

**Compliance Questionnaire and**

**Reliability Standard Audit Worksheet**

**FAC-010-2.1 — System Operating Limits Methodology for the Planning Horizon**

**Registered Entity:** *(Must be completed by the Compliance Enforcement Authority)*

**NCR Number:** *(Must be completed by the Compliance Enforcement Authority)*

**Applicable Function(s): PA**

**Auditors:**

**Disclaimer**

NERC developed this Reliability Standard Audit Worksheet (RSAW) language in order to facilitate NERC’s and the Regional Entities’ assessment of a registered entity’s compliance with this Reliability Standard. The NERC RSAW language is written to specific versions of each NERC Reliability Standard. Entities using this RSAW should choose the version of the RSAW applicable to the Reliability Standard being assessed. While the information included in this RSAW provides some of the methodology that NERC has elected to use to assess compliance with the requirements of the Reliability Standard, this document should not be treated as a substitute for the Reliability Standard or viewed as additional Reliability Standard requirements. In all cases, the Regional Entity should rely on the language contained in the Reliability Standard itself, and not on the language contained in this RSAW, to determine compliance with the Reliability Standard. NERC’s Reliability Standards can be found on NERC’s website. Additionally, NERC Reliability Standards are updated frequently, and this RSAW may not necessarily be updated with the same frequency. Therefore, it is imperative that entities treat this RSAW as a reference document only, and not as a substitute or replacement for the Reliability Standard. It is the responsibility of the registered entity to verify its compliance with the latest approved version of the Reliability Standards, by the applicable governmental authority, relevant to its registration status.

The NERC RSAW language contained within this document provides a non‑exclusive list, for informational purposes only, of examples of the types of evidence a registered entity may produce or may be asked to produce to demonstrate compliance with the Reliability Standard. A registered entity’s adherence to the examples contained within this RSAW does not necessarily constitute compliance with the applicable Reliability Standard, and NERC and the Regional Entity using this RSAW reserves the right to request additional evidence from the registered entity that is not included in this RSAW. Additionally, this RSAW includes excerpts from FERC Orders and other regulatory references. The FERC Order cites are provided for ease of reference only, and this document does not necessarily include all applicable Order provisions. In the event of a discrepancy between FERC Orders, and the language included in this document, FERC Orders shall prevail. .

# Subject Matter Experts

Identify your company’s subject matter expert(s) responsible for this Reliability Standard. Include the person's title, organization and the requirement(s) for which they are responsible. Insert additional lines if necessary.

**Response: *(Registered Entity Response Required)***

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| **SME Name** | **Title** | **Organization** | **Requirement** |
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# Reliability Standard Language

**FAC-010-2.1 — System Operating Limits Methodology for the Planning Horizon**

**Purpose:**

To ensure that System Operating Limits (SOLs) used in the reliable planning of the Bulk Electric System (BES) are determined based on an established methodology or methodologies.

**Applicability:**

Planning Authority

**NERC BOT Approval Date: 11/05/09**

**FERC Approval Date: 4/19/2010**

**Reliability Standard Enforcement Date in the United States: 4/19/2010**

**Requirements:**

**R1.** The Planning Authority shall have a documented SOL Methodology for use in developing SOLs within its Planning Authority Area. This SOL Methodology shall:

**R1.1.** Be applicable for developing SOLs used in the planning horizon.

**R1.2.** State that SOLs shall not exceed associated Facility Ratings.

**R1.3.** Include a description of how to identify the subset of SOLs that qualify as IROLs.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R1 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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| *Audit Team: Additional Evidence Reviewed:* | |  |  | |
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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC-010-2.1 R1.**

\_\_\_ Verify the Planning Authority has a documented SOL Methodology to be used for developing SOLs within its Planning Authority Area. Verify the SOL Methodology:

\_\_\_ Is applicable for developing SOLs used in the planning horizon.

\_\_\_ States the SOLs do not exceed associated Facility Ratings.

\_\_\_ Includes a description of how to identify the subset of SOLs that qualify as IROLs.

**Auditors Detailed notes:**

**R2.** The Planning Authority’s SOL Methodology shall include a requirement that SOLs provide BES performance consistent with the following:

**R2.1.** In the pre-contingency state and with all Facilities in service, the BES shall demonstrate transient,

dynamic and voltage stability; all Facilities shall be within their Facility Ratings and within their thermal, voltage and stability limits. In the determination of SOLs, the BES condition used shall reflect expected system conditions and shall reflect changes to system topology such as Facility outages.

**R2.2.** Following the single Contingencies1 identified in Requirement 2.2.1 through Requirement 2.2.3, the system shall demonstrate transient, dynamic and voltage stability; all Facilities shall be operating within their Facility Ratings and within their thermal, voltage and stability limits; and Cascading or uncontrolled separation shall not occur.

**R2.2.1.** Single line to ground or three-phase Fault (whichever is more severe), with Normal Clearing, on any faulted generator, line, transformer, or shunt device.

**R2.2.2.** Loss of any generator, line, transformer, or shunt device without a Fault.

**R2.2.3.** Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system.

1 The Contingencies identified in R2.2.1 through R2.2.3 are the minimum contingencies that must be studied but are not necessarily the only Contingencies that should be studied.

**R2.3.** Starting with all Facilities in service, the system’s response to a single Contingency, may include any of the following:

**R2.3.1.** Planned or controlled interruption of electric supply to radial customers or some local network customers connected to or supplied by the Faulted Facility or by the affected area.

**R2.3.2.** System reconfiguration through manual or automatic control or protection actions.

**R2.4.** To prepare for the next Contingency, system adjustments may be made, including changes to

generation, uses of the transmission system, and the transmission system topology.

**R2.5.** Starting with all Facilities in service and following any of the multiple Contingencies identified in

Reliability Standard TPL-003 the system shall demonstrate transient, dynamic and voltage stability; all

Facilities shall be operating within their Facility Ratings and within their thermal, voltage and stability

limits; and Cascading or uncontrolled separation shall not occur.

**R2.6.** In determining the system’s response to any of the multiple Contingencies, identified in Reliability

Standard TPL-003, in addition to the actions identified in R2.3.1 and R2.3.2, the following shall be

acceptable:

**R2.6.1.** Planned or controlled interruption of electric supply to customers (load shedding), the planned

removal from service of certain generators, and/or the curtailment of contracted Firm (non-recallable

reserved) electric power Transfers.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R2 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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| *Audit Team: Additional Evidence Reviewed:* | |  |  | |
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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC-010-2.1 R2.**

\_\_\_ Verify the Planning Authority's SOL Methodology included a requirement that SOLs

provide BES performance consistent with:

\_\_\_ In the pre‑contingency state and with all Facilities in service, the BES shall demonstrate

transient stability, dynamic stability and voltage stability

\_\_\_ All Facilities shall be within their Facility Ratings

\_\_\_ All Facilities shall be within their thermal, voltage and stability limits.

\_\_\_ Verify in the determination of SOLs, the BES condition used reflected expected system

conditions and reflected changes to system topology such as Facility outages.

Following the single Contingencies identified in Requirement 2.2.1 through Requirement 2.2.3, the system shall demonstrate transient stability, dynamic stability and voltage stability

\_\_\_ All Facilities shall be within their Facility Ratings

\_\_\_ All Facilities shall be within their thermal, voltage and stability limits.

\_\_\_ Verify Cascading Outages or uncontrolled separation shall not occur.

\_\_\_ Single line to ground or three‑phase Fault (whichever is more severe), with Normal

Clearing, on any Faulted generator, line, transformer, or shunt device.

\_\_\_ Loss of any generator, line, transformer, or shunt device without a Fault.

\_\_\_ Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system.

Note: Starting with all Facilities in service, the system’s response to a single Contingency, may include any of

the following:

\_\_\_Planned or controlled interruption of electric supply to radial customers or some local network

customers connected to or supplied by the Faulted Facility or by the affected area.

System reconfiguration through manual or automatic control or protection actions

\_\_\_

Verify the methodology addresses preparation for the next Contingency, including system

adjustments, changes to generation, uses of the transmission system, and the

transmission system topology.

Starting with all facilities in service and following any of the multiple Contingencies identified in Reliability

Standard TPL‑003, the system shall:

Demonstrate transient, dynamic and voltage stability;

All Facilities shall be operating within their Facility Ratings and within

their thermal, voltage and stability limits.

**\_\_\_** Verify Cascading Outages or uncontrolled separation shall not occur.

Note: In determining the system’s response to any of the multiple Contingencies, identified in Reliability

Standard TPL‑003, in addition to the actions identified in R2.3.1 and R2.3.2, the following shall be acceptable:

\_\_\_Planned or controlled interruption of electric supply to customers (load shedding),

The planned removal from service of certain generators,

The curtailment of contracted Firm (non‑recallable reserved) electric power Transfers.

**Auditors Detailed notes:**

**R3.** The Planning Authority’s methodology for determining SOLs, shall include, as a minimum, a description of the following, along with any reliability margins applied for each:

**R3.1.** Study model (must include at least the entire Planning Authority Area as well as the critical modeling details from other Planning Authority Areas that would impact the Facility or Facilities under study).

**R3.2.** Selection of applicable Contingencies.

**R3.3.** Level of detail of system models used to determine SOLs.

**R3.4.** Allowed uses of Special Protection Systems or Remedial Action Plans.

**R3.5.** Anticipated transmission system configuration, generation dispatch and Load level.

**R3.6.** Criteria for determining when violating a SOL qualifies as an Interconnection Reliability Operating Limit (IROL) and criteria for developing any associated IROL Tv.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R3 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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|  | **Provide the following:**  **Document Title and/or File Name, Page & Section, Date & Version** | | |
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| *Audit Team: Additional Evidence Reviewed:* | |  |  | |
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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC-010-2.1 R3.**

Verify the Planning Authority’s methodology for determining SOLs includes at a

minimum, a description of the following, along with any reliability margins applied for

each:

Study model (must include the entire Planning Area and critical modeling details from

areas that would impact the Facility(s) under study)

Selection of applicable Contingencies.

Level of detail of models used to determine SOLs

Allowed uses of Special Protection Systems or Remedial Action Plans.

Anticipated transmission configuration, generation dispatch and Load level.

Criteria for determining when violating SOL qualifies as and IROL

**Auditors Detailed notes:**

**R4.** The Planning Authority shall issue its SOL Methodology, and any change to that methodology, to all of the following prior to the effectiveness of the change:

**R4.1.** Each adjacent Planning Authority and each Planning Authority that indicated it has a reliability-related need for the methodology.

**R4.2.** Each Reliability Coordinator and Transmission Operator that operates any portion of the Planning Authority’s Planning Authority Area.

**R4.3.** Each Transmission Planner that works in the Planning Authority’s Planning Authority Area.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R4 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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|  | **Provide the following:**  **Document Title and/or File Name, Page & Section, Date & Version** | | |
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| *Audit Team: Additional Evidence Reviewed:* | |  |  | |
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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC-010-2.1 R4.**

\_\_\_ Verify the Planning Authority issued its SOL Methodology, and any change to that

methodology, to all of the following prior to the effectiveness of the change:

\_\_\_ Each adjacent Planning Authority and each Planning Authority that indicated it has a

reliability-related need for the methodology.

\_\_\_ Each Reliability Coordinator and Transmission Operator that operates any portion of

the Planning Authority’s Planning Authority Area.

\_\_\_ Each Transmission Planner that works in the Planning Authority’s Planning Authority

Area.

**Auditors Detailed notes:**

**R5.** If a recipient of the SOL Methodology provides documented technical comments on the methodology, the Planning Authority shall provide a documented response to that recipient within 45 calendar days of receipt of those comments. The response shall indicate whether a change will be made to the SOL Methodology and, if no change will be made to that SOL Methodology, the reason why.

(Retirement approved by FERC effective January 21, 2014.)

# Supplemental Information

**Other ‑** The list of questions above is not all inclusive of evidence required to show compliance with the Reliability Standard. Provide additional information here**, as necessary that** demonstrates compliance with this Reliability Standard.

**Entity** **Response: *(Registered Entity Response)***

# Compliance Findings Summary (to be filled out by auditor)

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| **Req.** | **NF** | **PV** | **OEA** | **NA** | **Statement** |
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| **5** | (Retirement approved by FERC effective January 21, 2014.) | | | | |

**Excerpts From FERC Orders -- For Reference Purposes Only**

**Updated Through September 1, 2010**

**FAC-010-2.1**

**Order 693**

**March 16, 2007**

P 1050. …The FAC series of standards contain the Reliability Standards that form the technical and procedural basis for calculating transfer capabilities. … FAC-010-1 and FAC-011-1 provide the system operating limits methodologies for the planning and operational horizon respectively and FAC-014 provides for the communication of those ratings.

**Order 705**

**December 20, 2007**

P 8. Both FAC-010-1 and FAC-011-1 include an Interconnection-wide regional difference for the Western Interconnection administered by WECC. These regional differences incorporate a more detailed methodology to determine SOLs based on specified multiple contingencies. They also provide that the “Western Interconnection may make changes” to the contingencies required to be studied and/or the required responses to contingencies for specific facilities.

P 83. The Commission agrees that it is appropriate in this instance to adopt NERC’s revised effective dates of July 1, 2008 for FAC-010-1, October 1, 2008 for FAC-011-1 and January 1, 2009 for FAC-014-1. Given that this Final Rule will not be effective until January 2008, it is reasonable to allow responsible entities in the United States adequate time to comply with these Reliability Standards.

P 84. As for … concerns with the different implementation dates in Ontario and the United States, we agree that effective dates should be coordinated if practicable. In these circumstances, however, we foresee no problems arising from the effective dates approved here.

P 159. With regard to FAC-010-1, Requirement R2, and FAC-011-1, Requirement R2, the Commission agrees with NERC that Requirement R2, without its sub-Requirements, includes no required performance or outcome. As such, no Violation Risk Factor needs to be assigned to Requirement R2 in either FAC-010-1 or FAC-011-1. Further, the Commission agrees with NERC that FAC-010-1, sub-Requirements R2.2.1-R2.2.3 are topics to be included in an SOL methodology which do not require an assessment or analysis to be performed. As such, a medium Violation Risk Factor is appropriate.

P 161. The Commission believes that violations of FAC-010-1, sub-Requirements R2.1 and R2.2 present similar, if not the same, risk to Bulk-Power System reliability as violations of TPL-001-0, Requirement R1 and TPL-002-0, Requirement R1. TPL-001-0, Requirement R1 establishes reliable pre-contingency Bulk-Power System performance. … The Commission believes both TPL Requirements establish similar, if not the same, Bulk-Power System performance metrics as FAC-010-1, Requirements R2.1 and R2.2.

P 162. Further, contrary to NERC’s position, the Commission believes that to demonstrate the pre- and post-contingency performance metrics required by Requirements R2.1-R2.2 an assessment or analysis would need to be performed. As such, Requirements R2.1-R2.2 provide for actions that go beyond NERC’s characterization of the subject of the requirements as limited to a list of topics that must be included in a methodology. Therefore, we conclude that these properly treated as implementation or operational requirements that may have a direct impact on reliability.

P 164. The Commission agrees with NERC that the Requirements to follow a methodology when determining SOLs are included in FAC-014-1. However, as the Commission states above, FAC-010-1, Requirements R2.1-R2.2 establish the performance metrics of the SOL methodology used. Thus, if the planning authority’s methodology to develop SOLs does not meet the demonstrated performance metrics of these Requirements in a planning time horizon, then under emergency, abnormal, or restorative conditions, the Bulk-Power System would be at risk of instability, separation, or cascading failures.

P 178. Reliability Standard FAC-010-1, Requirement 3.6 establishes the criteria for determining, in the planning time horizon, when violating an SOL qualifies as an IROL, and criteria for developing any associated IROL Tv. NERC proposed to assign Requirement 3.6 a lower Violation Risk Factor. However, NERC proposed a medium Violation Risk Factor assignment to Reliability Standard FAC-011-1, Requirement R3.7 which establishes the same criteria in the operating time horizon. The Commission believes that the criteria for determining when violating an SOL qualifies as an IROL should be the same regardless of whether in the planning time horizon or the operating time horizon. This fact is supported by the Blackout Report finding that FirstEnergy did not have an adequate criterion to determine voltage stability in both the planning and operating time frames. That failure led to the company in adopting an inappropriate 90 percent minimum acceptable voltage factor.**94** Based on these facts, the Commission concludes that the potential reliability risk to the Bulk-Power system for a violation of those criteria in the planning horizon is the same as the potential reliability risk in the operating horizon. The Commission expects consistency between similar, and in this instance, identically-worded, Requirements of Reliability Standards. Therefore, the Commission directs NERC to ensure that the proposed Violation Risk Factor for FAC- 010-1, Requirement R3.6 is changed from lower to medium.

**Revision History**

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| **Version** | **Date** | **Reviewers** | **Revision Description** |
| 1.1 | July 1, 2010 | RSAW Working Group | Effective dates and version # change |
| 1.1 | September 2010 | NERC Legal & NERC Compliance | Added regulatory language & reviewed for formatting consistency. |
| 1.1 | December 2010 | QRSAW WG | Revised Findings Table, modified Supporting Evidence tables and Added Revision History |
| 1.1 | January 2011 | Craig Struck | Reviewed for format consistency and content. |
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