SPP RE on Lessons Learned
From the Sept 8, 2011 Southern California/Arizona Event

On Sept 8, 2011, an 11-minute system disturbance resulted in cascading outages across Arizona and Southern California leaving ~2.7 million customers without power. Read the FERC/NERC Arizona-Southern California Outages on Sept. 8 2011 Report for more details. The SPP RE Event Analysis staff would like to highlight some of the event’s Lessons Learned that could be of benefit to the SPP region.

Verification of Work Steps When Switching High Priority Facilities
The event was initiated by a worker trying to switch out a 500 kV line capacitor bank through a series of pre-determined work order steps. Before commencing work, the worker and the TOP system operator verified the steps to be performed. After work was initiated, the worker erroneously recorded a step as being complete when two prior critical steps had not been completed. Because the worker was no longer engaged with the TOP system operator, there was no verification process for the completed switching order steps. Had a TOP operator been engaged with the worker at the time, the erroneous recording error could have been easily recognized, thus avoiding the line trip that subsequently occurred.

As a standard practice, it is important that TOP operators verify each completed work step when switching high priority bulk power system facilities:
1) The system operator needs to be aware that switching changes have actually occurred for situational awareness purposes, and
2) The system operator may be aware of changes on the system that may require the existing switching order be delayed or changed.

Consideration of Existing System Configuration in Next-Day Planning Studies
The cascading event highlights the need for the RC to be aware of all existing conditions (e.g. transmission and generator maintenance outages) when conducting next-day studies. Due to the way the impacted RC, BAs and TOPs conduct next-day planning studies, critical generator and transmission line maintenance outages were not captured in next-day planning studies. As a result, N-1 contingency analysis did not indicate any SOL or IROL violations should a single 500 kV line be taken out of service.

It is important to model conditions more closely to those in the operational space and ensure SOLs are properly set and IROLs properly identified, particularly in shoulder months when load can be high and maintenance activities have already begun.
Consideration of Sub-100 kV Lines in Planning Studies
The Bulk Electric System is defined as resources and equipment that are “generally operated at voltages of 100 kV and above.” As a result, sub-transmission systems are typically not studied or monitored, but the Southern California/Arizona event demonstrated the importance of including sub-100 kV facilities that can impact reliability in system studies. When a large high-voltage line trips, the load, which can be quite high, is instantly redistributed through interconnecting transmission systems regardless of voltage level. This increased flow, if not studied and planned for, can create overloads on the sub-transmission system that can lead to cascading outages, which is exactly what happened on September 8. It is important that parallel flows on lower voltage systems be identified that can result from transmission contingency outages on higher voltage systems.

Coordination of Transformer Ratings & Relay Settings
This event demonstrates the need to consider relay settings when determining the most limiting piece of equipment on a TOs system. Several transformer relay settings on the impacted systems did not allow operators sufficient time to take action to mitigate an overload before the facility was automatically isolated by its overload protection system. No relay settings should be set below a facility’s emergency rating.

FERC and NERC recommended that TOs review their relay settings with their TOPs and consider using the settings of Reliability Standard PRC-023-1 R.1.11, even for those transformers not classified as BES. PRC-023-1 R.1.11 requires relays to be set to allow the transformer to be operated at an overload level of at least 150% of the maximum applicable nameplate rating, or 115% of the highest operator established emergency transformer rating, whichever is greater.”

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