



## Presenter

**Michael L. Terbrueggen,**  
**CEO, O-T-S**

Mike Terbrueggen was born in Grosse Pointe, Michigan in 1954. He graduated from De La Salle High School in 1972. Upon graduation in 1972 he entered the U.S. Army and was stationed in Colorado Springs, Colorado. He was in the 4th infantry with the 4th Combat Engineers. He has two daughters, one son, two grandsons, and two granddaughters and lives in Longmont, Colorado where, in his spare time, enjoys golfing and hiking.

Mike's undergraduate degree is from Michigan and is in Electronics Engineering. His graduate degree is from University of Colorado and is in Power Engineering.

Mike formed Operations-Training-Solutions in 1994, is the CEO and Principal Engineer, and designs, develops, and delivers advanced training seminars, develops training programs and materials, and provides consulting services for power operations and engineering personnel.

## 2017 System Fundamentals

*This Power System Fundamentals course includes the following learning activity*  
**NERC CEH allocation:**

CEHs awarded are:

34 Operating Topics, 5 Standards, 0 Simulation



*This course is designed by*

*Mike to provide Operations*

*Personnel with an understanding of power system fundamental concepts and applications.*

## 2017 Power System Fundamentals for Operations Personnel

Otter Tail Power Company  
is proud to host the

**Power System Fundamentals  
for Operations Personnel**  
**November 13-16, 2017**  
**Bigwood Event Center**  
**Fergus Falls, Minnesota**



Primary Business Address  
215 South Cascade Street  
Fergus Falls, MN 56537

Phone: 218-739-8264  
Fax: 218-739-8625  
E-mail: [tsmith@otpc.com](mailto:tsmith@otpc.com)



## Course Schedule:

### Monday, November 13

0800-1700 System Fundamentals (Mike T.)

- Review of fundamental concepts
- Selected areas of math concepts:
  - Fractions
  - Decimals
  - Exponents & Roots
  - Per Unit Values & Measurement Systems
  - Trigonometry
  - Vectors & Phasors
- Learning activity's content:
  - Add, subtract, multiply and divide fractions and solve simple problems.
  - Calculate squares and square roots of given quantities. Convert power system quantities to and from per unit values and identify commonly used units of measurements. Use vectors & phasors to represent physical quantities to solve simple problems.

### Tuesday, November 14

0800-1700 System Fundamentals (Mike T.)

- Review of AC electricity fundamentals
- Selected areas of AC electricity concepts:
  - Electricity fundamentals
  - Inductance and capacitance
  - Impedance, resonance & AC power
  - Multi-phase AC systems
  - Microprocessor Relays
- Learning activity's content:
  - Define the following quantities as applied to AC voltage & current: frequency, period, wavelength, peak value, & use sine waves to represent AC values. State the advantages of using AC to using AC to transmit power over long distances. Describe the physical properties & electrical behavior of Inductive & capacitive circuits, represent current & voltage in inductive and capacitive circuits using phasors and sine waves and use the principle of mutual inductance to explain the operation of a transformer.

### Wednesday, November 15

0800-1700 System Fundamentals (Mike T.)

- Review of DC electricity fundamentals
- Selected areas of DC electricity concepts:
  - Electron theory
  - Sources of electricity
  - Electrical current
  - Magnetism
  - Electrical circuits
- Learning activity's content: Describe the structure of an atom and identify the charge of each component particle and explain the difference between conductors and insulators. Using accepted convention for the direction for current carrying conductor and a current carrying coil, and describe the principle of operation of an electromagnet. Define resistance of a conductor & resistivity of a conducting material and state Ohm's Law and apply the law to simple series and parallel circuits, as well as state Kirchoff's law and it's application to simple DC circuits.

### Thursday, November 16

8:00-17:00 System Fundamentals (Mike T.)

- Review of fundamental theory of generators/motors
- Theory of generators & motors concepts:
  - Review of voltage sources
  - Fundamental theory of AC/DC generators
  - Type of AC generators
  - AC motors/DC motors
  - Substation equipment's and transformers
- Learning activity's content: Describe the theory of operation of AC generators. Review of concept of a voltage source. Identify and describe the types of AC generators. Describe the theory of operation of DC generators. Describe DC motor operation and applications. Describe AC/DC motor operation and applications. The connection of power system elements. Controlling power in substations. Purpose of the substation control house. Needs for substation grounding, usage of one-line diagrams. Basic transformer theory, electrical effects of three-phase transformers, operation of auto-transformers, transformer ratings, operations and usage in system operation. Use of transformers as a ground reference.

## Registration form

Cost is \$1,200.00 per attendee. This includes breakfasts, breaks, and Lunches.

Name \_\_\_\_\_

Company \_\_\_\_\_

Billing address \_\_\_\_\_

Phone \_\_\_\_\_

E-mail \_\_\_\_\_

NERC Cert# \_\_\_\_\_

### Method of payment

Bill me  Check

### Hotel accommodations

#### Best Western - The Falls Inn and Suites

(Bigwood Events Center)

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

\$89.99 for Otter Tail Power Company

\$89.00 for Government - single occupancy

Best Western Inn: 218-739-2211

Toll free: 1-800-293-2216

925 Western Ave., Fergus Falls, MN 56537

E-mail: [www.bestwestern.com](http://www.bestwestern.com)



### For registration:

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