

Project 2015-09 – System Operating Limits Drafting Team Meeting Notes

Tuesday, January 13, 2016 | 8:30 AM – 5:00 PM, EST
Wednesday, January 14, 2016 | 8:30 AM – 5:00 PM, EST

Orlando Utilities Commission
6003 Pershing Ave
Orlando, FL 32822

ReadyTalk | Dial In: 1-866-740-1260 | Access Code: 5216143 | Security Code: 11316

Attendees:

Name	Company	Member/ Observer	In-person (IP)/ Web (W)	
			1/13	1/14
Vic Howell	Peak Reliability	Chair	IP	IP
Hari Singh	Xcel Energy	Vice-chair	IP	IP
David Bueche	CenterPoint Energy	Member	IP	IP
David Hislop	PJM Interconnection	Member	IP	IP
Samuel Jager	Independent Electricity System Operator	Member	IP	IP
Dean LaForest	ISO New England	Member	IP	IP
Thomas Leslie	Georgia Transmission Corp	Member	IP	IP
Jason Smith	Southwest Power Pool	Member	IP	IP
Stephen Solis	Electric Reliability Council of Texas	Member	IP	IP
Aaron Staley	Orlando Utilities Commission	Member	IP	IP
Dede Subakti	California ISO	Member	IP	IP
Kumar Agarwal	FERC	Observer	W	W
Dennis Fuentes Pedrosa	FERC	Observer	IP	IP
Mike Steckelberg	Great River Energy	Observer	IP	IP
Li Fang	Orlando Utilities Commission	Observer	IP	IP
Guy Zito	NPCC	Observer	IP	--
Lacey Ourso	NERC – Standards	NERC staff	IP	IP
Mark Olson	NERC – Standards	NERC staff	IP	IP

Agenda Items:

1. Welcome and administrative items (NERC Antitrust Guidelines, public meeting notice, etc.)
2. Discuss meeting objective(s)
3. Group discussion, evaluation and resolution of issues list: Bucket 1 – Definition of SOL, IROL and SOL Exceedance
4. Update project schedule and work plan
5. Next steps
6. Action items

Meeting Notes:

Roundtable discussion regarding individual understanding and application of SOL definition:

1. **D. Hislop (PJM)**
 - a. PJM identifies which Facilities SOLs are established for (to include all BES Facilities and some designated non-BES elements that may impact reliability; for example: previously designated 230kv and above).
 - b. Stability limits and reactive transfer limits are moving/dynamic calculation (not a static number); these are calculated in real-time. Also, it is possible for Facility ratings to be dynamic calculation.
 - c. SOL Exceedance is a time-based issue. You would violate the applicable Rating based on time; an exceedance for a pre-determined amount of time may be a violation.
2. **D. Bueche and S. Solis (Texas)**
 - a. Similar to PJM except for voltage drop, which is not labeled as a SOL unless it is the most restrictive or limiting at a specific point in time (or condition). The SOL is determined/defined at the time of the study.
 - b. Every Facility has thermal limitations, therefore, every Facility must have an SOL. For the most part, Facility Ratings will be the SOL, but in some instances, stability limits will.
 - c. Texas RE monitors all BES Facilities for SOL exceedance...operating actions to eliminate the SOL exceedance are determined
 - d. Facility ratings:
 - i. pre-Contingency (base case) – if you go over, it’s an SOL exceedance. For system voltage limits, determination is whether it is outside of normal limits (low and high).
 - ii. post-Contingency (emergency) - if over the 2 hour limit, SOL exceedance
 - e. Stability limits
 - i. pre-calculate N-1 limits – if flow exceeds limit, this is SOL exceedance
 - ii. limit is calculated to ensure acceptable post-Contingency performance; but limit is only monitored pre-Contingency
 - iii. keeping actual flows within the limit ensures acceptable post-Contingency performance
 - f. Voltage limits
 - i. normal (actual base case)
 - ii. emergency (wider band; post-Contingency exceedances)
 - g. other “operating limits” – weighted short circuit ratio (WCR) and sub- synchronous oscillation (SSO)
3. **H. Singh**
 - a. Provided background regarding “operating limits.” In 2002, NERC OC established the “operating limit” task force. Previously “operating security limit” was defined term but inconsistent understanding by industry. OC came up with (1) system operating limit and (2) IROL. Both limits served to identify what adverse effects could negatively impact the system. Difference was supposed to be SOL that is something that affects a limited set of Facilities, not the entire Interconnection. The limited set is essentially the Flowgates. IROLs were intended to focus on limits that pose serious threat to reliability of BPS, including instability, Cascading, etc. to raise to the level of IROL – it needed to relate to interconnection integrity. Previously, OSL was not applied for all facilities but only to those that impact the system; however, the problem was that: (1) no clear delineation regarding what “some impact to the system” meant and (2) there is no TOP standard that requires an entity to operate within their Facility Rating. In operating horizon, no standard that required TOP to operate within the Facility Rating and voltage limit. Instead they just

used “SOL” – so, if modify SOL to only include those Facilities that could “affect a limited set of Facilities.” But then, what happens to the rest of the BES Facilities that do not fall into this category? What is “limited impact?”

4. D. LaForest

- a. All current-carrying Elements have thermal ratings, which in the operational space, have limits (data points that are housed in a database). These are potentially a system operating limit at any given time (*i.e.*, Have ratings for short-term emergency, long-term emergency, etc). For example, TO provides rating to the PC. Then, in operations space, at that point it may become a SOL. Operations may take the rating provided by the owner, and operate more conservatively (*i.e.*, 150 operated at 100).
 - b. Facility Rating
 - i. Have uniform definition of rating throughout entire footprint – which is different than other areas. This is possible because both the PC and RC for the area. Allows for a uniform methodology to be used in planning and carried forward to operations.
 - ii. Operating philosophy – give TOP option that if in real-time, exceed rating, it becomes an enhanced rating. May avoid pre-Contingency load shedding. Drastic limits with pre-determined system conditions, owner allowed to elect to shed load or give essential operating steps for TOP to take. For example: a load pocket with voltage issues: may want to change rating to address the issue instead of pre-Contingency load shedding.
 - c. Voltage limits
 - i. Duplicative of thermal – with high/low and time based: Normal, short-term emergency, long-term emergency; pre- and post-Contingency.
 - ii. Maintain one document identifying and classifying all voltage limits (which is one part of the set of operating documents). This defines what level constitutes voltage collapse (which is an SOL exceedance). Provides for allowable exceedance of low voltage on radial line (not an SOL exceedance because does not impact the system) and considered differently only when considered pre-Contingency load shedding. Range limits are provided by the asset owner.
 - iii. The distinction between SOL vs. IROL is based on MW. IROL = 1200MW
 - d. Stability limits and reactive voltage limits
 - i. Typically determined by RC for defined interfaces or groupings of 1+ generators
 - ii. Moving targets; monitored in real-time
 - iii. Limits adjusted through outage coordination, topology changes, generation dispatch. Adjusted through EMS or if not a previously studied conditions, operation staff determination.
 - e. “SOL exceedance” – Limited to when timer is applicable. When you are above the highest limit (per RTCA or monitoring) or no other actions possible except for very extreme. If operating in a state where you will exceed the highest or lowest available voltage limit. For stability and voltage reactive limits: any monitored value in excess of the limit is an exceedance (pre-defined Contingencies and defined system criteria). Similar to Texas RE in that SSR and control function predictability are built-in.
- 5. J. Smith (SPP):** Planners perform planning study (work with the Transmission Planner to review inputs and assumptions and from this determine the SOL/ flowgates); then, they provide seasonal assessments to the RC for use.

- a. Ratings and other limits are continually monitored to ensure meeting acceptable performance criteria. If criteria is not met, then a new SOL is established.
 - b. Every time a RTCA is conducted, establish a SOL for that particular point in time and system condition.
6. **S. Jager:**
- a. Thermal limits: All SOLs. RTCA only used for thermal limit calculations.
 - b. Voltage limits: similar to Texas and ISO-NE. There are generic minimums and maximums and in real-time, have exceptions to go higher.
 - c. Other limits: Relay margin criteria limit
 - d. If you go over a rating, this is an exceedance. If you exceed a rating for a certain amount of time, then you violate the SOL.
 - e. Difference between thermal exceedance and stability exceedance: for thermal, can violate OPA (static numbers), but when in real-time, may contact the Transmission Owner to see if it is possible to adjust the limits.
7. **V. Howell:**
- a. Facility Ratings, voltage limits, transient stability limits and voltage stability limits are all SOLs.
 - b. Historically, WECC used the defined term “OTC”
 - c. WECC Path SOLs are proxies

Questions raised during roundtable discussion:

1. Is every BES Facility required to have a System Operating Limit? Or should there be some pre-determined or limited set?
2. At what point in time does an “exceedance occur”? Is an exceedance an “SOL violation”? For example, if you exceed SOL for 30 minutes; does the exceedance become a violation after the 30 minutes? Differentiate between how you determine the limit versus how you monitor for exceedance?
3. Is there a difference between an operating plan that outlines acceptable system performance vs. an operating plan that addresses every potential SOL exceedance?
4. Do you agree that if your calculated post-Contingency flow exceeds the highest available Facility Rating, this constitutes unacceptable system performance and SOL exceedance? (SOL white paper position)
5. Are RTA and SOL definitions redundant because both include pre- and post-Contingency? RTA definition may create issue with SOL definition because RTA definition includes both post-Contingency assessment; and SOL definition already includes this.
6. Definition of IROL: Is all instability covered under definition of IROL?
7. When Facility Rating is provided by the owner, when does it “become” a SOL?
8. Definition of SOL: Current definition does not provide clarity regarding what is meant by “stability” ... this allows flexibility for each RC to define what “stability” means. Is this flexibility good for reliability?
9. Does the limit change? Is the SOL a static limit or is it dynamic/changes (sub-set)?
10. What about the use of “proxy” limits vs. actual limits? Differences in RTA technology will always change gap between entities. Should all TOP be able to avoid proxy limits for at least thermal and voltage limits? These can exist for stability limits too. Proxy limits as a static target are easier for operators to understand – compared to actual limits dictated by a RTA, which are dynamic and change as system conditions change.

Discussion regarding revisions to definitions:

1. Revisions to definition of System Operating Limit (SOL)

- Essentially these are the values that are used to operate in real-time to ensure operation within acceptable reliability criteria
- Limits used to assess if the system will perform acceptably (both pre- and post-Contingency)

Existing language	Possible language (under consideration by SDT)
<p>The value (such as MW, Mvar, amperes, frequency or volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:</p> <ul style="list-style-type: none"> • Facility Ratings (applicable pre- and post-Contingency Equipment Ratings or Facility Ratings) • transient stability ratings (applicable pre- and post- Contingency stability limits) • voltage stability ratings (applicable pre- and post-Contingency voltage stability) • system voltage limits (applicable pre- and post-Contingency voltage limits) 	<p>Reliability limits used for operations, to include Facility Ratings, System voltage limits, any (identified) stability limitations, and any (identified) equipment limitations.</p>

Open items for further discussion/resolution:

1. “used for operations” – Should time horizon be included in definition to provide greater clarity?
2. “to include”– Is this an exhaustive/complete listing? Allow for use of proxy limits?
3. (identified) stability limitations – Consider whether the standard/requirement is best way to allow for RC to include in methodology what other stability limitations must be respected in its RC area.
4. (identified) equipment limitations

2. New definition: SOL Exceedance

- Highest rating is not necessarily the most limiting one; removed language from definition.
- Pre- and post-Contingency language replaced with normal and emergency limits

Existing language	Possible language (under consideration by SDT)
N/A	<p>When any of the following occur or are observed as part of Real-time monitoring or a Real-time Assessment:</p> <ul style="list-style-type: none"> actual flow on a Facility is above the Normal Rating calculated post-Contingency flow on a Facility is above the Emergency Rating(s) actual bus voltage is outside normal System voltage limits calculated post-Contingency bus voltage is outside emergency System voltage limits operating parameters are beyond identified stability limitations operating parameters are beyond identified equipment limitations

Open items for further discussion/resolution:

1. Should definition be developed for: Normal system voltage limits? Emergency? How do we address emergency voltage limits without using the existing defined term “Emergency” – may create industry confusion.
2. Should definition be developed for: “system voltage limits”?
3. How is “stability limit criteria” being defined/used? Consider whether to use word “parameter” instead of stability exceedance definition

3. Revisions to definition of Interconnection Reliability Operating Limit (IROL)

Existing language	Possible language (under consideration by SDT)
<p>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.</p>	<p>A System Operating Limit that if exceeded could lead to instability that cannot be restrained from spreading beyond an area predetermined by studies, Cascading or uncontrolled separation.</p>
	<p>A System Operating Limit that if exceeded has been demonstrated to result in instability that cannot be restrained from spreading beyond an area predetermined by studies, Cascading or uncontrolled separation.</p>
	<p>A System Operating Limit that, if exceeded, has been demonstrated by studies to result in Cascading, uncontrolled separation, or instability that cannot be restrained from spreading beyond a predetermined area.</p>

Open items for further discussion/resolution:

1. “could lead to” vs. has been demonstrated vs. has been demonstrated by studies.
2. “if exceeded” vs. “if violated”
3. “stability” – want to be clear that localized stability should not be labelled IROL. IROL is widespread.

Meeting Reference Materials:

1. Reliability Standards
 - a. [FAC-008-3](#) – Facility Ratings
 - b. [FAC-010-3](#) – System Operating Limits Methodology for the Planning Horizon
 - c. [FAC-011-3](#) – System Operating Limits Methodology for the Operations Horizon
 - d. [FAC-014-2](#) – Establish and Communicate System Operating Limits
 - e. [TPL-001-4](#) – Transmission System Planning Performance Requirements
 - f. [TOP-001-3](#) – Transmission Operations
 - g. [TOP-002-4](#) – Operations Planning
 - h. [IRO-002-4](#) – Reliability Coordination – Monitoring and Analysis
 - i. [IRO-008-2](#) – Reliability Coordinator Operational Analyses and Real-time Assessments
2. Project 2015-03 – Periodic Review of SOL Standards
 - a. [Periodic Review Team \(PRT\) Recommendations for FAC-010-3](#)
 - b. [PRT Recommendations for FAC-011-3](#)
 - c. [PRT Recommendations for FAC-014-2](#)
 - d. [PRT Rationale for Revising the Definition of SOL](#)
 - e. [PRT Consideration of Comments Report](#)
3. Project 2014-03 – Revisions to TOP/IRO Standards
 - a. [White Paper: SOL Definition and Exceedance Clarification](#)
 - b. [FERC Order No. 817](#) Approving TOP and IRO Standards (Nov 19, 2015)
 - c. [FERC Order No. 802](#) (Nov 20, 2014)
 - d. [FERC “Remand NOPR”](#) (Nov 21, 2013)