Michehl R. Gent
President and CEO

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

Princeton Forrestal Village, 116-390 Village Boulevard, Princeton, New Jersey 08540-5731

February 24, 2005

The Honorable Patrick H. Wood III, Chairman
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Dear Chairman Wood:

Midwest Independent System Operator Readiness

I am writing to explain the steps that NERC has taken to evaluate the capability of the Midwest Independent System Operator (MISO) to meet its reliability responsibilities as MISO begins its market operations, now scheduled for April 1, 2005.[1] I am pleased to report that we believe MISO is ready, from a reliability standpoint, to commence its market operations.

NERC's evaluation had two principal goals: First, to understand MISO's capability for operating the bulk electric systems for which it has responsibility in a reliable manner; second, to verify MISO's ability to carry out certain obligations to manage the reliability impacts of its market operations on third parties. MISO described these obligations and methods for achieving them in Attachment A of its Reliability Plan, which the NERC Operating Committee approved on March 25, 2004.[2] In anticipation of MISO's market operations, the NERC Operating Committee granted, in July 2003, MISO's request for waivers to NERC's operating policies to allow MISO to serve as a "scheduling agent" for its control area members and upload its market flow calculations directly into the Eastern Interconnection's Interchange Distribution Calculator. (The latter waiver requires MISO to calculate its market flows between dispatch zones and upload these flow details directly into the Interchange Distribution Calculator in the same manner that PJM does for its market operations.) When NERC approved the waivers and the MISO Reliability Plan, it did so on the condition that NERC would audit MISO's capability to meet the reliability obligations associated with MISO's market operations before MISO began market operations.

[1]NERC previously conducted reliability readiness audits of MISO's Carmel and St. Paul operations centers on February 19–20 and April 1, 2004, respectively. NERC posted the final reports from those audits on NERC's public website on April 6 and July 2, 2004 (http://www.nerc.com/~rap/audits.html). NERC also performed an on-site verification of MISO's capabilities in June 2004. Those audits provided NERC with the assurance that MISO was capable of carrying out its responsibilities as a reliability coordinator.

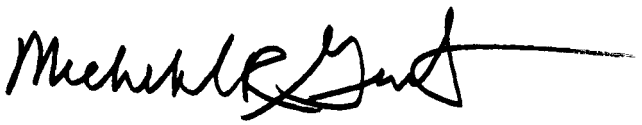
[2]The NERC Board of Trustees ratified the action of the Operating Committee and notified the Commission of its action on April 2, 2004.

NERC staff conducted extended discussions with MISO and reviewed material supplied by MISO to ascertain the status of MISO's efforts to improve its state estimation and real-time contingency analysis capabilities. As detailed in the attached letter from Roger Harszy, MISO's Vice President for Real Time Operations, to David Hilt, NERC's Vice President for Compliance, MISO has made tremendous progress since August 2003 in improving its state estimation and real-time contingency analysis capabilities. MISO now has state-of-the-art state estimation and real-time contingency analysis tools for use in monitoring and operating the bulk electric system facilities for which it has responsibility. While we cannot verify that MISO has included every operating scenario and every transmission element in its market operations, based on our previous audits of MISO and the additional information we have received from MISO, we are confident that MISO is capable of operating the system within its boundaries reliably.

To determine whether MISO can successfully enter its market flow calculations into the IDC, NERC's Interchange Distribution Calculator Working Group, which is responsible for managing the IDC and its functional specifications, recently spent five days at MISO testing MISO's ability to effectively load its market dispatch into the IDC and perform the other actions necessary to implement the waivers granted by the Operating Committee. The working group also tested the IDC to ensure that it is capable of properly handling MISO's market flow calculations when calculating transmission loading relief curtailments in the Eastern Interconnection. The IDC Working Group has verified MISO's ability to carry out its obligations, as MISO has explained them to NERC, to manage the reliability impacts of its market operations on third parties. The working group also verified that MISO has the ability to meet the rest of its reliability obligations associated with the startup of its market operations. Based on the work done by the working group, on February 9–10 NERC's Operating Reliability Subcommittee accepted the results of the technical verification of MISO's readiness to implement the NERC policy waivers and continue with market startup.

Please contact me if you have questions or need additional information regarding this matter.

Sincerely,



cc: Commissioner Nora Mead Brownell
Commissioner Joseph Kelliher
Commissioner Suedeen Kelly
James Torgerson

MIDWEST INDEPENDENT TRANSMISSION SYSTEM OPERATOR, INC.

Roger Harszy
Vice President, Real Time Operations

January 25, 2005

Sent via email: Dave.Hilt@nerc.net

Mr. David Hilt
North American Electric Reliability Council
116-390 Village Boulevard
Princeton, NJ 08540-5731

Dear Mr. Hilt:

As we have discussed, the Midwest ISO is aware of state estimator modeling issues expressed by certain Midwest ISO members, in various forums, including the ones recently mentioned in an industry trade publication. These modeling issues have been expressed as a potential concern for the reliable start up of the Midwest ISO market operations. The Midwest ISO has worked directly with our members to resolve their concerns and will continue to do so with any potential future concerns.

Although the Midwest ISO is unaccustomed to responding to third parties about unsubstantiated allegations made in industry trade publications, we understand your questioning the validity of the reliability issues that were raised with the Midwest ISO state estimator (SE) and real time contingency analysis (RTCA) tools and are taking this opportunity to update you on the status of those tools.

Bottom line, the results achieved in the Midwest ISO SE and RTCA tools are among the finest in the industry, are used continuously by the Midwest ISO Reliability Coordinators to effectively and very reliably monitor the entire Midwest ISO transmission system and surrounding areas, and are a solid reliability foundation on which to launch the Midwest ISO market operations as planned on March 1, 2005. The Midwest ISO SE and RTCA have undergone unprecedented review and validation by our members and an independent readiness advisor.

As you know, the core mission of the Midwest ISO is to ensure the safe, efficient and reliable function of the transmission infrastructure, which these tools facilitate. However, we are not willing to state these conclusions without providing you supporting facts and statistics. We believe this information will be of particular interest to you given your extensive experience and expertise with state estimation/contingency analysis.

The Midwest ISO's SE and RTCA tools were fully developed and continuously used by the Reliability Coordinators as of one year ago. In the mean time, we have continued to maintain, expand and enhance the state estimator model.

SE and RTCA Statistics

Some current statistics for the SE and RTCA tools:

- The number of network buses is now approximately 31,000 (This is the largest we know of in the world and at least twice as many as the next largest model)
- The total number of ICCP measurements applied to the model as a whole, is approximately 127,800. Approximately 67,100 of these are status measurements and approximately 60,700 are analog measurements.
- There are approximately 11,400 measurements applied to the TVA portion of the model. Please note that the TVA representation in the model is node-breaker representation.
- There are approximately 6,000 measurements applied to the newly implemented node-breaker representation of the classic PJM companies consisting of AP, DPL, DLCO and PENN ELECTRIC.
- We continue to have excellent measurement observability in the AEP and CE portions of the model. Specifically, there are approximately 8,123 AEP measurements and approximately 10,325 CE measurements applied to the State Estimator model.
- The State Estimator takes approximately 15 seconds to solve and is triggered as part of a real time sequence every 90 seconds. We also have the ability to trigger a new SE case on-demand when needed.
- Approximately 8,500 contingencies are solved in the Real Time Contingency Analysis, which takes approximately 120 seconds to solve and is performed at least every five minutes as part of the real-time sequence. Again, we can trigger the RTCA on demand when desired. This is the largest number of contingencies we know of monitored for any electrical transmission system.

SE and RTCA Maintenance

During the past two years, MISO has been working with the Transmission Owners (TO's) and Market Participants (MP's) to review and improve the various MISO models (Network, FTR and Commercial models). The following examples highlight specific steps that MISO has taken to establish processes, procedures and methods for updating and improving the models:

- Since October 2002, MISO has been inviting Transmission Owners to Carmel and St. Paul to conduct on-site reviews of the EMS model and the state estimator solution. A log of the members' review of the model and state estimator solution is presented in the attached document.

- In May 2003, MISO established the EMS/FTR Modeling Task Force, whose purpose is for the Midwest ISO to discuss Network Model related issues and concerns with the Market Participants, Transmission Owners and industry experts. Representatives from our control areas and transmission operators participated in the meetings during 2003 and 2004. Also, in

May 2003, the Midwest ISO implemented the Web Tool that allows TO's to submit their transmission system changes to MISO for the models to be updated and improved.

- The Midwest ISO discussed a model update procedure with the EMS/FTR Modeling Task Force that requires updating the models every 2-3 months. Since September 2003, the Midwest ISO has been executing this plan. Moreover, each time the models are materially updated, they are posted on the MISO Extranet for review by the TO's and Market Participants. In addition to the above regularly scheduled model updates, the Midwest ISO has the capability to include changes to network topology on demand.

- In June, July and August 2004, the Midwest ISO organized three (3) modeling workshops to provide a forum for all the stakeholders to express their concerns and make suggestions that could help the Midwest ISO to improve the models. These workshops were well attended by many stakeholders, including Xcel Energy Services.

- For over 12 months, the Midwest ISO has provided remote terminals at member's sites, including Xcel, to assist them to remotely review the Midwest ISO EMS model and State Estimator solution.

- Midwest ISO is completing an extensive ICCP Point to Point Checkout with our members, using Xcel as an example; the Midwest ISO and Xcel have completed the checkout process for approximately 90% of Xcel's real-time data. Errors were identified on only 3% of the ICCP points checked with Xcel as of January 25th. State Estimator solutions are based on the entire measurement set (~ 127,000 total ICCP measurements across the footprint and surrounding areas). While this error rate is low, the state estimator is designed to and does effectively deal with the errors to provide solutions.

- The Midwest ISO presented the Model Business Practice Manual (BPM) to stakeholders for their review and comments. Updates to the manual are posted on the Midwest ISO Extranet. The Midwest ISO has followed the practices outlined in the Model BPM.

- The Midwest ISO has posted the EMS model (in PSS/E format) for review by the stakeholders on a daily basis.

MISO Network Model and State Estimator Metrics

The Midwest ISO has established extensive metrics, with stakeholder input and consensus, to directly measure the readiness for MISO to commence market operations. The completion of the metrics are being verified by SAIC who is the independent Readiness Advisor to the Midwest ISO Board.

A summary of twelve of the metrics directly related the SE model is depicted in the table below. All of these metrics have been verified complete by the independent SAIC Readiness advisor. You may discuss their completeness directly with the independent Readiness Advisor by contacting Don McCormick via 317-805-0490.

Metric Number	Metric Description
01	State Estimator is functioning according to specification
02	State Estimator has ninety-seven percent (97%) availability of five (5) minute solutions for a one (1) week period.
37	Coordinate and host a final review of the network model inputs, including first tier systems beyond Midwest ISO's footprint (as defined as of November 1, 2003).
38	Provide a monthly snapshot of the network model topology before Day in the Life Enhanced Market Trials and when any changes occur.
46	Real-Time Performance Criteria For thirty (30) consecutive days a Valid State Estimator solution must be achieved for ninety-seven percent (97%) of the five (5) minute periods within that thirty (30) day period. *Note, average availability is 98.5%.* There will be no more than three (3) consecutive five (5) minute periods without a valid solution (except when there is a planned system software migration as required by the Energy Markets project or when ICCP data is unavailable due to remote CA ICCP node errors). Valid solution is defined as one converged solution in a 5 minutes period using converge tolerance of .005 per unit voltage magnitude and/or angle and maximum power mismatch of 50MW inside the State Estimator model within the Midwest ISO Market footprint. *It is important to put the mismatch metric in context. While these metrics were achieved, the actual performance is much better. The 50 MW mismatch target criteria for metric 46 is based on suggestions from MISO stakeholders on standard levels of State Estimator solved mismatch for a model of a large electrical footprint. This 50 MW target is based on what the stakeholders would expect for a state estimator achieving good solutions. This is not the amount of mismatch observed at each bus, but the largest mismatch allowed at any given single bus. On average our largest single bus mismatch is in the 25 MW range. However, if you look at the entire footprint, the total mismatch divided among all buses is negligible (less than one MW). This is a remarkably low level of mismatch to achieve for a model the size of MISO's.* *SE solved to an average voltage angle of .0008 pu and an average voltage magnitude of .0017 pu across MISO.*
47	On the fifty (50) most limiting elements (at least one per Control Area within the Midwest ISO System), the absolute difference between the telemetered flow and the State Estimator Megawatt ("MW") flow is within five percent (5%) but no greater than 50 MW for the selected elements, of the base rating (i.e., normal rating for Power Transfer Distribution Factor ("PTDF") flowgates and emergency rating for Outage Transfer Distribution Factor ("OTDF") flowgates). The fifty (50) most limiting elements will be defined by historical data from the Midwest ISO. The remaining elements will be defined by MISO, with Stakeholder input. All flowgates (elements) will be inside the observable Midwest ISO Market model.
47.1	On 50 units (at least one per Control Area within the Midwest ISO system), the absolute difference between the telemetered MW output and the State Estimator solved MW output will be within five percent (5%) but no greater than 50 MW of the base rating or Pmax for each selected unit. The list of monitored units will be selected by MISO with stakeholder input.
48	On the fifty (50) most limiting flowgates, the absolute difference between the State Estimator solved flow and the power flow base case solution is within one percent (1%) of the base rating (i.e. normal rating for PTDF flowgates and emergency rating

	for OTDF flowgates). The fifty (50) most limiting flowgates will be defined by historical data from the Midwest ISO. The power flow base case solution to be compared with the State Estimator solution is the ESCA power flow solution. All flowgates (elements) will be inside the observable Midwest ISO Market model.
49	On thirty (30) buses where voltage is deemed critical, the solved State Estimator voltage will be within two percent (2.0%) +/- accuracy of the metered voltage, provided that the metered voltage is measured to within the notified accuracy. The thirty (30) critical buses will be defined by the Midwest ISO with Transmission Owner input. All buses (elements) will be inside the observable Midwest ISO Market model.
50	On ten (10) tie lines to outside of the Midwest ISO System, the absolute difference between the telemetered flow and the State Estimator MW flow is within fifty (50) MW or five percent (5%) for lines 100kv and above, of the base rating. The ten (10) tie lines will be defined by Midwest ISO, with Stakeholder input. All tie lines (elements) will be inside the observable Midwest ISO Market model.
51	On all other branches (greater than 100kV) within the Midwest ISO footprint, the absolute difference between the telemetered flows and the State Estimator flows on transmission lines and transformers are within ten percent (10%) of the base rating. All other branches (elements) will be inside the observable Midwest ISO Market model. MISO will also complete a benchmark review of the reliability coordinator's contingency analysis results
52	Day-Ahead Performance Criteria - The saved case used for the Day-Ahead Reliability Assessment will be converted to the PSS/E format and sensitivities calculated using MUST for fifty (50) flowgates. The fifty (50) flowgates will be defined by Midwest ISO, with Stakeholder input. The sensitivities calculated using MUST will be compared to the sensitivities calculated in the Day-Ahead Reliability Assessment and must be within five percent (5.0%). Given that sensitivities are already expressed as a percentage, the range estimate must be with 5% of that value. For example, the sensitivity range for a 10% value from MUST will be 10.5% to 9.5%.

In conclusion, I trust the above information fully answers any questions you may have regarding the Midwest ISO SE and RTCA tools. Please contact me with any questions concerning this information.

Sincerely,

Roger Harszy
Vice President of Real Time Operations
Midwest ISO