



Balancing Authority/Transmission Operator Reliability Readiness Evaluation Report

**Ohio Valley Electric Corporation
Piketon, Ohio**

March 19–22, 2007

Table of Contents

Introduction and Evaluation Process	1
Evaluation Team	1
Organization Profile.....	2
Executive Summary	3
Positive Observations.....	4
Recommendations.....	4
Discussion.....	5
1. Culture.....	5
1.1 General.....	5
1.2 Organizational Effectiveness	5
1.2.1 Foundation for System Reliability	5
1.2.2 Leadership and Management	5
1.2.3 Corporate Oversight and Monitoring.....	6
1.2.4 Human Resources	6
1.2.5 Corporate Communications	6
2. Fundamentals of Operations	6
2.1 General.....	6
2.2 Operational Focus	7
2.2.1 Operational Safety	7
2.2.2 Operational Decision-Making.....	7
2.2.3 Operational Alignment.....	7
2.3 Managing System Configuration	8
2.4 Emergency Preparedness	9
3. Fundamentals of Maintenance	9
3.1 General.....	9
3.2 Equipment Reliability	10
3.2.1 Equipment Performance.....	10
3.2.2 Work Management.....	10
4. Fundamentals of Operational Planning.....	10
5. Fundamentals of Training	11
5.1 General.....	11
5.2 Organizational Effectiveness	12
5.2.1 Human Performance	12
APPENDIX 1: Critical Infrastructure.....	13
APPENDIX 2: Entity Participants.....	14
APPENDIX 3: Documents Reviewed	15

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 organization evaluated and is not included in the public version of the report.

An evaluation team met on-site with Ohio Valley Electric Corporation (OVEC) representatives on March 19–22, 2007. This report reflects the views and recommendations of the evaluation team regarding the readiness of OVEC to meet its responsibilities as a balancing authority and a transmission operator.

Evaluation Team

Mitch Needham*	NERC
Norb Mizwicki*	ReliabilityFirst Corporation
Roderick Conwell	Indianapolis Power and Light
Donnie Harrell	Entergy
J. Doug Benda	Northern Indiana Public Service Company
Lee Gladish	NERC

*Team co-leader

Organization Profile

Ohio Valley Electric Corporation and its wholly owned subsidiary, Indiana-Kentucky Electric Corporation (together “OVEC”), were created in the early 1950s to supply the energy needs of the government uranium enrichment facility located near Piketon, Ohio. Fifteen investor-owned electric companies operating in the Ohio River Valley region agreed to form OVEC. Until 2001, the only load directly served by OVEC generation was the Department of Energy (DOE) facility. That power contract was cancelled by DOE in 2001.

Since that time, all of the OVEC generation has been made available for power deliveries to eight entities: American Electric Power (AEP), Allegheny Energy, Buckeye Power, Dayton Power and Light, Duke Energy, FirstEnergy, E.ON/Louisville Gas & Electric, and Vectren. The OVEC system peak load for 2006 was 108 MW, occurring on October 17 at 1700 hours. This peak load includes the power supplied to the DOE facility from off-system purchases and internal system losses (OVEC does not have any native load). OVEC is the balancing authority and transmission operator for its system.

Because OVEC was formed to provide the power requirements of the DOE facility, it does not have a service territory. The transmission system operates at nominal voltages of 345 and 138 kV and extends through southern Indiana, northern Kentucky, and southern Ohio. The OVEC transmission system is made up of approximately 774 circuit miles of transmission lines connecting the Clifty Creek generating station in Madison, Indiana, and its Kyger Creek generating station in Gallipolis, Ohio, to various interconnection points with the systems listed above and the DOE facility. The Clifty Creek generating station has six coal-fired units, and the Kyger Creek generating station has five coal-fired units. Each of the eleven units has a nominal capability of 220 MW.

OVEC owns five substations, including the ones associated with the two generating stations that provide the interconnections to neighboring utilities. Interconnections and voltage levels are as follows:

- AEP — seven at 345 kV; two at 138 kV
- Dayton Power & Light — two at 345 kV
- Duke Energy — five at 345 kV; one at 138 kV
- E.ON/Louisville Gas & Electric — one at 345 kV; two at 138 kV

(Note: Two of the 345 kV substations are co-owned.)

OVEC is a regular member of the Reliability *First* regional reliability organization. OVEC is not a member of any regional transmission organization or independent system operator. PJM Interconnection (PJM) functions as OVEC’s reliability coordinator under contract. OVEC is registered with NERC as a balancing authority, transmission operator, planning authority, and transmission planner.

Executive Summary

The evaluation team found no significant operational problems and concluded that OVEC has adequate facilities, processes, plans, procedures, tools, and trained personnel to perform the balancing authority/transmission operator functions necessary to maintain the reliable operation of the bulk power system.

OVEC's overall corporate culture is one of engagement exhibited by both its management group and its system operators. Discussions with representatives of each group revealed a high level of trust and openness. Management is receptive to feedback and suggestions for improvements from the OVEC system operators. Some OVEC managers are NERC certified, and OVEC stated its intention to maintain these credentials.

In cooperation with OVEC representatives, the team identified some key recommendations. The key recommendations encourage OVEC to develop documentation for blackstart availability, enhance communication procedures with its reliability coordinator, and complete the transition to a new document management system.

Overall, the evaluation team identified six positive observations. It also offers eight recommendations that, if implemented, will enhance OVEC's readiness to operate reliably and maintain the reliability of the bulk power system. The findings are listed in order of importance.

Positive Observations

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

1. OVEC encourages an open-door policy between its management staff and its system operators, and corporate level management routinely visits the control center for informal discussions (Section 1.2.2).
2. OVEC intends for its NERC-certified managers to maintain their current operator credentials (Section 5.1).
3. Both the operations supervisor and his manager are NERC certified (Section 5.1).
4. OVEC has made good progress with its training program since its 2004 reliability readiness audit, including regular reports of training status, annual training of all operators on blackstart and system restoration processes, and a commitment of resources to maintain the Reliability Operator credential for all certified personnel (Section 5.1).
5. *See discussion in Appendix 1.*
6. Construction of its new system operations facility will relieve existing space constraints and improve survivability of the center in case of severe weather events (Section 2.3).

Recommendations

The evaluation team recommends that OVEC take the following actions to address issues discovered during the evaluation process:

1. Ensure that wording regarding blackstart provisions from sponsoring companies is included in the upcoming revision to the *Inter-Company Power Agreement*, as identified in the 2004 reliability readiness audit (Section 2.4).*
2. Add a requirement in the 'Loss of EMS,' 'Loss of Telecommunications,' and 'Facility Evacuation' procedures to notify the reliability coordinator of the status of the OVEC system and details of the situation (Section 2.4).*
3. Post the statement of operator authority in both the main and backup control centers (Section 2.4).
4. Continue and expedite the migration of OVEC procedures and processes to the formal document management program, including ownership, required approvals, review cycles, procedure designation, and distribution (Section 2.2).*
5. *See discussion in Appendix 1.*
6. Develop and implement a formal lessons-learned training process for both adverse system occurrences and human errors (Section 5.2).
7. Document the process for advancement to the senior operations coordinator position that includes task checklists and/or task proficiency testing (Section 5.1).
8. *See discussion in Appendix 1.*

*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 OVEC system operators stated that they have sufficient resources available to support safe, reliable system operations. They noted that with the high level of communication available to them that any emergent needs are quickly reviewed with management. The system operators said that they are looking forward to working with the new energy management system (EMS) and the move to a new control facility that OVEC is constructing; the operators anticipate learning new tools.

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.

OVEC’s system operators are confident that the organization is dedicated to improving system reliability, citing the designation of a training coordinator and the pending move to a new control facility. Management’s emphasis on training is evident in its commitment of resources to this effort.

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.

OVEC encourages an open-door policy between its management staff and its system operators, and corporate-level management routinely visits the control center for informal discussions. The evaluation team cites this availability of upper-level management to the system operations personnel as a positive observation and believes it provides an excellent basis for the high level of engagement by OVEC employees.

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.

OVEC does not use performance indicators that are specific to the transmission environment, but all employees are aware of corporate directives and programs related to operational efficiency.

1.2.4 Human Resources

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

Due to its age demographics (there is no evidence of a workforce nearing retirement age in general), OVEC does not have a formalized staffing plan. Corporate human resources representatives stated that there is an ongoing informal assessment of future needs, and that it is monitored for any unanticipated changes. The system operators and management believe that any vacancies could be filled quickly from either within the OVEC company or from outside if necessary.

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.

Corporate communications with relevance to the system operations environment are limited. OVEC management noted that several corporate-level indicators are routinely updated and presented annually to the OVEC Board of Directors. The corporate communications methods employed include a quarterly newsletter and e-mails as the company deems appropriate.

2. Fundamentals of Operations

2.1 General

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

OVEC monitors 100 percent of its transmission system from its secure location near Piketon, Ohio. Due to OVEC's contractual use of generation and the fact that there is no 'native load,' balancing load and generation is not an issue. (OVEC transmission facilities are used to serve approximately 30 MW of load at the DOE facility, but OVEC is not under contract to supply the load.) OVEC uses two operators on-shift during normal business hours and one operator during back-shift hours, all working 12-hour rotating shifts.

The OVEC system has no locations where voltage control is an issue, and generation voltage regulation maintains the voltage at the predetermined level on the system, which is primarily 345 kV. Voltages are monitored throughout the system, and alarms are provided at three levels for high-voltage conditions and three levels for low-voltage conditions. OVEC recognizes the three

high-voltage levels as concern high (indicating a need to closely monitor the voltage for any trends), normal high, and emergency high, with three similarly described levels for low voltage.

The OVEC system operators demonstrated that they monitor several flowgates as designated by the reliability coordinator. If it is necessary to take any action on these circuits, it is coordinated by the operations supervisor and the reliability coordinator.

OVEC generation is made available to and scheduled by the OVEC sponsors. Normally, all OVEC generation is online and in production, with adequate reserves in place. Due to the DOE facility load noted above, OVEC carries ample reserves. All automatic voltage regulators (AVRs) on the OVEC generators are normally in service (all were in service during the evaluation). If an AVR fails, a procedure is in place for it to be placed in manual operation mode. OVEC maintains a record of such events in its operators' log. OVEC does not use any switched capacitors or reactors. (Such devices did exist previously inside the DOE facility; but with production curtailed, they are not maintained or used.)

Primary data communications on the OVEC system are provided by a microwave communication system, using dial-up communications facilities. OVEC system operators use a simple shift-turnover process that includes verbal briefings and notations in the operators logbook. In addition, operators have an erasable white board for noting unusual system conditions or configurations.

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.

OVEC has made corporate-level decisions that support operational safety. The control facility is operated in a professional manner, and all operators maintain good working relationships with one another. Supervisors and other management personnel visit the control facility regularly. OVEC has corporate rules of conduct that provide the baseline for acceptable behaviors throughout the company.

2.2.2 Operational Decision-Making

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

In addition to internal review, daily operations are also monitored by the contracted reliability coordinator, PJM. Communications occur between the two entities on a regular basis. Energy schedules are verified at least 30 minutes in advance of implementation.

2.2.3 Operational Alignment

Organizational structure supports safe and reliable system operation.

OVEC has all necessary agreements in place to support normal operations. PJM conducts operational studies as part of its reliability coordinator functions, and AEP supports routine planning activities. OVEC noted that this arrangement does not result in a delegation of authority and that it remains responsible for the timeliness and accuracy of the studies. OVEC uses a software package called the System Operator Management System, a tagging and tracking system, for management and record keeping of system switching and maintenance.

The OVEC system operators are aware of their operational authority, as this authority is noted in their job descriptions as well as via an individual letter to each operator from a corporate vice president. The evaluation team recommends that OVEC develop and post a specific statement of operator authority in both the primary and backup control centers to provide additional support for operator activities and to serve as notice to any visitors in the facility.

Changes in agreements with other entities as well as new or revised operating processes and procedures are typically communicated to the system operators via e-mail and by face-to-face discussions. For persons not on-shift at the time, this process is covered in the shift-turnover procedure, with appropriate notations located in the operators' logs as well as a message board. Changes to operating procedures are normally initiated by the planning personnel, who are responsible for conveying the information to the operations supervisor.

OVEC has recently acquired a document management system and is in the early stages of migrating its existing processes and procedures to this system. The evaluation team applauds this effort and recommends that OVEC continue and expedite the migration of OVEC procedures and processes to the formal document management program, including ownership, required approvals, review cycles, procedure designation, and distribution. Such a document management system will allow for version control, distribution tracking, and review cycle management.

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.

OVEC's EMS is an industry standard system, with application consoles available for each on-shift operator. In addition to the EMS displays available to each operator, there are tools for monitoring weather, performing tagging activities, hour-to-hour reporting, e-mail, and tracking of maintenance outages. OVEC is constructing a new control facility that will relieve existing space constraints and improve survivability of the center during severe weather events, and the evaluation team cited this as a positive observation.

The health of the EMS is monitored, and the system operators noted that the reliability of the system has been acceptable. OVEC plans to replace the existing EMS coincident with the occupation of the new control facility. Support for the EMS and communications system is provided by internal technicians, and additional support is available from AEP personnel should the need arise.

OVEC does not currently run state estimation models or real-time contingency analysis. With the replacement of the EMS system, this would be a possibility; but OVEC noted that the cost associated with the technology, coupled with the small size and configuration of the OVEC system, makes its employment unlikely. The OVEC system operators indicated a willingness to train on such software packages if the decision is made to use them in the future.

OVEC does not experience transmission system congestion on a routine basis. If such a situation exists, OVEC follows relief directives from the reliability coordinator.

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 OVEC system operators have the authority to perform all activities needed to support reliability up to and including the shedding of firm load. This is documented in the operators' job descriptions, and in a letter to each operator from a corporate vice president which verifies such authority. There is not a posted statement of operator authority present in either the primary or backup facility, and the evaluation team recommends that OVEC develop such a letter of authority and post it in each control location.

OVEC receives generator blackstart support from neighboring systems and does not designate any of its generation as blackstart capable. The evaluation team recommends that OVEC include agreements regarding blackstart provisions from sponsoring companies in the upcoming revision to the *Inter-Company Power Agreement*, as identified in OVEC's 2004 reliability readiness audit.

OVEC has procedures in place for the loss of EMS and telecommunications, and for evacuation of the primary control facility. The evaluation team recommends that OVEC add a requirement in the 'Loss of EMS,' 'Loss of Telecommunications,' and 'Facility Evacuation' procedures to notify the reliability coordinator of the status of the OVEC system and details of the situation.

Fuel supplies at the generation stations are monitored on a daily basis and that information is supplied to system operations via daily teleconferences. OVEC stated that it tracks fuel shipments by location, whether in a harbor, in transit, or actually located at the generation facility. There are no nuclear power plant facilities within the OVEC transmission territory.

3. Fundamentals of Maintenance

3.1 General

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

Maintenance activities related to OVEC's computer hardware, database, and communications equipment are performed by competent on-site technicians. There are diagrams available showing the overall data flow paths along with information for each system. OVEC technicians

are assigned to provide around-the-clock support services, and each one has a backup in place if he or she is unreachable.

OVEC provides system operators with procedures that describe the proper response for specified scenarios and list who to call for assistance.

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.

OVEC routinely tests its backup generators at the control facilities and routinely monitors the uninterrupted power supply capacity at each facility.

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.

OVEC generally performs all maintenance activities related to the control facilities with in-house employees. OVEC has an agreement with AEP to provide some support activities, which are normally performed remotely. Work activities are coordinated with operations to minimize any impacts on system operations. With its limited size, OVEC has defined communications expectations so that any corrective maintenance activities can proceed on a timely basis. The system operators have a display available that provides detailed contact information for assistance with any problems with the computer systems or communications equipment.

4. Fundamentals of Operational Planning

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

Through an agreement, AEP conducts operational planning activities for OVEC. The OVEC system has undergone no major projects (except for equipment replacement) in several years. OVEC is represented like other entities at the 345 kV level by NERC's Multiregional Modeling Working Group. OVEC does not currently conduct any real-time contingency analysis, relying on AEP and the reliability coordinator for the needed information. OVEC is studying the amount of resources that would be needed if this and other advanced network applications were added with the new EMS installation.

Coordination of outage activities is accomplished via an automated process using a standard database and an e-mail notification system. OVEC's energy scheduling department coordinates generation outages with neighboring systems and the reliability coordinator.

OVEC primarily uses prewritten switching sequences for obtaining equipment clearances, and the system operator examines each one prior to issuance to verify its accuracy. The OVEC

system operators have discussions with the reliability coordinator relating to any operational or potential safety issues for most job evolutions.

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.

In OVEC's 2004 reliability readiness report, NERC recommended a more formalized training approach, and OVEC has made good progress with its training program since then, including regular reports of training status, annual training of all operators on blackstart procedures and system restoration processes, and a commitment of resources to maintain the Reliability Operator credential for all NERC-certified personnel. The evaluation team cited this progress and commitment as a positive observation.

The training plan provides for both initial and ongoing training activities. OVEC relies primarily on outside vendors for the development and delivery of its training objectives, but also uses on-the-job training as it deems appropriate.

The evaluation team discussed the overall progression mechanism with OVEC representatives, who indicated a generalized plan and approach. OVEC does not have a checklist or job task list for advancement to the position of senior operations coordinator. The evaluation team recommends the documentation of the process for advancement to the senior operations coordinator position to include task checklists and/or task proficiency testing.

OVEC's training coordinator acts primarily in an administrative role, setting plans and tracking progress. The evaluation team discussed the possibility of some level of certification for the training manager, and asks that OVEC consider pursuing NERC certification for the training manager. This would allow for the development of more OVEC-specific training sessions.

All OVEC system operators are currently certified with the Reliability Operator credential, and the policy is to have operators maintain this credential. Both the operations supervisor and his manager are NERC certified, and the evaluation team cited a positive observation for this philosophy, which adds credibility among the work force. Additionally, the evaluation team is impressed that OVEC intends for its NERC-certified managers to maintain their current credentials.

The OVEC system operators participate in several training activities for which operator continuing education credit might be allowed. The evaluation team notes that OVEC can apply for NERC accreditation, as appropriate, for internal training activities that may qualify for credit towards NERC continuing education hour requirements. The team also notes that the backup control center activation drill is an example of an activity that could qualify and is required of all OVEC system operators.

OVEC does not have a dispatcher training simulator, but one is available for the new EMS OVEC will install. OVEC is currently analyzing the support resources required should a simulator be procured in the future.

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.

OVEC operators and management do not employ second-party verification in the writing and issuance of switching orders in a formal fashion. Most switching jobs are performed using previously written switching documents that have been used successfully in the past. Prior to issuance, the operator is expected to verify that the switching orders are complete and sufficient for the needed clearance.

OVEC management uses system and industry events for operator development opportunities, but does not have a formal process in place. The evaluation team recommends that OVEC develop and implement a formal lessons-learned training process for both adverse system occurrences and human errors. The team believes this will provide for reiterative training for system operators in prevention of human errors by studying past events.

OVEC operators receive training in operational decision-making from a vendor and use those methods to arrive at the best outcome. The training is designed to help system operators to avoid common mistakes.

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.