authority to deny generation maintenance outages only in cases where such outages would place MISO in an emergency situation.

[3] While the MISO Reliability Coordination Plan describes MISO's general practices of providing RC services and in some circumstances MISO RC's endeavor to use best practices beyond what is required by the NERC Reliability Standards , Nothing in this plan shall require MISO RC to go beyond what is required by the NERC Reliability Standards with regard to meeting NERC compliance requirements.

A. Responsibilities – Authorization

1. Reliable Operations - MISO has certain defined responsibilities for the reliable operation of the Bulk Power System within the its RC Area in accordance with NERC Standards, Regional policies and standards, as well as the governing documents listed in Appendix C of this document. The MISO RC Area is composed of the Transmission Owners' Areas listed in Appendix A.

   1.1 The MISO RC has a Wide Area view of its RC Area and neighboring areas that have an impact on MISO's Area. The MISO RC and MISO BA have the operating tools, processes and procedures, including the authority, to prevent or mitigate emergency operating situations in both next-day analysis and during real-time conditions per the NERC Standards and Regional standards, as well as the governing documents listed in Appendix C of this document.

   The MISO RC operating tools, which provide the Wide Area View, are listed in Section I.

   1.2 The MISO RC has clear decision-making authority to act and to direct actions to be taken by its members and non-MISO members within its Reliability Coordination Area to preserve the integrity and reliability of the Bulk Power System.

   1.3 The MISO RC and the MISO BA have not delegated any of its RC or BA responsibilities.

2. Independence - MISO does and will act first and foremost in the best interest of the reliability for its RC Area and the Eastern Interconnection before that of any other entity. This expectation is clearly identified in the governing documents listed in Appendix C and in the job descriptions of the MISO personnel acting in the role of RC or BA.

3. MISO RC Operating Instructions Compliance - Per the governing documents in Appendix C, the BAs, TOPs and other operating entities in the MISO RC Area shall carry out required emergency actions as given in operating instructions by the MISO RC, including the shedding of firm load if required, except in cases involving endangerment to the safety of employees or the public. In those cases, members of the MISO RC Area must immediately inform the MISO RC of the inability to perform the operating instruction.

B. Responsibilities – Delegation of Tasks

1. The MISO RC and the MISO BA have not delegated any RC or BA tasks. Local Balancing Authorities (LBAs) within the MISO Balancing Area are responsible for and will perform tasks per the MISO BA/LBA Coordinated Functional Registration with NERC and the MISO Amended BA Agreement.

C. Common Tasks for Next-Day and Current-Day Operations

This section documents how the MISO conducts current-day and next-day reliability analysis for its Reliability Coordination Area.

1. Determination of Interconnection Reliability Operating Limits (IROLs) – The MISO RC determines IROLs based on local, regional and inter-regional studies including seasonal assessments and ad hoc studies. As required, the voltage stability IROLs are calculated in the next day security analysis and limits are conveyed to neighboring RCs and TOPs in the MISO RC Area via the next day security analysis report. The IROL limits are also reviewed each weekday morning during reliability conference calls.

   During the operating day, real time voltage stability analyses are performed to provide updated IROLs, based on the latest system conditions, to the MISO RC. Significant IROL changes are communicated to impacted TOPs in the MISO RC Area and neighboring RCs by email and phone as necessary. Standing IROL interfaces are highlighted in bold in MISO operator displays to differentiate them from System Operating Limit (SOL) flowgates.

   During real time operations, the MISO RC recognizes that a new IROL limit can be created during multiple, normally non-critical outage conditions and the MISO RC determines additional IROLs real-time. To determine these additional IROLs, the MISO RC utilizes a state estimator and real time contingency analysis to analyze real-time and first contingency conditions. These contingency analyses are normally repeated every one to two minutes. In the event a first contingency would cause a post-contingency flow of 125% of the emergency rating, it is automatically assumed the SOL is now an IROL unless there are studies or system knowledge that the SOL is not an IROL. An example of an SOL greater than 125% that would not be considered an IROL is a radial system that would not result in uncontrolled cascading or collapse should the monitored element(s) trip. Contingency analysis results indicating an unsolved contingency which is confirmed to be valid is also considered to be an IROL.

2. Operation to prevent the likelihood of a SOL or IROL exceedance in another area of the Interconnection and operation when there is a difference in limits - The MISO RC, through agreements with its RC neighbors, coordinates operations to prevent the likelihood of an SOL or IROL exceedance in another area. These agreements include data exchange, Available Transfer Capability coordination, and Outage Coordination and are listed in Section H.

   TOPs in the MISO RC Area are required to follow operating instructions provided by the MISO RC per NERC Standards and operate to NERC Standards to prevent the likelihood that a disturbance, action, or non-action in its Reliability Coordination Area will result in an SOL or IROL exceedance in another area of the Interconnection.

   When there is a difference in derived limits, MISO RC utilizes the most conservative limit until the difference is resolved.

3. Operation under known and studied conditions and re-posturing without delay and no longer than 30 minutes - The MISO RC ensures that entities within its RC Area always operate under known and

studied conditions and that they return their systems to a secure operating state following contingency events within approved timelines, regardless of the number of contingency events that occur or the status of their monitoring, operating and analysis tools. The MISO RC also ensures its BAs and TOPs re-posture the system to within all IROLs following contingencies within T*v* or 30 minutes, whichever is shorter.

On a daily basis, the MISO RC conducts next-day security analysis utilizing planned outages, forecasted loads, generation commitment, and expected net interchange. The analyses include contingency analysis, voltage stability analysis on key interfaces and a review of reactive reserves for defined areas when appropriate. These analyses model peak conditions for the day and are conducted utilizing first contingency (N-1) analysis. Results and mitigation are documented in the Next-Day Security Analysis Report and distributed to MISO Reliability staff. The Next-Day Security Analysis Report is also posted on the MISO Extranet secure website for distribution from this secure website for TOPs and BAs in the MISO Reliability Coordination Area and neighbors to view and download. Mitigation plans are formed as needed for potential exceedances determined in the next day security analysis. Mitigation is of the form of additional unit commitment or may be documented in an operating guide to be utilized by the MISO RC and TOP.

MISO performs Current Day Security Analysis studies as needed throughout the day. Voltage Stability analyses are also performed continuously and on demand as system conditions warrant for each voltage stability flowgate. Results from Voltage stability analysis are available to MISO Reliability staff and also posted to the MISO Extranet for the TOPs and BAs in the MISO Reliability Coordination Area and neighbors.

The MISO Daily Reliability Coordination Report is also posted on the MISO Extranet secure web site for TOPs and BAs in the MISO Reliability Coordination Area and neighbors to view and download. The MISO Daily Reliability Coordination Report includes significant generation outages, significant line outages, projected constraints, voltage security assessment results, reactive reserves for defined areas when appropriate, TLR summary from the past 24 hours, and forecasted weather conditions. The MISO Daily Reliability Coordination Report is reviewed each weekday morning with TOPs, the MISO BA, Balancing Areas in the MISO Reliability Coordination Area, and neighboring RCs where expected system conditions for the day are discussed, along with action required to mitigate any abnormal conditions. Additional conference calls are conducted with the same group when conditions warrant.

4. Communicating SOLs and IROLs to Transmission Service providers within RC Area – MISO communicates IROLs within its wide-area view and provides updates to IROLs as described above via reports, morning conference calls, and real-time via voice and messaging. Standing IROLs are documented and communicated via operating guides. In general, SOLs are in the form of thermal equipment limits and are provided by Transmission Owners to MISO. If transmission service is sold on the IROL or SOL Flowgate, an adjustment is made to the AFC to account for the reservation.

5. MISO RC and BA process for issuing operating instructions - MISO has implemented a communication protocol for the issuing/receiving of operating instructions. The MISO RC and/or MISO BA issues operating instructions in a clear, concise and definitive manner. The MISO RC and/or MISO BA ensures that the person receiving the operating instruction repeats the information back correctly, and acknowledges the response as correct or repeats the original statement again to

resolve any misunderstandings. MISO's process for issuing operating instructions is documented in the "Communications Protocol For Operating Instructions" procedure.

D. Next-Day Operations

This section documents how the MISO conducts next-day reliability analysis for its Reliability Coordination Area.

1. Reliability Analysis and System Studies - The MISO RC conducts next-day reliability analyses for its Area to ensure that the Bulk Power System can be operated reliably in normal and post contingency conditions.

   On a daily basis, the MISO RC conducts next-day security analysis utilizing known outages, forecasted loads, generation commitment and dispatch, and expected net interchange. All facilities 100 kV and above and some non-BES facilities in the MISO RC Area and first tier Balancing Areas are monitored for all contingency cases and the base case. Base case flows on all monitored facilities are compared against the normal rating. Post-contingent flows for all monitored facilities are compared against their emergency rating for all contingencies. Voltage and transient stability analysis is conducted on key critical interfaces to determine a flow limit. Reactive reserves for specific areas are reviewed to ensure they are above necessary levels.

   Mitigation plans are formed as needed for potential violations determined in the next day security analysis. Mitigation is of the form of additional unit commitment, restriction on unit output, or may be documented in an operating guide to be utilized by the MISO RC and TOPs.

   1.1 Parallel Flows – The MISO RC monitors parallel flows to ensure that its Reliability Coordination Area does not burden another Reliability Coordination Area. To ensure that the impact of parallel flows is considered in the next day security analysis, all first tier BA Areas and key second and third tier BA Areas are modeled in detail and updated in the analysis each day. This includes updating their unit status, transmission outages, load forecast, interchange and generation dispatch.

2. Information Sharing – BAs, Generation Operators and TOPs in the MISO Reliability Coordination Area and neighboring RCs provide to the MISO RC all information required for system studies, such as critical facility status, load, generation, and Operating Reserve projections via the SDX. The entities in the MISO Reliability Coordination Area provide generation and transmission facility statuses to the MISO outage scheduling application per MISO outage scheduling requirements. MISO Reliability Coordination Area load forecast is provided in the SDX. MISO BA load is determined by MISO load forecasting tools. Known interchange transactions are provided as NERC E-Tags. MISO obtains the equivalent information for entities outside the MISO Reliability Coordination Area from the SDX and NERC E-Tags.

3. Sharing of Study Results - When conditions warrant or upon request, the MISO RC shares the results of its system studies with the entities within its Reliability Coordination Area or with other RCs. Study results for the next day typically are available no later than 16:00 Eastern Standard Time, unless circumstances warrant otherwise.

   Next-Day Security Analysis Report is distributed to MISO Reliability staff. The Next-Day Security Analysis Report is also posted on the MISO Extranet secure website for distribution to TOPs and

BAs in the MISO Reliability Coordination Area and neighboring RCs to view and download. Any reliability entity that is subject to the NERC Data Confidentiality Agreement may access the Next-Day Security Analysis Report, with approved access, via the MISO Extranet secure web site.

The MISO RC has procedures indicating when it will initiate a conference call or other appropriate communications to address the results of its reliability analyses. The MISO RC hosts a conference call each business day that is normally utilized for this purpose.

E. Current-Day Operations

This section documents how the MISO conducts current-day reliability analysis for its Reliability Coordination Area.

1. The process MISO RC uses to monitor all Bulk Power System facilities, including sub-transmission information as needed, within the MISO Reliability Coordination Area and adjacent areas as necessary to ensure that, at any time, regardless of prior planned or unplanned events, the MISO RC is able to determine any potential SOL and IROL exceedances within its Reliability Coordination Area is as follows:

   MISO RC utilizes a state estimator and real-time contingency analysis as its primary tool to monitor facilities. The state estimator model includes all facilities 100 kV and above in the MISO Reliability Coordination Area and extensive representation of 69 kV facilities. The model also has extensive representation of neighboring facilities in order to provide an effective wide-area view. This model is updated quarterly and may be updated on demand when deemed necessary.

   Real Time Contingency Analysis (RTCA) is performed on over 10,000 contingencies utilizing the state estimator model normally at least every five minutes. Contingencies include all MISO Reliability Coordination Area equipment 100 kV and above, some non-BES equipment, and neighboring contingencies that would impact MISO Reliability Coordination Area facilities.

   MISO utilizes a Real-Time Line Outage Distribution Factor (RTLODF) Tool to monitor selected PTDF and OTDF flowgates to provide a backup to RTCA monitoring. Post-contingent loading on OTDF flowgates is calculated using SCADA data and LODFs automatically updated from a topology processor that does not rely on the state estimator solution.

   SCADA alarming is utilized to alert the MISO RC of any actual low or high voltages or facilities loaded beyond their normal or emergency limits.

   In addition to the above applications, MISO utilizes a dynamically updated transmission overview display to maintain a wide area view. Transmission facilities 230 kV and above are depicted on the overview with flows (MW and MVAR). This display provides indication of facilities out of service, high and low voltage warning and alarming, and facilities loaded to 90% and 100% of ratings. For more detailed monitoring, dynamically updated Balancing Area wide displays are used to view facilities 100 kV and above, including flows (MW and MVAR), voltages, generator outputs, and facilities out of service. Finally, bus level one-line diagrams are utilized for station level information.

   1.1. The MISO RC notifies neighboring RCs of operational concerns (e.g. declining voltages, excessive reactive flows, or an IROL exceedance) that it identifies within the neighboring Reliability Coordination Area via direct phone calls, conference calls, NERC hotline calls, and/or RCIS messages. The MISO RC has documented seams agreements with neighboring RCs that are listed in Section H. MISO RC directs action to provide emergency assistance to all Reliability Coordination neighbors, during declared emergencies, which is required to mitigate the operational concern to the extent that the same entities are taking in kind steps and the assistance would be effective.

2. The MISO RC maintains awareness of the status of all current critical facilities whose failure, degradation or disconnection could result in an SOL or IROL exceedance within its Reliability Coordination Area via State Estimator, RTCA, SCADA alarming, and transmission displays. The MISO RC is aware of the status of any facilities that may be required to assist Reliability Coordination Area restoration objectives via these same displays and tools.

3. The MISO RC is continuously aware of conditions within its Reliability Coordination Area includes this information in its reliability assessments via automatic updates to the state estimator, Flowgate Monitoring Tool, and transmission displays. The MISO RC monitors its MISO Reliability Coordination Area parameters, including the following:

   3.1. Current status of Bulk Power System elements (transmission or generation including critical auxiliaries such as Automatic Voltage Regulators and Special Protection Systems and system loading are monitored by state estimator, RTCA, SCADA Alarming, Flowgate Monitoring Tool, and transmission displays. Balancing Areas are required to report to MISO RC when Automatic Voltage Regulators are not in-service. TOPs are required to report to the MISO RC when Special Protection Systems change status.

   3.2. Current pre-CONTINGENCY element conditions (voltage, thermal, or stability) are monitored by state estimator, SCADA Alarming, Flowgate Monitoring Tool, and transmission displays.

   3.3. Current post-CONTINGENCY element conditions (voltage, thermal, or stability) are monitored by RTCA, Flowgate Monitoring Tool, and transmission displays.

   3.4. System real reserves are monitored versus required per Balancing Area in the Market Monitoring Tool. Reactive reserves versus required are monitored via monitoring adequacy of calculated post-contingent steady state voltages versus voltage limits, voltage stability interfaces against limits, and reactive reserves versus required for defined zones.

   3.5. Capacity and energy adequacy conditions via monitoring reserve requirements and regional reporting.

   3.6. Current ACE for all Balancing Areas is displayed in a trend graph to MISO RC. When ACE exceeds L_{10}, graph changes colors and alerts operator of magnitude of ACE and duration ACE has exceeded L_{10} .

   3.7. Current local procedures, such as operating guides, monitored via discussions with local TOP and statuses of their use are logged in the MISO RC log. TLR procedures in effect are monitored via the NERC Interchange Distribution Calculator.

   3.8. Planned generation dispatches for MISO market area are provided to the MISO RC in the form of the unit commitment plan. For the non-market area, generation outages are reported to MISO via the MISO Outage Scheduler application.

   3.9. Planned transmission or generation outages are reported to MISO via the MISO Outage Scheduler application.

3.10. Contingency Events are monitored by state estimator, RTCA, SCADA Alarming, Flowgate Monitoring Tool, and transmission displays. TOPs and BAs are required to report Contingency Events to MISO RC.

4. The MISO RC monitors Bulk Power System parameters that may have significant impacts upon its Reliability Coordination Area and neighboring Reliability Coordination areas with respect to:

4.1. The MISO RC maintains awareness of all Interchange Transactions that wheel-through, source, or sink in its Reliability Coordination via NERC E-tags and NERC IDC displays. Interchange Transaction information is made available to all RCs via NERC E-tags.

4.2. The MISO RC, in concert with the Balancing and Interchange Authorities within its Reliability Coordination Area, evaluates and assesses any additional Interchange Transactions that would exceed IROL or SOLs by using the NERC IDC as a look-ahead tool. As flows approach their IROL or SOLs, the MISO RC evaluates the incremental loading next-hour transactions would have on the SOLs or IROLs and determines if action needs to be taken to prevent an SOL or IROL exceedance. The MISO RC has the authority to direct all actions necessary and may utilize all resources to address a potential or actual IROL exceedance up to and including load shedding.

4.3. The MISO RC and MISO BA monitors Balancing Area Operating Reserves versus required to ensure the required amount of Operating Reserves are provided and available as required to meet NERC Control Performance Standards via the Market Monitoring Tool. The MISO RC and the MISO BA are alerted if reserves fall below required. If necessary, the MISO RC will direct the Balancing Area to replenish reserves including obtaining assistance from neighbors as needed.

4.4. The MISO RC identifies the cause of potential or actual SOL or IROL exceedances via analysis of state estimator results, RTCA results, SCADA Alarming of outages, Flowgate Monitoring Tool results, transmission displays of changes, and Interchange Transaction impacts. The MISO RC will initiate control actions including transmission switching, generation redispatch, and/or emergency procedures to relieve the potential or actual IROL exceedance without delay, and no longer than 30 minutes. The MISO RC is authorized to direct utilization of all resources, including load shedding, to address a potential or actual IROL exceedance. The MISO RC will not rely solely on NERC TLR to mitigate an IROL exceedance.

4.5. The MISO RC communicates start and end times for time error corrections to all Balancing Areas within its Reliability Coordination Area via its messaging system. The MISO RC communicates Geo-Magnetic Disturbance forecast information to BAs, TOPs, and Generation Operators via its messaging system. MISO RC will assist in development of any required response plan and will establish an Emergency Operating Guide as needed or move to conservative operating mode to mitigate impacts as needed.

4.6. The MISO RC (Carmel, Eagan, and Little Rock locations) participates in NERC Hotline discussions, assist in the assessment of reliability of the Regions and the overall interconnected system, and coordinate actions in anticipated or actual emergency situations. The MISO RC will disseminate this information via text messaging, individual phone calls, or blast calls within its area as appropriate.

4.7. The MISO RC monitors system frequency via trend graph. The graph visually alerts the MISO RC when frequency falls below 59.95 Hz or is greater than 60.05 Hz. MISO BA monitors its ACE, while the MISO RC monitors each Balancing Area's ACE via trend graph within the Reliability Coordination Area. Both the MISO BA and the MISO RC receive a visual indication when ACE exceeds L_{10} and/or BAAL. When necessary, MISO RC directs Balancing Areas with ACEs larger than L_{10} to return within L_{10}, and directs Balancing Areas to return to within BAAL. The MISO RC will direct BAs to utilize all resources, including firm load shedding, as necessary to relieve an emergency condition.

4.8. The MISO RC coordinates with other RCs and its BAs, Generation Operators, and TOPs, as needed, on the development and implementation of action plans and operating guides to mitigate potential or actual SOL or IROL exceedances, or CPS1, BAAL, or Reportable Balancing Contingency Event criteria.. The MISO RC coordinates pending generation and transmission maintenance outages with other RCs and its BAs, Generation Operators, and TOPs, as needed and within code of conduct requirements, real time via telephone and next-day, per the MISO outage scheduling process.

4.9. The MISO RC will assist its BA Areas in arranging for assistance from neighboring RCs or BA Areas via the Energy Emergency Alert (EEA) notification process and will conference parties together as appropriate.

4.10. The MISO RC monitors Balancing Areas' ACEs to identify the sources of large ACEs that may be contributing to frequency, time error, or inadvertent interchange and directs corrective actions with the appropriate BAs per 4.7 above.

4.11. The TOPs within MISO Reliability Area inform MISO of all changes in status of Special Protection Systems (SPS) including any degradation or potential failure to operate as expected by the TOP. The MISO RC factors these SPS changes into its reliability analyses.

5. The MISO RC issues alerts, as appropriate, to all its Balancing Areas and TOPs via dedicated text messaging, individual phone calls, or blast calls when it foresees a transmission problem (such as an SOL or IROL exceedance, loss of reactive reserves, etc.) within its Reliability Area that requires notification. The MISO RC issues alerts, as appropriate, to all RCs via the Reliability Coordinator Information System when it foresees a transmission problem (such as an SOL or IROL exceedance, loss of reactive reserves, etc.) within its Reliability Area that requires notification.

6. The MISO RC confirms reliability assessment results via analyzing results of state estimator/RTCA, and discussions with local TOPs and neighboring RCs. The MISO RC identifies options to mitigate potential or actual SOL or IROL exceedances via examining existing operating guides, system knowledge, and power flow analysis to identify and implement only those actions as necessary as to always act in the best interests of the interconnection.

F. Emergency Operations

1. The MISO RC utilizes the MISO Emergency Operating Procedures, posted on the www.misoenergy.org site, to return the transmission system to within the IROL as soon as possible, but no longer than 30 minutes. This procedure includes the actions (e.g. reconfiguration, re-dispatch or load shedding) the MISO RC will direct until relief is achieved.

2. The MISO RC utilizes the MISO Emergency Operating Procedures when it deems that an IROL exceedance are imminent. The MISO Emergency Operating Procedures documents the processes and procedures the MISO RC follows when directing its BAs and TOPs to re-dispatch generation, reconfigure transmission, manage Interchange Transactions, or reduce system demand to mitigate the IROL exceedance, to return the system to a reliable state. The MISO RC coordinates its alert and emergency procedures with other RCs via seam coordination agreements listed in Section H.

3. The MISO RC takes or directs action in the event the loading of transmission facilities progresses to or is projected to progress to an SOL or IROL exceedance.

   3.1 The MISO RC directs reconfiguration and/or re-dispatches within its market area as needed to prevent or relieve SOL or IROL exceedances. In the non-market area of MISO Reliability Coordination Area, the MISO RC will direct reconfiguration and re-dispatch to resolve IROL exceedances. The MISO RC will not rely on or wait for NERC TLR to relieve IROL exceedances. The MISO RC may implement NERC TLR if doing so will provide additional relief.

   3.2 The MISO RC utilizes market-to-market re-dispatch for its market area for reciprocally coordinated flowgates per the Congestion Management Process posted on the www.misoenergy.org site and filed with FERC.

   3.3 The MISO RC acknowledges provisions of the NERC TLR and communicates curtailment information as appropriate to impacted Balancing Authorities.

   3.4 The MISO RC will initiate re-configuration, re-dispatch for market areas, and NERC TLR reductions to relieve overloaded facilities as necessary. The MISO RC will not rely on NERC TLR as an emergency action.

4. The MISO RC utilizes the MISO Emergency Operating Procedures to mitigate an energy emergency within its Reliability Coordination Area. The MISO RC will provide assistance to other RCs per its seams agreements listed in Section H.

5. The MISO RC utilizes the MISO Emergency Operating Procedures when it is experiencing a potential or actual Energy Emergency within any BA, Reserve-Sharing Group, or Load-Serving Entity within its Reliability Coordination Area. The MISO Emergency Operating Procedures document the processes and procedures the MISO RC uses to mitigate the emergency condition, including a request for emergency assistance if required.

G. System Restoration

1. Knowledge of members' Restoration Plans - The MISO RC is aware of each member's Restoration Plan and has a written copy of each plan. The MISO has the plans and procedures of every member, which are listed in Appendix A.

   During system restoration, MISO RC monitors restoration progress and acts to coordinate any needed assistance.

2. MISO Restoration Plan - The MISO Restoration Plan includes all BAs and TOPs in its Reliability Coordination Areas. MISO RC takes action to restore normal operations once an operating emergency has been mitigated in accordance with its Restoration Plan. This Restoration Plan is drilled at least annually.

3. Dissemination of Information - The MISO RC serves as the primary contact for disseminating information regarding restoration to neighboring RCs and members not immediately involved in restoration.

   The MISO RC approves, communicates and coordinates the re-synchronizing of major system islands or synchronizing points so as not to cause a burden on member or adjacent Reliability Coordination Areas.

H. Adjacent RC Agreements and Data Sharing

1. Coordination Agreements:

   - MISO and PJM have a Joint Operation Agreement
   - MISO and TVA have a RC Coordination and Notification Plan
   - MISO and IESO have a Coordination Agreement.
   - MISO and SPP have a Joint Operating Agreement.
   - MISO and Southeastern RC have a RC Coordination and Notification Plan.
   - MISO and SaskPower have a RC to RC Agreement.

2. Data Sharing - The MISO RC determines the data requirements to support its reliability coordination tasks and requests such data from members or adjacent RCs. The MISO RC provides for data exchange with members and adjacent RCs, TOPs and BAs via a secure network. MISO Reliability Coordination Area members provide data to MISO via ICCP. MISO RC provides data to entities outside MISO via direct links and ISN.

I. Facility

MISO performs the RC function at the MISO Headquarters in Carmel, Indiana along with the MISO offices in Eagan, Minnesota, and Little Rock, Arkansas. The Carmel, Eagan, and Little Rock offices have the necessary voice and data communication links to appropriate entities within their Reliability Coordination Area for the MISO RC to perform their responsibilities. These communication facilities are staffed and available to act in addressing a real-time emergency condition.

1. Adequate Communication Links - The MISO RC maintains satellite phones, Voice Over IP phones which run across the dedicated MISO WAN, cell phones, and redundant, diversely routed telecommunications circuits. Additionally, there are also video links between MISO Carmel Control Room and the MISO Eagan and Little Rock Control Rooms.

2. Multi-directional Capabilities – The MISO RC has multi-directional communications capabilities with its members, and with neighboring RCs, for both voice and data exchange to meet reliability needs of the Interconnection.

3. Real-time Monitoring - The MISO RC has detailed real-time monitoring capability of its Reliability Coordination Area and all first tier companies surrounding the MISO Reliability Coordination Area to ensure that potential or actual System Operating Limit or Interconnection Reliability Operating Limit exceedances are identified.

   3.1 The MISO RC monitors Bulk Power System elements (generators, transmission lines, buses, transformers, breakers, etc.) that could result in SOL or IROL exceedances within its Reliability Coordination Area. The MISO RC monitors both real and reactive power system flows, and operating reserves, and the status of the Bulk Power System elements that are, or could be, critical to SOLs and IROLs and system restoration requirements within its Reliability Coordination Area.

4. Study and Analysis Tools

   4.1 The MISO RC has adequate analysis tools, including state estimation, pre-and post-contingency analysis capabilities (thermal, stability, and voltage), and wide-area overview displays. The MISO RC has detailed monitoring capability of the MISO Reliability Area and sufficient monitoring capability of the surrounding Reliability Areas to ensure potential reliability issues are identified. The MISO RC continuously monitors key transmission facilities in its area in conjunction with the Members monitoring of local facilities and issues.

   The MISO RC ensures that SOL and IROL monitoring and derivations continue if the main monitoring system is unavailable. The MISO RC has backup facilities that shall be exercised if the main monitoring system is unavailable.

The systems utilized by the MISO RC are:

- State Estimator and Contingency Analysis
- Market Monitoring Tool
- Status and Analog Alarming
- Overview Displays of MISO Transmission System via Wallboard
- One line diagrams for entire MISO Transmission System
- Transmission Delta Flow Tool
- Flowgate Monitoring Tool
- Generation Monitoring Tool

The MISO RC utilizes these tools, which provide information that is easily understood and interpreted by the MISO RC operating personnel. The alarm management is designed to classify alarms in priority for heightened awareness of critical alarms.

4.2 The MISO RC controls its RC analysis tools, including approvals for planned maintenance. The MISO RC has procedures in place to mitigate the effects of analysis tool outages.

J. Staffing

1. Staff Adequately Trained and NERC Certified - MISO maintains trained RCs, BAOs, and a Shift Manager on duty at all times, as well shift Reliability Engineers. The MISO RC and MISO BA staff all operating positions that meet following criteria with personnel that are NERC certified for the applicable functions:

   - Positions that have the primary responsibility, either directly or through communications with others, for the real-time operation of the interconnected Bulk Power System.

   - Positions directly responsible for complying with NERC Standards.

   The MISO RC and MISO BA operating personnel each complete a minimum of 40 hours per year of training and drills using realistic simulations of system emergencies, in addition to other training required to maintain qualified operation personnel.

2. Comprehensive Understanding - The MISO RC operating personnel have an extensive understanding of the BAs and TOPs within the MISO Reliability Coordination Area, including the operating staff, operating practices and procedures, restoration priorities and objectives, outage plans, equipment capabilities, and operational restrictions.

   The MISO RC operating personnel place particular attention on SOLs and IROLs and inter-tie facility limits. The MISO ensures protocols are in place to allow MISO RC operating personnel to have the best available information at all times.

   MISO's System Operator Training process describes the process by which System Operations personnel are trained to perform their duties, both at entry level and in continuous training status. MISO also uses the Operator Training Manual to establish training and documentation requirements for System Operators in the form of position specific curricula, NERC certification Guidelines, On-the-Job qualification Guides, and Technical Qualification Training Checklists. The Technical Qualification Training Checklists contain competencies for the RC System Operator position and other operation positions. An analysis of each operator position was conducted by Subject Matter Experts (SME), Management, and training representatives to develop the checklists. These checklists provide a way to identify, track status, and document completion of required initial training for any new System Operator.

   MISO uses several means to provide initial and continuous training opportunities for System Operators. MISO Operations Technical Training provides the majority of the technical training. MISO Corporate Training provides much of the corporate and non-technical courses such as Standards of Conduct, Fitness for Duty, Ethics and Employee Conducts and Disciplinary Guidelines. Information Technology (IT) Education conducts training on computer-based applications such as Word, Excel, Access Database, etc. Continuing training is designed to keep all operating personnel knowledgeable of current policies, equipment and management expectations. Drills on emergency procedures and simulated exercises are included in the on-going training activities. Training records are maintained.

3. Standards of Conduct - MISO RC and MISO BA are independent of the merchant function. RC and BA Operators do not pass information or data to any wholesale merchant function or retail merchant function that is not made available as soon as practicable to all such wholesale merchant functions. MISO RC and MISO BA staff have completed training on MISO's Standards of Conduct. Refresher training on MISO's Standards of Conduct is conducted every year. Training records are maintained.

Appendix A

List of Transmission Owners within the MISO Reliability Coordination Area & the documents associated with each:

MISO Members	MISO Authority Documents				
	MISO TO Agreement	MISO Tariff	Coordination Agreement	RC Services Agreement	Appendix I
AEP Indiana Michigan Transmission Company, Inc.	X	X			
AmerenCILCO	X	X			
AmerenIP	X	X			
AmerenUE and AmerenCIPS	X	X			
American Transmission Company, LLC	X	X			
Arkansas Electric Cooperative Corporation	X	X			
Big Rivers Electric Corporation	X	X			
CLECO	X	X			
Central Minnesota Municipal Power Agency	X	X			
City of Alexandria (LA)	X	X			
City of Ames	X	X			
City of Marshall (MN)	X	X			
Dairyland Power Cooperative	X	X			
Duke Energy Indiana, Inc.	X	X			
East Texas Electric Cooperative, Inc	X	X			
Entergy Arkansas, Inc.	X	X			
Entergy Gulf States Louisiana, L.L.C.	X	X			
Entergy Louisiana, LLC	X	X			
Entergy Mississippi Inc.	X	X			
Entergy New Orleans, Inc	X	X			
Entergy Texas, Inc.	X	X			
Cedar Falls Utilities	X	X			
City of Columbia, MO	X	X			
City Water, Light & Power (Springfield, IL)	X	X			
Great River Energy	X	X			
GridLiance Heartland LLC (3/1/2020)	X	X			
Henderson Municipal Power & Light	X	X			
Hoosier Energy Rural Electric Cooperative	X	X			
Indiana Municipal Power Agency	X	X			
Indianapolis Power and Light	X	X			
Lafayette Utility System	X	X			
Louisiana Energy and Power Authority	X	X			
Louisiana Generating	X	X			
Michigan Electric Transmission Co, LLC	X	X			
Michigan Public Power Agency	X	X			
Michigan South Central Power Agency	X	X			
MidAmerican Energy Company	X	X			
Minnesota Power, Inc and subsidiary	X	X			
Minnesota Municipal Power Agency	X	X			
Missouri River Energy Services	X	X			
Muscatine Power and Water	X	X			
Montana-Dakota Utilities Co.	X	X			
Northern Indiana Public Service Company	X	X			
Northwestern Wisconsin Electric Company	X	X			

Otter Tail Power Company	X	X			
Pioneer Transmission	X	X			
Prairie Power	X	X			
Rochester Public Utilities	X	X			
Republic Transmission	X	X			
Cooperative Energy	X	X			
Southern Illinois Power Cooperative	X	X			
Southern Minnesota Municipal Power Agency	X	X			
Vectren for Southern Indiana Gas & Electric	X	X			
Wabash Valley Power Association, Inc.	X	X			
Wolverine Power Supply Cooperative, Inc.	X	X			
Xcel Energy, Inc.	X	X			
Manitoba Hydro			X		
International Transmission Company					X
Non-MISO Members					
Consumers Energy				X	
GridLiance Heartland LLC (3/1/2020)				X	
Lansing Board of Water and Light				X	
Minnkota Power Cooperative				X	
NorthWestern Energy				X	

Appendix B

Balancing Areas within the MISO Reliability Coordination Area

	Balancing Area Name	Balancing Area	Local BA within MISO BA	Under MISO Tariff	Reliability Coordination Office		
					Carmel, IN	Eagan, MN	Little Rock, AR
0	Midcontinent ISO	MISO	-	Yes	X	X	X
1	Alliant Energy - CA - ALTE	ALTE	Yes	Yes	X		
2	Alliant Energy - CA - ALTW	ALTW	Yes	Yes		X	
3	Ameren Illinois	AMIL	Yes	Yes	X		
4	Ameren Missouri	AMMO	Yes	Yes	X		
5	Big Rivers Electric Corporation	BREC	Yes	Yes	X		
6	Duke Energy	CIN	Yes	Yes	X		
7	City Water Light & Power	CWLP	Yes	Yes	X		
8	Columbia Water & Light	CWLD	Yes	Yes	X		
9	Consumers Energy Company	CONS	Yes	Yes	X		
10	Dairyland Power Cooperative	DPC	Yes	Yes		X	
11	Detroit Edison Company	DECO	Yes	Yes	X		
12	Entergy Arkansas	EAI	Yes	Yes			X
13	Entergy Electric System	EES	Yes	Yes			X
14	Entergy Mississippi	EMBA	Yes	Yes			X
15	Great River Energy	GRE	Yes	Yes		X	
16	GridLiance Heartland (3/1/2020)	GLH	Yes	Yes	X		
17	GridLiance Heartland BA (3/1/2020)	GLHB	No	No	X		
18	Henderson Municipal Power & Light	HMPL	Yes	Yes	X		
19	Hoosier Energy	HE	Yes	Yes	X		
20	Indianapolis Power & Light Company	IPL	Yes	Yes	X		

21	MidAmerican Energy Company	MEC	Yes	Yes		X	
22	Madison Gas and Electric Company	MGE	Yes	Yes	X		
23	Michigan Electric Coordinated System	MECS	Yes	Yes	X		
24	Michigan Upper Peninsula	MIUP	Yes	Yes	X		
25	MHEB, Transmission Services	MHEB	No	No		X	
26	Minnesota Power, Inc.	MP	Yes	Yes		X	
27	Montana-Dakota Utilities Co.	MDU	Yes	Yes		X	
28	Muscatine Power and Water	MPW	Yes	Yes		X	
29	Northern Indiana Public Service Company	NIPS	Yes	Yes	X		
30	Northern States Power Company	NSP	Yes	Yes		X	
31	Otter Tail Power Company	OTP	Yes	Yes		X	
32	Southern Indiana Gas & Electric Co.	SIGE	Yes	Yes	X		
33	Southern Illinois Power Cooperative	SIPC	Yes	Yes	X		
34	Southern Minnesota Municipal Power Agency	SMP	Yes	Yes		X	
35	Upper Peninsula Power Co.	UPPC	Yes	Yes	X		
36	Wisconsin Energy Corporation	WEC	Yes	Yes	X		
37	Wisconsin Public Service Corporation	WPS	Yes	Yes	X		
38	CLECO	CLECO	Yes	Yes			X
39	Lafayette Utility System	LAFA	Yes	Yes			X
40	Louisiana Energy and Power Authority	LEPA	Yes	Yes			X
41	Louisiana Generating	LAGN	Yes	Yes			X
42	Cooperative Energy	SME	Yes	Yes			X

Appendix C

Responsibilities and Authorities

The following lists the responsibilities/authorities of the MISO and the documents where those responsibilities/authorities are defined.

MISO Responsibilities / Authorities	
Document	**Responsibilities / Authorities**
MISO Transmission Owner Agreement	• **Security and Reliability of the Transmission System** • **Provide outage coordination** • **Take emergency action – including shedding load**
MISO Tariff	• **Curtailment of transmission service**
Coordination Agreement	• **Security and Reliability of the Transmission System** • **Provide outage coordination**
Interconnection Agreements	• **Agreement between Transmission Owners and Generation Owners**
Appendix "I"	• **Security and Reliability of the Transmission System** • **Outage coordination for independent transmission Companies (ITC, METC)**
RC Agreement	• **Provide Reliability Coordination Services**
Agreement Between Midcontinent ISO and Midcontinent ISO BAs to Implement TEMT	• **Agreement between Midcontinent ISO and BAs that are signatories to the agreement. The agreement does not apply to non-MISO members.** • **The agreement delineates the responsibilities between Midcontinent ISO and the BAs as is necessary to allow the TEMT, market tariff, to be implemented.**
MISO BA – Local BA Agreements	• **The agreement documents the coordination of the actions associated with the defined BA responsibilities**