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 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 on 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 uses of the transmission system include the generation to load impacts on the Flowgates 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 and day ahead time periods.

- **Outage Transfer Distribution Factor (OTDF):** An OTDF Flowgate is a Flowgate that monitors the flow on a single or multiple transmission elements for the loss of other transmission elements.

- **Planning Horizon:** The Planning Horizon is defined to be 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 flow 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

MISO Seams Administration Engineers - Are responsible for calculating TRM values on MISO owned flowgates using the methodology described in this document.

Contingency Reserve Requirements and DCS data provider – MISO Dispatch & Balancing 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 MWs) for each Flowgate which AFC values are calculated and are applied to the TFC 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 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.

MISO will include TRM in its transmission service planning process to ensure that, as the MISO transmission system is being expanded, it continues to accommodate the TRM as necessary.
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:

1. A PTDF Flowgate is created to represent every OTDF Flowgate (these will be called OTDF placeholders) to avoid limiting the system flow with multiple outages, except for Flowgates whose transmission owner’s planning criteria requires that post-contingency safety of one transmission line plus one generator outage.

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.

5.2.1.1 “a” and “b” TRM Coefficients

The “a” and “b” TRM coefficients are utilized to calculate the final amount of TRM to be applied to each Flowgate when calculating 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 Horizon when using Reservations to calculate AFC and in the Planning Horizon. The “a” TRM coefficient utilized for each Flowgate is generally 1. The “b” TRM coefficient is normally the ARS component divided by the full TRM value for each Flowgate. These coefficient values are applied as multipliers to the TRM value calculated above when MISO is calculating non-firm AFC values.

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 MW amount required to deliver contingency reserves that reflect 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 as conditions approach 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 rating on top of the ARS component for each Flowgate as described above. Specifically, the 2% factor is intended to address the following uncertainties associated with calculation of AFC values in the Planning Horizon:

- **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 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 captured through this uncertainty component.

- Variations in generation dispatch (including, but not limited to, forced or unplanned outages, maintenance outages and location of future generation): MISO uses generator outage information from the NERC SDX file for AFC calculations. Unplanned generator outages are included in this uncertainty component. 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 factors.

5.4 Additional Considerations

Only the uncertainties described in Section 5.3.2 are included in TRM calculation. The following uncertainties are not utilized or addressed in the TRM values established by MISO: 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 (“CBM”) values are removed during CBM calculations, as required by FERC Order 890, NERC Reliability standard MOD-004-1, and NERC Reliability standard MOD-008-1. 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 make a determination whether to increase the uncertainty component or TRM under these circumstances and announce their decision at the open meeting of the Available Flowgate Capability Working Group (“AFCWG”).

5.5 TRM Update Schedule

TRM updates are performed at a minimum of twice per calendar year. Please note that actual TRM values may remain unchanged even after an update has been performed if the supporting input data remains unchanged. 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 after each update. 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 AFC Methodology Contact posted on OASIS.

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
- NERC MOD-008-1 – TRM Calculation Methodology
- TP-OP-005 Available Transfer Capability Implementation Document
- TP-PL-003 Capacity Benefit Margin Implementation Document

7 Disclaimer
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### 8 Revision History

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