

# FIREFIGHTER SAFETY

Stay safe during substation fires



# FIREFIGHTERS AND SUBSTATIONS

Electrical substations reduce the high voltages used to move electricity over long distances to the lower voltages that distribute electricity to homes and businesses. Substations connect to the grid through power lines, and they are dangerous locations for anyone not well trained in electrical safety.

Contact with substation equipment can cause serious injury or even death. Personnel trained to work inside substations must take appropriate safety precautions and always wear personal protective equipment (PPE).

## Voltages

At transmission substations, high-voltage electricity passes through a transformer. For example, a 345,000-volt feed might be stepped down to 138,000 volts. Power is then routed to a distribution substation, which steps it down further. Voltages leaving a distribution network are typically in the 13,000- to 33,000-volt range, but they can vary from area to area. Small-area substations and, finally, pole-mounted or underground transformers in the field reduce the voltage further for the end user. Commercial voltages range from 208 to 480 volts; standard residential voltage is 120 to 240 volts.

## Overhead Clearance and Exposed Conductors

When dealing with high voltages, a person does not have to touch an electrical conductor to get hurt. Substations use a high-voltage, open-air conductor (called a “bus”) that resembles a large conduit or angled aluminum pipe. These metal pipes running overhead through a substation are the conductors of electricity. They do not contain wires; the electricity is carried on the pipes’ surface. Ground clearance for wires entering and leaving a substation is lower than ground clearance on the typical distribution system. Be aware of the wires entering and leaving a substation, and stay away from them at all times.

## Overhead Electric Bus

If someone gets close enough to the overhead bus, the electricity may produce a high-temperature electrical arc. The potential for an electrical arc becomes greater as voltage increases. For this reason, everyone should stay at least 20 feet from the conductors inside the substation. **To keep a safe distance from the electric bus inside a substation, do not climb fences or equipment, and do not carry tools or ladders above your shoulders, even when Duke Energy personnel are on-site.**

## Ground-level Electrical Hazards

The overhead bus is not the only electrical hazard in a substation. Many electrical hazards are also found at ground level, so access to certain equipment is restricted. Some electrical equipment is placed in cages, or enclosures. Circuit breakers, which protect and isolate exposed electrical equipment, may be housed in locked cubicles. Lead-acid batteries, similar to large car batteries, are stored behind locked doors. **Do not ignore posted warning signs. Remaining outside of these locked doors, gates and fenced areas will help keep you safe.**

## Copper Theft

Fires can occur in substations due to copper theft. If a person attempting theft is electrocuted, the body can be electrically energized, and an emergency responder must consider his or her own safety. **Do not attempt to recover the victim or come in contact with any equipment at the substation until Duke Energy personnel declare the site safe for you to enter.**

## Step Potential

When an energized line makes contact with the ground, the earth becomes energized and the voltage dissipates in concentric circles away from the initial contact point. “Step potential” is the voltage difference between the span of one step. When each foot is referenced to a different potential or voltage, the difference is called a Step Potential Hazard. The current will travel from one foot to the other, which can be fatal.

## Response Tactics

Because of the hazardous environment found in substations, firefighters must not use aggressive tactics. Substation fires require specialized knowledge, close consultation with operating personnel and a heightened sense of caution. First-responding officers must closely supervise firefighters to ensure their safety. All firefighters operating at the scene must be aware of the potential dangers and act accordingly. Even touching the fence or gate of a substation can be a dangerous situation. When you respond to incidents at substations, **Duke Energy will provide an experienced representative who is knowledgeable about substation safety.**

## Exposure to PCBs and Other Contaminants

The following practices will help avoid exposure to contaminants for responders and civilians:

- Because of the possibility of a PCB (polychlorinated biphenyl) spill and the presence of PCBs and other contaminants in the smoke, wear full PPE. Also, attempt to work away from the smoke, water runoff or any liquid spills by staying uphill and upwind if possible. Use your self-contained breathing apparatus even in light smoke.
- If possible, channel the water runoff or liquid spills away from civilians and access to waterways.
- You should evacuate anyone exposed to PCB-contaminated smoke.
- Consider decontamination after being exposed to any smoke, oil or water runoff. This precaution will avoid possible contamination of the apparatus, the firehouse or your own home.

## Upon Arrival

**When called to a substation, do not force entry. Instead, survey the situation from the exterior.**

Unescorted access exposes you to the hazards mentioned previously. These guidelines will help keep firefighters safe at substation incidents:

- **Before arrival.** Remind all crew members to not touch the fence or gate. Substations contain high voltages. If there is damage to the grounding system, the fence and/or gate may be energized. Stay away from the fence and gate until Duke Energy arrives and advises it is safe to approach.
- **Scene size-up.** Upon arriving at a substation for an emergency, remain in your vehicle and take note of anything that may be in contact with the fence. If a conductor or other object is lying on a fence, do not allow anyone to approach it. If a conductor is energized, the fence is energized as well. If hazards are obvious, remain in your vehicle until Duke Energy arrives and secures the scene.
- **Wait for Duke Energy personnel to arrive.** If a Duke Energy representative is not present, call Duke Energy immediately. If a number is not posted on a sign on the exterior of the gate, your dispatcher will be able to contact Duke Energy. As we routinely monitor these facilities electronically, a representative will likely be on the way by the time you arrive and call.

- **Protect exposures outside of the substation.** If a substation fire is exposing residential or commercial neighbors, set up lines or large-caliber streams for exposure protection. It is safe to put water on the threatened exposures outside of the substation.
- **Do not apply water directly on electrical equipment inside the substation without first consulting Duke Energy.** Electricity follows the path of least resistance and a water stream has less resistance than the air, which could result in electrocution to the person spraying the water. The Duke Energy representative will tell you what is energized and where you can safely apply water. For a fire inside the substation, you must decide which extinguishing agent is safe, where to position the apparatus and the safe standoff distance for applying the stream. The Duke Energy representative may have recommendations.
- **Prepare to supply the sprinkler system.** Some substations have a deluge sprinkler system, but coverage is typically limited to the transformers. The sprinkler system has its own water supply, which may be augmented by an external connection. If there is a water main break or a fire pump fails, Duke Energy personnel may ask that you augment that system.



# FIREFIGHTERS AND SUBSTATIONS

If there is a fire or hazard in a Duke Energy substation, let it burn until a Duke Energy representative arrives and advises you on appropriate actions.

Basic rules for enforcing electrical safety at substation incidents:

1. **Do not take any action until a qualified representative arrives and advises it is safe to enter.** Wait to confer with the Duke Energy representative.
2. **Let it burn.** Burning electrical equipment is already ruined and will be replaced. Contact Duke Energy and wait for a representative to arrive.
3. **Evacuate the area.** Keep people at least 300 feet away. Protect exposures to prevent fire from spreading.
4. **Observe and respect posted warning signs.** Do not enter a substation until the Duke Energy representative arrives and makes the scene safe.
5. **If the Duke Energy representative says it is safe to enter the substation, avoid bringing metal or partially metal tools into the substation and do not carry tools projecting over your shoulder.** Carry all tools below the shoulder, so that you do not reduce the allotted safe-clearance distances. Note: Even a wooden or fiberglass ladder can conduct the substation's high voltages. And, if approved to enter a substation, at minimum a fire helmet, safety glasses and flame retardant clothing must be worn.
6. **Don't climb.** Always maintain the necessary clearance from the overhead conductors. After the Duke Energy representative deems it safe to enter, stay on the ground for your own safety.

7. **Even raising ladders outside the substation may not be safe.** High-voltage electrical equipment may be just inside a fence or a wall. Placing a ladder against an aerial platform near or over a fence or wall can violate the safe standoff distance, putting firefighters in danger of electrocution. It is best to leave the aerial devices bedded until after consultation with the Duke Energy representative.
8. **Never use water on or near electrical equipment inside a substation.** When considering hose or large-caliber stream operations, consider the path that the water takes from the hose or appliance to the fire. Is any live electrical equipment in the path or alongside it? If your stream could contact it, measure a safe distance from that point.
9. **Always operate as if PCBs or other contaminants are present in the smoke, oil and water runoff, and decontaminate as a precaution.**
10. **Always consult with the Duke Energy representative** on the hazards and safety of any proposed tactics.



## Contact Information

If you see downed power lines or another electrical danger, call for help immediately:

Duke Energy Carolinas

**800.769.3766**

Duke Energy Indiana

**800.343.3525**

Duke Energy Kentucky or Ohio

**800.543.5599**

Duke Energy Progress

**866.464.7250**

Duke Energy Florida

**800.228.8485**

