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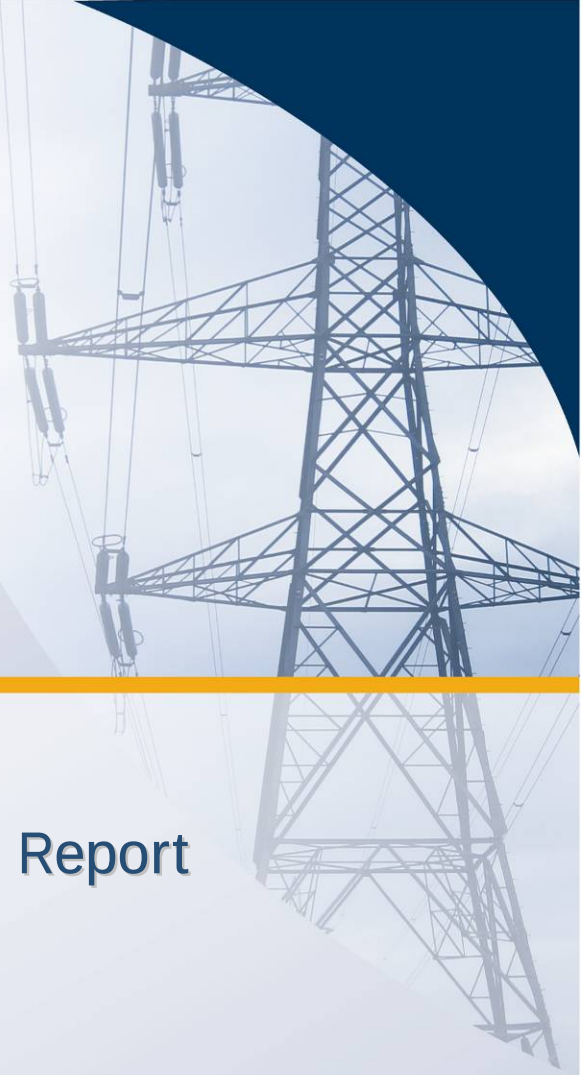

Reliability Readiness Evaluation Report

Transmission Owner

New York Power Authority

Marcy, New York

to ensure the reliability of the bulk power system

December 4–6, 2007

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Introduction and Evaluation Process

The North American Electric Reliability Council (NERC) Reliability Readiness Evaluation and Improvement Program is one of the commitments of NERC and the industry following the blackout of August 14, 2003, to strengthen the reliability of the North American bulk power system. The program conducts independent evaluations of balancing authorities, transmission operators, reliability coordinators, transmission owners 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. Documents related to the program are available at http://www.nerc.com/.

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 energy 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.

The evaluation team for the New York Power Authority (NYPA) met on-site with NYPA representatives on December 4–6, 2007. This report reflects the views and recommendations of the evaluation team regarding the readiness of NYPA to meet its responsibilities as a transmission owner.

Evaluation Team

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Organization Profile

The Power Authority of the State of New York, also known as New York Power Authority (NYPA), is a non-profit public-benefit energy corporation owning and operating 18 generating facilities and more than 1,400 circuit miles of transmission lines within the state of New York.

NYPA is a member of the New York Independent System Operator (NYISO), which performs the reliability coordinator, transmission operator, and balancing authority functions for the NYISO service area footprint. NYPA is also a member of the Northeast Power Coordinating Council (NPCC) and is registered with NERC as a transmission owner, generator owner, purchasing-selling entity, and load-serving entity.

NYPA is divided into seven separate business units: Business Services; Corporate Services and Administration; Transmission; Power Generation; Energy Services and Technology; Energy Marketing and Corporate Affairs; and Law. The executive vice presidents and senior vice presidents of these units report to the president and chief executive officer, who, in turn, reports to the authority's Board of Trustees. Board of Trustees members are appointed by the governor of New York, and these appointments are approved by the New York State Senate.

NYPA does not have a franchise area; however, it delivers power to government agencies, community-owned electric systems, rural electric cooperatives, private-sector companies, private utilities for resale to their customers, and neighboring states under federal requirements. Its facilities are distributed throughout the state of New York.

Service territory: NYISO service footprint

NYISO all-time peak load: 33,939 MW, experienced on August 2, 2006

Interconnection points: NYPA's transmission lines interconnect within the state of New York with the facilities of National Grid (NY), New York State Electric & Gas, Rochester Gas & Electric, Orange & Rockland Utilities, Consolidated Edison Company, Long Island Power Authority, and Central Hudson Gas & Electric. NYPA also has transmission line interconnections with Hydro-Quebec, Hydro-One Networks, and Vermont Electric Power Company.

Company-owned generation:

Hydro	3319 MW
Pumped storage	1284 MW
Oil/natural gas steam	891 MW
Natural gas/combined-cycle	628 MW
Natural gas/gas Turbine	460 MW

Transmission:

765 kV	155 circuit miles
345 kV	925 circuit miles
230 kV	338 circuit miles
115 kV	54 circuit miles

Executive Summary

The evaluation team found no significant operational problems and concluded that NYPA has adequate facilities, processes, plans, procedures, tools, and trained personnel to perform the transmission owner functions necessary to maintain the reliable operation of the bulk power system. The evaluation team identified a number of positive observations. It also offers 11 recommendations that, if implemented, will enhance NYPA'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. NYPA has an intelligent alarm processor that converts raw alarm data into element outage information (Section 11.b).
2. NYPA uses a curve tool on the EMS that monitors the health of the EMS data (Section 11.b).
3. NYPA has a comprehensive individual performance evaluation checklist for the backup control center operating drills (Section 9).
4. NYPA effectively uses "expert sheets" to facilitate system operations for normal and contingency operations (Section 8).
5. NYPA has a well-documented and comprehensive testing, calibration, and maintenance programs for relays and substation equipment (Section 15).
6. NYPA has a comprehensive, well-documented vegetation management program (Section 16).
7. Confidential information on physical security redacted from public report. See discussion in Appendix 1.
8. Confidential information on emergency power resources redacted from public report. See discussion in Appendix 1.
9. Confidential information on critical facilities redacted from public report. See discussion in Appendix 1.
10. NYPA has a comprehensive, well-documented training program that is driven by the job task analysis performed on two of the system operator job classifications (Section 5).
11. NYPA has a fully redundant, independent backup control center that is fully functional in operational capability to support system operating requirements (Section 9).

Recommendations

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

1. Review all operating practices to determine if they are adequately documented by a NYPA operating bulletin, procedure, and/or instruction (Section 6).
2. Explore and facilitate, if possible, the participation of all entities involved in the operation and operating support of the Fitzpatrick nuclear power plant in annual bulk power system restoration training for system operating personnel (Section 17).
3. Implement a document management tool for operating policies and procedures to include cataloging, review and revision cycles, and managing system operator check-off procedures and records (Section 6).
4. Increase the integration of the state estimator and real-time contingency analysis into the system operators' tool set as a routinely used tool to increase situational awareness (Section 10).
5. Review and revise the operations shift-change procedure to strengthen the hand-off procedures between shifts and documentation of the process; include requirements for bringing a system operator back on-desk after an extended period of absence (Section 6).
6. Restore the functionality of the dispatcher training simulator (DTS) and expand the use of the DTS as a preferred tool for training delivery to provide opportunities for system operators to practice event-response techniques (Section 5).
7. Review and implement as appropriate moving the backup control center to another location to enhance survivability and sustainability of operations (Section 9).
8. Monitor the growth in training requirements and appropriately assign a dedicated training resource to coordinate this essential activity (Section 5)
9. Place system operator authority verbiage in the chief system operator, senior system operator II, senior system operator I, and senior system operator job descriptions (Section 2).
10. Prepare and post an operator authority letter in the primary and backup control centers (Section 2).
11. Perform an annual comparison of real-time peak operating conditions with the corresponding seasonal assessment studies and address any model assumption or other corresponding issues identified (Section 7).

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 safe and reliable operation of the bulk power system. This term will be used for the discussions unless additional specificity is required, such as *balancing* system operator or *transmission* system operator.

1. Agreements

The transmission owner must have agreements that establish its authority as a transmission owner. The transmission owner must have agreements that establish the reliability coordinator and balancing authority/transmission operator for its footprint.

NYISO is the reliability coordinator, balancing authority, and transmission operator for the interconnected electric transmission system in the geographic boundaries of the state of New York. NYISO has an agreement with all the transmission owners of the electric transmission system in the state of New York titled *Agreement between the New York Independent System Operator and Transmission Owners.* As a transmission owner, NYPA is a signatory of this agreement and operates within its defined parameters.

NYPA has interconnection agreements with all interconnected neighboring utilities. These agreements are supplemented by the operation coordination agreements, which are amended as needed, usually every two to three years, to ensure that the operating environment defined is consistent with current NYISO, NPCC, and NERC requirements. Since NYPA operates as a vertically integrated state-owned power entity, there is no interconnection or operating agreements with the 18 NYPA generating plants in the NYPA footprint. The NYPA energy control center (primary control center) acts as the interface between NYPA and NYISO for these generating plants.

The *Interconnection and Operation Agreement between the Power Authority of the State of New York and Entergy Nuclear Fitzpatrick, LLC* document provides procedural guidance for the operating coordination between NYPA, NYISO, and the interconnected nuclear power plant. *NYPA Operating Policy 10-0* provides additional operational guidance for communications and coordination.

NYPA has interconnection requirements documents for any new transmission entity, generation entity, or end user that wishes to connect to the NYPA system. These entities would also be subject to the interconnection requirements of NYISO.

2. Operator Authority

The transmission owner is responsible for establishing and authorizing the system operator position that will have the on-shift responsibility for the safe and reliable operation of its portion

of the bulk power system in cooperation with neighboring operating entities, the balancing authority/transmission operator, and the reliability coordinator.

The NYPA job description documents for the chief system operator, senior system operator, and the system operator state these employees have the authority to operate the NYPA transmission system in a safe and reliable manner. The senior system operator and system operator job descriptions include the authority to shed firm load in a section titled "Decision Making Authority." In addition, *NYPA Operating Policy OP1-2 ECC System Operations* authorizes the system operators to take any action necessary for safe and reliable operation of the transmission system; however, the overall authority to operate the transmission system in a safe and reliable manner with the authority take any and all required actions up to and including the shedding of firm load needs to be strengthened in these job descriptions. The evaluation team recommends that the job descriptions of the chief system operator, senior system operator I and II, and system operator I and II be revised to accordingly strengthen this authority element in this family of job descriptions.

The transmission system operator interviews conducted by the readiness evaluation team indicate that the NYPA system operators are both willing and able to operate the transmission system in a safe and reliable manner up to and including the shedding of firm load. The interconnected neighbors are confident of the NYPA system operator's ability and authority to operate the transmission system in a safe and reliable manner.

There is not a posted letter of operator authority in the primary control center or the backup control center. The evaluation team recommends that a system operator letter of authority be written to include this element of operator authority, signed by a NYPA senior corporate officer, and posted in the primary and backup control centers.

3. Delegation of Authority

Any functions that have been delegated must be clearly documented. The documentation must recognize that the balancing authority/transmission operator that is delegating the function continues to be responsible for that function.

NYISO has not delegated any reliability coordinator, balancing authority, or transmission operator authority to NYPA. NYPA has not delegated any transmission owner responsibilities to NYISO or any other entity.

NYPA performs some overlapping operating functions with the balancing authority/transmission operator; however, these should not be considered as delegated operational functions. In the opinion of the evaluation team, the net result of these overlapping activities serves to strengthen operational reliability.

4. Staff Certification

Transmission owner operators are not required to be NERC-certified transmission operators. The reliability coordinator and the balancing authority/transmission operator must have sufficient NERC-certified operators for continuous coverage of all operator positions.

NYPA has nine NERC-certified operators with the transmission operator credential, and NYPA requires that specific certification for the chief system operator, senior system operator I and II, and system operator I and II operator positions. The assistant system operator I and II positions do not require NERC certification. Neither the NPCC nor NYISO has an operator certification program other than the NERC operator certification program.

The readiness evaluation team reviewed the certification numbers of the nine NERC-certified NYPA operators. Five of these certifications are due for renewal in 2008. The evaluation team encourages NYPA to exercise careful oversight of the renewal process so as not to risk expiration of any of these certificates.

5. Training

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

The NYPA training program uses vendor-supplied training, internal training by subject matter experts, NYISO training seminars, regional training, externally supplied training, and on-the-job training provided by the system operators. The training responsibilities are shared by five NYPA employees with general oversight provided by the manager of system operations. The evaluation team recommends that NYPA monitor the growth in training requirements and appropriately assign a dedicated training resource with the responsibility for management of the training program and the associated budget. Additionally, the evaluation team suggests that, as the training program continues to grow and mature, NYPA investigate and implement, as appropriate, a management tool for the training program and associated records to ensure the training program integrity is maintained.

The chief system operator and senior system operator positions have had a job task analysis performed so as to define the skill sets required and the training needed to develop and maintain these skill sets. NYPA plans to perform a job task analysis on the system operator and assistant system operator job classifications to validate and modify the present training requirements and resources for these operating positions. NYPA has been approved by NERC to provide continuing education hours required to maintain the NERC-certification of its chief system operator, senior system operator, and system operator positions. The evaluation team commends NYPA for the comprehensive, well-documented training program related to the job task analysis that has been performed.

NYPA's human resources department defines the minimum requirements for a prospective assistant system operator as an associate degree in electrical technology or an equivalent level of education. The candidate is interviewed by the manager of system operations and the chief system operator. Newly hired assistant system operators complete a four-week NYISO operator training course that includes a two-week consecutive segment on general electrical power system theory and another two-week consecutive segment on a more detailed look at power system operations with emphasis on the NYISO transmission system. Additionally, the assistant system operator utilizes in-house computer-based training on basic power system operations and

participates in an informal program of in-house presentations and shadowing a senior system operator or system operator. This progress is tracked by a shadowing senior system operator or system operator using a critical task and competency checklist to document competencies and provide feedback to the assistant system operator. The assistant system operator usually completes the Western Area Power Administration course in preparation for the NERC-certification examination. To become a system operator, the assistant system operator must obtain NERC certification and successfully pass a final review by the chief system operator for readiness to go on-desk and perform independent operations.

The chief system operator, senior system operator, and system operator positions receive a minimum of 70 hours of training annually. This training includes the annual NYISO system operator training seminar, emergency operating drills, vendor-supplied training, field trips, and NYPA-supplied training of supervisory and interpersonal skills development. NYPA uses its dispatcher training simulator (DTS) as a training delivery tool. The simulator contains 17 scenarios unique to operating the NYPA transmission system, and each operator is required to spend 15 hours per year practicing these scenarios. At present, the DTS is undergoing enhancements to provide for compatibility with the last upgrade of the EMS. The evaluation team recommends that NYPA not only expedite the upgrade enhancements but also expand the use of this valuable tool in training delivery.

6. Operating Policies and Operating Procedures

The transmission owner must have an established procedure to ensure that system operators and operations staff is aware of any changes to NERC, regional, and/or local policies or procedures prior to taking over control of a shift position.

The balancing authority/transmission operator must have shift change procedures for updating incoming shift personnel on the current status of the system.

NYPA has operating instructions, methods and procedures, and operating-policy documents maintained both electronically and in hard-copy manuals. NYISO issues technical bulletins to address the interim period between operating policy changes and the placement of these changes into the appropriate manual. NYPA operating instructions are reviewed yearly; operating bulletins, policies, methods, and procedures are reviewed every three years. Operating coordination agreements are reviewed every five years or as needed. The document review and revision process is a manually managed process. The evaluation team recommends that NYPA investigate and implement, as appropriate, a document management tool for cataloging, managing review and revision cycles, and recording operator check-off for new and revised documents to maintain up-to-date policies and procedures.

When NYPA issues a new or revised operating document, it is sent by e-mail to all system operators; the communication indicates the nature of the change or the reason for the new document. Operators must read and sign the document to verify receipt and understanding. If a system operator has a question, immediate clarification can be obtained from shift supervision or the operations manager. More complex issues are discussed in the regularly scheduled quarterly operations staff meeting. Two meetings are held each quarter so as not to exclude those system operators working during the first meeting.

The evaluation team member who reviewed the NYPA operating documents found connectivity between the NYPA, NYISO, and NPCC documents. This review found that NYPA has not documented all operating practices. The system operator interviewed by the evaluation team did not have access to any NPCC documents; therefore, the team suggests that NYPA review the library of operating reference material in the control rooms in hard copy or available electronically and cover these resources with the system operators. The team recommends that NYPA review the documentation of its operating practices to determine if any gaps exist and create documents for any undocumented practices.

The evaluation team reviewed the shift-change process and found it lacks documented procedural clarity. The evaluation team recommends that NYPA develop and implement a detailed checklist-driven shift-change procedure and include the requirements associated with bringing a system operator back on-desk after an extended absence.

7. Planning

The transmission owner and its supporting planning organizations must have a process for day-ahead planning and for longer-term planning, such as week-ahead, seasonal, and year-ahead, for the operation and outage scheduling of transmission facilities and generation and reactive resources.

The transmission owner and its supporting planning organizations must have agreements with the reliability coordinator to ensure that day-ahead and longer-term plans for the operation and outage scheduling of transmission facilities and reactive resources will not jeopardize the reliability of the bulk power system.

NYPA's transmission planning department consists of two groups: operations planning, consisting of five engineers, which focuses on short-term planning; and transmission planning, consisting of six engineers, which focuses on long-term planning. Both groups use the Power Technologies International Power System Simulator for Engineers load-flow program, voltage program, and dynamic analysis program for transmission system analysis. Additionally, the NYPA transmission planning department uses the Physical and Operations Margin load-flow tool for large-case-contingency load-flow analysis. The tool can also analyze remedial actions for voltage and stability analysis in static as well as dynamic study environments. In the opinion of the evaluation team, this is an adequate portfolio of transmission load-flow tools to accomplish a level of analysis necessary to support reliable system operations.

The long-range planning process for the bulk power system is the responsibility of NYISO and is performed by NYISO's Electric System Planning Working Group, of which NYPA is a participating member. This group develops and publishes the coordinated reliability plan, which is the transmission expansion plan for the next 10 years.

Regional planning studies and seasonal assessments are also the responsibility of NYISO to perform and publish. NYPA participates in these studies in accordance with the guidance contained in the *NYPA Operations Planning — Seasonal Planning Process* document. These studies are reviewed and approved by the NYISO Operating Committee.

NYISO performs studies for assessing the week-ahead to month-ahead time frame. NYPA operations planning personnel review the maintenance outage schedule in the week-ahead to month-ahead time frame to determine if the planned outages will cause any problems on the NYPA system. NYPA operations planning send daily update reports to the system operators regarding planned outages. NYISO performs studies in the day-ahead to real-time operations window and sends these studies to NYPA. NYISO has the final responsibility for reviewing and approving all planned outages.

NYISO develops the base-case models. Data are retained in the *NYISO Data Bank* of which NYPA is a member. NYPA also maintains a *NYPA Facility Ratings Book* that is coordinated with the *NYISO Data Bank*. NYISO coordinates the tie-line ratings with the interconnected neighboring systems and communicates this information to the Operations Studies Task Force members. NYISO develops the annual, seasonal, and long-term base case used by NYPA for any independent studies performed by its transmission planning department.

As a result of the interviews with NYPA operating personnel, the evaluation team determined that NYPA has not performed a comparison of real-time peak operating conditions with the projected conditions in the seasonal assessment study. The team recommends that NYPA perform an annual comparison of real-time peak operating conditions with the corresponding seasonal assessment studies and address any model assumption or other corresponding issues identified. Additionally, in the interview with the system operator, the evaluation team learned that the system operators are not familiar with the transmission study products to the extent that the team thinks appropriate. The team suggests that additional emphasis be placed on the review of the annual transmission studies with the system operators.

8. Outage Coordination and Communication

Planned outages by the transmission owner of transmission facilities must be coordinated with the balancing authority/transmission operator and reliability coordinator to ensure that conflicting outages do not jeopardize the reliability of the bulk power system.

Information relative to forced outages of transmission facilities that may jeopardize the reliability of the bulk power system must be shared with affected balancing authorities, transmission operators, and the reliability coordinator as expeditiously as possible.

NYPA follows the outage coordination rules as set forth in the *NYISO Outage Scheduling Manual* and further detailed in *NYPA Methods and Procedures 3-2 NYPA Transmission Facility Outage Coordination, Scheduling and Reporting.* NYPA also coordinates the scheduling of NYPA generation with document guidance provided in *NYPA Methods and Procedures 2-0 NYPA Generator Outage Coordination, Scheduling and Reporting.* NYPA is the transmission owner for the James A. Fitzpatrick nuclear power plant, and the outage coordination follows the same procedures as the non-nuclear generation.

The appendices in the above-mentioned NYPA outage coordination procedures specify the lead time required for each kind of outage on each class of equipment in service on the NYPA transmission system. NYPA manages the outage coordination process with a third-party software application that tracks the life cycle of the outage; the software also tracks status even

while the outage is in progress. NYPA coordinates all transmission and generation outages with its interconnected transmission owner neighbors and NYPA generators. NYPA studies and approves or rejects all outages on its system. All NYPA-approved transmission and generation outages are sent to NYISO for final approval before any work begins. NYISO coordinates all outages with neighboring balancing authorities/transmission operators and reliability coordinators on an as needed basis. In the opinion of the readiness evaluation team, the NYPA outage coordination process is carefully managed and well coordinated with its interconnected neighbors, balancing authority, and the transmission operator.

NYPA uses a unique system of "expert sheets," which are available electronically, that lists any concern or unique aspects associated with removing any transmission element from service. These may specify the particular operating conditions, such as load levels or generation dispatch, in which the risk elements are increased. If a concern is flagged, the sheet is passed to the system operator for review and consideration. These are living documents and updated as need. It should be noted that these documents are used for normal as well as contingency operations. The evaluation team commends NYPA for the development and use of this tool that provides for an enhanced level of safety and reliability.

The NYPA system operators work with the NYISO system operators and the system operators of other interconnected transmission owners to monitor system conditions, review outage and switching requests, and give permission to accomplish switching. The NYPA system operators do not prepare or review switching orders and do not oversee switching operations. This function of transmission system operations is performed in the field at the NYPA operating projects.

9. Plans for the Loss of Control Facilities

The transmission owner must have a workable plan to continue to perform the transmission owner functions that are required to maintain a reliable bulk power system following the sudden catastrophic loss of its primary control facility, or the partial or full failure of its computer facilities or monitoring tools at the primary control facility.

NYPA has a fully functional backup control center with a dynamic mapboard and advanced applications, which include a state estimator and real-time contingency analysis application. Other tools available at the primary control center exist at the backup control center, except for the lightning-strike detection tool. The backup control center is equipped with three work stations for system operators and two additional work stations for management and support staff. The evaluation team commends NYPA for the quality operating environment provided by the backup control center.

The backup control center is located in a separate building on the same site as the primary control center. *NYPA OP4-1 Emergency Energy Control Center* provides documentation for evacuation of the primary control center, transition to the backup control center, start-up of the backup control center, and relocation back to the primary control center. The backup control center testing and training consists of two 4-hour drills and one 24-hour drill each year with full operational control and monitoring being performed. The drills are graded using a checklist and reviewed to assess conformance with established procedures and identify any potential areas for

improvement. The evaluation team commends NYPA for the effective use of the individual performance evaluation checklist utilized during the backup control center operating drills.

With the backup control center being located on the same site as the primary control center, the evaluation team discussed the issues of survivability and sustainability of operations in the backup control center. The evaluation team recommends that NYPA review and implement, as appropriate, plans to relocate the backup control center to a different location to address these areas of risk.

10. Tools

The transmission owner must have adequate analysis tools to perform the appropriate control and monitoring functions. Such tools include state estimation, pre-contingency and post-contingency analyses capabilities (thermal, stability, and voltage), mapboard (static, dynamic, hardwired, or projected), e-tagging program, weather service, outage scheduling system, trending tools, and a voice recording system.

NYPA has a full suite of tools to fulfill its operating and monitoring responsibilities for the safe and reliable operations of the interconnected transmission system, including an EMS with basic and advanced functionality, a state estimator with real-time contingency analysis capability, and a DTS. NYPA has established a good EMS availability performance record of 99.959 percent in the first nine months of 2007 and 99.976 percent availability in 2006. The EMS upgrades are tested off-line before going live, which results in an enhanced level of EMS performance availability. The evaluation team recommends that NYPA increase the integration of the state estimator and real-time contingency analysis tools into system operations to the extent that these tools are routinely utilized to enhance the system operators' situational awareness.

NYPA has a dynamic mapboard (that displays generator and transmission device status), outage scheduling programs, trending applications, intercontrol center communications protocol (ICCP) node for NYISO data, historical data archiving and associated tools, and a digital voice recording system. Additionally, NYPA uses weather data from lightning-detection applications, cable television weather stations, an Internet-based weather tool, and a camera showing the ice flows on the Niagara River.

NYPA system operators use a third-party independent telemetry system that displays tie-line and generation data on 18 digital trend recorders, mounted on either side of the dynamic mapboard. This telemetry system is totally independent of the EMS. NYPA also uses a "spider display" that represents a visual depiction of the NYPA communications path availability.

11. Load Shedding Plans

The transmission owner must establish plans for automatic load shedding for underfrequency or undervoltage conditions, coordinate load shedding plans with other interconnected entities, implement load shedding in steps to minimize further uncontrolled events, and have plans for operator-controlled manual load shedding to mitigate violations of system operating limits (SOLs) or interconnection reliability operating limits (IROLs).

NYPA does not have any connected load per se, but delivers electric energy to various entities as identified in the Organization Profile section of this report. NYPA has an underfrequency load shedding (UFLS) program and an underfrequency generator tripping scheme, but it does not have a manual load shedding program. Given this unique condition of the NYPA operating environment, the load shedding requirements, training and drills are conducted in the NYPA operational environment versus the traditional load serving transmission owner environment.

NYPA employs UFLS and a underfrequency generator tripping on its system; however, it does not have a manual load shedding program and associated plans due to the fact that NYPA does not have any "connected" load (though NYPA delivers electric energy to various entities as identified in the Organization Profile section of this report). These load shedding schemes are procedurally documented in *New York Power Authority Procedure for Application of automatic Under-Frequency Load Shedding and Generator Tripping Schemes Document No. PRC-PRO-UFLS-PRS.*

The only load that NYPA is capable of shedding is the 210 MW of aluminum plant loads connected to the St. Lawrence/FDR Project (This is respectively step 1 and step 2 of the UFLS plan). The Blendheim—Gilboa pumped storage unit that consists of 1,120 MW of motor load when pumping is not counted in the area's UFLS totals. NYPA does not utilize an undervoltage load shed scheme nor does it employ automatic load restoration.

12. Real-Time Monitoring

a. System Visibility

The transmission owner must monitor operating data and status in real time for its area and adjacent areas as necessary to maintain situational awareness of its system.

The NYPA transmission system operators can monitor all the transmission facilities in the NYPA footprint to show voltage, real and reactive power flows, and circuit breaker and switch status. NYPA also monitors its generating plants, the Fitzpatrick nuclear power plant, and two New York City Department of Environmental Conservation hydro-generation facilities. NYPA also has a wide-area view into neighboring systems that is configured and used on an as needed basis. The data are available; therefore, all NYPA has to do is build the model to display the data if a need exists. Tie-line data also exists on the independent analog telemetry system displayed on digital trend recorders, as discussed in Section 10 of this report. In the opinion of the evaluation team, NYPA has a wide-area system display that enables it to fulfill all of its operating responsibilities in a safe and reliable manner.

b. Alarms

The transmission owner must have effective and reliable alarming capability. This should be supported in the energy management system (EMS) and/or supervisory control and data acquisition (SCADA) system by alarm priority.

NYPA has an effective alarm-monitoring methodology that uses an alarm display screen with multiple alarm lists based on alarm type. The latest alarm received goes to the top of the respective list and cannot be removed from the list unless the alarm has been acknowledged

with a response. In addition to multiple lists, four color codes are used along with audible tones to indicate the severity of the alarm.

The NYPA has an "intelligent" alarm processor that converts raw alarm data to equipment status or outage nomenclature. This application is also used to incorporate NYPA-defined logic into the monitoring algorithms to monitor certain operating conditions. The evaluation team commends NYPA for this creative alarm application.

NYPA uses a "curve tool" application within the EMS to provide a visual indicator of the alarm processor functionality. Values are chosen that constantly fluctuate so that when those values flat-line, the system provides an indication that the alarm processor has malfunctioned. NYPA also uses displays to indicate that servers and communication devices are functioning properly and within a prescribed operational time-frame. These indicate the health of the alarm processor; however, NYPA has an active project with the EMS vendor to develop and implement a stand-alone function that will monitor the health of the alarm processor. The evaluation team commends NYPA for the creative use of the "curve tool" to monitor alarm system functionality in the absence of a stand-alone system.

c. Frequency

The balancing authority/transmission operator must monitor frequency, direct actions to resolve significant frequency errors, and correct real-time trends that indicate potentially developing problems. Frequency monitoring points should be of sufficient number and from several locations with sufficient area coverage to allow the balancing authority/transmission operator to effectively monitor the balancing authority/transmission operator footprint to determine possible islands.

The primary frequency monitoring responsibility of the NYPA transmission system is performed by NYISO; however, NYPA also monitors the frequency at seven locations on its transmission system. These seven frequencies are viewed on a single EMS display. The NYPA transmission system operator can also monitor a frequency point that is independent of the EMS on the independent telemetry system (discussed in Section 10 of this report). The NYPA transmission system frequencies can be charted using the "curve tool" application for system performance analysis.

NYPA has installed seven phasor measurement units as part of a Department of Energy project for the evaluation of this technology. The data from these units is sent to NYISO and then on to a central data collection point in the Tennessee Valley Authority, which is hosting the project.

d. Voltage/Reactive Reserve

The balancing authority/transmission operator and the transmission owner must monitor voltage levels and take appropriate actions to support the bulk power system voltage if real-time trends indicate potentially developing problems. Voltage measuring points must be of sufficient number and from several locations and voltage levels to allow the balancing authority/transmission operator to effectively monitor the voltage profile of its footprint.

The balancing authority/transmission operator must ensure that reactive reserves are available and properly located to satisfy the most severe single contingency.

The voltage and reactive monitoring and control on the NYPA transmission system is the responsibility of NYISO as the transmission operator. NYPA system operators also monitor the transmission system voltages using single-line diagrams and tabular displays of system voltages tied to alarm set points. The reactive reserves are monitored by the NYPA system operators using the reactive reserve tabular display.

NYPA uses a desktop computer running third-party software to control and monitor a convertible static var compensator. Coordination regarding voltage and reactive control between the NYPA generating plants and NYISO flows through the NYPA system operator. The automatic voltage regulator status is verbally communicated to the NYPA system operator, who in turn notifies the NYISO system operator of the status change; however, no documentation to support this process was made available to the evaluation team.

NYPA has adequate reactive reserves to support all system reactive requirements for expected contingencies and extreme weather events. The system reactive requirements are studied and specified by the NYISO Electric System Planning Working Group, of which NYPA is a participating member.

e. Critical Facilities

Monitoring of facilities that are critical to the reliability of the bulk power system is a joint responsibility of the balancing authority, transmission operator, the reliability coordinator, and the transmission owner.

An established process must determine which facilities are critical to the reliability of the bulk power system. Real-time operating information (data, status and operating limits) for these critical facilities must be provided to the balancing authority, transmission operator, and the transmission owner by the reliability coordinator.

NYISO performs transmission system analysis and informs NYPA of the critical facilities on the bulk power system (as defined by NPCC) and the mitigation procedures associated with IROLs) and SOLs.

The bulk power facilities on the NYPA transmission system are monitored and continually analyzed in the contingency analysis program. Any directives related to the bulk power facilities to mitigate conditions resulting from a contingency on the NYPA transmission system would be implemented by NYPA, as directed by NYISO.

f. Transmission System Congestion

The transmission operator must monitor transmission flowgates and be prepared to take actions to alleviate congestion in conjunction with, and as directed by, its reliability coordinator.

This area of transmission system reliability is managed by the NYISO. NYPA will comply with any directives that it receives from the NYISO related to transmission system congestion.

g. Load Generation Balance

The balancing authority must monitor the balance of load, generation, and net scheduled interchange in its balancing area. The balancing authority must take actions to mitigate unacceptable load, generation, and net scheduled interchange imbalance.

This area of transmission system reliability is managed by NYISO as the balancing authority/transmission operator.

h. Contingency Reserves

The balancing authority must monitor the required reserves and the actual operating reserves in real time, and take action to restore acceptable reserve levels when reserve shortages are identified.

This area of transmission system reliability is managed by NYISO as the balancing authority/transmission operator.

i. Special Protection Systems

The balancing authority/transmission operator and the reliability coordinator must be aware of the operational condition of special protection systems that may have an effect on the operation of the bulk power system.

NYPA has 11 special protection systems (SPSs) on its transmission system. All except one SPS are manual systems and remain armed at all times. The status is communicated verbally from the NYPA projects group to the primary control center. The primary control center will then notify NYISO of the status or condition change.

One SPS, a cross-tripping scheme known as PV-20, is alarmed and enabled or disabled via SCADA. The status change is then communicated to NYISO.

13. System Restoration

The transmission operator must have a documented system-restoration plan that is consistent with NERC Reliability Standard EOP-005-0 — System Restoration Plans. This restoration plan must be provided to its reliability coordinator.

The transmission operator must be prepared to restore its transmission area following a partial or total collapse of the system and coordinate system restoration with its transmission owners, neighboring transmission operators and with the reliability coordinators.

NYPA Operating Policy OP2-2 Restoration Procedure provides the procedural guidance for the NYPA system restoration process and conforms to the requirements of *NPCC Document A-3 Emergency Operation Criteria* and the *NYISO Emergency Operations Manual*. NYISO has the

primary responsibility for system restoration; however, NYPA is the owner of the blackstart generation in the NYISO footprint and a significant portion of the transmission lines identified as the blackstart backbone transmission network. Each of the three hydroelectric blackstart facilities has a formal set of procedures for accomplishing the blackstart activity. These plans are reviewed and updated annually as well as being a training subject in the NYISO System Operator Training Seminar held twice per year. Also, the plans are validated annually in the NYISO System Restoration Drill.

NYPA converted a room next to the primary control center into a "war room" equipped with a fully functional set of EMS displays, weather displays, and telephone consoles. This room is used as coordination and communications center to coordinate system restoration internally as well as with NYISO and interconnected neighbors. Additionally, it serves as a clearing point and/or source of critical restoration information to NYPA senior management and NYISO support staff personnel. This facility prevents the restoration effort in progress from compromising the integrity of the system operating functions that are being performed in the primary control center.

14. Capacity and Energy Emergency Plan

Each balancing authority must have a capacity and energy emergency plan that addresses the applicable requirements of NERC Reliability Standards EOP-001-0 — Emergency Operations Planning and EOP-002-0 — Capacity and Energy Emergencies.

The capacity and energy emergency plan is owned and administered by NYISO as the balancing authority/transmission operator. NYPA will respond to any directives by NYISO with respect to the implementation of this plan.

15. Equipment Maintenance and Testing

Transmission owners must ensure that maintenance of transmission lines, substation equipment, and transmission protective systems are carried out according to company, regional, and/or NERC requirements.

NYPA uses the Maximo maintenance management program to schedule and track relay testing, calibration, and maintenance on protection and control devices on the bulk power transmission systems. The NYPA maintenance, testing, and calibration on the bulk power system relays meets the criteria specified in *NPCC A-05 Bulk Power System Protection Criteria* for transmission system protection and control devices. The 2007 relay maintenance program is on schedule and the program for 2006 was completed on schedule. There were no misoperations of protective equipment on the NYPA bulk power transmission system for the 12-month period prior to August 1, 2007. The evaluation team noted that NYPA has a long-range program to replace bulk power system solid state relays with micro-processor relays. This program was 75 percent complete at the time of this evaluation.

NYPA uses an in-house developed program to track relay setting changes and ensure the latest settings are in-place on transmission system relays. This process includes a unique aspect of quality control in that these system relay changes now require the seal of a licensed professional engineer in the state of New York.

As with relays, NYPA uses the Maximo maintenance management system to schedule and track its substation equipment maintenance program. The maintenance program includes a number of analytical and standard industry maintenance practices, such as gas-in-oil analysis, Doble testing, visual inspections, and other operational inspection procedures. NYPA has named a committee to evaluate the current substation equipment maintenance and testing practices so as to explore an effective way to migrate from a periodic and preventative maintenance program to a reliability-centered maintenance program. The substation equipment maintenance program was completed on schedule for 2006 and is on schedule for 2007. There were no bulk power system substation equipment failures on the NYPA system for the 12 months prior to this evaluation.

NYPA has 20 stand-alone digital fault recorders and 13 stand-alone sequence-of-events recorders for disturbance and event monitoring. These devices are time synchronized and can be remotely interrogated to obtain fault or disturbance data for events on the NYPA transmission system. NYPA is currently contracting for a new network-based fault data analyzer to use the remote interrogation capabilities to determine fault location and perform analysis. The devices are maintained in accordance with procedures based on the manufacturer's recommended maintenance practices. The maintenance of the digital fault recorders and sequence-of-events recorders is on schedule for 2007.

NYPA uses Maximo to manage the transmission line maintenance program. NYPA performs bi-annual helicopter patrols and annual driving patrols of its transmission system. In addition to these activities, NYPA utilizes a helicopter service to perform a comprehensive inspection of one-quarter of the transmission system each year. Maximo allows for the prioritization of the identified work orders produced by these inspections.

16. Vegetation Management

The transmission owner must have a documented vegetation-management program.

NYPA has a well-defined, carefully implemented vegetation-management program, general performed on a four-year cycle. The NYPA vegetation-management program employs a process of integrated vegetation management to ensure the operational integrity of the rights-of-way. The integrated program balances the use of cultural, biological, physical, and chemical procedures for controlling the growth of tall undesirable woody species while promoting desirable low-growing plant species on the rights-of-way. The NYPA vegetation-management program also includes a comprehensive geographic information system site data inventory, mapping, and analysis used to create an annual work plan.

The NYPA vegetation-management program is managed by the NYPA system forester and includes a defined multifaceted inspection program that evaluates minimum clearance distances and wire protection zones to ensure that there are no vegetation-related outages. The NYPA program includes a danger tree element and mid-cycle activities as needed to ensure rights-of-way integrity. The vegetation management work is contractor supplied with inspection and oversight provided by NYPA lineman/inspectors.
The NYPA vegetation-management program was completed on scheduled in 2006 and is on-schedule for 2007 (as of the date of this readiness evaluation). The readiness evaluation team commends NYPA for its effectively managed vegetation-management program.

17. Nuclear Power Plant Requirements

Transmission operators must support nuclear power plants in meeting regulatory requirements that allow the plant operators to maintain voltages within design limits and adequate off-site power sources in both normal and abnormal operating conditions (n-1 and system restoration). Transmission owners monitor critical bus voltages and respond to the directives of the transmission operator.

NYPA is the transmission owner for two 345 kV transmission lines that connect to the National Grid-owned substations in the yard of the James A. Fitzpatrick nuclear power plant. The actual NYPA ownership of the 345 kV lines ends at the transmission structure just outside the fence of the switchyard. In the capacity of transmission owner, NYPA is responsible for maintenance, switching, notification of system events, and outage scheduling. This is procedurally documented in *NYPA Operating Policy 10-0 Energy Control Center Notifications to Entergy/JAF Nuclear Plant*.

The monitoring of the critical bus voltage at this nuclear plant is performed by the NYISO, and National Grid provides the station service and off-site power requirements for contingency operations. In the event of a major outage, NYPA would bring its designated blackstart units on-line and follow NYISO instructions for energizing the 345 kV lines to the plant.

Due to the involvement of multiple entities in monitoring and maintaining the critical facilities and the critical bus voltage at the Fitzpatrick nuclear power plant, the team recommends that NYPA explore and facilitate, if possible, the participation of all entities involved in the operation and operating support of the Fitzpatrick nuclear power plant in an annual bulk power system restoration training for system operating personnel. The team believes that joint emergency operations' training has the potential of providing a significant reliability enhancement.

APPENDIX 1: Critical Energy Infrastructure

APPENDIX 2: Evaluation Participants

APPENDIX 3: Documents Reviewed