

## Lesson Learned

### Analysis and Repair of Power Line Carriers

#### Primary Interest Groups

Reliability Coordinators  
Transmission Operators  
Transmission Owners

#### Problem Statement

An ongoing neglect of proper maintenance and repair of Power Line Carriers (PLC) caused a limitation to the high-speed response of an entity's Relay Protection Systems. The lack of maintenance was coupled with a practice of temporary removal of a failed PLC from service for months at a time in this situation.

#### Details

During weekly tests, some PLC systems failed the check-back tests performed by the system operators. System operators notified field personnel to troubleshoot and repair the PLC systems. At times, field engineers evaluated and disabled the PLCs in response to the system operator's reported failures. The number of failed carrier systems was allowed to accumulate, compounding the response of the protection systems due to a single fault. In this system up to 16 PLCs were out of service for long periods of time (up to two years). This compromised the relay coordination and resulted in the tripping of multiple lines in response to a single-line fault on the system. This scenario occurred on more than one occasion and affected adjacent transmission operators' systems. Several times, a single-line fault resulted in tripping of multiple lines external to the faulted line.

The entity was aware the carriers had been disabled for long periods of time; however it did not study the risk of relay mis-coordination from the carrier outages on its own and neighboring transmission systems. The entity did not communicate the risk from the PLC outages to its reliability coordinator or to neighboring reliability entities.

#### Corrective Actions

- The entity evaluated, repaired, and or replaced the failed PLCs
- The entity developed a procedure to identify:
  - PLC failures;
  - the appropriate notification for PLC failures; and
  - the expected priority required for repairs and maintenance.
- A letter was issued to clarify the authority of system operators to request repairs based on the potential reliability risks.

### Lessons Learned

Personnel responsible for the repair and installation of communication equipment utilized in the entity's relay protection system should be made keenly aware of the importance the communication equipment has on the overall responsiveness of the relay protection system. Any unnecessary delay in the repair or installation of communication equipment does adversely influence protective relay schemes and the size of the geographic area affected by a fault. In addition, entities should:

- Have in place adequate and timely maintenance procedures that address the maintenance of bulk power relay protection systems to mitigate carrier downtime.
- Routinely test the carrier systems to be certain they are operational.
- Insure all personnel are properly trained on the operation and maintenance of protection systems

In addition, when failures are identified:

- Schedule and implement repairs as soon as possible.
- Evaluate coordination of backup protection elements remaining in service and the effect of slower relay response.
- Contact the RC and other affected reliability entities when relay schemes are disabled or broken carriers are discovered and their backup relay schemes are not operative.

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