NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

# Balancing Authority/Transmission Operator Reliability Readiness Evaluation Report

## South Mississippi Electric Power Association
## Hattiesburg, Mississippi

## September 10–13, 2007

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## Introduction and Evaluation Process

The North American Electric Reliability Corporation (NERC) Reliability Readiness Evaluation and Improvement Program is one of the commitments of NERC and the industry to strengthen the reliability of the North American bulk power system. The program conducts independent evaluations of balancing authorities, transmission operators, reliability coordinators, and other key entities that support the reliable operation of the bulk power system to assess their preparedness to meet their assigned reliability responsibilities. The evaluations identify strengths and areas for improvement in an effort to promote excellence in operations among these organizations.

Since its inception in 2004, NERC and the industry have been working collaboratively to enhance the program. The evaluation process is based on fundamental aspects of reliability: culture, operations, maintenance, planning, and training. The document *NERC Readiness Evaluation Procedure* describes and defines the process used for reliability readiness evaluations. This document and other documents related to the program are available at http://www.nerc.com/~rap/.

The reliability readiness evaluation teams, each led by a NERC staff member and a regional co-leader, include industry volunteers with considerable expertise selected to provide representation from other interconnections, other regions, and neighboring operating entities. The teams also typically include representatives from the Federal Energy Regulatory Commission (FERC) staff.

The public version of the reliability readiness evaluation report contains the majority of the evaluation team's findings. Any discussion of findings pertaining to critical infrastructure will be contained in Appendix 1, a confidential appendix to the report that is sent privately to the evaluated entity and is not included in the public version of the report.

An evaluation team met on-site with South Mississippi Electric Power Association (SMEPA) representatives on September 10–13, 2007. This report reflects the views and recommendations of the evaluation team regarding the readiness of the SMEPA to meet its responsibilities as a balancing authority and transmission operator.

## Evaluation Team:

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|---|---|
| Chad Chandler | Alabama Electric Cooperative |
| Steve Corbin ** | Southeast Reliability Coordinator |
| Donnie Harrell* | Entergy |
| Tom Glock | Arizona Public Service |
| Jim Jensen * | NERC |
| Howard Rulf | We Energies |

*Team co-leader
**Observer

## Organization Profile

Headquartered in Hattiesburg, Mississippi, SMEPA is a non-profit rural electric cooperative, operating as a balancing authority and transmission operator. The company generates, transmits, and sells wholesale power to eleven member distribution cooperatives, which provide service to approximately 377,000 customers in 56 Mississippi counties.

SMEPA is within the SERC Reliability Corporation (SERC) region of NERC and is structured as a vertically integrated utility with generation and transmission control in the same control room. SMEPA is registered with NERC as a balancing authority, transmission owner, transmission operator, transmission service provider, resource planner, distribution provider, generation owner, generation operator, load serving entity, purchasing-selling entity, planning authority, and reserve sharing group.

The FERC Standards of Conduct do not apply to SMEPA because SMEPA is not a Federal Power Act "public utility," but SMEPA is vigilant in observing its own code of conduct with regard to transmission information.

SMEPA has a total generation capability of 1,282 MW. Summer and winter peaks are nearly equal; SMEPA hit an all-time peak of 2,081 MW in August 2007. SMEPA has long-term power contracts and purchases seasonal power to meet demands plus a margin of reserve.

SMEPA has interconnections with Entergy, Southern Company, Alabama Electric Cooperative, and Tennessee Valley Authority.

The SMEPA internal transmission system has 83.4 miles of 230 kV, 345.2 miles of 161 kV, and 957.5 miles of 69 kV transmission lines. SMEPA also owns 227.3 miles of 115 kV lines within other areas. The distribution cooperatives have approximately 52,000 miles of distribution lines.

## Executive Summary

The evaluation team found no significant operational problems and concluded that SMEPA has adequate facilities, processes, plans, procedures, tools, and trained personnel to perform the balancing authority and transmission operator functions necessary to maintain the reliable operation of the bulk power system, with three areas of notable exceptions: training, energy management system (EMS) alarm processing, and documentation.

The evaluation team believes the three areas for improvement listed above are most important. The system operator training needs to be more formalized and include a dedicated trainer. The EMS audible alarm system needs to be enabled. It is normally muted due to the large number of alarms. Finally, SMEPA should implement a document control procedure.

SMEPA managers are open to discussion and suggestions with employees, especially the system operators. System operators may call a supervisor or manager at any time. The quarterly system operator meetings are attended by all system operators, even those who are off shift.

Overall, the evaluation team identified five positive observations and nine recommendations that, if implemented, will enhance South Mississippi Electric Power Association's readiness to operate reliably and maintain the reliability of the bulk power system. The recommendations are listed in order of importance.

## Positive Observations

The evaluation team noted the following positive observations during the reliability readiness evaluation process:

1. The EMS sends messages to managers with system events and system data (Section 2.1).

2. All system operators are required to attend regional training (Section 5.1).

3. Mapboard is dynamic; it includes alarms, frequency and voltage data, and generator status (Section 2.1).

4. Power Technologies Inc.'s Power System Simulator for Operators and Engineers is used to replace EMS advanced applications (Section 2.3).

5. Reactive reserves, dynamic and static, are displayed on a large overhead monitor (Section 2.1).

## Recommendations

The evaluation team offers the following recommendations:

1. Create a dedicated trainer position to provide better structure to the program and more direct training time with trainees (Section 5.1).*

2. Modify the alarm process priorities and enable the audible alarm feature to ensure operators are quickly aware of high priority items (Section 2.1).*

3. Produce a document control procedure with proper control parameters — unique title, date and/or revision number, review period, responsible parties for review and approval, and distribution list — to ensure operators are provided with up-to-date information (Section 2.2.3). *

4. Expedite, to the extent possible, the filling of vacant system operator positions (Section 1.2.4).

5. Implement a feedback mechanism to confirm that operators have received and understood new or revised policies and procedures (Section 1.2.3).

6. Provide a training area away from the operator positions so operators can train without control-room interruptions and distractions (Section 5.1).

7. Resubmit a system-specific training simulator in the SMEPA budget process. (Section 5.1).

8. Document the institutional knowledge of the director of engineering systems to ensure important company and system information can be transferred to other employees and continue to benefit the company (Section 5.2.1).

9. Confidential information on communication systems and support redacted from public report. Confidential information on communication systems and support redacted from public report.

*Jointly identified by the company and lead evaluator as a key recommendation

## Discussion

The reliability readiness evaluation team examined the following key areas during the evaluation. The detailed discussion that follows provides the foundation for the recommendations, and positive observations that the team identified. The report uses the generic term "system operator" to refer to all on-shift operating personnel responsible for executing the functions necessary to operate reliably and maintain the reliable operation of the bulk power system. This term will be used for the discussions unless additional specificity is required, such as the *balancing* system operator, or *transmission* system operator.

## 1. Culture

### 1.1 General

*The corporate organization provides the necessary leadership and management for system operations to sustain high levels of safe, reliable operation.*

The priorities of SMEPA are, in order of importance, safety, reliability, and economics. Management and executives support this priority order. Reliability is not sacrificed for economics, and safety of personnel and equipment is of utmost importance. As evidence of this safety commitment, SMEPA employees have reached 2.6 million man-hours without a lost-time accident. SMEPA has a small utility waiver from the FERC Codes of Conduct. Since marketing, generation control and transmission operations are conducted within the same arena, however, SMEPA places a high importance on confidentiality of information.

SMEPA's managers and engineers work well together. Routine department meetings are held prior to managers' meetings, and board meetings are held after the managers' meetings. This bottom-up method of information keeps everyone well informed of happenings and concerns.

During the 2004 readiness visit, the team produced nine recommendations. Four of these have been completed. The training simulator has been budget constrained. The others are in progress as time and resources allow.

### 1.2 Organizational Effectiveness

#### 1.2.1 Foundation for System Reliability

*The organization's values and behaviors—modeled by its leaders and practiced by its members—serve to make system reliability a top priority.*

The system operators have authority to take any necessary action, including the shedding of firm load, to preserve reliability. The system operators are in a professional environment with the power supply office close to the control room. Managers frequent the control room to give their support to the system operators. SMEPA regards reliability as a top priority with only safety being more important.

SMEPA's mission is to "Deliver the South's best value for safe and reliable electric energy and serve as a common resource for our Member-owners." SMEPA considers its competitive strengths to be:

- An experienced, skilled work force
- A commitment to employee safety and system reliability
- A long-term contractual relationship with our Member systems
- Financial health, including our Members
- Sustained load growth in our Members' service territories
- Long range planning for cost-effective generation resources
- Fuel diversity in generation resources
- Environmental stewardship

### 1.2.2 Leadership and Management

*Managers, by leadership, commitment, and example, establish and reinforce high standards of performance and align the organization to achieve safe, reliable system operation.*

The SMEPA managers have daily contact with the system operators and are available to the system operators to discuss any issues that are important to safety and reliability. As an example of its involvement in operations, the management team receives automatic messages from the EMS on system data and status.

### 1.2.3 Corporate Oversight and Monitoring

*Line management is used to strengthen reliability and improve performance. System reliability is kept under constant scrutiny through techniques such as self-assessments, performance indicators, and periodic management meetings.*

Located in the control room, the lead system operator is the first overseer of the system operators. Daily contact and interaction between the system operators and the lead system operator is the first line of safety, and reliability, and training. The system operators have quarterly meetings to discuss any procedures, policies, and operating issues.

E-mails from corporate communications and management keep the system operators well informed of new and changed activities. The system operators respond with questions and discussion at scheduled meetings. However, this process is not a full feedback loop. The evaluation team recommends that SMEPA implement a method to confirm that system operators receive and understand new and changed policies and procedures. One easy method would be to use voting buttons on the e-mails that provide options for the system operators to select — button examples might include I understand; I have questions; I need further explanation; etc.

### 1.2.4 Human Resources

*Personnel resource needs are anticipated and individuals are systematically recruited, developed, and assigned positions in the system operations organization.*

The human resources group manages the safety program. Representatives from each group make up the Safety Committee, which meets monthly. Committee representatives then meet monthly

with the employees in their respective groups. Each employee is provided a safety manual, and incentives towards safety include awards, called safety bucks, for safety milestones. These safety bucks are gift certificates for a local store. SMEPA has completed 2.6 million man-hours without a lost time accident, and its next major milestone is 3 million man-hours.

Currently, SMEPA has nine NERC certified system operators. With two around-the-clock desks to fill, SMEPA is forced to leave some shifts with only one system operator on duty. One trainee was scheduled to take the NERC certification test the day after this evaluation was completed. In addition, two operator positions are approved. The evaluation team recommends that SMEPA expedite, to the extent possible, the filling of the vacant system operator positions. When these vacant positions are filled, SMEPA will have twelve system operators, allowing the company to fill the generation and transmission desks as well as provide ample training time.

The engineering systems group (EMS support) has three positions, but one of these employees has duties assigned beyond EMS support, effectively leaving about two and one half employees for EMS support. Depending on how SMEPA may implement a training simulator, additional personnel may be required to support training scenarios. The evaluation team suggests that SMEPA review the staffing level of the engineering systems group to ensure enough resources are available to complete EMS changes and upgrades in a timely manner.

### 1.2.5 Corporate Communications

*System operations communications inform and engage both corporate and system operations employees so they can contribute to the strategic priorities of the organization.*

Employees of SMEPA are kept informed of news items by corporate e-mail, meetings, and general conversation among employees. Key personnel have wireless communications that alert them to system events, data, and important new items. These communications are automatically delivered by the EMS.

# 2. Fundamentals of Operations

## 2.1 General

*Operations personnel monitor and control the system in a manner that ensures safe, reliable operation.*

SMEPA uses its EMS to perform real-time monitoring, and alarms are set to alert the system operators whenever an operating limit is nearing a thermal limit. Power Technologies Inc.'s Power System Simulator for Operations (PSS/O) and Power System Simulator for Engineering (PSS/E) are used to replace advanced EMS applications, such as the state estimator and real-time contingency analysis (RTCA). Internal data are received from the EMS and external data are received from neighbors via intercontrol center communications protocol, or ICCP. The contingency list consists of each single contingency and several multiple contingencies in the SMEPA system. The state estimator/RTCA is scheduled to run automatically every five minutes and on any system status change; it can also be initiated manually by system operators on demand. The diagrams in the PSS/O are identical to the mapboard, making the program familiar and easy to navigate for the system operators.

The evaluation team discovered that the EMS audible alarm feature was muted much of the time because operators classify many of the alarms as nuisance alarms. The nuisance alarms could be redirected to a different or new priority that does not cause the audible alarm to activate. The audible alarm could then be enabled to alert for high priority items. The evaluation team recommends that SMEPA modify the alarm process priorities. The XA/21 EMS has a process failure alarm that monitors the applications including the alarm processing.

The system operators, with the aid of the EMS automatic generation control application, control all fully owned generation. SMEPA has partial interest in a nuclear power plant that is controlled by the neighboring host system. A pseudo tie, which is much like a dynamic schedule for control purposes, is used to import power from this plant.

The generator automatic voltage regulators are normally kept in service. The plant operator notifies the system operator of regulator status changes.

There are three frequency sources available to the EMS for the area control error calculation. These three frequency measurements are automatically switched should the active one fail. The system operators also monitor frequency from four other locations across the system. This provides the system operators enough visibility to determine system splits or islanding.

The evaluation team cites a positive observation about the EMS — the system provides wireless data to key personnel. System data as well as status changes and weather information are provided to portable hand-held units.

SMEPA's dynamic mapboard indicates status of transmission lines and generators, and displays frequency and voltage. The small text is difficult to read from a distance. When status or flows alarm in an area, mapboard attracts the system operator's attention to view the detailed area displays.

Several large overhead displays provide a good overview of the system, including frequency, contingency reserve, reactive reserve, weather, and other types of information. The reactive reserve display is broken into dynamic, static, and system total.

## 2.2 Operational Focus

### 2.2.1 Operational Safety

*System operation activities are conducted in a manner that maintains high levels of safety and reliability for all system conditions.*

SMEPA has no special protection systems or remedial action schemes. Switching orders are first written on the day shift, checked on the night shift, and checked again immediately before being issued. This triple check of switching orders is designed to prevent switching errors and ensure safety of personnel and equipment.

### 2.2.2 Operational Decision-Making

*Operational decisions are reached using a systematic and thorough approach that supports safe, reliable, and efficient system operations.*

SMEPA has determined through risk assessment that it has no critical facilities that could lead to a defined system operating limit or an interconnection reliability operating limit at this time. The system operators consider the risks of safety, reliability, and economy respectively. These priorities are described in the system operator's job description, the control center operations manual, the energy deficiency plan, public appeal and load shedding plan, the emergency response plan, and the blackstart plan.

### 2.2.3 Operational Alignment

*Organizational structure supports safe and reliable system operation.*

SMEPA maintains a large volume of operating policies and procedures, and many documents are updated annually. These documents are reviewed and approved by department managers. The evaluation team reviewed a large amount of documents and found many that do not include specific control parameters, such as dates or revision levels. Certain documents that are changed on a daily or weekly basis do not need all control parameters, but most other documents need these key tracking points. The evaluation team recommends that SMEPA produce a document control procedure to ensure that documents contain the proper control parameters, such as a unique title, a date and/or revision number, the review period, responsible party for reviewing, person approving, distribution list, and other parameters as necessary.

Agreements are in place with all interconnected companies. The operator authority document is posted on both the primary and backup control centers. This authority document is signed by the current general manager. There are no delegations of authority beyond the usual reliability coordinator empowerment agreement.

## 2.3 Managing System Configuration

*Power system configuration is carefully designed, analyzed, maintained, and controlled throughout the life of the infrastructure, ensuring that system and equipment margins are understood, considered in decision-making, and managed consistent with design and system requirements.*

The planning department performs three studies annually: 1) summer (the most important), 2) winter, and 3) shoulder months. The system operators each receive the summer operating study along with a detailed presentation discussing the results. The summer study is used for detailed presentations and operator training, but all three are available to the system operators. Operating procedures are included with the study for any unusual results. The operators have the ability to recreate the scenarios using PSS/O. Operations planning provide the operators with additional seasonal studies that give operational solutions to contingencies. Engineering and construction provides the operators with timelines for construction of equipment and necessary outages.

SMEPA's EMS monitors the system with the incorporated supervisory control and data acquisition (SCADA) system. Thermal limits are implemented in the SCADA system to analog points that alert the system operators to problems.

Facility ratings provided by SMEPA planning are consistently used by operations, neighboring systems, and the reliability coordinator. SMEPA has no critical facilities as defined by the region.

Transmission congestion is a responsibility of SERC's Southeast reliability coordinator. SMEPA system operators follow the requests or directives of the reliability coordinator. Only safety of personnel and equipment has a higher priority. If a request or directive is received involving safety, the system operators will discuss the issue with the reliability coordinator for resolution.

The SMEPA system operators are both transmission and generation operators. They also buy and sell electricity as marketers. SMEPA has a small utility waiver of FERC's Order 889. Load, generation, and interchange are balanced by the system operators. SMEPA load is in three different areas. First, SMEPA has a generation and transmission area that is balanced in the traditional way. The second area involves several member substations connected to two different neighboring systems. One of the neighbors regulates load for SMEPA with the system operators providing an hourly schedule of power for those connections. An imbalance in this second area is corrected by adjusting the hourly schedule with the regulating neighbor. The load in the third system is included in the SMEPA regulation area by telemetry as part of the traditional (first) system. SMEPA is a joint owner of a nuclear unit that is operated and controlled by the host system. Energy from the plant is imported to SMEPA by a dynamic schedule.

## 2.4 Emergency Preparedness

*The organization is prepared to manage and mitigate the impact of system emergencies in order to preserve the reliability of the system and to protect the interests of the public.*

The load shedding program of SMEPA is compliant with regional requirements. There are three steps, each dropping approximately 10 percent of the load. The generation and transmission area has slightly different frequency points than the area regulated by the neighboring system. For SMEPA to manually reduce load, it calls on the member cooperatives.

SMEPA has a proven restoration program. The program implemented in real time with Hurricane Katrina, when the SMEPA system was in a state of blackout. The program is coordinated with neighbors and the reliability coordinator.

The capacity and energy emergency plan addresses all the requirements that apply to SMEPA. Several requirements are implemented by member systems, but are directed by the system operators. SMEPA does not utilize voltage reduction due to the difficulty to implement.

SMEPA has no nuclear power plants within its boundaries. It is a partial owner of a nuclear plant that is operated by the host company as described in the above section 2.3. It would be extremely difficult for SMEPA to provide emergency off-site power to the plant.

# 3. Fundamentals of Maintenance

## 3.1 General

*Maintenance is conducted by skilled personnel to achieve safe, reliable control center equipment and system performance.*

The control center equipment is well maintained. Any equipment failures are promptly investigated and repairs are made. The EMS support group is located adjacent to the control room and interacts with the operators daily.

## 3.2 Equipment Reliability

### 3.2.1 Equipment Performance

*The organization achieves high levels of equipment reliability. Equipment problems that impact reliability are resolved in a thorough and timely manner.*

The EMS has operated continuously for four years without a cold start. Individual components have been restarted for upgrades or failures, but the system has been available to perform the functions as desired.

### 3.2.2 Work Management

*Work activities, including corrective, elective, and preventive maintenance, surveillance testing, and modifications, are managed effectively to support safe, reliable operation during both outage and routine periods.*

Scheduled equipment outages are planned ahead by at least two weeks. During this time, the outage is studied by SMEPA personnel and then the reliability coordinator. If all approvals are made, the switching orders are written, double checked, and studied by the night shift prior to the actual switching. The system operators have the authority to cancel, delay, or recall outages. SMEPA has an Outage Request Database tool that is used to coordinate, approve, and schedule outages.

Emergency outages are reported to neighbors and the reliability coordinator as soon as practical. The cause of an emergency outage is determined and field personnel dispatched to make repairs.

# 4. Fundamentals of Operational Planning

*Operational planning provides the technical information and support necessary for safe, reliable system operation.*

The SMEPA planning process is complete and proven. SMEPA coordinates planning with the SERC regional planning activities and has four time periods of planning, as listed below.

<u>Long-Term Resource Plan</u>
From system forecast and meter data, a 20-year plan for meeting system needs is developed. System improvement projects are developed, and options are presented to the management team,

which presents to the SMEPA Board for budget approval. Once approved, the project becomes part of the five-year construction plan.

Five-Year Construction Plan
From the long-term (20-year) resource plan study work, a five-year construction plan is developed with specific projects approved and budgeted.

Seasonal
Transmission planning provides operation planning with all current equipment ratings. Operation planning then runs seasonal studies based on peak-load forecast. These studies are reviewed by the director of operations, manager of power supply, and supervisor of operations. The completed study is then presented to the operators, who receive associated training and a quiz. The seasonal study identifies n-1 contingencies, and operating solutions are included for the mitigation of many contingencies.

Day Ahead
System operators have an hourly forecast and outage request database and run PSS/O for a base case and any planned outage contingencies. Any forced outages are directly communicated the reliability coordinator and transmission planning. System operators have the authority to deny any planned outage based on system conditions. The planning engineer is notified of any forced outages for 100 kV and above facilities.

# 5. Fundamentals of Training

## 5.1 General

*Training in both specific job-related skills and broader technical fundamentals is used to provide highly skilled, knowledgeable personnel for safe, reliable operations, and to achieve performance improvement.*

The training program includes training for new personnel as well as ongoing training for credential maintenance of NERC system operator certifications. The program would work much better with a dedicated trainer to provide better structure and more time for training preparation. As stated above the lead system operator has multiple duties including safety, reliability issues, and training. The new trainee spends a considerable amount of time working with one of the system operators. There are vendor-supplied programs for all system operators to work at a self-directed pace. The evaluation team recommends that SMEPA create a dedicated trainer position.

The current trainee studies at a workstation in a corner of the control room. Often, ongoing training is at the same location as the on-duty system operator operating the system. Night shifts and weekends allow the system operators some spare time that can be used for training. However, this method is prone to distractions and interruptions. The evaluation team recommends that a training area be provided away from the operations control room.

SMEPA uses a vendor-supplied generic training simulator. The simulation process would be more useful if it were designed around the SMEPA system. The PSS/O program is good for studying contingencies but has limited capability to run a scenario. A training simulator was

requested in a previous budget and removed in favor of higher-priority projects. The evaluation team recommends that SMEPA resubmit a system training simulator for budget approval.

An outside vendor is used for the system operators to obtain continuing education hours (CEHs) for credential maintenance of NERC system operator certifications. Certain SMEPA training sessions as well as SMEPA and regional-required training could count towards CEHs. The evaluation team suggests that SMEPA consider becoming a NERC-approved continuing education provider.

SMEPA has supervision personnel NERC certified, including the lead system operator, supervisor of operations, and the director of operations.

All system operators are required to attend regional annual training. This training includes blackstart/restoration sessions and accounts for part of the emergency operations training requirement.

Events caused by errors are discussed at employee meetings as lessons learned. Serious situations that affect safety and reliability are often transcribed into a procedure and placed in the operations manual.

## 5.2 Organizational Effectiveness

### 5.2.1 Human Performance

*Personnel select and apply appropriate human error prevention techniques commensurate with the importance of assigned tasks to minimize the frequency and consequences of events.*

The director of engineering systems has much undocumented information that would be a great loss should he depart for any reason. It would be advantageous to have these skill sets available to others. The evaluation team recommends that SMEPA document the institutional knowledge of the director of engineering systems.

SMEPA does not have a system operator succession program. When a system operator position opening is posted, the names of all applicants are kept on record for future openings.

## APPENDIX 1: Critical Infrastructure

The following discussion will be presented under private letter to the evaluated entity only and will not be included within the public version of the report.

## APPENDIX 2: Entity Participants

The following will be presented under private letter to the evaluated entity only and will not be included within the public version of the report.

## APPENDIX 3: Documents Reviewed

The following will be presented under private letter to the evaluated entity only and will not be included within the public version of the report.