

NERC Lessons Learned:

“Initiatives to Address and Reduce Misoperations”

“Avoiding IROL Exceedances with Rigorous Inspections during Commissioning, Consistent IROL Alarms, and Improved Training”

“Cascading Analysis Identifies Need for Pre-Contingent Load Shed”

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- **Title**
 - Initiatives to Address and Reduce Misoperations
- **Source of Lesson Learned**
 - ReliabilityFirst
- **Date Published**
 - December 17, 2018

- A registered entity experienced a high rate of BES misoperations
- Over last 15 months, the most prominent categories of misoperations were:
 - 24.5%: relay failure or relay condition related
 - 22%: communication equipment or communication path related
 - 18%: relay setting or schematic design related

- Established several initiatives to address those top causes of misoperations:
 - Target Worst Performing Communication Assisted Schemes
 - Identify Solutions for “Holes” in Carrier DCB Carrier Schemes and Misapplied Directional Settings
 - Identify Legacy Relay Settings that Are too Sensitive for Present Transmission System Short Circuit Conditions and Topology
 - Obtain Industry Peer Review and Assistance
- NERC provides recommendations for improvements in these areas

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- One of three transformers at a substation tripped via differential protection because of a miswiring on its protection panel
- Remaining two transformers picked up the load and the system operator immediately received critical alarms in EMS
 - Alarms indicated IROL exceedance for a transformer trip because the last remaining transformer would then overload and also trip
- 30-minute IROL countdown timer did not activate because this particular case was not programmed to flag an IROL
 - Without the countdown timer, the system operator was slow to act due to being unaware there was an IROL exceedance
- Operator's mitigating instructions given 32 minutes after the IROL exceedance

- Miswiring on the differential protection was quickly detected and fixed and the transformer was back in-service after 60 minutes mitigating the IROL
- Improved post-contingency thermal limit monitoring/mitigation training
- IROL countdown timer programming updated
- More rigorous on-site inspections to prevent protection miswirings
- Ensure alarm response procedures provide clear guidance for analyzing/mitigating IROLs/SOLs
- Reevaluate monitoring/analysis tools for consistency in alarm management
 - IROL exceedances should be clearly identified on EMS screens
- Perform commissioning tests to detect miswirings on pre-fabricated panels

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 - Cascading Analysis Identifies Need for Pre-Contingent Load Shed
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- A 138 kV line tree contact followed by the misoperation of a 345/138 kV transformer resulted in two contingency overloads
- Upon performing cascading analysis, the entity realized that one of the contingencies could cascade if left unmitigated
- The operator took action to shed 21 MW load pre-contingent to prevent the possible cascade
- Transformer was able to be returned to service and then load restored
- Recallable outages in the area also returned

- Enhance vegetation management
- Review auto-calculated relay settings that may have a forward-looking bias
- Identify additional controls to ensure the TOP's and RC's EMS models align
- Work with the EMS vendor to enhance cascade analysis alarming, visualization, and (if possible) automation
- Consider running additional studies (beyond N-1 criteria) during a hot weather alert before taking non-emergency outages
 - Consider pre-staging personnel and equipment needed for recovering from the outages

- https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20181201_Initiatives_to_Address_and_Reduce_Misoperations.pdf
- https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20181202_Avoiding_IROL_Exceedances.pdf
- https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20181203_Cascading_Analysis_IDs_Load_Shed_Need.pdf