

August 23-31 | **APPA ACADEMY**
2022 | Virtual Training

Overhead Distribution Principles and Applications

Agenda, Learning Outcomes and
Instructor Bios

Instructors

M. Thomas Black, P.E.

R. John Miner, P.E.

Ted Dimberio, P.E.

Erich Schoennagel, P.E.



Overhead Distribution Principles and Applications

Recommended CEUs 1.7/PDHs 17.5/CPEs 21

Field of Study: Specialized Knowledge

All times below are **Eastern**.

Tuesday, August 23

Session 1: Introduction to Overhead Distribution

Noon **Course Introduction**

- Purpose and learning objectives
- Logistics

12:15 p.m. **The Overhead Distribution System**

- Business purpose and technical function
- Line and equipment electrical ratings
- Line components
- Line equipment

1:15 p.m. **Break**

1:30 p.m. **The Legal and Regulatory Context for Overhead Distribution**

- Risk exposures and management strategies
- Design and operating accountabilities (moral, legal, regulatory)
- Design and operating criteria
- Design and construction standards
- Other considerations
 - Aesthetics
 - Rights-of-way
 - Joint use

2:15 p.m. **NESC Overview and Applicability to Overhead Distribution**

- Abstract and forward
- Brief historical context

2:45 p.m. **Break**

3 p.m. **NESC Overview and Applicability to Overhead Distribution (continued)**

- Organization and contents
- Interpretations
- Related publications
- Applicability of NESC to overhead distribution

3:50 p.m. **Assigned Check-Up Quiz and Wrap-Up**

4 p.m. **Adjourn**

Wednesday, August 24

Session 2: Overhead Line Conductors/Cables and NESC Clearances

- Noon** **Review of Check-Up Quiz and Session 1 Questions**
- 12:15 p.m.** **Overhead Distribution Line Conductors and Cables**
- Overhead line conductor/cable types, characteristics and applications
 - Electrical properties of conductors
 - Electrical loading conditions and thermal capacity
- 1:15 p.m.** **Break**
- 1:30 p.m.** **Overhead Distribution Line Conductors and Cables (continued)**
- Mechanical loading conditions on conductors/cables
 - Basic conductor/cable sag and tension characteristics
- 2:45 p.m.** **Break**
- 3 p.m.** **Overhead Distribution Line Conductors and Cables (continued)**
- Introduction to conductor/cable clearances
- 3:50 p.m.** **Assigned Check-Up Quiz and Wrap-Up**
- 4 p.m.** **Adjourn**

Thursday, August 25

Session 3: Overhead Line Structure Loading and Strength, Part 1

- Noon** **Review of Check-Up Quiz and Session 2 Questions**
- 12:15 p.m.** **Overhead Distribution Line Structure Loading and Strength**
- Overhead line structure types, characteristics and applications
 - Mechanical Forces on Structures
- 1:15 p.m.** **Break**
- 1:30 p.m.** **Overhead Distribution Line Structure Loading and Strength (continued)**
- Overview of NESC mechanical loading and strength requirements
 - NESC load factors
 - NESC strength factors
 - Structure loading application examples
- 2:45 p.m.** **Break**
- 3 p.m.** **Overhead Line Structures – Application Examples**
- 3:50 p.m.** **Assigned Check-Up Quiz, and Wrap-Up**
- 4 p.m.** **Adjourn**

Tuesday, August 30

Session 4: Overhead Line Structure Loading and Strength, Part 2

Noon **Review of Check-up Quiz and Session 3 Questions**

12:15 p.m. **Overhead Line Guying and Anchoring**

- Functions of guys and guy forces
- Guy types, characteristics, and applications
- Anchor types, characteristics and applications
- Structure guying application examples

1:15 p.m. **Break**

1:30 p.m. **Wood Poles**

- Wood pole species, characteristics & applications
- ANSI O5.1 Standard for Wood Poles
- Wood pole preservatives
- Embedment of wood poles

Manufactured Poles

- Types of materials and characteristics
- Pros and cons of manufactured poles
- NESC requirements for manufactured poles
- Embedment of manufactured poles

2:45 p.m. **Break**

3 p.m. **Overhead Line Structures – Application Examples**

3:50 p.m. **Assigned Check-Up Quiz, and Wrap-Up**

4 p.m. **Adjourn**

Wednesday, August 31

Session 5: Review of Assigned Quiz, Application Exercises and Session 4 Questions

Noon **Review of Check-up Quiz and Session 4 Questions**

12:15 p.m. **Overhead Distribution Grounding**

- Functions of Purposes of grounding
- Grounding system components
- NESC grounding requirements
- Circuit grounding
- Equipment grounding
- Structure grounding

1:15 p.m. Break

1:30 p.m. Overvoltage Protection

- Characteristics of lightning
- Lightning surges & surge impedances
- Lightning arresters
- Effects of grounding
- Pole-top insulation coordination

2:45 p.m. Break

3 p.m. Overvoltage Protection (continued)

- Application examples

3:20 p.m. Course Wrap-Up

- Q & A
- Open discussion

4 p.m. Course Adjourns

Overhead Distribution Principles and Applications

Recommended CEUs 1.7/PDHs 17.5/CPEs 21

Field of Study: Specialized Knowledge

Upon completion of this course, participants will be able to successfully:

1. Explain the business purposes and technical functions of overhead distribution
2. Recognize common overhead distribution line components and equipment and be able to explain their characteristics
3. Outline the legal and regulatory context for overhead lines
4. Describe overhead line design and operating risks as well as the role of design/operating criteria and design/construction standards in managing those risks
5. Explain the basic purpose and organization of the NESC and how it applies to overhead lines
6. Describe the various types of overhead line conductors and cables, their physical and electrical characteristics, and typical applications
7. Describe the mechanical forces that act on overhead line structures and the NESC requirements for conductor design calculations (sag & tension)
8. Describe the basic NESC requirements for overhead line clearances
9. Describe the functions & types of typical overhead distribution line support structures
10. Describe the mechanical forces that act on overhead line structures and the NESC requirements for structure loading and strength calculations
11. Perform basic conductor/cable & structure loading calculations by hand
12. Identify common structure guying schemes and components
13. Perform basic guying calculations by hand
14. Outline the basic characteristics, advantages and disadvantages of wood poles
15. Outline the basic characteristics, advantages and disadvantages, and typical applications of manufactured poles (steel, concrete, fiberglass, ductile iron)
16. Understand and apply basic principles of grounding and be able to identify common components and practices use for the grounding of overhead lines
17. Understand and apply basic principles of insulation coordination and overvoltage protection and be able to identify insulating components and lightning arresters on overhead lines

Tom Black, P.E.
**Consultant and Continuing Education Program Developer and
Instructor, Collaborative Learning Inc.**



Tom Black, P.E., Technical Consultant and Continuing Education Program Developer and Instructor, Collaborative Learning Inc. Tom is an accomplished executive manager, consultant and continuing education course instructor with more than thirty (30) years of experience in the electric and gas utility industries. In addition to working with Collaborative Learning, Tom's experience includes employment with both municipal (Colorado Springs and City of Fountain, CO) and Investor owned (Progress Energy) utilities across multiple jurisdictions in Colorado, North Carolina, South Carolina and Florida.

Tom teaches courses on such topics as electrical distribution principles, overhead and underground distribution systems, the NESC, electric system planning, construction, operations, and maintenance. Tom has extensive executive level experience in managing electric and gas utility systems. System responsibilities include planning and engineering, standards, construction, operations and maintenance, gas pipeline safety, energy management (EMS), supervisory control and data acquisition (SCADA), outage management (OMS), field-related outage response and the planning and implementation of a SMART Grid system.

Tom earned his bachelor's degree from Washington University in St. Louis (with honors) and is a registered professional engineer in the states of Colorado and Arizona. He is a member of the Institute of Electrical and Electronics Engineers (IEEE).

Ted Dimberio, P.E.
**President and CFO, Utility Line Design
President, Line Design University**



Ted Dimberio, P.E. has 40-years' experience in distribution line design and has worked for rural electric cooperatives and consulting firms, and most recently, is a private business owner. Ted has worked in all capacities of distribution line design that includes field staking, supervision, management, and consulting. Ted has a vision to enhance distribution line design by incorporating engineering software, best practice and engineering ethics.

Ted is currently President and CFO of Utility Line Design and President of Line Design University. Ted has been an industry leader in developing engineering software for electric distribution utilities that auto-generates profile drawings and required line

design calculations to verify and document engineering decisions and provide long-term engineering documentation. Ted keeps abreast with the engineering trends by maintaining close contact with numerous state engineering boards, the National Council of Examiners for Engineers and Surveyors and the National Society of Professional Engineers.

Ted received his civil and structural engineering education from Mesabi State Junior College and the University of Minnesota and is a licensed professional engineer in the states of Minnesota and Wisconsin.

John Miner, P.E.
President and Principal Consultant,
Collaborative Learning Inc.



John is a Registered Professional Engineer and an accomplished executive manager and educator with over forty years of experience in the electric utility industry. He is President of Collaborative Learning, Inc. of Austin and San Antonio Texas, a firm that presents management and technical education programs and, through Collaboration Unlimited, provides management consulting services to the electric utility industry.

Before forming his own company in 1995, John worked as a management consultant with two nationally recognized consulting/engineering firms, served as Chief Operating Officer for the Austin, Texas, Electric Utility Department, as General Manager of the Rochester, Minnesota Public Utilities, as an Assistant Professor on the faculty of the University of Houston's College of Technology, and as a Senior Engineer at the Toledo Edison Company.

John has been an instructor of technical and management courses for the American Public Power Association for 30 years and for the University of Wisconsin Madison for 20 years. He was also involved for 20 years in the accreditation of engineering technology degree programs as a member of the Accreditation Board for Engineering and Technology (ABET) and the IEEE Committee on Technology Accreditation Activities.

John has conducted educational programs for utility organizations in thirty-five states, the District of Columbia, Canada, and six overseas locations. His technical seminars and workshops for utilities have covered such topics as application of the National Electrical Safety Code (NESC), overhead and underground distribution systems, electric system planning, construction, operations and maintenance. He has also served as an expert witness on litigation involving electrical accidents and compliance with the NESC and OSHA regulations.

During his career, John has been responsible for transmission and distribution projects ranging in voltage from 2.4 kV to 500 kV and for the operation of transmission and distribution systems totaling more than five hundred miles of transmission and ten thousand miles of distribution lines.

John Miner earned a Bachelor of Science degree in Electrical Engineering, with honors, and a Master of Science degree in Engineering Science, both from the University of Toledo. He is a member of Tau Beta Pi and Eta Kappa Nu engineering honorary societies. John is a Senior Life Member of the IEEE.

Erich F. Schoennagel, P.E.
Consultant
Collaborative Learning Inc.



Erich is a former manager and engineer with CenterPoint Energy. He managed the Transmission Project Engineering group, which served the company's needs for transmission system design, substation and telecom site improvement, and civil engineering for transmission, substation, distribution, and telecom structures.

Erich began his utility career in 1977 as a co-op student with Houston Lighting and Power, where he gained exposure to power generation, fuel procurement, and civil engineering support. Upon graduation in 1980 from Texas A&M University, he joined Houston Lighting and Power in the Civil Engineering group, where he designed structures and foundations for transmission, substation, distribution, and telecom projects. In 1988, Erich joined the Fossil Plant Engineering group where he designed civil engineering projects for the generation assets of the company, while continuing to support the projects of the power delivery system.

Erich transferred to the Transmission Engineering group in 1996, where he designed upgrades and new lines for the overhead and underground transmission system. The group was later included in the consolidation of the regulated assets to become CenterPoint Energy.

Erich served for fifteen years as a member advisor and later, chairman of the Underground Transmission Task Force for the Electric Power Research Institute until his retirement from CenterPoint Energy. There he directed research related to underground transmission and superconductivity. He was a board member of the annual TSDOS symposium, and a former member of the American Concrete Institute 336 committee related to foundation design and construction.

Erich received his bachelor's degree in Civil Engineering from Texas A&M University. He is a registered Professional Engineer in the state of Texas.