FirstEnergy®

Safety and the Emergency Responder

For Emergency Medical Services, Public Safety and Public Works Employees

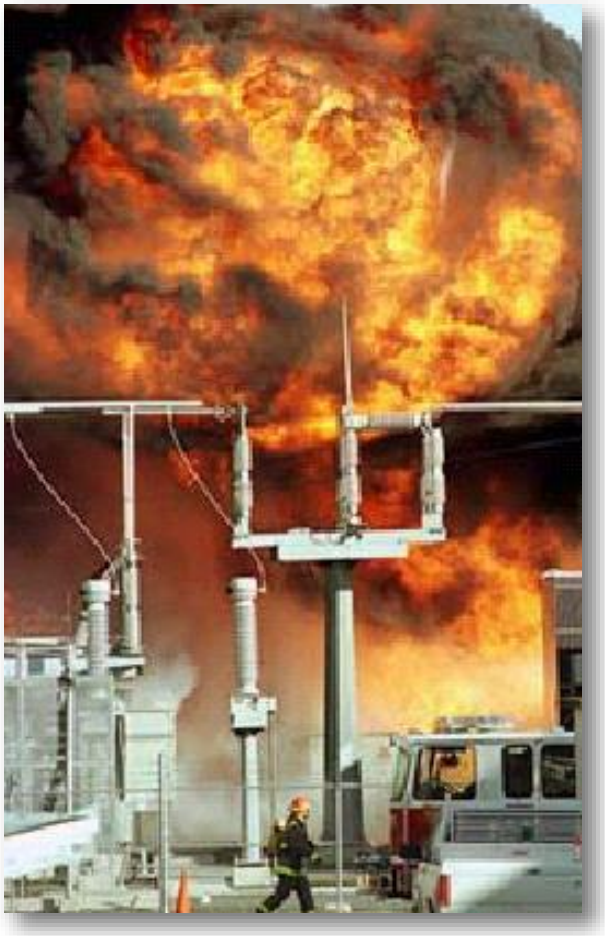
FEU **Safety**

2016

FirstEnergy® | Utilities

Objectives

- **Raise awareness of potential dangers with utility facilities**
- **Help emergency responders identify and report damage to electrical facilities**
- **Understand that utility expertise is critical to a successful resolution**
- **Recommend development of Department SOGs/SOPs**



Electricity Basics

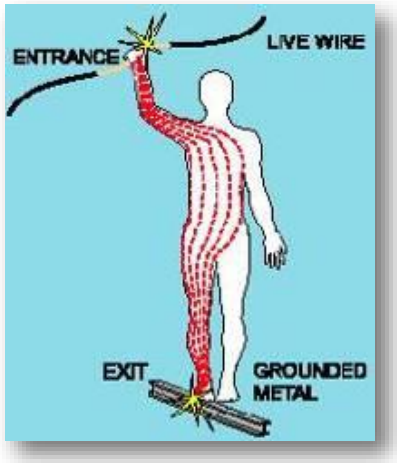
- **Voltage (V), a measure of force or pressure in system driving the electric current**
  - Increasing voltage will make more current flow
  - Under certain circumstances, humans can withstand thousands of volts
  - Stun guns = 50,000 volts, but no amps
- **Amperage, or amps, measures the amount of current**
  - Presents the greatest danger during electrical contact
  - One-fifth of 1 amp – about what a household night light carries – can stop the human heart
- **Resistance (r), in an electrical circuit, measured in ohms**
- **Current (I) = voltage / resistance**
- **Power (P) = voltage x current**
- **Watts are a measure of the rate of electrical energy being used**

Electricity Basics

- **Travels 186,000 miles per second**
- **One lightning strike can generate 100 million to 1 billion volts of electricity**
- **More people are killed from 120-240 (household) volts than any other voltage**

Electric Shock

- **Occurs when a part of your body completes an electrical circuit by …**
  - Touching a live wire and an electrical ground, or
  - Touching a live wire and another wire at a different voltage
- **Severity of the shock depends on:**
  - **Path** of electric current through the body
  - **Amount** of current flowing through the body (amps)
  - **Duration** of the current through the body
- **Low voltage does not mean low hazard**
- **Electrocution remains the fourth-highest cause of industrial fatalities**



Electric Shock

Amps or current, not voltage, causes electric shock

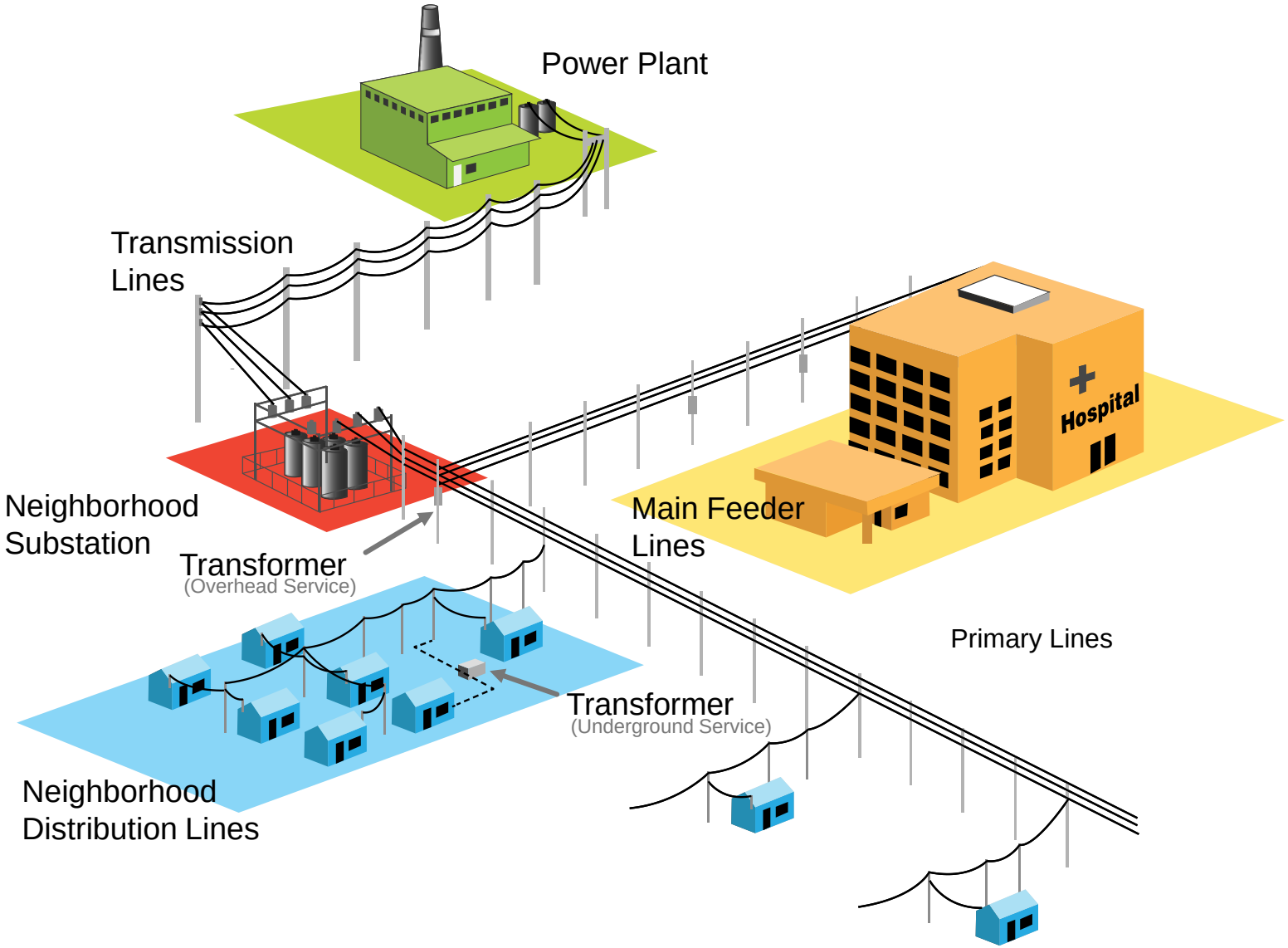
Milliamps	Effect on Person
0.5 – 3	Tingling sensations
3 – 10	Muscle contractions and pain
10 – 40	“Let-go” threshold
30 – 75	Respiratory paralysis
100 – 200	Ventricular fibrillation
200 – 500	Heart clamps tight
1500 +	Tissue and organs start to burn

Notes:

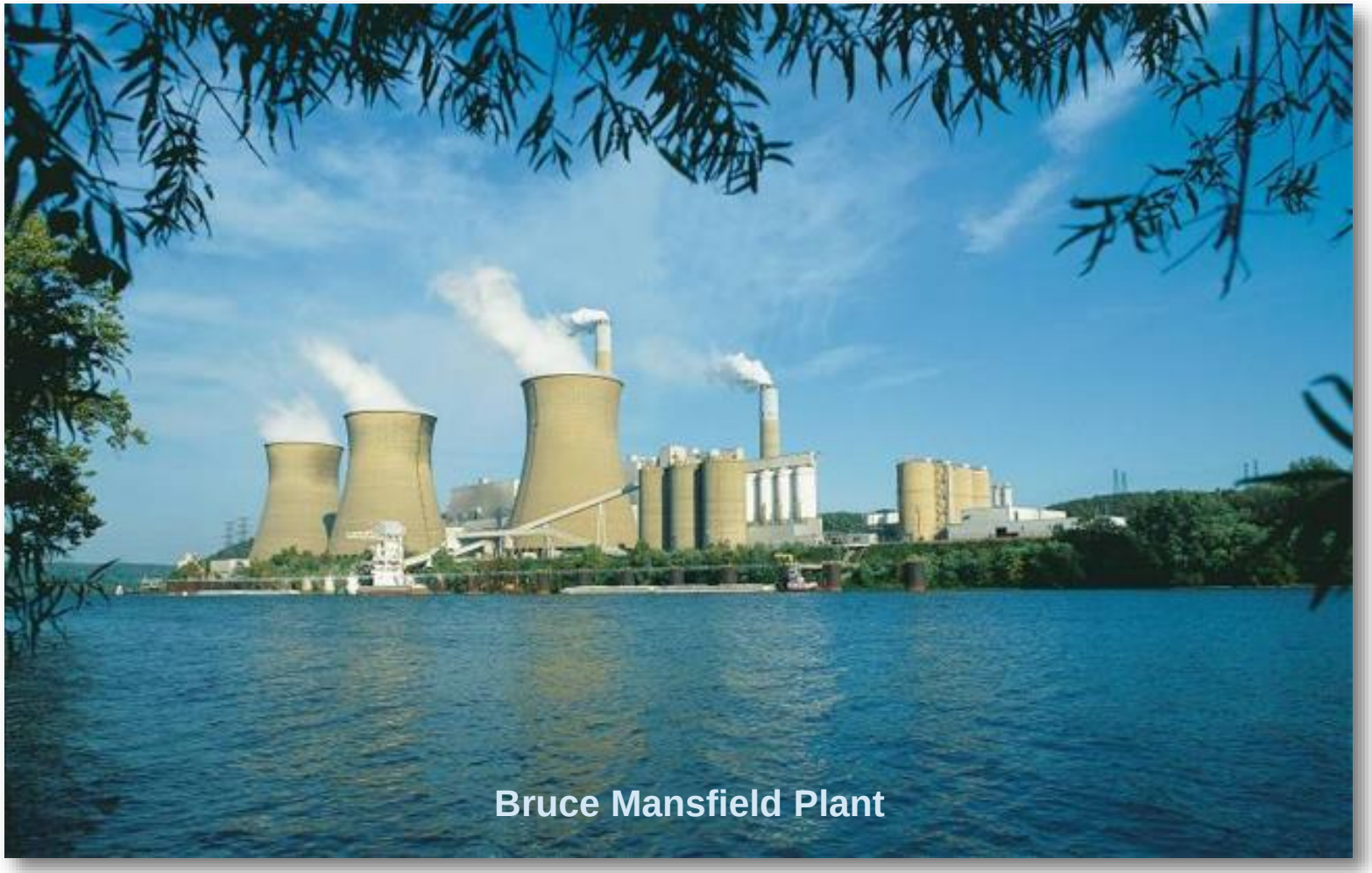
Reaction will vary with frequency and time of exposure.

Electrical burns require a longer in hospital stay and recovery than thermal burns

Electrical System Components



Generating Facilities



Transmission Facilities

Transmission – 115 kV to 500 kV

Sub-transmission – 26 kV to 69 kV

Substations

- **Surrounded by fences with barbed wire; gates are locked; “danger” signs posted**
- **Transmission 115 kV – 500 kV**
- **Sub-transmission 26 kV – 69 kV**
- **Distribution 2,400-19,900 volts**
- **Electromagnetic fields near high-voltage wires can result in a shock without even touching a conductor connected to the power system**

Distribution Substation

Transmission Substation

Substation Equipment

Power Circuit Breakers

- **Device used to open or close an electric power circuit either during normal power system operation or during abnormal conditions**

Circuit Switchers

- **Is used to protect a 69 kV or 138 kV transformer primary in a distribution substation**
- **Circuit switchers are also used for capacitor bank switching**

Substation Control House

- **Batteries for DC supply**
- **Station AC electrical panels**
- **Relay and control systems**

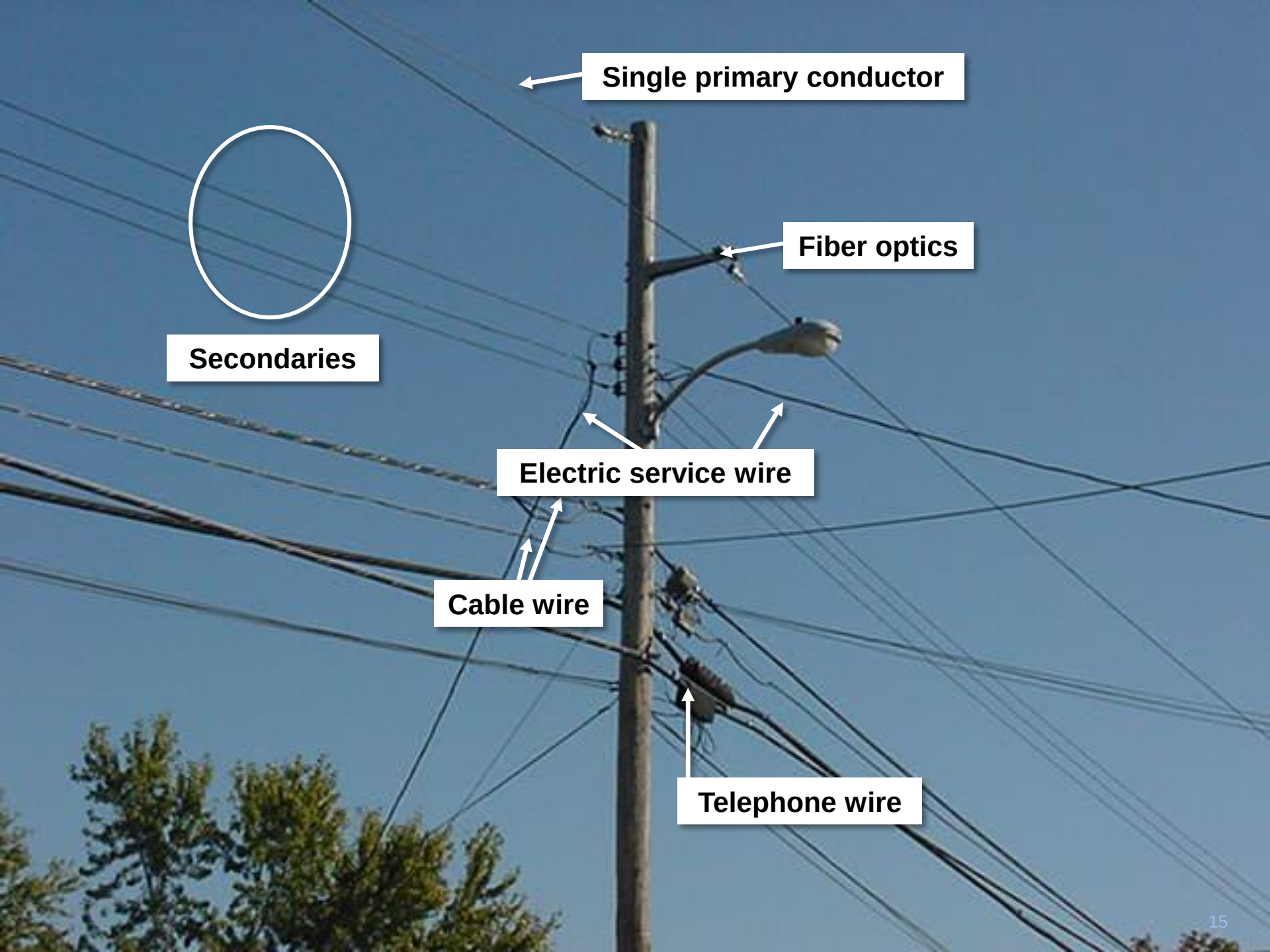
Transformers

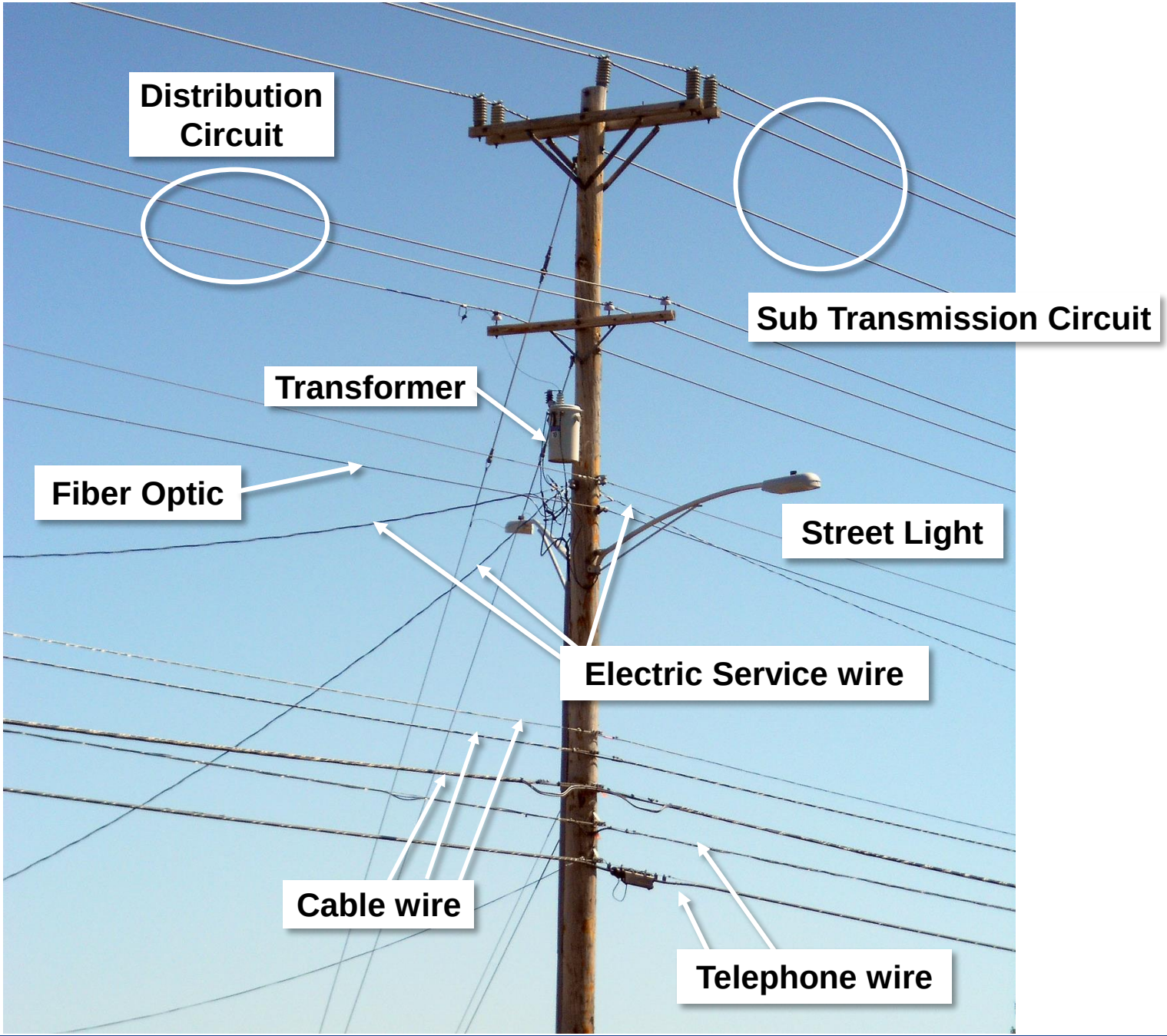
- **Most are core form, circular coil winding construction; transformer windings are surrounded by the core steel**
- **Contains large quantities of mineral oil, used for cooling and insulation**

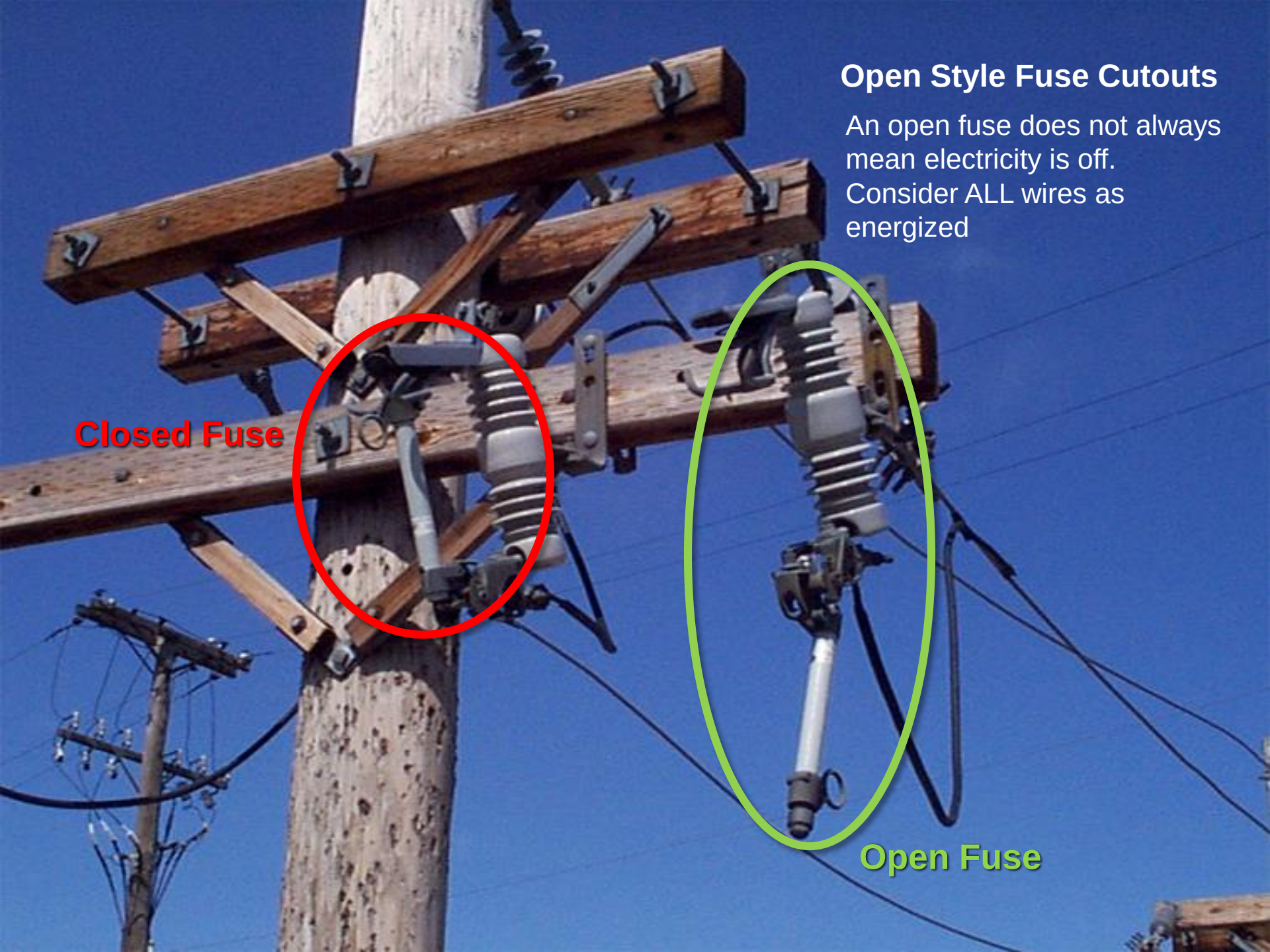
Pole Equipment

- **Installed on poles from the top down**
- **Primary wires* (top of pole)**
  - 2,400 to 69,000 volts
  - Wire bare or weather coating only (not insulated)
- **Secondary* for local use**
  - Less than 600 volts (usually 120/240)
  - Wire bare or weather coating only (not insulated)
- **Fiber optics**
  - Can be installed in the power space or communications space
- **Fire alarm**
- **Cable television (CATV)**
- **Telephone lines**

*Power lines may have a cover to protect against weather, but they are not insulated for contact.


Single primary conductor
Fiber optics
Secondaries
Electric service wire
Cable wire
Telephone wire


Distribution Circuit
Sub Transmission Circuit
Transformer
Fiber Optic
Street Light
Electric Service wire
Cable wire
Telephone wire


Open Style Fuse Cutouts
An open fuse does not always mean electricity is off. Consider ALL wires as energized
Closed Fuse
Open Fuse

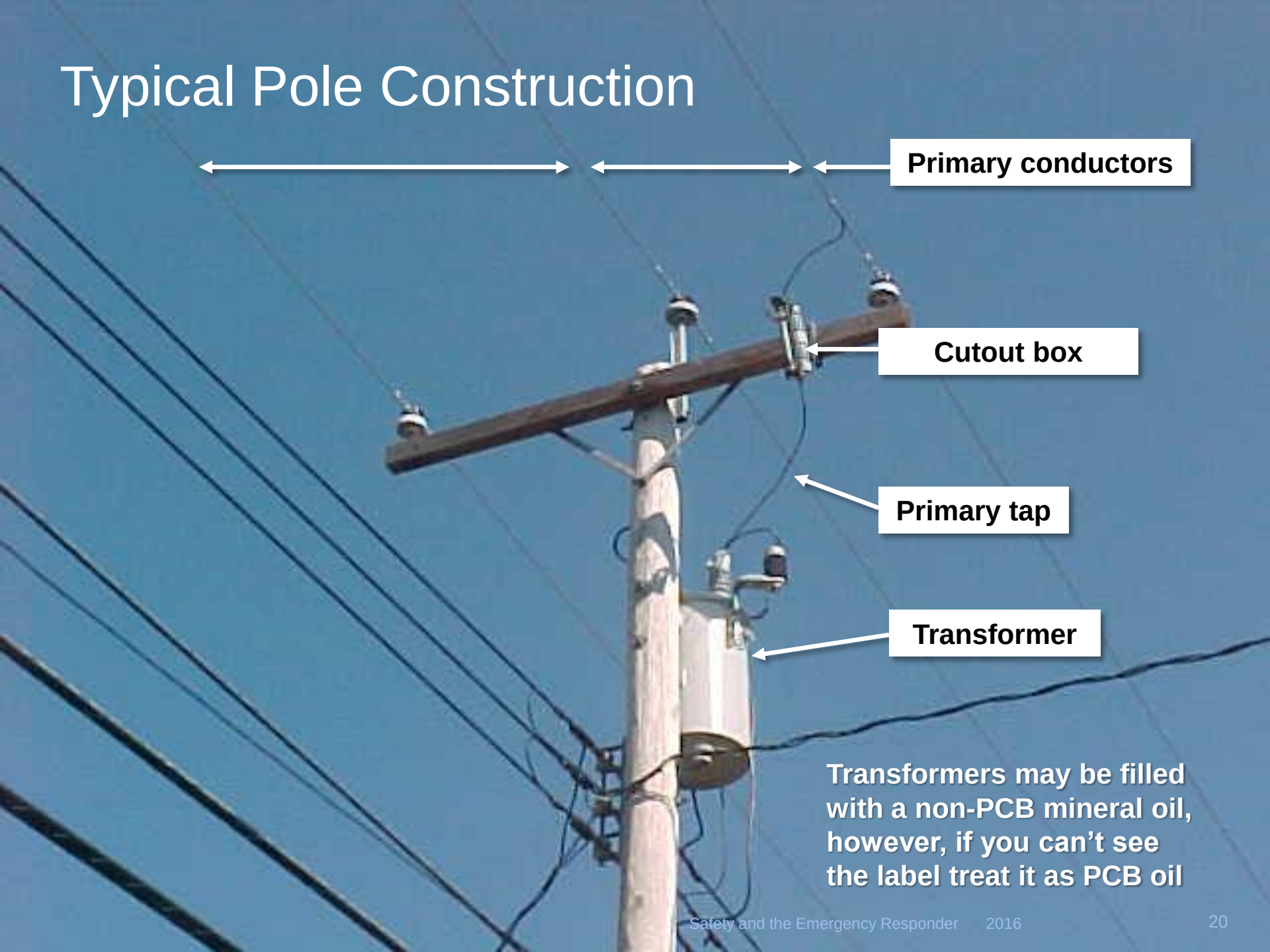
Pole Equipment – Insulators

- **Made from materials such as glass, porcelain, polymer and plastic**
- **Provide a means of clearance to prevent voltage from tracking to ground or another energized phase**
- **The more insulators on a single string, the higher the voltage**

Pole Equipment – Transformers

- **Located on some poles**
- **Can step up or step down voltage**
- **May step down primary voltage to secondary**
- **Many step down one primary voltage to another primary voltage**
- **Residential**
  - Single transformer
  - 120-240 volts
- **Industrial**
  - Two or three transformers grouped together on the same pole
  - 120-480 volts

Typical Pole Construction

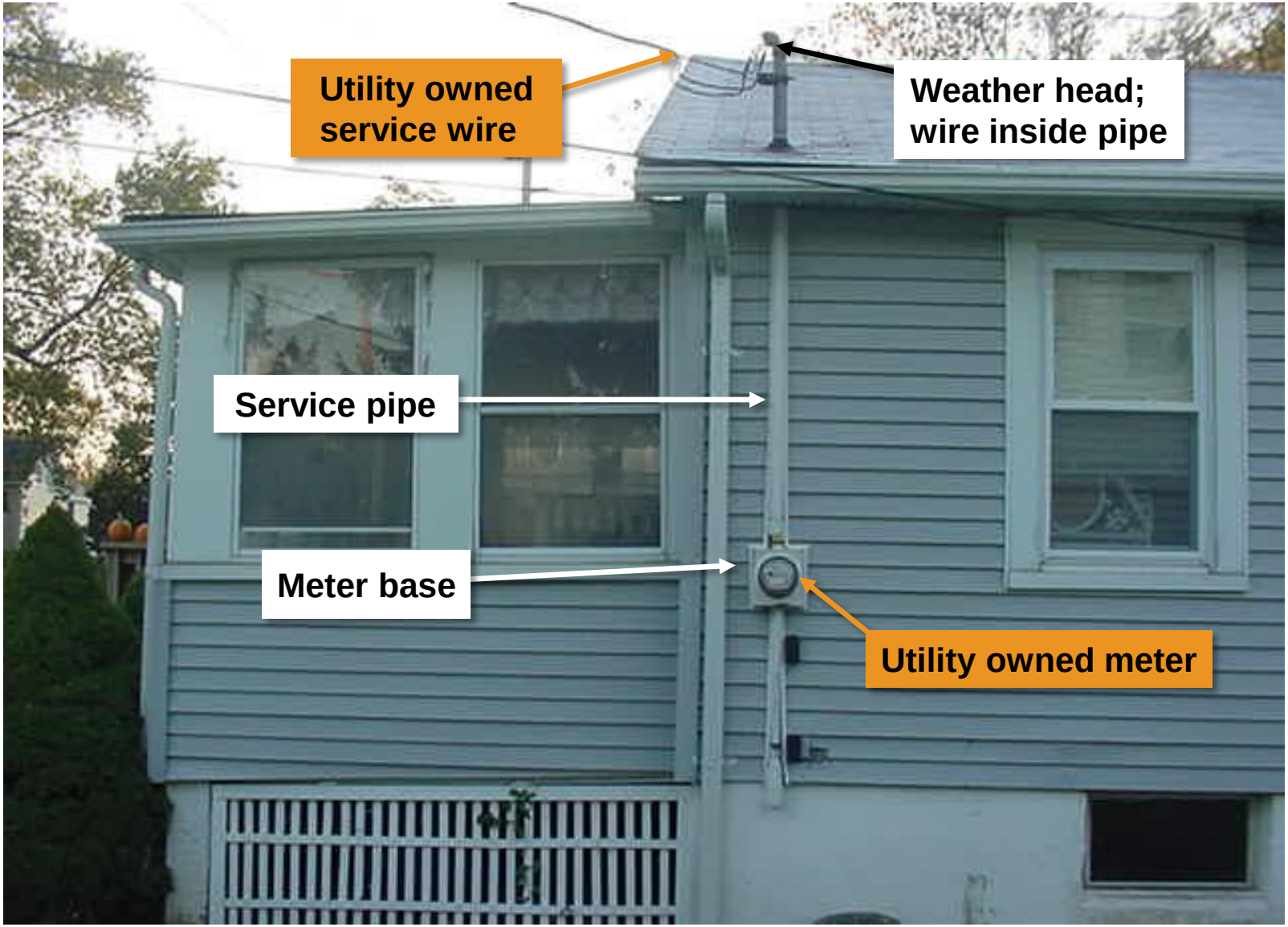


Transformers may be filled with a non-PCB mineral oil, however, if you can't see the label treat it as PCB oil

Other Equipment

- **Risers, enclosed in pipes, run up the sides of utility poles; contain wires that connect overhead and underground systems.**
- **Service wires run from a utility pole to a house or other buildings**
- **Guy wires support utility poles**

Customer Owned Equipment

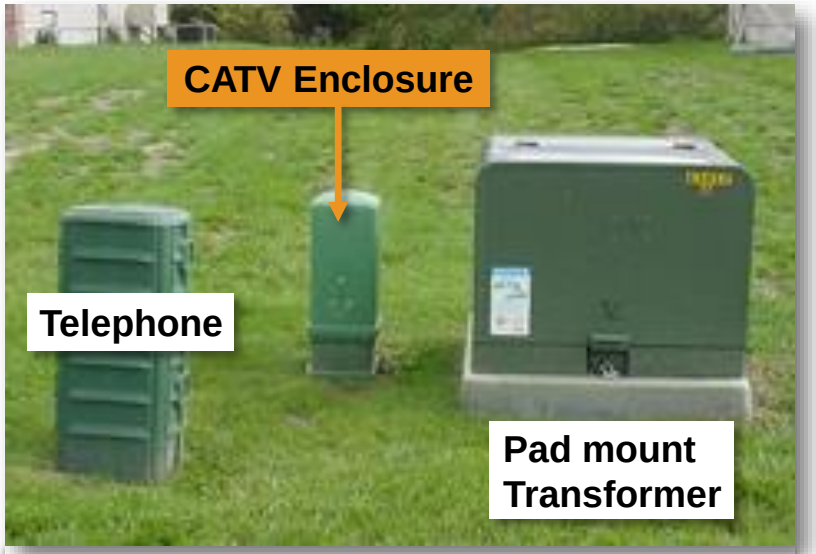


Meters

- **Meters are not switches, they are metering devices**
- **Emergency responders should never remove a meter**
- **If necessary, emergency responders should turn off main disconnect to the building**

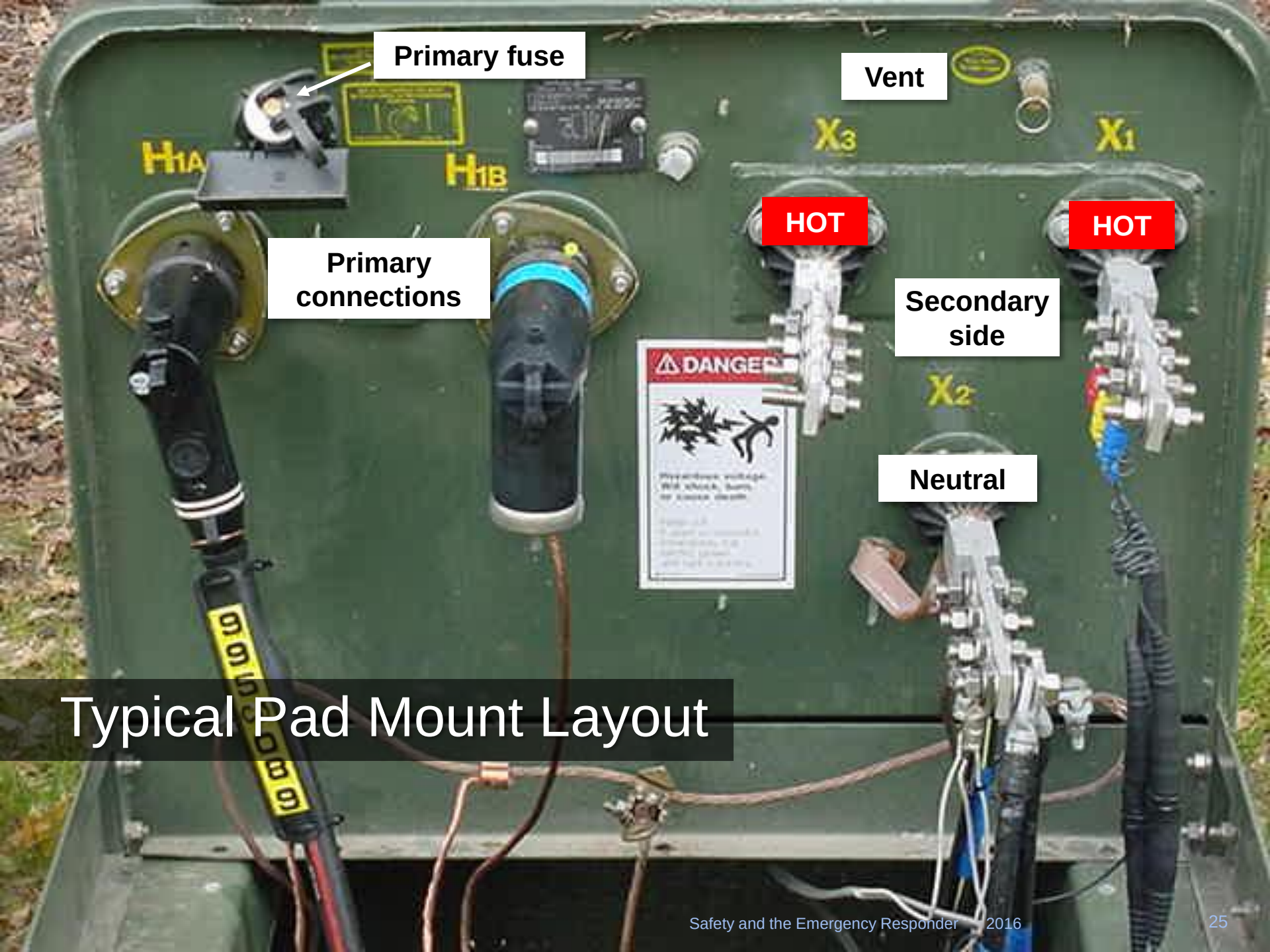
Underground Electrical Systems

- **Voltages are same as overhead**
- **Oil-filled transmission cables, called pipe-cable, may be installed**
- **In residential and commercial areas**
- **Cable television and telephone usually in close proximity**
- **Facilities can be exposed or damaged by excavations, cave-ins, uprooted trees**
- **If any cables are exposed, assume they are energized and call local utility**
- **Do not attempt to reposition box or identify cables**



Transformers found in two types:

- Underground
  - Installed below ground level
- Pad mount
  - Installed on a base (pad) at ground level
  - Have all the cables and connections locked inside the locked cabinet.



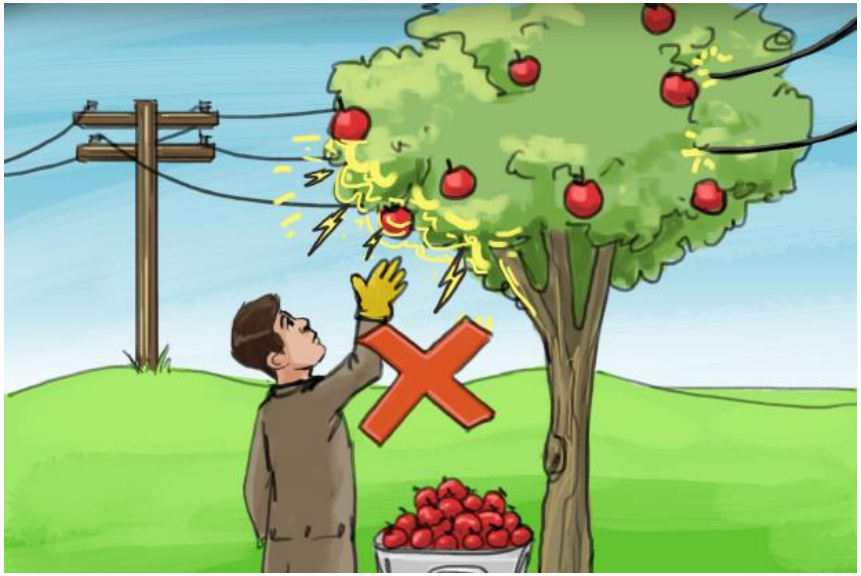
Typical Pad Mount Layout

Potential Hazards/Types of Emergencies

- **Downed wires**
- **Downed service wires to buildings**
- **Pole and transformer fires**
- **Vehicle-pole accidents**
- **Wires on vehicles**
- **Oil spills**
- **Hazardous material**
  - PCBs
  - Asbestos
- **Explosions/BLEVEs**
- **Backfeeds**
- **Electrical arcs and flashes**
  - Caused by a fault on the line
  - Tool or piece of metal getting across the lines
  - Faulted piece of equipment
  - Reaches 11,000 degrees Fahrenheit in one-tenth of a second

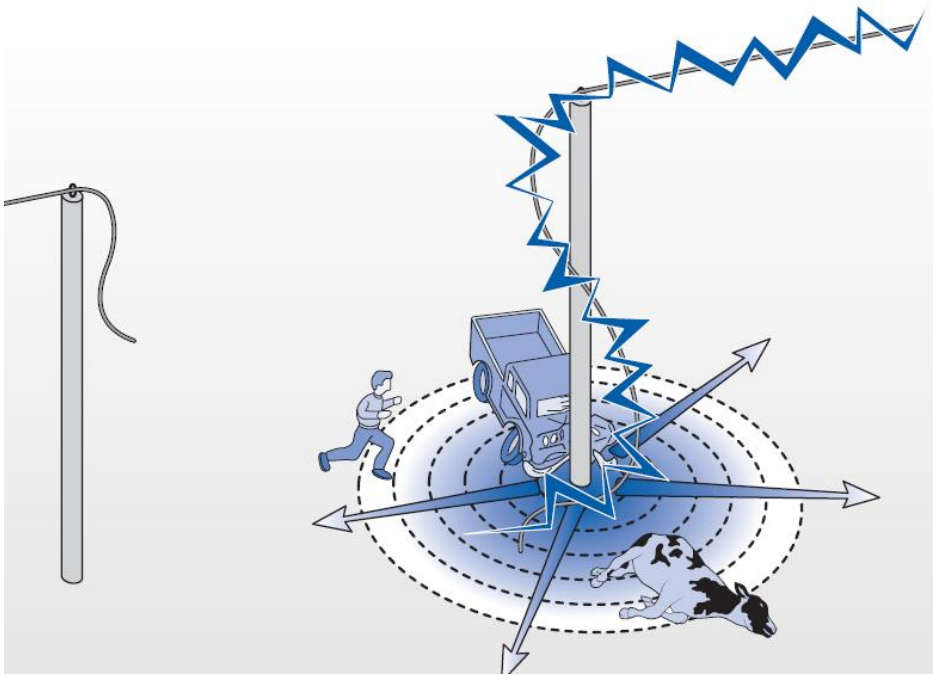
Step Potential/Touch Potential

- **Potential difference between a grounded object and the earth's surface**
- **Voltage decreases as the distance from the point of contact increases**
- **Under fault conditions, a person touching any part of an aerial apparatus and standing on the ground may be subject to hazardous currents**
- **Current can seriously injure or cause death**



Step Potential/Touch Potential (continued)

- **Step potential is created when current from downed line makes direct contact with ground**
  - Can seriously injure or kill someone who is walking near the point where energized wires make contact with ground
  - As electricity flows through the soil, voltage dissipates with distance away from point of contact
  - Person's legs make better conductor than ground
  - By striding across affected area, emergency responder could have each foot in different voltage zone



Electrical Hazards – Types of Emergencies

Downed Wires

Upon arrival

- **Establish a safety zone and secure the area**
- **If possible, the safety zone should extend a minimum of two full span lengths of wire in each direction beyond the downed wire**
  - Poles may break and fall due to stress
  - Wires can slip through insulators and sag to the ground
  - Wires may be contacting metal fences, guard rails, buildings, etc.

Electrical Hazards – Types of Emergencies

Downed Wires

- **Bodies in contact with live wires may be energized. DO NOT TOUCH the individual until the wire is tested and cleared from the body**
- **Wires should not be assumed dead until they are tested dead or certain assurance from local utility personnel is received**

Electrical Hazards – Types of Emergencies

Substation Fires

- **Assess situation, including potential hazards, report to Incident Commander**
- **Establish command post**
- **Do not enter substation, wait for utility**
- **Wait until utility de-energizes equipment and establishes a safe area**
- **Do not go beyond safe area without obtaining utility guidance**
- **Begin fire suppression operation**

Electrical Hazards – Types of Emergencies

Substation Fires

- **Using AFFF foam hose line, cover ground surface under and around equipment**
- **Maintain distance from transformer and point of operation**
- **Treat transformer as delayed bomb – strong BLEVE potential**
- **Assume oil is contaminated and provide maximum protection to personnel**
- **Water could trigger explosion or create electrical contact**
- **If water is applied, use fog pattern**

Electrical Hazards – Types of Emergencies

Vehicle/Pole Accidents

- **All potential hazards should be thoroughly evaluated**
- **Approach cautiously – establish a safety zone**
- **If fire is present, use a fog pattern rather than straight stream**
- **Remember: the vehicle and anything attached to it may be energized**
- **Do not come within 30 feet of the vehicle**

Electrical Hazards – Types of Emergencies

Vehicle/Pole Accidents

- **Occupants have one thought … to get out of the vehicle**
- **Gain their confidence and order them to remain in vehicle**
- **If it is necessary to have the occupants exit the vehicle, they should be given explicit instructions and told not to come in contact with the vehicle and the ground at the same time**
- **Once on the ground, small shuffling steps should be taken to move away from the involved vehicle (remember – step potential)**

Electrical Hazards – Types of Emergencies

Manhole/Vault Fires

Never enter a manhole or vault until a local utility representative indicates it is safe

- **Do not approach the vault/manhole or attempt extinguishing operations**
- **Do not attempt to remove vault lid or grate covers**
  - Covers, if mistakenly dropped into vault, can cause serious problems or injury
- **Establish safety perimeter, evacuate endangered civilians, and notify the local utility**
- **Be aware of:**
  - Possible BLEVE
  - Manhole covers being blown into air
  - Fire erupting from vaults/manholes
- **Do not position fire apparatus on top of manhole covers**

Ladders and Other Lifts

- **Before raising or extending any kind of ladder, metal pole, or other equipment capable of reaching a power line, check in all directions for power lines**
- **Be careful while carrying or positioning any kind of ladder, tool, equipment, or extension and keep them well away from energized overhead power lines, especially the weather head or service drop**

Electrical Hazards – Types of Emergencies

Summary

- **Treat all wires as dangerous and energized at high voltage until tested and proven otherwise**
- **Exercise extreme caution when approaching the scene, especially at night**
- **Establish a safety zone and prevent all unauthorized persons from approaching the scene**
- **Secure the scene until relieved by local utility**
- **Never tamper with energized wires or equipment**

Pole Identification

- **Every pole is identified by a number**
- **Located on side of the pole that faces the street, approximately 6 feet above the ground**
- **If number is missing, check adjacent pole and use as a reference point**

Reporting to the Utility

- **Describe nature of emergency/damage**
- **If injury or danger is involved**
- **Community, town, borough**
- **Building number**
- **Street name**
- **Nearest cross street and direction from the location (north, east, west or south)**
- **Identifying equipment numbers (pole, padmount)**
- **If emergency is adjacent to the street or rear of property**
- **Call-back number**

Tips

- **Always treat all downed wires, including cable TV and telephone wires, as energized at high voltage until proven otherwise**
  - It's possible that a few spans away, an energized power line could be touching the phone or cable line, energizing it as well
  - There's always a possibility that what you think is a phone line is really a power line
  - Both cable television and phone lines can carry primary voltage
- **There may be hazards you can't see**
  - Downed line hidden by vegetation
  - Energized, downed line a few spans away
  - Other hazards

Tips

Do

- Communicate information received in field to your dispatcher, who will immediately notify utility
- Assume any fallen wire is energized and dangerous
- Keep spectators and traffic clear of sparking or fallen wires at the scene of vehicular accidents
- Stay clear of any electric wire when working with aerial equipment
- Notify utility if electric service has to be disconnected
- Advise occupants of a vehicle in contact with an electric wire to remain inside and not to attempt to exit

Do Not

- Allow a sense of urgency to influence hasty action which might result in your becoming a victim
- Touch a person in contact with a fallen wire
- Touch anything hanging from an electric wire. Even a kite string or tree limb can carry a deadly current
- Assume covered wires are insulated
- Cut or attempt to remove any wire from an area
- Attempt to rescue a person in contact with an energized wire until the plug or main switch is disengaged
- Reconnect the electric if it has been disconnected

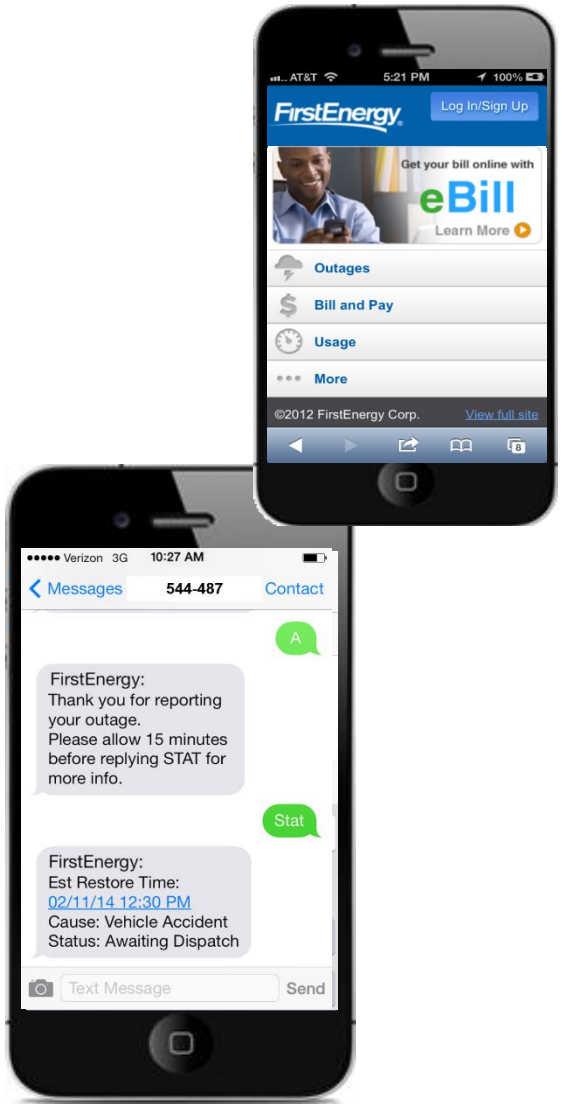
References and Resources

- **Firefighter's Handbook – Addendum; New Jersey Edition by Delmar Learning**
- **National Association of State Fire Marshals – www.firemarshals.org**
- **National Fire Protection Association (NFPA)**
- **National Institute for Occupational Safety and Health, CDC**
  - www.bt.cdc.gov/planning
  - www.cdc.gov.niosh/homepage.html
  - www.osha.gov/Publications/osha3071.pdf
  - www.osha.gov/SLTC/emergencypreparedness/
- **NIMS - National Incident Management System – www.fema.gov/nims**
- **Responding to Utility Emergencies; Michael Callan, Red Hat Publishing – www.redhatpub.com**
- **U.S. Fire Administration – www.usfa.fema.gov**
- **Writing Effective Policies and Procedures; Nancy J. Campbell, 1998 AMACOM, American Management Association**

Reporting an Outage

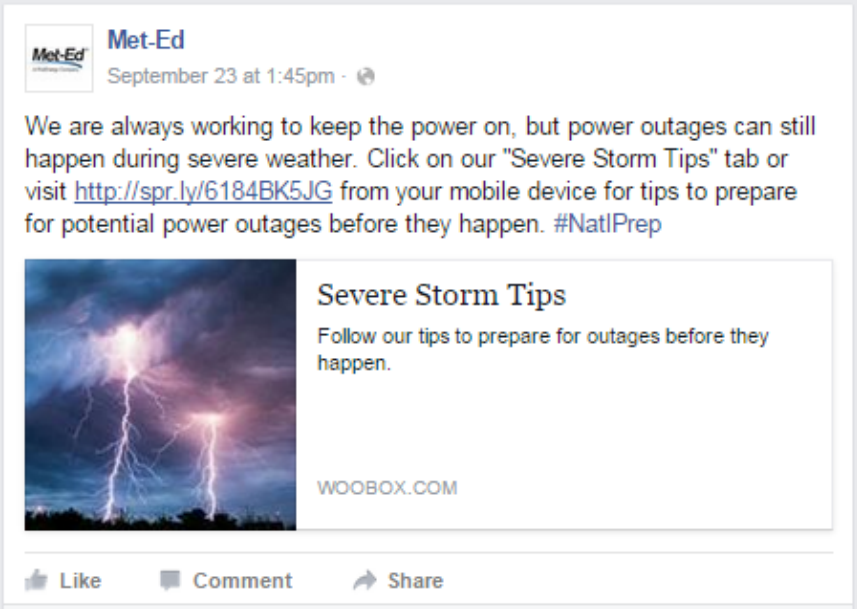
Staying Connected With Customers

- **Mobile Tools**
  - **Mobile Website and Smartphone App**
    - Report and outage, access outage information or review your bill from a smart phone
  - **Text and email alerts**
    - Subscribe to receive notifications related to outages and your electric account
  - **Text Messaging**
    - Send a text message to 544487 (LIGHTS) to report outages, get status updates and receive account information.
  - **Outage Maps**
    - View outage cause, crew status, ETR and number of customers impacted



Staying Connected With Customers

- **Social Media**
  - Source for storm updates, customer service and resolution of customer issues, news about company initiatives, and tips on electric safety and efficiency
    - Follow us on **Twitter**
    - Like us on **Facebook**
    - View video and photos on **YouTube** and **Flickr**



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Questions & Comments