# NERC

## **Lesson Learned**

A Generating Station Ground Mat Problem Led to the Trip of Two Generating Units (2000 MW)

#### **Primary Interest Groups**

Transmission Operators (TOPs) Transmission Owners (TOs) Generator Operators (GOPs) Generator Owners (GOs)

#### **Problem Statement**

Problems with a station ground mat resulted in high resistance between areas of the ground mat. This, coupled with a dc battery ground, resulted in a generating station experiencing relay and communication equipment failures. These failures caused misoperations, which ultimately led to the loss of two generating units with a total output of 2000 MW.

#### Details

A number of exothermic welds were not made during installation of the station ground grid. The addition of a ground on the dc system caused a flashover from a grounded control cabinet surface to a terminal board terminal during a close in phase-to-ground fault. This impressed high voltage ac on the dc system, causing numerous protection and control equipment failures. These equipment failures resulted in the opening of all the station's breakers. With no outlet for the generation, two generating units—with a total output of 2000 MW—tripped off-line.

Further investigation uncovered that inadequate workmanship during the initial installation (in 1982) of the 138 kV ground mat system in the 138 kV switchyard caused a latent issue with the ground mat. There were nine deficient ground cable-to-rod connections. Additionally, seven ground cable-to-rod connections were never made. The multiple connection failures in the 138 kV ground system installation allowed an excessive ground potential rise (GPR) at the breaker control cabinet when the fault occurred.

#### **Corrective Actions**

The entity:

- Excavated the applicable 138 kV ground system and replaced all failed ground connections;
  - Additionally, all initial exothermic weld connections, which were never made, were performed per current prints and specs. Post-repair electrical testing was completed.
- Evaluated ground system installation electrical testing techniques and developed recommendations to ensure ground system integrity, in light of the improper workmanship identified by this event with respect to deficient welds; and

### NERC

• Reviewed and revised applicable Project Management and Construction Management procedures to improve quality inspection criteria for the ground system.

#### **Lesson Learned**

To ensure that grounding systems are built to specifications and meet intended performance criteria, installation of grounding systems should have appropriate oversight. Testing of new station ground grids should be performed to ensure ground grid resistance is as expected per the design specifications. Additionally, entities may want to consider periodic testing of ground mats to ensure the integrity of the grounding system.

NERC's goal with publishing lessons learned is to provide industry with technical and understandable information that assists them with maintaining the reliability of the bulk power system. NERC requests that you provide input on this lesson learned by taking the short survey provided in the link below.

#### Click here for: Lesson Learned Comment Form

#### For more information, please contact:

<u>NERC – Lessons Learned</u> (via email)	Jacquie Smith (via email) or (303) 247-3067
Source of Lesson Learned:	ReliabilityFirst
Lesson Learned #:	20140202
Date Published:	February 18, 2014
Category:	Generation Facilities

This document is designed to convey lessons learned from NERC's various activities. It is not intended to establish new requirements under NERC's Reliability Standards or to modify the requirements in any existing Reliability Standards. Compliance will continue to be determined based on language in the NERC Reliability Standards as they may be amended from time to time. Implementation of this lesson learned is not a substitute for compliance with requirements in NERC's Reliability Standards.