# Standard Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

**Development Steps Completed:**

1. Standard drafting team appointed by the Standards Authorization Committee on June 21, 2006.
2. Standards drafting team posted draft standard for comment on September 27, 2006.
3. Standards drafting team responded to comments and posted the revised standard on August 15, 2007.

**Proposed Action Plan and Description of Current Draft:**

This is the second posting of the proposed standard and its associated implementation plan for a 45-day comment period, from August 15, 2007 to September 28, 2007.

**Future Development Plan:**

| Anticipated Actions | Anticipated Date |
|---|---|
| 1. Respond to comments on the second draft of the proposed standard. | November 1, 2007 |
| 2. Obtain the Standards Committee's approval to move the standard forward to balloting. | November 15, 2007 |
| 3. Post the standard and implementation plan for a 30-day pre-ballot review. | December 1–January 1, 2008 |
| 4. Conduct an initial ballot for 10 days. | January 2–January 11, 2008 |
| 5. Respond to comments submitted with the initial ballot. | February 15, 2008 |
| 6. Conduct a recirculation ballot for 10 days. | February 15–February 25, 2008 |
| 7. Post for a 30-day preview for board. | March 1–March 31, 2008 |
| 8. Board adoption. | April 15, 2008 |

## A. Introduction

**1. Title:** **System Personnel Training**

**2. Number:** PER-005-1

**3. Purpose:** To ensure that System Operators performing real-time, reliability-related tasks on the North American Bulk Electric System are competent to perform those reliability related tasks. The competency of System Operators is critical to the reliability of the North American Bulk Electric System.

**4. Applicability:**

**4.1. Functional Entities:**

**4.1.1** Reliability Coordinator.

**4.1.2** Balancing Authority.

**4.1.3** Transmission Operator.

**4.2.** This standard applies to System Operator positions of the entities listed in 4.1 and their delegates who can directly, or through communications, impact reliability by producing a real-time response from the Bulk Electric System.

**5. Proposed Effective Dates:**

**5.1.** Requirement 3 in the standard shall become effective on the first day of first quarter after applicable regulatory approval (or the Reliability Standard otherwise becomes effective on the first day of first quarter after Board of Trustee adoption in jurisdictions where regulatory approval is not required).

**5.2.** Requirement 2 in the standard shall become effective 18 months after the first day of the first quarter following regulatory approval (or the Reliability Standard otherwise becomes effective 18 months after the first day of the first quarter after Board of Trustee adoption in those jurisdictions where regulatory approval is not required).

**5.3.** Requirement 1 and Requirement 4 shall become effective 36 months after the first day of the first quarter following regulatory approval (or the Reliability Standard otherwise becomes effective 36 months after the first day of the first quarter after Board of Trustee adoption in those jurisdictions where regulatory approval is not required).

## B. Requirements

**R1.** Each Reliability Coordinator, Balancing Authority and Transmission Operator shall complete the five phases of a systematic approach to training (SAT) (which includes analysis, design, development, implementation, and evaluation) to establish a new or modify an existing training program(s) that addresses Bulk Electric System (BES) company-specific reliability-related tasks performed by its System Operators. [Risk Factor: Medium] [Time Horizon: Long-term Planning]

**R1.1.** To create a company-specific list of BES reliability-related tasks, each Reliability Coordinator, Balancing Authority and Transmission Owner shall select all tasks performed by its System Operator positions from the Generic Task List (provided in Attachment A) and add other BES reliability-related tasks performed by its System Operator positions.

**R2.** Each Reliability Coordinator, Balancing Authority and Transmission Operator shall assess at least annually the training needs of each System Operator position to determine the mis-match between acceptable and actual performance capability. [Risk Factor: Medium] [Time Horizon: Long-term Planning]

**R2.1.** The assessment shall include identification of mis-matches between acceptable and actual performance capability that need to be addressed through future training.

**R2.2.** The assessment shall include identification of training required to perform new or revised tasks from the company-specific reliability related tasks.

**R3.** Each Reliability Coordinator, Balancing Authority and Transmission Operator shall provide each System Operator with at least 32 hours annually of emergency operations and system restoration training. [Risk Factor: Medium] [Time Horizon: Long-term Planning]

**R3.1.** The emergency operations and system restoration training shall include the principles and procedures needed for recognizing and responding to emergencies, using drills, exercises or simulations of system conditions in subject areas from the Emergency Operations Topics (provided in Attachment B).

**R3.1.1.** Each Reliability Coordinator, Balancing Authority and Transmission Operator shall add or remove topics from the Emergency Operations Topics to reflect emergency operations and system restoration topics that apply to its organization.

**R4.** Each Reliability Coordinator, Balancing Authority and Transmission Operator shall verify the capabilities of each of its real-time System Operators to perform each assigned task on its list of company-specific BES reliability-related tasks. [Risk Factor: Medium] [Time Horizon: Long-term Planning]

## C. Measures

M1. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall have available for inspection evidence of a SAT-developed BES System Operator training program with evidence of the following SAT-related outcomes:

M1.1. Analysis that results in a list of company-specific BES reliability-related tasks and measurable or observable criteria for desired performance for each task

M1.2. Design and development of training materials that result in learning objectives and content that is derived from results of training analysis

M1.3. Implementation of the training program, as identified in the training analysis

M1.4. Evaluations and assessments of training delivered to determine if learning objectives are met

M2. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall have available for inspection the results of its latest assessment for each position, as specified in R2.

M3. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall provide evidence that each System Operator has obtained 32 hours of emergency operations or system restoration training, as specified in R3.

M4. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall have available for inspection verification of the capabilities for each real-time System Operator, as specified in R4.

## D. Compliance

**1. Compliance Monitoring Process**

**1.1. Compliance Monitoring Responsibility**

Compliance Enforcement Authority (CEA)

**1.2. Compliance Monitoring Period and Reset**

The performance reset period for all requirements is one month.

**1.3. Data Retention**

For all requirements and measures, each Reliability Coordinator, Balancing Authority and Transmission Operator shall retain evidence of compliance for four years or since its most recent on-site compliance audit, whichever is greater. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall retain all data used to show evidence it is following or followed any mitigation plan associated with this standard.

The Compliance Monitor shall retain data, including self-certifications, since its last on-site audit and all documentation from other compliance monitoring methods used since the last on-site compliance audit. The Compliance Monitor shall retain any data used in mitigation plans associated with this standard.

**1.4. Additional Compliance Information**

Each Reliability Coordinator, Transmission Operator and Balancing Authority shall demonstrate compliance through self-certification submitted to its Compliance Enforcement Authority annually.

The Compliance Enforcement Authority shall conduct a scheduled on-site review once every three years, and may conduct spot checks and investigations to assess performance.

**2. Violation Severity Levels**

**2.1. Lower: There shall be a lower violation for each subsection in which one or more of the following conditions exist:**

**2.1.1** **None**

**2.1.2** **None**

**2.1.3** The responsible entity did not add or remove topics from the Emergency Operations Topics that apply to their organization.

**2.1.4** **None**

**2.2. Moderate: There shall be a moderate violation for each subsection in which one or more of the following conditions exist:**

**2.2.1** The responsible entity has completed a list of company-specific reliability-related tasks from the Generic Task List (Provided in attachment A), and has started creating a list identifying all other reliability-related task that the company performs, but the list is not complete.

**NOTE: If the entity violates R1.1, the entity is also in violation of R1, (failure to perform the Analysis phase of the SAT process).**

**2.2.2** The responsible entity has determined training required based on the mis-match between acceptable and actual performance capability but has not included the training identified in its current schedule.

**2.2.3** The responsible entity provided at least 32 hours of training on emergency operations or system restoration, annually, but did not include training in subject areas listed in Attachment B.

**2.2.4** **None**

**2.3.** **High: There shall be a high violation for each subsection in which one or more of the following conditions exist:** The responsible entity has only partially achieved the reliability objective of the requirement and is missing one or more significant elements.

**2.3.1** The responsible entity has a system operator training program for all its system operator positions (identified in Section 4.2) but the entity did not use or provide evidence of use of one of the five phases of a SAT process listed below when establishing new system operator training: (R1)

- Analysis that results in a list of company-specific reliability-related tasks and measurable or observable criteria for desired performance for each task
- Design that results in learning objectives
- Develop training content that is derived from results of training analysis and learning objectives.
- Implementation of the training program, as identified in the training analysis
- Evaluations and assessments of training delivered to determine if learning objectives are met

**OR**

The responsible entity has a system operator training program for all its system operator positions (identified in Section 4.2) but the entity did not use or provide evidence of use of one of the five phases of a SAT process listed below when making modifications to an existing system operator training program:

- Analysis that results in a list of company-specific reliability-related tasks and measurable or observable criteria for desired performance for each task
- Design that results in learning objectives
- Develop training content that is derived from results of training analysis and learning objectives.
- Implementation of the training program, as identified in the training analysis
- Evaluations and assessments of training delivered to determine if learning objectives are met

**OR**

The responsible entity does not have a system operator training program based on the SAT process for one of its system operator positions (as identified in Section 4.2).

**2.3.1.1** The responsible entity has started creating a list or has a partial list identifying its company specific list of reliability related tasks from the generic task list (in Attachment A), but the list is not complete

NOTE: If the entity violates R1.2, the entity is also in violation of R1, (failure to perform the implementation phase of the SAT process).

**2.3.2** The responsible entity has not performed an assessment which includes identification of measurable or observable criteria for desired performance to each task for the determination of the training needs for one of its system operating position.

**2.3.2.1** The responsible entity has not identified training required based on the mis-match between acceptable and actual performance capability.

**2.3.3** The responsible entity provided to its system operators at least, 32 hours of emergency operations or system restoration training, annually, but not all its System Operators has completed or evidence shows will not have completed the required annual training.

**2.3.3.1** The responsible entity provided at least 32 hours of training on emergency operations or system restoration, but the training did not include training in principles and procedures needed for effectively recognizing and responding to emergencies **OR**

The emergency operations or system restoration training delivery method did not include drills, exercises, or simulations of system conditions,

**2.3.4** The responsible entity has performed an assessment of its System Operator's capabilities to perform each identified task that is on its company-specific reliability-related task, but not for each of its System Operators.

**2.4. Severe: There shall be a severe violation for each subsection in which one or more of the following conditions exist.** The responsible entity has failed to meet the reliability objective of the requirement.

**2.4.1** The responsible entity has a system operator training program for all its system operator positions (identified in Section 4.2) but the entity did not use or provide evidence of use of two of the five phases of a SAT process listed below when establishing new system operator training:

- Analysis that results in a list of company-specific reliability-related tasks and measurable or observable criteria for desired performance for each task
- Design that results in learning objectives
- Develop training content that is derived from results of training analysis and learning objectives.
- Implementation of the training program, as identified in the training analysis
- Evaluations and assessments of training delivered to determine if learning objectives are met

**OR**

The responsible entity has a system operator training program for all its system operator positions (identified in Section 4.2) but the entity did not use or provide evidence of use of two of the five phases of a SAT processes listed below when making modifications to an existing system operator training program. :

- Analysis that results in a list of company-specific reliability-related tasks and measurable or observable criteria for desired performance for each task
- Design that results in learning objectives

- Develop training content that is derived from results of training analysis and learning objectives.
- Implementation of the training program, as identified in the training analysis
- Evaluations and assessments of training delivered to determine if learning objectives are met

**OR**

The responsible entity does not have a SAT program for its system operators.

**2.4.1.1** The responsible entity failed to create a company specific list of reliability related tasks from the generic task list. (in attachment A) **OR**

The responsible entity failed to create a list of all other reliability-related task the company performs.

**2.4.2** The responsible entity has not performed an assessment which includes identification of measurable or observable criteria for desired performance to each task for the determination of the training needs for two of its system operating position **OR**

The responsible entity has not performed an annual assessment as required by R2.

**2.4.3** The responsible entity did not provide to its system operators at least 32 hours of emergency operations or system restoration training **OR**

The responsible entity has provided 32 hours of emergency operations and system restoration training but the training has not provided annually.

**2.4.4** The responsible entity has not performed an assessment on its System Operator's capabilities to perform each identified task that is on its company-specific reliability-related task list

## E. Regional Variances

None.

### Version History

| Version | Date | Action | Change Tracking |
|---|---|---|---|
| | | | |
| | | | |

## Attachment A: Generic Task List

Attachment A presents a generic list of tasks to assist with the creation of a company-specific list of reliability-related tasks. Entities shall add or remove from the list to create a list of reliability-related tasks applicable to their organization.

### *General Control Center Operations Tasks:*

| ITEM# | TYPE OF ACTIVITY | GENERAL CONTROL CENTER OPERATIONS TASKS |
|---|---|---|
| 1 | Communication | Provide real-time system information to the Reliability Coordinator. |
| 2 | Communication | Coordinate reliability processes and actions with and among other Reliability Coordinators. |
| 3 | Communication | Issue reliability alerts to Generator Operators, Load-Serving Entities, Transmission Operators, Transmission Service Providers, Balancing Authorities, Regional Councils, and NERC |
| 4 | Communication | Produce and publish system status information (e.g., OASIS, IRN, and RCIS) |
| 5 | Communication | Prepare and provide data to reliability coordinator for later inclusion in NERC reports |
| 6 | Communication | Ensure all balancing authorities or transmission operators are aware of solar magnetic disturbances (SMD) forecast information |
| 7 | Communication | Communicate the status of system conditions with appropriate reliability coordination offices |
| 8 | Communication | Communicate the status of system conditions with appropriate balancing authorities and/or transmission operators |
| 9 | Communication | Report disturbances to NERC following the guidelines within the U.S. Department of Energy's most recent Power System Emergency Reporting Procedures |
| 10 | Communication | Communicate with interconnected systems during normal and emergency conditions using established procedures |
| 11 | Communication | Coordinate operations between the host balancing authority or transmission operator and any transmission operating entities that exist within the host balancing authority and/or transmission operator's boundaries to ensure transmission reliability |
| 12 | Communication | Report to the regional council staff within 24 hours after a disturbance affecting your system has occurred |
| 13 | Communication | Report any disturbances or unusual occurrences, suspected or determined to be caused by sabotage to the appropriate systems, governmental agencies, and regulatory bodies |
| 14 | Communication | Coordinate reliability processes and actions with and among other reliability coordinators |

| ITEM# | TYPE OF ACTIVITY | GENERAL CONTROL CENTER OPERATIONS TASKS |
|---|---|---|
| 15 | Communication | Utilize the voice and data telecommunication systems as required while adhering to Interconnection and regional operating procedures |
| 16 | Monitor | Monitor real-time operational information from balancing authorities and transmission operators. |
| 17 | Monitor | Interpret SCADA-generated alarms and information, and then take appropriate actions to maintain system reliability |
| 18 | Monitor | Check data and verify accuracy of each metering point used by Supervisory Control and Data Acquisition (SCADA) |
| 19 | Monitor | Monitor performance of power system equipment and call out system personnel when appropriate |
| 20 | Monitor | Monitor system load and generation |
| 21 | Monitor | Ensure all special protection systems and special design features are in service as needed |
| 22 | Monitor | Monitor real-time market prices for accuracy |
| 23 | Monitor | Monitor and respond to alarms from status of special protective schemes |
| 24 | Monitor | Verify data used in operation |
| 25 | Monitor | Monitor the RCIS and respond to any information provided |
| 26 | Monitor | Monitor all reliability-related system parameters, such as MW, MVAR, voltage, and amps to determine system conditions |
| 27 | Monitor | Monitor and control access to the control center to prevent sabotage |
| 28 | Monitor | Monitor all reliability-related data within a reliability coordinator area |
| 29 | Monitor | Monitor and periodically test normal and emergency telecommunication systems that link with interconnected systems to ensure communications are adequate and continuous |
| 30 | Monitor | Monitor and respond to telecommunication alarms or failures and notify the appropriate personnel |
| 31 | Monitor | Monitor and maintain defined voltage profiles to ensure system reliability |
| 32 | Monitor | Monitor and validate telemetry data for accuracy |
| 33 | Monitor | Monitor control center systems and support equipment and call out appropriate assistance as needed |
| 34 | Operating | Analyze operations log, and oral information from system operator leaving shift |
| 35 | Operating | Maintain records of special protection system, special design feature, and transmission protection system mis-operations |
| 36 | Operating | Evaluate impact of current weather conditions on system operations |

| ITEM# | TYPE OF ACTIVITY | GENERAL CONTROL CENTER OPERATIONS TASKS |
|---|---|---|
| 37 | Operating | Evaluate system conditions and apply operating guides when applicable |
| 38 | Operating | Evaluate the extent of an outage or disturbance and develop a plan of restoration |
| 39 | Operating | Identify operating problems and deficiencies, and recommend corrective measures |
| 40 | Operating | Respond to performance survey requests |
| 41 | Operating | Provide input to ensure that the operations computer database is up to date |
| 42 | Operating | Prepare daily reports and logs generated to meet company and regulatory requirements |
| 43 | Operating | Adjust control systems to compensate for any equipment errors or failures |
| 44 | Operating | Perform same-day reliability analysis of the electric system |
| 45 | Operating | Perform next-day reliability analysis of the electric system |
| 46 | Operating | Analyze and authorize requests for equipment outages |
| 47 | Operating | Enforce operational reliability requirements |
| 48 | Operating | Compile regional system data reports |
| 49 | Operating | Operate primary and backup telecommunications systems as required |
| 50 | Operating | Schedule system telecommunications, telemetering, protection, and control equipment outages to ensure system reliability |
| 51 | Operating | Maintain current knowledge of power system modifications and additions |
| 52 | Operating | Ensure that every effort is made to remain connected to the Interconnection |
| 53 | Operating | Take action as necessary to protect the system if it becomes endangered by remaining interconnected |
| 54 | Operating | Apply guidelines, including lists of utility contact personnel, for reporting disturbances due to sabotage events |
| 55 | Operating | Direct to the appropriate entities those options necessary to relieve reliability threats and violations in a reliability coordinator area |
| 56 | Operating | Ensure the accuracy of current system status by updating necessary operating procedures, diagrams, and map board |
| 57 | Operating | Provide input to system planners to help maintain accuracy in system models used for reliability assessments |
| 58 | Operating | Evaluate, test, and/or confirm the accuracy of reliability assessment tools |
| 59 | Operating | Utilize interconnected operation services as needed to maintain system reliability |

| ITEM# | TYPE OF ACTIVITY | GENERAL CONTROL CENTER OPERATIONS TASKS |
|---|---|---|
| 60 | Operating | Utilize reactive resources from transmission and generator owners to maintain acceptable voltage profiles |
| 61 | Operating | Enforce compliance of operating reliability limits |
| 62 | Operating | Arm or verify that special protection systems are armed to meet system conditions (contingencies) as needed |
| 63 | Operating | Test, evaluate, and operate backup control center facilities/systems as needed |
| 64 | Operating | Implement procedures for the recognition of sabotage events on your facilities and multi-site sabotage affecting larger portions of the Interconnection |
| 65 | Operating | Implement specified procedural actions in the event of a FERC Standards of Conduct violation |
| 66 | Procedure | Complies with reliability requirements specified by Reliability Coordinator. |
| 67 | Procedure | Evaluate current operating practices and make recommendations for improvement to meet NERC reliability standards' requirements |
| 68 | Procedure | Implement system restoration procedures |
| 69 | Procedure | Maintain a working knowledge of regional, NERC, FERC, and company specific guides, policies, and standards |

***Transmission Tasks:***

| ITEM# | TYPE OF ACTIVITY | TRANSMISSION TASKS |
|---|---|---|
| 1 | Limits | Monitor and operate or direct the operations of the transmission system within equipment and facility ratings. |
| 2 | Operating | Notify Generator Operators of transmission system problems in compliance with NERC requirements. |
| 3 | Outage | Adjust transmission configuration to implement proposed transmission system outage plan |
| 4 | Outage | Build contingency case for scheduled outages for next day |
| 5 | Outage | Coordinate planned and unplanned transmission outages with all impacted systems to ensure transmission system reliability |
| 6 | Outage | Direct transmission operators to revise maintenance plans as required, and as permitted by agreements |
| 7 | Outage | Implement transmission outages to ensure system reliability |
| 8 | Outage | Initiate the cancellation of scheduled transmission work when system conditions require |
| 9 | Outage | Interpret relay targets, oscillograph readings, breaker operations, and field observations to determine proper restoration methods during forced outages |
| 10 | Outage | Notify others of any planned transmission changes that may impact the operation of their facilities |
| 11 | Outage | Perform reliability analysis to determine impact of both scheduled and forced transmission outages |
| 12 | Outage | Receive and review transmission maintenance plans from transmission operators for reliability assessment |
| 13 | Outage | Report transmission outages to the reliability coordinators and other affected utilities |
| 14 | Limits | Coordinate with impacted systems, and monitor actual and/or expected operating reliability limit violations and respond as required |
| 15 | Limits | Develop or calculate system operating limits |
| 16 | Limits | Direct transmission operators to take actions to mitigate interconnection reliability operating limits |
| 17 | Limits | Ensure all tie-line limits are not exceeded |
| 18 | Limits | Ensure that transmission contract paths are not exceeded |
| 19 | Limits | Identify, communicate, and direct actions to relieve reliability threats and limit violations in the reliability coordinator area |
| 20 | Limits | Initiate control actions resulting from thermal limit violations, considering the responsiveness of the system |
| 21 | Limits | Monitor and respond to transmission system equipment rating violations |
| 22 | Limits | Monitor bulk transmission elements to determine constraints and operating limit violations |
| 23 | Limits | Monitor major transmission lines, flow gates, and scheduling paths |

| ITEM# | TYPE OF ACTIVITY | TRANSMISSION TASKS |
|---|---|---|
| 24 | Limits | Coordinate with transmission operators and transmission service providers on real-time transmission system limitations. |
| 25 | Limits | Monitor interconnection reliability operating limits . |
| 26 | Limits | Recalculate interconnection reliability operating limits based on current or future conditions, and according to transmission and generator owners' specified equipment ratings |
| 27 | Limits | Develop interconnected operating reliability limits |
| 28 | Operating | Analyze/research any bulk system disturbances affecting your system |
| 29 | Operating | Respond to disturbance conditions |
| 30 | Operating | Monitor and operate transmission system within its designed capabilities |
| 31 | Operating | Monitor radio system for calls requiring response |
| 32 | Operating | Monitor system frequency and initiate a hotline conference call when frequency error exceeds specified limits |
| 33 | Operating | Monitor the condition of the transmission system and respond as required (including shedding firm load) to avoid voltage collapse and/or Interconnection separation |
| 34 | Operating | Monitor the voltages, and coordinate the reactive dispatch of transmission facilities, and the interconnections with neighboring systems |
| 35 | Operating | Develop special operating procedures to allow continued operation of the transmission system based on the results of a reliability analysis |
| 36 | Operating | Direct and/or control all energization and/or modification of new or existing facilities |
| 37 | Operating | Direct and/or control phase shifting transformer taps |
| 38 | Operating | Direct and/or control transmission switching |
| 39 | Operating | Direct and/or regulate the operation of the transmission system |
| 40 | Operating | Ensure adequate transmission facilities are available to meet external and internal requirements (real-time or hourly) |
| 41 | Operating | Implement corrective actions from transmission problems resulting from an underlying sub-transmission or distribution event (local reliability issues) |
| 42 | Operating | Maintain constant awareness of neighboring transmission system conditions |
| 43 | Operating | Maintain safe operating conditions for all persons and property within the transmission system |
| 44 | Operating | Operate control equipment to continuously and accurately meet its system and Interconnection control obligation and measure its performance |
| 45 | Operating | Perform reliability analysis (actual and contingency) for the reliability coordinator area |
| 46 | Operating | Provide oversight of transmission operational plans, direct revisions as required, and as permitted by agreements |
| 47 | Operating | Respond to solar magnetic disturbance (SMD) warnings as required by system |

| ITEM# | TYPE OF ACTIVITY | TRANSMISSION TASKS |
|---|---|---|
| | | operating procedures |
| 48 | Operating | Specify interconnected operation services requirements for transmission reliability (e.g., reactive requirements, location of operating reserves) |
| 49 | Operating | Supervise and coordinate all activity at switching stations, generating stations, and transmission switchyards |
| 50 | Operating | Utilize load flow modeling tools to determine power flow changes and optimum system configurations during normal and emergency conditions |
| 51 | Voltage | Deploy reactive resources to maintain acceptable voltage profiles. |
| 52 | Voltage | Coordinate voltage reduction as requested by the balancing authority or as directed by the reliability coordinator. |
| 53 | Voltage | Direct voltage reduction |
| 54 | Voltage | Approve system voltage regulating equipment outages to ensure adequate system voltage and system reliability is maintained |
| 55 | Voltage | Coordinate operation of voltage control equipment with interconnected utilities |
| 56 | Voltage | Direct transmission operators to reduce voltage or shed load if needed to ensure balance in real-time |
| 57 | Voltage | Identify and respond to conditions likely to lead to voltage collapse |
| 58 | Voltage | Implement voltage reductions as directed by a transmission operator |
| 59 | Voltage | Minimize system voltage decay and prevent cascading outages |
| 60 | Voltage | Schedule system voltage regulating equipment outages to ensure adequate system voltage and system reliability is maintained |
| 61 | Voltage | Utilize HVDC systems' reactive power control capabilities as a voltage control tool when appropriate |
| 62 | Voltage | Utilize transmission line removal as a voltage control tool only if system studies indicate that system reliability will not be degraded below acceptable levels |
| 63 | Limits | Request reliability coordinator to mitigate equipment overloads. |
| 64 | Congestion | Identify special operating procedures that may be necessary to maintain acceptable transmission loading |
| 65 | Congestion | Initiate line loading relief procedures upon request of members of the Interconnection using appropriate priority levels |
| 66 | Congestion | Initiate transmission loading relief procedures to relieve potential or actual loading on a constrained facility |
| 67 | Congestion | Manage transmission loading by directing the redispatch of generators or reconfiguring the transmission system to mitigate impact, including the load curtailment process |
| 68 | Congestion | Notify all affected areas that line loading relief has been requested, and that corrective actions are required |
| 69 | Congestion | Request the reliability coordinator to mitigate equipment overloads |
| 70 | Congestion | Run day-ahead congestion management market |

| ITEM# | TYPE OF ACTIVITY | TRANSMISSION TASKS |
|---|---|---|
| 71 | Congestion | Run hour-ahead congestion management market to allocate available transmission capacities |
| 72 | Congestion | Use the results from an available transfer capability (ATC) calculator to determine the impact of an interchange transaction on the transmission system |
| 73 | Congestion | Utilize the Interchange Distribution Calculator to determine transaction curtailments for transmission load relief |
| 74 | Congestion | Calculate and post changes in available transmission capacity |
| 75 | Congestion | Implement terms of interruption for transmission services according to contractual provisions |
| 76 | | Direct load shedding |
| 77 | Load | Coordinate load shedding as requested by the balancing authority or as directed by the reliability coordinator. |
| 78 | Load | Issue corrective actions (e.g., curtailments or load shedding) to transmission operators, transmission service providers |
| 79 | Load | Adjust both short-term and future forecasts using actual load data and correction factors |
| 80 | Load | Call for interruptible loads to be shed when required |
| 81 | Load | Collect individual load profiles and forecasts of end-users energy requirements, and develop overall load profiles |
| 82 | Load | Compile load forecasts from load-serving entities within a balancing area |
| 83 | Load | Coordinate load shedding, and load restoration with, or as directed by the reliability coordinator |
| 84 | Load | Coordinate or direct use of controllable loads that have been bid as interconnected operations services |
| 85 | Load | Develop both short-term and future forecasts using actual load data and correction factors |
| 86 | Load | Monitor an area’s estimated and actual loads |
| 87 | Load | Respond to light load conditions |

***Generation Tasks:***

| ITEM# | TYPE OF ACTIVITY | GENERATION TASKS |
|---|---|---|
| 1 | Balancing | Direct resources (generator operators and load-serving entities) to take action to ensure balance in real time |
| 2 | Balancing | Ensure adequate generation capacity is available to meet external and internal requirements (real-time, or hourly) |
| 3 | Balancing | Respond to manual time error correction requests by regional time error monitor |
| 4 | Balancing | Allocate generation resources to meet system requirements |
| 5 | Balancing | Allocate load resources to meet system requirements |
| 6 | Balancing | Monitor AGC to ensure compliance with NERC CPS1 and CPS2 standards |
| 7 | Balancing | Perform system configuration evaluation for dispatching of imbalance energy based on real-time conditions |
| 8 | Balancing | Minimize inadvertent flows, losses, and CPS1 and CPS2 criteria violations |
| 9 | Balancing | Monitor AGC performance to diagnose and identify telemetry problems |
| 10 | Balancing | Compare actual generator output with anticipated schedules, and take action to account for the difference |
| 11 | Balancing | Dispatch generation resources economically while maintaining system reliability |
| 12 | Balancing | Monitor time error and initiate corrections |
| 13 | Balancing | Manually calculate ACE as necessary |
| 14 | Balancing | Publish next-day market results |
| 15 | Balancing | Monitor ramping capability for requested interchange schedules |
| 16 | Balancing | Ensure that the balancing authority is satisfying its Interconnection frequency regulation obligation |
| 17 | Balancing | Ensure that the balancing authority’s frequency bias value is continually set at the proper value |
| 18 | Balancing | Monitor ACE to determine if the calculation is correct |
| 19 | Balancing | Inform the appropriate balancing authority of the status of its overlap regulation service |
| 20 | Balancing | Verify that the regulating capacity is distributed equitably over as many units as possible |
| 21 | Balancing | Manage generation biasing to avoid reliability limit violations |
| 22 | Balancing | Monitor response of units to the AGC signals |
| 23 | Balancing | Operate the AGC system in tie-line bias control mode unless such operation is adverse to system or Interconnection reliability |
| 24 | Balancing | Obtain replacement energy upon a loss of any major generating or interchange resource |
| 25 | Balancing | Respond to generation losses, recognizing reliability restrictions to effectively maintain tie-line flows |
| 26 | Balancing | Apply the principles of economic dispatch to generating units |

| ITEM# | TYPE OF ACTIVITY | GENERATION TASKS |
|---|---|---|
| 27 | Balancing | Respond to generation losses, recognizing economic and reliability restrictions |
| 28 | Balancing | Publish hour-ahead market results |
| 29 | Balancing | Publish day-ahead market results |
| 30 | Balancing | Declare an Energy Emergency Alert (EEA) when generation resources and reserves are inadequate to meet demand |
| 31 | Balancing | Consult with other impacted balancing authorities, adjust the AGC algorithm for the proper time periods (on-peak and off-peak) to account for known tie-line metering errors |
| 32 | Balancing | Review generation commitments, dispatch, and load forecasts |
| 33 | Balancing | Receive and review generation operations plans and commitments from balancing authorities for reliability assessment |
| 34 | Balancing | Control or direct generation biasing to provide overlap regulation service to other balancing authorities in accordance with contractual obligations |
| 35 | Balancing | Ensure adequate energy resources are available to meet external and internal requirements (real-time or hourly) |
| 36 | Congestion | Direct the reduction or shedding of load if needed to ensure balance within its balancing authority area. |
| 37 | Congestion | Direct generator operators to implement redispatch for congestion management. |
| 38 | Congestion | Issue corrective actions (e.g., curtailments or load shedding) to balancing authorities. |
| 39 | Congestion | Procure alternate sources of energy when reliability coordinator curtails transactions or calls for generation re-dispatch |
| 40 | Congestion | Issue generation dispatch adjustments to mitigate transmission congestion |
| 41 | Congestion | Direct balancing authorities to take actions to mitigate interconnection reliability operating limits |
| 42 | Congestion | Control, direct, or manage generation dispatch to avoid transmission reliability limit violations |
| 43 | Operating | Monitor output of units ensuring that MW output is within operating limits |
| 44 | Operating | Monitor output of units ensuring that MVAr output is within operating limits |
| 45 | Operating | Operate generation to minimize inadvertent power flow |
| 46 | Operating | Operate the SCADA and analog systems to control generation and monitor telemetered information |
| 47 | Operating | Select proper mode of automatic generation control for system conditions |
| 48 | Operating | Suspend automatic generation control as required |
| 49 | Operating | Monitor system fuel reserves |
| 50 | Operating | Communicate with generating station regarding work for anticipated increases or decreases that may cause limit changes |
| 51 | Operating | Monitor generation production data for correctness and ensure that records are developed and maintained as required |

| ITEM# | TYPE OF ACTIVITY | GENERATION TASKS |
|---|---|---|
| 52 | Operating | Monitor output of units ensuring that MW output is operating according to schedules |
| 53 | Operating | Monitor output of units ensuring that MVAr output is operating according to schedules |
| 54 | Operating | Supervise and coordinate all activity at generating stations |
| 55 | Operating | Monitor hydro generation and pond levels |
| 56 | Operating | Monitor generating unit governors to verify their operational status |
| 57 | Operating | Initiate manual control of generation, and maintain scheduled interchange following an AGC system component failure |
| 58 | Operating | Operate power facilities in compliance with environmental standards (e.g., air quality, wildlife) |
| 59 | Operating | Ensure that the AGC and other vital control performance equipment are functioning properly when using the backup power supply following the loss of the primary power supply |
| 60 | Operating | Verify the accuracy of the AGC tie-line metering by comparing hourly MWh meter totals to the totals derived from tie-line meter registers |
| 61 | Operating | Monitor the status and availability of generator voltage regulators and/or power system stabilizers, and respond as required to deficiencies that may impact system reliability |
| 62 | Operating | Test/verify the reactive capability of generating units |
| 63 | Operating | Administer generator start-up and shutdown schedules |
| 64 | Operating | Report the status of generator automatic voltage regulators and/or power system stabilizers to transmission operators |
| 65 | Operating | Provide oversight of generation operational plans, direct revisions as required, and as permitted by agreements |
| 66 | Operating | Validate adequacy of resource plans (in near real time) |
| 67 | Operating | Procure interconnected operations services from generator owners to ensure voltage support from generating resources is adequate |
| 68 | Operating | Notify generator operators of voltage limitations, or equipment overloads that may impact, or are impacting generator operations |
| 69 | Outage | Inform the reliability coordinator and impacted balancing authorities of interchange schedule interruptions due to generation or load interruptions within its balancing authority area. |
| 70 | Outage | Plan next-day generation required to implement a proposed outage |
| 71 | Outage | Implement terms of interruption for generation services according to contractual provisions |
| 72 | Outage | Implement or delay generation outages to ensure system reliability |
| 73 | Outage | Coordinate ramp down of unit going on planned outage |
| 74 | Outage | Adjust generation levels to implement proposed transmission system outage plan |
| 75 | Outage | Perform reliability analysis to determine impact of both scheduled and forced |

| ITEM# | TYPE OF ACTIVITY | GENERATION TASKS |
|---|---|---|
| | | generation outages |
| 76 | Outage | Separate or shut down generators that are unsafe to operate during or after an area disturbance |
| 77 | Outage | Direct generation operators to revise maintenance plans as required, and as permitted by agreements |
| 78 | Reserves | Apply operating reserves when needed |
| 79 | Reserves | Respond to reserve sharing group requests for emergencies |
| 80 | Reserves | Perform day-ahead ancillary services auction |
| 81 | Reserves | Produce list of resources to meet additional energy requirements (from ancillary service market) to purchase in real time |
| 82 | Reserves | Monitor and analyze regional reactive reserve availability |
| 83 | Reserves | Perform instantaneous reserve checks |
| 84 | Reserves | Dispatch operating reserves to alleviate system emergency conditions |
| 85 | Reserves | Perform hour-ahead ancillary services auction |
| 86 | Reserves | Monitor and analyze regional operating reserves availability |
| 87 | Reserves | Reestablish required operating reserve levels as soon as possible following a contingency that results in operating reserve usage |
| 88 | Reserves | Administer performance tests for generating resources providing ancillary services (e.g., spinning, regulation, unit ramp rates) |
| 89 | Reserves | Determine required quantities of ancillary services |
| 90 | Reserves | Determine reserves needed for the next hour |
| 91 | Reserves | Determine reserves needed for the next day |
| 92 | Reserves | Determine reserves needed for future days (long term) |
| 93 | Reserves | Monitor reactive reserve levels to ensure adequate reactive reserves exist and are properly located to provide for adequate voltage levels under normal and emergency conditions |
| 94 | Reserves | Restore reactive reserves to acceptable levels as soon as possible after use |
| 95 | Reserves | Ensure adequate spinning and operating reserves are on line |
| 96 | Reserves | Ensure adequate spinning and/or operating reserves are dispersed throughout the system |
| 97 | Reserves | Monitor available operating reserves and take corrective actions to correct deficiencies |

***Interchange Tasks:***

| ITEM# | TYPE OF ACTIVITY | INTERCHANGE TASKS |
|---|---|---|
| 1 | Communication | Communicate with real-time scheduler regarding the purchase of resources |
| 2 | Communication | Notify source balancing authority and transmission service providers, or transmission operators when an interchange transaction must be modified or terminated |
| 3 | Communication | Notify intermediate balancing authorities when an interchange transaction must be modified or terminated |
| 4 | Communication | Notify participants of transaction curtailments or adjustments observing NERC communication protocols |
| 5 | Communication | Notify sink balancing authority or transmission service provider when an interchange transaction needs to be modified or terminated |
| 6 | Communication | Notify the interchange authority when interchange transactions are cancelled or terminated |
| 7 | Congestion | Curtail, terminate, or modify interchange transaction requests that aggravate operating limits |
| 8 | Congestion | Curtail transactions as directed across interfaces |
| 9 | Congestion | Ensure that the maximum net scheduled interchange with other balancing authorities does not exceed the available transfer capability |
| 10 | Congestion | Ensure that all curtailments are properly applied per reliability coordinators instructions |
| 11 | Congestion | Analyze the impact of proposed requests for transmission service and interchange schedules on the bulk power system |
| 12 | Congestion | Reestablish curtailed interchange transactions with affected balancing authorities or transmission operators |
| 13 | Congestion | Coordinate reallocation and reloading of interchange transactions during transmission loading relief procedures |
| 14 | Monitor | Monitor status of NERC interchange transaction tags to ensure timely approval and implementation |
| 15 | Operating | Arrange transactions for energy to serve projected demand |
| 16 | Operating | Determine proper use of dynamic schedules of remote generating units as to their contribution to operating reserves |
| 17 | Operating | Manually calculate net interchange when needed |
| 18 | Operating | Determine energy excess after meeting load, reserves, and contract obligations |
| 19 | Operating | Verify the accuracy of time error monitoring equipment |
| 20 | Operating | Maintain the confidentiality of interchange transactions |
| 21 | Operating | Protect the confidentiality of all interchange transaction information |
| 22 | Operating | Check inadvertent interchange accounts with other balancing authorities at the end of each day |

| ITEM# | TYPE OF ACTIVITY | INTERCHANGE TASKS |
|---|---|---|
| 23 | Operating | Ensure that all appropriate transmission rights are assigned to all energy schedules (e.g., OASIS reservations) prior to their implementation |
| 24 | Operating | Agree upon daily schedule totals and energy imbalance totals with balancing authorities or transmission operators and other schedulers as needed |
| 25 | Operating | Assess, approve, or deny interchange transaction requests based on reliability analysis from the ATC calculator |
| 26 | Operating | Create NERC interchange transaction tag with all required information |
| 27 | Operating | Implement or terminate interchange transactions when needed |
| 28 | Operating | Adjust interchange transactions |
| 29 | Operating | Monitor the electronic (interchange) tagging system for accuracy of information (e-tagging) |
| 30 | Operating | Ensure all import and export schedule totals are checked for accuracy and correctness with each utility at the end of the day |
| 31 | Operating | Ensure interchange transactions are conducted in accordance with regional and NERC standards |
| 32 | Operating | Implement inadvertent interchange payback schedules with other entities |
| 33 | Operating | Submit a request to obtain the necessary transmission reservations to implement transactions |
| 34 | Operating | Manually calculate ACE as necessary |
| 35 | Operating | Adjust transfers across interfaces to maintain system reliability |
| 36 | Operating | Submit NERC interchange transaction tag to transmission providers and balancing authority or transmission operators on the scheduling path within proper timeframe |
| 37 | Operating | Secure appropriate transmission rights in response to system emergencies |
| 38 | Operating | Enter interchange transactions into the control area’s scheduled interchange |
| 39 | Operating | Coordinate with any controlled interface operators (e.g., DC ties) that are part of an interchange transaction-scheduling path |
| 40 | Operating | Participate in system planning studies to determine transfer capabilities and operating limits |
| 41 | Operating | Check and validate hourly tie-line data |
| 42 | Operating | Monitor inadvertent accumulations in both the on-peak and off-peak accounts |
| 43 | Operating | Maintain knowledge of existing and proposed Interconnection agreements and contracts |
| 44 | Operating | Maintain accurate settlement records for bulk power sales and purchases |
| 45 | Operating | Apply tariffs associated with rates and services uniformly to all parties |
| 46 | Operating | Evaluate and respond to customer requests for transmission and ancillary services via the OASIS |
| 47 | Operating | Ensure that the ramp rate, start and end times, energy profile, and losses are communicated to all parties in the transaction |

| ITEM# | TYPE OF ACTIVITY | INTERCHANGE TASKS |
|---|---|---|
| 48 | Operating | Identify potential parallel flow impacts on pending interchange |
| 49 | Operating | Approve interchange transactions based upon a reliability perspective |
| 50 | Operating | Monitor dynamic energy schedules for the appropriate use of transmission rights |
| 51 | Operating | Administer interchange scheduling and recordkeeping requirements with interconnected balancing authorities or transmission operators or other utilities |
| 52 | Operating | Implement interchange schedules |
| 53 | Operating | Approve or deny bilateral schedules from the reliability perspective |
| 54 | Operating | Confirm and approve interchange transactions from ramping ability perspective |
| 55 | Operating | Enter interchange transaction information into reliability assessment tools |
| 56 | Operating | Determine and post available transfer capability values |
| 57 | Operating | Secure energy and transmission services to serve end-use customers |
| 58 | Operating | Perform after-the-hour checkout of actual and scheduled interchange with adjacent balancing authorities |
| 59 | Operating | Approve or deny transmission service requests in accordance with any tariff requirements (OASIS) |
| 60 | Operating | Ensure transmission reliability margins, total transfer capabilities and available transfer capabilities are correctly posted |

***Emergency Operations Tasks:***

| ITEM# | TYPE OF ACTIVITY | EMERGENCY OPERATIONS TASKS |
|---|---|---|
| 1 | Capacity | Request emergency energy upon loss of a resource |
| 2 | Capacity | Respond to capacity deficiency |
| 3 | Capacity | Respond to loss of energy resources within allowable regional or pool timeframe |
| 4 | Capacity | Prepare for a capacity emergency by bringing on all available generation |
| 5 | Capacity | Prepare for a capacity emergency by postponing equipment maintenance |
| 6 | Capacity | Prepare for a capacity emergency by scheduling emergency energy purchases |
| 7 | Capacity | Prepare for a capacity emergency by reducing load |
| 8 | Capacity | Prepare for a capacity emergency by initiating voltage reductions |
| 9 | Capacity | Prepare for a capacity emergency by requesting emergency assistance from other systems |
| 10 | Capacity | Schedule available emergency assistance with as much advance notice as possible given a capacity emergency |
| 11 | Capacity | Utilize the assistance provided by the Interconnection’s frequency bias (in a capacity emergency) only for the time period necessary to utilize operating reserves |
| 12 | Capacity | Utilize the assistance provided by the Interconnection’s frequency bias (in a capacity emergency) only for the time period necessary to analyze ability to recover using own resources |
| 13 | Capacity | Utilize the assistance provided by the Interconnection’s frequency bias (in a capacity emergency) only for the time period necessary to schedule emergency assistance from others |
| 14 | Freq | Direct corrective actions to correct abnormal frequency |
| 15 | Load Shed | Manually shed load to alleviate system emergency conditions |
| 16 | Load Shed | Following the activation of automatic load shedding schemes, restore system load as appropriate for current system conditions and in coordination with adjacent systems |
| 17 | Load Shed | Following the activation of automatic load shedding schemes, shed additional load manually if there is insufficient generation to support the connected load |
| 18 | Load Shed | Following the activation of automatic load shedding schemes, monitor system voltage levels to ensure high voltage conditions do not develop |
| 19 | Load Shed | Following the activation of automatic load shedding schemes, monitor system frequency to ensure high frequency conditions do not develop |
| 20 | Load Shed | Following the activation of automatic load shedding schemes, monitor the performance of any automatic load restoration relays |
| 21 | Load Shed | Following the activation of automatic load shedding schemes, resynchronize transmission at preplanned locations if possible |
| 22 | Load Shed | Following the activation of automatic load shedding schemes, disable automatic underfrequency relays if system conditions warrant |
| 23 | Load Shed | Direct distribution providers to shed load when required for system reliability |

| ITEM# | TYPE OF ACTIVITY | EMERGENCY OPERATIONS TASKS |
|---|---|---|
| 24 | Load Shed | Use manual load shedding to prevent imminent separation from the Interconnection due to transmission overloads or to prevent voltage collapse |
| 25 | Procedure | Implement emergency procedures. |
| 26 | Procedure | Notify the reliability coordinator of the implementation of its own emergency procedures. |
| 27 | Procedure | Comply with reliability coordinators' instructions during emergency conditions |
| 28 | Procedure | Direct implementation of emergency procedures |
| 29 | Procedure | Maintain knowledge of existing and proposed emergency assistance agreements and contracts |
| 30 | Procedure | Mandate the sale or purchase of energy to optimize reliability |
| 31 | Procedure | Respond to system emergencies and frequency deviations to meet local, regional, and NERC DCS requirements |
| 32 | Procedure | Notify appropriate personnel or departments in event of an emergency |
| 33 | Procedure | Perform or direct actions such as starting generation, canceling pre-scheduled maintenance, schedule interchange, or shed load to return the system to a secure state |
| 34 | Procedure | Perform regular testing of emergency procedures to determine preparedness and alertness of shift personnel |
| 35 | Procedure | Provide emergency services coordination for field personnel |
| 36 | Procedure | Respond to generation losses, recognizing economic and reliability restrictions to effectively maintain tie-line flows |
| 37 | Procedure | Respond to requests for emergency assistance from neighboring systems |
| 38 | Procedure | Declare system emergencies |
| 39 | Procedure | Develop and/or implement contingency plans when facilities/equipment are forced out of service |
| 40 | Procedure | Formulate a plan to implement corrective actions when equipment ratings are exceeded or anticipated to be exceeded |
| 41 | Procedure | Use sub-regional, regional, and NERC hotline to coordinate actions during emergency conditions |
| 42 | Procedure | Schedule emergency energy when needed and create interchange transaction tags within one hour |
| 43 | Procedure | Coordinate response to system emergencies |
| 44 | Procedure | Request emergency assistance from neighboring systems |
| 45 | Procedure | Assume sole control of designated telecommunication systems for use during an emergency |
| 46 | Procedure | Implement emergency procedures related to generating resources within a balancing area as directed by the reliability coordinator |
| 47 | Restoration | Direct the restoration of the transmission system following a major system outage, load shedding, islanding, or blackout |

| ITEM# | TYPE OF ACTIVITY | EMERGENCY OPERATIONS TASKS |
|---|---|---|
| 48 | Restoration | Ensure adequate protective relaying exists during all phases of the system restoration sequence |
| 49 | Restoration | Test or simulate system restoration procedures to validate restoration plans |
| 50 | Restoration | Following a partial or total system shutdown, implement the appropriate provisions and procedures of the system's restoration plan in a coordinated manner with adjacent systems |
| 51 | Restoration | Following a partial or total system shutdown, arrange for start-up and/or emergency power for generation units as required |
| 52 | Restoration | Following a partial or total system shutdown, arrange for and utilize emergency (backup) telecommunications facilities as required |
| 53 | Restoration | Following a partial or total system shutdown, restore the integrity of the Interconnection as soon as possible |
| 54 | Transmission | Formulate a plan to implement corrective actions when an operating reliability limit violation is anticipated |
| 55 | Transmission | Determine the cause and extent of transmission system disturbances and interruptions and the impact on other facilities |
| 56 | Transmission | Apply relief measures as necessary to permit re-synchronizing and reconnecting to the Interconnection when separated from the Interconnection |
| 57 | Transmission | Use manual load shedding to prevent imminent separation from the Interconnection due to transmission overloads, or to prevent voltage collapse |
| 58 | Transmission | Implement load shedding as directed by a transmission operator |
| 59 | Transmission | Identify and take appropriate actions when partial or full system islanding occurs |
| 60 | Voltage | Implement voltage reductions to alleviate system emergency conditions |
| 61 | Voltage | Identify and take appropriate actions when a partial or full system voltage collapse occurs |

## Attachment B: Emergency Operations Topics

These topics are identified as meeting the topic criteria for Emergency Operations training per Requirement 3 of this standard.

### A. Recognition and Response to System Emergencies

**1.** Emergency drills and responses
**2.** Communication tools, protocols, coordination
**3.** Operating from backup control centers
**4.** System operations during unstudied situations
**5.** System Protection
**6.** Geomagnetic disturbances weather impacts on system operations
**7.** System Monitoring – voltage, equipment loading
**8.** Real-time contingency analysis
**9.** Offline system analysis tools
**10.** Monitoring backup plans
**11.** Sabotage, physical, and cyber threats and responses

### B. Operating Policies Related to Emergency Operations

**1.** NERC standards that identify emergency operations practices (e.g. EOP Standards)
**2.** Regional reliability operating policies
**3.** Sub-regional policies and procedures
**4.** ISO/RTO policies and procedures

### C. Power System Restoration Philosophy and Practices

**1.** Black start
**2.** Interconnection of islands – building islands
**3.** Load shedding – automatic (under-frequency and under-voltage) and manual
**4.** Load restoration philosophies

### D. Interconnected Power System Operations

**1.** Operations coordination
**2.** Special protections systems
**3.** Special operating guides
**4.** Voltage and reactive control, including responding to eminent voltage collapse
**5.** Understanding the concepts of Interconnection Reliability Operating Limits versus System Operating Limits
**6.** DC tie operations and procedures during system emergencies
**7.** Thermal and dynamic limits
**8.** Unscheduled flow mitigation − congestion management
**9.** Local and regional line loading procedures
**10.** Radial load and generation operations and procedures
**11.** Tie line operations
**12.** E-tagging and Interchange Scheduling
**13.** Generating unit operating characteristics and limits, especially regarding reactive capabilities and the relationship between real and reactive output

### E. Technologies and Tools

**1.** Forecasting tools
**2.** Power system study tools
**3**. Interchange Distribution Calculator (IDC)

## F. Market Operations as They Relate to Emergency Operations

**1.** Market rules
**2.** Locational Marginal Pricing **(**LMP)
**3.** Transmission rights
**4.** OASIS
**5.** Tariffs
**6.** Fuel management
**7.** Real-time, hour-ahead and day-ahead tools