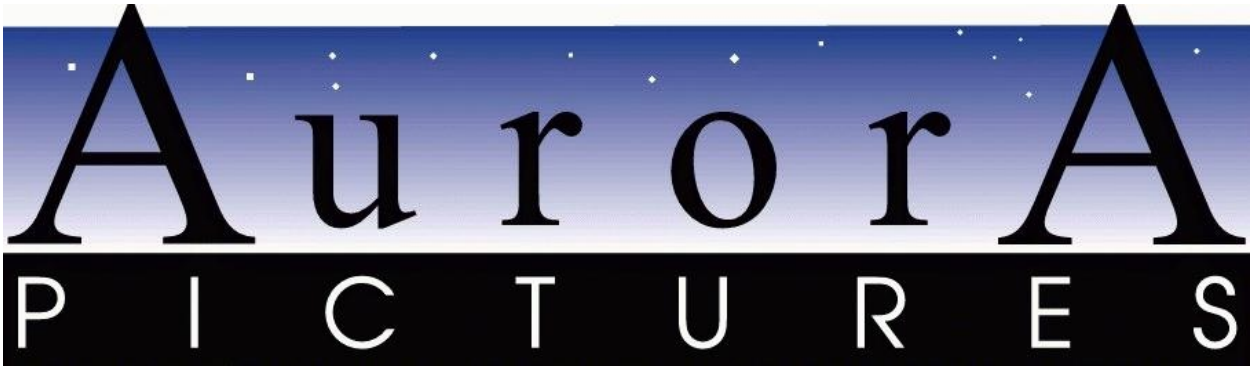

Electrical Safety

Leader's Guide and Quiz

Structure and Organization

Information in this program is presented in a definite order so that employees will see the relationships between the various groups of information and can retain them more easily. The sections included in the program are:

- The basics of electricity.
- Circuits and the flow of electrical current.
- Recognizing and avoiding electrical hazards.
- Special electrical environments.
- Dealing with an electrical accident.

Each of the sections gives an overview of important information in one topic area, providing employees with the basis for understanding how to work safely with and around electricity.

Background

Electricity lights our homes, runs our computers, smartphones, toaster ovens and refrigerators, as well as powers the equipment and machinery that we use in our jobs. It is so much a part of everyday life that it's easy to forget that it can also be dangerous.

Electricity is involved in thousands of injuries and hundreds of fatalities every year, and those numbers are increasing. It can also start fires and cause explosions that result in extensive and costly damage.

To work safely with and around electricity, employees need to understand how electricity "operates", what its hazards are, and what procedures and equipment they should use to avoid them.

Objectives

This education and training program is designed to present basic information on electrical safety. Upon completion of the program, employees should:

- Understand the basics of electricity, how it works and how it is used.
- Understand the terms "current", "volts", "amperes" and "watts".
- Know the hazards that can be associated with electricity and electrical equipment in a workplace.
- Know the equipment to use and procedures they should follow to avoid these hazards.
- Understand what "arc flash" is, and the hazards that it presents.
- Know how to respond effectively if an electrical accident occurs.

OUTLINE OF MAJOR PROGRAM POINTS

BACKGROUND

- Electricity is so much a part of everyday life that it's easy to forget that it can be also be dangerous.

- It lights our homes, runs our computers, smartphones, toaster ovens and refrigerators, as well as powers the equipment and machinery that we use in our jobs, but electricity causes thousands of injuries and hundreds of fatalities every year, and those numbers are increasing.

- In addition to harming people, electrical energy can also start fires and cause explosions that may result in extensive and costly damage.

BASICS OF ELECTRICITY/FAMILIAR TERMS

- To work safely around electricity, it's important to understand how it "works", itself. To do that, we need to become familiar with a few terms: "current", "volts", "amperes" and "watts".

- Current is the flow of electricity, for example in a wire. The amount of current that is flowing is measured in amperes, or "amps" for short. Most household and industrial electric wiring carries 15 to 20 amps.

- It's the current that gives you a shock, and it doesn't take much current to hurt, or even cause a serious injury. In fact, the amount of electrical current that's needed to light up a holiday bulb can be fatal if it passes through a person's heart.

- Volts are another term we hear a lot when we're talking about electricity. It describes the amount of force behind the flow of current. In North America, most power tools and household appliances run on 120 volt current. But some specialized and heavy-duty equipment that you may encounter on the job can require 220 volts or more.

- The next term, watts, describes how much energy a piece of electrical equipment uses when it's operating. An incandescent night light burns about 5 watts of electricity. A three-foot ceiling fan running on high uses about 50. A small window air conditioner draws about 500 watts. An electric clothes dryer uses close to 5,000.

- When you divide the number of watts by the voltage of the wiring system, the result is the equipment's power usage in amps. For example, a 500-watt air conditioner running on a 120-volt electrical system draws about four amps of current, whereas a 120-watt light bulb only uses a single amp.

- Running a 1200-watt hair dryer draws 10 amps, and as many of us know, that is sometimes enough to dim the lights when you turn the dryer on!

CIRCUITS & THE FLOW OF ELECTRICAL CURRENT

- To harness the power of electrical energy, we take advantage of the fact that electricity naturally flows in a loop, called a "circuit".

- A circuit begins at the power source, continues through wires and electrical equipment, and then returns to the source. In order for power to flow so that electrical equipment can run, the circuit has to be "complete"; that is with no interruptions.

- As you might expect, an "on/off" switch works by making and breaking the electrical circuit. When the switch is "on", the circuit is complete, electricity flows and the equipment runs. Moving the switch to the "off" position breaks the circuit, which stops the flow of electricity and the equipment.

- You could think of an outlet as "half a circuit" that's waiting to be completed. W hen you plug in an electrical device, you're attaching the rest of the circuit, which will be complete when we turn the power switch on, but you have to be careful.

- Plugging in too many pieces of equipment, or connecting devices that draw too much power, can overload the receptacle and the wiring that supplies it with power. An overload condition can cause the wiring to get hot enough to damage the equipment and possibly start a fire.

- The circuit breakers and fuses that are built into electrical systems have been designed to prevent this. If equipment tries to pull too much electricity through the wiring, these safety devices automatically break the

circuit, to stop the flow of energy.

- A device called a "ground fault circuit interrupter" or GFCI performs a similar function within the electric outlet itself. If the GFCI senses a dramatic change in the flow of current through the receptacle, such as when a cracked power cord starts leaking power to the ground, it breaks the circuit.

GROUNDING

- One of the most important things to understand about electricity is that it will always try to find the shortest and easiest way to get back to the beginning of the circuit or to the earth itself, whichever it can find first.

- This return path is called "ground" and if that path leads the electricity through you, you're in for a nasty shock or worse. One way to prevent this from happening is to build a safe return path into electrical devices, so that the grounding is controlled.

- Equipment that has a controlled grounding feature is called grounded equipment. Grounded equipment will have a three-prong plug on the power cord. The round connector on the plug is the "ground" prong. It connects to ground through the outlet, so that any stray electricity can be channeled safely out of the equipment.

- For this to occur, the outlet itself must also be grounded, with an electrical connection to the earth. Don't assume that an electric outlet has this connection just because it can accept a three-pronged plug. The only way to be certain that an outlet is grounded is to test it.

RECOGNIZING & AVOIDING ELECTRICAL HAZARDS

- Like the sign says, electricity can be dangerous. In addition to thousands of injuries, electricity is involved in more than 300 workplace fatalities each year. To stay safe, you need to be able to recognize potential electrical hazards and know how to avoid them.

- Start by always inspecting power cords and extension cords for wear and damage before you plug them in. Look for worn or cracked insulation, exposed or fraying wires and other defects. If you find problems, take the cords out of service immediately, then have them repaired or replaced.

- Watch out for overloaded outlets as well. Plugging too many cords into a single outlet can damage the wiring it is attached to, or even start a fire. You can prevent an overload by plugging some of the equipment into other outlets that are on different circuits.

- While extension cords can be convenient, they can create problems as well. Remember that they are safe only for temporary set-ups. They are not designed to be used as permanent power-supply solutions.

- To prevent overloading a cord, be sure to choose one that's rated to handle the amount of electricity you're going to be using.

- All electrical equipment should be properly grounded, so watch out for adapters that are being used to connect three-prong plugs into two-prong outlets. If the adapter's ground wire isn't connected to a grounding source, it's a dangerous set-up.

- Another bad idea is trying to make three-prong plugs more versatile by removing the ground prong. If you find plugs that have been altered this way, take them out of service and have them repaired or replaced.

- You shouldn't try to repair any electrical problem yourself unless you're qualified to do so. "Winging it" could endanger both you and your coworkers. Instead, advise your supervisor about the problem so a qualified repair person can handle it.

- Before a qualified electrician tries to service or repair electrically-powered equipment, they will disconnect all power sources and then follow proper lock-out/tag-out procedures to ensure the power is not turned back on by mistake.

- If you encounter equipment in your workplace that has been locked and tagged by someone else, do not try to restore power. Never remove locks or tags unless you are authorized to do so and you installed them yourself.

• Your last line of defense when you're working around electricity is personal protective equipment, such as insulated gloves and rubber-soled shoes. What you should wear can vary significantly from job to job. To find out what PPE is right for you, talk to your supervisor.

SPECIAL ELECTRICAL ENVIRONMENTS

• Some work environments create special electrical hazards and it's important for you to know about these situations, so you can take appropriate safety precautions.

• The first thing to remember is that water conducts electricity. Using electrical equipment in the rain or areas that are wet creates very serious shock hazards.

• Even double-insulated tools can give you a shock if water gets inside them so OSHA recommends not using electrical tools in damp conditions at all, unless the tool is connected to a ground fault circuit interrupter (GFCI).

• You should keep power and extension cords out of puddles as well. It's also a good idea to wear shoes with non-conductive soles. Make sure your hands are dry before you plug anything in too and never plug in extension cords or electrical equipment that has gotten wet.

• High-voltage power lines also create special hazards. If possible, the lines should be de-energized before you begin working near them. When that's not possible, it's crucial to stay a safe distance away.

• Keep yourself, and any conductive object that you're holding, at least 10 feet away from any power line that's carrying up to 50,000 volts. If the voltage is higher, you should stay even further away.

• It's critical to remember that you must also maintain these distances if you're driving a vehicle or operating equipment such as a forklift or a boom crane . If they get too close to a live wire, the electricity can try to go to ground through them and you.

• Metal ladders can also create problems. No matter what the voltage is, never use a metal ladder when you are working near power lines, electrical wiring or energized machine parts; the metal in them will conduct stray electricity straight to your body. Use a non-conductive fiberglass or wooden ladder instead.

• Sparks are something else you need to watch out for. Since electric tools and machinery can create sparks when they're operating, they can cause problems in work areas that contain flammable materials, since a stray spark could easily ignite them.

• If there could be flammable gases or vapors in an area you want to work in, stop! Don't turn electrical equipment on or off. It could cause a fire or even an explosion. Make sure the atmosphere has cleared before you touch a switch.

ARC FLASH HAZARDS

• When you are working around high-energy electrical systems, it's also important to understand the potential for arc flash. An arc flash is essentially an "electrical explosion" that creates enough heat, light, noise and power to injure or kill anyone unlucky enough to be near it.

• There are several things that can cause an arc flash: accidentally dropping a metal tool into high-voltage equipment can create one; so can digging or cutting into a power line. Shorting out a high voltage electrical panel can cause an arc flash too.

• Fortunately, most arc flash hazards are clearly labeled, so pay attention. Talk to your supervisor before starting any work near a potential arc flash environment.

DEALING WITH AN ELECTRICAL ACCIDENT

• Sometimes despite our best efforts, things still go wrong. If an electrical accident occurs in your workplace, it's important for you to know what to do as well as what not to do.

• For example, if a coworker is being shocked by a live electrical source, do not touch them. That will expose you to the same electrical charge that they are receiving.

• Instead, cut the power. This might require pulling out a plug or throwing a switch or a circuit breaker. Do

whatever is necessary to turn the electricity off, then assist the victim.

- An electrical fire can result from a short circuit, sparks or overloaded wiring. You can try to put these fires out with a fire extinguisher, but only if you've been trained to do it.

- You can't use an extinguisher that contains water, because water conducts electricity. Wetting down an electrical fire could get somebody killed.

- In these of situations you need to use a Class C extinguisher. They contain non-conductive fire retardants, and can put out electrical fires safely. You can find an extinguisher's letter code displayed on its label.

- Different types of electrical accidents can result in different degrees of injuries, ranging from minor to severe even life-threatening, so having a working knowledge of first aid can literally be a lifesaver.

- Since even minor burns can be very painful, hold them under cool running water to lessen the discomfort. You can then apply moisturizing cream, aloe vera gel or a burn treatment product. If a blister has formed, try not to break it.

- More serious wounds such as those caused by an arc flash will require medical attention. Call 911 for burns with large blistered areas or charring, wounds that are deep or have gaping or jagged edges or spurting blood or bleeding that will not stop.

- The 911 dispatcher may also be able to advise you on how to care for the victim until the EMTs arrive.

- We all know that electric shock can be used to jump start a person's heart, but it can also cause a heart to stop beating. If a victim of an electrical accident stops responding to you, or stops breathing, they may be going into cardiac arrest.

- In this situation, you should have someone call 911, begin CPR immediately or use an AED (Automated External Defibrillator) if one is available and you know how to administer it.

- Just remember, the best way to deal with electrical accidents and the problems they can cause is to prevent them from happening in the first place.

QUIZ Electrical Safety

Employee Name:_____ **Training Date:** _____

1. True or False?... The term "watts" describes the "force" behind the flow of electrical current.
   ____ True ____ False

2. True or False?... Any electrical outlet that will accept a three-prong plug will always have an electrical connection to the earth.
   ____ True ____ False

3. True or False?... An "on/off" switch works by completing and breaking an electrical circuit.
   ____ True ____ False

4. True or False?... If you encounter an electrical problem on the job, the first thing you should do is try to repair it.
   ____ True ____ False

5. True or False?... Plugging too many cords into a single outlet can damage the wiring it is connected to, or even start a fire.
   ____ True ____ False

6. True or False?... A "double insulated" power tool will protect you from shock even if water gets inside it.
   ____ True ____ False

7. True or False?… When an arc flash occurs, it can create enough heat, light, noise and power to injure or kill anyone nearby.
   ____ True ____ False

8. True or False?... You should use a fire extinguisher that contains water to fight an electrical fire.
   ____ True ____ False

9. True or False?... If a coworker is being shocked by live electricity, you should first separate the person from the source of the electricity, then turn the power off.
   ____ True ____ False

10. True or False?... Class C fire extinguishers can be used to fight electrical fires because they contain non-conductive fire retardants.
    ____ True ____ False

QUIZ Electrical Safety

PRESENTER'S COPY...WITH ANSWERS

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