Contents

1. Scope and Purpose

NERC requires registered entities to outline and provide its SOL Methodology for the Planning Horizon to its adjacent/neighboring Planning Authorities and the Reliability Coordinator. Additional recipients are any Planning Authority who has indicated a reliability need for the methodology, any Transmission Operator who operates any portion of EPE's Planning Authority Area, and any Transmission Planner working within EPE's Planning Authority Area. In response to NERC's governing Reliability Standard, EPE has documented its SOL Methodology for the Planning Horizon for the purposes of providing information to the above listed entities. EPE is registered as a Planning Authority, Transmission Operator and Transmission Planner, and there are no other Planning Authorities, Transmission Operators and/or Transmission Planners operating or working within its Planning Authority Area.

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2. Methodology for Determining System Operating Limits for the Planning Horizon

EPE ***determines*** its SOLs and IROLs utilizing computer simulations of the EPE's Facilities and/or Transmission Paths. In determining its SOLs and IROLs, EPE reviews such simulations, and categorizes operating limits for its Facilities and Transmission Paths based on their potential to serve as "system" operating limits by making the following initial inquiry:

- Does a facility or path limit serve as a limit to the EPE system under a specified system configuration, such that it serves as a *system* operating limit, or SOL?
    - If so, the limit is considered an SOL, and a further inquiry is made to determine whether the SOL has the potential to lead to instability, uncontrolled separation or Cascading Outages that adversely impact the reliability of the BES, such that it serves as an IROL.
    - If not, the limit is considered a Facility limit with the potential capability, under the specified system configuration, for the Facility to adversely impact EPE's local distribution of power, but without the potential to adversely affect the transfer of bulk power across the interconnected bulk electric transmission system and the reliability of the BES.

The limits of individual facilities and transmission paths are studied under various system configurations for their impact to the EPE system, the BES, and interconnections with its neighboring entities. When EPE develops system configurations for which it plans to operate under in the planning horizon, it categorizes its limits as (i) regional, (ii) system, or (iii) other/internal, depending upon their potential impacts. Specifically, the category limits are described as (i) limits with the potential to impact the BES on a regional level; (ii) limits with the potential to impact entities immediately adjacent to the EPE system and the transfer of bulk power across the interconnected system; or (iii) internal limits with no potential impact on interconnected entities and no potential to have significant impact on BES reliability and performance. A Facility Rating on an individual facility may be a SOL in the planning horizon under certain system configurations, but not every individual Facility Rating on every individual EPE facility is the most restrictive operating element *of the EPE system* under every system configuration. For purposes of FAC-010, EPE distributes to the RC and its neighboring Planning Authorities the Facility Ratings of EPE's individual facilities without regard to whether the individual facility is categorized within category (i), (ii), or (iii). However, the ability of an individual EPE facility to impact interconnected entities, or to impact the BES beyond EPE's local system, is not present for category (iii).

EPE's SOLs under a specified system configuration may be the result of any one of the following: (i) thermal ratings on individual Facilities; (ii) sag ratings on individual Facilities (iii) system voltage and/or voltage drop (applies to steady state voltage); or (iv) system stability (transient stability, small signal stability (oscillations), or voltage stability). The most restrictive applicable limit of an EPE SOL under a system configuration may be one of the limits listed above. However, EPE plans its system so that as it develops system configurations, the system configurations do not call for individual facility ratings to be exceeded.

A. Determining and Establishing SOLs[1]

i. Computer Simulations or Other Limitations

Computer simulations are used to perform planning studies in the planning horizon. Studies will be performed using approved WECC base cases which reflects an anticipated system configuration, generation dispatch, and load level (peak, intermediate and/or off-peak) for seasonal (i.e., winter, spring, summer, and/or fall) system conditions. The results of these studies are dependent upon the specific system conditions modeled in the simulation. SOLs determined in networked systems can be impacted substantially with changed system conditions and modeling in the base cases. Before a study is performed the following listed items are considered: (i) system configuration including expected system conditions, changes in the system topology, facility outages and new facilities; (ii) load level; and (iii) generation dispatch. Additionally, the study shall outline the criteria for determining if an SOL qualified a from IROL.

The results of a study must show that under all lines in service and following contingencies all Facilities are within their Facility Ratings and within thermal, sag and voltage limits and EPE's BES system shall demonstrate transient, dynamic and voltage stability.

ii. System Performance Requirements

EPE ***shall*** establish SOLs consistent with EPE's BES performance for the following:

1. Pre-Contingency State. In a pre-contingency state and all Facilities in service the system performance and EPE's BES shall demonstrate voltage stability and all facilities shall be operating within their Normal Facility Ratings.

2. Post-contingency State. Following the single Contingencies listed below, the system shall demonstrate: (i) transient, dynamic and voltage stability; (ii) all facilities shall be operating within their Emergency Facility Ratings, and within thermal, sag, voltage and stability limits; and (iii) Cascading or uncontrolled separation shall not occur:

    a. Most severe single line to ground or three phase faults with Normal Clearing on any Faulted generator, line, transformer, or shunt device;
    b. Loss of any generator, line, transformer, or shunt device without a Fault;
    c. Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current (DC) system[2]; and

[1] EPE provides the SOLs it develops to the RC and to its adjacent Planning Authorities. With respect to the Facility Ratings of EPE's individual facilities, those ratings are shared with the RC and adjacent Planning Authorities as part of EPE's power flow case.

[2] EPE does not own/operate a DC system, and the New Mexico transmission system does not contain a DC system.

d. Other applicable single contingencies.

ii. *Single Contingency System Performance.* In determining the system's response to single Contingencies, the following performance ***shall*** include:

a. Planned or controlled interruption of service to customers connected to or supplied by the Faulted Facility or by the affected area;
b. System reconfiguration through manual or automatic control or protection actions.

iii. *Next Contingency.* To prepare for the next Contingency, system adjustments must be made, including changes to generation, changes to available reactive devices, uses of the transmission system and transmission system topology.

iv. *Multiple Facilities Contingencies.* EPE ***shall*** evaluate the following multiple Facility Contingencies, as applicable, when establishing SOLs:

a. Simultaneous permanent phase to ground faults on different phases of two adjacent transmission circuits on a common structure with Normal Clearing[3];
b. Permanent phase to ground fault of any generator, transmission circuit, transformer, or bus section with delayed Fault Clearing;
c. Permanent phase to ground fault of any generator, transmission circuit, transformer, or bus section with delayed Fault Clearing;
d. Simultaneous permanent loss of both poles of a DC bipolar facility without an alternating current Fault;
e. Failure of a special protection scheme breaker to operate following a non-fault loss of any element or permanent phase to ground Fault with Normal Clearing;
f. Non-three phase fault on common mode contingency of two adjacent circuits on separate structures with Normal Clearing[4];
g. Common mode outage of two generating units connected to the same switchyard; and
h. Loss of multiple bus sections as the result of a permanent phase to ground fault and the failure or delayed clearing of bus tie or bus sectionalizing breakers.

SOLs established for Multiple Contingencies (a) through (e) ***shall*** demonstrate consistent system performance with the following:

a. System demonstrates transient, dynamic and voltage stability;
b. All facilities shall be operating within their Post-Contingency thermal sag, voltage, and stability limits;

[3] Does not apply to station entrance/exit if the circuits don't share more than five structures.

[4] Does not apply if probability of fault is less than one in thirty years.

c. Cascading does not occur; and
d. Uncontrolled separation does not occur.

If the established SOL for Multiple Contingencies does not demonstrate consistent performance as listed above, the follow activities may be required:

a. Load shedding, the planned removal from service of certain generators, and/or the curtailment of contracted firm electric power transfers may be necessary to maintain the overall security of the interconnected transmission systems, all of which depends on system design and expected impacts;

b. Interruption of firm transfer, Load or system reconfiguration is permitted through manual or automatic control or protection actions; and

c. To prepare for the next Contingency, system adjustments are permitted, including changes to generation, Load and the transmission system topology when determining limits.

SOLs established for Multiple Contingencies (f) and (h) ***shall*** demonstrate consistent system performance with the following with respect to impacts on other systems:

a. Cascading does not occur.

The contingencies listed and used for transient stability studies is a subset of the contingencies used for thermal, sag and voltage stability studies. They are chosen based on historical system response, previous study results or the judgment of the study engineer.

v. *Multiple Contingencies System Performance*. In determining the system's response to Multiple Contingencies, the following performance ***shall*** include:

a. Planned or controlled interruption of service to customer(s) (load shedding);
b. Planned removal from service of generator(s);
c. Curtailment or interruption of firm transfer(s);
d. System reconfiguration, topology and/or load, by manual or automatic control;
e. System reconfiguration, topology and/or load, by protection actions; and
f. System adjustments required to prepare for the next contingency, including generation re-dispatch and adjustments to load, reactive devices and/or transmission system topology.

vi. *Remedial Action Schemes*. EPE does not currently have a RAS. However, if EPE develops a RAS it would be modeled to include:

a. Tripping groups of loads in a predetermined priority and grouping under certain double

Contingencies.

vii. *Other Technical Limitations.* In general, planning studies are not performed to determine if an SOL exists for a path consisting of a single transmission system facility (i.e. a line or transformer). If such limits occur, they are determined by the most limiting equipment (terminal device, line conductor, etc.) for that facility.

B. Stability SOLs

A stability SOL violation can impact the BES much more quickly than a SOL resulting from thermal, sag or steady state voltage violations, and may qualify as an IROL depending on the potential consequences. The Reliability Coordinator and EPE ***shall*** collaborate to understand the nature of the stability SOL, the conditions that resulted in the establishment of such stability SOL and determination of BES impact.

3. Availability of SOL Methodology for Comments

EPE ***shall*** issue its SOL Methodology for the planning horizon and any changes to that Methodology, to all the following prior to the effectiveness of the change:

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

b. The Reliability Coordinator and any Transmission Operator that operates any portion of EPE's Planning Authority Area. At present, EPE is the only Transmission Operator in its Planning Authority Area.

c. Each Transmission Planner that works in the EPE Planning Authority Area. At present, EPE is the only Transmission Planner in the EPE Planning Authority Area.

4. Documenting Results

This methodology, distribution communication and associated documentation ***shall be retained*** in Livelink as follows:

FAC-010	R1 – R3	SOL Methodology for Planning Horizon Documentation supporting SOL Methodology assumptions
FAC-010	R4	Correspondence issuing/disturbing updated SOL Methodology

5. Detective Control

The Methodology section of this document acts as a preventive control, establishing expected performance. One of the detective controls is addressed in the Document Management section is a review process. This review process is a collaboration between the business units and the NCG Team member prior to finalization. Another detective control is the annual Oati webCompliance tracking records for System Planning to annually review the Methodology.

6. Corrective Controls

If a risk is identified or an event has occurred relative to this Methodology, System Planning with the assistance of an NCG Team member will determine next steps for mitigating and recovering from an event, as well as preventing future occurrences. One or more of the following corrective controls can be utilized.

- Reviews
- Event Learning Analysis
- Discipline
- Training/Education

7. Training Through Collaborative Review

The ***annual review*** cycle shall be a collaboration of all applicable parties. This collaboration includes in person meetings and electronic communication until the Methodology is reviewed and adjusted, as necessary.

Additionally, a tabletop simulation may be conducted from time to time to familiarize applicable parties with the steps of this Methodology.

8. Definitions

The definitions in this section are applicable to this document and are extracted from the NERC Reliability Standards Glossary of Terms:

System Operating Limit

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:

- Facility Ratings (Applicable pre - and post- Contingency equipment 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) Interconnection

Reliability Interconnection Reliability Operating Limit

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.

Bulk Electric System

Unless modified by the lists shown below, all Transmission Elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher. This does not include facilities used in the local distribution of electric energy.

Inclusions:

- **I1** - Transformers with the primary terminal and at least one secondary terminal operated at 100 kV or higher unless excluded by application of Exclusion E1 or E3.
- **I2** – Generating resource(s) including the generator terminals through the high- side of the step-up transformer(s) connected at a voltage of 100 kV or above with:
  a. Gross individual nameplate rating greater than 20 MVA. Or,
  b. Gross plant/facility aggregate nameplate rating greater than 75 MVA.
- **I3** - Blackstart Resources identified in the Transmission Operator's restoration plan.
- **I4** - Dispersed power producing resources that aggregate to a total capacity greater than 75 MVA (gross nameplate rating), and that are connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage of 100 kV or above.

Thus, the facilities designated as BES are:

a. The individual resources, and
b. The system designed primarily for delivering capacity from the point where those resources aggregate to greater than 75 MVA to a common point of connection at a voltage of 100 kV or above.

- **I5** –Static or dynamic devices (excluding generators) dedicated to supplying or absorbing Reactive Power that are connected at 100 kV or higher, or through a dedicated transformer with a high-side voltage of 100 kV or higher, or through a transformer that is designated in Inclusion I1 unless excluded by application of Exclusion E4.

Exclusions:

- **E1** - Radial systems: A group of contiguous transmission Elements that emanates from a single point of connection of 100 kV or higher and:
  a. Only serves Load. Or,
  b. Only includes generation resources, not identified in Inclusions I2, I3, or I4, with an aggregate capacity less than or equal to 75 MVA (gross nameplate rating). Or,

c. Where the radial system serves Load and includes generation resources, not identified in Inclusions I2, I3 or I4, with an aggregate capacity of non- retail generation less than or equal to 75 MVA (gross nameplate rating).

Note 1 – A normally open switching device between radial systems, as depicted on prints or one-line diagrams for example, does not affect this exclusion.

Note 2 – The presence of a contiguous loop, operated at a voltage level of 50 kV or less, between configurations being considered as radial systems, does not affect this exclusion.

- **E2** - A generating unit or multiple generating units on the customer's side of the retail meter that serve all or part of the retail Load with electric energy if: (i) the net capacity provided to the BES does not exceed 75 MVA, and (ii) standby, back-up, and maintenance power services are provided to the generating unit or multiple generating units or to the retail Load by a Balancing Authority, or provided pursuant to a binding obligation with a Generator Owner or Generator Operator, or under terms approved by the applicable regulatory authority.
- **E3** - Local networks (LN): A group of contiguous transmission Elements operated at less than 300 kV that distribute power to Load rather than transfer bulk power across the interconnected system. LN's emanate from multiple points of connection at 100 kV or higher to improve the level of service to retail customers and not to accommodate bulk power transfer across the interconnected system. The LN is characterized by all the following:
  a. Limits on connected generation: The LN and its underlying Elements do not include generation resources identified in Inclusions I2, I3, or I4 and do not have an aggregate capacity of non-retail;
  b. Real Power flows only into the LN and the LN does not transfer energy originating outside the LN for delivery through the LN; and
  c. Not part of a Flowgate or transfer path: The LN does not contain any part of a permanent Flowgate in the Eastern Interconnection, a major transfer path within the Western Interconnection, or a comparable monitored Facility in the ERCOT or Quebec Interconnections, and is not a monitored Facility included in an Interconnection Reliability Operating Limit.
- **E4** – Reactive Power devices installed for the sole benefit of a retail customer(s).

Note - Elements may be included or excluded on a case-by-case basis through the Rules of Procedure exception process.

The definition of SOL lists units of measurement (MW, MVar, Amperes, Frequency or Volts). EPE typically expresses SOLs in MW.

9. Acronyms

BES – Bulk Electric System
EPE – El Paso Electric Company
IROL – Interconnection Reliability Operating Limits
NERC – North American Reliability Corporation

RAS – Remedial Action Scheme
SOL – System Operating Limit
WECC – Western Electricity Coordinating Council

10. Document Management

Review Cycle and Update Responsibility
Storage location: An electronic copy of the Methodology will be retained in Livelink.
Review Responsibility: System Planning and NERC Compliance Group
Review Cycle: The Methodology shall be reviewed annually, and/or updated as necessary
Review Procedure: Document shall be cross referenced to cite any relevant policies, contracts, contact information, other Standards, source documents and procedures to confirm target user actions are current and correct.

11. Approvals

Date	Name	Title
	David Tovar	Manager – System Planning

12. Revision History

Date	Version	Revised By	Revision History
11/05/2008	0	Dennis Malone	New Document
05/31/2011	0.1	Rhonda Bryant Dennis Malone	Revised version history format
06/01/2012	1.0	Rhonda Bryant Dennis Malone	Revised to comply with RC's SOL Methodology changes
10/22/2014	2.0	Rhonda Bryant David Tovar	Updated references
09/15/2015	3.0	Rhonda Bryant David Tovar	Expand SOL discussion on the study of specified system configurations
01/15/2020	3.1	System Planning NCG	Reviewed and updated contact information
07/20/2021	4.0	System Planning NCG	Review and update current version of the Methodology to include changes from the previous version of the Standards.

13. Distribution

Date	Name	Department
	Abel Bustillos	System Operations
	Louis Vigil	System Planning
	Joe Natividad	Systems Operations
	Luz Ramos	System Operations Engineering
	Michael Sahs	System Operations
	David Tovar	System Operations
	Rhonda Bryant	NERC Compliance Group