PROTECTION SYSTEM TRAINING
ANNUAL CERTIFICATION

Protection Systems Training

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Introduction

The Protection Systems training is site-specific and covers the site's electrical system, as defined by NERC. The training is intended for use by the Facility's applicable O&M personnel and the Facility's other personnel as deemed appropriate by management. The training also satisfies the NERC standard's requirement for training of personnel identified in Applicability section 4.1.1.1. of PER-006-1 Specific Training for Personnel.

Protection System as defined in the NERC Glossary of Terms.

1. Protective relays which respond to electrical quantities.
2. Communications systems necessary for the correct operation of protective functions.
3. Voltage and current sensing devices providing inputs to protective relays.
4. Station dc supply associated with protective functions (including station batteries, battery chargers, and non-battery-based dc supply).
5. Control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices.

Summary of PER-006-1 – Specific Training for Personnel

- **Purpose:** To ensure that personnel are trained on specific topics essential to reliability to perform or support Real-time operations of the Bulk Electric System.
- **Applicability:**
  - **4.1. Functional Entities:**
    - **4.1.1.** Generator Operator that has:
      - **4.1.1.1.** Plant personnel who are responsible for the Real-time control of a generator and receive Operating Instruction(s) from the Generator Operator's Reliability Coordinator, Balancing Authority, Transmission Operator, or centrally located dispatch center.
- **Requirements and Measures:**
  - **R1.** Each Generator Operator shall provide training to personnel identified in Applicability section 4.1.1.1. on the operational functionality of Protection Systems and Remedial Action Schemes (RAS) that affect the output of the generating Facility(ies) it operates. [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]
  - **M1.** Each Generator Operator shall have available for inspection, evidence that the applicable personnel completed training. This evidence may be documents such as training records showing successful completion of training that include training materials, the name of the person, and the date of training.

Training Summary

The following plant personnel have completed the annual training on the operational functionality of Protection Systems that affect the output of the generating Facility it operates. The Facility does not own Remedial Action Schemes (RAS).

The Course consists of four Modules. A minimum score of 80% is required to pass each Module before proceeding to the next one. The Final Score is the average score of the four Modules plus any Extra Credit. Extra Credit, up to 20%, shall be credited per contribution. The training Participants can earn Extra Credit for any Modules by contributing suggestions and comments.

Advanced standing is awarded to participants who demonstrate exceptional skill by achieving a Final Score of 100% or more on the Course.

Participants

Group 1				
	Name	Completion Status	Completion Date	Final Score %
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Group 2				
	Name	Completion Status	Completion Date	Final Score (%)
1				
2				
3				
4				
5				
6				
7				
8				

Group 3				
	Name	Completion Status	Completion Date	Final Score (%)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Objectives and Benefits

The benefits of compliance training include averting mistakes that may lead to power production losses and legal breaches. Therefore, proper training can ensure a capable and confident O&M team that works within regulatory parameters. The training is intended to help satisfy the following:

1. Refresher - Annual refresher training of the facility's Power Systems for applicable O&M personnel.
2. Introduction - Introductory training of the facility's Power Systems for applicable new O&M personnel.
3. Workplace Culture - Encourages a better workplace culture.
4. Effectiveness - Improve staff effectiveness.
5. Compliance - Satisfies NERC compliance requirements for the Facility's Protection Systems Training.

Training Approach

The training is online via a Learning Management System (LMS). The instructor monitors participants' progress and assists as needed, usually within 24 hours via email or asap via telephone.

Frequency

The training is conducted with the following terms.

1. Annually.
2. Revision to the Facility's Protection Systems.
3. Applicable to newly hired O&M personnel.

Subjects

The training is specific to the facility's Protection Systems. The Course consists of four Modules. The subjects include:

1. AC Synchronous Generator Protection
    a. Generator Faults
    b. Generator Events
2. Overview of the different types of protection used on the system for:
    a. Generators
    b. Busses/Conductors/Transmission line(s)
    c. Transformers
    d. The zones of protection, fault locations, and which relay would operate based on the location
3. Voltage and current sensing devices providing inputs to protective relays
4. Station DC supply associated with protective functions
5. Control circuitry associated with protective functions
6. Communications systems necessary for correct operation of protective functions
7. How the detection of fault is accomplished
8. Limitation of protection to include the zone of protection and fault location
9. High Impedance Differential Protection
    a. Application to Generators, Transformers and Busbars
10. Associated generator interconnection facilities

Summary of Training Modules

1) Module 1: Generator Protection

a) Objectives
b) Types of Generator Incidents
c) Examples of Generator Incidents
d) Generator Protection Fundamental
e) Turbine Generator Ratings
f) Aerial View – The facility and its switchyards
g) Essential Items – The facility and its switchyard one-line diagram (North)
h) The facility and its switchyard one-line diagram (North)
i) Essential Items – The facility and its switchyard one-line diagram (South)
j) The facility and its switchyard one-line diagram (South)
k) Essential Items - Generator and XFMRs Protection Panels

l) Generator and XFMRs Protection Panels
m) Essential Items – The facility's north and south switchyard Protection Panels
n) The facility's north and south Switchyard Protection Panel
o) NERC Protection System Definition
p) Generator Faults
q) Essential Items - Zone 1 - Generator Protection
r) Zone 1 – Generator Protection
s) Essential Items - Zone 1 - Generator Protective Relays
t) Zone 1 - Generator Protective Relays

2) Module 2: Excitation Transformer, Exciter, and Auxiliary Transformer Protections

a) Objectives
b) Essential Items – Zone 2 - Excitation XFMR and Exciter Protection
c) Zone 2 – Excitation XFMR and Exciter Protections
d) Essential Items – Zone 2 – Excitation XFMR and Exciter Protective Relays
e) Zone 2 – Excitation XFMR and Exciter Protective Relays
f) Essential Items Zone 3 – Unit Aux XFMR (UAT) Protection
g) Zone 3 – Unit Aux XFMR (UAT) Protection
h) Essential Items Zone 3 – Unit Aux. XFMR Protective Relays
i) Zone 3 – Unit Aux XFMR Protective Relays

3) Module 3: GSU, Overall, South Switchyard, and North Switchyard Protections

a) Objectives
b) Essential Items – Zone 4 – GSU Protection
c) Zone 4 – GSU Protective Relays
d) Essential Items – Zone 5 – Overall Protection
e) Zone 5 – Overall Protective Relays
f) Essential Items - Zone 6 – The facility's North Switchyard and South Switchyard Protection
g) Zone 6 – The facility's North Switchyard and South Switchyard Protection
h) Differential Protection Key Diagram

4) Module 4: Station DC Supply and Communication System

a) Objectives
b) Battery Banks 1 & 2 (UMA Mezzanine)
c) Battery Bank Substation (Switchyard)
d) Battery Chargers 1, 2, 3, 4 (UMA Mezzanine)
e) Battery Charger Substation (Switchyard)
f) Communications Systems (Fiber Optic associated with the Protection System
g) Reference Drawings

Acceptance and Approval

Signature: _____

Name: _____

Title: Facility Manager

Date: _____