



NORTHEAST POWER COORDINATING COUNCIL, INC.

# Risk and Internal Controls Better Practices

NPCC Entity Risk Assessment Group  
April 19, 2018

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# Purpose

- Identify relationship of the key reliability tasks and key standard requirements by function.
- Mentor on better practices to establish internal controls that are fully implemented.



# Outline

- Controls vs Compliance
- Controls – benefits, types, attributes, design
- Examples of Control Designs for Reliability Tasks
- Controls – Monitoring and Management
- Cybersecurity Outreach Presentation
- Questions

# Risk Based Compliance Monitoring

- Follows the Risk Based Compliance Framework
- Annual *ERO Enterprise CMEP Implementation Plan* and Appendix A3, *NPCC CMEP Implementation Plan*
- Risk Elements/Focus Areas (excerpt)

## *Areas of Focus*

| Table 4: Maintenance and Management of BPS Assets                                  |                |                                                  |                                                                |
|------------------------------------------------------------------------------------|----------------|--------------------------------------------------|----------------------------------------------------------------|
| Standard                                                                           | Requirements   | Inactive/Future Enforcement Date (if applicable) | Entities for Attention                                         |
| FAC-008-3:<br>Facility Ratings                                                     | R6             | n/a                                              | Generator Owner<br>Transmission Owner                          |
| FAC-003-4:<br>Transmission Vegetation Management                                   | R1, R2, R6, R7 | n/a                                              | Generator Owner<br>Transmission Owner                          |
| PRC-005-6:<br>Protection System, Automatic Reclosing, and Sudden Pressure Relaying | R3, R4, R5     | n/a                                              | Distribution Provider<br>Generator Owner<br>Transmission Owner |



# Controls vs Compliance

- Compliance with the requirement does not necessarily mean you have good controls for them – EOP-004, PRC-004, VAR-002, COM-002
- What is the purpose of controls? To mitigate the risks to reliability for the above.
- Documented controls and effectiveness testing/monitoring benefits:
  - Understanding of Key Reliability Functions
  - Training/Succession Planning
  - Resilience
  - Progress toward High Reliability Organization



# Internal Controls Evaluation

Expected benefits derived from a review of entity internal controls typically include the following:

- Enhanced attainment of BES reliability, Corporate Goals and Objectives;
- Greater alignment of staff performance to Key Performance Indicators;
- Improved operational performance (i.e., exceeding standards and requirements);
- Enhanced entity communication and interaction across organizational business functions;
- Targeted BES reliability risk-focused scoping;
- Possible reduction in audit duration;
- Improved risk and control awareness;
- Internal Control Design evaluation including:
  - Functional and Business Process Assessment;
  - Risk Identification, Mitigation & Remediation;
  - Design and Gap Analysis
  - Non-binding Recommendations for Internal Control Design Enhancement.
- Training/Succession Planning
- Resilience
- Progress toward High Reliability Organization



# Internal Controls

- Types
  - **Preventative:** designed to avoid an unintended event or consequence (noncompliance with Reliability Standards). They are proactive internal controls that help ensure the management objective of compliance with Reliability Standards.
  - **Detective:** designed to find errors or irregularities and support effective compliance. An example is a documented process that requires a quarterly review of completed training records to identify individuals that have not completed training by the required deadline.
  - **Corrective:** designed to assess instances of noncompliance and return an activity to a state of compliance.
  - Institute of Internal Auditors strongly suggests a combination of all three types.



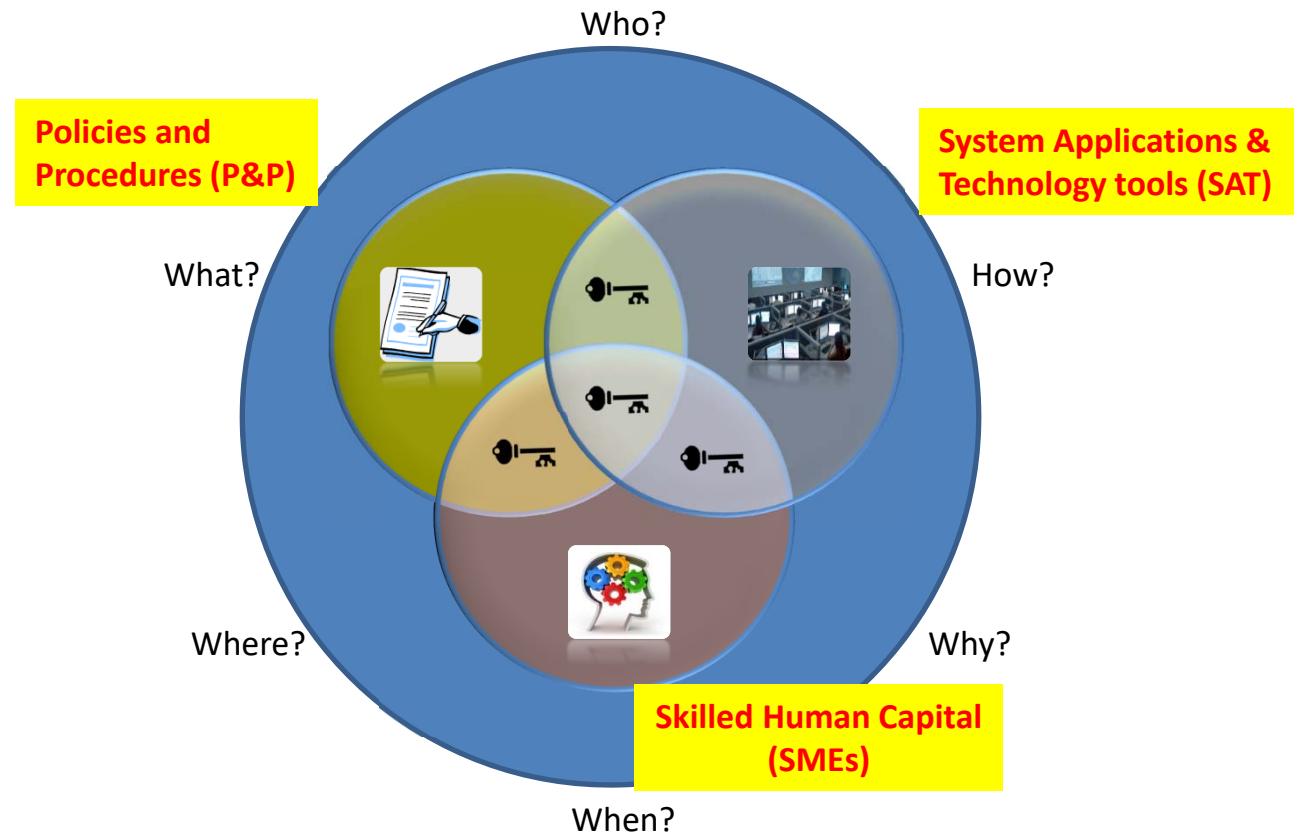
## Internal Controls

- Attributes of good controls design
  - Address Single Point of Failure
  - redundancy/alternate means to achieve objective
  - Confirmation of expected actions or timely response
  - Layering - Institute of Internal Auditors strongly suggests combination of all three types (P, D, C).
  - Enables consistency, repeatability, resiliency
  - Automation, early warning reminders
  - Frequent monitoring/shorter intervals



# “Control Silos” - Internal Control Designs

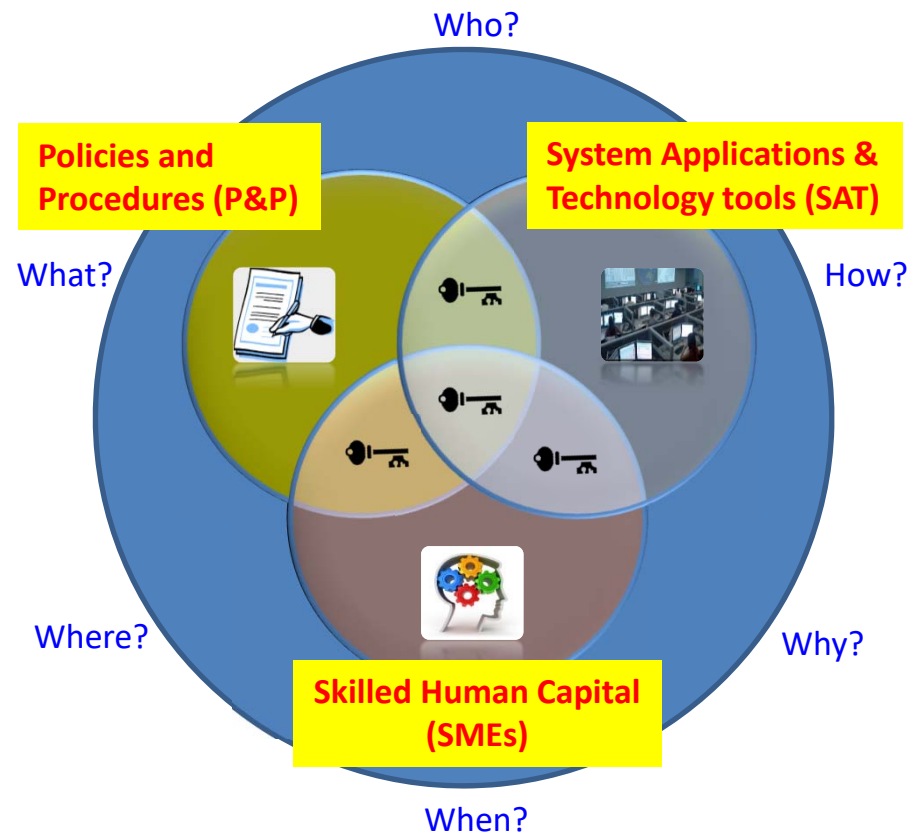
Internal Control Designs generally consist of a combination of the three “Control Silos” shown below



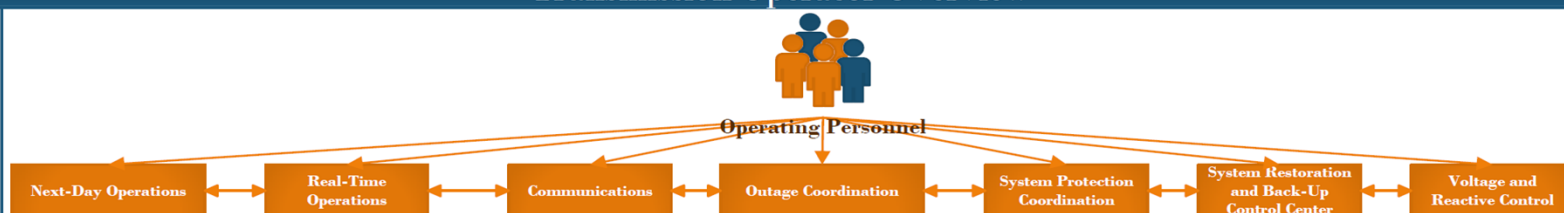
# “Control Silos” - Internal Control Designs

Internal Control Designs generally consist of a combination of the three “Control Silos” shown below

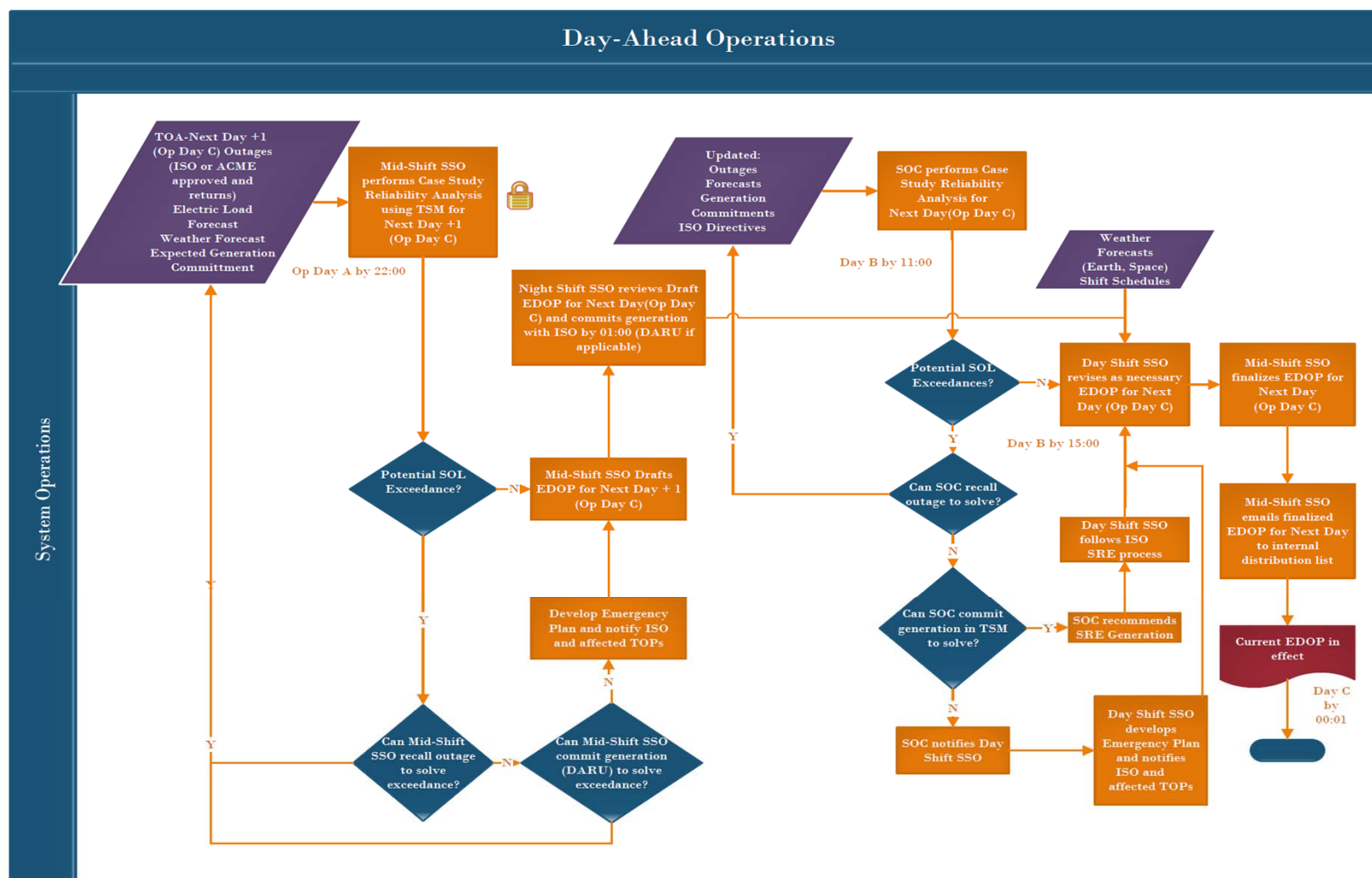
- Document, review and assess Internal Controls that help you achieve your objective
- “Tease out” and document controls that are taken for granted, or not formalized.
- Identify Key Controls
- Ask the 5 “W” and 1 “H” questions pertaining to the control silos that are preventative, detective and/or corrective to “drift from compliance”.
- Interview Subject Matter Experts and task performers to determine how implementation of controls have been verified and monitored for effectiveness.
- Self-assess and obtain reasonable assurance that internal controls mitigate risks to BES reliability and meet compliance with specific NERC Reliability standards.



## Reliability Task Identification

| System Operations              |                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                               |                                                                                                                                                        |                                                                                                                                                                                                                               |                                                                                                                                                                                                                                        |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transmission Operator Overview |                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                               |                                                                                                                                                        |                                                                                                                                                                                                                               |                                                                                                                                                                                                                                        |
| Business Functions             |                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                               |                                                                                                                                                        |                                                                                                                                                                                                                               |                                                                                                                                                                                                                                        |
|                                | Next-Day Operations                                                                                                                                                                                                         | Real-Time Operations                                                                                                                                                                                                                                                                                                              | Communications                                                                                                                                                                                                                                                                                                   | Outage Coordination                                                                                                                                           | System Protection Coordination                                                                                                                         | System Restoration and Back-Up Control Center                                                                                                                                                                                 | Voltage and Reactive Control                                                                                                                                                                                                           |
| Objectives                     | Identify and collect the required operating data necessary to perform next-day reliability analysis and develop an Electric Daily Operating Plan (EDOP) for next-day operations.                                            | Determine responsibilities and required actions during real-time operations for both normal and emergency conditions.                                                                                                                                                                                                             | Establish Interpersonal Communication capabilities necessary to maintain reliability and improve communications for the issuance of Operating Instructions with predefined communications protocols.                                                                                                             | Plan and coordinate scheduled generator and transmission outages that may affect the reliability of interconnected operations.                                | Ensure system protection is coordinated between ACME and other operating entities.                                                                     | 1) Restore the ACME System following a total or partial electric system collapse.<br>2) Ensure continued reliable operations of the BES in the event that a control center becomes inoperable.                                | Ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in Real-time to protect equipment and the reliable operation of the Interconnection.                        |
| Reliability Risks              | Failure to develop and maintain a set of next-day plans designed to evaluate options and set procedures for the reliable operation of the BES.                                                                              | Ensure that the transmission system is operated so that instability, uncontrolled separation, or cascading outages will not occur as a result of the most severe single Contingency and specified multiple Contingencies.                                                                                                         | Failure to establish Interpersonal Communication capabilities necessary to maintain reliability.                                                                                                                                                                                                                 | Failure to properly assess a scheduled outage to ensure reliability is maintained.                                                                            | Failure to coordinate system protection with neighboring entities and the ISO to ensure reliability is maintained.                                     | 1) Failure to have Restoration and Operating Plans.<br>2) Failure to implement restoration or back-up according to Plan.<br>3) Failure to have back-up control center or functionality.                                       | 1) Failure to specify a system voltage schedule.<br>2) Failure to schedule sufficient reactive resources to avoid an SOL exceedance.<br>3) Failure to operate or direct any real-time operation of devices to avoid an SOL exceedance. |
| Internal Controls              | SOP-01 (P, D, C)<br>TOA (P)<br>TSM (D: Key Control)<br>ISO (D) Managerial (D)                                                                                                                                               | SOP-02 (P, D, C)<br>OPG-05 and 06 (P)<br>ISO-TO CFR Agreement(P)<br>SCADA (D,C: Key Control)<br>TSM (P,D,C: Key Control) ISO – Operating Reserve Deficiency(C)                                                                                                                                                                    | SOP-07 (P,D,C)<br>SCADA (P,D,C – Key Control)<br>Physical Security – PSP (P)<br>Communication technology redundancy (P,C)<br>Communications Equipment and System Testing (P,D,C – Key Control)<br>Managerial documentation reviews (P)<br>ISO collaboration (P,D,C)<br>OATI webCompliance annual email alert (P) | SOP-01 – Sec 3.1 (P,D,C)<br>Manual of Safe Practices – Sections 12 and 14 (P)<br>ISO Outage Scheduling Manual (P,D)<br>TSM (P,D,C - Key Control)<br>TOA (P,D) | SOP-02 (P,D,C)<br>ESP's PRC-001 Procedure (P)<br>SCADA (P,D,C – Key Control)<br>Training provided to Operators by ESP on System Protection schemes (P) | SOP-22 (P,D,C - Key Control)<br>ISO EOM (P,D,C); ISO SRM (P,D,C) SCADA (D,C)<br>OATI webCompliance (P)<br>SOP-039 (D, C – Key Control)<br>ACC (C - Key Control)                                                               | SOP-01 (P,D,C)<br>SOP-02 (P,D,C)<br>ISO-TO CFR Agreement (P)<br>SCADA (D,C - Key Control)<br>TSM (P,D,C - Key Control)                                                                                                                 |
| Applicable Standards           | TOP-004-2: R1, R2, R3<br>TOP-005-2: R2<br>TOP-006-2: R1, R4, R6<br>TOP-008-1: R1, R2,R4<br>EOP-001-2.1b: R2.2, R2.3<br>EOP-003-2: R3<br>FAC-014-2: R2, R5.2<br>IRO-004-2: R1<br>TOP-002-2.1b: R1, R4, R5, R6, R10, R11, R19 | TOP-001-1a: R1, R2, R3, R5, R6, R7, R7.1, R7.2, R7.3, R8<br>TOP-002-2.1b:R16.1,R16.2, R17, R19<br>TOP-004-2: R1, R2, R3, R4, R5, R6.1, R6.2, R6.3, R6.4<br>TOP-006-2: R2, R5.1, R6, R7<br>TOP-007: R1, R2, R3<br>TOP-008-1: R1, R2, R3, R4<br>IRO-001-1.1: R8<br>EOP-001-2.1b: R3, R3.1, R3.2 R3.3, R3.4, R4, R5<br>EOP-003-2: R8 | COM-001-2.1: R1, R1.1, R3, R3.1, R3.2, R3.3, R3.4, R3.5, R3.6, R4, R4.1, R4.2, R4.3, R4.4, R7, R7.1, R7.2, R9, R10, R11<br>COM-002-4: R1, R1.1, R1.2, R1.3, R1.5, R1.6, R2, R3, R4, R4.1 R4.2, R5, R6, R7                                                                                                        | TOP-002-2.1b: R4<br>TOP-003-1: R1.1, R1.2, R1.3, R2, R3<br>TOP-006-2: R1.2                                                                                    | PRC-001-1.1(ii): R1, R2, R2.2, R3, R3.2, R4, R5, R5.2                                                                                                  | EOP-001-2-2.1b R5<br>EOP-003-2: R6<br>EOP-005-2: R1, R1.1, R1.3, R1.4, R1.5, R1.6, R1.7, R1.8, R1.9, R2, R5, R6, R6.1, R6.2, R6.3, R7, R8, R10, R10.1, R10.2, R10.3, R10.4, R11, R12<br>EOP-008-1: R1, R2, R4, R5, R6, R7, R8 | VAR-001-4.1: R1, R1.1, R2, R3                                                                                                                                                                                                          |
| Flowcharts                     | Next-Day Operations.pdf<br>Pages 1-2                                                                                                                                                                                        | Real-Time Operations.pdf<br>Pages 1-2                                                                                                                                                                                                                                                                                             | Communications.pdf<br>Pages 1-4                                                                                                                                                                                                                                                                                  | Outage Coordination.pdf<br>Pages 1-2                                                                                                                          | System Protection Coordination.pdf<br>Pages 1-3                                                                                                        | System Restoration.pdf<br>Pages 1-2;<br>Loss of Control Center Functionality.pdf<br>Pages 1-2                                                                                                                                 | Voltage and Reactive Control.pdf<br>Pages 1-2                                                                                                                                                                                          |

## Next-Day Operations

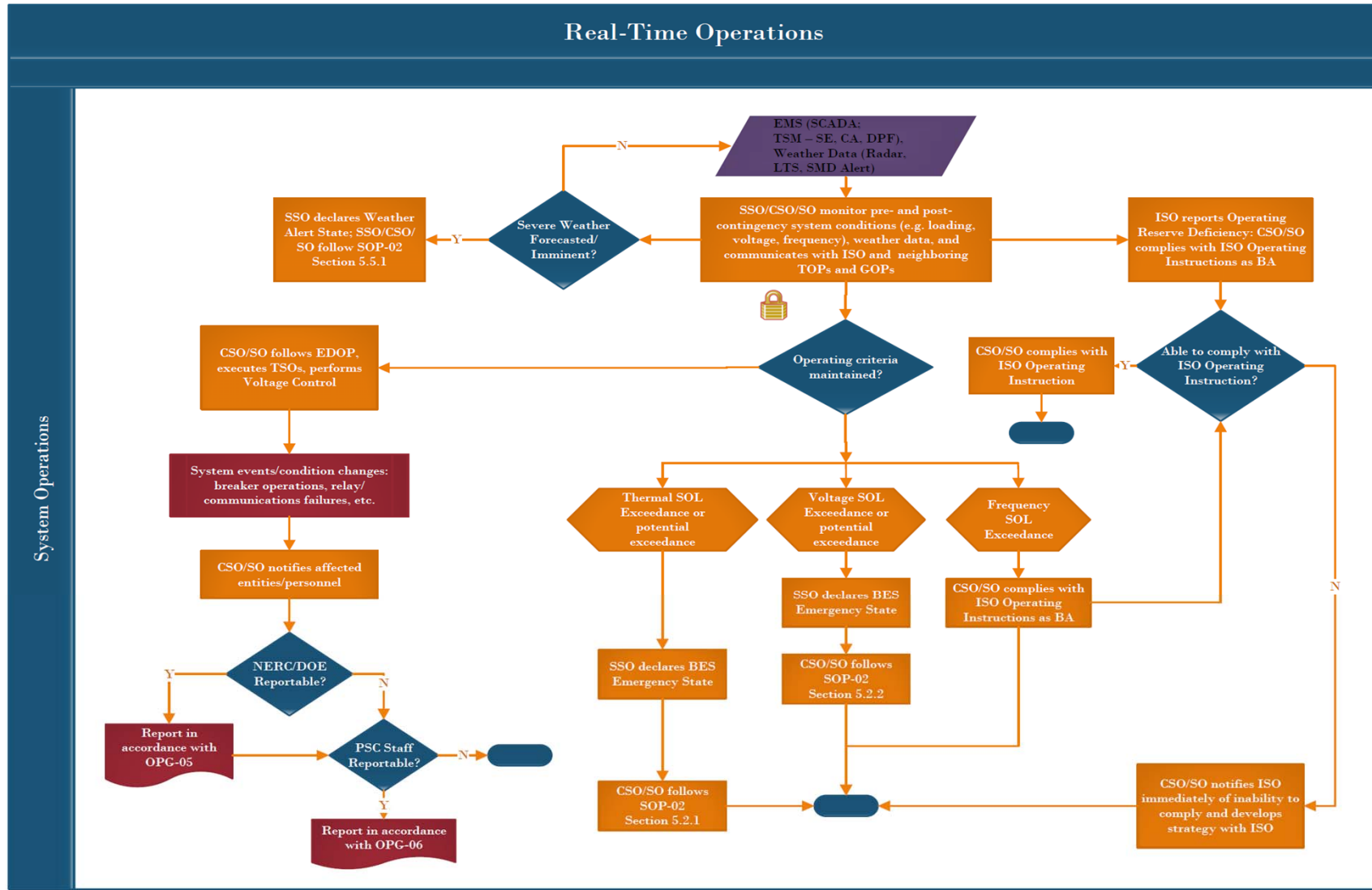




## Next-Day Operations - Legend

| Legend               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acronyms             | <div>SSO - Senior System Operator<br/>SOC - System Operator Coordinator<br/>CSO - Chief System Operator<br/>SO - System Operator</div> <div>EDOP - Electric Daily Operating Plan<br/>DARU - Day Ahead Reliability Unit<br/>TOA - Transmission Outage Application<br/>TSM - Transmission Security Management<br/>SRE - Supplemental Resource Evaluation</div>                                                                                                                                                                                                                                                                                 |
| Applicable Standards | <div>TOP-004-2 R1, R2, R3<br/>TOP-005-2 R2<br/>TOP-006-2 R1, R4, R6<br/>TOP-008-1 R1, R2, R4<br/>EOP-001-2.1b R2.2, R2.3, R3.2</div> <div>EOP-003-2 R3<br/>FAC-014-2 R2, R5.2<br/>IRO-004-2 R1<br/>TOP-002-2.1b R1, R4, R5, R6, R10, R11, R19</div>                                                                                                                                                                                                                                                                                                                                                                                          |
| Procedures           | <div>SOP-01: Electric Transmission System Next Day Operations<br/>ISO-TO CFR Agreement - 3-3-16</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Tools                | <div>TOA<br/>TSM</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Internal Controls    | <div>(P = Preventive; D = Detective; C = Corrective)</div> <div>Documented Procedure: SOP-01 (P, D, C)<br/>TOA - Conflict check of outages (P)<br/>TSM - Analysis provides SOLs and inputs to cascading determinations (D; Key Control); Alarming included for non convergence of cases; Transmission Planning and EMS provide back-up support and alternative study cases; Contract in force with third-party who provides technical support to model.<br/>ISO - Performs reviews with respect to TOA (BES element outage requests) (D); Peer checks of DARU (D) and load flows (D);<br/>Managerial - Each EDOP draft is reviewed (D)</div> |

## Real Time Operations



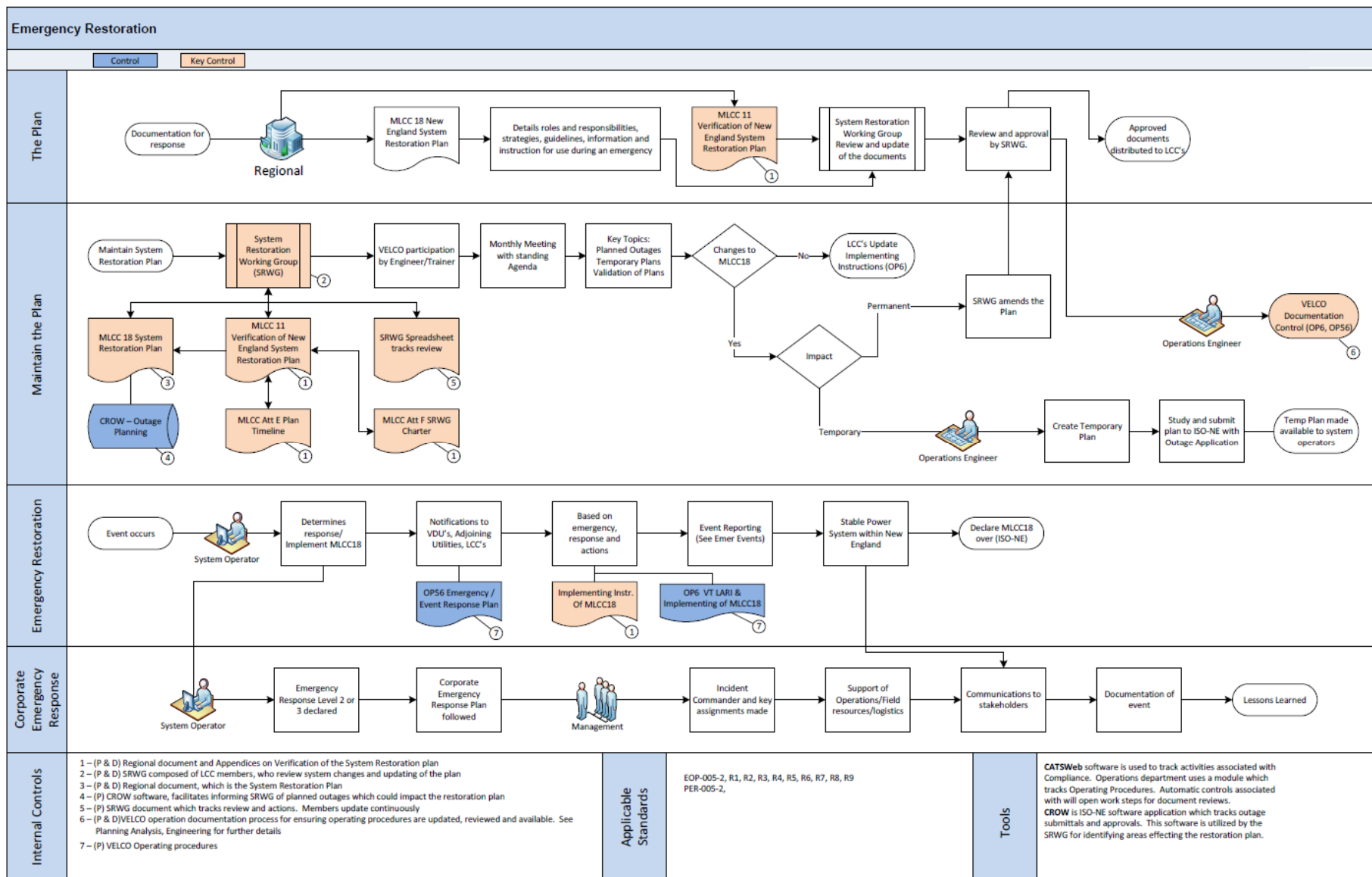


# Real Time Operations - Legend

| Legend                   |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acronyms                 | <div>SSO - Senior System Operator<br/>CSO - Chief System Operator<br/>SO - System Operator</div> <div>SCADA – Supervisory Control and Data Acquisition<br/>TSM – Transmission Security Management<br/>SE – State Estimator<br/>CA – Contingency Analysis<br/>DPF – Dispatch Power Flow</div> <div>VAISALA LTS – Lightning Tracking System</div>                                                                                      |
| Applicable Standards     | <div>TOP-001-1a: R1, R2, R3, R5, R6, R7, R7.1, R7.2, R7.3, R8<br/>TOP-002-2.1b: R16.1, R16.2, R17, R19<br/>TOP-004-2: R1, R2, R3, R4, R5, R6.1, R6.2, R6.3, R6.4<br/>TOP-006-2: R2, R5.1, R6, R7,<br/>TOP-007: R1, R2, R3</div> <div>TOP-003-1: R1, R2, R3, R4<br/>IRO-001-1.1: R8<br/>EOP-001-2.1b: R3, R3.1, R3.2, R3.3, R3.4, R4, R5<br/>EOP-003-2: R8</div>                                                                      |
| Procedures/Documentation | <div>SOP-02: Real-Time Normal and Emergency Operations<br/>OPG-05 NERC DOE Event Reporting<br/>OPG-06 – PSC-DOT Event Reporting<br/>ISO Emergency Operations Manual – Section 4.4 ISO-TO CFR Agreement - 3-3-16</div>                                                                                                                                                                                                                |
| Tools                    | <div>TSM<br/>SCADA<br/>VAISALA LTS<br/>Weather Radar<br/>OATI web Compliance</div>                                                                                                                                                                                                                                                                                                                                                   |
| Internal Controls        | <div>(P = Preventive; D = Detective; C = Corrective)<br/><br/>Documented Procedures: SOP-02 (P, D, C), OPG-05 and 06 (P)<br/>Agreement with ISO-TO CFR Agreement – 3-3-16 (P)<br/>SCADA (D.C: Key Control – SOL Exceedance detection)<br/>TSM (P.D.C: Key Control – System Condition Monitoring)<br/>ISO – Operating Reserve Deficiency©<br/>OATI web Compliance (P) – Automatic annual email alert to review emergency plans.</div> |



# Emergency Operations



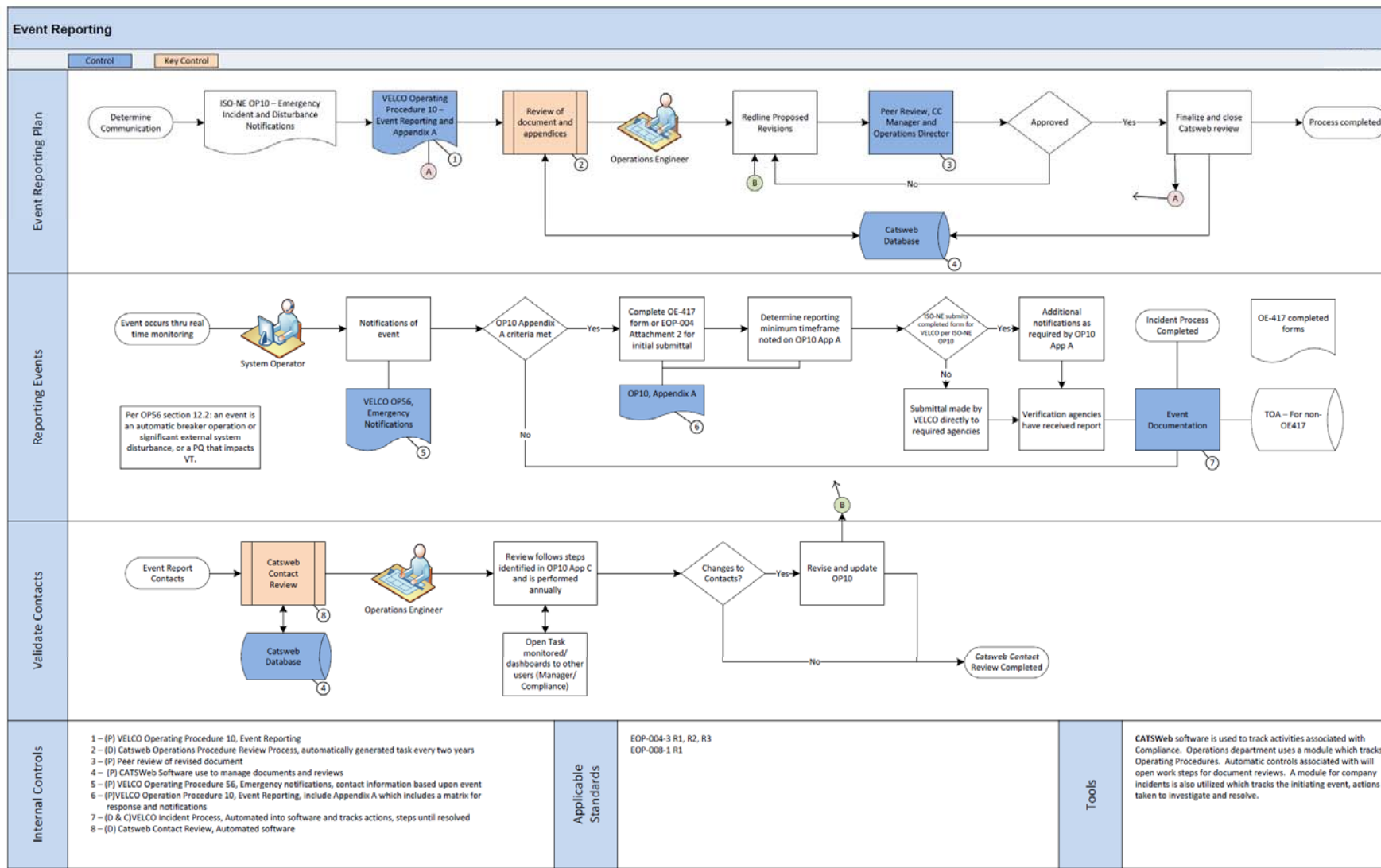


## Operations – Process Map Legend

| Process Map Legend |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|
|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Control | Key Control |
| Swimlanes          | <p>Suggested use:</p> <ol style="list-style-type: none"> <li>1. Technical Compliance/Requirements</li> <li>2. VELCO Department(s)</li> <li>3. ISO-NE or other External entities</li> <li>4. Program or process identified by name</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |         |             |
| Symbols/Objects    | <div> <div>Start/End</div> <div>Represents a start or end of a process</div> </div> <div> <div>Process/Task</div> <div>Contains detail or overview</div> </div> <div> <div>Sub Process</div> <div>Sub Process which then has process/ tasks underlying</div> </div> <div> <div>Decision</div> <div>Question to be answered</div> </div> <div> <div>Document</div> <div>Represents a document or procedure</div> </div> <div> <div>Database</div> <div>Identification of software and storage of information</div> </div> <div> <div>A</div> <div>On Page reference. As used letters will increment. Open arrow indicates direction on page to take</div> </div> <div> <div>1</div> <div>Controls Identifier. Number corresponds to identified Internal Control and classification</div> </div> <div> <div>Connector-Arrows indicate direction, uni or bi</div> </div> <div> <div>Dashed line indicates automatic processes/communication</div> </div>                                                                               |         |             |
| Internal Controls  | <div> <div>(P) Preventative - These are pro-active internal controls that are managed to ensure compliance with NERC reliability standards and requirements</div> <div>Examples of are: automated software; process controls; procedures; training</div> </div> <div> <div>(D) Detective – Designed to find issues or errors</div> <div>Examples of: annual reviews; alarm reporting; internal audit/process review: peer review</div> </div> <div> <div>(C) Corrective - For discovered issues requiring remediation</div> <div>Examples of: CATSWeb Incident reporting; TOA Trouble Reports, TOA Event Reports</div> </div> <div> <div>Types of Controls: (Answers the Who, What, Where, When, Why and How)</div> <ul style="list-style-type: none"> <li>- Policies and Procedures (P&amp;P)</li> <li>- System Applications and Technology Tools (SAT)</li> <li>- Skilled Human Capital (SMEs)</li> </ul> <div>Key Controls:</div> <ul style="list-style-type: none"> <li>- Any two of the above in combination</li> </ul> </div> |         |             |
| Tools              | <div> <div><b>Transmission Outage Applications (TOA)</b> is a software utilized by the Operations department and examples of functions are: Operator Log; Sequence of Events; Evernty Reports, Trouble Reports, OP-07 Report, Daily Log, System Status, Outage Requests, Reports</div> </div> <div> <div><b>CATSWeb</b> software is used to track activities associated with Compliance. Operations department uses a module which tracks Operating Procedures. Automatic controls associated with will open work steps for document reviews. A module for company incidents is also utilized which tracks the initiating event, actions taken to investigate and resolve.</div> </div> <div> <div><b>Footprints</b> is a software utilized to perform communication assessments. The software automatically generates tasks for identified personnel</div> <div><b>Redbox</b> database stores all communications from the Operations department for assessment or event analysis</div> </div>                                      |         |             |



# Event Reporting





## Controls Associated with NERC Standards/Requirements

### Standards and Related Internal Controls Report

This report is a list of Internal Controls related to the Standards and Requirements provided by NPCC's pre-ICE evaluation list. It lists the Standard, Requirement, related internal control name, description, owner and any added notes.

#### Standards and ISO-NE Internal Controls

##### BAL-002-1 Disturbance Control Performance

**R1.** Each Balancing Authority shall have access to and/or operate Contingency Reserve to respond to Disturbances. Contingency Reserve may be supplied from generation, controllable load resources, or coordinated adjustments to Interchange Schedules.

| Internal Control Name                                     | Internal Control Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | IC Owner |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Compliance Monitoring Plan (CMP)</b>                   | The CMP is a formal compliance monitoring plan for each of the applicable NERC Standards. The CMP indicates the monitoring method, the group responsible for monitoring, the frequency of monitoring, the monitoring triggers, the time horizons and actions required by Reliability and Operations Compliance (ROC). The CMP is stored on ROC's Compliance database and reports are available on various aspects of the CMP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |
| <b>Coordination with LCC's and Neighboring RC's</b>       | ISO Coordinates with Local Control Centers (LCC's) and neighboring Reliability Coordinators (RCs) to assure the reliable operation of the electric system. This includes coordination for load shed, capacity remedial actions, disturbance remedial action, transmission redial actions, error or failure of EMS, GMD, transferring operating to or from a control center, adjust the short-term load forecast (STLF) or implement operations during abnormal conditions. This also includes weekly NPCC teleconference and participation in working groups. In New England, TOP dispatch responsibilities are divided and/or shared between ISO, the Local Control Centers (LCCs). This requires close coordination of Operational Planning Analyses, Real-time monitoring, and Real-time Assessments on BES facilities. Further, due to the Interconnected nature of the electric system, such close coordination is also required with Neighboring RCs and, in some instances, those not neighboring (i.e. PJM for NE source loss that can impact PJM). M/LCC 13 ISO and LCC Communication Practices (Section 4.4.3) contains provisions for ISO and LCC System Operators to evaluate and discuss potential System Operating Limit (SOL) exceedances, including exceedances of voltage limits, and identify action plans to mitigate the potential exceedances. |          |
| <b>Intercontrol Center Communications Protocol (ICCP)</b> | "Intercontrol Center Communications Protocol" is used to obtain real-time data from assets in the field to populate the model used for Operational Planning Analyses, Real-time monitoring, and Real-time Assessments. This data is essential for conducting analysis in the EMS environment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |
| <b>NEPEX Reserve Monitor on EMS</b>                       | This is a system that resides on ISO's Energy Management System (EMS) that stores ACE Information, Generation and Load, Interchange values, Reserves, Time Error, Frequency, AGC, Inadvertent Energy and Area Totals. This information is displayed in real time for System Operators who can review the information and take action as required to assure ISO has appropriate reserves. Used by operators to monitor real-time 10 minute, 30 minute and operating reserves, in comparison to the required reserves outlined in the daily forecast.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |
| <b>ODMS Procedure Review Process</b>                      | All ISO Operating Procedures are reviewed and approved on a scheduled basis by both Participants and ISO-NE. Procedures are publically posted on ISO's external facing web page and available for all to see. This process uses Operations Document Management System (ODMS) software. ODMS software is programmed to schedule annual reviews of M/LCC 13, ISO and LCC Communications Practices, which is the procedure that contains ISO's documented communications protocols for its operating personnel that issue and receive Operating Instructions. ODMS software is programmed to schedule annual reviews of the documents that contain ISO's system voltage schedule [M/LCC 15 System Operating Limits Methodology (which contains a description of ISO's system voltage schedule) and OP-12B Voltage & Reactive Schedules (which contains generator voltage schedules)]. ODMS software also prompts the assigned Operations Business Process Analyst to post approved documents, including M/LCC 15 and OP-12B (public posting is how ISO "provides a copy" of these documents to other entities, including adjacent TOPs).                                                                                                                                                                                                                               |          |



## Controls Associated with NERC Standards/Requirements

### Standards and ISO-NE Internal Controls

#### BAL-002-1 Disturbance Control Performance

- R1.** Each Balancing Authority shall have access to and/or operate Contingency Reserve to respond to Disturbances. Contingency Reserve may be supplied from generation, controllable load resources, or coordinated adjustments to Interchange Schedules.

| Internal Control Name                                                                  | Internal Control Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | IC Owner |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| PowerFlow                                                                              | For real-time and near real-time thermal and voltage analysis, the EMS network study model Powerflow is used. This model includes the applicable approved transmission outages, generation outages, load forecast, estimated external transaction schedules and generation schedule. ISO also uses the EMS applications including Study-time Contingency Analysis (STCA), Real-time Contingency Analysis (RTCA) and the Interface Limit Calculator (ILC) to model all identified contingencies. The ISO network study model also includes the modeling and operation of approved Special Protection Systems (SPSs), where appropriate. The Application is for System Operators to conduct off-line analysis of various system conditions; used by System Operators to evaluate the next day operating plan and may be used in real-time.                                                                                                                                                                                                                                                                                                                                                                                                                              |          |
| Reserve Adequacy Assessment (RAA Process) Completed by 1700 and Time Stamped Save Case | ISO New England (ISO) will perform a Reserve Adequacy Assessment (RAA) and if necessary commit Generators to meet capacity and reserve requirements. Its primary focus is to review the difference between the ISO forecast of demand and the total demand that was cleared in the Day-Ahead (DA) Market. Should insufficient capacity be committed in the DA Market, Generators are committed to ensure adequacy of capacity in Real-Time to meet Load, Operating Reserve, and Replacement Reserve Requirements (Replacement Reserve Requirements may be set to zero). The objective function in the RAA is the minimization of the Start-up fees and costs to operate at Economic Minimum (Eco Min) for any additional Generators that are committed. In short, "Reserve Adequacy Assessment" is a process to ensure sufficient capacity is committed for the next day to meet Load and Operating Reserve Requirements in real-time.                                                                                                                                                                                                                                                                                                                                |          |
| Shift Turnover Process                                                                 | Shift turnovers provide on-coming shift personnel with an accurate picture of the overall status of the bulk power system. Shift turnover is an important part of System Operations and should be performed in a professional and deliberate manner. Complete and accurate shift turnovers contribute to clear understanding, optimum performance of duties, and safe operation of the bulk power system. On-coming and off-going Control Room staff members are expected to have a high degree of confidence that an appropriate information transfer has taken place before shift turnover has been completed. On-coming Control Room staff members conduct a comprehensive review of appropriate logs, records and system information before responsibility for their shift position is transferred. These reviews are then complemented by a discussion between the off-going and on-coming Control Room staff. This control helps ISO to identify when ISO is approaching or experiencing an Operating Emergency. Operators are trained to use three-part communication protocol when issuing operating instructions, especially during an Operating Emergency, so this tool or process helps the System Operator to recognize an Operating Emergency condition. |          |

- R3.** Each Balancing Authority or Reserve Sharing Group shall activate sufficient Contingency Reserve to comply with the DCS.

| Internal Control Name                        | Internal Control Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | IC Owner |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Compliance Monitoring Plan (CMP)             | The CMP is a formal compliance monitoring plan for each of the applicable NERC Standards. The CMP indicates the monitoring method, the group responsible for monitoring, the frequency of monitoring, the monitoring triggers, the time horizons and actions required by Reliability and Operations Compliance (ROC). The CMP is stored on ROC's Compliance database and reports are available on various aspects of the CMP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |
| Coordination with LCC's and Neighboring RC's | ISO Coordinates with Local Control Centers (LCC's) and neighboring Reliability Coordinators (RCs) to assure the reliable operation of the electric system. This includes coordination for load shed, capacity remedial actions, disturbance remedial action, transmission redial actions, error or failure of EMS, GMD, transferring operating to or from a control center, adjust the short-term load forecast (STLF) or implement operations during abnormal conditions. This also includes weekly NPCC teleconference and participation in working groups. In New England, TOP dispatch responsibilities are divided and/or shared between ISO, the Local Control Centers (LCCs). This requires close coordination of Operational Planning Analyses, Real-time monitoring, and Real-time Assessments on BES facilities. Further, due to the Interconnected nature of the electric system, such close coordination is also required with Neighboring RCs and, in some instances, those not neighboring (i.e. PJM for NE source loss that can impact PJM). M/LCC 13 ISO and LCC Communication Practices (Section 4.4.3) contains provisions for ISO and LCC System Operators to evaluate and discuss potential System Operating Limit (SOL) exceedances, including exceedances of voltage limits, and identify action plans to mitigate the potential exceedances. |          |



## NERC Standards/Requirements related to Controls

### Internal Controls and Related Standards

#### Demand Response Activation Analysis

Preventive

A Demand Response Activation Analysis shall be executed when a Planned Outage request is reviewed and produces a Long Term Operable Capacity Margin (LTOCM) or Locational Operable Capacity Margin (LOCM) that indicates Real-Time Demand Response Resources will be dispatched but does not result in the forecast of the OP-4 Action where a Power Watch is declared.

#### Standards Related to This Control

| Standard  | Standard Title       | Req.    |
|-----------|----------------------|---------|
| EOP-001-1 | Emergency Operations | R2.4.7. |

#### Double Contingency Evaluation

Preventive

On a nightly basis, the ISO Security Operator performs Double Contingency studies in accordance with CROP.34001 Double C. These studies are performed to ensure that limits are not exceeded for certain double transmission line contingencies and certain double generator contingencies.

#### Standards Related to This Control

| Standard    | Standard Title               | Req. |
|-------------|------------------------------|------|
| VAR-001-4.1 | Voltage and Reactive Control | R3.  |

#### Eastern Interconnect Data Sharing Network (EIDSN)

Preventive and Detective

"Eastern Interconnect Data Sharing Network" a wide-area-network for the sharing of operating reliability data, including both SCADA and synchrophasor data, among entities that manage the high-voltage power system in the eastern two-thirds of the United States and Canada. This exchange of data is essential to maintaining the reliability of the bulk electric power system. The system is located at: <https://eidsn.org/>. The mission of EIDSN is to develop a new, more efficient and effective network for the sharing of operating reliability data, including both SCADA and synchrophasor data, among appropriate entities to promote the reliable and efficient operation of the Eastern and Quebec Interconnections.

#### Standards Related to This Control

| Standard  | Standard Title                                     | Req. |
|-----------|----------------------------------------------------|------|
| IRO-002-4 | Reliability Coordination — Monitoring and Analysis | R1.  |
| IRO-002-5 | Reliability Coordination - Monitoring and Analysis | R6.  |

#### Emergency Load Reduction Plans for Mitigating IROL Violations

Preventive

"Emergency Load Reduction Plans For Mitigating IROL Violations" instructs System Operators to operate to the most limiting/conservative parameter in instances where there is a difference in IROLs ("In any instance where there is a difference in any derived operating limit, ISO and each applicable LCC shall always operate the BES to the most limiting parameter").



## NERC Standards/Requirements related to Controls

### Internal Controls and Related Standards

#### Standards Related to This Control

| Standard    | Standard Title                                                         | Req. |
|-------------|------------------------------------------------------------------------|------|
| IRO-008-2   | Reliability Coordinator Operational Analyses and Real-time Assessments | R1.  |
| IRO-008-2   | Reliability Coordinator Operational Analyses and Real-time Assessments | R2.  |
| TOP-002-4   | Operations Planning                                                    | R1.  |
| TOP-002-4   | Operations Planning                                                    | R2.  |
| VAR-001-4.1 | Voltage and Reactive Control                                           | R2.  |
| VAR-001-4.1 | Voltage and Reactive Control                                           | R3.  |

#### Heart Beat Monitor



Detective

A "HeartBeat Monitor" is displayed on the wall board which updates every 4 seconds when Real-Time ICCP data is refreshed. Upon two runs of stale data, an audible alarm will indicate ICCP link failures and the data will turn a Magenta color indicating bad data.

#### Standards Related to This Control

| Standard     | Standard Title                                             | Req. |
|--------------|------------------------------------------------------------|------|
| TOP-010-1(i) | Real-time Reliability Monitoring and Analysis Capabilities | R4.  |

#### HPI Barrier Effectiveness Identification Process



Preventive and Corrective

ISO has a procedure designed to reduce human-error-induced events through the adoption of fundamental behaviors and a defense-in-depth philosophy regarding Human Performance (HP) within Operations; collectively known as the Human Performance Improvement (HPI) program. The HPI program consists of two processes along with various administrative tasks and functions that are implemented utilizing the guidelines within the procedure, "SOP-RTMKTS.0210.0040, Perform Human Performance Improvement".

#### Standards Related to This Control

| Standard    | Standard Title               | Req. |
|-------------|------------------------------|------|
| EOP-011-1   | Emergency Operations         | R1.  |
| EOP-011-1   | Emergency Operations         | R2.  |
| VAR-001-4.1 | Voltage and Reactive Control | R2.  |
| VAR-001-4.1 | Voltage and Reactive Control | R3.  |

#### HPI Observation Process



Preventive and Corrective

The Human Performance Observation Process provides a method of documenting observations for review, tracking performance improvement, and identifying latent organizational weaknesses. The recommended number of Operations observations is determined on a quarterly basis by the HPI Core Team; typically three (3) observations per calendar quarter are conducted.

A feedback session is to take the form of a two way discussion in which the observer offers information to the individual or group observed on how the observed activity went, what could have gone better, and what went well (the observer should incorporate their observation notes in the discussion). All feedback should be discussed with the applicable Manager/Supervisor prior to being discussed with the individual or group observed.

# Controls – Monitoring and Management

What should I do after I have identified and cataloged my controls?

- Document implementation testing
- Monitor effectiveness of control design
- Controls can be overridden or degrade over time
  - Control Designs are living and dynamic, not static
  - Apply Change Management
  - Has the control objective changed?

## Closing Remarks

- Challenges to Reliability are prevalent
- Compliance may no longer be enough to be Reliable and Resilient
- Be proactive and self-aware of your control designs that enable you to remain compliant with applicable NERC Reliability Standards.
- Internal Controls allow you to showcase where you surpass the requirements objective



# Questions

Please email questions and/or feedback to [ERA@npcc.org](mailto:ERA@npcc.org)

More information available at NPCC ERA webpage

<https://www.npcc.org/Compliance/Entity%20Risk%20Assessment/Forms/Public%20List.aspx>

# Thank you!!!



NORTHEAST POWER COORDINATING COUNCIL, INC.

# Cyber Security Outreach Program

Jenifer Wallace



# Assessment Process

- 1-2 day onsite review:
  - High level network architecture review
  - Physical inspection of control system
  - CIS Critical Security Controls review



# Assessment Report

- Onsite debrief and confidential non-public report:
  - Positive observations
  - Better practice elements



# Assessment Examples

## Current Practice

- Using sticky note for password storage
- 8 char password length
- No formal asset inventory
- Does not build / maintain secure images

## Better Practice Elements

- Use secure password manager
- Use passphrases that are longer than 14 char
- Use centralized asset repository
- Remove bloatware, configure security settings, and store secure images in air-gapped environment



# Questions?

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