

# Lesson Learned

## Transmission Facilities and Winter Weather Operations

### Primary Interest Groups

Generator Owners (GO)      Generator Operators (GOP)  
Transmission Owners (TO)      Transmission Operators (TOP)

### Problem Statement

Unit 1 at a 1700 Mw plant was forced off line during a severe weather event due to the failure of the disconnect "B" phase switch.

### Details

After a winter storm at a generating plant, the "B" phase disconnect switch connection started to arc in the plant switchyard. The Control Room was notified immediately and operations manually tripped the turbine and took the generator off line. It was found that the arc originated toward the pivot point of the switch just inside the contact region. The disconnect switch did not arc in the contact area of the switch. Once electricians removed the disconnect switch arm it was found to be full of ice. Under normal circumstances water should not be inside the disconnect switch arm. Water, which had ingress in the disconnect arm, froze during the cold weather, causing the weld on the end of the arm to crack and reduced the current carrying capabilities of the arm. This added heat to the area, which progressed to an arc.

### Corrective Actions

To prevent reoccurrence, all three disconnect switch arms were replaced. The transformer side contacts were replaced on the "B" phase connection as well as the corona ring between the contacts and the insulators and the bottom corona ring. Each contact was verified with a visual inspection and an electrical test. The insulators on the "B" phase transformer side connection were tested. The insulators on the center pivot, which supports the switch arm, were also tested. All insulators tested to be good. Research of available industry technical documentation did not find any documentation on similar occurrences. The manufacturer was contacted and reported that they had not seen this type of failure. The manufacturer recommended drilling holes into the switch arm to eliminate water collection. This recommendation was completed by maintenance personnel. Other units at the facility have the same disconnect switches but did not experience the same issues. They were inspected and were changed per the manufacturer recommendations.

### Lessons Learned

All plant and transmission electrical disconnect equipment should be inspected for areas where water could collect and freeze – especially in geographic areas not accustomed to freezing temperatures. Any areas found with the potential to retain moisture should be modified as prescribed by the equipment manufacturer or by an adequate engineer design.

With regards to transmission and substation equipment, other lessons which the GO, GOP, TO and TOP should consider in their winter preparation plans are:

- Power transformers should have their equipment checked to ensure:
  - Control cabinet heaters are working correctly
  - Oil is at its appropriate level for the oil temperature.
  - Bushing oil levels are appropriate
  - Nitrogen levels are correct
- SF6 gas-insulated devices should be checked to ensure:
  - SF6 gas in breakers, current transformers and other electrical equipment is at the correct pressure and temperature to operate safely during extreme cold
  - Heaters (when so-equipped) and associated support circuits are functioning correctly
- The minimum operating ambient temperature should be known on all transmission facilities. This temperature should also take into account fire protection systems.

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Source of Lesson Learned:

Texas Reliability Entity

Lesson Learned #:

20120103

Date Published:

January 6, 2012

Category:

Transmission Facilities

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