

## Mapping Document

### Project 2015-09 Establish and Communicate System Operating Limits

Standard FAC-011-3 - System Operating Limits Methodology for the Operations Horizon		
Requirement in Approved Standard	Translation to New Standard or Other Action	Description and Change Justification
<p>FAC-011-3, Requirement R1.</p> <p>The Reliability Coordinator shall have a documented methodology for use in developing SOLs (SOL Methodology) within its Reliability Coordinator Area. This SOL Methodology shall:</p>	<p>FAC-011-4, Requirement R1.</p> <p>Each Reliability Coordinator shall have a methodology for establishing SOLs (“SOL Methodology”) within its Reliability Coordinator Area.</p>	<p>No change.</p>
<p>FAC-011-3, Requirement R1, R1.1.</p> <p>[This SOL Methodology shall] Be applicable for developing SOLs used in the operations horizon.</p>	<p>This requirement was removed.</p>	<p>The stated purpose of FAC-011-4 is “To ensure that System Operating Limits (SOLs) used in the reliable operation of the Bulk Electric System (BES) are determined based on an established methodology or methodologies.” The title of FAC-011-4 is “System Operating Limits Methodology for the Operations Horizon”. Therefore, every requirement in FAC-011-4 is intended for developing SOLs used in the operations horizon. Accordingly, there is no reliability-</p>

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		related need to have a requirement specifying that the Reliability Coordinator’s (RC’s) SOL Methodology is applicable for developing SOLs used in the operations horizon.
<p>FAC-011-3, Requirement R1, R1.2.</p> <p>[This SOL Methodology shall] State that SOLs shall not exceed associated Facility Ratings.</p>	<p>This requirement is addressed in proposed FAC-011-4 Requirement R2 in conjunction with the definitions for Operational Planning Analysis and Real-time Assessment in the NERC Glossary of Terms.</p> <p><u>FAC-011-4 Requirement R2</u>: Each Reliability Coordinator shall include in its SOL Methodology the method for Transmission Operators to determine the applicable owner-provided Facility Ratings to be used in operations. The method shall address the use of common Facility Ratings between the Reliability Coordinator and the Transmission Operators in its Reliability Coordinator Area.</p> <p><u>Operational Planning Analysis</u> is defined in the NERC Glossary of Terms as “An evaluation of projected system conditions to assess anticipated (pre-Contingency) and potential (post-Contingency) conditions for</p>	<p>Facility Ratings to be used in operations as SOLs is addressed through FAC-011-4, Requirement R2.</p> <p>Facility Ratings that are determined per Requirement R2 are a required input for Operational Planning Analyses (OPA) and Real-time Assessments (RTA) per the definitions, and therefore address the analysis of system performance with respect to Facility Ratings. Facility Rating exceedances are determined through OPAs and RTAs.</p>

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	<p><i>next-day operations. The evaluation shall reflect applicable inputs including, but not limited to, load forecasts; generation output levels; Interchange; known Protection System and Special Protection System status or degradation; Transmission outages; generator outages; Facility Ratings; and identified phase angle and equipment limitations. (Operational Planning Analysis may be provided through internal systems or through third-party services.)”</i></p> <p><u>Real-time Assessment</u> is defined in the NERC Glossary of Terms as “An evaluation of system conditions using Real-time data to assess existing (pre-Contingency) and potential (post-Contingency) operating conditions. The assessment shall reflect applicable inputs including, but not limited to: load, generation output levels, known Protection System and Special Protection System status or degradation, Transmission outages, generator outages, Interchange, Facility Ratings, and identified phase angle and equipment limitations. (Real-time Assessment may be provided through</p>	

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	<i>internal systems or through third-party services.)”</i>	
<p>FAC-011-3, Requirement R1, R1.3.</p> <p>[This SOL Methodology shall] Include a description of how to identify the subset of SOLs that qualify as IROs.</p>	<p>FAC-011-4, Requirement R6 and Part 6.1.</p> <p>R6. Each Reliability Coordinator shall include in its SOL Methodology</p> <p>6.1. A description of how to identify the subset of SOLs that qualify as IROs.</p>	<p>The language from the approved standard was maintained in the proposed FAC-011-4.</p>
<p>FAC-011-3, Requirements R2, R2.1 and R2.2.</p> <p>R2. The Reliability Coordinator’s SOL Methodology shall include a requirement that SOLs provide BES performance consistent with the following:</p> <p>R2.1 In the pre-contingency state, 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 current or expected system conditions and shall reflect changes to system topology such as Facility outages.</p>	<p>These requirements are addressed in:</p> <ol style="list-style-type: none"> <li>1. TOP and IRO requirements for TOPs and RCs to perform OPAs, to develop Operating Plans for SOL exceedances identified in those OPAs, to perform RTAs, and to implement Operating Plans to address SOL exceedances identified in those RTAs.</li> <li>2. The definition of OPA and RTA</li> <li>3. FAC-011-4, Requirement R4 addresses the establishment of stability limits and the associated performance requirements.</li> <li>4. FAC-011-4 Requirement R6 and its Parts relating to IROs.</li> </ol>	<p>“BES performance” as stated in FAC-011-3 Requirement R2 is not determined through SOLs in and of themselves. SOLs are an input into OPAs and RTAs. The OPA and RTA evaluation against those SOLs provide for reliable system performance by ensuring through these analyses/assessments that the system performs reliably in the pre- and post-Contingency states (i.e., that the system is within thermal (Facility Ratings), System Voltage Limits, and stability limits pre- and post-Contingency). If SOL exceedance is occurring, the system is not performing reliably. Per the Transmission Operator (TOP) standards, SOL exceedance triggers the development and</p>

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<p>R2.2. Following the single Contingencies identified in Requirement R2, R2.2.1 - R2.2.3, 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.</p>	<p>5. The definition of IROL and the TOP and IRO standards that address operation within IROLs.</p> <p><u>TOP-002-4, Requirement R1:</u> Each Transmission Operator shall have an Operational Planning Analysis that will allow it to assess whether its planned operations for the next day within its Transmission Operator Area will exceed any of its System Operating Limits (SOLs).</p> <p><u>TOP-001-4, Requirement R2:</u> Each Transmission Operator shall have an Operating Plan(s) for next-day operations to address potential System Operating Limit (SOL) exceedances identified as a result of its Operational Planning Analysis as required in Requirement R1.</p> <p><u>TOP-001-4, Requirement R13:</u> Each Transmission Operator shall ensure that a Real-time Assessment is performed at least once every 30 minutes.</p> <p><u>TOP-001-4, Requirement R14:</u> Each Transmission Operator shall initiate its Operating Plan to mitigate a SOL</p>	<p>implementation of an Operating Plan to address that SOL exceedance.</p> <p>The items in approved FAC-011-3, Requirement R2 and its sub-requirements are addressed through the related TOP standards that reference SOL exceedance.</p> <ol style="list-style-type: none"> <li>1. Per TOP-002-4, Requirement R1, TOPs have OPAs to identify SOL exceedances.</li> <li>2. Per TOP-002-4, Requirement R2, TOPs develop Operating Plans for SOL exceedances identified in the OPA.</li> <li>3. Per TOP-001-3, Requirement R13, TOPs perform RTAs at least once every 30 minutes to identify SOL exceedances.</li> <li>4. Per TOP-001-3, Requirement R14, TOPs implement Operating Plans to mitigate SOL exceedances.</li> <li>5. Per IRO-008-2, Requirement R1, RCs perform OPAs to identify SOL and IROL exceedances.</li> </ol>

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	<p>exceedance identified as part of its Real-time monitoring or Real-time Assessment.</p> <p><u>IRO-008-2, Requirement R1:</u> Each Reliability Coordinator shall perform an Operational Planning Analysis that will allow it to assess whether the planned operations for the next-day will exceed System Operating Limits (SOLs) and Interconnection Operating Reliability Limits (IROLs) within its Wide Area.</p> <p><u>IRO-008-2, Requirement R2:</u> Each Reliability Coordinator shall have a coordinated Operating Plan(s) for next-day operations to address potential System Operating Limit (SOL) and Interconnection Reliability Operating Limit (IROL) exceedances identified as a result of its Operational Planning Analysis as performed in Requirement R1 while considering the Operating Plans for the next-day provided by its Transmission Operators and Balancing Authorities.</p> <p><u>IRO-008-2, Requirement R4:</u> Each Reliability Coordinator shall ensure that a Real-time</p>	<ol style="list-style-type: none"> <li>6. Per IRO-008-2, Requirement R2, RCs develop coordinated Operating Plans for SOL and IROL exceedances identified in its OPA.</li> <li>7. Per IRO-008-2, Requirement R4, RCs perform RTAs at least once every 30 minutes to identify SOL and IROL exceedances.</li> <li>8. Per IRO-008-2, Requirement R5, RCs notify TOPs and BAs of SOL or IROL exceedances identified in its RTA.</li> </ol> <p>The portion of FAC-011-3, Requirement R2, R2.1 that states <i>“In the determination of SOLs, the BES condition used shall reflect current or expected system conditions and shall reflect changes to system topology such as Facility outages”</i> is addressed specifically by FAC-011-4 Requirement R4, Part 4.4 which requires that System conditions including any changes to System topology such as Facility outages are to be included as part of the process for determining stability limits. While stability</p>

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	<p>Assessment is performed at least once every 30 minutes.</p> <p><u>IRO-008-2, Requirement R5</u>: Each Reliability Coordinator shall notify impacted Transmission Operators and Balancing Authorities within its Reliability Coordinator Area, and other impacted Reliability Coordinators as indicated in its Operating Plan, when the results of a Real-time Assessment indicate an actual or expected condition that results in, or could result in, a System Operating Limit (SOL) or Interconnection Reliability Operating Limit (IROL) exceedance within its Wide Area.</p> <p><u>Operational Planning Analysis</u> is defined in the NERC Glossary of Terms as “An evaluation of projected system conditions to assess anticipated (pre-Contingency) and potential (post-Contingency) conditions for next-day operations. The evaluation shall reflect applicable inputs including, but not limited to, load forecasts; generation output levels; Interchange; known Protection System and Special Protection System status</p>	<p>limits are frequently dependent on system conditions and Facility outages, Facility Ratings and System Voltage Limits are not dependent on system conditions and Facility outages. However, system conditions and topology changes such as Facility outages are critical for determining whether or not Facility Ratings and System Voltage Limits are being exceeded for the pre- or post-Contingency state, which is accomplished through performing OPAs and RTAs that address expected and actual system conditions and Facility outages for the pre- and post-Contingency state.</p> <p>Regarding the stability portions of Requirement R2, R2.1 and R2.2:</p> <p>FAC-011-4, Requirement R4 improve reliability by requiring the RC’s SOL Methodology to address several stability-related phenomena and associated performance criteria in its SOL Methodology, as seen in Requirement R4, Part 4.1.</p>

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	<p><i>or degradation; Transmission outages; generator outages; Facility Ratings; and identified phase angle and equipment limitations. (Operational Planning Analysis may be provided through internal systems or through third-party services.)”</i></p> <p><u>Real-time Assessment</u> is defined in the NERC Glossary of Terms as “An evaluation of system conditions using Real-time data to assess existing (pre-Contingency) and potential (post-Contingency) operating conditions. The assessment shall reflect applicable inputs including, but not limited to: load, generation output levels, known Protection System and Special Protection System status or degradation, Transmission outages, generator outages, Interchange, Facility Ratings, and identified phase angle and equipment limitations. (Real-time Assessment may be provided through internal systems or through third-party services.)”</p>	<p>Requirement R4, Part 4.2 requires the RC’s SOL Methodology to require that stability limits be established to meet those performance requirements.</p> <p>Furthermore, Requirement R4, Part 4.6 requires the RC’s SOL Methodology to specify how the RC establishes stability limits when there is an impact to more than one TOP in its Reliability Coordinator Area RC’s SOL Methodology.</p> <p>Requirement R4 works together with FAC-014-3, Requirement R2 which requires TOPs to establish SOLs in accordance with the RC’s SOL Methodology and with FAC-014-3, Requirement R4 which requires the RC to establish stability limits that impact more than one TOP in its RC Area.</p> <p>Instability is also addressed through FAC-011-4, Requirement R6 which requires the RC’s SOL Methodology contain a description of how to identify the subset of SOLs that qualify as Interconnection Reliability Operating Limits (IROLs), and through FAC-014-3, Requirement R1 which requires the</p>



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	<p><u>FAC-011-4 Requirement R4:</u> Each Reliability Coordinator shall include in its SOL Methodology the method for determining the stability limits to be used in operations. The method shall:</p> <p>4.1. Specify stability performance criteria, including any margins applied. The criteria shall include the following:</p> <p>4.1.1. steady-state voltage stability;</p> <p>4.1.2. transient voltage response;</p> <p>4.1.3. angular stability;</p> <p>4.1.4. System damping.</p> <p>4.2. Require that stability limits are established to meet the criteria specified in Part 4.1 for the Contingencies identified in Requirement R5.</p> <p>4.3. Describe how the Reliability Coordinator establishes stability limits when there is an impact to more than one Transmission Operator in its Reliability Coordinator Area.</p>	<p>RC to establish IROLs in accordance with its SOL Methodology.</p> <p>IRO-009-2, Requirement R3 requires the RC to act or direct others to act so that the magnitude and duration of an IROL exceedance is mitigated within the IROL's <math>T_v</math>, as identified in the Reliability Coordinator's Real-time monitoring or Real-time Assessment.</p> <p>Additionally, TOP-001-3, Requirement R12 requires that the TOP not operate outside any identified IROL for a continuous duration exceeding its associated IROL <math>T_v</math>.</p>

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	<p>4.4. Describe how instability risks are identified, considering levels of transfers, Load and generation dispatch, and System conditions including any changes to System topology such as Facility outages;</p> <p>4.5. Describe the level of detail that is required for the study model(s), including the extent of the Reliability Coordinator Area, as well as the critical modeling details from other Reliability Coordinator Areas, necessary to determine different types of stability limits.</p> <p>4.6. Describe the allowed uses of Remedial Action Schemes (RAS) and other automatic post-Contingency mitigation actions.</p> <p><u>IROL</u> is defined in the NERC Glossary of Terms as – <i>A System Operating Limit that, if violated, could lead to instability, uncontrolled separation, or Cascading outages that adversely impact the reliability of the Bulk Electric System.</i></p>	

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	<p><u>FAC-011-4, Requirement R6</u>: Each Reliability Coordinator shall include in its SOL Methodology:</p> <p>6.1. A description of how to identify the subset of SOLs that qualify as IROLs.</p> <p>6.2. Criteria for determining when violating a SOL qualifies as an Interconnection Reliability Operating Limit (IROL) and criteria for developing any associated IROL T<sub>v</sub>.</p> <p><u>FAC-014-3, Requirement R1</u>: Each Reliability Coordinator shall establish Interconnection Reliability Operating Limits (IROLs) for its Reliability Coordinator Area in accordance with its System Operating Limit Methodology (SOL Methodology).</p> <p><u>IRO-009-2, Requirement R3</u>: Each Reliability Coordinator shall act or direct others to act so that the magnitude and duration of an</p>	

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	<p>IROL exceedance is mitigated within the IROL's <math>T_V</math>, as identified in the Reliability Coordinator's Real-time monitoring or Real-time Assessment.</p> <p><u>TOP-001-3, Requirement R12:</u> Each Transmission Operator shall not operate outside any identified Interconnection Reliability Operating Limit (IROL) for a continuous duration exceeding its associated IROL <math>T_V</math>.</p>	
<p>FAC-011-3, Requirement R2, sub-requirements R2.2.1, R2.2.2, and R2.2.3</p> <p>R2.2.1. Single line to ground or 3-phase Fault (whichever is more severe), with Normal Clearing, on any Faulted generator, line, transformer, or shunt device.</p> <p>R2.2.2. Loss of any generator, line, transformer, or shunt device without a Fault.</p> <p>R2.2.3. Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system.</p>	<p>FAC-011-4, Requirement R5, Part 5.1.1</p> <p>Loss of any of the following either by single phase or three phase Fault to ground with normal clearing, or without a Fault:</p> <ul style="list-style-type: none"> <li>• generator;</li> <li>• transmission circuit;</li> <li>• transformer;</li> <li>• shunt device;</li> <li>• single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system.</li> </ul>	<p>The requirements in approved FAC-011-3 were consolidated into a single requirement in proposed FAC-011-4.</p>

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<p>FAC-011-3, Requirement R2.3, sub-requirements R2.3.1, R2.3.2, R2.3.3, and Requirement R2.4.</p> <p>R2.3 In determining the system’s response to a single Contingency, the following shall be acceptable:</p> <p>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.</p> <p>R2.3.2. Interruption of other network customers, (a) only if the system has already been adjusted, or is being adjusted, following at least one prior outage, or (b) if the real-time operating conditions are more adverse than anticipated in the corresponding studies</p> <p>R2.3.3. System reconfiguration through manual or automatic control or protection actions.</p> <p>R2.4 To prepare for the next Contingency, system adjustments may be made, including changes to generation, uses of the</p>	<p>The reliability issues denoted in FAC-011-3 Requirement R2.3, sub-requirements R2.3.1, R2.3.2, R2.3.3, and R2.4 represent a combination of issues that are relevant to the establishment of SOLs and those that are relevant to “how the system is to be operated.”</p> <p>The issues that pertain to the establishment of SOLs are addressed through FAC-011-4 Requirement R4 :</p> <p>R4. Each Reliability Coordinator shall include in its SOL Methodology the method for determining the stability limits to be used in operations. The method shall:</p> <p>4.1. Specify stability performance criteria, including any margins applied. The criteria shall include the following:</p> <p>4.1.1. steady-state voltage stability;</p> <p>4.1.2. transient voltage response;</p> <p>4.1.3. angular stability;</p> <p>4.1.4. System damping.</p>	<p>Requirement R2, R2.3 describes an acceptable System response to single Contingencies. These requirements are sub-requirements of Requirement R2, which addresses the establishment of SOLs that “provide a certain level of BES performance”. “BES performance” as stated in FAC-011-3, Requirement R2 is not determined through SOLs in and of themselves. SOLs are an input into OPAs and RTAs. The OPA and RTA evaluation against those SOLs provide for reliable system performance by ensuring through these analyses/assessments that the system performs reliably in the pre- and post-Contingency states (i.e., that the system is within thermal (Facility Ratings), System Voltage Limits, and stability limits pre- and post-Contingency). If SOL exceedance is occurring, the system is not performing reliably. Per the TOP and IRO standards, RTAs must be performed at least once every 30 minutes. Accordingly, each new operating state is “studied” at least once every 30 minutes. Additionally, per the TOP</p>

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<p>transmission system, and the transmission system topology.</p>	<p>4.2. Require that stability limits are established to meet the criteria specified in Part 4.1 for the Contingencies identified in Requirement R5.</p> <p>4.3. Describe how the Reliability Coordinator establishes stability limits when there is an impact to more than one Transmission Operator in its Reliability Coordinator Area.</p> <p>4.4. Describe how instability risks are identified, considering levels of transfers, Load and generation dispatch, and System conditions including any changes to System topology such as Facility outages;</p> <p>4.5. Describe the level of detail that is required for the study model(s), including the extent of the Reliability Coordinator Area, as well as the critical modeling details from other Reliability Coordinator Areas, necessary to determine different types of stability limits.</p> <p>4.6. Describe the allowed uses of Remedial Action Schemes (RAS) and other</p>	<p>standards, SOL exceedance triggers the development and implementation of an Operating Plan to address that SOL exceedance.</p> <p>Insofar as the issues in FAC-011-3, Requirement R2, R2.3 and R2.4 correlate to the establishment of SOLs, automatic control actions relevant to the establishment of stability limits are addressed in FAC-011-4 Requirement R4, Part 4.6 which requires the SOL Methodology to describe the allowed uses of Remedial Action Schemes (RAS) and other automatic post-Contingency mitigation actions as part of stability limit establishment. Accordingly, any RAS or automatic mitigation scheme (which includes those that interrupt customers or reconfigure the system) are required to be reflected in the establishment of stability limits per Requirement R4, Part 4.6. Furthermore, per Requirement R4, Part 4.4, stability limits are required to take into consideration the configuration of the system, which may include any necessary</p>

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	<p>automatic post-Contingency mitigation actions.</p> <p>The issues that are more centric to “how the system is to be operated” are more appropriately addressed in the development and implementation of Operating Plans as denoted in the following standards:</p> <ol style="list-style-type: none"> <li>1. <u>TOP-002-4, Requirement R2</u>: Each Transmission Operator shall have an Operating Plan(s) for next-day operations to address potential System Operating Limit (SOL) exceedances identified as a result of its Operational Planning Analysis as required in Requirement R1.</li> <li>2. <u>TOP-002-4, Requirement R3</u>: Each Transmission Operator shall notify entities identified in the Operating Plan(s) cited in Requirement R2 as to their role in those plan(s).</li> <li>3. <u>TOP-002-4, Requirement R6</u>: Each Transmission Operator shall provide</li> </ol>	<p>manual actions taken by the System Operator to configure the system in a manner that supports the use of a given stability limit.</p> <p>However, insofar as FAC-011-3, Requirement R2, R2.3 and R2.4 correlate to “how the system is to be operated”, the operational decisions related to customer interruption and system reconfiguration are governed by the Operating Plan, if such actions are necessary to address SOL exceedance. The need for making system adjustments to prepare for the next Contingency is standard operational practice and does not need to be specified or required by the Reliability standards. Any such actions related to the interruption of customers, reconfiguration of the system, or operational preparations for the next Contingency are expected to be included in an Operating Plan, if such actions are required by System Operators to address SOL exceedances.</p>

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	<p>its Operating Plan(s) for next-day operations identified in Requirement R2 to its Reliability Coordinator.</p> <p>4. <u>TOP-012-3, Requirement R14</u>: Each Transmission Operator shall initiate its Operating Plan to mitigate a SOL exceedance identified as part of its Real-time monitoring or Real-time Assessment.</p> <p>5. <u>IRO-008-2, Requirement R2</u>: Each Reliability Coordinator shall have a coordinated Operating Plan(s) for next-day operations to address potential System Operating Limit (SOL) and Interconnection Reliability Operating Limit (IROL) exceedances identified as a result of its Operational Planning Analysis as performed in Requirement R1 while considering the Operating Plans for the next-day provided by its Transmission Operators and Balancing Authorities.</p> <p>6. <u>IRO-008-2, Requirement R3</u>: Each Reliability Coordinator shall notify</p>	<p>In the current body of TOP and IRO reliability standards, the Operating Plan is the mechanism for addressing SOL exceedances. The mitigation actions that System Operators take to prevent or address SOL exceedances are expected to be contained within the Operating Plan. TOPs need to have the flexibility in their Operating Plan to address the wide-ranging operational issues they may encounter. There is no reliability need for reliability standards to provide such highly prescriptive requirements which specify how TOPs are to operate the system.</p> <p>Because the development and implementation of Operating Plans is addressed in the current body of reliability standards, reliability is not compromised by the removal of FAC-011-3, Requirement R2, R2.3 and R2.4.</p> <p>Any concepts in this section may need to be retained are better suited in a Reliability Guideline (e.g., Reliability Guideline for the development of Operating Plans) rather</p>



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	<p>impacted entities identified in its Operating Plan(s) cited in Requirement R2 as to their role in such plan(s).</p> <p>7. IRO-008-2, Requirement R5: Each Reliability Coordinator shall notify impacted Transmission Operators and Balancing Authorities within its Reliability Coordinator Area, and other impacted Reliability Coordinators as indicated in its Operating Plan, when the System Operating Limit (SOL) or Interconnection Reliability Operating Limit (IROL) exceedance identified in Requirement R5 has been prevented or mitigated.</p>	<p>than a NERC Reliability Standard requirement.</p>
<p>FAC-011-3, Requirement R3, R3.1</p> <p>R3. The Reliability Coordinator’s methodology for determining SOLs, shall include, as a minimum, a description of the following, along with any reliability margins applied for each:</p>	<p>FAC-011-4, Requirement R4, Part 4.5</p> <p>R4. Each Reliability Coordinator shall include in its SOL Methodology the method for determining the stability limits to be used in operations. The method shall:</p> <p>4.5. Describe the level of detail that is required for the study model(s), including</p>	<p>FAC-011-3, Requirement R3, R3.1 and R3.4 both address the study model. These two requirements are addressed with the single requirement in proposed FAC-011-4, Requirement R4, Part 4.5.</p> <p>Facility Ratings are created and provided through FAC-008 and further examined</p>

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<p>R3.1 Study model (must include at least the entire Reliability Coordinator Area as well as the critical modeling details from other Reliability Coordinator Areas that would impact the Facility or Facilities under study.)</p>	<p>the extent of the Reliability Coordinator Area, as well as the critical modeling details from other Reliability Coordinator Areas, necessary to determine different types of stability limits.</p>	<p>through FAC-011-4, Requirement R2. System Voltage Limits are created per FAC-011-4, Requirement R3. Neither of these types of SOLs are necessarily a byproduct of a “study” or study model. As a result, no study model reference is needed in FAC-011-4 for Facility Ratings or System Voltage Limits.</p> <p>However, for those RCs or TOPs that determine stability limits, a study model is needed to perform the “study”. Therefore, the level of detail of the study model falls under the requirement associated with establishing stability limits (R4).</p> <p>FAC-011-4, Requirement R4, Part 4.5 affords the RC with the flexibility to the extent of the modeling area (including other RC areas) that must be modeled to reflect the varying needs for different types of stability limits (e.g. local single unit stability up to wide-area or inter-area instability). Part 4.5 acknowledges that some types of localized stability issues do not require a model of</p>

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		the entire RC area to establish certain types of stability limits.
<p>FAC-011-3, Requirement R3, R3.2</p> <p>R3.2 [The RC’s SOL Methodology shall include] Selection of applicable Contingencies</p>	<p>FAC-011-4, Requirement R5</p> <p>R5. Each Reliability Coordinator shall include in its SOL Methodology the method for identifying the single Contingencies and multiple Contingencies for use in determining stability limits and performing Operational Planning Analyses (OPAs) and Real-time Assessments (RTAs). The method shall include:</p> <p>5.1. The following list of single Contingency events for use in determining stability limits and performing OPAs and RTAs:</p> <p>5.1.1. Loss of any of the following, either by single phase to ground or three phase Fault (whichever is more severe) with normal clearing, or without a Fault:</p> <ul style="list-style-type: none"> <li>• generator;</li> <li>• transmission circuit;</li> <li>• transformer;</li> </ul>	<p>All requirements regarding Contingencies are consolidated and addressed in proposed FAC-011-4, Requirement R5.</p>

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Requirement in Approved Standard	Translation to New Standard or Other Action	Description and Change Justification
	<ul style="list-style-type: none"> <li>• shunt device;</li> <li>• single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system.</li> </ul> <p>5.2. Any additional types of single Contingency events identified for use in determining stability limits, or for use in performing OPAs and RTAs.</p> <p>5.3. Any types of multiple Contingency events identified for use in determining stability limits, or for use in performing OPAs and RTAs.</p> <p>5.4. The method for considering the Contingency events provided by the Planning Coordinator in accordance with FAC-015-1 Requirement R6 to identify the Contingencies for use in determining stability limits.</p>	
<p>FAC-011-3, Requirement R3, R3.3 and R3.3.1.</p> <p>R3.3 [The RC’s SOL Methodology shall include] A process for determining which of the stability limits associated with the list of</p>	<p>FAC-011-4, Requirement R5, Part 5.4</p> <p>R5. Each Reliability Coordinator shall include in its SOL Methodology the method for identifying the single Contingencies and</p>	<p>FAC-011-4, Requirement R5, Part 5.4 and FAC-015-1 Requirement R6 address the reliability objective in FAC-011-3, Requirement R3, R3.3.1.</p>

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<p>multiple contingencies (provided by the Planning Authority in accordance with FAC-014, Requirement 6) are applicable for use in the operating horizon given the actual or expected system conditions.</p> <p>R3.3.1. This process shall address the need to modify these limits, to modify the list of limits, and to modify the list of associated multiple contingencies.</p>	<p>multiple Contingencies for use in determining stability limits and performing Operational Planning Analyses (OPAs) and Real-time Assessments (RTAs). The method shall include:</p> <p>5.4. The method for considering the Contingency events provided by the Planning Coordinator in accordance with FAC-015-1 Requirement R6 to identify the Contingencies for use in determining stability limits.</p> <p>FAC-015-1 Requirement R6:</p> <p>R6. Each Planning Coordinator shall communicate any instability, Cascading or uncontrolled separation identified in either its Planning Assessment of the Near-Term Transmission Planning Horizon or its Transfer Capability assessment to each impacted Reliability Coordinator and Transmission Operator. This communication shall include:</p>	<p>In FAC-015-1, Requirement R6, the Planning Coordinator is required to identify and communicate any instability, Cascading, or uncontrolled separation, as well as the related information contained in the Parts of Requirement R6, to the RC and associated TOPs. Once the RC receives this information, the RC then applies the method required by FAC-011-4, Requirement R5, Part 5.4 for considering those Contingencies for use in determining stability limits.</p> <p>These requirements collectively address the reliability objectives of FAC-011-3, Requirement R3, R3.1.</p>

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	<p>6.1 The type of instability identified (e.g., voltage collapse, angular instability, transient voltage dip criteria violation);</p> <p>6.2 The associated stability criteria used as part of determining the instability;</p> <p>6.3 The associated Contingency(ies) which result(s) in the instability, Cascading or uncontrolled separation;</p> <p>6.4 Any Remedial Action Scheme action, under voltage load shedding (UVLS) action, under frequency load shedding (UFLS) action, interruption of Firm Transmission Service, or Non-Consequential Load Loss required to address the instability, Cascading or uncontrolled separation;</p> <p>6.5 Any Corrective Action Plan associated with the instability, Cascading or uncontrolled separation.</p>	
<p>FAC-011-3, Requirement 3, R3.4.</p> <p>R3.4 [The RC’s SOL Methodology shall include] Level of detail of system models used to determine SOLs.</p>	<p>FAC-011-4, Requirement R4, Part 4.5</p> <p>R4. Each Reliability Coordinator shall include in its SOL Methodology the method</p>	<p>Reference the explanation provided for FAC-011-3, Requirement R3, R3.1.</p>

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Requirement in Approved Standard	Translation to New Standard or Other Action	Description and Change Justification
	<p>for determining the stability limits to be used in operations. The method shall:</p> <p>4.5. Describe the level of detail that is required for the study model(s), including the extent of the Reliability Coordinator Area, as well as the critical modeling details from other Reliability Coordinator Areas, necessary to determine different types of stability limits.</p>	
<p>FAC-011-3, Requirement R3, R3.5. R3.5 [The RC’s SOL Methodology shall include] Allowed uses of Remedial Action Schemes.</p>	<p>FAC-011-4, Requirement R4, Part 4.6</p> <p>R4. Each Reliability Coordinator shall include in its SOL Methodology the method for determining the stability limits to be used in operations. The method shall:</p> <p>4.6. Describe the allowed uses of Remedial Action Schemes (RAS) and other automatic post-Contingency mitigation actions<sup>1</sup>.</p> <p>Footnote 1 states “The planned use of underfrequency load-shedding (UFLS) is not allowed in the establishment of stability limits.”</p>	<p>FAC-011-3, Requirement R3, R3.5 was carried over into FAC-011-4, Requirement R4, Part 4.6. The requirement has been clarified by including other automatic mitigation actions that are not a RAS, for example UVLS.</p>

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<p>FAC-011-3, Requirement R3, R3.6.</p> <p>R3.6 [The RC’s SOL Methodology shall include] Anticipated transmission system configuration, generation dispatch and Load level</p>	<p>FAC-011-4, Requirement R4, Part 4.4:</p> <p>R4. Each Reliability Coordinator shall include in its SOL Methodology the method for determining the stability limits to be used in operations. The method shall:</p> <p>4.4. Describe how instability risks are identified, considering levels of transfers, Load and generation dispatch, and System conditions including any changes to System topology such as Facility outages;</p> <p><u>TOP-002-4, Requirement R1</u>: Each Transmission Operator shall have an Operational Planning Analysis that will allow it to assess whether its planned operations for the next day within its Transmission Operator Area will exceed any of its System Operating Limits (SOLs).</p> <p><u>IRO-008-2, Requirement R1</u>: Each Reliability Coordinator shall perform an Operational Planning Analysis that will allow it to assess whether the planned operations for the next-day will exceed System Operating Limits (SOLs) and Interconnection Operating</p>	<p>The requirements in FAC-011-3, Requirement R3, R3.6 are addressed in proposed FAC-011-4, Requirement R4, Part 4.4.</p> <p>Part 4.4 was included as a Part to Requirement R4 because the information is relevant to the establishment of stability limits. Facility Ratings are created and provided through FAC-008 and further examined through FAC-011-4, Requirement R2, and System Voltage Limits are created through FAC-011-4, Requirement R3. Neither of these types of SOLs are necessarily a byproduct of a “study” or study model that requires inclusion of the items in FAC-011-3, Requirement R3, R3.6.</p> <p>Additionally, TOP-002-4, Requirement R1 and IRO-008-2, Requirement R1 require the TOP and the RC respectively to have/perform an OPA.</p> <p>Per the definition of OPA, the OPA shall reflect applicable inputs which include the</p>



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	<p>Reliability Limits (IROLs) within its Wide Area.</p> <p><u>Operational Planning Analysis</u> is defined in the NERC Glossary of Terms as “An evaluation of projected system conditions to assess anticipated (pre-Contingency) and potential (post-Contingency) conditions for next-day operations. The evaluation shall reflect applicable inputs including, but not limited to, load forecasts; generation output levels; Interchange; known Protection System and Special Protection System status or degradation; Transmission outages; generator outages; Facility Ratings; and identified phase angle and equipment limitations. (Operational Planning Analysis may be provided through internal systems or through third-party services.)”</p>	<p>items required by FAC-011-3, Requirement R3, R3.6.</p> <p>Accordingly, when stability limits include the information required in Requirement R4, and the TOPs and RCs perform their required OPAs, the information in FAC-011-3, Requirement R3, R3.6 is inherently addressed.</p>
<p>FAC-011-3, Requirement R3, R3.7.</p> <p>R3.7 [The RC’s SOL Methodology shall include] Criteria for determining when violating a SOL qualifies as an Interconnection Reliability</p>	<p>FAC-011-4, Requirement R6, Part 6.2</p> <p>R6.2 Criteria for determining when violating a SOL qualifies as an Interconnection Reliability Operating Limit (IROL) and</p>	<p>The reliability objective of FAC-011-3, Requirement R3, R3.7 was carried over into FAC-011-4, Requirement R6, Part 6.2.</p>

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Requirement in Approved Standard	Translation to New Standard or Other Action	Description and Change Justification
<p>Operating Limit (IROL) and criteria for developing any associated IROL <math>T_v</math>.</p>	<p>criteria for developing any associated IROL <math>T_v</math>.</p>	
<p>FAC-011-3, Requirement R4 and Requirement R4.1:</p> <p>R4. The Reliability Coordinator shall issue its SOL Methodology and any changes to that methodology, prior to the effectiveness of the Methodology or of a change to the Methodology, to all of the following:</p> <p>R4.1. Each adjacent Reliability Coordinator and each Reliability Coordinator that indicated it has a reliability-related need for the methodology.</p>	<p>FAC-011-4, Requirement R8, Parts 8.1 and 8.4:</p> <p>R8. Each Reliability Coordinator shall provide its new or revised SOL Methodology to:</p> <p>8.1. Each adjacent Reliability Coordinator within its Interconnection prior to the effective date of the SOL Methodology;</p> <p>8.4. Each requesting Reliability Coordinator that indicates a reliability-related need and is not considered adjacent in Part 8.1, within 30 calendar days of receiving the request.</p>	<p>The reliability objective of FAC-011-3, Requirement R4 was carried over to FAC-011-4, Requirement R8, Parts 8.1 and 8.4</p> <p>Clarifications were made in Part 8.1 that adjacent RCs include those within an Interconnection. This was added to clarify the intent of adjacent RCs for the purposes of communicating SOL Methodologies. These adjacent RCs are required to receive the SOL Methodology prior to the effective date of the Methodology because they can be directly impacted by it.</p> <p>Non-adjacent RCs, which are addressed in Part 8.4, do not require communication of the SOL Methodology prior to its effective date because these RCs are less likely to be directly impacted; however, provisions are made with Part 8.4 for non-adjacent RCs to obtain the SOL Methodology within 30 days of the request if they indicate a reliability-related need for it.</p>

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<p>FAC-011-3, Requirement R4, R4.2</p> <p>R4.2 [communicate the SOL Methodology to] Each Planning Authority and Transmission Planner that models any portion of the Reliability Coordinator’s Reliability Coordinator Area.</p>	<p>FAC-011-4, Requirement R8, Part 8.2</p> <p>R8. Each Reliability Coordinator shall provide its new or revised SOL Methodology to:</p> <p>8.2. Each Planning Coordinator and Transmission Planner responsible for planning any portion of the Reliability Coordinator Area prior to the effective date of the SOL Methodology;</p>	<p>The language was changed to better reflect the intent of the requirement. The requirement is intended to addresses PCs and TPs that are responsible for planning within the RC Area.</p>
<p>FAC-011-3, Requirement R4, R4.3</p> <p>R4.3 [communicate the SOL Methodology to] Each Transmission Operator that operates in the Reliability Coordinator Area.</p>	<p>FAC-011-4, Requirement R8, Part 8.3</p> <p>R8. Each Reliability Coordinator shall provide its new or revised SOL Methodology to:</p> <p>8.3. Each Transmission Operator within its Reliability Coordinator Area prior to the effective date of the SOL Methodology;</p>	<p>The reliability objective of FAC-011-3, Requirement R4, R4.3 was carried over to FAC-011-4, Requirement R8, Part 8.3.</p>