Emergency Responders

Emergency Dial 911

CUC
You've got the power

CUC Safety Tips

Objectives

- Introduction
- Common Electrical Terms
- Electrical Power System
- Electricity And The Human Body
- Touch Potential
- Step Potential
- Downed Power Lines
- Overhead Power Lines
- Underground Power Equipment
- Hazards
- Substations
- Electrical Hazards When Fire Fighting In Houses And Buildings

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Introduction

This presentation has been designed and developed to help save the lives of emergency responders who are called upon to respond to emergencies involving electrical systems.

Culture is generally defined as the behaviors, attitudes, values, and beliefs that are shared within a group or organization. It reflects the collective perception of right and wrong, good and bad, or desirable and undesirable actions and characteristics.

As an example, “the safety culture within a fire department is reflected through its members’ behaviors, attitudes and actions in and out of the station as well as on the fire ground. The 1st Initiative asks us to explore the characteristics of our departments to bring about a higher commitment to safety.”

http://www.everyonegoeshome.com/16-initiatives/1-cultural-change/

This overview has been designed to provide the emergency responder(s) with **a basic knowledge** to assist in coping with electrical hazards that will be potentially encountered in your day to day duties.

You've got the power

Common Electrical Terms

"Voltage" the difference in electrical *potential* between two points in a circuit. It is the force that causes the flow of electricity, and it is measured in volts. Can be compared to water pressure.

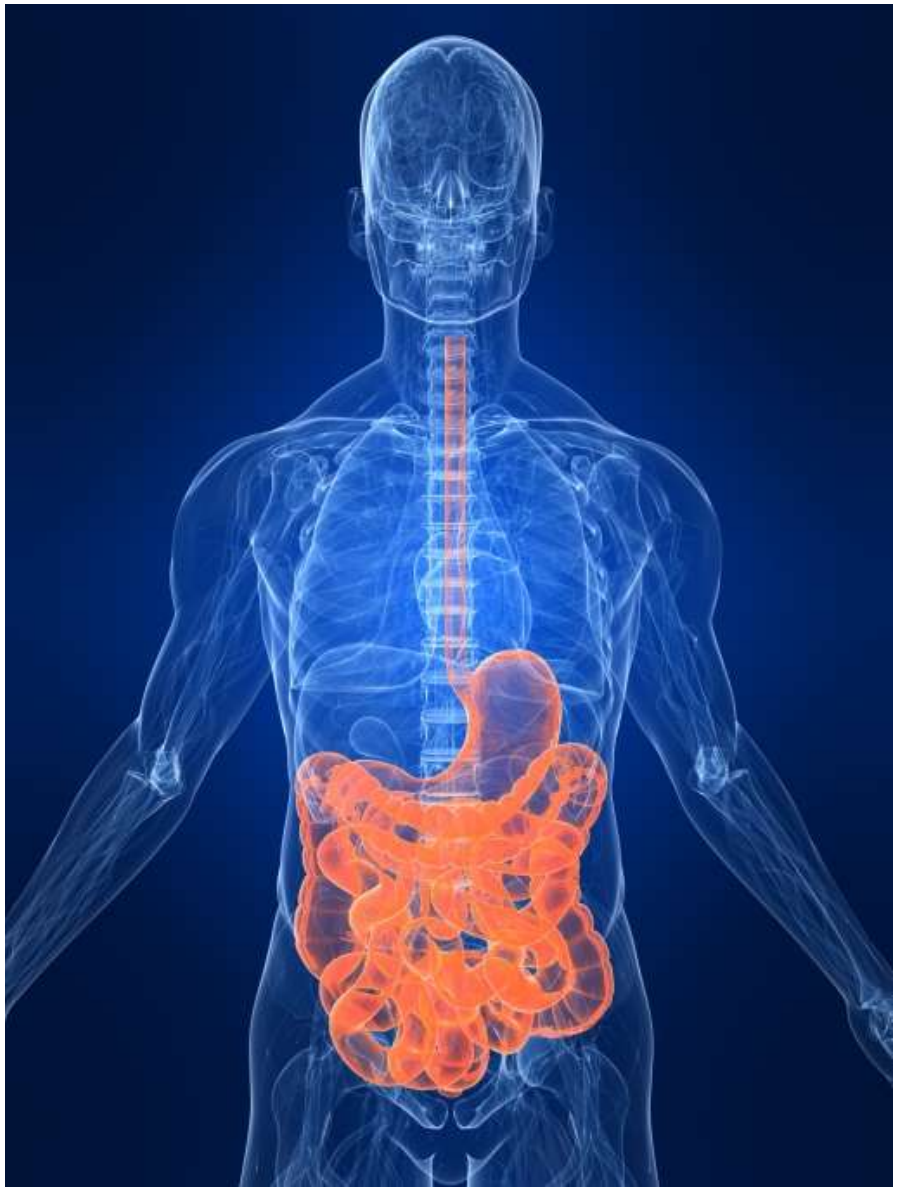
"Current" a flow of electrical charge. It can be compared to the rate of flow of water in a pipe. *Current* is typically measured in amperes.

"Resistance" is similar to the effect of friction on the flow of water in a pipe. (Water flows more freely in a large pipe than in a small one.) Different materials have different *resistance* to the flow of electricity. Very high *resistance* materials are called insulators, while the low *resistance* materials are called conductors. *Resistance* is measured in ohms.

"Grounding" is the process of mechanically connecting *isolated* wires and equipment to the earth, with sufficient capacity to carry the *fault current* and to ensure the wires and equipment remain at the same *potential* (same *voltage*) as the earth (ground).

Electricity And The Human Body

The effect of electricity on the body is dependent on the **amount of *current*** and the **length of time** the body is exposed to it. The higher the *current*, the less time a human can survive the exposure.
The path of electricity through the body is also critical.

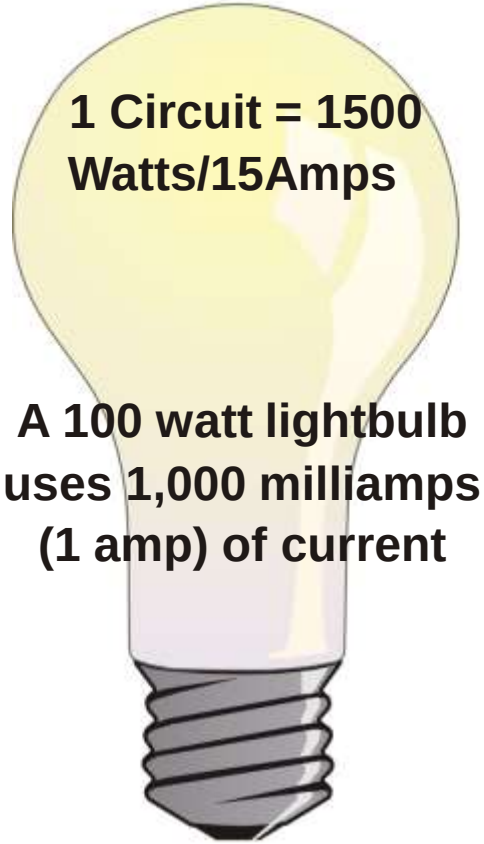


Electricity And The Human Body

Example, *current* passing through the heart or brain is more life threatening than *current* passing through the fingers. It takes approximately 1,000 milliamps (1 amp) of *current* to light a 100-watt bulb.

Featured are the effects you can expect from just a fraction of that *current* for a few seconds

Normal Household Current



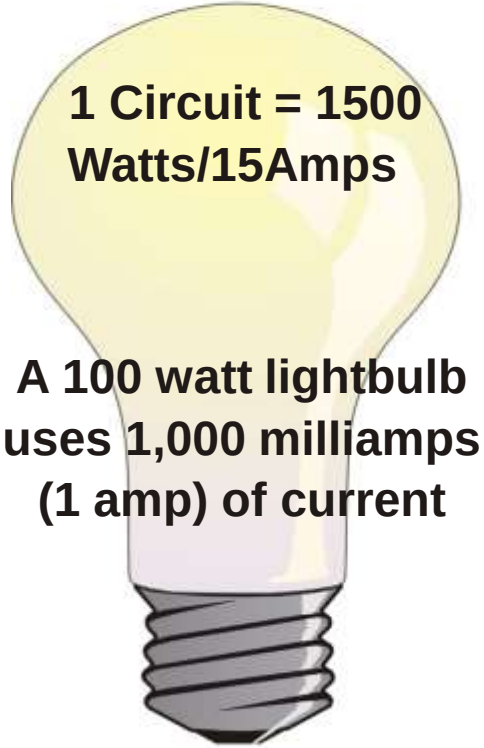
1 Circuit = 1500 Watts/15Amps

A 100 watt lightbulb uses 1,000 milliamps (1 amp) of current

5 milliamps will trip a ground fault circuit interrupter

Electricity And The Human Body

Normal Household Current



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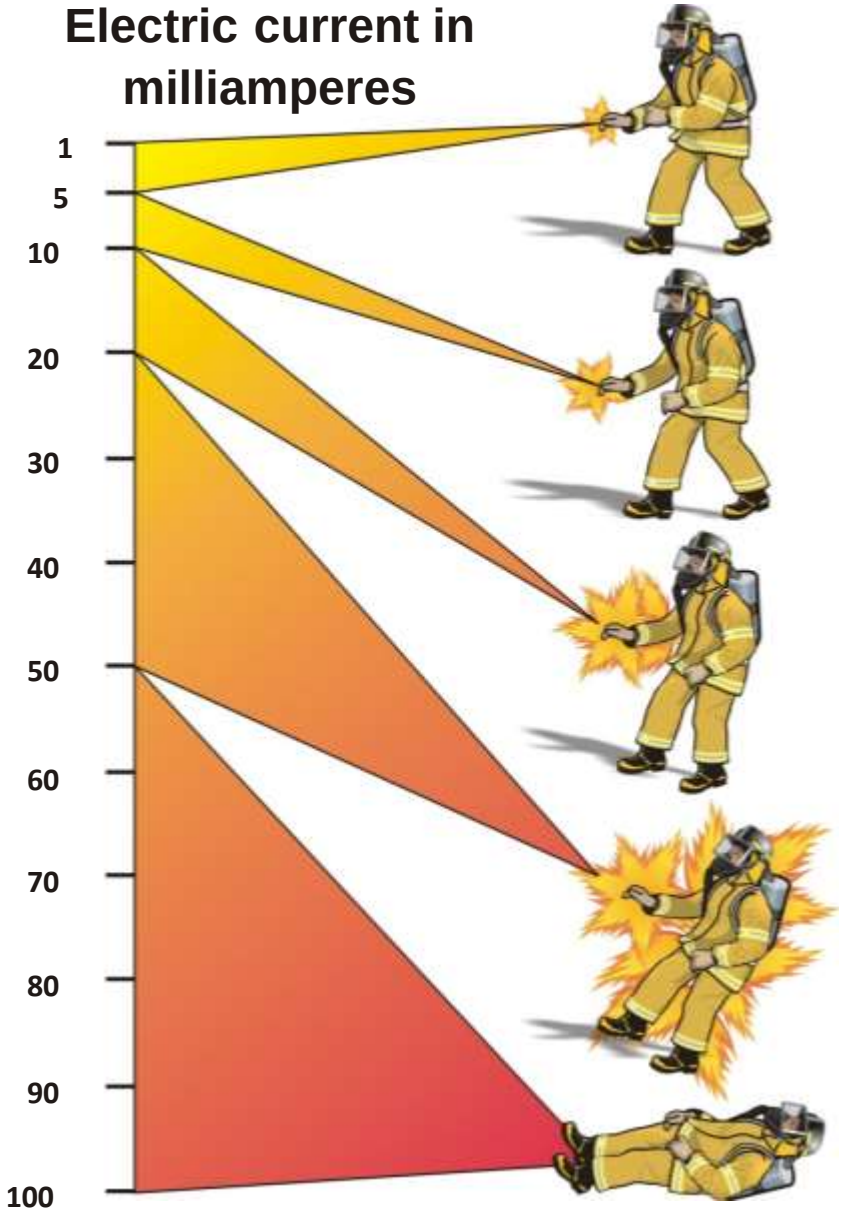
Electric current in milliamperes



Can just be felt.

Increasing Pain.

Cannot let go.

Two firefighters injured when ladder touches power line

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Fire fighters and paramedics at the scene of a fire in the 2400 block of W. Norris St., in North Philadelphia where two firefighters were injured when a ladder came in contact with electric lines on Mar. 16, 2015. (Ed Hille / Staff Photographer.)

The effect of electricity on the body is dependent on the **amount of *current*** and the **length of time** the body is exposed to it. The higher the *current*, the less time a human can survive the exposure. The path of electricity through the body is also critical. For example, *current* passing through the heart or brain is more life threatening than *current* passing through the fingers. It takes approximately 1,000 milliamps (1 amp) of *current* to light a 100-watt bulb. Here are the effects you can expect from just a fraction of that *current* for a few seconds

FIREFIGHTERS DOWN/CLOSE CALL/ELEC SHOCK-HOMEOWNER DEAD (The Secret List)

Tuesday, May 19, 2015 Hey,In Ottawa County (western MI, west of Grand Rapids) a 43-year-old man was reported unresponsive in the front yard of his home early this evening.

5 Firefighters from Crockery Township arrived on the scene and started to help the man. Not realizing he had been electrocuted and thinking he had a heart problem, they tried CPR and then used an automated external defibrillator (AED).

While the Firefighters were working, one of them got too close to the still-charged telehandler (a portable mobile boom device) and was shocked. He fell into another Firefighter, who was also shocked. They suffered electric shock, as the forks on the machine were fully extended and in contact with an overhead power line.

EXTREME CLOSE CALL: The initial shock caused the first Firefighter--a 38-year-old four-year veteran, to be electrocuted and to go into cardiac arrest, but other Firefighters with an AED were able to regain a pulse.

The second Firefighter was able to continue working, but was taken to a hospital for evaluation--and was subsequently released, having suffered minor injuries.

What Is Step and Touch Potential?

Step Potential

Step potential is the step voltage between the feet of a person standing near an energized grounded object. It is equal to the difference in voltage, given by the voltage distribution curve, between two points at different distances from the electrode. A person could be at risk of injury during a fault simply by standing near the grounding point.

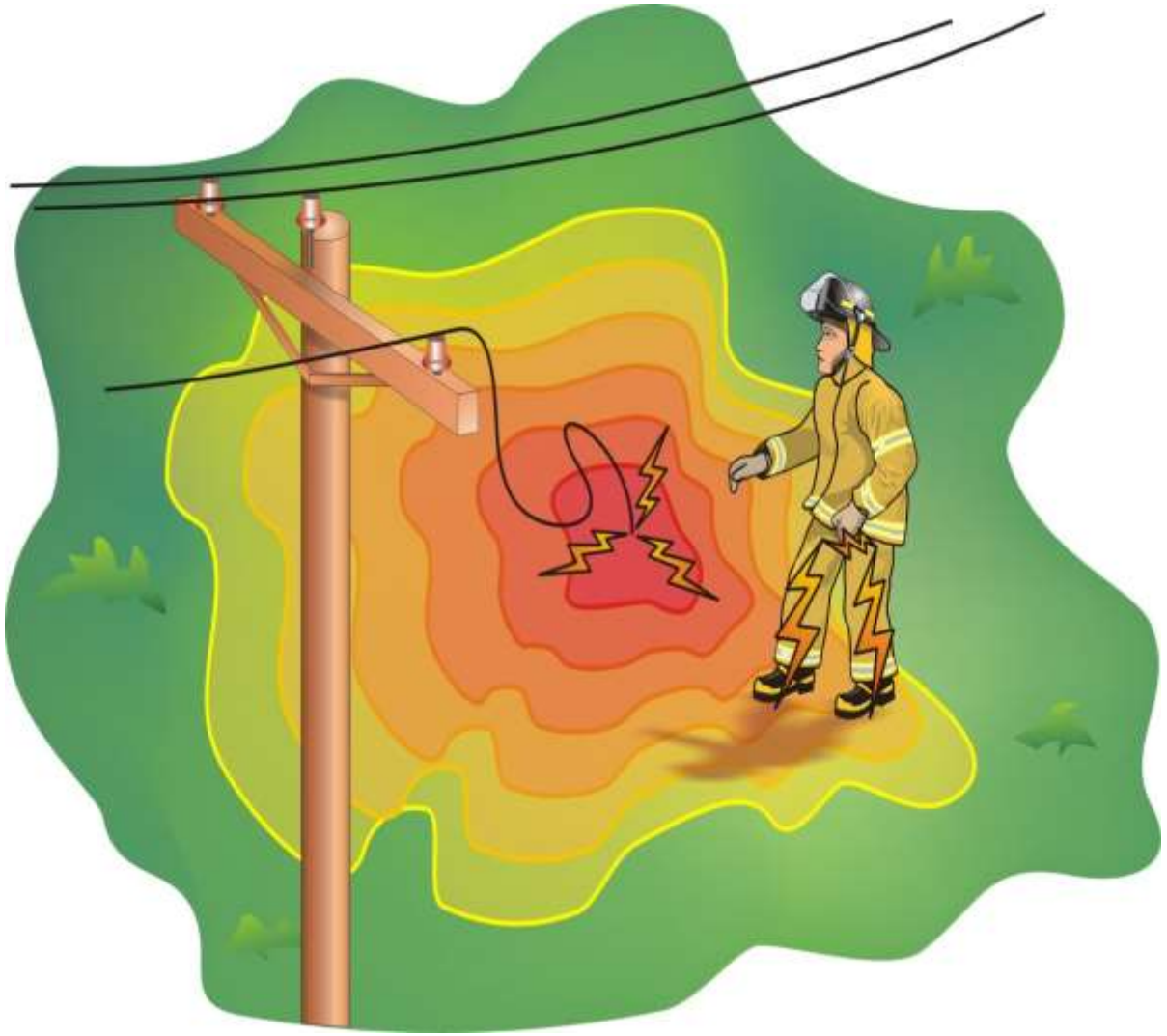
Touch Potential

Touch potential is the touch voltage between the energized object and the feet of a person in contact with the object. It is equal to the difference in voltage between the object and a point some distance away. The touch potential or touch voltage could be nearly the full voltage across the grounded object if that object is grounded at a point remote from the place where the person is in contact with it. For example, a crane that was grounded to the system neutral and that contacted an energized line would expose any person in contact with the crane or its uninsulated load line to a touch potential nearly equal to the full fault voltage.

Touch Potential

When a fault occurs at a tower or substation, the current will enter the earth. Based on the distribution of varying resistivity in the soil (typically, a horizontally layered soil is assumed) a corresponding voltage distribution will occur.

The voltage drop in the soil surrounding the grounding system can present hazards for personnel standing in the vicinity of the grounding system. Personnel “stepping” in the direction of the voltage gradient could be subjected to hazardous voltages.



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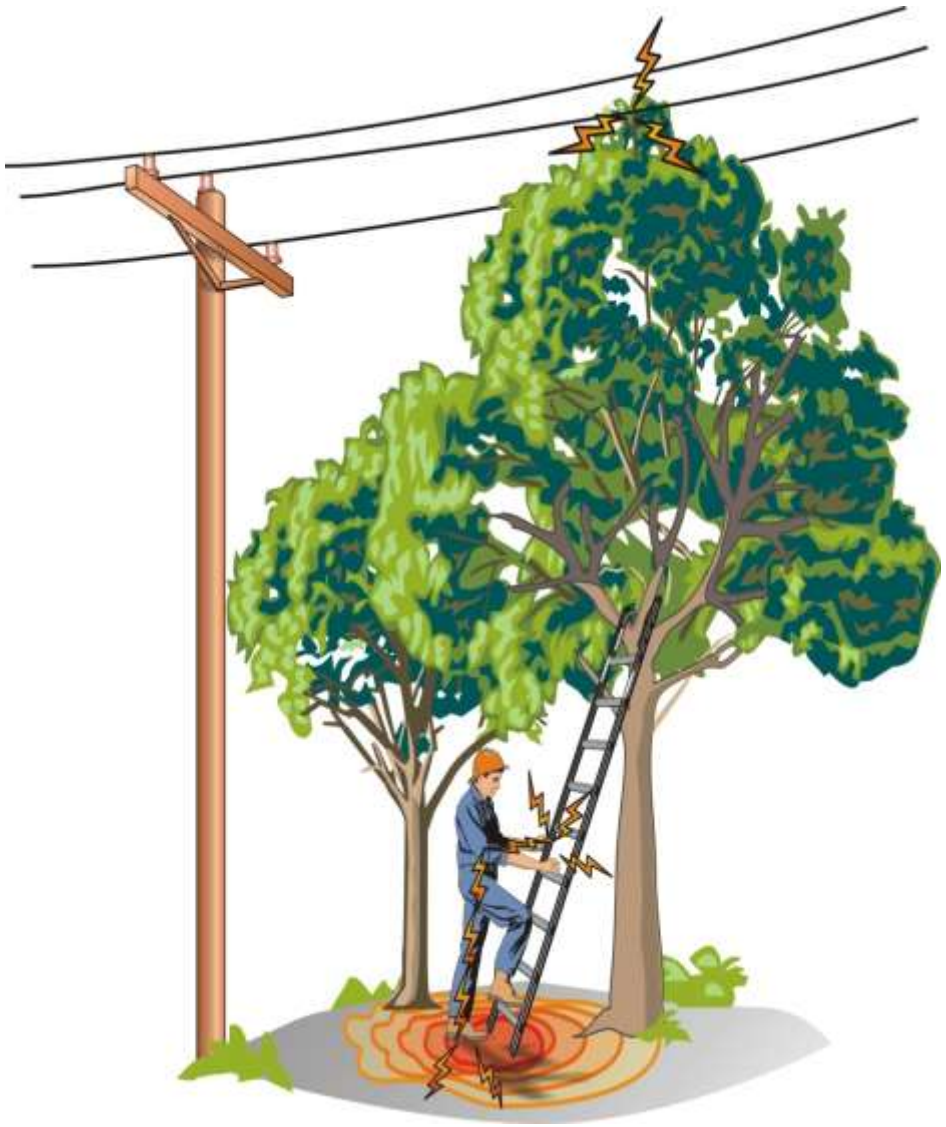
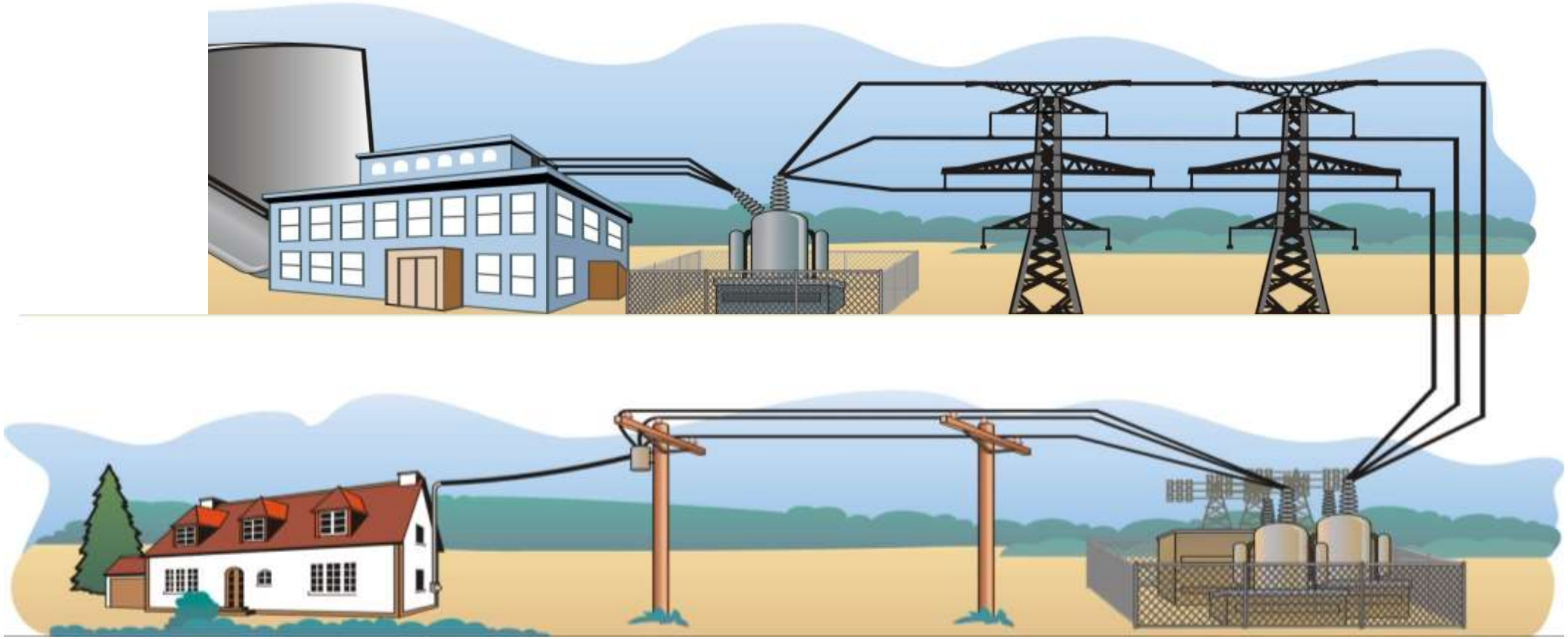


Electrical Installations



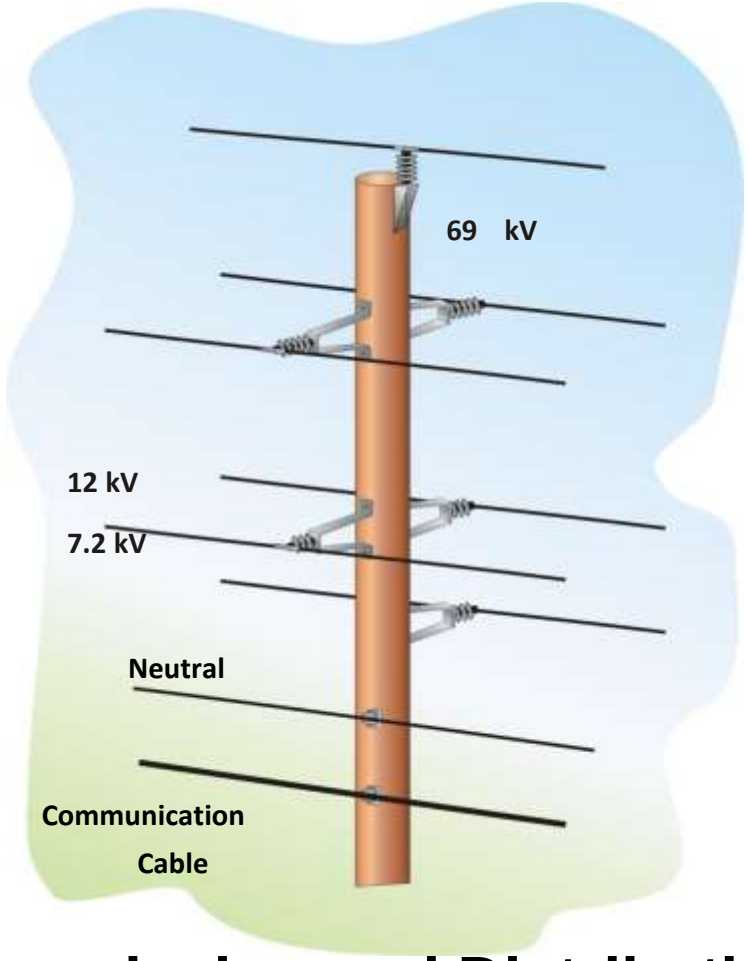
Electrical Installations

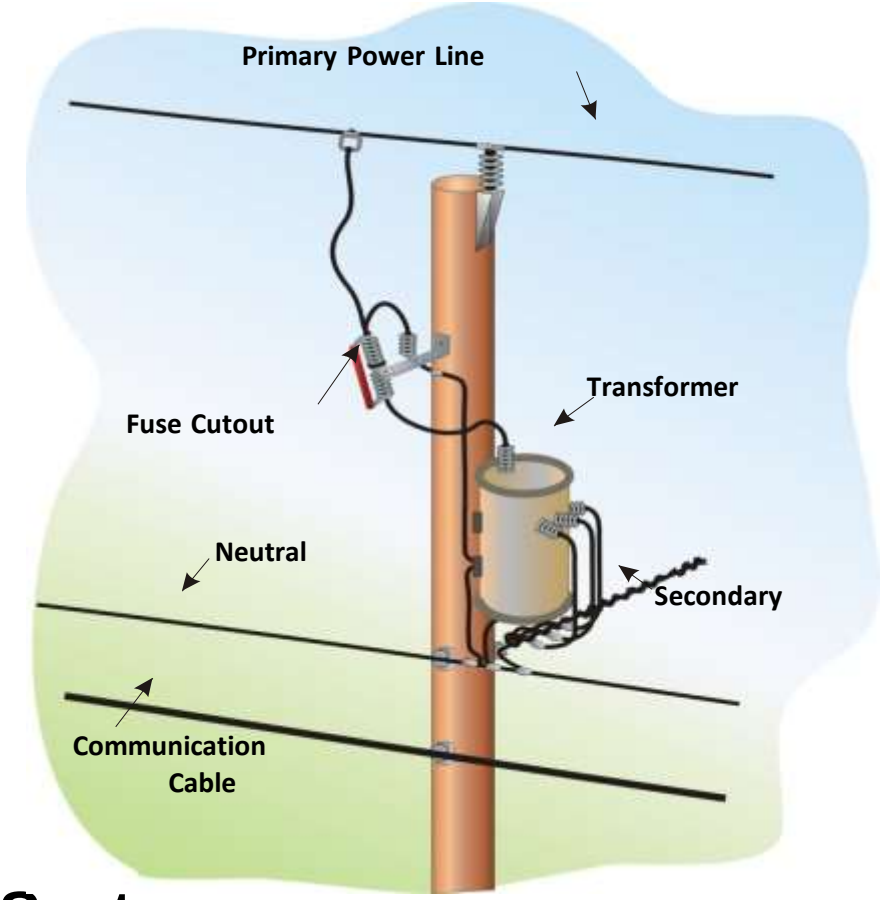
Generating Plant

CUC's power system is comprised of 26 generating units (24 diesel and two gas turbine) with a combined capacity of 145.75 megawatts (MW). In addition, the Company has 11 mobile units (four owned and seven rented), each with a capacity of 1.5 MW. At CUC electricity is generated at voltages ranging from 13,000 to 69,000 volts.

DEMAG

Electrical Installations

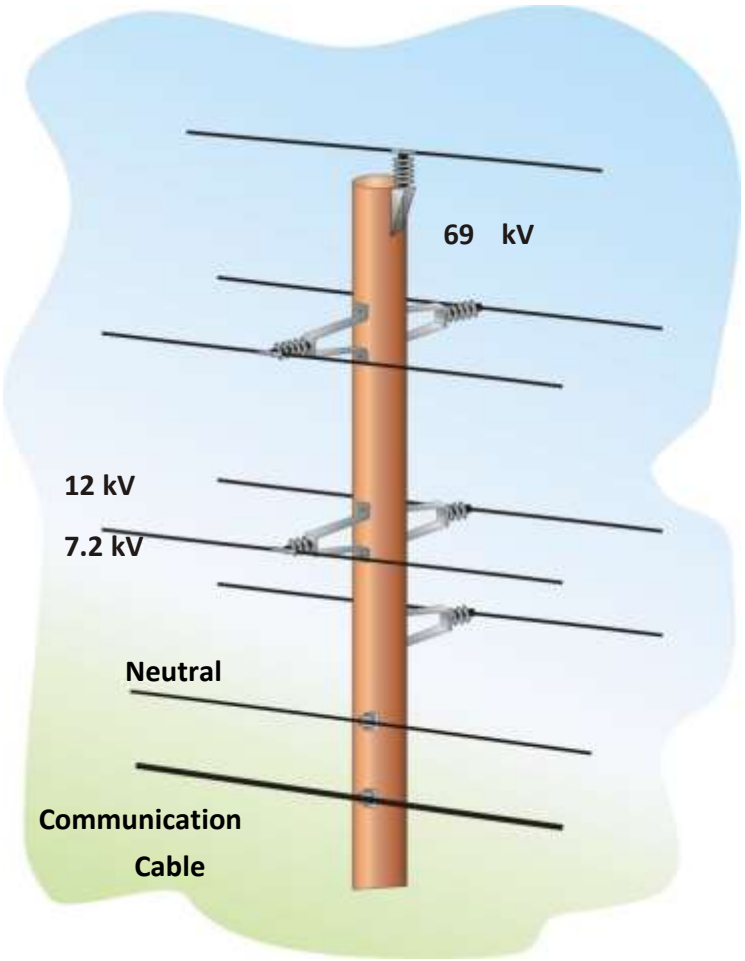


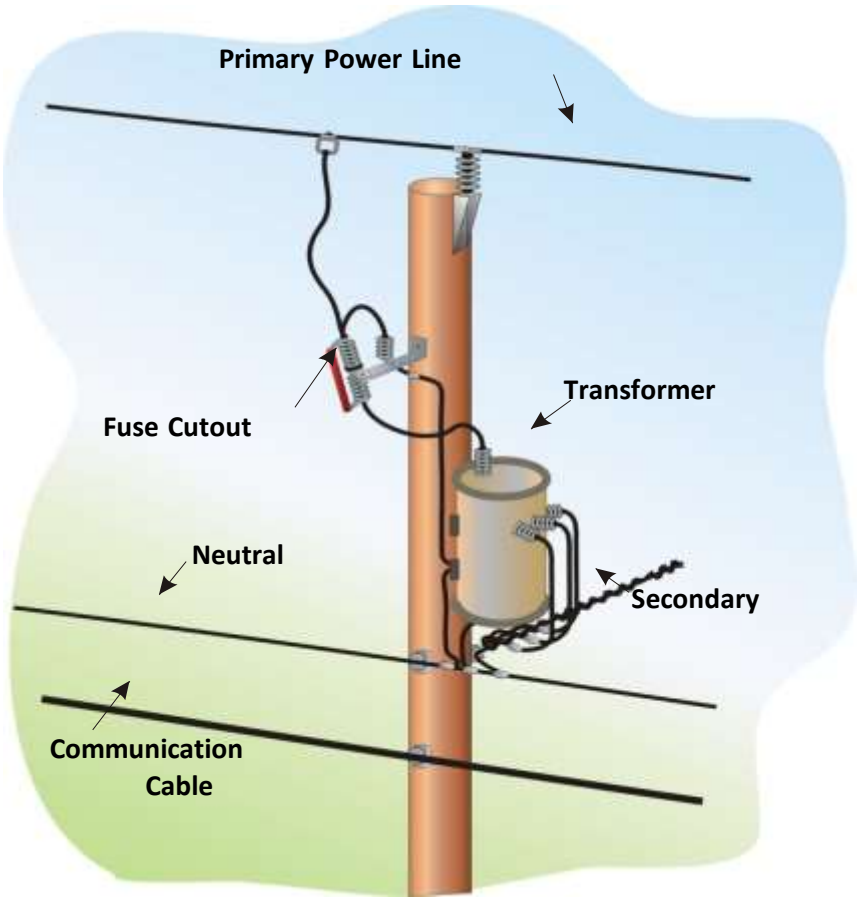


Transmission and Distribution (T&D) System

The Company's system is comprised of eight major transformer substations, approximately 302 miles of overhead high-voltage (69 kilovolt and 13 kilovolt) T&D lines and 14 miles of high-voltage submarine cable in Grand Cayman.

Electrical Installations





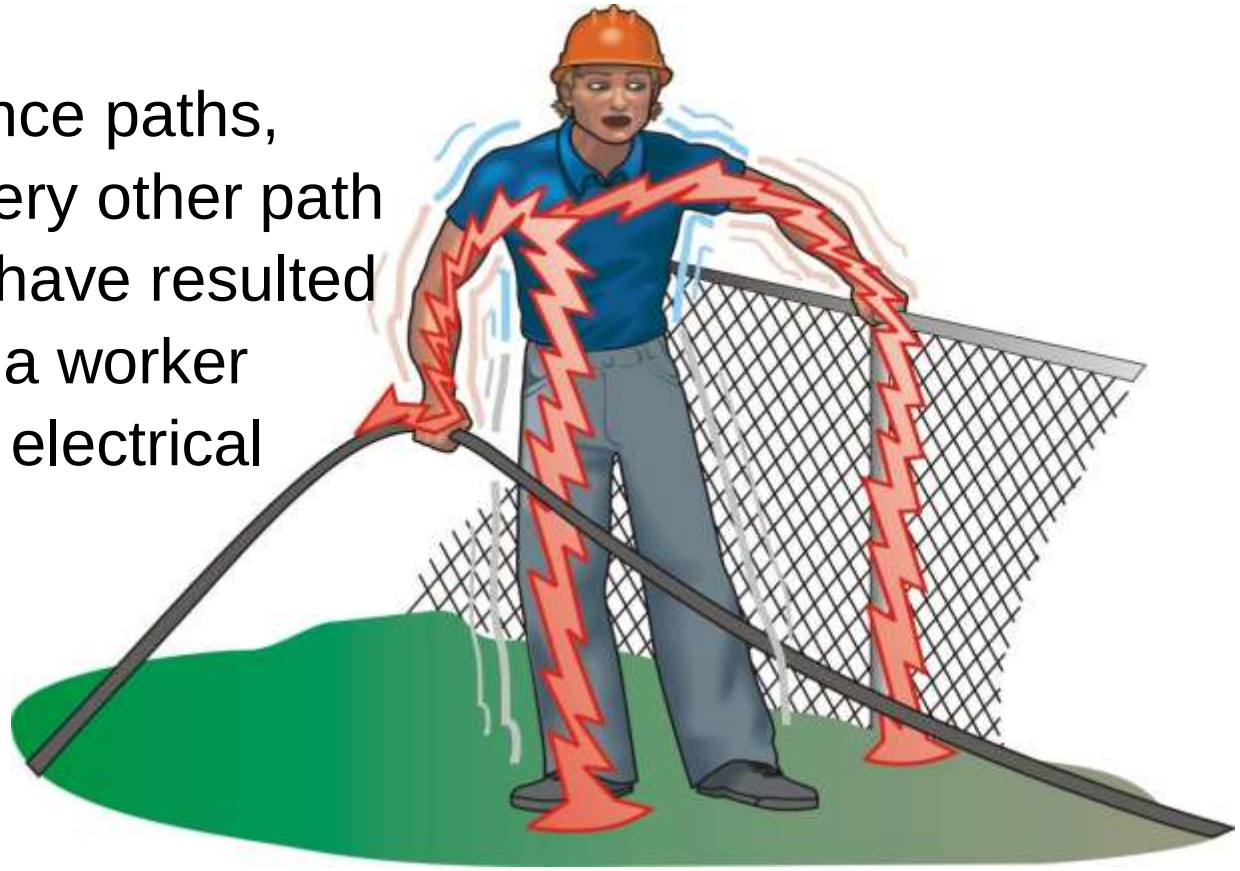
Transmission and Distribution (T&D) System

The T&D lines and substations are designed for high winds and flooding that might result from a hurricane.

Downed Power Lines

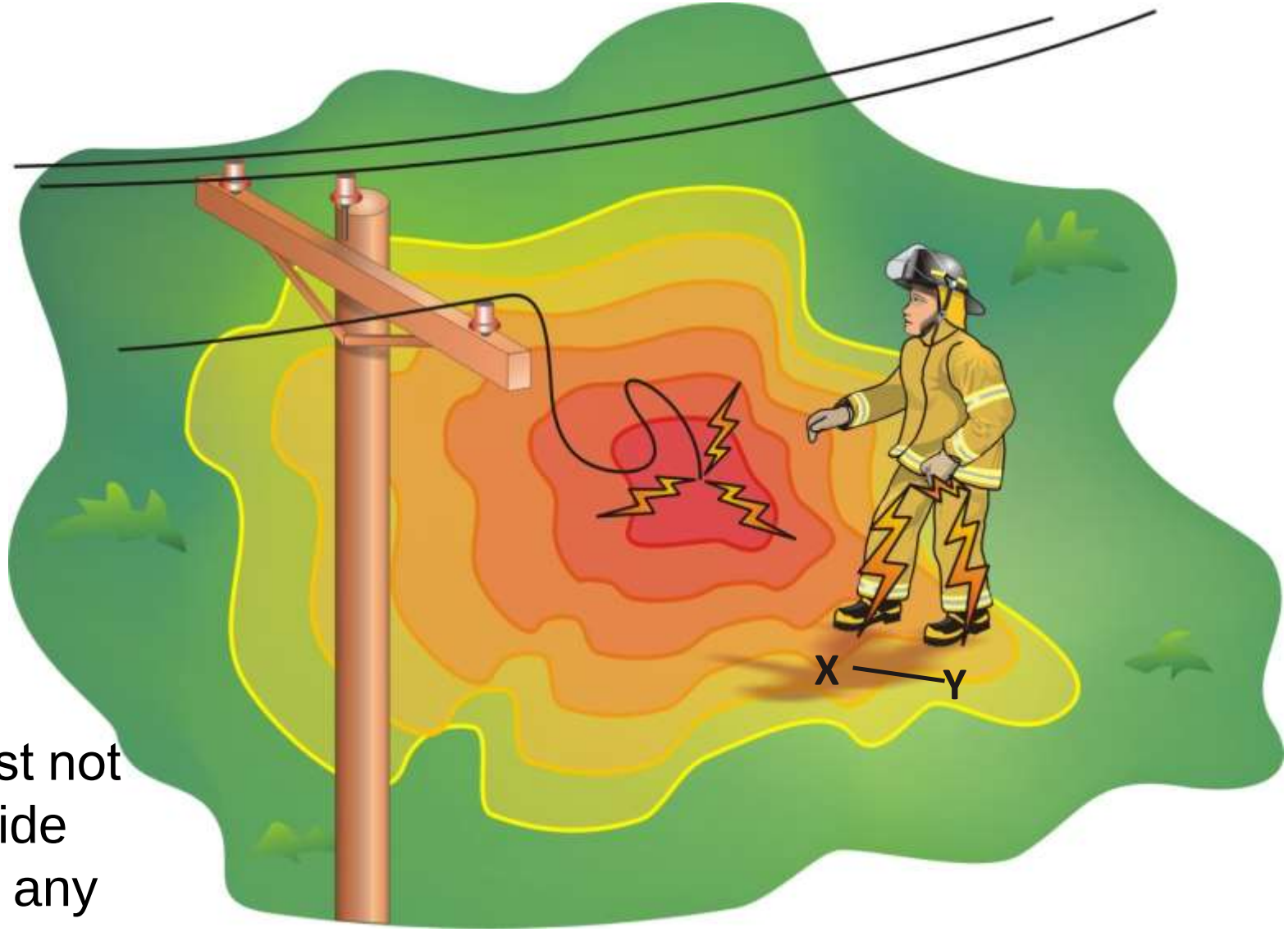
Caution: Electricity will take <u>All</u> Available Paths

Electricity seeks low-resistance paths, **however** it can also take every other path available to it. Many deaths have resulted from the misconception that a worker could not become part of an electrical circuit.



Downed Power Lines

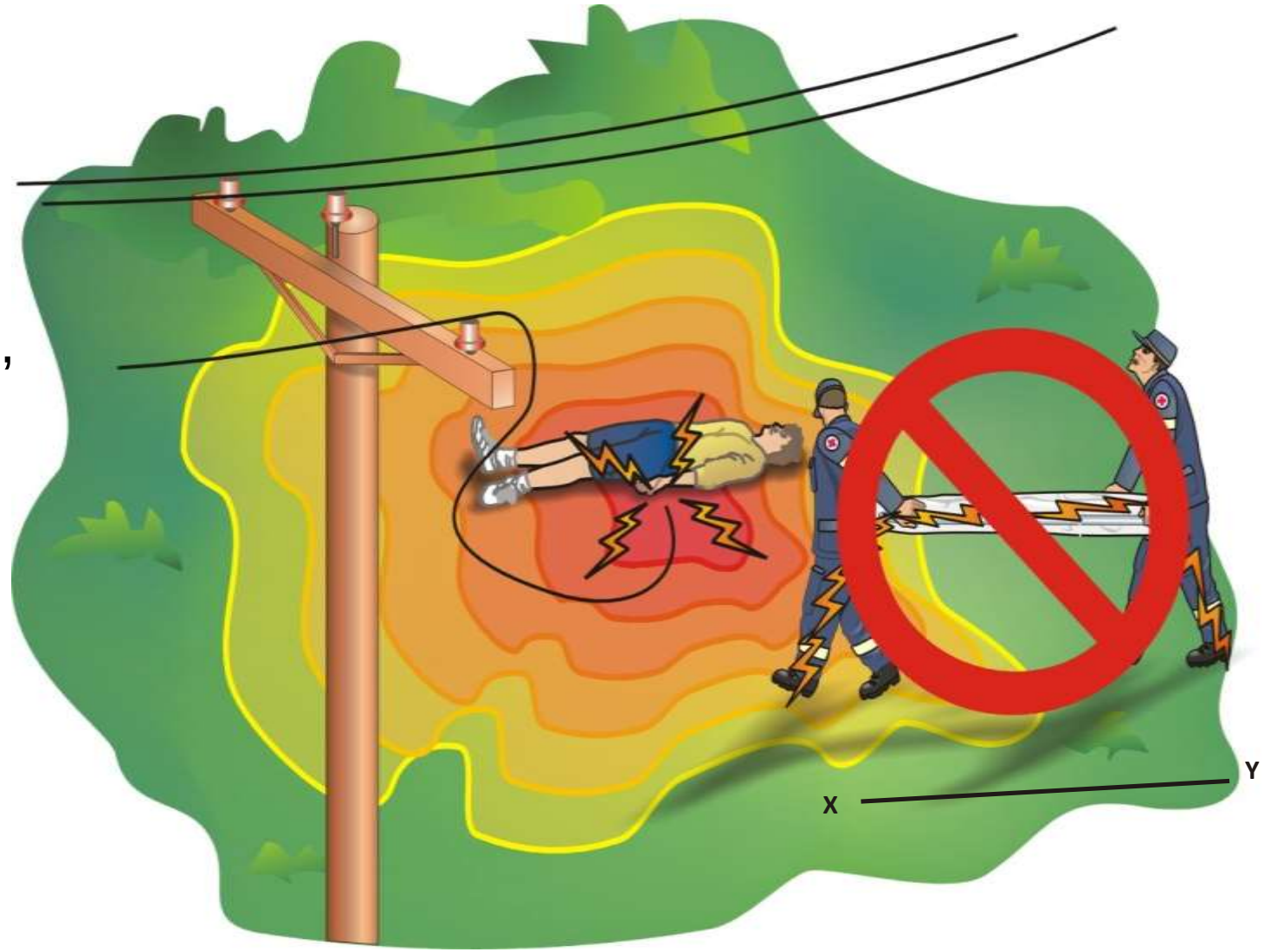
Step Potential
A difference in voltage (potential gradient) between points X and Y can cause electricity to flow up one leg, through the abdomen and back down the other leg.



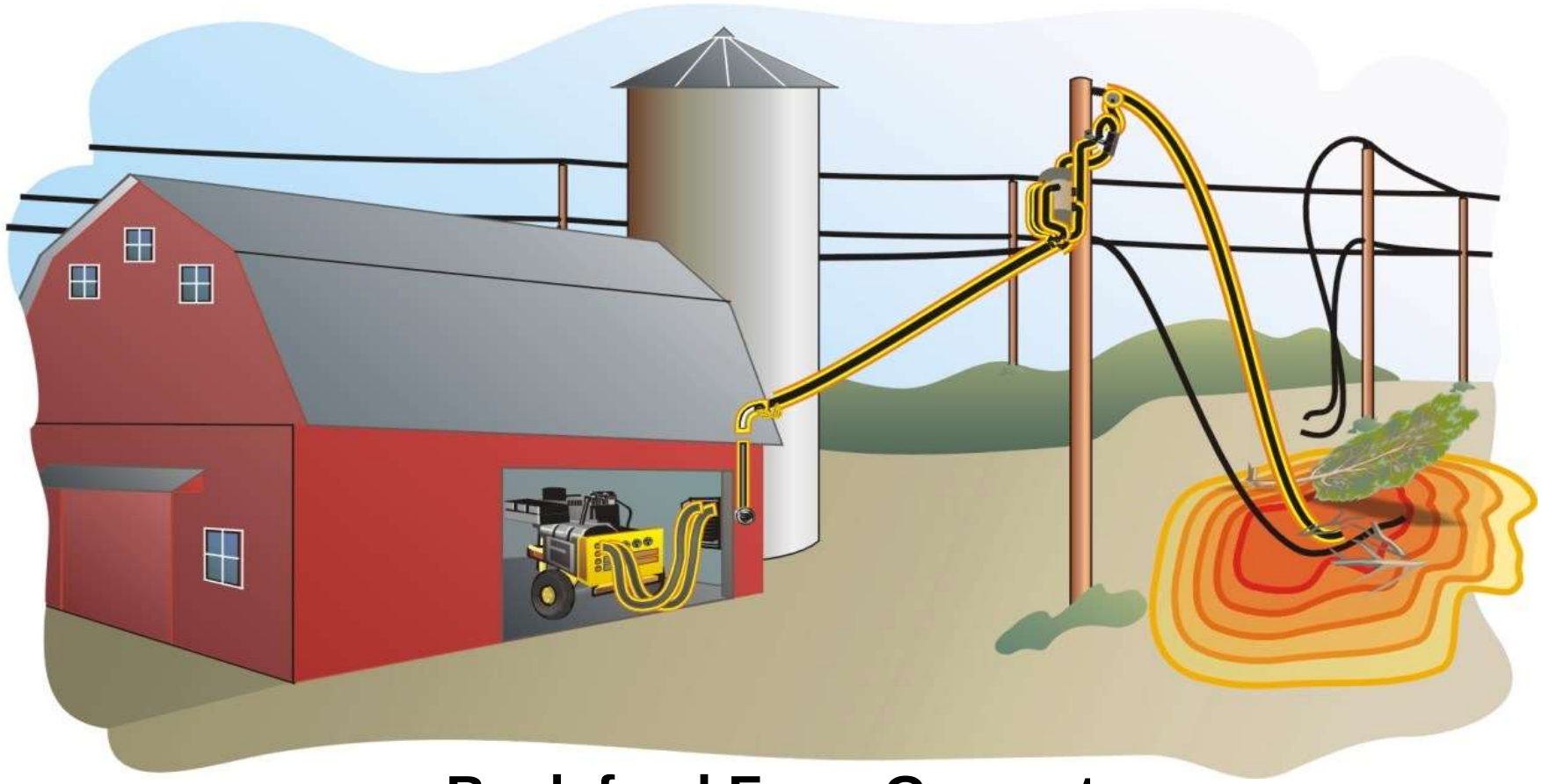
Caution!
Due to extreme wear, Firefighters' boots must not be relied upon to provide electrical protection in any situation.

Downed Power Lines

Equipment Hazards
Ladders, stretchers, communication antennas, and other emergency response equipment can present significant “step and touch potential” hazards.



Back feed



Back feed From Generator

If the situation is life threatening, it may be possible to determine if backfeed is a hazard and eliminate it. To do this contact the home, farm or business owner or manager. Ask the owner or manager if they have a generator and if they do, ask them to turn it off.

Situation Awareness

1. **Before getting out of your vehicle, examine the surroundings carefully and make sure you are parked well away from the fallen wires.**

Situation Awareness

2. Stand well back, at least 10 meters (33 ft.) away. Look for and locate all wire ends.

3. Establish the safe zone, at least 10 meters (33 ft.) away from wires and anything the wires may be touching.

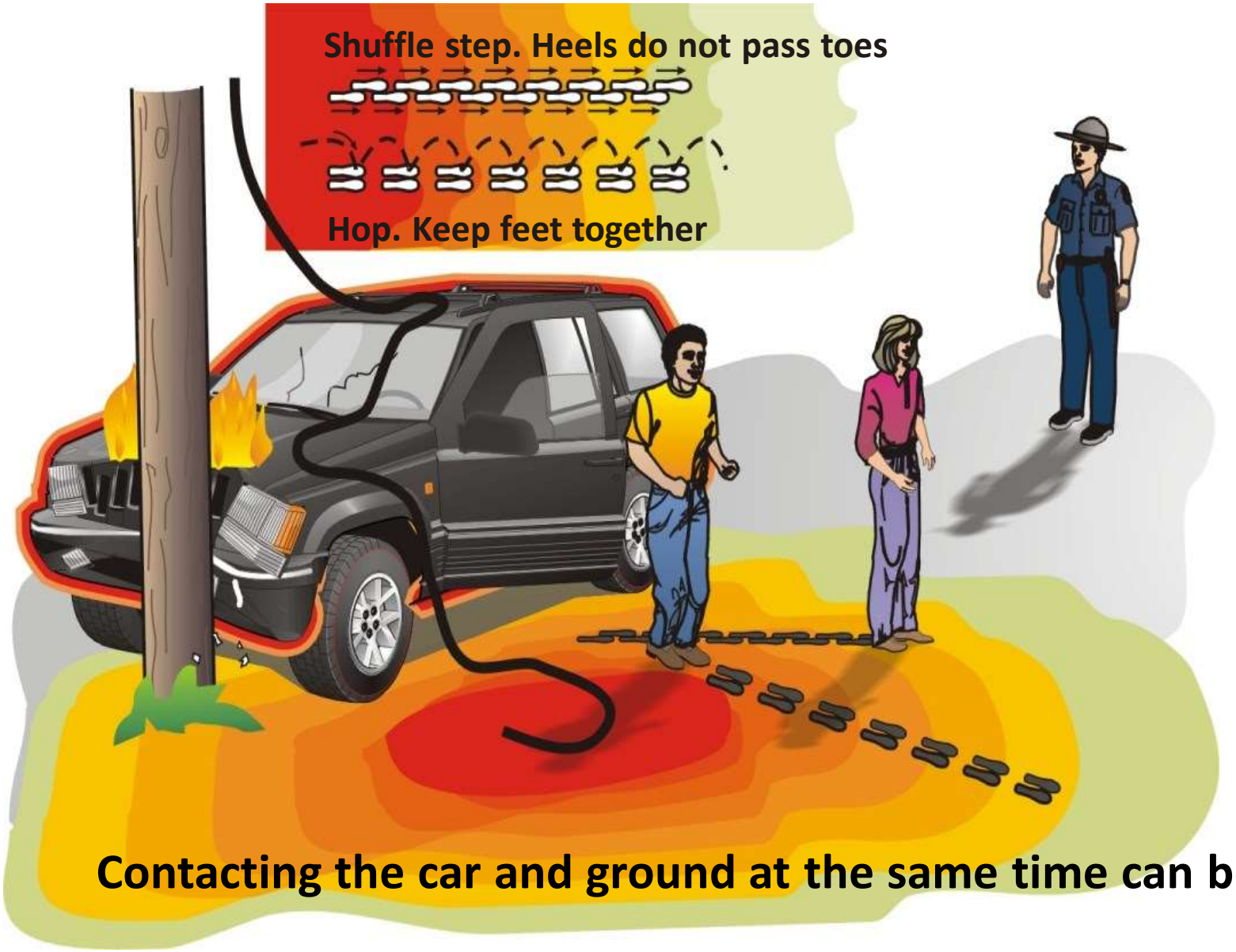
Assistance Around Downed Power Lines

4. Secure the area. Face oncoming pedestrians and traffic and keep people away from broken or low hanging wires or other electrically charged objects.

5. Do not attempt to move any fallen wires, call and wait for Electrical Utility personnel.

Assistance Around Downed Power Lines

Assistance Around Downed Power Lines



Contacting the car and ground at the same time can be FATAL

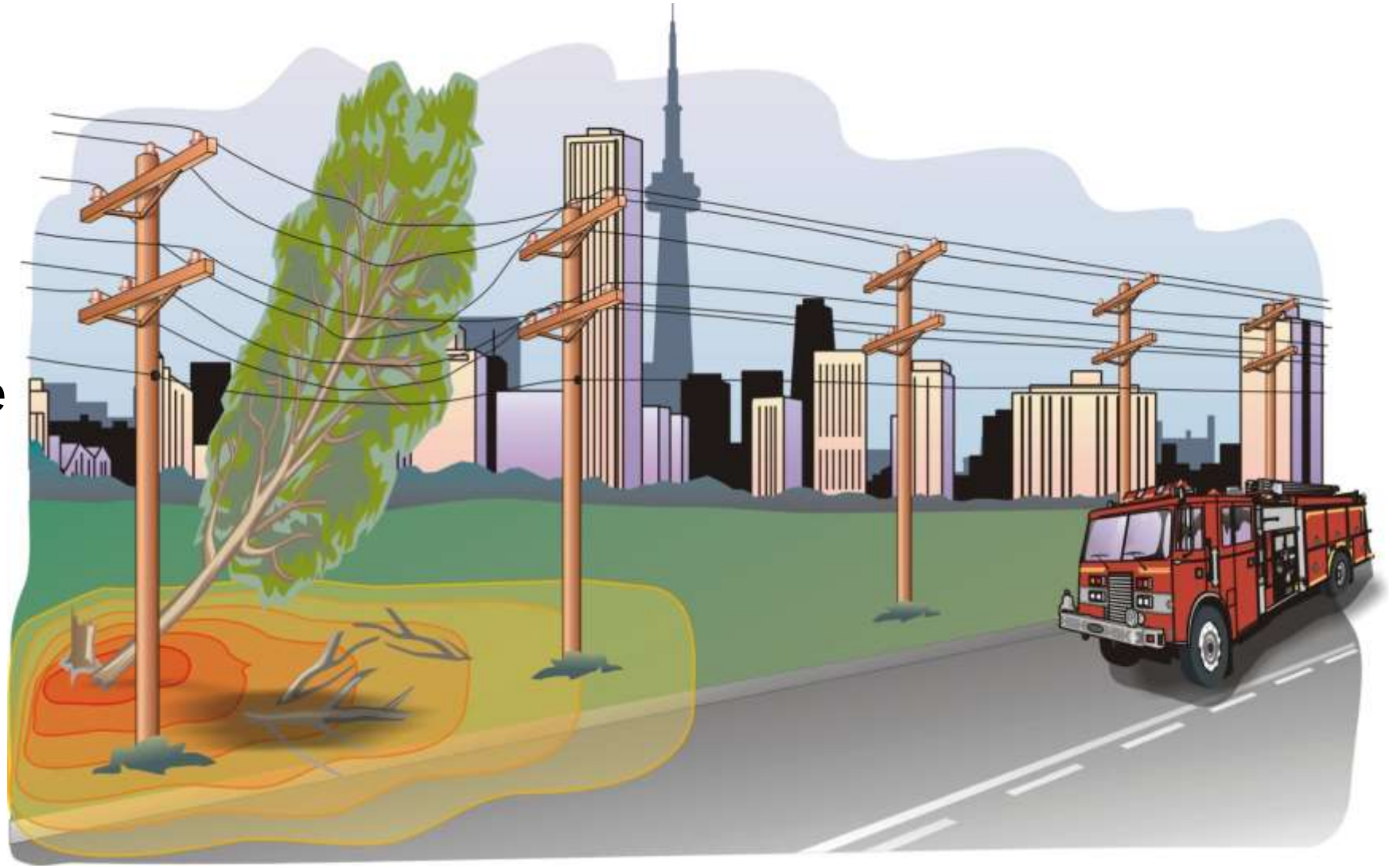
Assistance Around Downed Power Lines

Assistance Around Downed Power Lines

Assistance Around Downed Power Lines

Trees In Contact Power Lines

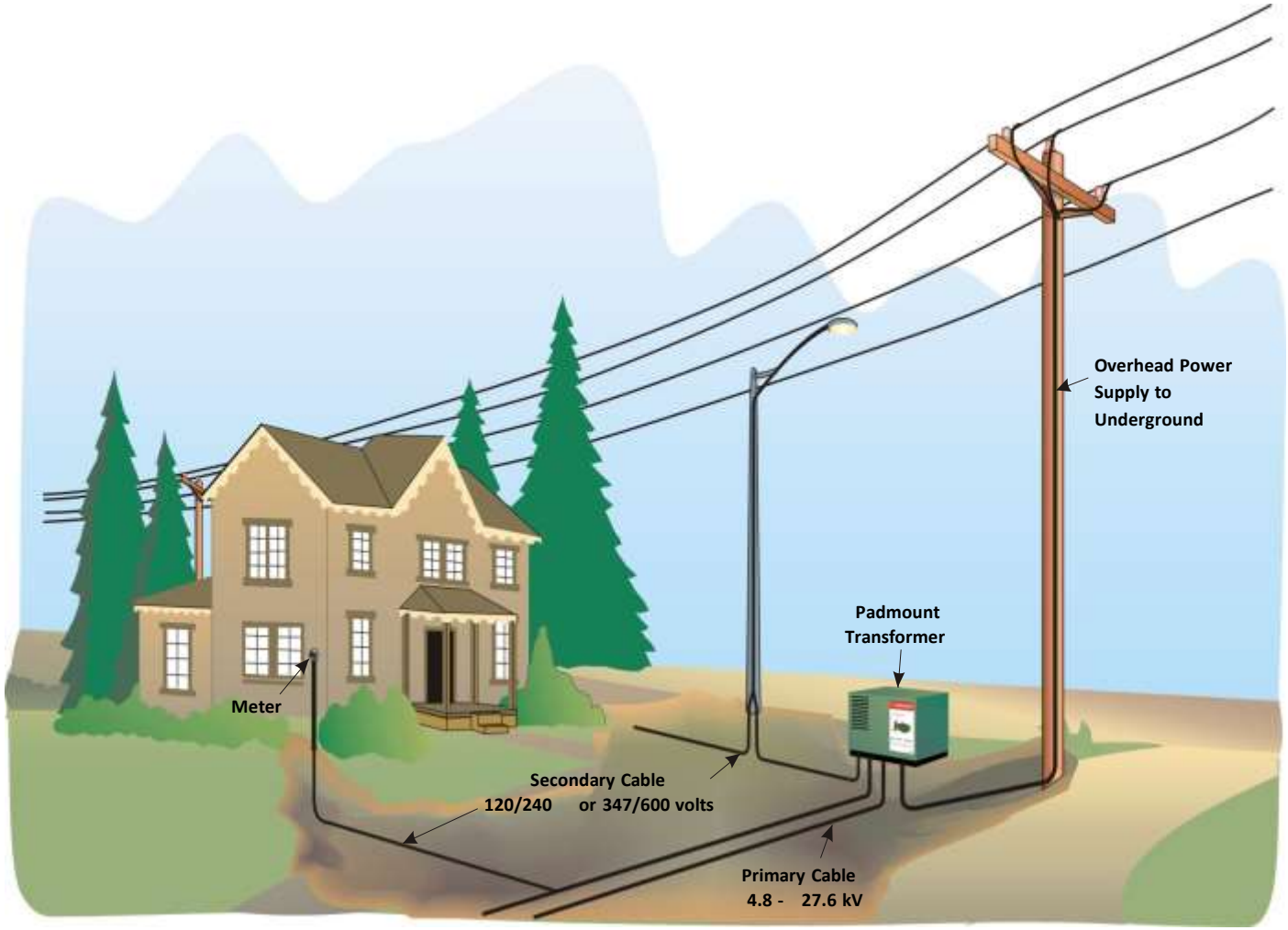
When it comes to high voltage power lines, virtually all things (regardless of composition), will conduct electricity. Responders need to be aware of the potential for severe electrical shock that can occur if contact is made with any object that is in contact with or very near power lines.



Underground Electrical Facilities

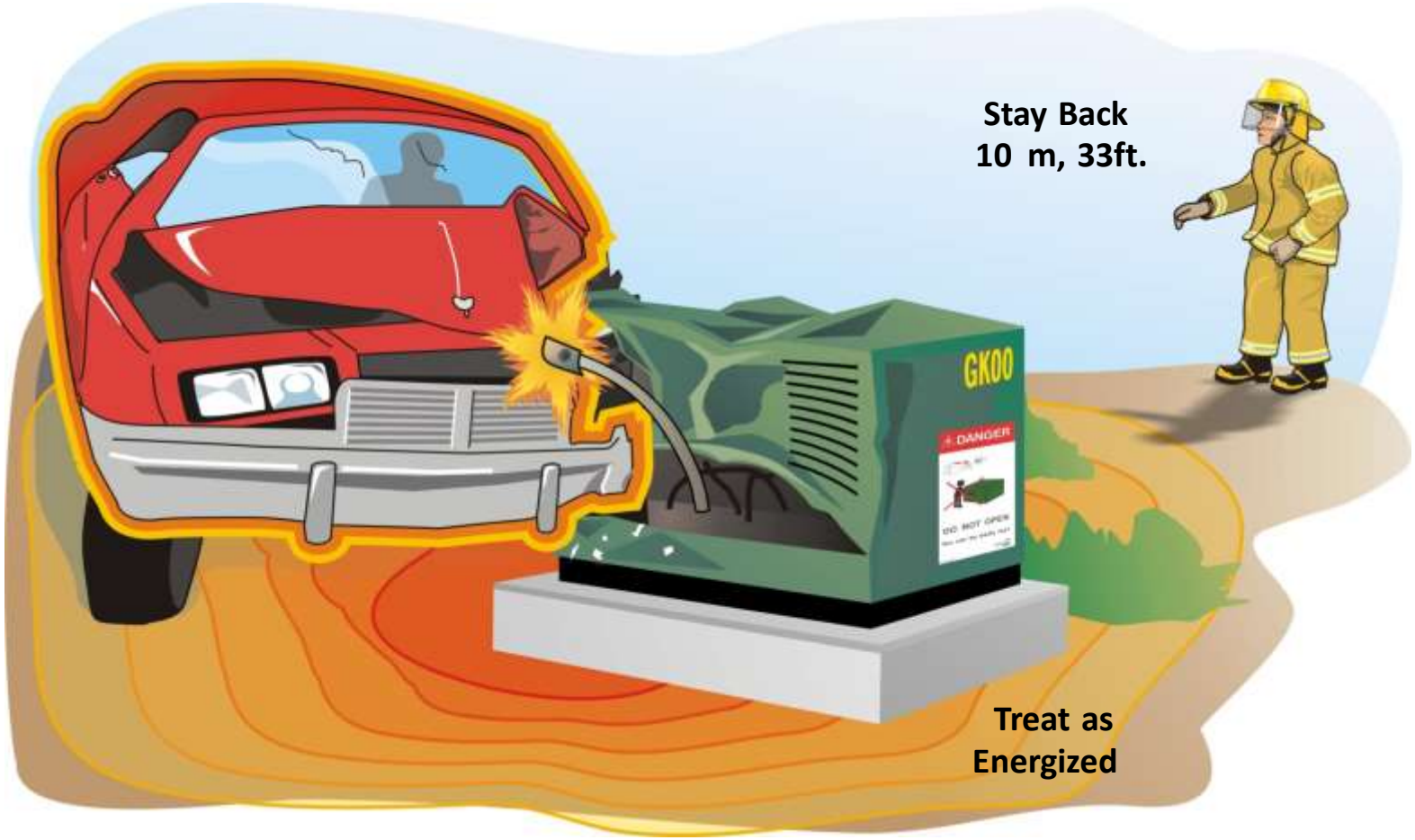
Underground cables are normally buried at least one meter (3 ft.) below ground level; however, changes in topsoil cover could increase or decrease the depth.

It is impossible to predict the location of these cables without using a detector.



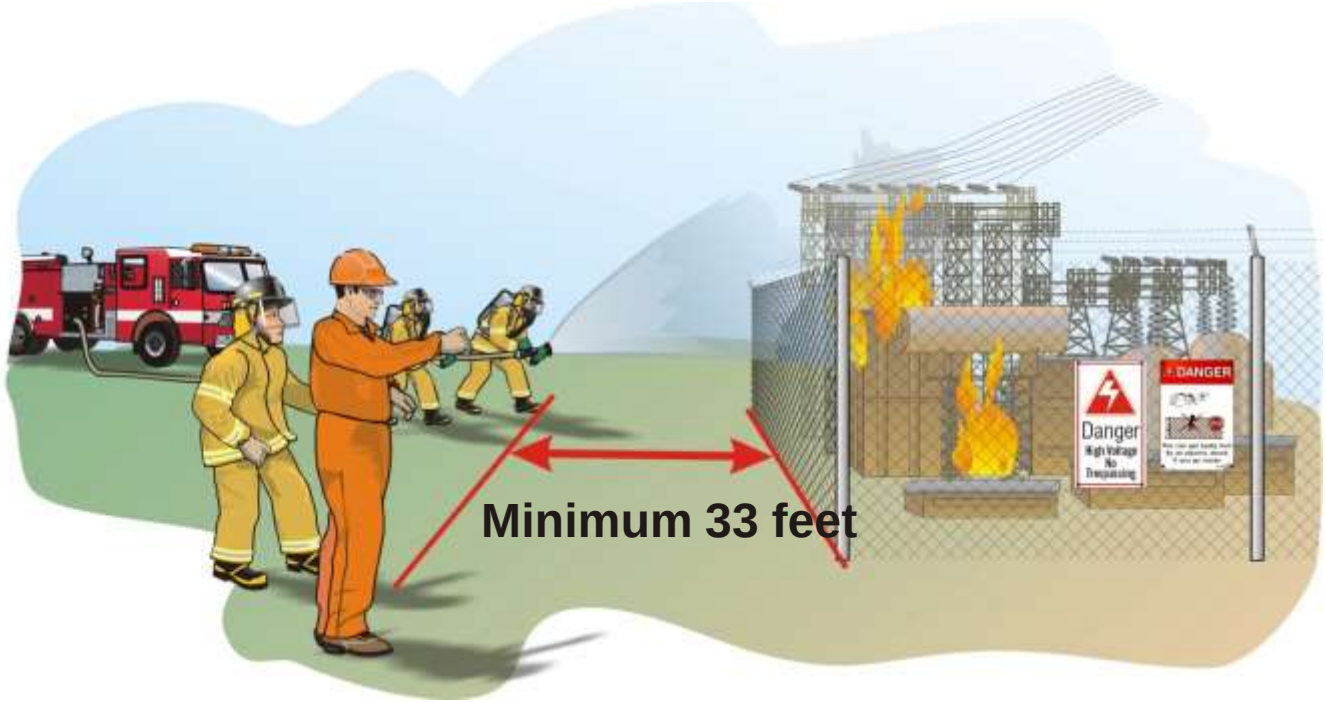
Underground Electrical Facilities

Electrical Utility personnel will ensure proper isolation and grounding of the transformer or kiosk and will authorize the removal of the vehicle after everything is safe.



Substations Fires

- Keep onlookers well back (min.100 meters) due to the risk of explosion.
- Prepare equipment and protect surrounding property.
- Do **NOT** enter any substation without a qualified Electrical Utility representative.



Substations

CUC Substation At South Sound

Electrical Hazards When Fire Fighting In Houses And Buildings

- Locate all power lines before setting up equipment and ensure limits of approach can be maintained.

- Aerial device operator must be standing on a platform that is bonded to the device.

- Extra precautions must be taken when forced to work overtop power lines.

Electrical Hazards

July 20, 2015

Meanwhile, an electrical fault was said to be the cause of a fire at a George Town restaurant at the weekend.

The China Village restaurant at the Plaza Venezia in George Town was badly damaged by the blaze that ignited Saturday morning but no one was hurt as the restaurant was closed.

Police Discover East End House Fire

House Fire Off The Queens Highway

Electrical Hazards

Restaurant Fire

July 21, 2015

China Village in Plaza Venezia

Electrical Hazards When Fire Fighting In Houses And Buildings

Engine Room Fire Knocks Out CUC Generator

September 14, 2015

CUC power plant, North Sound Rd

Electrical Hazards When Fire Fighting In Houses And Buildings

Firefighters Battle Major South Sound Blaze

November 23, 2016

House fire in South Sound

- **A Safe Attitude Is The Key**
- **Expect The Unexpected**
- **Situational Awareness**

Remember: The Life You Save Maybe That Of Your Own

You don’t have a dangerous job, you have a hazardous job. Your job becomes dangerous when the hazards are ignored.