

Lesson Learned

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

Primary Interest Groups

Reliability Coordinators (RCs)
Transmission Operators (TOPs)
Transmission Owners (TOs)
Generator Owners (GOs)

Problem Statement

During the morning peak with the system in a configuration to support planned maintenance, the differential protection on a transformer tripped because of a miswiring, resulting in the remaining two transformers picking up the load. This caused a calculated (based on N-1 for loss of a next transformer) interconnection reliability operating limit (IROL) exceedance on them. Actions taken to reduce the IROL were unable to be performed before exceeding T_v .

Details

One of three transformers at a substation tripped via differential protection because of a miswiring on its protection panel; the remaining two transformers picked up the load, and the system operator immediately received critical alarms in energy management system (EMS). These alarms indicated a calculated IROL exceedance for an additional transformer trip because the last remaining transformer would then overload and also trip. This IROL is based on the facility rating of one transformer and is a post-contingency thermal limit.

The IROL count-down timer ($T_v=30$ minutes) did not activate because this particular case was not programmed to flag an IROL. Without the count-down timer, the system operator assumed the alarms were due to a system operation limit (SOL) instead of an IROL. As a result, the system operator was slow to act due to being unaware there was an IROL exceedance. Consequently, the most appropriate actions were not undertaken.

The operator's proper instruction in order to mitigate the violation was given 32 minutes after the IROL exceedance began, thereby failing to mitigate the IROL within the T_v period ($T_v=30$ minutes).

The miswiring on the differential protection was quickly detected and fixed and the transformer was back in-service after 60 minutes. The flow on the two other transformers at the substation returned within the IROL limit.

Corrective Actions

The entity conducted an analysis to prevent a similar situation and several corrective actions and areas for improvement were identified:

- Training for system operators and real-time support staff was improved to further educate about post-contingency thermal limits and their associated mitigation actions. Training topics included addressing infrequently used configurations and adequate communications with impacted entities.
- The IROL count-down timer programming was updated to include the case involved in this event.
- More rigorous on-site inspections during installation/commissioning are used to prevent protection miswirings.

Lessons Learned

- Ensure alarm response procedures provide clear guidance for analyzing and dealing with IROLs and SOLs.
- Improve training regarding SOLs and IROLs. Analysis concluded that more training should be provided for the identification of limits (SOLs versus IROLs) and the associated mitigation actions for system operators and real-time support staff with special attention to infrequently used configurations.
- Re-evaluate the monitoring and analysis tools to ensure consistency in alarm management. IROL exceedances should be clearly identified on EMS screens.
- Perform field commissioning tests to detect miswirings on pre-fabricated protection panels.

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Source of Lesson Learned:

Northeast Power Coordinating Council

Lesson Learned #:

20181202

Date Published:

December 17, 2018

Category:

Transmission Facilities and Communications

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