

Utility Technician Development

Program Outline

Four Year Program

Module One:

1. Introduction to Power Delivery
2. Safety One
3. Climbing Wood Poles
4. Knots, Splices, and Rope
5. Electrical Systems
6. First Aid
7. Applied Mathematics
8. Basic Electrical Theory
9. Transformer Basics
10. OSHA 1910.269
(Parts A, B, C, G, I, K, & N)

Module Three:

1. Safety Three
2. Special Elements One
3. Metering
4. System Power Flow
5. Advanced Transformers
6. Maps and Standards
7. System Protection
8. NESC One
9. NESC Two
10. OSHA 1910.269
(Parts E, F, P, Q T U, & W)

Module Two:

1. Safety Two
2. AC Fundamentals
3. Personal Protective
Grounding & Jumpering
4. Live Line Equipment &
Methods
5. Rigging
6. Underground Conductors
7. Overhead Conductors
8. Electrical Test Equipment
9. Substations
10. OSHA 1910.269
(Parts H, J, L, M, & R)

Module Four:

1. Safety Four
2. Communication Systems
3. Special Elements Two
4. Vegetation Management
5. System Operation
6. System Automation
7. Overhead Line Design
8. Underground Line Design
9. Trouble Investigation
10. Crew Leadership

Introduction to Power Delivery

Program Outline

1. The Importance of Electricity
 - a. In The Beginning
 - b. Dependence on Electricity
 - c. The Lineman's Role

2. Brief History of Power Delivery
 - a. The Controversy of AC vs. DC
 - b. The First AC Systems
 - c. Early Designs & Construction Practices
 - d. Rural Electrification

3. Types of Companies
 - a. Large Power Companies
 - b. Small Public Power Utilities
 - c. Large Line Contractors
 - d. Small Line Contractors

4. Positions and Career Paths
 - a. Power Delivery Positions
 - b. Related Position
 - c. Typical Career Paths

5. Key Agencies and Organizations
 - a. Department of Energy
 - b. North American Electric Reliability Council
 - c. Utility Commissions
 - d. Federal Energy Regulatory Commission
 - e. OSHA
 - f. Edison Electric Institute
 - g. National Rural Electric Cooperative Association
 - h. National Electric Safety Code
 - i. EPRI

Safety Meeting One

Program Outline

1. Introduction to Safety
 - a. Safety Priorities vs. Safety Values
 - b. Accident Causes

2. Personal Protective Equipment
 - a. Glasses
 - b. Safety Hat
 - c. Work Gloves
 - d. Hearing Protection
 - e. Traffic Vests
 - f. Safety Belt and Harnesses
 - g. Safety Shoes and Boots

3. Hazards
 - a. Hazard Assessment Skills
 - b. Common Hazards
 - c. Vehicular Hazards
 - d. Environmental Hazards
 - e. Material Handling Hazards
 - f. Job Hazards
 - g. Electrical Hazards

4. Safety Attitude
 - a. You Control Safety
 - b. Perception of Risk

5. Accident Review
 - a. Accident 1: Lineman Loses Eye
 - b. Accident 2: Linetruck Rolls On Highway
 - c. Accident 3: Lineman Receives Electrical Burns

Climbing Wood Poles

Program Outline

1. Climbing Tools
 - a. Climbing Belts
 - b. Positioning Strap
 - c. Climbers
 - d. Climber Pads
 - e. Climbing Boots
 - f. Climbing Equipment
 - g. Sizing & Fitting Climbing Tools

2. Assessing The Pole
 - a. Visual Inspection
 - b. Pole Testing
 - c. Climbing Route

3. Basic Technique
 - a. Ascending The Pole
 - b. Descending The Pole
 - c. Free Climbing

4. Additional Techniques
 - a. Working With The Positioning Strap
 - b. Mobility On The Pole
 - c. Working Positions
 - d. Maintaining Your Skill

Knots, Splices, & Ropes

Program Outline

1. Rope Types
 - a. Natural Fiber Ropes
 - b. Synthetic Fiber Ropes
 - c. Wire Ropes
 - d. Care of Rope
 - e. Proper Use of Rope
 - f. Strength of Rope

2. Knots
 - a. Knot Terminology
 - b. Efficiency of Knots
 - c. Common Knots & Their Uses

3. Splices
 - a. Eye Splice
 - b. Short Splice

4. Web Slings
 - a. Web Sling Configurations
 - b. Web Sling Nametags

5. Chains & Shackles
 - a. Chain Usage
 - b. Care of Chains
 - c. Shackles
 - d. Shackle Usage

Electrical Systems

Program Outline

1. Electrical Systems
 - a. Generation
 - b. Transmission
 - c. Sub Transmission
 - d. Distribution
 - e. Substations
 - f. Voltage Change

2. Generation
 - a. Generation Station Types
 - b. Steam
 - c. Hydroelectric
 - d. Combustion Engine
 - e. Combustion Turbine
 - f. Wind
 - g. Co-Generation
 - h. Biomass
 - i. Resource Recovery
 - j. Dispersed Micro Generation

3. Transmission
 - a. Basic Function of Transmission
 - b. Key Components of Transmission Lines
 - c. Voltage
 - d. Lightning Protection
 - e. Underground Transmission

4. Distribution
 - a. Basic Function of Distribution
 - b. System Design
 - c. Voltage Levels
 - d. Overhead or Underground
 - e. Key Components of Overhead
 - f. Key Components of Underground
 - g. Circuit Design

5. Substations
 - a. Substation Types
 - b. Substation Types
 - c. Substation Equipment
 - d. Basic Substation Design
 - e. Environmental Considerations

First Aid

Program Outline

1. General Principals
 - a. First Steps of a Medical Emergency

2. Signs of a Problem
 - a. Breathing Problems
 - b. Chest Pains and Heart Attack
 - c. Fainting
 - d. Diabetes
 - e. Stroke
 - f. Seizures

3. Injury Emergencies
 - a. Bleeding
 - b. Shock
 - c. Broken Bones
 - d. Sprains

4. Environmental Emergencies
 - a. Bites and Stings
 - b. Temperature Related Emergencies
 - c. Poison Emergencies

Applied Mathematics

Program Outline

1. Whole Numbers
 - a. Whole Numbers
 - b. Addition
 - c. Subtraction
 - d. Multiplication
 - e. Division

2. Fractions, Decimals, and Percentages
 - a. Fractions
 - b. Decimals
 - c. Percentages

3. Power and Roots
 - a. Powers
 - b. Roots

4. Algebra and Geometry
 - a. Algebra
 - b. Word Problems
 - c. Geometry

5. Trigonometry and Binary Systems
 - a. Trigonometry
 - b. Binary Systems

Basic Electrical Theory

Program Outline

1. Atomic Structure
 - a. Atomic Structure
 - b. Law of Charges
 - c. Law of Centrifugal Force
 - d. The Valence Shell
 - e. Current Flow

2. Magnetism and Static Electricity
 - a. Magnetism
 - b. Magnetic Materials
 - c. Static Electricity
 - d. Lightning

3. Voltage and Amperage
 - a. Alessandro Volta
 - b. The Volt
 - c. Andre Ampere
 - d. The Coulomb
 - e. The Amp

4. Ohms and Watts
 - a. Georg Simon Ohm
 - b. The Ohm
 - c. James Watt
 - d. The Watt

5. Ohm's Law
 - a. Ohm's Law
 - b. Power
 - c. Electrical Quantities Wheel

Transformer Basics

Program Outline

1. Identification
 - a. Identification
 - b. Overhead Transformers
 - c. Underground Transformers
 - d. Transformer Rating
 - e. Types of Transformers

2. Anatomy
 - a. The Core
 - b. The Windings
 - c. Insulating Fluid
 - d. Pressure Relief Valve
 - e. Internal Fuses

3. Theory
 - a. Turns Ratio
 - b. Polarity
 - c. Losses
 - d. Impedance

4. Nameplates
 - a. The Purpose, When To Use and Location
 - b. What Can Happen

5. Transformer Installation
 - a. Sizing Transformers
 - b. Locating The Transformers
 - c. Selecting and Transporting
 - d. Bussing Out The Transformer
 - e. Lifting and Mounting The Transformer
 - f. Transformer Grounding
 - g. Transformer Fusing
 - h. Energizing and Connecting Load

OSHA 1910.269 (Parts A, B, C, G, I, K, & N)

Program Outline

1. Introduction & Subparts A & B
 - a. OSHA Inspections
 - b. Standard CFR 1910.269
2. Subpart C: Job Briefing
 - a. Job Briefings
 - b. OSHA's Involvement
3. Subpart G: Personal Protective Equipment
 - a. Personal Protective Equipment
 - b. OSHA's Involvement
4. Subparts I & K: Hand and Portable Power Tools & Materials Handling & Storage
 - a. Hand and Portable Power Tools
 - b. Material Handling and Storage
5. Subpart N: Personal Protective Grounding
 - a. Grounding for the Protection of Workers

Safety Meeting Two

Program Outline

1. Safety Meetings
 - a. The Importance of Safety Meetings
 - b. Safety Meetings
 - c. Delivery of Safety Meetings

2. Poor Safety
 - a. Shortcuts
 - b. Consequences of Poor Safety
 - c. Financial Impact of Poor Safety

3. Public Safety
 - a. Jobsite Protection
 - b. Public Safety Education
 - c. Line Design and Inspection
 - d. Responsibility For Public Safety

4. Communications
 - a. Hand Signals
 - b. Radio and Cellular Communications
 - c. Addressing Crew Safety Issues

5. Accident Review
 - a. Transformer Backfeed Fatality
 - b. No Harness = Serious Injuries
 - c. If It Isn't Grounded, It Isn't Dead

AC Fundamentals

Program Outline

1. AC Generation
 - a. The Generation Process
 - b. Sine Waves
 - c. RMA
 - d. Resistive Load

2. Series and Parallel Circuits
 - a. Basic Circuits
 - b. Series Principles
 - c. Parallel Principles

3. Inductance
 - a. Induction
 - b. CEMF
 - c. Strength of Inductance
 - d. Power in Inductive Circuits

4. Capacitance and Power Factor
 - a. Capacitors
 - b. Capacitors on AC Circuits
 - c. Capacitive Reactance
 - d. Power in Capacitive Circuits
 - e. Phase Shift
 - f. Power Factor

5. Three-Phase Power
 - a. Three-Phase Systems
 - b. Three-Phase Generation
 - c. Three-Phase vs. Single Phase
 - d. Three-Phase Connections
 - e. Wye and Delta Systems
 - f. System Rotation
 - g. Three-Phase Motors

Person Protective Grounding & Jumpering

Program Outline

1. General Information
 - a. Current Flow and the Human Body
 - b. Theory of Protection
 - c. Sources of Electric Energy
 - d. Fault Current
 - e. Ground Sources
 - f. Testing
 - g. Inspection and Storage
 - h. Testing Grounds
 - i. The Grounding Process
 - j. Job Briefing

2. Overhead Distribution
 - a. Grounding Components
 - b. Ground Sources
 - c. Installation Procedures
 - d. Grounding Methods
 - e. Vehicle Grounding
 - f. Grounding Capacitor Banks
 - g. Key Considerations

3. Underground Distribution
 - a. Grounding Components
 - b. Installation Procedure
 - c. Grounding Methods
 - d. Key Considerations

4. Transmission
 - a. Grounding Components
 - b. Ground Sources
 - c. Installation Procedures
 - d. Grounding Methods
 - e. Grounding Aerial Lift Vehicles
 - f. Key Considerations

5. Substations
 - a. Grounding Components
 - b. Barricading and Marking
 - c. Ground Sources
 - d. Grounding Methods
 - e. Key Considerations

Live Line Equipment & Methods

Program Outline

1. Live Line Work
 - a. The Evolution of Live Line Work
 - b. The Need To Perform Live Line Work
 - c. Minimum Approach Distance

2. Live Line Tools
 - a. Live Line Tool Composition
 - b. Live Line Tool Companies
 - c. Distribution Tool Identification
 - d. Transmission Tool Identification
 - e. Care & Storage of Live Line Tools

3. Protective Equipment
 - a. Rubber Cover-up Equipment
 - b. Plastic Cover-up Equipment
 - c. Rubber Gloves and Sleeves
 - d. Temporary Jumpers
 - e. Protective Equipment Manufacturers

4. Rubber Glove Methods
 - a. Regulations
 - b. Rubber Gloving Key Considerations
 - c. Pre-Job Procedures
 - d. Rubber Gloving Applications

5. Hot Stick Methods
 - a. Regulations
 - b. Hot Sticking Key Considerations
 - c. Pre-Job Procedures
 - d. Hot Sticking Applications

6. Barehand Methods
 - a. Concepts of the Barehand Method
 - b. Work Methods

Rigging

Program Outline

1. Weights and Loads
 - a. Working Load Limit
 - b. Reduced Working Load Limit
 - c. Shock Load
 - d. Weights
2. Sling Angles
 - a. Applications in Linework
3. Parted Blocks
 - a. Inspection
 - b. Weight Rating
 - c. Mechanical Advantage
 - d. Calculating Haul Line Tension
 - e. Calculating Hook Strain
4. Snatch Blocks
 - a. Snatch Block Tension
 - b. Calculating Snatch Block Tension
5. Applications
 - a. Transformer Installation
 - b. Pole Setting
 - c. Transmission Structures

Underground Conductors

Program Outline

1. Conductor Types and Specifications
 - a. Common Cable Components
 - b. Types of Cable
 - c. Cable Specifications and Testing

2. Substructure and Cable Installation
 - a. Trenches
 - b. Conduit Installation
 - c. Enclosures

3. Pulling Underground Cables
 - a. Cable Installation

4. Slicing, Terminating, and Marking
 - a. Terminating Cables
 - b. Splicing Cables
 - c. Marking Cables

5. Transmission and Underwater Installations
 - a. Reasons for Underground Transmission
 - b. Selecting the Type of Cable Installation
 - c. Installation
 - d. Splicing and Terminating

Overhead Conductors

Program Outline

1. Conductor Basics
 - a. Evolution of Conductors
 - b. Atomic Structure
 - c. Solid or Stranded
 - d. Copper Compared to Aluminum
 - e. Skin Effect
 - f. Temperature
 - g. Standards for Sizing Conductors
 - h. Conductor Splices, Terminations and Connections

2. Conductor Types
 - a. Copper Conductors
 - b. Aluminum Conductors
 - c. Types of Aluminum Conductors

3. Conductor Selection
 - a. Line Losses
 - b. Strength Considerations
 - c. Conductor Motion Considerations

4. Stringing and Sagging
 - a. Stringing
 - b. Equipment
 - c. Conductor Attachments
 - d. Conductor Installation Procedures
 - e. Sagging and Tensioning
 - f. Sag Tables

5. Splicing and Attaching
 - a. Deadending and Splicing
 - b. Attaching to the Insulators
 - c. Vibration Dampeners
 - d. Spacers
 - e. Corona Shields
 - f. Connections

Electrical Test Equipment

Program Outline

1. Low Voltage Test Equipment
 - a. Digital Multi-meter
 - b. Digital Clamp-on Ammeter
 - c. Recording Voltmeter and Ammeter
 - d. Phase Sequence Indicator
 - e. Service Conductor Tester

2. High Voltage Test Equipment
 - a. Phasing Meter
 - b. Voltage Detector
 - c. Halo Ammeter

3. Cable & Fault Locating Equipment
 - a. Cable Locator
 - b. DC Hi-Pot Tester
 - c. Arc Reflection System
 - d. Secondary Fault Locator

4. Substation Test Equipment
 - a. Insulation Power Factor Tester
 - b. Oil Tester
 - c. Transformer Turns Ratio Tester
 - d. Micro Ohmmeter

5. Specialized Test Equipment
 - a. Regulator Neutral Detector
 - b. Insulator Tester
 - c. Insulation Tester

Substations

Program Outline

1. Substations – An Overview
 - a. Substation Diagram
 - b. Substation Components
 - c. Single-Line Diagram
 - d. Substation Inspections

2. Circuit Breakers and Disconnects
 - a. Circuit Breakers
 - b. Disconnects
 - c. Circuit Breaker and Disconnect Maintenance

3. Transformers
 - a. Power Transformers
 - b. Three Single Phase Transformers
 - c. Power Transformer Cooling System
 - d. Transformer Oil Preservation

4. Regulators/LTCs
 - a. Regulator/LTC Function
 - b. Regulator Inspection and Testing

5. Relays and Metering
 - a. Relays
 - b. Control House

OSHA 1910.269 (Parts H, J, L, M, & R)

Program Outline

1. Subpart H: Ladders & Platforms
 - a. Ladders and Platforms
 - b. Standard CFR 1910.269
2. Subpart J: Live Line Tools
 - a. Tool Design and Construction
 - b. Tool Inspection and Care
 - c. Test Methods
3. Subpart L: Working on (or near) Exposed Energized Parts
 - a. Number of Workers Required
 - b. Minimum Approach Distances
 - c. Development of Minimum Approach Distance Tables
 - d. Altitude Correction
 - e. Overvoltage Correction
 - f. Making Connections
4. Subpart M: De-energizing Lines and Equipment for Employee Protection
 - a. Systems With System Operators
 - b. Systems Without System Operators
5. Subpart R: Line Clearing Tree Trimming
 - a. Electrical Hazards
 - b. Brush Chippers
 - c. Sprayers and Related Equipment
 - d. Stump Cutters
 - e. Gasoline Powered Saws
 - f. Backpack-Type Units for Pruning and Clearing
 - g. Rope
 - h. Fall Protection

Safety Meeting Three

Program Outline

1. Job Briefing
 - a. OSHA Requirements
 - b. Enhancing Job Briefings
 - c. Elements of Effective and Ineffective Job Briefings
 - d. Recording Job Briefing

2. Trench Safety
 - a. Protective Systems
 - b. Additional Safety Requirements

3. Electric and Magnetic Fields
 - a. EMFs in Nature
 - b. Electric and Magnetic Fields
 - c. EMF Exposure
 - d. Health Risks

4. Oil Spills
 - a. Oil Spill Prevention
 - b. What To Do When A Spill Occurs
 - c. What Can Happen

5. Material Safety Data Sheets
 - a. Understanding the MSDS Form
 - b. Acquiring MSDS Forms
 - c. What Can Happen

Special Elements One

Program Outline

1. Power Quality
 - a. Voltage Variation Terms
 - b. Correcting Voltage Variations
 - c. Neutral and Ground Voltage Variations
 - d. Frequency Variations
 - e. Site Analysis
 - f. Surge Suppression
 - g. Power Quality Analysis

2. Streetlights
 - a. Streetlight Materials
 - b. Streetlight Circuits
 - c. Sizing and Design
 - d. Mapping and Billing
 - e. Maintenance and Trouble Investigation

3. Line Inspections
 - a. Immediate Inspections
 - b. Routine Inspections
 - c. Prioritizing Repairs

4. Helicopter Utilization
 - a. Safety Rules and Procedures
 - b. Helicopter Applications

5. Hydraulics
 - a. Pascal's Law
 - b. Basic Hydraulic System
 - c. Hydraulic Tools and Equipment
 - d. Safety Considerations

Metering

Program Outline

1. Metering – An Overview
 - a. The Typical Power Bill
 - b. Determining Rates
 - c. Types of Metering
 - d. Typical Metering Locations
 - e. Sequence of Equipment
 - f. Types of Meters
 - g. Major Manufacturers of Electric Meters

2. Self Contained Meters
 - a. Parts of an Electro-mechanical Meter
 - b. Meter Sockets
 - c. Meter Installation
 - d. Testing a Meter Socket
 - e. Meter Removal
 - f. Reading a Meter Register

3. Transformer-Rated Metering
 - a. Components
 - b. Multipliers
 - c. Meter Connection Diagrams

4. AMR & Energy Diversion
 - a. Benefits of AMR
 - b. Energy Diversion

5. Meter Testing
 - a. Meter Testing
 - b. Confirming Accuracy

System Power Flow

Program Outline

1. Power Flow Fundamentals
 - a. Power System Structure
 - b. Critical Control Elements
 - c. Control Requirements

2. Transmission Power Flow
 - a. Power Wheeling
 - b. Control and Operation of the Transmission System
 - c. Generation Power Flow Equipment
 - d. Transmission Power Flow Equipment
 - e. Parallel Path Flows
 - f. Buy and Sell Transactions
 - g. Transmission Limitations

3. Distribution Power Flow
 - a. Distribution Transformers
 - b. Load Tap Changes/Regulators
 - c. Capacitors
 - d. Standard Voltage Levels
 - e. Micro Generation

4. Customer Power Flow
 - a. System Design
 - b. Voltage Levels
 - c. Surge Protection
 - d. Uninterruptible Power Supply
 - e. Customer Power Flow
 - f. Customer Efficiency
 - g. Customer Load Management

5. Power System Losses
 - a. Losses in Dollars
 - b. Losses Versus Load
 - c. Minimizing System Losses

Advanced Transformers

Program Outline

1. Winding Designations
 - a. Winding Voltage Ratings
 - b. Dual-Rated Transformers
 - c. Tap Changers
 - d. Transformer Testing

2. Three Phase Connections
 - a. Transformer Selection
 - b. Delta and Wye Connections
 - c. Determining the Proper Connections
 - d. Secondary Coils
 - e. Open Banks
 - f. Wye-Wye Banks
 - g. Wye-Delta Banks
 - h. Delta-Wye Banks
 - i. Delta-Delta Banks
 - j. Three Phase Underground Transformers
 - k. Non-Standard Connection

3. Fusing & Loading
 - a. Fusing the Primary
 - b. Types of Fuses
 - c. Transformer Loading
 - d. Transformer Overload
 - e. Delta Secondary

4. Transformer Vectors
 - a. Wye Primary Vectors
 - b. Delta Primary Vectors
 - c. Secondary Vectors
 - d. Angular Displacement
 - e. Paralleling

5. Installation
 - a. Transformer Mounting
 - b. Transformer Grounding
 - c. Secondary Busing

Maps and Standards

Program Outline

1. Mapping Basics
 - a. Longitude and Latitude
 - b. Township and Range
 - c. Global Position
 - d. Symbols
 - e. Computerized Mapping
 - f. Mapping Department

2. Distribution Mapping
 - a. Circuit Maps
 - b. Plant Detail Maps
 - c. Construction Drawings
 - d. Device and Plant Numbering

3. Transmission Mapping
 - a. System Maps
 - b. Operating Diagrams
 - c. Plan and Profile Maps
 - d. Construction Drawings
 - e. Device and Plant Numbering

4. Substation Mapping
 - a. Single Line Diagram
 - b. Construction Drawings
 - c. Device and Plant Numbering

5. Construction Standards
 - a. Specification Books
 - b. RUS Specifications

System Protection

Program Outline

1. System Protection Fundamentals
 - a. Basic Objectives
 - b. Faults
 - c. Coordination

2. Distribution System Protection
 - a. Equipment
 - b. Switches and Disconnects
 - c. Surge Protection
 - d. Coordination

3. Distribution Substation Protection
 - a. Equipment
 - b. Protection Schemes
 - c. Surge Protection

4. Transmission Protection
 - a. Equipment
 - b. Surge Protection
 - c. Protection Schemes

5. Reporting and Monitoring Service Reliability
 - a. Transmission Outages
 - b. Distribution Outages
 - c. Reporting Outages
 - d. Performance Indices
 - e. Utilizing the Information
 - f. System Protection Impacts

NESC I

Program Outline

1. Applying the NESC
 - a. Availability of the NESC
 - b. Development of the NESC
 - c. Comparison of the NESC, NEC and OSHA Standards
 - d. Interrelationships of the NESC, NEC, and OSHA Regulations
 - e. Determining the Appropriate Code
 - f. Use of the NESC
 - g. Format of NESC Requirements
 - h. General Requirements of the NESC
 - i. Determining the Applicable Edition
 - j. Determining the Applicable Part of the NESC
 - k. Application of Rules
 - l. Key Code Editions
 - m. The NESC is Not a Design Code
 - n. Key NESC Rules

2. Inspection of Utility Facilities
 - a. Inspection of Overhead Systems
 - b. Facilities Inspections
 - c. Pole Inspections
 - d. Supply Station Equipment Inspections
 - e. Inspection of Underground Systems
 - f. Frequency and Consistency of Inspections
 - g. When Defects Are Found

3. Grounding
 - a. Grounded Versus Effectively Grounded
 - b. Grounding Requirements of the NESC
 - c. Using the Earth as Part of a Circuit
 - d. Grounding Methods

4. Electric Supply Stations And Equipment
 - a. Enclosures
 - b. Clearance of Energized Parts Above Ground
 - c. Vertical Clearance From Personnel Space
 - d. Guarding
 - e. Signs
 - f. Working Space Clearances
 - g. Rotating Equipment
 - h. Storage Batteries
 - i. Location and Arrangement of Power Transformers and Regulators
 - j. Conductors
 - k. Circuit Breakers, Reclosers, Switches and Fuses
 - l. Switchgear and Metal Enclosed Bus
 - m. Arresters

(continued)



NESC I

Program Outline (cont.)

5. Underground Lines
 - a. General Requirements
 - b. Underground Conduit Systems
 - c. Supply Cables
 - d. Cable in Underground Structures
 - e. Direct-Buried Cables
 - f. Risers
 - g. Supply Cable Terminations
 - h. Equipment
 - i. Safety Signs
 - j. Section 39 - Tunnels

6. Work Rules
 - a. Key Rules for Employees
 - b. Key Rules for All Employees
 - c. Additional Key Rules for Communication Employees
 - d. Additional Key Rules for Supply Employees
 - e. Protective Grounding
 - f. Rule 445 – Live Work

NESC II

Program Outline

1. Overhead Lines & Equipment
 - a. Attachment Levels
 - b. Conflict
 - c. Joint Use
 - d. Installing and Reserving Class
 - e. Installing Communication Facilities
 - f. Installing Electric Supply Facilities
2. Conductor Movement & Resulting Clearance
 - a. Key Clearance Terms
 - b. Using Ruling Span Information
 - c. Additional Clearances at Installation
 - d. Calculating Expected Conductor Temperatures
 - e. Shape of Sag Curve
 - f. Development of Clearance Requirements
 - g. Key NESC Clearance Rules
3. Clearance Above Ground, Rails & Water
 - a. Rule 231
 - b. Rule 232
4. Clearance Between Crossing & Parallel Lines
 - a. Rule 233
 - b. Rule 233 Coverage
5. Clearance To Buildings & Other Installations
 - a. NESC Building Clearances (Rule 234)
6. Clearance Between Wires, Conductors & Cables
 - a. Major Rules (Rule 235 through 239)
7. Overhead Strength & Loading
 - a. NESC Strength and Loading Rules
 - b. Grades of Construction
 - c. Causes of Loads
 - d. Ice-covered Conductors and Cables
 - e. Assumed Loadings on Structures and Supporting Facilities
 - f. Overload Factors and Strength Requirements
 - g. Reactions of Structural Members
 - h. Strength Factors
 - i. Inspection and Maintenance of Structures

OSHA 1910.269 (Parts E, F, P, Q, T, U, & W)

Program Outline

1. Subpart E: Enclosed Spaces
 - a. Enclosed Space Entry
 - b. Additional Requirements
2. Subpart F: Excavations
 - a. Protecting Workers in Excavations
 - b. Additional Requirements
 - c. Excavation Protection Process Flow
3. Subpart P: Mechanical Equipment
 - a. General Requirements
 - b. Outriggers
 - c. Applied Loads
 - d. Operations Near Energized Lines and Equipment
4. Subpart Q: Overhead Lines
 - a. Elevated Structures
 - b. Installing and Removing Overhead Lines
 - c. Live-Line Bare-hand Work
 - d. Towers and Structures
5. Subpart T: Underground Electrical Installations
 - a. Access
 - b. Lowering Materials into Manholes
 - c. Attendants
 - d. Rodding Ducts
 - e. Cables
6. Subpart U: Substations
 - a. Access and Work Space
 - b. Draw-out Type Circuit Breakers
 - c. Substation Fences
 - d. Guarding of Rooms Containing Electric Supply Equipment
 - e. Guarding of Energized Parts
 - f. Substation Entry
7. Subpart W: Special Conditions
 - a. Capacitors
 - b. Current Transformer Secondaries
 - c. Series Street Lighting
 - d. Protection Against Drowning
 - e. Employee Protection in Public Work Areas
 - f. Backfeed
 - g. Lasers
 - h. Hydraulic Fluids



Safety Meeting Four

Program Outline

1. Blood Borne Pathogens
 - a. Exposure
 - b. Protection from Exposure

2. Ergonomics
 - a. Ergonomics
 - b. Repetitive Motion Injuries
 - c. Hand/Arm Vibration
 - d. Preventative Measures

3. Safety Audits
 - a. Equipment Audits
 - b. Yard/Facility Audits
 - c. Crew Audits
 - d. Program Evaluation Profile

4. Equipment Safety
 - a. Pre-trip Inspection
 - b. Digger Derrick
 - c. Material Handler
 - d. Backhoes

5. Key Safety Considerations
 - a. Commitment to Safety
 - b. Establish a Reputation for Being Safe
 - c. Case Analysis
 - d. Safety Philosophy

Communication Systems

Program Outline

1. Communications Basics
 - a. The Beginning of Electronic Communications
 - b. Telephones
 - c. Radio and Cellular
 - d. The Radio Spectrum
 - e. Analog and Digital
 - f. Cable TV Networks
 - g. Data Transmission Mediums
 - h. The Lineworker's Role

2. Communication System Utilized by Power Companies
 - a. Internal Telephone Systems
 - b. Company Radio Systems
 - c. Powerline Carrier Systems
 - d. SCADA
 - e. Mobile Data Systems
 - f. Satellite Systems

3. Services Offered By Power Companies
 - a. The 1996 Telecommunications Act
 - b. Facility Rental
 - c. Dark Fiber
 - d. Broadband
 - e. Telephone Service
 - f. Other Services

4. Distribution Fiber Installation
 - a. Cable Types and Installation Considerations
 - b. System Components
 - c. Rules and Regulations

5. Transmission Fiber Installation
 - a. Optical Ground Wires
 - b. Optical Ground Wire Hardware
 - c. Installation Methods

Special Elements Two

Program Outline

1. Customer Relations
 - a. Customer Satisfaction
 - b. Company Image
 - c. Personal Contact With Customers

2. Corrosion
 - a. Oxidation
 - b. Dissimilar Metals
 - c. Cathodic Protection

3. Flame Resistant Clothing
 - a. OSHA Regulation
 - b. Industry Response
 - c. Clothing and Care

4. Security
 - a. Building Security
 - b. Facilities Security
 - c. Vehicle and Work Area Security
 - d. Personnel

5. Disaster Restoration
 - a. Types of Disasters
 - b. Advanced Preparation
 - c. Damage Assessment
 - d. Priority of Restoration
 - e. Transmission System Restoration
 - f. Distribution System Restoration
 - g. Hazards

Vegetation Management

Program Outline

1. Vegetation Management
 - a. Goals of Vegetation Management
 - b. Scheduling
 - c. Public Education
 - d. The Lineman's Role

2. Tools And Equipment
 - a. Hand Tools
 - b. Equipment

3. Vegetation Control
 - a. Vegetation Management Philosophies
 - b. Control Method

4. Pruning Methods
 - a. Pruning
 - b. Removing Problem Limbs
 - c. Felling Trees

5. Safety Standards
 - a. Safety Standards
 - b. Pruning Standards

System Operation

Program Outline

1. The System Operator
 - a. Jurisdiction
 - b. System Operations Center
 - c. System Operator Qualifications and Training
 - d. System Operator Responsibilities and Duties
 - e. Operating Center Staff
 - f. Routine Operations
 - g. Emergency Operations
 - h. Switching Orders
 - i. Operating Errors

2. Clearing Lines and Equipment
 - a. Objectives
 - b. Definitions
 - c. Types of Clearance
 - d. Energy Sources
 - e. Clearance Points
 - f. Operating Switches
 - g. Tagging and Locking
 - h. Impacts of Clearing
 - i. Procedure

3. Distribution Operations
 - a. Energizing Distribution Circuits
 - b. Fault Indication
 - c. Paralleling and Looping Distribution Circuits
 - d. Procedures for Paralleling and Separating Circuits
 - e. Procedures for Looping
 - f. Non-Reclose Condition
 - g. Clearing Lines and Equipment
 - h. Distribution Generation

4. Substation Operating
 - a. Operating a Substation
 - b. Clearing Equipment
 - c. Testing a Bus
 - d. Testing a Transformer Bank
 - e. Testing Circuits
 - f. Operating Disconnects

5. Transmission Operation
 - a. Clearing Transmission Lines
 - b. Loop Switching
 - c. Testing Transmission Lines
 - d. Fault Locating
 - e. Non-Reclose Condition
 - f. Power Flow Control
 - g. Summary

System Automation

Program Outline

1. Overview
 - a. Benefits of Automation
 - b. Defining Terms
 - c. Analog and Digital
 - d. Communications
 - e. Communications Protocols
 - f. EMS Systems
 - g. SCADA Fundamentals
2. Key Equipment
 - a. Computer Equipment
 - b. Measuring Equipment
 - c. Other Equipment
 - d. Equipment Locator
3. Substation Automation
 - a. Substation Automation Benefits
 - b. Data Acquisition
 - c. Equipment Control
 - d. Equipment Monitoring
 - e. Basic Design
4. Distribution Automation
 - a. Line Automation Benefits
 - b. Data Acquisition
 - c. Equipment Control
 - d. Automation Examples
5. Automated Meter Reading
 - a. Benefits of AMR
 - b. Key Equipment
 - c. Communications Media
 - d. Types of AMR
 - e. DSM
 - f. Lineworker Impacts

Overhead Line Design

Program Outline

1. Line Routes
 - a. Distribution Line Routes
 - b. Structure Locations
2. Structure Design
 - a. Pole Selection
 - b. Structure Height
 - c. Structure Strength
 - d. Conductor Supports
 - e. Anchors and Guys
3. Insulation and Equipment
 - a. Insulation Levels
 - b. Insulators
 - c. Arresters
 - d. Switches
 - e. Protective Equipment
4. Transformers, Services and Secondary
 - a. Transformer Location and Installation
 - b. Secondary and Services
 - c. System Neutral
5. Transmission
 - a. Transmission Right-of-Way
 - b. Transmission Structures
 - c. Structure Foundations
 - d. Insulators
 - e. Shielding
 - f. Hardware

Underground Line Design

Program Outline

1. Fundamental Design
 - a. Design Considerations
 - b. Basic Designs
 - c. Key Components

2. Location and Trench Design
 - a. Location
 - b. State/Interstate Highways
 - c. Staking the Trench Line

3. Substructure Design
 - a. Types of Enclosures
 - b. Selecting Enclosures
 - c. Locating Enclosures
 - d. Equipment Pads
 - e. Conduit or Direct Buried
 - f. Conduit
 - g. Direct Buried Cables
 - h. Riser Poles

4. Switches and Protective Equipment
 - a. Switch/Fuse Combination
 - b. Switches
 - c. Other Protective Equipment
 - d. Lightning Arrester Application
 - e. Faulted Circuit Indicators

5. Transformers, Secondary and Services
 - a. Types of Transformers
 - b. Installation Considerations
 - c. Transformer Schematics
 - d. Transformer Clearances
 - e. Transformer Selection
 - f. Sizing the Transformer
 - g. Secondary and Services
 - h. Riser Poles

Trouble Investigation

Program Outline

1. Communication
 - a. Receiving Calls
 - b. Customer Communication
 - c. Emergency Communication

2. Investigating Customer Complaints
 - a. Investigation Considerations
 - b. Bright and Dim Lights
 - c. Flickering Lights
 - d. Partial Out
 - e. All Out
 - f. Low Voltage
 - g. High Voltage

3. Transformer Trouble Investigation
 - a. Initial Assessment
 - b. Defective Transformer
 - c. Transformer Overload
 - d. Blown Transformer Fuse
 - e. Temporary Rewiring of Transformer Banks

4. Radio and TV Interference
 - a. Common Causes
 - b. Investigative Techniques
 - c. Common Solutions

5. Case Studies
 - a. Customer Complaint Case Studies
 - b. Transformer Trouble Investigation Case Studies
 - c. Radio/TV Interference Case Studies

Crew Leadership

Program Outline

1. Background
 - a. Crew Leader Evolution
 - b. Today's Crew Leader
 - c. Employer Expectations
 - d. Scheduling Line Crews
2. Crew Leader Resources
 - a. The Resources
 - b. Additional Key Elements
 - c. Cost of Resources
3. Knowledge, Skills and Abilities
 - a. Technical Knowledge
 - b. Supervisory Skills
 - c. Other Skills
 - d. Abilities
 - e. Selection of Crew Leaders
4. Job Responsibilities
 - a. Responsibilities
 - b. Performance Evaluation
5. Assisting the Crew Leader
 - a. The Benefits of Being a Crew Leader
 - b. Understanding the Crew Leader
 - c. Assisting the Crew Leader
 - d. Examples of Assisting the Crew Leader
 - e. Preparing for the Future