Post Contingency Compliance with System Operating Limits

Market Surveillance Committee Meeting

January 17, 2013

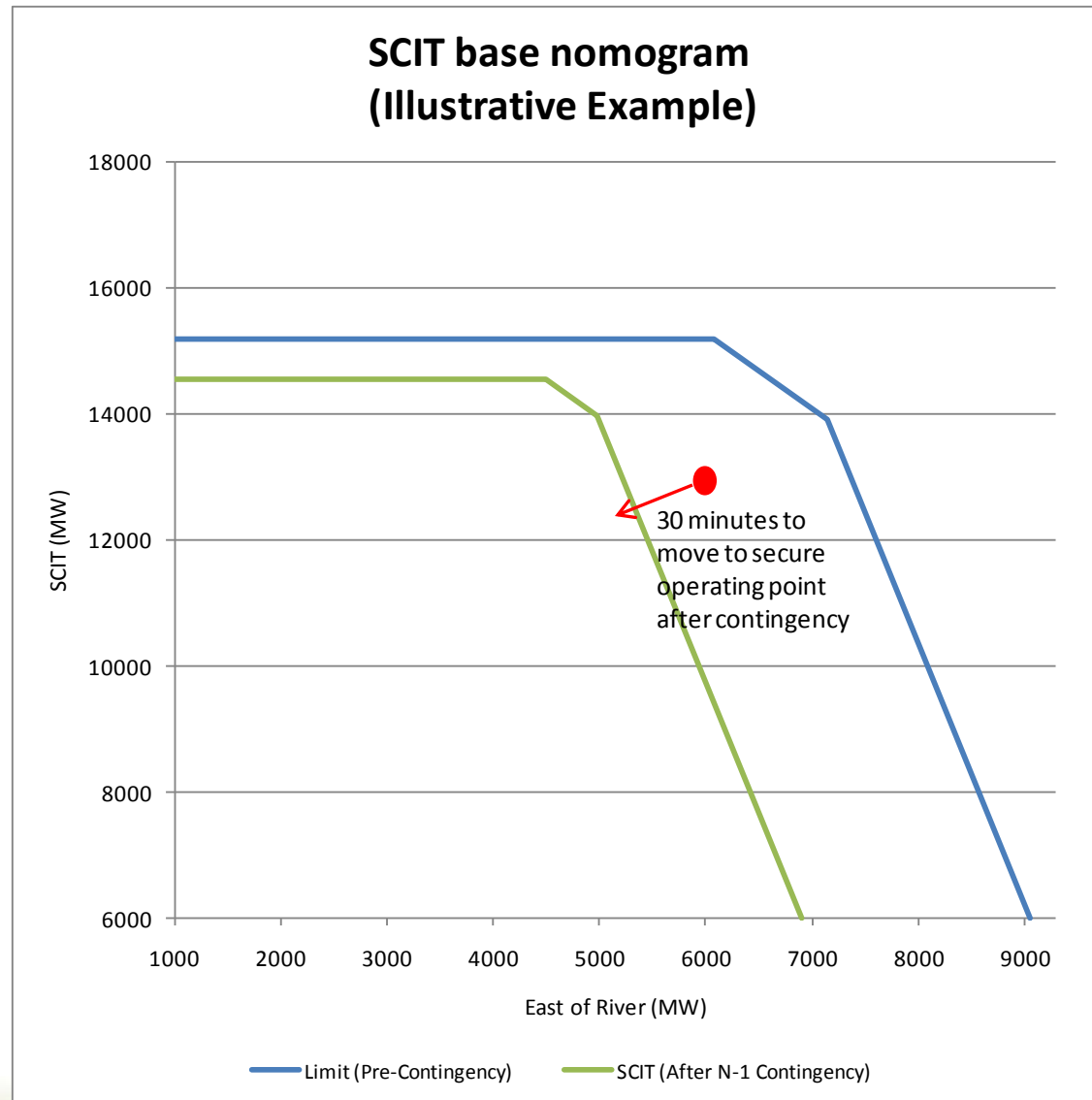Lin Xu, Ph.D.

Senior Market Development Engineer
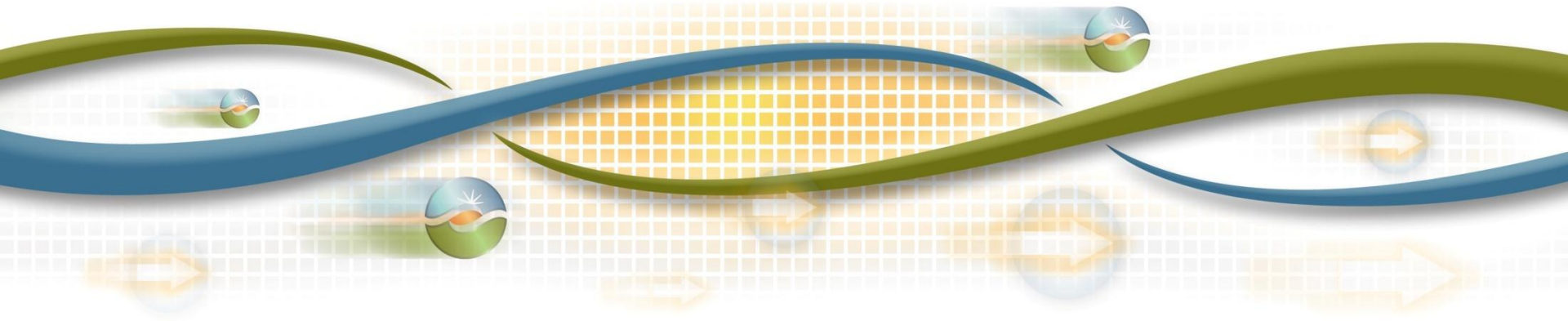
NERC definitions for System Operating Limit (SOL)

- SOL: 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 applicable pre- and post-contingency…

- Interconnection Reliability Operating Limit (IROL): a SOL that, if violated, could lead to instability, uncontrolled separation, or Cascading Outages that adversely impacts the reliability of the Bulk Electric System.

    - IROL Tv: The maximum time that an IROL can be violated before the risk to the Interconnection or other Reliability Authority Area(s) becomes greater than acceptable. Each IROL Tv shall be less than or equal to 30 minutes.

- WECC also identifies certain Major Transfer Paths that are treated similar to IROL, such as COI, path 15, path 26 and SCIT.
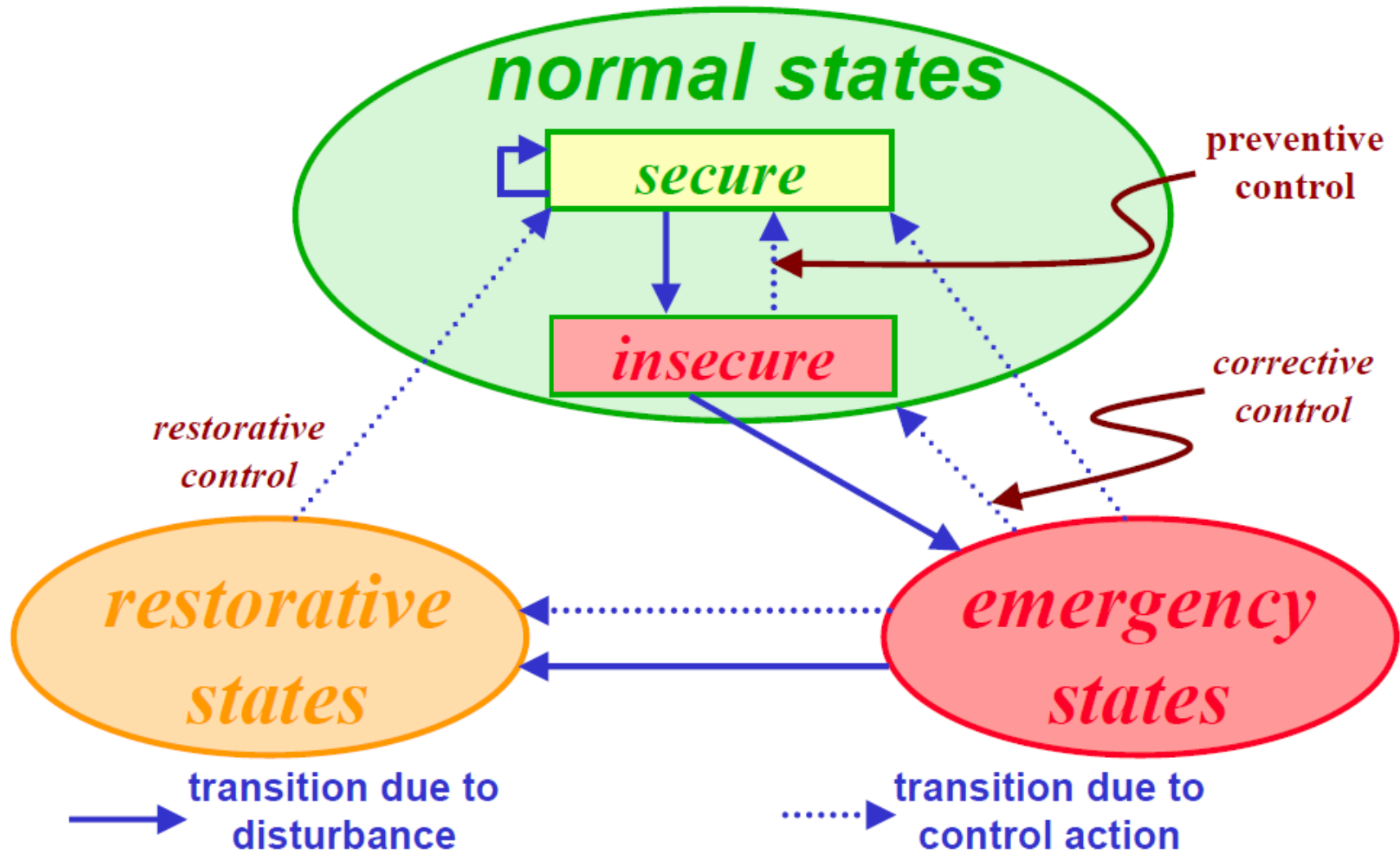
NERC and WECC requirements for IROLs and Major WECC Transfer Paths

- **NERC TOP-007-0 R2.** Following a Contingency or other event that results in an IROL violation, the Transmission Operator shall return its transmission system to within IROL as soon as possible, but not longer than 30 minutes.

- **WECC TOP-007-WECC-1 R1.** When the actual power flow exceeds an SOL for a Transmission path, the Transmission Operators shall take immediate action to reduce the actual power flow across the path such that at no time shall the power flow for the Transmission path exceed the SOL for more than 30 minutes.

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System operating limit (SOL): an example of SCIT

**SCIT base nomogram
(Illustrative Example)**

30 minutes to move to secure operating point after contingency

SCIT (MW)

East of River (MW)

Limit (Pre-Contingency) — SCIT (After N-1 Contingency)

Power system security framework

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Post-contingency compliance with SOL

- Assume system is in n-1 secure state before contingency happens
  - Flow below normal n-1 secure SOL
- After contingency happens, the system need to transition to another n-1 secure state within 30 minutes
  - System operates in normal state, but may not be n-1 secure immediately after contingency happens
  - We need the system to transition from a normal insecure state to a secure state in 30 minutes, which is preventive control.
  - However, is it feasible to do so? Or do we have enough preventive control capability?

Preventive control capability

- How to get enough preventive control capability to comply with the SOL post-contingency 30-minute requirement?
  - Exceptional dispatch
    - Operator judgment. Not optimized, not transparent.
    - Not compensated at marginal price. Incorrect or insufficient incentive.
  - 30-minute post contingency model in the market optimization
    - An optimal solution that establishes pre-contingency flow and resource positions that ensures post-contingency limitations are feasible
    - Compensate resources that provide the preventing control capability.

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