

**Report to the U.S.-Canada
Power System Outage Task Force**

**The August 14, 2003 Blackout
One Year Later:
Actions Taken in the
United States and Canada
To Reduce Blackout Risk**

**Natural Resources Canada
U.S. Department of Energy**



Canada

August 13, 2004

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Acknowledgments

As co-leads of the staff to the U.S.-Canada Power System Outage Task Force, we are pleased to release this report, which has been prepared jointly by electricity staff at the U.S. Department of Energy and Natural Resources Canada. Its authors, however, wish to acknowledge the support and cooperation provided by their colleagues at the U.S. Department of Homeland Security, the U.S. Federal Energy Regulatory Commission, Public Safety and Emergency Preparedness Canada, and the North American Electric Reliability Council.

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The August 14, 2003 Blackout One Year Later: Actions Taken in the United States and Canada To Reduce Blackout Risk

Introduction

On August 14, 2003, the largest power blackout in North American history affected eight U.S. States and the Province of Ontario, leaving up to 50 million people with no electricity. On August 20, the leaders of the United States and Canada established the U.S.-Canada Power System Outage Task Force and gave it a two-part mandate: (1) to identify the causes of the power outage, and (2) to make recommendations to reduce the possibility and scope of future outages. The Final Report of the Task Force, released on April 5, 2004, presented 46 recommendations for action.

Shortly after the formation of the Task Force, a team of electricity experts from government agencies in the United States and Canada, from the North American Electric Reliability Council (NERC), and from the electricity industry was created to aid in investigating the causes of the blackout and developing the Task Force's recommendations. Even before the Final Report was issued, however, work was under way on several fronts to address problem areas that had been identified in the investigation.

After the issuance of the Final Report in April 2004, the mandate of the U.S.-Canada Power System Outage Task Force was extended for a year, underscoring the two governments' commitment to ensuring that the recommendations would be implemented. In the period since the release of the report, government agencies, NERC, and the electricity industry have continued to pursue a wide array of initiatives to reduce the risk of future blackouts. Some actions have already been completed. Other actions launched analyses or processes that will not be completed for several months or, in some cases, even longer.

One effect of the complexity of North American bulk power systems is that in order for the suite of actions undertaken over the past year to be

effective, those actions have had to be diverse but still appropriately focused and well-coordinated. Overall, these requirements appear to have been met. Many of the actions, though worthwhile in themselves, have acquired greater significance because they leverage and reinforce each other. An example is the synergistic relationship between the restatement of reliability standards in clearer, more specific language and programs for monitoring compliance and gauging the readiness of organizations to meet their responsibilities under challenging conditions.

The aggregate result of these actions has been to reduce significantly the risk of future blackouts—even though that risk can never be eliminated entirely. Further, despite these actions, the need for the U.S. Congress to enact the reliability provisions in pending legislative proposals (H.R. 6 and S. 2095) has in no way diminished. It remains essential to enact the legislation to establish the jurisdiction of the U.S. Federal Energy Regulatory Commission (FERC) for reliability matters over all participants in the U.S. portions of the North American bulk power systems, to provide a solid legal foundation for the certification of an electric reliability organization (ERO) that will develop technically sound reliability standards, and to make compliance with such standards mandatory and enforceable under U.S. law.

The actions taken over the past year fall under ten broad headings:

- ◆ Institutional changes, many of them by government agencies, to strengthen the institutional infrastructure for maintaining electric reliability in North America.
- ◆ Actions to clarify existing standards and develop new standards where needed.
- ◆ Actions to improve monitoring and ensuring compliance with reliability standards.
- ◆ Remedial actions to correct the direct causes of the August 14 blackout.

- ◆ Actions to improve operator training and certification requirements.
- ◆ Actions to improve operators' real-time tools.
- ◆ Actions to strengthen practices for voltage management and provision of reactive power.
- ◆ Actions to improve system protection plans and practices.
- ◆ Actions to improve the physical and cyber security of the bulk power systems.
- ◆ Actions to improve the response of the Canadian nuclear power sector to events involving loss of off-site power supplies.

The sections below present more detail on the actions taken under these headings. Actions that respond to or fulfill some of the 46 recommendations in the Task Force's Final Report are so noted. Some of the most significant actions are displayed in a graphic (Figure 1). It was not practical, however, to incorporate all of the actions discussed below into the figure. In addition to the actions discussed below, the Northeast Power Coordinating Council (NPCC) hosted workshops in New York City (April 28, 2004) and Toronto (July 7, 2004) to discuss regional blackout issues and appropriate responses.

Key Accomplishments—and Major Challenges Still Ahead

Accomplishments

- ◆ As presented in the Task Force's Final Report, the investigation team identified the direct causes of the August 14, 2003 blackout and recommended that FirstEnergy, MISO, ECAR, and PJM implement specific remedial actions before June 30, 2004. NERC teams have independently verified that, with minor exceptions, these actions were completed by that date.
- ◆ NERC teams conducted 23 readiness audits at some of the largest utilities and other electricity organizations across the Eastern Interconnection to assess the capability of these entities to meet their reliability responsibilities, even under adverse circumstances.
- ◆ The Task Force held a workshop on May 14, 2004, hosted by FERC, with NERC and other interested parties to develop a common understanding of the need to restate and clarify NERC's existing reliability standards, and a process and timeframe for that effort.
- ◆ The United States and Canada established a Bilateral ERO Oversight Group to address institutional issues concerning an international framework for reliability.
- ◆ Government agencies in the two countries and NERC have cooperated to track progress on actions related to implementation of the Task Force's recommendations.
- ◆ With few exceptions, individual grid operators in North America's interconnected bulk power systems received at least five days of emergency preparedness training before June 30, 2004.
- ◆ NERC extended the life of its existing Urgent Action Standard 1200 (which concerns the physical and cyber security of the bulk power systems) to August 2005. NERC has also worked with the industry on an aggressive plan to develop a successor version (Standard 1300) by that date.

Major Challenges Still Ahead

- ◆ Enactment of reliability legislation by the U.S. Congress.
- ◆ Completion of the revision of NERC's existing standards.
- ◆ Certification of the ERO by government agencies and approval of its standards.
- ◆ Independent funding for NERC (or the ERO) and the regional councils.
- ◆ Reform of the roles, responsibilities, and boundaries of the regional councils.
- ◆ Enhancement of the overall security of the electricity sector.

1. Institutional changes to strengthen North America's reliability infrastructure

The actions under this heading are generally of two types: (1) Those taken by government agencies to enable them to address reliability matters more effectively, and (2) those taken by NERC to strengthen and better focus its capacities and those of the 10 regional reliability councils.

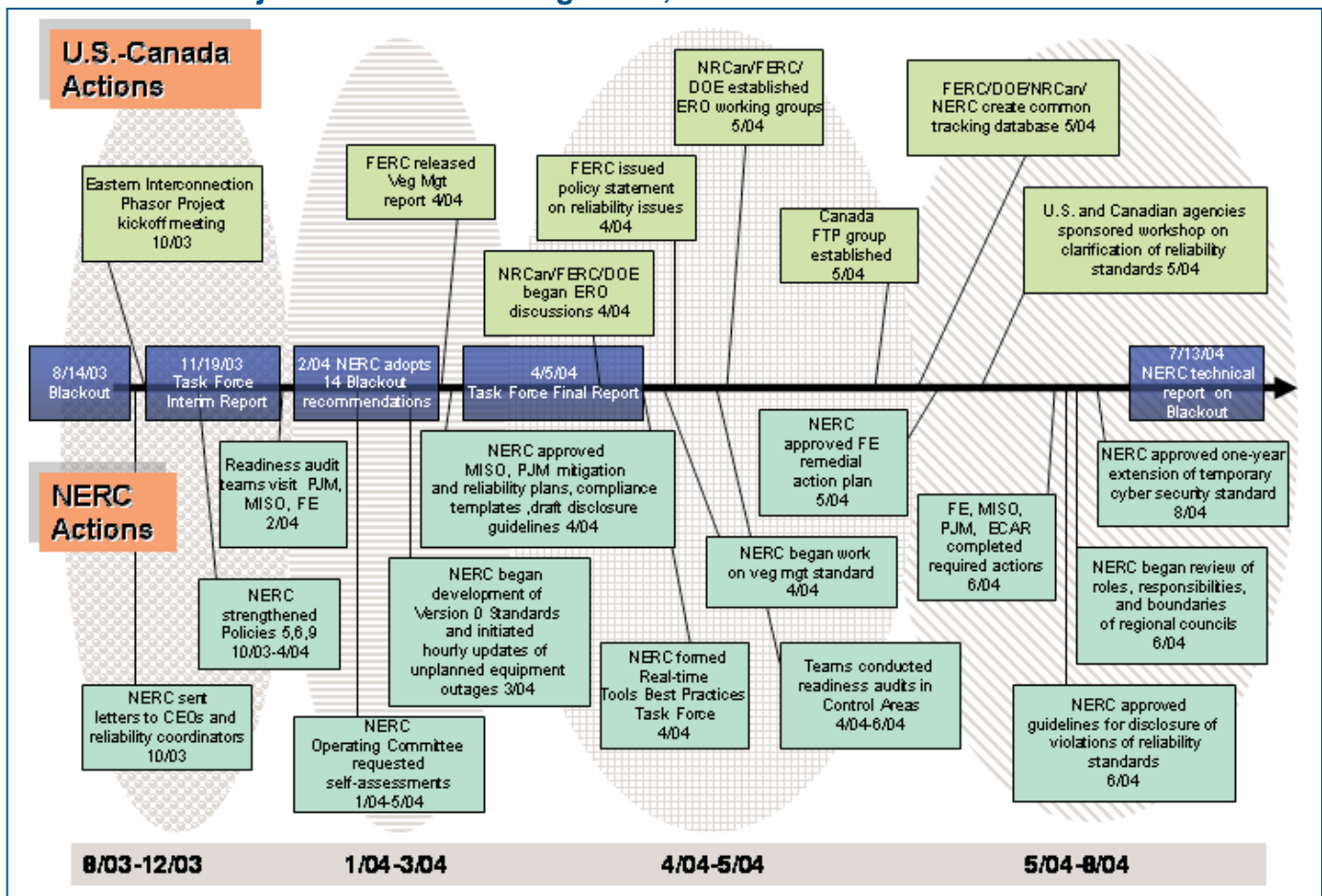
Government actions

- ◆ Agencies in the United States and Canada have created a standing Bilateral ERO Oversight Group, the function of which is to provide consistent, coordinated government guidance and input to NERC and its regional reliability councils. This group, or something functionally similar, will be needed indefinitely. On the U.S. side, the participating agencies are the Federal Energy Regulatory Commission (FERC), the Department of Energy (DOE), the Department of Homeland Security (DHS), and (as needed) the

U.S. Nuclear Regulatory Commission (NRC). On the Canadian side, the participating agencies are Natural Resources Canada (NRCan), the National Energy Board (NEB), Public Safety and Emergency Preparedness Canada (PSEPC), the Canadian Nuclear Safety Commission (CNSC), and the provincial and territorial agencies responsible for electric regulatory matters. **This action fulfills Task Force Recommendation 1-D.**

- ◆ The Council of Energy Ministers in Canada has created a Federal-Provincial-Territorial Group (FPT Group), as a Canadian subset of the Bilateral Group. The FPT Group will coordinate the development of reliability-related policies and actions by Canadian federal and provincial agencies. **This action, and subsequent actions by the FPT Group, will fulfill Task Force Recommendation 1-C.**
- ◆ The Bilateral Group has designated a team to work in cooperation with the North American Electric Reliability Council (NERC) to track and

Major Actions Since August 14, 2003 to Reduce Blackout Risk



report on the status of actions to implement the 46 recommendations of the U.S.-Canada Power System Outage Task Force. **This action, and actions such as publication of this report, will fulfill Task Force Recommendation 5-A.**

- ◆ The U.S. Federal Energy Regulatory Commission (FERC) created a new reliability division to help ensure the reliability of bulk power supplies and assist the Commission in considering reliability impacts in its decisions. Staff from this division have participated in the 23 readiness audits conducted by NERC between mid-February and June 30, 2004. **These actions partially fulfill Task Force Recommendations 9 and 18.**
- ◆ In a policy statement of April 19, 2004, FERC reaffirmed its standing policy that the Commission will approve applications to recover prudently incurred costs necessary to ensure bulk electric system reliability. The same statement also reaffirmed that the Commission will take reliability considerations into account before authorizing a new independent system operator (ISO) or regional transmission organization (RTO) to become operational. **This action fulfills Task Force Recommendations 4 and 6.**

NERC actions

- ◆ In June 2004 NERC launched a review of the roles, responsibilities, and boundaries of the regional reliability councils. The principal product of this review will be a report and recommendation to the NERC Board for consideration and action at the Board's mid-October 2004 meeting. For additional details and documents related to this review, see NERC's web site, <http://www.nerc.com/~filez/roleofregions.html>. **This action, and subsequent deliberations and actions, will contribute to fulfillment of Task Force Recommendation 3-C.**
- ◆ NERC clarified the standards defining Reliability Coordinator and Control Area functions, responsibilities, capabilities, and authorities. The investigation of the August 14, 2003 blackout found that effective responses to the unfolding emergency were impeded by confusion among some of the parties immediately involved about their respective roles and responsibilities. **NERC's action will partially fulfill Task Force Recommendation 20.**

2. Actions to clarify existing reliability standards and develop new standards where needed

The Task Force Report found that NERC needed to make its standards more specific and easier to enforce, that new standards were needed on some subjects, and that NERC efforts to restate its standards needed to be accelerated.

Government actions

- ◆ FERC commissioned a firm specializing in utility vegetation management, CN Utility Consulting, LLC, to analyze the transmission line outages related to vegetation management involved in the August 14, 2003 blackout, analyze the vegetation management practices of three Midwestern utilities, and identify best practices in vegetation management. Note: Inadequate tree-trimming near transmission lines was a major cause of the August 14 blackout and previous blackouts in North America. For CN Utility Consulting's report to FERC, go to FERC's website at <http://www.ferc.gov/cust-protect/moi/uvm-final-report.pdf>.
- ◆ On April 19, 2004, FERC issued an order requiring transmission owner to file reports with the Commission on their practices for management of vegetation in transmission right-of-way areas.
- ◆ In the policy statement FERC also issued on April 19, 2004, the Commission affirmed that NERC standards are minimum requirements and that regional reliability councils have the option of setting more stringent requirements. **This action is part of FERC's implementation of Task Force Recommendation 1-B.**
- ◆ U.S. and Canadian agencies sponsored a public workshop at FERC headquarters on May 14, 2004, with NERC and other interested parties to develop a common understanding of the need to restate and clarify NERC's existing reliability standards, and a process and timeframe for that effort.

NERC actions

- ◆ NERC made post-blackout changes to strengthen existing Policy 5 (Emergency Operations), Policy 6 (Operations Planning), and Policy 9 (Reliability Coordinator Procedures).

- ◆ NERC approved a plan to replace all of its existing operating policies and planning standards in February 2005 with a new version of its standards that will include compliance metrics for each standard. **This action, when completed, will fulfill Task Force Recommendation 25.**
- ◆ NERC initiated procedures to develop new standards on three subjects:
 - Vegetation management. **When completed, this action will fulfill Task Force Recommendation 16.**
 - Calculation of transmission line ratings. **When completed, this action will fulfill Task Force Recommendation 27.**
 - Operator training and certification. **When completed, this action will contribute to implementation of Task Force Recommendation 19.**

3. Actions to improve monitoring and ensure compliance with reliability standards

Government actions

- ◆ FERC's policy statement on April 19, 2004 declared that adherence to reliability standards is required under its Open Access Transmission Tariff. **This action fulfills Task Force Recommendation 1-B.**
- ◆ Canada's Council of Energy Ministers instructed the FPT Group to determine what actions by provincial legislatures or regulatory agencies are needed to make compliance with reliability standards mandatory and enforceable in Canada. **This action, and subsequent actions, will fulfill Task Force Recommendation 3-C.**

NERC actions

- ◆ In October 2003, before the Task Force had issued its reports, NERC requested CEOs of all reliability coordinators and control areas to initiate organizational self-assessments and certify that their organizations were in compliance with NERC and regional reliability council standards and good utility practices. This request focused in particular on problem areas identified in preliminary findings from the blackout investigation.

- ◆ NERC strengthened its compliance audit program by requiring the regional reliability councils to report significant violations of NERC or regional standards within 48 hours of occurrence, and to provide quarterly reports on all violations. Audit teams will conduct onsite investigations if necessary to determine whether a violation occurred and the circumstances of the violation. **This action partially fulfills Task Force Recommendations 17-A and 17-B.** (Note: "Compliance audits" are retrospective, and focus on possible violations of standards. "Readiness audits" are forward-looking, and focus on whether the parties are fully prepared to maintain reliability, under adverse circumstances if necessary.)
- ◆ NERC created a readiness audit program, under which NERC teams (including some FERC staff) conducted 23 readiness audits [including FirstEnergy, the Midwest Independent System Operator (MISO), and PJM Interconnection (PJM)] between mid-February and June 30. Twenty-five more audits will be completed by December 31. Final reports by readiness audit teams are posted for public review on NERC's web site. **This action will fulfill Task Force Recommendations 18-A and 18-B.**
- ◆ NERC developed and approved guidelines for public disclosure of the results of readiness and compliance audits, including the identities of violators of standards. **This action supports implementation of Task Force Recommendations 17 and 18.**

4. Remedial actions to correct the direct causes of the August 14, 2003 blackout (by June 30, 2004)

Government action

- ◆ On December 24, 2003, FERC issued an order to FirstEnergy directing that firm to retain an independent expert to prepare a study of the adequacy of transmission and generation facilities in northeastern Ohio. FirstEnergy submitted the study to FERC on April 22, 2004, and affirmed that the results of the study were being incorporated into the company's planning and operations.

NERC actions

- ◆ In February 2004, before the Task Force published its Final Report, NERC issued very specific directions to FirstEnergy, the Midwest Independent System Operator (MISO), PJM Interconnection (PJM), and the East Central Area Reliability Coordination Agreement (ECAR) concerning a series of remedial actions each organization was to take in its respective area by June 30. The Task Force strongly supported all of these actions in its Final Report of April 5.
- ◆ NERC reviewed and approved detailed compliance plans submitted by FirstEnergy, MISO, PJM, and ECAR showing how they would accomplish the required actions by June 30.
- ◆ NERC provided on-site oversight and assistance to the four organizations, and verified that all required actions were completed by June 30 except for a longer-term review being conducted by ECAR as directed.

The above three actions, when fully completed, will fulfill Task Force Recommendation 15.

5. Actions to improve operator training and certification requirements

The Task Force's Final Report found that inadequate training of operators to recognize and cope with emergency conditions was a major cause of the August 14 blackout, and several previous blackouts. In recognition of this:

- ◆ NERC issued a new requirement for operating entities to provide operators with five days of emergency preparedness training by June 30 and five days annually thereafter.

NERC and FERC are designing parallel but coordinated studies of operator training requirements, including reviews of training practices used in other industries (e.g., nuclear plant operations, air traffic control, airline pilots) that require operators to be prepared to deal immediately and effectively with unusual or adverse conditions. The results of these studies will help to guide a revision of NERC requirements concerning grid operator training and certification.

These actions, when completed, will partially fulfill Task Force Recommendation 19.

6. Actions to improve operators' real-time tools

The Task Force also found that in the August 14, 2003 blackout and in several earlier blackouts in North America, there was a clear need for improved real-time tools that would enable operators across a broad regional area to view a common screen and discuss an evolving problem at an early stage in its development. Major actions in response to this need are discussed below.

Government/industry action:

- ◆ Even before the August 14, 2003 blackout, DOE and industry experts were planning an effort called the Eastern Interconnection Phasor Project. This project will establish a network of time-synchronized data recording instruments across the Interconnection that will provide participants with common information and early warnings of possible disturbances. A pilot-scale network involving 20 or so instruments will be activated and tested beginning in August 2004. Over a period of years the project's sponsors expect the network to be expanded geographically and to integrate data from as many as 350 instruments across the Eastern Interconnection.

NERC actions:

- ◆ NERC is implementing a plan to provide operators with hourly updates concerning unplanned equipment outages. On August 14, 2003, MISO's operators were hampered in their efforts to understand and deal with mounting problems because some of their diagnostic tools were using data that was no longer accurate.
- ◆ NERC has created a Real-time Tools Best Practices Task Force (RTBPTF) to identify best practices for building and maintaining real-time networks, and develop guidelines based on these practices. This task force will present recommendations in April 2005 for specific, auditable requirements for inclusion in new standards concerning real-time tools for operators.

When completed, these three actions will fulfill Task Force Recommendation 22.

7. Actions to strengthen practices for voltage management and provision of reactive power

The Task Force Final Report found that inadequate preparations for voltage management and the provision of reactive power were contributing factors in the August 14, 2003 blackout and in earlier blackouts in North America. Relevant actions on this subject include:

- ◆ On February 10, 2004, the NERC Board required ECAR to conduct an extensive evaluation of its reactive power and voltage assessment practices and requirements, and to report its findings and proposed changes to the Board by June 30. ECAR complied with this directive.
- ◆ The Board also required the NERC Planning Committee to evaluate the effectiveness of existing reactive power and voltage control standards in all 10 NERC regions, and recommend improvements by February 2005.

These actions will partially fulfill Task Force Recommendation 23.

8. Actions to improve system protection plans and practices

The Task Force's Final Report found that on August 14, 2003 the automatic activation of zone 3 relays on transmission lines in northern Ohio and southern Michigan accelerated and broadened the spread of the blackout. It also found that there was a need for broader reliance on pre-planned under-voltage load shedding programs in order to be prepared for emergencies, and a need to improve the coordination of relay protection devices and load shedding programs.

Relevant actions in this area include:

- ◆ NERC required all transmission owners to evaluate zone 3 relays on lines 230 kV and higher to minimize tripping under inappropriate conditions. These evaluations are to be completed by September 30, 2004, and needed changes are to be completed by December 31, 2005.
- ◆ NERC required each regional reliability council to investigate the benefits of Under-Voltage Load Shedding in its respective area and report its findings by February 1, 2005.
- ◆ By June 2005, a NERC System Protection and Control Task Force will review the regional

findings and propose recommendations concerning load shedding programs.

When completed, these actions will partially fulfill Task Force Recommendation 21.

9. Actions to strengthen the physical and cyber security of the bulk power systems

Although the Task Force found no evidence linking the August 14, 2003 blackout to malicious acts, it identified a number of security-related matters of concern in the electricity sector. The U.S. DOE and DHS, Public Safety and Emergency Preparedness Canada (PSEPC), NERC, and industry officials have collaborated over the past year on a number of actions, including:

- ◆ DHS and NERC launched a Cyber Log Analysis project in October 2003, designed to distinguish, summarize, and prioritize threatening cyber activity directed against the electric power infrastructure.
- ◆ In August 2004, with government and industry support, NERC approved a 1-year extension of the existing Urgent Action Standard 1200 until August 2005. Cyber Security Standard 1300, which is now being developed, will then replace the existing standard.
- ◆ NERC is working with the industry to design an educational program on physical and cyber security for industry personnel responsible for corporate physical security, cyber security, system operations, and compliance with security standards.
- ◆ NERC, DHS and PSEPC are working to implement procedures to reduce the risk of inadvertent disclosure of sensitive critical infrastructure information.
- ◆ NERC, DHS, and PSEPC are preparing a bilateral (Canada-U.S.) study to develop ways to mitigate infrastructure vulnerabilities and update vulnerability assessment methodologies. The objective of the study is to reduce the risks and vulnerabilities associated with a shared electricity infrastructure and cross-border interdependencies.
- ◆ DOE, in cooperation with NERC and DHS, is developing the electricity-sector component of the U.S. National Infrastructure Protection Plan.

- ◆ NERC, in cooperation with DHS, DOE, and PSEPC, is expanding and refining plans for an Electricity Sector Information Sharing and Analysis Center.
- ◆ In cooperation with DHS, DOE, PSEPC, and vendors, NERC is identifying ways to improve the security of grid control systems and electronic protection devices.
- ◆ NERC has worked with the industry to establish a data base to identify spare transformers available for emergency situations. NERC is assessing the need to expand this data base to include other critical equipment.

When completed, these actions will wholly or partially fulfill Task Force Recommendations 32, 36, 42, and 44.

10. Actions to improve the response of the Canadian nuclear power sector to events involving the loss of off-site power supplies

The Task Force's Final Report included two recommendations pertaining to the Canadian nuclear power sector.

- ◆ Recommendation 45 called on the Canadian Nuclear Safety Commission (CNSC) to review operating procedures and operator training associated with the use of adjuster rods, with the objective of accelerating the restart of nuclear units. The CNSC is responding to this recommendation as part of its ongoing work with licensees to ensure safe operation of their reactors.
- ◆ Recommendation 46 called on the CNSC to purchase and install backup generation equipment at CNSC for use in emergency situations. This capacity has been installed and will be operational in mid-August 2004.

Acronyms

CNSC	Canada Nuclear Safety Commission
DHS	U.S. Department of Homeland Security
DOE	U.S. Department of Energy
ECAR	East Central Area Reliability Coordination Agreement
EIPP	Eastern Interconnection Phasor Project
ERO	Electric Reliability Organization
FE	FirstEnergy
FERC	Federal Energy Regulatory Commission (U.S.)
FPT group	Federal-Provincial-Territorial group (Canada)
ISO	Independent System Operator
MISO	Midwest Independent System Operator
NEB	National Energy Board (Canada)
NERC	North American Electric Reliability Council
NPCC	Northeast Power Coordinating Council
NRC	U.S. Nuclear Regulatory Commission
NRCan	Natural Resources Canada
PJM	PJM Interconnection
PSEPC	Public Safety and Emergency Preparedness Canada
RTO	Regional Transmission Organization

