

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 <u>documented</u> methodology for establishing SOLs (“(i.e., 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 which owner-provided Facility Ratings <u>are</u> to be used in operations. The method shall address the use of common Facility Ratings between the Reliability Coordinator and such that the Transmission Operators <u>Operator and</u> its Reliability Coordinator Area <u>use common Facility Ratings</u>.</p> <p><u>Operational Planning Analysis</u> is defined in the NERC Glossary of Terms as "An <i>evaluation of projected system conditions to</i></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>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.)”</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</p>	

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	<p><i>and equipment limitations. (Real-time Assessment may be provided through internal systems or through third-party services.)”</i></p>	
<p>FAC-011-3, Requirement R1, R1.3. [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 R6R7 and Part 67.1. R6R7. Each Reliability Coordinator shall include in its SOL Methodology 67.1. A description of how to identify the subset of SOLs that qualify as <u>Interconnection Reliability Operating Limits (IROs)</u>.</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. R2. The Reliability Coordinator’s SOL Methodology shall include a requirement that SOLs provide BES performance consistent with the following: 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</p>	<p>These requirements are addressed in:</p> <ol style="list-style-type: none"> 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. 2. The definition of OPA and RTA 	<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</p>

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<p>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>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>3. FAC-011-4, Requirement R4 addresses the establishment of stability limits and the associated performance requirements.</p> <p>4. FAC-011-4 Requirement R6 and its Parts relating to IROs.</p> <p>5. The definition of IROL and the TOP and IRO standards that address operation within IROs.</p> <p><u>TOP-002-4, Requirement R1: 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).</u></p> <p><u>TOP-001-4, Requirement R2: 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.</u></p>	<p>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 implementation of an Operating Plan to address that SOL exceedance.</p> <p>The items in approved FAC-011-3, Requirement R2.1 and its sub-requirements R2.2 are addressed through the related TOP standards that reference SOL exceedance proposed FAC-011-4, Requirement R6 and its subparts as well as proposed FAC-014-3 R7.</p> <ol style="list-style-type: none"> 1. Per TOP-002-4, Requirement R1, TOPs have OPAs to identify SOL exceedances. 2. Per TOP-002-4, Requirement R2, TOPs develop Operating Plans for SOL exceedances identified in the OPA. 3. Per TOP-001-3, Requirement R13, TOPs perform RTAs at least once

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	<p>TOP-001-4, Requirement R13: Each Transmission Operator shall ensure that a Real-time Assessment is performed at least once every 30 minutes.</p> <p>TOP-001-4, Requirement R14: 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>IRO-008-2, Requirement R1: 6.1, 6.2, 6.3, and 6.4. 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>IRO-008-2, Requirement R2: 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</p>	<p>every 30 minutes to identify SOL exceedances.</p> <p>4. Per TOP-001-3, Requirement R14, TOPs implement Operating Plans to mitigate SOL exceedances.</p> <p>5. Per IRO-008-2, Requirement R1, RCs perform OPAs to identify SOL and IROL exceedances.</p> <p>6. Per IRO-008-2, Requirement R2, RCs develop coordinated Operating Plans for SOL and IROL exceedances identified in its OPA.</p> <p>7. Per IRO-008-2, Requirement R4, RCs perform RTAs at least once every 30 minutes to identify SOL and IROL exceedances.</p> <p>8. Per IRO-008-2, Requirement R5, RCs notify TOPs and BAs of SOL or IROL exceedances identified in its RTA.</p> <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</i></p>

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	<p>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>IRO-008-2, Requirement R4: Each Reliability Coordinator shall ensure that a Real-time Assessment is performed at least once every 30 minutes.</p> <p>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 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>Operational Planning Analysis is defined in the NERC Glossary of Terms as “An evaluation of projected system conditions to</p>	<p>shall reflect changes to system topology such as Facility outages” 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 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>While FAC-011-3 R2.1 focuses on pre-contingency BES performance for all three types of SOL (Facility Ratings, System</p>

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	<p>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><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</p>	<p><u>Voltage Limits and stability limits) together, FAC-011-4 Requirement R6 Parts R6.1, 6.1.1, 6.1.2, and 6.1.3 divide system performance requirements for the pre-contingency state (N-0) into each of the three categories (Facility Ratings, System Voltage Limits, and stability limits) into its own subpart for clarity. Cascading and uncontrolled separation were included in Part 6.1.3. The proposed language adds clarity by clearly identifying expectations relative to normal and emergency Facility Ratings and System Voltage Limits.</u></p> <p>Similarly, FAC-011-3 Requirement R2.2 focuses on post-contingency BES performance for all three types of SOL (Facility Ratings, System Voltage Limits and stability limits) together, FAC-011-4 Requirement R6 Parts 6.2, 6.2.1, 6.2.2, and 6.2.3 divides system performance requirements for the evaluation of Contingencies against the pre-Contingency state for the anticipated post-Contingency</p>

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	<p>and equipment limitations. (Real time Assessment may be provided through internal systems or through third party services.)”</p> <p>FAC 011-4 Requirement 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, at a minimum, 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><u>state (N-1) or (N-x) into each of the three categories (Facility Ratings, System Voltage Limits, and stability limits) into its own subpart for clarity. Cascading and uncontrolled separation were included in Part 6.2.3. The proposed language adds clarity by clearly identifying expectations relative to normal and emergency Facility Ratings and System Voltage Limits.</u></p> <p><u>In a similar fashion, Part 6.3 identifies the minimum requirement for BES performance for those Contingencies identified in FAC-011-4 Requirement R5 Part 5.2 which is to demonstrate “that instability, Cascading, or uncontrolled separation does not occur.”</u></p> <p><u>FAC-011-4 Proposed Part 6.4 is meant to clearly delineate the system performance requirements related to establishing stability limits using the Contingencies identified in Requirement R5, Part 5.3.</u></p> <p><u>FAC-014-3, Requirement R7 supports FAC-011-4 Requirement R6 and its parts by requiring TOPs and RCs to use the</u></p>

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	<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 automatic post-Contingency mitigation actions.</p>	<p><u>performance criteria identified in the SOL Methodology.</u></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> <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</p>

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	<p>R6. IROL is defined in the NERC Glossary of Terms as—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. <u>performance criteria:</u></p> <p>FAC-011-4, Requirement 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 IROLs.</p> <p><u>6.1.</u> 6.2. Criteria for determining when violating a SOL qualifies as an Interconnection Reliability Operating Limit (IROL) and criteria for developing any associated IROL. <u>The actual pre-Contingency state (Real-time monitoring and Real-time</u></p>	<p>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 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</p>

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	<p><u>Assessment) and anticipated pre-Contingency state (Operational Planning Analysis) demonstrates the following:</u></p> <p><u>Flow through Facilities are within Normal Ratings; however, Emergency Ratings may be used only when System adjustments to return the flow within its Normal Rating can be executed and completed within the specified time =</u></p> <p>FAC-014-3, Requirement R1: 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>6.1.1. IRO-009-2, Requirement R3: Each Reliability Coordinator shall act</u></p>	<p>T_v, 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 T_v.</p>

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	<p>or direct others to act so that the magnitude and duration of an IROL exceedance is mitigated those <u>Emergency Ratings.</u></p> <p>6.1.2. <u>Voltages are within normal System Voltage Limits; however, emergency System Voltage Limits may be used only when System adjustments to return the voltage within its normal System Voltage Limits can be executed and completed within the specified time duration of those emergency System Voltage Limits.</u></p>	

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	<p><u>6.1.3. Instability, Cascading or uncontrolled separation do not occur.</u></p> <p><u>6.2. The evaluation of potential single Contingencies listed in Part 5.1.1 against the actual pre-Contingency state (Real-time monitoring and Real-time Assessments) and anticipated pre-Contingency state (Operational Planning Analysis) demonstrates the following:</u></p> <p><u>6.2.1. Flow through Facilities are within applicable Emergency Ratings, provided that System adjustments can be executed and completed within the specified time duration of those Emergency Ratings.</u></p>	

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	<p><u>Flow through a Facility must not be above the Facility's highest Emergency Rating.</u></p> <p><u>6.2.2. Voltages are within emergency System Voltage Limits.</u></p> <p><u>6.2.3. Instability, Cascading or uncontrolled separation do not occur.</u></p> <p><u>6.3. The evaluation of the potential Contingencies identified in Part 5.2 against the actual pre-Contingency state (Real-time monitoring and Real-time Assessments) and anticipated pre-Contingency state (Operational Planning Analysis) demonstrates that instability, Cascading, or</u></p>	

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	<p><u>uncontrolled separation does not occur.</u></p> <p><u>6.4. The evaluation of the potential Contingencies identified in Part 5.3 demonstrates that instability does not occur.</u></p> <p><u>6.5 In determining the System’s response to any Contingency identified in Parts 5.1 through 5.3, planned load shedding is acceptable only after all other available System adjustments have been made.</u></p> <p><u>FAC-014-3, Requirement IROL’s T_v, as identified R7.</u></p> <p><u>R7. Each Transmission Operator and Reliability Coordinator shall use the Bulk Electric System performance criteria specified in the Reliability Coordinator’s SOL Methodology when performing OPAs, RTAs,</u></p>	

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	<p>and Real-time monitoring or Real time Assessment to determine SOL exceedances.</p> <p>TOP-001-3, Requirement R12: Each Transmission Operator shall not operate outside any identified Interconnection Reliability Operating Limit (IROL) for a continuous duration exceeding its associated IROL T_v.</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 <u>to ground</u> or three phase Fault to ground (whichever is more severe) with normal clearing <u>Normal Clearing</u>, or without a Fault:</p> <ul style="list-style-type: none"> • generator; • transmission circuit; • transformer; • shunt device; 	<p>The requirements in approved FAC-011-3 were consolidated into a single requirement in proposed FAC-011-4- <u>Requirement R5, Part 5.1.1.</u></p> <p><u>FAC-011-4 Requirement R5, Part 5.1.1. is also referenced in FAC-011-4 Requirement R6, Part 6.2 for the system performance requirements for anticipated post-contingency state.</u></p>

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	<ul style="list-style-type: none"> single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system. 	
<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>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.<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, <u>at a minimum</u>, include the following:</p>	<p><u>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.”</u></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</p>

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<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 transmission system, and the transmission system topology.</p>	<p>4.1.1. steady-state voltage stability;</p> <p>4.1.2. transient voltage response;</p> <p>4.1.3. angular<u>unit</u> stability; <u>and</u></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>4.4. Describe how instability risks<u>stability limits</u> are identified<u>determined</u>, 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</p>	<p>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 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</p>

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	<p>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>4.7 State that the use of underfrequency load shedding (UFLS) and Undervoltage Load Shedding Programs are not allowed in the establishment of stability limits.</u></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"> <u>1. FAC-014-3, Requirement R8: In addressing any potential or actual SOL exceedances, each Reliability Coordinator and Transmission Operator shall allow for Non-Consequential Load Loss within their</u> 	<p>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 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. <u>The SDT has proposed retaining the concept captured in FAC-011-3 Requirement R2.3.2 in proposed FAC-011-4</u></p>

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	<p><u>Operating Plan only if all other means of System adjustments have been exhausted to prevent:</u></p> <ul style="list-style-type: none"> • <u>equipment damage, or</u> • <u>instability, Cascading, uncontrolled separation</u> <p>1-2. <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.</p> <p>2-3. <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).</p> <p>3-4. <u>TOP-002-4, Requirement R6:</u> Each Transmission Operator shall provide its Operating Plan(s) for next-day operations identified in</p>	<p><u>Requirement R6.5 albeit with improved language for clarity. Rather than specifying the operating conditions where interruption of network customers is allowed, the SDT has clarified when planned load shedding is acceptable. This recognizes that RTAs must be conducted every 30 minutes (i.e. system is constantly being evaluated and readjusted at least every 30 minutes) as well as incorporating the principle that load shed will be a measure of last resort as supported by FERC Orders (e.g. FERC Order 693 para 591.) While a System Operator maintains authority to take whatever action is needed to ensure reliability, entities should not “plan” to shed load until all other system adjustments (e.g. generation commitment, generation redispatch, transmission system adjustments, interruptible loads, etc.) have been made.</u></p> <p><u>Regarding The FAC-011-3 Requirement R2.4, 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</u></p>

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	<p>Requirement R2 to its Reliability Coordinator.</p> <p>4.5. <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>5.6. <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>6.7. <u>IRO-008-2, Requirement R3</u>: Each Reliability Coordinator shall notify impacted entities identified in</p>	<p>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> <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</p>

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	<p>its Operating Plan(s) cited in Requirement R2 as to their role in such plan(s).</p> <p><u>8. 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 System Operating Limit (SOL) or Interconnection Reliability Operating Limit (IROL) exceedance identified in Requirement R5 has been prevented or mitigated.</p> <p><u>The SDT has proposed retaining the concept captured in FAC-011-3 R2.3.2 in proposed FAC-011-4 R6.5 albeit with improved language for clarity.</u></p> <p><u>FAC-011-4 Requirement R6. Each Reliability Coordinator shall include in its SOL Methodology, at a minimum, the following Bulk Electric System performance criteria:</u></p>	<p>addressed in the current body of reliability standards <u>and proposed FAC-011-4 Requirement 6.5</u>, 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 than a NERC Reliability Standard requirement.</p>

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	<p><u>R.6.5 In determining the System’s response to any Contingency identified in Parts 5.1 through 5.3, planned load shedding is acceptable only after all other available System adjustments have been made.</u></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>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>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 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, R3.1 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 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</p>

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		<p>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 the entire RC area to establish certain types of stability limits.</p>
<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<u>identify</u> in its SOL Methodology the method for identifying the single Contingencies and multiple Contingencies<u>Contingency events</u> for use in determining stability limits and performing Operational Planning Analyses<u>Analysis</u> (OPAs) and Real-time Assessments (RTAs).]</p>	<p>All requirements regarding Contingencies are consolidated and addressed in proposed FAC-011-4, Requirement R5.</p>

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	<p>for the area under study. The method<u>SOL Methodology</u> shall include:</p> <p>5.1. The<u>Specify the</u> 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<u>Normal Clearing</u>, or without a Fault:</p> <ul style="list-style-type: none"> • generator; • transmission circuit; • transformer; • shunt device; • single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system. <p>5.2. —Any<u>Identify any</u> additional types of single Contingency events identified for use in determining stability limits, or <u>multiple</u></p>	

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	<p><u>Contingency events or types of Contingency events</u> for use in performing OPAs and RTAs.</p> <p>5.3. Any types of <u>Identify any additional single or multiple Contingency events identified or types of Contingency events</u> for use in determining stability limits, or for use in performing OPAs and RTAs.</p> <p>5.4. The <u>Describe the</u> method(s) for considering identifying which, if any, of the Contingency events provided by the Planning Coordinator in accordance with FAC-015-1, Requirement R6R4, to <u>identify the Contingencies for</u> 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 multiple contingencies (provided by the Planning Authority in accordance with FAC-014, Requirement 6) are applicable for use in</p>	<p>FAC-011-4, Requirement R5, Part 5.4</p> <p>R5. Each Reliability Coordinator shall include <u>identify</u> in its SOL Methodology the method for identifying the single Contingencies and multiple Contingencies Contingency events for use in determining stability limits and performing Operational Planning Analyses <u>Analysis</u> (OPAs) and Real-</p>	<p>FAC-011-4, Requirement R5, Part 5.4 and FAC-015-1 Requirement R6R4 address the reliability objective in FAC-011-3, Requirement R3, R3.3.1.</p> <p>In FAC-015-1, Requirement R6R4, the Planning Coordinator is required to identify and communicate any instability, Cascading, or uncontrolled separation, as well as the</p>

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<p>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>time Assessments (RTAs) for the area under study. The method SOL Methodology shall include:</p> <p>5.4. The Describe the method(s) for considering identifying which, if any, of the Contingency events provided by the Planning Coordinator in accordance with FAC-015-1, Requirement R6R4, to identify the Contingencies for use in determining stability limits.</p> <p>FAC-015-1 Requirement R6R4:</p> <p>R6R4. 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>related information contained in the Parts of Requirement R6R4, 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>6.4.1 The type of instability identified (e.g., voltage collapse, angular instability, transient voltage dip criteria violation);</p> <p>6.4.2 The associated stability criteria used as part of determining the instability;</p> <p>6.4.3 The associated Contingency(ies) which result(s) in the instability, Cascading or uncontrolled separation;</p> <p>6.4—<u>4.4</u> <u>A description of the studied system conditions when the instability, Cascading or uncontrolled separation was identified;</u></p> <p><u>4.5</u> 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; <u>and</u></p> <p><u>4.6-5</u> Any Corrective Action Plan associated with the instability, Cascading or uncontrolled separation.</p>	

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<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 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>Reference the explanation provided for FAC-011-3, Requirement R3, R3.1.</p>
<p>FAC-011-3, Requirement R3, R3.5.</p> <p>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 <u>and Part 4.7</u></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 actions¹ <u>actions</u>.</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. <u>adding Part 4.7 which restricts the use of UFLS programs and UVLS Programs in the establishment of stability limits.</u></p>

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	<p>Footnote 1 states “The planned</p> <p>4.7 State that the use of underfrequency load shedding (UFLS) is <u>programs and Undervoltage Load Shedding (UVLS) Programs are</u> not allowed in the establishment of stability limits.”.</p>	
<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 <u>stability limits are determined</u>, 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</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>

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	<p>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 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</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 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>

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	<i>may be provided through internal systems or through third-party services.)”</i>	
<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 Operating Limit (IROL) and criteria for developing any associated IROL T_v.</p>	<p>FAC-011-4, Requirement R6R7, Part 67.2</p> <p>R6.2 Criteria for determining when violating a SOL qualifies as an Interconnection Reliability Operating Limit (IROL) and criteria for developing any associated IROL T_v.</p>	<p>The reliability objective of FAC-011-3, Requirement R3, R3.7 was carried over into FAC-011-4, Requirement R6R7, Part 67.2.</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 R8R9, Parts 89.1, 9.2.1 and 89.2.4:</p> <p>R8R9. Each Reliability Coordinator shall provide its new or revised SOL Methodology to:</p> <p>89.1. 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 requests and indicates it has 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 R8R9, Parts 89.1, 9.2.1 and 89.2.4.</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>

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	<p><u>9.2. Each of the following entities prior to the effective date of the SOL methodology:</u></p> <p><u>9.2.1. Each adjacent Reliability Coordinator within an Interconnection</u></p> <p><u>9.2.4. Each Reliability Coordinator that has requested to receive updates and indicated it had a reliability-related need.</u></p>	<p><u>FAC-011-4 Requirement 9 was re-organized to address timely provisions of the RC's Methodology to requesting RCs in Part 9.1 and to those entities that are directly impacted and therefore must be informed for any change, in Part 9.2.</u></p> <p>Non-adjacent RCs, which are addressed in Part 8<u>Parts 9.1 and 9.2.4,</u> 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<u>Parts 9.1 and 9.2.4</u> for non-adjacent RCs to obtain the SOL Methodology within 30 days of the request if they indicate a reliability-related need for it. <u>Part 9.2 also includes a requirement to provide the SOL Methodology as soon as practicable if a change was necessary to address a reliability issue. This provides flexibility for an RC to make reliability needed changes to its SOL Methodology quickly.</u></p>
FAC-011-3, Requirement R4, R4.2	FAC-011-4, Requirement R8 <u>R9</u> , Part 8 <u>9</u> .2 and subpart <u>9.2.2</u> .	The language was changed to better reflect the intent of the requirement. The

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<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>R8-R9. Each Reliability Coordinator shall provide its new or revised-SOL Methodology to:</p> <p><u>89.2. Each of the following entities prior to the effective date of the SOL methodology:</u></p> <p><u>9.2.2.</u> Each Planning Coordinator and Transmission Planner <u>that is</u> responsible for planning any portion of the Reliability Coordinator Area prior to the effective date of the SOL Methodology;</p>	<p>requirement is intended to addresses PCs and TPs that are responsible for planning within the RC Area- <u>rather than just because it has a model for an RC Area.</u></p>
<p>FAC-011-3, Requirement R4, R4.3 R4.3 [communicate the SOL Methodology to] Each Transmission Operator that operates in the Reliability Coordinator Area.</p>	<p>FAC-011-4, Requirement R8R9, Part <u>89.2 and subpart 9.2.3.</u></p> <p>R8R9. Each Reliability Coordinator shall provide its new or revised SOL Methodology to:</p> <p>8.39.2. Each <u>of the following entities prior to the effective date of the SOL methodology:</u></p> <p><u>9.2.3</u> 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 R8R9, Part <u>89.2. and Subpart 9.2.3.</u></p>

