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AUTHOR:	Glenda Rodriguez
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ADDRESSEE:	CHRM Nils Diaz
SUBJECT:	Ameren final readiness audit report
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From: "Glenda Rodriguez" <Glenda.Rodriguez@nerc.net>
To: <regulators@nerc.com>
Date: Wed, Jun 30, 2004 9:41 AM
Subject: FW: Ameren Final Control Area Audit Report

-----Original Message-----
From: Glenda Rodriguez On Behalf Of Richard Schneider
Sent: Tuesday, June 29, 2004 4:34 PM
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Subject: Ameren Final Control Area Audit Report

To: Mr. Gerald D. Beckerle

Dear Mr. Beckerle:

For your review, attached is a letter and report regarding the final Ameren control area audit report. Please contact me if you have any questions.

Sincerely,
Richard Schneider
Compliance Assessment Engineer
North American Electric Reliability Council
116-390 Village Boulevard
Princeton, New Jersey 08540-5731
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cc: Robert K. Harbour, CCC Chair
Mark E. Fidrych, OC Chair
Richard A. Bulley, MAIN Regional Manager
Norbert Mizwicki, MAIN Regional Compliance Manager
Jim Dodge, Audit Team Member
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Mark Westendorf, Audit Team Member
Keith Comeaux, Audit Team Member
Keith Hartley, Audit Team Member
Clifford Franklin, Audit Team Member
John Kueck, Audit Team Member

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

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

June 29, 2004

Mr. Gerald D. Beckerle
Senior Power Supply Supervisor
Ameren Services Company
1901 Chouteau Avenue
St. Louis, Missouri 63103

Dear Mr. Beckerle:

Ameren Final Readiness Audit Report

For your review, attached you will find a copy of the audit team's final report for the Ameren Control Area readiness audit completed March 18, 2004. In that report are the findings and recommendations that were developed as a result of the audit. This report will be posted on the NERC website, http://www.nerc.com/~rap/audits.html, in accordance with the Certification and Compliance Committee (CCC) procedures.

That procedure states:

> *The final audit report will be posted to the NERC website. Should there be a disagreement regarding the findings and recommendations, the control area may provide a statement in writing to be posted in conjunction with final audit report.*
>
> *Should the control area seek adjudication of the dispute through the dispute resolution process, they shall notify NERC within thirty days from the time the audit is posted and transmitted to the control area.*

The audit report includes several recommendations from the audit team. The final procedures for tracking the implementation of these recommendations is being developed by the CCC, however, it is expected that the regions, working with NERC will monitor the implementation.

Once again I would like to thank you and your staff for all of your support during this audit and would welcome any suggestions you may have to improve the audit process.

Sincerely,

David W. Hilt
Vice President–Compliance

Attachment

cc: Robert K. Harbour, CCC Chair
Mark E. Fidrych, OC Chair
Richard A. Bulley, MAIN Regional Manager
Norbert Mizwicki, MAIN Regional Compliance Manager
Jim Dodge, Audit Team Member
Gary Campbell, Audit Team Member
Mark Westendorf, Audit Team Member
Keith Comeaux, Audit Team Member
Keith Hartley, Audit Team Member
Clifford Franklin, Audit Team Member
John Kueck, Audit Team Member

Control Area Readiness Audit Report

Ameren
March 17–18, 2004
St. Louis, Missouri

North American Electric Reliability Council

June 15, 2004

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Introduction

In response to the August 14, 2003 blackout, on February 10, 2004 the NERC Board of Trustees committed to take immediate actions to strengthen the reliability of the North American bulk electric system. Specifically, the board adopted the recommendations of the NERC Steering Group that investigated the August 14, 2003 blackout. These recommendations included:

- A list of specific actions to correct the deficiencies that led to the August 14 blackout;
- Near-term strategic initiatives by NERC and its regional reliability councils to strengthen compliance with existing standards and to formally track completion of recommended actions from August 14 and other significant power system events; and
- Longer-term technical initiatives to prevent or mitigate the impacts of future cascading blackouts.

NERC tasked the readiness audit team with assessing the degree to which the control area meets their responsibilities that are defined as:

> "The control area is responsible for the safe and reliable operation of their portion of the bulk electric system in cooperation with neighboring control areas and their reliability coordinators."

The audit process includes:

- A self-assessment questionnaire to the control area being audited
- A questionnaire to neighboring control areas
- A questionnaire to the reliability coordinator
- An on-site audit by a selected audit team

Neighboring control areas and the reliability coordinator responded to questionnaires that were designed to evaluate the working relationship between them and the control area being audited.

Pre-audit information was sent to the audit team, consisting of responses to the self-assessment questionnaire, questionnaire responses, a set of questions and guidelines to assist them in the on-site audit, and copies of some of the documentation provided by the reliability coordinator being audited, to assist in the readiness evaluation. The team met prior to the on-site audit, to discuss and review interview assignments, the audit process, interview questions, questionnaire responses and complete necessary preparations for the audit.

Ameren Participants

Vice-president Ameren Services
Manager, Energy Supply
Senior Power Supply Supervisor
Power Supply Supervisor
Transmission Coordinator
Transmission Dispatcher
Training Supervisor
Director Transmission Planning and Services
Principal Transmission Planning Engineer
Supervisor, System Protection
Supervising Engineer, Transmission and Interconnections
Supervising Engineer, Transmission Service Analysis
EMS Supervisor
Security Analyst

Auditors

James Dodge, Independent Contractor, NERC Co-Lead
Gary Campbell, MAIN, MAIN Region Co-Lead
Cliff Franklin, FERC
John Kueck, FERC
Norb Mizwicki, MAIN, MAIN Region
Mark Westendorf, Soyland, MAIN Region
Keith Comeaux, Cleco Power LLC, Non-Region Representative
Keith Hartley, Sacramento Municipal Utility District, WECC Representative

Preface

The North American Electric Reliability Council (NERC) has prepared this report. The report represents a review of the readiness of Ameren to meet its responsibilities as a control area and contains recommendations for follow-up action. It is the responsibility of Ameren to address these areas for improvement and to operate its system in a reliable manner.

Executive Summary

The NERC control area readiness audit performed and the information contained in this audit report is only for the Ameren control area. The audit process performed for this report does not include the Ameren CILCO control area.

Ameren is a member of the Mid-America Interconnected Network, Inc. (MAIN) Regional Reliability Council and utilizes the MAIN reliability coordinator as its reliability coordinator. There is no written agreement between Ameren and its reliability coordinator. The reliability coordination service, registered with NERC, is paid for and there is an implicit contract. The power supply supervisor is designated as the control area operator within Ameren's organizational structure and has the authority to take actions up to and including load shedding. Ameren has a sufficient number of NERC-certified operators to provide continuous coverage of the control area operating positions.

Access to the Ameren primary control room and backup facility is controlled for security purposes. Ameren has a formal training program for its system operators and the training does adequately delineate circumstances in which system operators can take pro-active action rather than reactive action to mitigate system abnormal operating conditions.

Ameren's planning department performs required system studies and communicates them to the operations staff. These studies determine the control area voltage operating ranges, reactive requirements and the amount (and to some small extent the location) of operating reserves.

Ameren's real-time monitoring system utilizes an ESCA Energy Management System (EMS). The EMS is located at Ameren's primary control center, but there is has no backup EMS at the backup facility. The main EMS is operable at the backup facility, but if it is not available at the main control room center, it is not available at the backup facility. A spreadsheet system is used at the backup facility, if the EMS is unavailable. Ameren has adequate voice and data gathering facilities.

Ameren provides the system operators with a geographical map display with the locations of frequency transducers to monitor Ameren's system and for possible islands within the boundaries of Ameren's control area footprint in both Illinois and Missouri. Ameren also has voltage monitoring points in several locations.

If there is a high probability that a flow gate may become congested, Ameren and its reliability coordinator will implement a transmission loading relief (TLR) at 95 % of the operating security limit (OSL) or N-1 operating conditions.

Ameren's policy regarding unacceptable load, generation, and net scheduled interchange imbalance is to operate according to NERC Operating Policy 1, Generation Control and Performance.

Ameren's system operators and its reliability coordinator are aware of the status of Ameren's Special Protection Systems (SPS). SPSs are on file with Ameren's reliability coordinator and write ups are on file at the Ameren Energy Supply Operations (ESO) office.

Ameren has a documented Control Area System Restoration Plan. It is on file with MAIN and is practical to implement. Ameren's control area operators are trained by performing system restoration drills with MAIN to comply with NERC recommendations.

Ameren's Capacity and Energy Emergency Plan is used by the system operators as part of their operating procedure. Ameren informs its system operators about changes to operating policies or procedures by sending a memo to all operating personnel.

Ameren has reviewed its policy with regards to vegetation management since August 14, 2003 and no changes were made. Ameren's transmission circuits are patrolled for vegetation and underbuild conditions. There have been no vegetation related transmission outages for a number of years due to the incentives built into the vegetation program.

Ameren has a procedure and an agreement with its nuclear unit concerning voltage and power requirements in both normal and abnormal operating conditions (N-1 and system restoration). Planning studies are performed and the system operator's EMS has alarms designated when notifications to the nuclear plant are required.

Commendations

Ameren has met the minimum requirements for most areas audited but the audit team has identified several areas that exemplify Ameren's commitment to reliable operation:

1. Ameren has provided detailed EMS computer screens and multi-view large screen projections to its system operators for monitoring system-operating parameters.

2. System operators were very knowledgeable about Ameren company procedures and processes.

3. Ameren management informed the audit team that its ESCA platform presently has most of ESCA's software functionality installed and that it will be updating its EMS system to the latest technology.

4. The audit team commends Ameren management for employing degreed engineers in its transmission coordinator and power supply supervisors operating positions.

5. The audit team commends Ameren on its planning department studies and the way it communicates seasonal studies to the operating staff.

6. From verbal responses by the system operators during the interview process and personal observations made by the audit team, the audit team concluded that Ameren has a well-staffed control center and that the operators work well together.

7. The audit team observed that Ameren management's philosophy puts a high value on reliability.

8. Ameren is closely attentive to the needs of its nuclear power plant during normal and abnormal operating conditions.

Recommendations

1. The audit team recommends that Ameren develop a written agreement with the reliability coordinator to delineate responsibility and authority of the reliability coordinator and ensure the system operators know the responsibilities and authority of the reliability coordinator.

2. The audit team recommends that a structured ongoing training program should be as intense and thorough as the program developed for newly hired system operators.

3. The audit team recommends that Ameren's backup facility be operationally tested with the manual tools at the backup facility and without EMS support. Also, the one-lines used at the backup facility should also be updated.

4. The audit team recommends that Ameren modify its letter of authority to shed load and its job descriptions for the transmission coordinator, transmission dispatcher and power dispatcher positions so all its system operating control operating position's job descriptions clearly state the level of authority to shed load.

5. The audit team recommends that documents presented for an audit process should be titled, dated, and, if applicable, signed by the appropriate officer.

6. Documentation reviewed by the audit team found a missing cross-reference to another document for the Capacity and Energy Emergency Plan. Load management and voltage reductions references in the Capacity and Energy Emergency Plan refer to the Ameren Operating Manual, Chapter XII, Section 1202 B. To also include the voltage reductions, Section 1202 D should be added to the statement on the Capacity and Energy Emergency Plan section for load management and voltage reductions. The audit team recommends that Ameren improve documentation and referencing.

7. The audit team recommends that the on-shift system operator schedule be changed to accommodate time for training (e.g. six man rotation or designated training weeks).

8. The audit team recommends that Ameren develop System Control and Data Acquisition (SCADA) system color-code logic for alarm monitoring to help the system operators.

9. The audit team recommends that Ameren improve its state estimation models to include first tier, neighboring control areas, i.e. Southwest Power Pool, Inc. (SPP), Mid-Continent Area Power Pool (MAPP) and Southeastern Electric Reliability Council (SERC) regional reliability organizations.

10. Ameren has indicated it has plans to improve the backup facility EMS and tools, upgrade its primary EMS system, and also provide increased backup facility training for operators. The audit team recommends that Ameren implement a follow-up plan in this area.

On-site Review Notes

The December 1997 merger of CIPSCO Incorporated and Union Electric Company created Ameren. In 2003, Ameren grew with the acquisition of CILCORP Inc., parent of Central Illinois Light Company, now operating as Ameren CILCO. Ameren employees, (totaling approximately 7,700) provide energy services to 1.7 million electric and 500,000 natural gas customers over 49,000 square miles in Illinois and Missouri.

Ameren is interconnected with 23 utilities. It currently operates two control areas — Ameren UE and CIPS (Ameren) with a combined load of 12,000 MW and CILCO with a load of 1,250 MW. It has coal-fired generation, one nuclear unit, two pumped storage units, two hydro units, and a number of gas peaking plants. Most of the generation is from nuclear and coal. Two trading organizations, Ameren Energy and CILCO have the short trading responsibilities. The company divested its generation assets in Illinois as part of deregulation; the Missouri assets are still regulated. All transmission dispatchers are located in St Louis. Ameren has limited distribution operations (69 kV and below) in the electric system operations; however, has distribution offices in St. Louis, Missouri, Jefferson City, Missouri, Peoria, Illinois and Mattoon, Illinois.

1. Criteria and Compliance

1.1. Agreements

The control area must have agreements that establish its authority as a control area. The control area must have agreements that establish the reliability coordinator for its control area.

Audit notes:
Ameren does not have a written agreement with its reliability coordinator, although the MAIN region reliability coordinator registered with NERC, acts as Ameren's reliability coordinator. No one is aware of any such document. There is no known written agreement with MAIN (as the reliability coordinator). MAIN has an implied agreement between control areas within MAIN and the MAIN reliability coordinator, which is a requirement for MAIN/NERC control area certification.

The audit team recommends that Ameren develop a written agreement with the reliability coordinator to delineate the responsibility and authority of the reliability coordinator and ensure the system operators know the responsibilities and authority of the reliability coordinator.

	Applicable Documents	Dated	Version
1	Ameren Standards of Conduct, registered with Federal Energy Regulatory Commission, Docket No. O97-270-000-001 and OA97-510-000	-	-

1.2. Staff Certification

Control area operators must be NERC operator certified. The control area must have sufficient NERC operator certified staff for continuous coverage of the control area operating positions.

Audit notes:
Ameren has a sufficient number of NERC-certified operators to provide continuous coverage of the control area operating positions. Ameren provided a document listing the various operating positions and staff that included NERC-certified operators' certificate numbers and expiration

dates. The audit team viewed the system operators shift schedule for months of January and February 2004.

	Applicable Documents	Dated	Version
1	Ameren NERC Certification document listing All control area personnel with certificate numbers, Date certified and date expired.	-	-
2	Operators schedule for January and February 2004	-	-

1.3. Security

Access to the control room must be controlled for security reasons.

Audit notes:
Approved personnel use a key card to access the Ameren site and the control room. Cameras also monitor the control room, which are fed to the Ameren alarm center.

The backup facility is located inside a works headquarters site that has a security guard at the gate. The buildings are also patrolled randomly several times per day. The actual backup facility control room is monitored by key card access. The property has several cameras that are monitored by the Ameren alarm center at the primary Ameren site.

Ameren does have a Cyber Security Policy.

	Applicable Documents	Dated	Version
1	NERC Urgent Action Standard 1200 Cyber Security document and responses, Self Certification MAIN 2004 Compliance Program, Officer Signature form	2/18/2004	-

1.4. Training

The control area operators must be adequately and effectively trained to perform their roles and responsibilities. The control area must have documents that outline the training plans for the control area operators. The control area must have training records and individual staff training records available for review.

Audit notes:
Ameren has a formal training program for control area operators. The training department provides the initial and ongoing training of system operators but the training does not include simulation of system disturbances, which let operators practice using mitigation procedures. Ameren procured a simulator to conduct annual operator black-start training and to participate in regional black-start drills. Presently, it is difficult to get the simulator to solve large-area black-start problems.

The simulator will not run with Ameren as an island and as a result, the system is not set up for contingency analysis. Ameren can, however, set up different islands, which can be used to simulate the Ameren island blackout. The simulator will be part of the power dispatcher training.

Based on the NERC Board of Director's Recommendation #6, Ameren will meet the required minimum five days per year of training and drills in system emergencies, using realistic simulations, for each staff person with responsibility for the real-time operation or reliability

monitoring of the bulk electric system. The requirement will be met by using "A" days for training (an "A" day is an eight hour day, non-shift operating position following the 14 days of non-consecutive twelve hour regular shift positions). The training is given to all on-shift system operators. Training can be done on the night shifts when time is available, using computer based training material. Most study is on line and presently courses are mostly self-taught. Ameren is developing a training matrix to better structure training and will make more use of "A" days.

Ameren does not have enough system operators to allow training to be done on-shift without overtime. The system operators are not allowed to take vacation during their assigned operating shift positions. Ameren could use two or three more people so staff members can go on vacation and still do training on "A" days.

The audit team recommends that the on-shift system operator schedule be changed to accommodate time for training purposes (e.g. six man rotation or designated training weeks).

The training supervisor has been developing a training matrix that includes topics, seminars and simulator training (once its operational problems are solved) with a primary focus on the on-shift system operators.

The new dispatcher training program consists of training lesson plans, a system operator training document, the Iowa state courses and the Power Technology Inc. (PTI) training course, video taped information, and the NERC tutorial courses. Ameren's normal operation training consists of numerous lessons plans. The audit team viewed several documents for operator training. A dedicated room is used for the training simulator.

Training for the EMS operation and the mitigation of partial or full loss of EMS is included in the normal operation training program. Training for emergency procedures, including operation from the backup control facility, is initially covered in the new dispatcher training program.

The transmission operators are taught how to monitor voltage levels, how to adjust voltages and the particulars of the system (basic electricity training).

Ameren does not have an annual training program for its Capacity and Energy Emergency Plan; however, procedures are in place for the plan. A training program is being developed to cover NERC Operating Policy 5, Emergency Operations, Energy Emergency Alerts (EEA) and NERC Operating Policy 9, Reliability Coordinator Procedures. The Ameren System Restoration Plan is covered in the initial dispatcher-training program. Ameren does participate in MAIN sponsored tabletop drills, optimally once per year. Ameren system operators will also attend the Iowa State dispatcher training program.

Ameren provides backup center training to its system operators, on a rotational basis, for one day each year. If Ameren had to operate from its backup facility, all four-system operators on shift would go. If the EMS system is unavailable, a manual system will be used at the backup facility. All appropriate documents are in a suitcase that the system operators will take to the backup facility. The system operators stated that operating manually from the backup facility will be difficult because they don't have enough training.

The audit team recommends that Ameren operate from its backup facility manually, with the tools at the backup facility and without EMS support. Also, the one-lines for use at the backup facility need to be updated.

Ameren determines how effective its training program is by using feedback from the power supply supervisor regarding a student's performance on material on which they have been trained. Ameren will readily pull people off of a shift to retrain them, if it is determined that they have an area that needs to be reinforced.

Training has been changed to incorporate the new requirements from the NERC Operating Committee. The department manager approved a training program revamp, and the vice-president has approved budget requests to hire additional trainers. Ameren is considering hiring more people for the dispatcher positions. This will allow Ameren greater flexibility to move people among the various shift positions and make it easier to meet shift training requirements.

It is clear that Ameren needs additional training development people. Only when the training program is finalized will Ameren know how to best staff operating positions. Ameren's yearly training plan, with NERC Operating Committee requirements built in, is in development and is 70% complete. Ameren has crossed trained some power supply supervisors and engineers on the power dispatcher position and plans on cross training the power dispatcher and the transmission coordinator for flexibility of staffing to meet training requirements.

The audit team recommends that a structured ongoing training program be as intense and thorough as the program developed for newly hired system operators.

The training supervisor, as the program administrator, can view each individual's course records and signs off when an individual has completed a training course. The training program tracks the time spent by each individual in the course. Training records are kept in the training file cabinet until an individual leaves the company.

Samples of training records were viewed for the transmission dispatcher position. The transmission dispatcher records also included a lesson plan checklist that indicated which lesson plans were completed by an individual. The records also included switching problems and Worker's Protection Assurance (WPA) records.

Sample training records were also reviewed for the power dispatcher position. The records included training and supporting documents. One document reviewed was a backup control center operations document (training on backup control center). The audit team also viewed records showing when system operators went out and started the backup facility.

	Applicable Documents	Dated	Version
1	PTI Manual ASOC Advanced System Operation Courseware'99	-	-
2	Transmission Dispatcher Training Lesson Plan	-	-
3	Transmission Dispatcher Training Book - #1	-	-
4	Power Dispatcher Training Lesson Plan	-	-
5	Transmission Dispatcher "A" Training Matrix	-	-
6	Training Dispatcher Record, including Lesson Plan checklist	-	-
7	Power Dispatcher Record, including Backup Control Center Operations document, training on Backup Control Center	2/14/02	-
8	PTI Program Administrator display document	-	-
9	Ameren Employee training records, Training Supervisor file	-	-
10	System Operator – Backup Facility Training, Performance Checklist	-	-

2. Authority

The control area is responsible for establishing and authorizing the control area operator position that will have the on-shift responsibility for the safe and reliable operation of their portion of the bulk electric system.

Audit notes:
The Ameren power supply supervisor has the written authority to take actions up to and including load shedding to maintain bulk electrical system reliability. The document is posted in the control room. If the power supply supervisor or transmission dispatcher calls up the regional offices and tells them to shed load, they will. The job description for the power supply supervisor clearly states the authority to order load shedding, but job descriptions for the transmission coordinator, transmission dispatcher, and power dispatcher positions do not state the authority to order load shedding. Ameren informed the audit team that degreed engineers are used in the power supply supervisor positions.

The audit team commends Ameren management for employing degreed engineers in the power supply supervisors operating positions.

The audit team recommends that Ameren modify its letter of authority to shed load and its job descriptions for the transmission coordinator, transmission dispatcher and power dispatcher positions so all its SOC operating positions job descriptions clearly state the level of authority to shed load.

The system operator's responsibilities and the responsibilities of the reliability coordinator intermingle and are not outlined definitively enough. The power supply supervisor has the responsibility to protect the Ameren control area and not to endanger the interconnection. The power supply supervisor (as control area operator) has the responsibility for the safe and reliable operation of the Eastern Interconnection.

	Applicable Documents	Dated	Version
1	Ameren Corporation, Authority to Shed Load	Last 1/24/04	-
2	Ameren Services, Position Guide, Power Supply Supervisor	09/17/02	-
3	Ameren Services, Position Guide, Transmission Coordinator	-	-
4	Ameren Services, Position Guide, Transmission Dispatcher	8/1/2000	-
5	Ameren Services, Position Guide, Power Dispatcher	-	-

3. Planning Time Frame Responsibilities

The control area must have a process for day-ahead planning, as well as a process for longer term planning, such as week-ahead, year-ahead etc., for the operation and outage scheduling of transmission facilities and generation and reactive resources.

The control area must have procedures to ensure that day-ahead and longer term plans for the operation and outage scheduling of transmission facilities and generation resources are provided to the reliability coordinator.

Audit notes:
Ameren described the processes that would be followed for day-ahead, week-ahead and year-ahead planning to determine transmission facility and generation facility operation. Ameren's transmission planning group performs reliability analysis studies for the control area's short-term and long-term planning. A transmission system analysis group, including the transmission coordinators, performs operations planning, real-time monitoring, and studies of the Ameren transmission system. This group is located in the Ameren control room.

Ameren takes into account the resource requirements and plans outages around required resources. Ameren adheres to MAIN operating requirements. Ameren described how the following are established for bulk electrical system reliability: voltage ranges are maintained in accordance with criteria and guidelines as filed in Ameren's FERC 715 filing; reactive requirements are based on seasonal reviews of operating requirements and contingency analysis studies; and the system operators decide on the amount of operating reserves needed based on economics and (possibly) internal constraints. Scheduled generator maintenance is taken into account as needed and transmission planning uses this as required. Ameren does not explicitly model operating reserve requirements in planning power flow cases; however, Ameren includes generation dispatch sensitivity in its planning studies.

On an annual basis, Ameren will use the standard NERC review of the NERC Compliance Program. The MAIN reliability study assessments are used to determine where constraints may exist. Ameren obtains the facility equipment ratings of components for the bulk electrical transmission system portion of its control area from its transmission planning group. These ratings are based on a lifetime of accumulated information and go into the NERC models.

For planning purposes, MAIN provides seasonal Available Transfer Capability (ATC) models that include all anticipated outages. This information can be used when assessing new outages. Ameren's role in the reliability coordinator's planning process is to provide input on the transmission and generator outages and other required operating information.

The audit team commends Ameren on its planning department studies and the way it communicates seasonal studies to the operating staff.

The power supply supervisor and the transmission coordinator run the State Estimator and Contingency Analysis programs. The power supply supervisor checks for overloads on the State Estimator program when transmission outages occur. The senior power supply supervisor, who does the week-ahead coordination, sets the operational plan and this is reflected in the model.

Ameren's transmission planning staff provided information to the audit team that seasonal studies look at the following:

a) focus on near term concerns and MAIN studies

b) develop models, and

c) identify transfer capability, stability studies, simultaneous transfers (imports from all around the area), limitations from the area where power purchases will come from

Short-term studies are validated by using PTI's Power System Simulator for Engineers (PSS/E) and PTI's Managing and Utilizing System Transmission (MUST) models, the ESCA advanced application state estimation, contingency analysis, and real time study power flow.

Ameren relies heavily on MAIN for model inputs and use, most notably snapshots for the next day peak and the snapshot for the Eastern Interconnection. The P0 case is used for next day, while shorter-term studies use up-to-date transmission service reservations. The P9 case looks nine days in advance and is usually updated every Wednesday. All cases are generated by MAIN and made available to its members. At 05:30, the transmission coordinator submits tag information to MAIN along with all generating unit information and other necessary information. The limitations on generators are different every day depending on problems that may exist at the plant. Independent Power Producers (IPPs) that are not designated resources, remain "VAR neutral" to the system. The transmission coordinators are the primary means of coordination between Ameren and its reliability coordinator.

For long-term studies, the tools used are primarily deterministic, although some are probabilistic. Extreme conditions are modeled to check for voltage collapse. Based on the studies, the voltage will be maintained. Analysis on voltage support is done seasonally to check on requirements and determine the needs for the upcoming summer. The Ameren system is not voltage constrained. Multiple contingencies are run by Ameren covering a one to five and five to ten year spans. A generation contingency is run for up to N-7 levels to determine weaknesses in the control area system. Results of the studies show that Ameren's system is limited in all cases by thermal constraints before voltage constraints for import capability. Simultaneous transfers are studied to test the import capability to the Ameren system.

ATC is revised each season and re-populated on the 15th of each the month (except the flow gate files, which are re-populated nightly). On seasonal cases, which are updated to MAIN weekly, new facilities that are expected to be operational are also included in the repopulation. Outages are also included and passed on by each shift.

If an item is not included in the MAIN data, the Ameren system operators will be contacted and can re-populate the data. The transmission coordinator updates the information at 5:30 p.m. each evening for MAIN use. P0, P1, and M1 cases are updated each day. Approximately, 350 buses in the Ameren area are in the model. Best-case tag details are included, but can be changed up to 20 minutes before the hour. The greatest benefit are realized when all tags are included in the study.

The contingency analysis program is always running. The transmission coordinator checks the Open Access Same-time Information System (OASIS) to update the study as changes are observed. The planning department can use PTI off-line power flow models to perform post-mortem reviews and analyses of system conditions and problem areas.

The power supply supervisors will coordinate and check for possible problems before committing to the outage that is scheduled. The senior power supply supervisor will coordinate activities within Ameren.

Ameren has the authority to modify transmission and generation operational plans and direct revisions as required to ensure that the bulk electric system can be operated reliably. Ameren does this by adjusting its system either through transmission configuration or by generation redispatch. The power supply supervisor has the authority to cancel transmission outages, order generation redispatch, or take action as required for system reliability.

Ameren includes one-in-ten peak load, forecast peak load, single contingencies, line and generator contingencies and multiple contingencies of generators in its planning studies. There is no probabilistic type of planning, but Ameren does deterministic scenarios that model several multiple contingency outages.

Ameren has a facility connection requirement document that is used by Ameren and its customers per NERC requirements.

	Applicable Documents	Dated	Version
1	Ameren, End User Connection to Ameren's Transmission System Procedures & Requirements	Last revision 08/12/02	-
2	Ameren, Generation Connection, Procedures & Requirements	July 5, 2001	-
3	Ameren, Transmission Facility Interconnection Procedures & Requirements	Last revision 08/09/02	-

4. Real Time Monitoring

4.1. General

The control area must provide the control area operators with effective, reliable computer and communication facilities for data and status monitoring, and voice communication at both the primary and the backup control facilities.

Audit notes:
Ameren has an ESCA EMS that can scan 350 Remote Terminal Units (RTUs) every two seconds. Ameren is constantly adding data points to the EMS database and adds them whenever a new facility is installed. New Inter-Control Center Communication Protocol (ICCP) points from other control areas are usually added on a weekly basis. The EMS uses two host computer systems with data servers such that any failure would initiate a failover to the backup host. Ameren has plans in place to change its data communication facilities for data and status reporting. Data circuits are planned for a more secure land based protocol line. There is no single loss of an installation that will cause the loss of most circuits.

Ameren is scheduled to replace the host computers of Ameren's EMS. These hosts will be moved to the backup facility to provide the basis of Ameren's backup facility and data collection. Ameren will take generation and important substations information and have it pulled into the backup site.

The State Estimator program has 3,540 buses of which 3,488 are observable. Ameren also utilizes the Wide Area Measurement System (WAMS), phasor measurement system study, to bring in additional data from the field

Ameren has a voice communication IPC phone (IPC is the manufacturer of the telephone turret system) that is independent of the corporate phone switchboard. Ameren also has 800 MHz radios for field personnel, a single frequency party line for communications up to 100 miles, satellite phones connected to the MAIN coordination center, and some remote plants, cell phones, and some microwave communication.

For the loss of communication incidents, Ameren's primary communication facilities back up each other. A 47 MHz emergency radio is also used to communicate with some plants and is tested on a weekly basis. A satellite phone is tested with MAIN on a weekly basis. If the telephone line or microwave communications were lost, operators would use the cell phones and two-way radios. In addition, a satellite phone with MAIN is available.

The Ameren system operator has received sufficient training in the use of the computer tools provided and to cover the failure of those tools. Procedures are in place to report problems and to control the maintenance and repairs to Ameren's EMS facilities.

4.2. Alarms

The control area operator must have effective and reliable alarming capability. This should be supported in the control area's EMS and/or SCADA system by alarm priority.

Audit notes:
Ameren's EMS has seven alarm categories, plus an 8th alarm for post contingency voltage for the nuclear power plant (the Callaway nuclear unit). Alarms are assigned a category which indicates priority. Analog alarms have a Limit 1 and Limit 2; Limit 1 is a precursor to a warning and Limit 2 means very close to a warning. Alarms are not color-coded by priorities. Alarms are all displayed on one screen. The system operator can choose displays to look at alarm categories or all of the alarms.

A lot of alarms do not require action and just distract the system operators Ameren needs to weed out unneeded alarms and do a better job visualizing alarms for the system operators. For example, when a system operator receives a transformer temperature alarm, the second and hotter alarm is the same color as the initial alarm. When the alarm resets, the transformer temperature alarm goes away after acknowledgement.

The audit team recommends that Ameren develop System Control and Data Acquisition (SCADA) system color-code logic for alarm monitoring to help the system operators.

4.3. Plans for the loss of Control Facilities

The control area must have a workable plan to continue to perform the control area functions that are required to maintain a reliable bulk electrical system following the sudden catastrophic loss of its primary control facility.

The control area must have a workable plan to continue to perform the control area functions that are required to maintain a reliable bulk electrical system following the partial or full failure of its computer facilities or monitoring tools at the primary facility.

Audit notes:
Ameren does not have a workable plan to continue the control area functions during the interim period between the sudden unplanned loss of their primary control facility and the implementation of the contingency plan. Cell phone communication is used until Ameren activates its backup facility. The control area operator roles are not delegated to other operating entities in a "Loss of Primary Control Facility" situation.

The system operator does have a workable contingency plan so he can continue to handle the control area functions following a sudden unplanned loss of the primary control facility. The plan is located on the power supply supervisor's desk. The system operator has had some training on how to perform the control area functions following the partial or full failure of the computer facilities or monitoring tools by using the backup facility.

Ameren's tools team provided a brief overview to the audit team on the "reduced capability" (in terms of the quantity and the quality of data, equipment status and voice communication certification capabilities) that occurs when Ameren operates without the primary control facility. If the EMS is still operating, then most of the data is available. However, if the EMS is down, then personnel will have to be sent out to obtain data. The extent of the EMS loss could require the use of data supplied by other entities, other control areas, and the reliability coordinator. If

the EMS is still working and the terminals are functioning, then Ameren has most of its monitoring capability.

Before the system operators leave the primary control center to go to the backup facility, they initiate a systems transfer to the backup center. When the system operators leave, the power supply supervisor takes the evacuation list, the binder of procedures, a suitcase with one-line drawings, cell phone batteries, forms for power dispatch, substation diagrams, and a copy of interchange schedules for transactions in and out of the Ameren control area.

When system operation has been transferred out to the backup facility the Open Access Technology International (OATI) scheduling database will be available, so the system operators can still validate tags. There is no standby EMS at the backup facility, but the primary EMS is remotely accessible if the primary EMS is in operation at the primary control center. The transmission dispatchers will bring WPA switching sheets, status and orders and the current alarm logs from the EMS.

Ameren has a number of direct ring-down phone lines for manual telephone calls to control areas and power plants. The system operator would use the regular telephone system as a back up if the direct ring-down lines failed. Ameren has a stable operating system and if the system operators lose the EMS, they call the MAIN coordination center to watch Ameren's system operations.

	Applicable Documents	Dated	Version
1	Ameren Black Start Units, including MAIN 2002 Planning Compliance Program testing	11/21/03	-

4.4. Monitoring Responsibilities

The control area operators must monitor operating data and status in real time operation, including:

- Multiple Frequency Monitoring
- Multiple Voltage Monitoring
- Facility Monitoring
- Transmission System Congestion
- Load Generation Balance
- Contingency Reserves
- Special Protection Systems
- LTC settings
- Status of rotating and static reactive resources

Audit notes:
Ameren has an ESCA platform for its EMS, which was updated in 1999. Ameren is updating its EMS to the latest version now, and hopefully will have the update completed by the end of this year.

The audit team commends Ameren for updating its EMS platform to the latest version.

The system operator informed the audit team that all the points listed above are monitored, with the exception of the exact LTC tap. Ameren has no LTCs installed on the transmission system and therefore has nothing to monitor. Ameren does have LTCs on the distribution system which are not directly monitored for tap position.

The Ameren tools team informed the audit team that the listed data is monitored through various displays that provide a tabular list of associated data or provided one-line displays. The transmission coordinator is responsible for checking the results of the State Estimator program and solving any solution problems. There are various tools to investigate solution problems. Displays are available on a station basis to check actual measurements with State Estimator program values. There have been no problems obtaining data from neighboring systems. This data is provided through MAIN via ICCP link.

The audit team recommends that Ameren improve its state estimation models to monitor first tier neighboring control areas, i.e. Southwest Power Pool, Inc. (SPP), Mid-Continent Area Power Pool (MAPP) and Southeastern Electric Reliability Council (SERC) RROs.

4.5. Frequency Monitoring

The control area operator must monitor frequency, direct actions to resolve significant frequency errors, and correct real-time trends that are indicative of potentially developing problems. Frequency monitoring points should be of sufficient number and from several locations with sufficient area coverage to allow the control area operator to effectively monitor the control area, and be able to determine possible islands. (Judicious selection of monitoring points may provide an indication of widespread separation during a major disturbance.)

Audit notes:
Directions by Ameren's reliability coordinator regarding actions for frequency excursions are reviewed to ensure that the directives were appropriate, why they had to be issued and that the actions taken were appropriate and timely. The last major frequency excursion occurred on August 14, 2003 and resulted in no reliability coordinator directives needing to be given.

Any significant frequency excursion event is reviewed by the system planning department after the fact. During the Northeast Blackout event, Ameren initially recognized a large loss of load had occurred somewhere; they knew frequency could go lower, so Ameren added additional spinning reserve. In 1992, they had a frequency oscillation, which was caused by a faulty field setting on an excitation system.

The system operator provided information to the audit team that there is a sufficient number of frequency monitoring points. Ameren provides the control area operators with a geographical display map showing the locations of frequency transducers to allow them to effectively monitor the status of their control area's portion of the bulk electric system and possible islands.

The audit team commends Ameren on the visual displays provided for the system operators.

The system operators do not know what the frequency trip points of the generating units are, but know, approximately, what the general trip point is 58.3 Hz. The system operators were aware of the frequency tripping points for generators in MAIN Guide 1B.

Ameren does have an underfrequency load-shedding program; up to 30% of load will be tripped automatically based on the system frequency. The system operators are aware of these standards

but do not know how much load is specifically available to shed in the different areas of the Ameren control area footprint. Information is readily available in an Ameren operating manual, which can be used by the system operator to determine at what frequency levels generating units in the Ameren control area will start to trip. The system operators did know at what level automatic load shedding would occur.

The process that Ameren will follow to initiate manual load shedding is as follows. When it becomes clear that load shedding will be required, the power supply supervisor will instruct the transmission dispatcher to contact the distribution dispatch offices and request the amount of load to be shed. The power supply supervisor through the transmission dispatchers then request that distribution dispatch offices open feeders. (The local dispatch office can drop load automatically, while other offices have to go into SCADA). Load can be shed at the distribution feeder, distribution bus and/or sub-transmission feeder levels, depending on the amount of load shedding required. About 50% of load can be shed automatically. If there is a system wide problem, there is a process to cut load in each region.

The system operator is aware of what authority the reliability coordinator has to direct actions of the system operators if unacceptable frequency levels are experienced. They will work together and do whatever they need to do and they oversee and contact each control area to ensure it is properly addressed.

4.6. Voltage Monitoring

The control area operator must monitor voltages and take appropriate actions to support the system voltage if real-time trends are indicative of potentially developing problems. Voltage measuring points must be of sufficient number and from several locations and voltage levels to allow the control area operator to effectively monitor the voltage profile of the control area.

Audit notes:
Ameren does provide the system operators with voltage monitoring points from several locations with sufficient area coverage to allow them to effectively monitor the voltage profile of their control area.

Ameren's EMS has high and low voltage alarms. Typically, Ameren is a dynamic system; voltage levels fluctuate depending on the reactive resources and Ameren tries to manage within this range. There are a few areas that are lower, some that are higher, but most are a little above 1.0pu. Ameren uses LTCs and capacitor banks to control voltage on the distribution side. The audit team thought the 1.03pu for 345 kV low voltage alarm is conservative. Although Ameren has no specific procedure to deal with voltage problems, Ameren will bring in experts from the transmission planning department if things get severe. Every summer, the planning department looks into the transmission and generating facilities that will be available and based on that does an operating study. The deterministic study looks at conditions seven outages deep and determines the combinations of units that could cause critical problems.

The system operator indicated that there are no voltage monitoring points that could be added to assist him in monitoring Ameren's control area. Ameren does not have voltage load shedding, except for a zero-voltage sectionalizing scheme for a black-start path.

If unacceptable voltages are experienced, the reliability coordinator would talk to the power supply supervisor and they would decide what action to take. If the power supply supervisor does not agree with the directive and if he thought it would jeopardize the system, he would not do it.

The audit team recommends that Ameren develop a written agreement with the reliability coordinator to delineate the responsibility and authority of the reliability coordinator and ensure the system operators know the responsibilities and authority of the reliability coordinator.

When unusual or severe voltage problems occur, Ameren reviews the system operator actions taken to rectify the problems to ensure that the actions taken were appropriate and timely.

The system operator described how acceptable voltage ranges are established by monitoring the voltage and watching the VARS. If he needs a unit to raise its VARS, he calls them.

Ameren typically does not have any voltage problems in its control area; however, in a few instances, the planning department has told the system operators that there is a voltage problem identified by post contingency analysis (e.g. a station load above a certain MW).

If there is a problem, Ameren will dispatch generating units to provide voltage relief. In Lake of the Ozarks, Osage units will be used as synchronous condensers for more voltage control. Advice will come from the operations planner on requirements for voltage control. Reliability concerns take precedent in organization of the utility.

When Power System Stabilizers (PSS), installed on generating units in their control area, are out of service but the unit remains in-service unit(s), records are kept. The transmission planning department develops the setpoints and parameters for tuning PSSs.

	Applicable Documents	Dated	Version
1	Ameren Operating Manual, Chapter VIII, System Voltage Management	Revised 11/21/01	-
2	Automatic Voltage Regulation Schedules	-	-

4.7. Reactive Reserve

The control area must ensure that reactive reserves are available and properly located to satisfy the most severe single contingency.

Audit notes:
The system operator stated that there are no areas in the control area footprint that require specific reactive reserves to be maintained. The system operator does not set reactive reserve levels, but assures reactive reserves are available. In real-time monitoring, the system operator has no tools available to determine that the Ameren control area has adequate reactive reserves. Ameren does use a State Estimator and Contingency Analysis Program, which is ran every six minutes and monitors voltage contingencies. However, there is a SCADA page that tells how many VARS are available. The transmission dispatcher monitors reactive reserves by knowing the Mvar loading of individual units and capacitor bank status.

4.8. Critical Facility Monitoring

Monitoring of facilities that are critical to the reliability of the bulk electrical system is a joint responsibility of the control area operators and reliability coordinators.

There must be an established process to determine which facilities will be considered critical to the reliability of the bulk electrical system, and real-time operating information (data and status)

and operating limits for the facilities must be provided to the control area operators and reliability coordinators.

Audit notes:
Ameren monitors all bulk electrical system facilities, 100 kV or higher in its control area and all are considered "Critical Facilities" for system operator and reliability coordinator monitoring. Ameren also monitors facilities below 100 kV as necessary. Special facilities are also identified that may be critical to local areas. The seasonal studies are provided to the system operators and transmission coordinators and they pay attention to those areas.

Ameren ensures that the same ratings are being used by both its reliability coordinator and its neighboring control areas. These ratings are used by Ameren in its contingency modeling and throughout the NERC power flow information process. Neighboring control areas send the ratings to their reliability coordinator and neighboring reliability coordinators.

If Ameren's system operators are directed by the reliability coordinator to correct a facility limit violation, there is a process used to review and verify that the directives were appropriate, why they had to be issued, and that the actions taken were appropriate and timely.

The system operator described the actions and timing he will take when critical facility operating parameters exceed thermal, voltage, or stability limits. There are operating guides to do switching, voltage reduction, red day check lists, appeals, and load shedding. A 'red day' can be triggered by several things, including:

1) Operating reserves approaching or below a minimum level (This can result in a Red Day prior to Ameren entering into any EEA level)
2) Yearly Peak Load conditions
3) System Wide problems, resulting from floods and other storm related outages.
4) Also, localized problems that could cause line loadings that could escalate into TLRs would be considered for special actions that could include canceling or delaying generation and/or transmission outages.

When operating limits are exceeded, the "Study Network" is used with a snapshot of the Ameren system. Ameren provides the reliability coordinator with real-time flows and limits of all critical facilities in real-time through an ICCP link.

4.9. Transmission System Congestion

The control area must monitor its transmission system and be prepared to take actions to alleviate congestion in conjunction with and as directed by the reliability coordinator.

Audit notes:
The role that Ameren expects its control area operators to play in transmission system congestion management is to grant all intra-day, non-firm transmission service and monitor real-time contingency analysis. Ameren does not schedule transactions higher than the current ATC.

When the TLR review is complete, decisions are made on how to mitigate the congestion and if any actions are required based on conditions (weather and other factors). If there is a high probability that a flow gate may become congested, Ameren and the reliability coordinator will implement a TLR at 95% of line loading or N-1 operating conditions. If loading relief is required

on a flow gate, Ameren contacts its reliability coordinator and requests the appropriate TLR. If the transmission coordinator sees a constraint, he will inform the power supply supervisor and decide what relief efforts to take. If called for, based on the risk assessment, redispatch will be done. Depending on weather conditions and the possibility of real-time rating adjustments, a decision will be made on whether to proceed to firm sale curtailments.

The transmission coordinator will also call the MAIN reliability coordinator and find out why power flows may be changing. The power supply supervisor and the transmission coordinator review the same application results and coordinate the development of congestion solutions.

The audit team observed that Ameren management's philosophy that puts a high value on reliability.

The system operator role in transmission system congestion management is to monitor the system, direct and call for appropriate TLR, if necessary, and utilize redispatch and transmission reconfiguration, if available. If the system operator believes there is a high probability that a flow gate may become congested, the system operator would call a TLR 3a at 95% of line loading or anytime the post-contingency would be over the rating with no curtailments. Ameren does TLR 3a to curtail non-firm transactions, before it goes to redispatch.

If immediate loading relief is required on a flow gate, the system operator would call a TLR 3b, then they would go up the ladder of TLR levels. The system operator does not call a TLR 3b unless they have redispatched. If you are in an operating security limit, you are in a 3b or higher. If a TLR will not be fast enough, he will redispatch immediately. The system operator notifies the reliability coordinator when they want to issue a TLR, assuming they have time. If immediate action is required to relieve an endangered facility, the reliability coordinator needs to take authority and responsibility.

The system operator informed the audit team that there are no interchange transactions involving Ameren's control area that are not tagged.

The system operator does consider the TLR process an effective way to relieve transmission facilities that are loaded beyond their operating limits in a timely manner. TLRs are not regarded as directives, but will be followed and coordinated with the reliability coordinator. In most cases, it is Ameren that requests the TLR procedure to be implemented to relieve its system.

If the Ameren tools team believed there was a high probability that a flowgate would become congested, the team would first monitor the situation via the contingency tools and then take action to relieve the problem. If loading relief is required on a flowgate, the tools team would use contingency tools and process similar to a critical facility to relieve the loading.

As a tag approval entity, Ameren reviews interchange transactions tags and approves or denies them. This process begins when the scheduling system receives information from OASIS. The information is checked to see if all measurements are acceptable. Then the transmission coordinator approves the tag.

Ameren's automated e-tag system screens tags as all OASIS information is loaded into the EMS. If a TLR is shown on a line, the e-tag system will reject the tag and generate a comment. Improvement in the TLR process would be beneficial to Ameren.

	Applicable Documents	Dated	Version
1	Energy Supply Operations, Ameren, Operating Security Limit Procedures, Approved GDB	10/18/02	-

4.10. Load Generation Balance

The control area operator must monitor the balance of load, generation, and net interchange within its control area. The control area operator must take actions to mitigate unacceptable area control error.

Audit notes:
Ameren's policy regarding unacceptable load, generation, and net scheduled interchange imbalance is to operate according to NERC Operating Policy 1, Generation Control and Performance. Any imbalance is unacceptable and resources will be adjusted to compensate. Schedules will be reviewed as required to correct any problem caused by an imbalance.

Ameren has no document concerning the authority whereby the reliability coordinator may direct its system operator to rectify the situation, if there is an unacceptable load, generation, and net scheduled interchange imbalance. The reliability coordinator can request actions and Ameren will follow the instructions.

The audit team recommends that Ameren develop a written agreement with the reliability coordinator to delineate the responsibility and authority of the reliability coordinator and ensure the system operators know the responsibilities and authority of the reliability coordinator.

	Applicable Documents	Dated	Version
1	Energy Supply Operations, Ameren, Capacity and Emergency Energy Plan	October 18, 2002	-
2	2004 Variable Frequency Bias Setting	-	-
3	AGC ACE Calculation	02/29/04 at 11:22:31	-
4	Copies of monthly CPS1 and CPS2 data for February 2004 back to March 2003, performance criteria met	-	-

4.11. Contingency Reserves

The control area operator must monitor the required reserves and the actual operating reserves in real-time and must take action to restore adequate reserve levels when reserve deficiencies are identified.

Audit notes:
Ameren does not track operating reserves in real-time and there is no audible alarm if the required operating or spinning reserve criteria is not met. The system operator does a daily and day-ahead analysis, and reruns the loss-of-a-significant-generating-unit analysis to verify that the minimum operating reserve requirement is fully attainable within the prescribed time frame. The system operator does have real-time operating status and data indications for all generating units in the Ameren control area, except for small generating units. The system operators adjust the daily estimate throughout the current day. When operating reserves are tight the power supply supervisor will take another look at the operating reserves calculation. The power supply

supervisor is responsible for using an Excel worksheet to develop current operating limits for the new system configurations.

Ameren expects that its control area operators will implement the Ameren Capacity and Energy Emergency plan, commit extra units, shed firm load, and appeal to the public if there is a shortage of operating reserves.

	Applicable Documents	Dated	Version
1	Power Sources & Obligations — Estimate equation Sheet for operating reserves	March 15, 2004	-
2	MAIN Guide 5A, Appendix A	12/31/03	-

4.12. Special Protection Systems

The control area operator must be aware of the operational condition of special protection systems (SPS) that have an effect on the operation of the bulk electrical system.

Audit notes:
Ameren's system operators and its reliability coordinator are aware of the function of each of Ameren's SPSs, the status of each SPS, and for what condition(s) the SPS should operate (including whether the SPSs are armed). The SPSs are on file with Ameren's reliability coordinator and write ups are on file at Ameren's ESO office for four schemes — two for overload and two for stability.

An alarm to the electric system operation and to the respective generating plant for the SPS, give the generator ten minutes to fix the overload problem or there will be an automatic run-back of generation. The Ameren planning department stated that there is a formal process in MAIN to review an SPS. The SPS scheme is defined to meet the NERC Planning Standard Table 1.1 and the MAIN Guide 10.

5. System Restoration

The control area operator must have a documented Control Area System Restoration Plan that must be provided to the reliability coordinator.

The control area operator must be prepared to restore his/her control area following a partial or total collapse of the system and coordinate the control area system restoration with its neighbors and with the reliability coordinators.

Control Area System Restoration Plans must include the following elements:

- Philosophies and strategies for control area restoration including the reliability coordinator's role in your plan
- Identification of the relationships and responsibilities of the personnel necessary to the restoration
- Identification of black-start resources including:
  a) generating unit resources
  b) sufficient fuel resources
  c) transmission resources

d) communication resources and power supply
e) mutual assistance arrangements

- Provisions for synchronizing islands
- Contingency plans for failed resources
- Identification of critical load requirements
- Provisions for training of personnel
- Provisions for simulating and where practical, actual testing and identification of the resources and procedures
- General instructions and guidelines for:
  a) system operators
  b) plant operators
  c) communication personnel
  d) transmission and distribution personnel

Audit notes:
Ameren does have a documented Control Area System Restoration Plan that is on file with MAIN and it is practical to implement.

6. Delegation of Reliability Coordinator Functions

Any reliability coordinator functions that have been delegated to a control area operator must be clearly documented. The documentation must recognize that the reliability coordinator continues to be responsible for that function.

Audit notes:
Neither Ameren nor its system operators are aware of any reliability coordinator functions that have been delegated to Ameren's control area operators.

7. Outage Coordination

Planned control area transmission facilities and generating unit outages must be coordinated with the reliability coordinator to ensure that conflicting outages do not jeopardize the reliability of the bulk electrical system.

Information relative to forced outages of transmission facilities and generating units that may jeopardize the reliability of the bulk electrical system must be shared with affected transmission operators and the control area's reliability coordinator as expeditiously as possible.

Audit notes:
Ameren documents and procedures ensure that planned generator and transmission outages that may affect the reliability of interconnected operations are planned and coordinated among affected systems and control areas. Ameren submits planned generator and transmission outages to MAIN daily, monthly, and seasonally, as required. Generator and transmission outage requests will result in a study by the planning department and the outage request will be coordinated through MAIN. All types of generator and transmission outages are reflected for a given period. Outages involving Illinois Power and

Associated Electric are coordinated directly with them. Other installations will be handled, case-by-case, by notifying the proper entities and providing planned generator and transmission outage schedules and coordination.

Immediately following the outage, Ameren uses the MAINnet communication system to notify its reliability coordinator and MAIN regional neighboring control area of forced transmission and generating unit outages. For non-MAIN regional neighboring control areas, Ameren notifies the neighboring control area(s) that is (are) affected and Ameren's reliability coordinator. Communications are via the normal and backup voice communication paths.

8. Transmission and Generation Relaying

Control areas must ensure that transmission and generator relay maintenance is carried out as per control area, Regional, and/or NERC established requirements.

Audit notes:
Ameren indicated that it does have a transmission and generator relay testing program. The system operator informed the audit team that the relay maintenance staff is required to notify the control area operators before they begin work on transmission circuit relays and generator relays. The system operator has an established procedure to declare a moratorium on any work around critical transmission or generation facilities when the control area is stressed to its limits (red days).

9. Capacity and Energy Emergency Plan

Each control area must have a Capacity and Energy Emergency Plan that addresses the following functions. (It should be noted that some of the items might not be applicable, as the responsibilities for the item may not rest with the entity being reviewed.)

1. **Coordinating functions.** The functions to be coordinated with and among neighboring systems. (The plan should include references to coordination of actions among neighboring systems when the plans are implemented.)
2. **Fuel supply.** An adequate fuel supply and inventory plan which recognizes reasonable delays or problems in the delivery or production of fuel, fuel switching plans for units for which fuel supply shortages may occur, e.g., gas and light oil, and a plan to optimize all generating sources to optimize the availability of the fuel, if fuel is in short supply.
3. **Environmental constraints.** Plans to seek removal of environmental constraints for generating units and plants.
4. **System energy use.** The reduction of the system's own energy use to a minimum.
5. **Public appeals.** Appeals to the public through all media for voluntary load reductions and energy conservation including educational messages on how to accomplish such load reduction and conservation.
6. **Load management.** Implementation of load management and voltage reductions.
7. **Appeals to large customers.** Appeals to large industrial and commercial customers to reduce non-essential energy use and start any customer-owned backup generation.
8. **Interruptible and curtailable loads.** Use of interruptible and curtailable customer load to reduce capacity requirements or to conserve the fuel in short supply.

9. **Maximizing generator output and availability.** The operation of all generating sources to maximize output and availability. This should include plans to winterize units and plants during extremely cold weather.
10. **Notifying IPPs.** Notification of co-generation and independent power producers to maximize output and availability.
11. **Load curtailment.** A mandatory load curtailment plan to use as a last resort. This plan should address the needs of critical loads essential to the health, safety, and welfare of the community.
12. **Notification of government agencies.** Notification of appropriate government agencies as the various steps of the emergency plan are implemented
13. **Notification to control areas and reliability coordinators.** Notification should be made to other control areas and to the reliability coordinator as the steps of the emergency plan are implemented.

Audit notes:
Ameren's Capacity and Energy Emergency Plan is designed to be used by the control area operators and is part of their operating procedure. Ameren's Capacity and Emergency Plan is typically implemented when operating reserves run short. The system operators will be aware of system conditions and implementation of Ameren's Capacity and Energy Emergency Plan steps will be started as needed. The Power Supply Supervisor, Ameren's system operator has full authority to implement the plan. The system operator has the authority to be proactive, if Ameren staff had gone home and several units were down but load could still increase, the system operator has the authority to apply all resources and shed firm load.

Until the load shedding is done, the system operators are not aware of any overlap between manual and automatic load shedding. The underfrequency and manual load shedding are both done at the sub-transmission substation and distribution level.

There are three stages of underfrequency load shedding: 59.3 Hz, 59.0 Hz and 58.7 Hz and there is a 10% automatic load reduction at each level. The system operator described his voltage reduction program as similar to the load shedding program. The system operator would contact the distribution dispatch office and request a 2.5%, 5% or a 7.5% distribution system voltage reduction.

Ameren's voltage reduction program is through the Ameren distribution system. Voltage can be reduced by 2.5% increments in the Ameren St. Louis area, with remote areas requiring manual operation by adjusting regulator controls.

Ameren has no undervoltage load-shed program. In general, if transmission voltage dips to 0.91pu, the system operators will apply or would have already applied all reactive resources available.

The audit team recognizes that Ameren is a net exporting control area. However, the audit team is uncertain of Ameren's decision to not install an undervoltage load-shedding program.

Documentation reviewed by the audit team found a missing cross-reference to another document for the Capacity and Energy Emergency Plan. Load management and voltage reductions references in the Capacity and Energy Emergency Plan refer to the Ameren Operating Manual, Chapter XII, Section 1202 B. Section 1202 D should be added to the statement on the Capacity and Energy Emergency Plan section for load management and voltage reductions to also include the voltage reductions.

The audit team recommends that Ameren improve documentation and referencing.

	Applicable Documents	Dated	Version
1	Energy Supply Operations, Ameren, Capacity and Emergency Energy Plan	October 18, 2002	Revised March 5, 2004
2	Ameren Operating Manual, Chapter XII, Section 1202 B	Revised 3/5/04	-

10. Operating Policy/Procedure Changes

Control areas must have an established procedure to ensure that control area operators and operations staff are aware of any changes to NERC, Regional, and/or local policies or procedures prior to taking over control of a shift position.

Control areas must have shift change procedures for updating incoming shift personnel on the current status of the system.

Audit notes:
Ameren informs its system operators about changes to operating policies or procedures by having a memo sent to all operating personnel. The power supply supervisor will require a review of the memos if someone returns after an extended leave. The system operators are expected to ask questions if they do not understand the memo.

11. Vegetation Management (Line Clearances)

Control areas must have a documented Vegetation and Line Clearance Program.

Audit notes:
Since August 14, 2003, Ameren has reviewed and made no changes to its policy with regards to vegetation management. Ameren's transmission circuits are patrolled for vegetation and underbuild conditions on a periodic basis. There have been no transmission outages for a number of years and the Vegetation group has 'no vegetation outages' built into its criteria for bonuses.

The system operator has not experienced many transmission line trips due to unknown causes where he might expect that vegetation was the cause. Transmission line trips were only because of wind or a branch being blown over to the transmission line, not because of an inadequate vegetation management program.

	Applicable Documents	Dated	Version
1	Ameren Vegetation Management Program of Transmission Right of Ways document	-	-

12. Nuclear Power Plant Requirements

There are regulatory requirements for voltage and power in both normal and abnormal operating conditions (N-1 and system restoration) for nuclear power plants.

Audit notes:
Ameren has a procedure and an agreement with its nuclear unit (but not with its reliability coordinator) to inform the nuclear plant operator when power system conditions are such that the nuclear plant post-trip voltage will not be adequate. This is the highest category alarm (a special alarm on the EMS) and the system operator will call the nuclear power plant if the alarm is activated.

Ameren keeps the nuclear plant operator informed of power system conditions (transmission lines out of service, other power plants in service, etc.) that can impact the adequacy of nuclear plant post-trip voltage.

Ameren identifies critical transmission line configurations and/or voltages in its control area as part of the nuclear stations agreement and it analyzes the nuclear plant voltage limits considering a trip of the nuclear power plant unit for both transmission and/or generator N-1 contingencies.

The nuclear power plant sets the voltage requirements and the planning department has to prove each year that the voltage will be adequate based on two seasonal studies (summer and winter). The nuclear plant tells Ameren what voltage is required immediately after the nuclear plant trips (while pumps are starting, and before switched capacitors and transformer taps can move) for the off-site power supply to be considered adequate. As long as the plant is operational, there will always be adequate support.

The nuclear plant operators have told Ameren how quickly adequate post-trip voltages must be restored to avoid a plant shut down. Voltage support is adequate to prevent this from happening. Ameren does inform the nuclear plant operator when power system conditions are such that the nuclear plant post-trip voltage will not be adequate. There is a procedure in place ("the green book") to inform the plant when conditions indicated that problems are likely.

The audit team commends Ameren for its responses to the "Nuclear Power Plant Requirements" section including the questions and interview.

13. Additional Documentation

The following documents were reviewed as part of the control area readiness audit and are related to the control area self-assessment questionnaire responses. Of the documentation presented to the audit team to support various document requirements, one did not have a title and several did not have dates and in some cases authorizing signatures.

The audit team recommends that documents presented for an audit process should be titled, dated, and if applicable contain appropriate signatures.

	Applicable Documents	Dated	Version
1	Organization chart of Energy Delivery Technical Services, Transmission Planning & Services	08/26/03	-
2	Organization chart of Energy Delivery Technical Services, Energy Supply Operations	03/26/04	-
3	Ameren Corporate Facts	-	-
4	Interconnection Agreements of Ameren Services Company, listing Ameren's IPPs units and MW amount	Last entry May 8, 2001	-
5	Ameren Operating Manual, Chapter IV, Operating Practices. Response for policy and procedures for switching of transmission elements.	Revised 11/08/01	-
6	Ameren Operating Manual, Chapter IV, Operating Practices, Section 406, Taking Equipment out of service. Response for policy and procedures for planned outages of transmission elements.	Revised 11/08/01	-
7	List of MAIN Disturbance Monitor/Fault Recorder/SER Summary Document. Response for provide list of disturbance monitoring equipment.	-	-
8	Ameren Operating Manual, Chapter IV, Operating Practices, Section 406, Taking Equipment out of service. Response for documented procedures that ensure that scheduled generator and transmission outages that may affect the reliability of interconnected operations are planned and coordinated among affected systems and control areas.	Revised 11/08/01	-
9	No title on document. Response to describe the methodology used for determining facility ratings.	-	-

Conclusion

The audit team feels that Ameren is ready and has the appropriate reliability plans, procedures, processes, tools, and trained personnel in place to operate its system in a safe and reliable manner and to respond to an unplanned event on its system. The audit team did not find any major problems that Ameren needs to address; however, the audit team does have several recommendations that are listed in the "Recommendations" section.