

# **PRESENTER'S GUIDE**

## **"ARC FLASH"**

**Part of the General Safety Series**

# **OUTLINE OF MAJOR PROGRAM POINTS**

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The following outline summarizes the major points of information presented in the program. The outline can be used to review the program before conducting a classroom session, as well as in preparing to lead a class discussion about the program.

- **Electricity... it's so common in our homes and workplaces that it's easy to take it for granted, and to forget about its hazards.**
  - But with more than a thousand people being killed every year in electrical accidents and about thirty thousand being injured, electrical safety literally is a matter of life and death.
  
- **Electricity poses two major hazards to those who work with or around it.**
  - The most intense of these is "arc flash", a sudden, violent release of electrical energy.
  - Its powerful heat and blast effects can cause severe injuries and fatalities.
  - The second is "shock", which occurs when electric current passes through your body.
  - Shock can cause burns, internal injuries, cardiac arrest... even death.
  
- **Many people think that arc flash is just a type of shock, but it's not.**
  
- **It doesn't take much electricity to cause a shock.**
  - Point-zero-six amps of electricity is just enough to make the filament in a holiday light bulb glow, for example.
  - But the same number of amps passing through your heart is all it takes to "put your lights out", permanently.

- **We all encounter situations that can result in a shock.**
  - Fortunately, there are safe work practices we can follow to reduce our risk of being shocked in the workplace.
  - They begin with keeping your eye out for hazards such as cracked wires and defective equipment.
- **You should always inspect tools and extension cords before plugging them in.**
  - If you see torn insulation or exposed wiring, don't use them.
- **This type of damage often results from "unsafe" work practices, such as:**
  - Picking up electric tools by their power cords
  - "Unplugging" an extension by yanking on the cord instead of pulling the plug.
- **It's important to treat power tools and cords with respect.**
- **Another problem can occur when someone removes the "ground" prong from a three-prong plug, so they can put it in a "two-prong" outlet.**
  - Don't use any plug that has been altered in this way.
  - Inform your supervisor immediately so it can be repaired or replaced.
- **Water conducts electricity and promotes "shock".**
  - Whenever possible, avoid using power tools and equipment in wet conditions.
  - Don't touch any electrical equipment that's wet.
  - Make sure your hands are dry when you're working with electricity as well.
- **A metal ladder will behave just like a lightning rod around an electrical source.**
  - Use a nonconductive fiberglass or wooden ladder instead.

- **While the potential for shock is all around us, and it can obviously be hazardous, shock seems "tame" compared to arc flash.**
- **Arc flashes are more common than you might think. Chances are you've witnessed them many times, without knowing it!**
  - When you see a flash of lightning, you're seeing an arc flash.
  - It gives off intense light, and loud noise.
- **As lightning comes closer, you get a better idea of its violence and destructive power.**
  - If it gets too close... you might not survive it.
- **While lightning occurs naturally, "man-made" arc flashes generally occur in high-energy electrical systems that provide power for business and industry.**
- **Arc flash events send a couple of thousand workers to burn units every year.**
  - They cause disabling injuries.
  - And they kill.
- **To better understand this hazard, let's take a closer look at what an arc flash is and how man-made arc flashes happen.**
- **Most of the time, energy moves safely through electrical systems, unless something happens to divert the power.**
  - When diverted electricity jumps through the air from contact to contact, or from a contact to "ground", that's an arc flash.
  - This can occur spontaneously when corrosion or conductive dust builds up in equipment.
  - But most arc flashes result from mistakes that are made when someone is working on or near an electrical system.

- **Touching a probe to the wrong circuit, or dropping a metal tool into the system, even digging a backhoe into an underground cable, can all cause arc flash.**
  - Like lightning, these types of arc flashes happen very quickly, and release huge amounts of light and heat energy.
  - Temperatures can reach 35,000 degrees Fahrenheit, three and a half times hotter than the sun's surface.
  - An arc flash instantly superheats the air, and can vaporize nearby structures and equipment.
  
- **Another phenomenon that is often associated with an arc flash is "arc blast".**
  - Basically, the equipment that is the source of the arc flash explodes.
  - This can throw melted metal and debris outward at nearly the speed of sound.
  - Workers lucky enough to survive a close encounter with an arc blast say it was like standing in front of a shotgun when it's fired.
  
- **"Arc flash trauma" is not a pleasant subject.**
  - But by examining the physical hazards of arc flash, we can gain a better understanding of what we can and cannot do to protect ourselves from it, and what type of PPE should be used in arc flash situations.
  
- **The light released by an arc flash is literally blinding.**
  - Its heat can cause first, second and third degree burns.
  - It can make everyday clothing burst into flame, and cause some synthetic fibers to actually melt into your skin.
  - When your clothes burn or melt, your body gets burned, too.
  - The more of your body that gets burned, the more likely you are to die from your injuries.

- **This is why electrical workers always put on "arc-rated" protective clothing and equipment when they approach a potential arc flash source.**
  - The "arc rating" describes how much heat the protection can resist without damage.
- **To calculate the arc rating you need for a particular task, you determine how many units of heat you would receive where you are working if an arc flash occurred in that equipment.**
  - You then can choose clothing with an arc rating that meets or exceeds the protection level for that amount of heat.
  - Other arc-rated PPE, such as gloves, safety glasses, or face shields, is selected in the same way.
- **But the heat energy generated by an arc flash is not the only hazard. There is also the "arc blast" to consider.**
  - It can throw you across the room, causing additional injuries such as a concussion and broken bones.
  - It can rupture your eardrums as well as collapse your lungs.
  - It can throw equipment fragments just like shrapnel from a grenade.
- **The unpleasant truth is that even arc-rated clothing and PPE cannot provide much protection from the violence of an arc blast.**
- **Protective clothing and PPE are your last lines of defense against an arc flash and arc blast.**
  - They provide as much protection as possible when an accident happens.
  - But real safety comes from preventing the arc flash in the first place.

- **The best way to reduce the risk of arc flash is to create an "electrically safe working condition" before any electrical work begins.**
  - This starts with powering down, or "de-energizing" the equipment to be worked on, but there is more to it than that.
  - Preventing electrical accidents also requires stringent adherence to safe work practices in every step of the work that is being done.
- **For example, the equipment to be disconnected may be located at some distance from, even out of sight of, its power control system.**
  - Once the energy has been turned off, it is all too easy for someone who can't see people working on the equipment to turn the electricity back on unexpectedly.
  - That's why the power control system must be locked-out and tagged after being turned off.
  - This physically prevents the equipment from being re-energized.
- **The equipment must still be treated as if it's energized, and a potential arc flash hazard, until it has been tested to make sure the power really is off.**
  - Electrical workers who are servicing the equipment must continue to adhere to safe work practices and wear protective clothing and PPE when they conduct the test.
- **Another important step in creating an "electrically safe working condition" is establishing an "Arc Flash Boundary".**
  - To determine where this boundary should be, you calculate at what distance from the equipment the "incident energy" of an arc flash would equal 1.2 calories of heat per square centimeter.
  - This "1.2 calories per square centimeter distance" is where the Arc Flash Boundary will be set up.



- **The boundary must be clearly labeled and must physically restrict access to the area.**
  - Unqualified electrical service personnel and other workers may not cross the Arc Flash Boundary.
  - Even qualified electrical workers can't cross the boundary unless they are wearing appropriate protective clothing and PPE with the right arc rating.
- **Once these precautions have been taken, the equipment can be tested.**
  - Only when it is verified that the power is off, does an "electrically safe working condition" exist.
  - That's when actual maintenance or repair of the equipment can begin, without any risk of arc flash or electric shock.
- **While preventing arc flash in your facility largely depends on the safe work practices of the qualified electrical workers who are servicing the equipment, there are things that other employees can do to keep safe around potential arc flash situations as well.**
  - First, if you're not qualified and authorized to operate or work on electrical equipment, you shouldn't try.
  - Small mistakes with high voltage can have big consequences.
- **It's also a good habit to stay clear of electrical equipment and potential arc flash sources under any circumstances.**
  - Warning labels make arc flash sources easy to recognize so you can keep your distance.
- **If electrical work is being done in your facility, you should keep in mind that "turning off the power" may not always be an option.**
  - You should always assume that the work is being performed on live, energized circuits, and use all the caution that this type of situation demands.
- **If an electrical worker has set up an Arc Flash Boundary to protect you from arc flash, don't cross it!**

**\* \* \* SUMMARY \* \* \***

- **Arc flash and electrical shock can pose a serious danger to people in the work place.**
  - But there are ways all of us can reduce the risk.
- **Always use caution around electrical power.**
  - "Safe work practices" will help to reduce your risk of injury from shock and arc flash events.
- **Inspect power tools and other electrical equipment for damage before you use them.**
  - Take them out of service if you find problems.
- **Avoid using electrical equipment in wet conditions if at all possible.**
- **An arc flash is a violent release of electrical energy.**
  - It can cause severe damage and injury through a combination of heat and blast effects.
- **PPE must be worn to lessen the physical risks of an arc flash, but the most effective way to protect against an arc blast is to prevent it from occurring in the first place.**
- **The best way to keep an arc flash from happening is to create an "electrically safe working condition" by turning off the power.**
- **Unless you're trained and authorized to do electrical work, stay away from power systems, especially when they're undergoing maintenance or repair.**
- **Though you can never take electrical safety for granted, understanding the risks and how to avoid them gives you the "power" to get through every workday safely!**