1 Purpose

This document describes the terms and methodologies used in the calculation of Transmission Reliability Margin (TRM). Specifically, the document describes the following:

- The methodology for calculation of TRM
- The method used to allocate TRM across Flowgates
- Use of TRM in AFC calculation

2 Scope

The scope of the Transmission Reliability Margin Implementation Document covers the process used for calculating the Transmission Reliability Margin (TRM) and the criteria for the use of TRM in AFC calculation.

3 Definitions

Capitalized terms herein shall have the meaning provided in the MISO Tariff, the NERC Reliability Standards (NERC Standards), the NERC Glossary of Terms used in Reliability Standards (NERC Glossary), or as defined by this document.

- **Available Flowgate Capability (AFC):** The AFC of a Flowgate refers to the amount of MW transfer capacity on a Flowgate that remains available for additional transmission service above and beyond existing uses of the Transmission System. Existing usage of the Transmission System include the generation to load impacts on the Flowgate and transmission service that has already been sold. AFC values are time and service-type dependent. MISO calculates firm and non-firm AFC values for 36 months into the future from the next hour.
- **Operating Horizon:** The Operating Horizon is defined to be the next forty-eight (48) hours of operation. This includes Real-Time (current day) and Day-Ahead (next day) timeframe.
- **Outage Transfer Distribution Factor (OTDF):** An OTDF Flowgate is a Flowgate that monitors the flow on a single or multiple transmission element for the loss of other transmission element(s).
- **Planning Horizon:** The Planning Horizon is defined as the time beyond the Operating Horizon up to 36 months ahead.
- **Power Transfer Distribution Factor (PTDF):** A PTDF Flowgate is a Flowgate that monitors the flows on a single or multiple transmission elements without a contingency.
- **Transmission Reliability Margin (TRM):** The amount of transmission transfer capability necessary to provide reasonable assurance that the interconnected

transmission network will be secure. TRM accounts for the inherent uncertainty in system conditions and the need for operating flexibility to ensure reliable system operations as system conditions change.

4 Roles and Responsibilities

- **Seams Administration Engineers**: Responsible for calculating TRM values on MISO-owned Flowgates using the methodology described in this document.
- **Contingency Reserve Requirements and DCS Data Provider**: MISO Resource Adequacy department is responsible for providing Contingency Reserve Requirement data and NERC Disturbance Control Standard (DCS) value for TRM calculation.

5 TRM Methodology Description

5.1 Introduction

MISO uses the Flowgate methodology. TRM values are calculated (in MW) for each Flowgate. AFC values are calculated starting with the TFC (Total Flowgate Capacity, also referred to as the Flowgate rating), in both firm and non-firm AFC calculations across all horizons for which AFC values are calculated as described in the Transmission Provider's ATCID.

On the MISO transmission system, TRM is applied to a Flowgate in the Operating and Planning Horizons to account for uncertainty in system conditions that result from the modeling of AFC values for future time periods and as necessary for Automatic Reserve Sharing (ARS). More specifically, immediately upon notification of an ARS triggering event, emergency replacement energy schedules are implemented from the MISO market and any Balancing Authority (BA) outside of the market taking Reserve Sharing Services from MISO. The reserve sharing component of TRM provides reasonable assurance that transmission capacity will be available to accommodate contingency reserve sharing when such is necessary. TRM will only be decremented on all MISO Flowgates where a margin is determined to be necessary.

The ATCID describes the consideration of TRM as related to the evaluation of transmission service requests (TSRs).

MISO will include TRM in its evaluation of transmission service requests to ensure that, as the MISO Transmission System is being expanded, it continues to accommodate the TRM as necessary.

Data Requests – MISO will provide clarification of its TTC/TFC methodology, ATCID, CBMID or TRMID, to any registered entity that demonstrates a reliability need within forty-five calendar days of receiving a request or on the schedule as specified by the requestor.[1] If the request for clarification is contrary to MISO's confidentiality, regulatory or security requirements, a written response will be provided explaining on what basis the clarification could not be provided and whether there are any options for resolving the confidentiality, regulatory or security concerns.

5.2 Allocation of TRM Values across Flowgates

5.2.1 Calculation of TRM Values

TRM is calculated for each Flowgate on the MISO Transmission System utilizing the following process[2]:

1. A PTDF Flowgate is created (these will be called OTDF placeholders) to represent every OTDF Flowgate (except Flowgates whose transmission owner's planning criteria require that post-contingency safety of one transmission line plus one generator outage) to avoid limiting the system flow with single or multiple outages.
2. Given a set of pre-determined generation contingencies:
    a. Create a set of participation factors for each contingency, given that the participation factors amongst Contingency Reserve Sharing Group (CRSG) members change depending upon the magnitude of the outage and its location.
    b. For every outage, simulate a transfer from the CRSG members to the outage location and record the impact on all Flowgates (use the OTDF placeholders if such a placeholder was created in Step 1).
3. The largest MW impact on a Flowgate as a result of the outage transfer is the calculated Automatic Reserve Sharing (ARS) Component for this Flowgate.
4. Two percent (2%) of the TFC is then added to the calculated Automatic Reserve Sharing Component to calculate the final TRM value for the Flowgate.
5. The TRM calculated for the OTDF placeholder is used on the original OTDF Flowgate.

[1] References retired CFR00132, NERC Standard MOD-008-1 R3. MISO will continue to perform this service for its members under NAESB standard WEQ-023-1.7.
[2] References retired CFR00132, NERC Standard MOD-008-1a R1. MISO will continue to perform this service for its members under NAESB standard WEQ-023-1.6.

5.2.1.1 "a" and "b" TRM Coefficients

The "a" and "b" TRM coefficients are applied as multipliers to the final TRM value for each Flowgate to calculate non-firm AFC values. The "b" coefficient is utilized in the Operating Horizon when schedules are used to calculate AFC; while the "a" coefficient is utilized in the Operating and Planning Horizons when reservations are used to calculate AFC. The "a" TRM coefficient utilized for each Flowgate is generally 1. The "b" TRM coefficient is typically the seasonal average of the ARS component divided by the final TRM value for each Flowgate.

5.2.2 Flowgate TRM Assignment

Discrete TRM values are determined for summer and winter seasons; however, the same TRM value of each Flowgate is used for the same season in all AFC/ATC calculation years, i.e., only one summer TRM value and one winter TRM value for each Flowgate. The default switch days of the two values are April 15th and October 15th.

5.3 TRM Components

The following components are included in MISO's TRM:

5.3.1 Automatic Reserve Sharing (ARS) Component

The ARS component of TRM is the contingency reserve MW amount that reflects the reserve sharing requirements for all Contingency Reserve Sharing Group members. MISO models the single larger contingency identified by the CRSG group, loss of a generator internal to MISO with a nameplate capacity greater than 300 MW, and other generators internal or external to MISO after review with MISO Transmission Owners. The ARS component of TRM will be determined on a seasonal basis (summer and winter) and is applicable to both the Operating and Planning Horizons of the AFC calculations.

5.3.2 Uncertainty Component

Modeling assumptions utilized to calculate AFC values can contribute to uncertainties between planning studies and real-time operations. The uncertainty component is, therefore, applicable only in the Planning Horizon of the AFC calculations. While MISO does not directly utilize uncertainty components to establish TRM values for Flowgates, it addresses them by applying a factor of two percent (2%) of the Flowgate TFC on the top of the ARS component Flowgate. Specifically, the 2% factor is intended to address

the following uncertainties associated with the calculation of AFC values in the Planning Horizon[3]:

- Aggregate Load Forecast: Load forecast error can contribute to an increase in real-time facility loading above predicted values. MISO uses load forecast information from the NERC SDX file for ATC/AFC calculations.
- Load Distribution Uncertainty: Load distribution uncertainty can also contribute to an increase in real-time facility loading above predicted values.
- Forecast Uncertainty in Transmission System Topology: Uncertainty in Transmission System topology, including, but not limited to, forced or unplanned outages and maintenance outages, can contribute to uncertainty in the AFC calculation. MISO uses outage information from the NERC SDX file for ATC/AFC calculations.
- Allowances for the Parallel Path (loop flow) Impacts: Real-time facility loading can be higher than predicted due to unaccounted parallel path flows resulting from scheduled transfers by other entities. MISO attempts to account for all parallel path flows by utilizing NERC schedules and OASIS transmission reservations in its AFC calculations. Parallel path flows that are not captured through this process are addressed through this uncertainty component.
- Variations in generation dispatch (including, but not limited to, forced, unplanned or rescheduled generation outages, and location of future generation): MISO uses generator outage information from the NERC SDX file for AFC calculations. Variations in the generation dispatch in the MISO market can also contribute to uncertainty in the AFC calculation. Market dispatch can vary from predicted levels based on economic and congestion variances.

5.4 Additional Considerations

Only the uncertainties described in Section 5.3.2 are included in the TRM calculation. The following uncertainties are not utilized or addressed in the TRM values established by MISO[4]: Allowances for simultaneous path interactions, Short- term System Operator response (Operating Reserve actions), and Inertial response and frequency bias. Further, any potential for double-counting between TRM values and Capacity Benefit Margin

[3] References retired CFR00132, NERC Standard MOD-008-1 R1. MISO will continue to perform this service for its members under NAESB standard WEQ-023-1.3.
[4] References retired CFR00132, NERC Standard MOD-008-1 R1. MISO will continue to perform this service for its members under NAESB standard WEQ-023-1.3.

(CBM) values are removed during CBM calculations, as required by FERC Order 890, NAESB Business Practices Standard WEQ-023-3.1, and NAESB Business Practices Standard WEQ-023-4.1. Please refer to the CBM Implementation Document (CBMID) for additional details regarding this process.

Finally, Flowgates that experience an excessive level of congestion may be subjected to additional TRM to reduce future congestion. The Transmission Owner may petition MISO for additional TRM (beyond the uncertainty, reserve sharing, and stability components) or MISO may identify the need for additional TRM. MISO will review these requests and will decide whether to increase the uncertainty component or TRM under these circumstances and announce their decision at the open meeting of the Reliability Operation Working Group (ROWG).

5.5 TRM Update Schedule

TRM studies and updates are performed at a minimum of twice per calendar year. Please note that actual TRM values may remain unchanged after the biannual study has been performed. Additional TRM updates may be performed when necessary, including, but not limited to Transmission Owner membership change. Study input data and results are posted to The MISO Extranet ROWG webpage after each biannual study. Transmission Service Providers, Reliability Coordinators, Planning Coordinators, Transmission Planners, and Transmission Operators may request any documentation underlying the establishment of TRM values or this TRMID that is not available through posting on OASIS or the MISO Extranet by submitting a written request to its MISO AFC Engineering Contact posted on OASIS.[5]

Within seven calendar days of the completion of a TRM study, MISO will apply the new values to its AFC calculations and notify its transmission planning department of the new values.

6 References

- Attachment C of EMT
- NAESB WEQ-023-4 TRM Requirements
- TP-OP-005 Available Transfer Capability Implementation Document
- TP-PL-003 Capacity Benefit Margin Implementation Document

[5] References retired CFR00132, NERC Standard MOD-008-1 R3. MISO will continue to perform this service for its members under NAESB standard WEQ-023-1.8.1.

7 Disclaimer

This document is prepared for informational purposes only, to support the application of the provisions of the Tariff and the services provided thereunder. MISO may revise or terminate this document at any time at its discretion without notice. While every effort will be made by MISO to update this document and inform its users of changes as soon as practicable, it is the responsibility of the user to ensure use of the most recent version of this document in conjunction with the Tariff and other applicable documents, including, but not limited to, the applicable NERC Standards. Nothing in this document shall be interpreted to contradict, amend, or supersede the Tariff. MISO is not responsible for any reliance on this document by others, or for any errors or omissions or misleading information contained herein. In the event of a conflict between this document, including any definitions, and either the Tariff, NERC Standards, or NERC Glossary, the Tariff, NERC Standards, or NERC Glossary shall prevail. In the event of a conflict between the Tariff and the NERC Standards, or NERC Glossary, the Tariff shall prevail until or unless the Federal Energy Regulatory Commission (FERC) orders otherwise. Any perceived conflicts or questions should be directed to the Legal Department.

8 Revision History

Doc Number	Description	Revised by:	Effective Date
TP-PL-002-r16	Conversion from NERC MOD standards to NAESB WEQ standards	A. Klueber	JAN-27-2023
TP-PL-002-r15	Completed Annual Review	Matt Sutton/ Yi Yuan	JUL-22-2022
TP-PL-002-r14	Completed Annual Review	S.Guo	JUL-26-2021
TP-PL-002-r13	Completed Annual Review	S.Guo	JUL-26-2020
TP-PL-002-r12	Update the section 5.4 with current meeting group “ROWG” instead of “AFCWG”. Completed Annual Review	S. Guo	JUL-26-2019
TP-PL-002-r11	Completed Annual Review	S.Guo J. Minks	JUL-26-2018
TP-PL-002-r10	Completed Annual Review	S. Guo/ J. Minks	JUL-26-2017
TP-PL-002-r9	Completed Annual Review	S. Guo	JUL-26-2016
TP-PL-002-r8	Completed Annual Review	K. Thomas	JUL-26-2015
TP-PL-002-r7	Completed Annual Review	K. Thomas/ J. Li	JUL-26-2014

TP-PL-002-r6	Revised Section 5.4 with correct reference to Section 5.3.2. Due to manual error added missing information in Revision History and 'a' and 'b' were added to distinguish versions of revisions 1 and 3.	T. Nguyen/ C. Risley	DEC-19-2013
TP-PL-002-r5	Completed Annual Review	T. Nguyen/ J. Li	JUL-26-2013
TP-PL-002-r4	Completed Annual Review	J. Harmon	JUN-28-2012
TP-PL-002-r3b	MISO Rebranding Changes JUL-12-2011	G. Krebsbach	APR-01-2011
TP-PL-002-r3a	Added additional information as required by NERC standard MOD-008-1.	J. Harmon	APR-01-2011
TP-PL-002-r1b	Annual Review completed 04/14/2010	C. Risley	MAY-26-2009
TP-PL-002-r1a	Added Appendix A to this document as approved by AFC Work Group in March 2008	K. Zhu	MAY-26-2009
TP-PL-002	Original	J. Harmon	JUL-31-2008