



Mike Terbrueggen, CEO, O-T-S



Mike Terbrueggen is the CEO and Principal Engineer at Operations-Training-Solutions, which he founded in 1994. He designs, develops, and delivers advanced training seminars, develops training programs

and materials, and provides consulting services for power operations and engineering personnel.

Mike received his undergraduate degree in Electronics Engineering from the University of Michigan (Go Blue!) and his graduate degree in Power Engineering from the University of Colorado.

Mike was born in Detroit, Michigan. After high school, he entered the U.S. Army and was stationed at Fort Carson, Colorado. He was in the 4th infantry with the 4th Combat Engineers. Mike has two daughters, one son, and four grandchildren. He lives in Longmont, Colorado, where he enjoys golf, music, and home improvement projects in his spare time.

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Operations-Training-Solutions and Otter Tail Power Company are recognized by the North American Electric Reliability Corporation as a continuing education provider that adheres to NERC Continuing Education Program Criteria.

2024

Power System Protection for Operations Personnel

HOSTED BY



Primary Business Address
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Fergus Falls, MN 56537

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September 16-19, 2024

Thumper Pond Resort
Ottertail, MN

2024 Power System Protection for Operations Personnel

Presented by Mike Terbrueggen, CEO, O-T-S

Course Description: Describe and illustrate how Power System Protection is designed and applied within the Bulk Electric System (BES), emphasizing the System Operations perspective. Please see daily agenda below for more detailed information.

O-T-S is recognized by the North American Electric Reliability Corporation (NERC) as a continuing education provider and this class has been approved through NERC's ILA process. Students who complete this course, with a passing score on the class assessment, will be awarded 32 Continuing Education Hours (CEHs) in the NERC SOCCED.

Course Schedule

Monday September 16, 2024

0800-1700

Describe the purpose of protective relaying and list and define important relaying terms and concepts, Including: Fundamental purpose, application, and types of protective relays. IEEE and NERC's definition of Protective Relaying. Evolution of relay designs and events monitored by Protective Relays. ANSI/IEEE device numbering system and the concept of zone of protection.

Describe The Purpose & Demonstrate The Usage Of The Per-Unit System and the concepts of Vectors, Phasors, Synchrophasors & Symmetrical Components. Convert between per-unit and Percent in Ohmic impedance values. Purpose and usage of North American Synchrophasor Initiative and of Symmetrical Components.

Tuesday September 17, 2024

0800-1700

Describe the purpose and illustrate the usage of instrument transformers, CTs, VTs, and CCVTs. Differential Relays, Over-current Relays, distance relays and grounding methods. Discussions on Differential Relay, Over-Current Relay, Distance Relay, Balance Beam Impedance Relay. NERC Standards: PRC-023-4, PRC-027-1

Describe and illustrate transmission line protection concepts. Non-directional inverse time overcurrent relays to protect radial lines. Coordination issues involved in looped line protection. Application of PRC-023-4 to transmission line protection. Discussion on Pilot Protection Schemes.

Wednesday September 18, 2024

0800-1700

Describe and illustrate generator protection concepts, including: Types, hazards, and manufacturers. How PRC-019-2 requires coordination between generators MVA capability, voltage regulating controls and protective relaying. How PRC-024-3 restricts voltage and frequency based generator protection settings.

Describe and illustrate transformer, reactor and capacitor protection concepts, including: Transformer protection and transformer differential relays. Describe how overall transformer protection is accomplished and how PRC-023-4 limits the application of overload protection in transformers. Protection of Shunt capacitors and reactors.

Thursday September 19, 2024

0800-1700

Describe and illustrate the application, design and operation of Bus Differential Relays, including: CT saturation impacts on Bus Differential Protection, End-zone fault detection, low and high impedance Bus Differential, and how Differential Relays are applied.

Describe and Illustration additional protection topics, including: Angle Stability, Impedance Relays, how PRC-026-1 impacts the usage of O-O-S protection. UVLS and UFLS Schemes and how they are designed in accordance with PRC-010-2 and PRC-006-5. NERC definition of RAS and examine a RAS application and discuss content of PRC-012-2.

Registration

NAME

COMPANY

BILLING ADDRESS

PHONE

EMAIL

NERC CERT#

Fee: \$1,200.00 per attendee
(Includes hotel breakfast, breaks, and lunches)

Method of payment: Bill me Check

Hotel accommodations:

Thumper Pond Resort
218-367-2000
300 Thumper Lodge Rd
Ottertail, MN 56571

A block of 10 rooms has been held from Sunday-Thursday for the week. Rooms are blocked under *Otter Tail Power Company Training*.

Room rate:

\$129.95 for Otter Tail Power Company block.
Government rate available upon request.

To register, email this form or contact:

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