



# Fire Fighters Exposed to Electrical Hazards During Wildland Fire Operations

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

HAZARD ID

## Description of Hazard

Among the various hazards fire fighters face are electrical hazards during wildland fire suppression activities. The National Fire Protection Association (NFPA) reports that 10 fire fighters died from contact with electricity during wildland fires between 1980 and 1999 (this figure does not include lightning strikes) [NFPA 2001]. As part of the National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program, NIOSH investigated two separate incidents in 1999 in which fire fighters died or were seriously injured from exposures to electricity while fighting wildland fires [NIOSH 1999a,b].

Fire fighters performing fireground operations near downed power lines may be exposed to electric shock hazards through the following means [NWCG 1998; IFSTA 1998b]:

- Electrical currents that flow through the ground and extend several feet (ground gradient)
- Contact with downed power lines that are still energized
- Overhead power lines that fall onto and energize conductive equipment and materials located on the fireground
- Smoke that becomes charged and conducts electrical current
- Solid-stream water applications on or around energized, downed power lines or equipment

## CASE STUDIES

### Case 1

On June 23, 1999, a 20-year-old male volunteer fire fighter was electrocuted while fighting a grass fire [NIOSH 1999a]. The volunteer fire fighter was one of a crew dispatched to a grass fire where a power line was reported to be down. The volunteer fire fighter arrived and immediately helped the Deputy Chief and a fire fighter/paramedic extinguish the fire on the east flank. The volunteer fire fighter then walked toward a smoldering pile of brush near the downed power line. As he pulled a charged, 1-inch line over the uneven terrain, he apparently tripped and fell onto the 6,700-volt, downed power line. Other fire fighters on the fireground used a nonconductive tool to pull the line from under the victim. He was moved to the street, received cardiopulmonary resuscitation (CPR), and was then taken to a local hospital, where he was pronounced dead.

### Case 2

On October 4, 1999, a 20-year-old male volunteer fire fighter was electrocuted and two other fire fighters were injured when they contacted an energized electric fence while fighting a grass fire [NIOSH 1999b]. Central Dispatch notified the fire department of a fire that was started when a downed power line ignited the surrounding grass. The Chief arrived first, followed by Engine 1 and two fire fighters. The Chief indicated to Central Dispatch and to the responding fire fighters that the electric fence bordering the area was energized by the downed power line. The driver of Engine 1 and the three fire fighters crawled underneath the bottom wire of the electric fence. They positioned themselves approximately 50 feet from the downed power line and attacked the primary fire. After the fire was extinguished, the three fire fighters crawled under the fence a second time. The two surviving fire fighters do not remember the injury event. However, it is believed that when one of the survivors was crawling on her back under the electric fence, a hook from her bunker coat might have contacted the bottom wire of the fence. It is believed that the other two

fire fighters were shocked while trying to help the fire fighter who was still energized. All three were removed from the energized area, and basic first aid procedures were administered until the ambulance arrived. One of the injured was transported by helicopter to an area hospital, and another was transported by ambulance to the local hospital and later to the burn unit of an area hospital. The third fire fighter was pronounced dead on arrival at a local hospital.

### Recommendations for Prevention

To minimize the risk of electrocution, electrical shock, and electricity-related burns while fighting wildland fires, NIOSH recommends that fire departments and fire fighters take the following precautions [IFSTA 1998a,b; NWCG 1998; NFPA 1997; 29 CFR\* 1910.332(b); 29 CFR 1910.335(b); Brunacini 1985]:

#### *Fire departments should do the following:*

- Keep fire fighters a minimum distance away from downed power lines until the line is de-energized. This minimum distance should equal the span between two poles.
- Ensure that the Incident Commander conveys strategic decisions related to power line location to all suppression crews on the fireground and continually reevaluates fire conditions.
- Establish, implement, and enforce standard operating procedures (SOPs) that address the safety of fire fighters when they work near downed power lines or energized electrical equipment. For example, assign one of the fireground personnel to serve as a spotter to ensure that the location of the downed line is communicated to all fireground personnel.
- Do not apply solid-stream water applications on or around energized, downed power lines or equipment.

\*Code of Federal Regulations. See CFR in references.

- Ensure that protective shields, barriers, or alerting techniques are used to protect fire fighters from electrical hazards and energized areas. For example, rope off the energized area.
- Train fire fighters in safety-related work practices when working around electrical energy. For example, treat all downed power lines as energized and make fire fighters aware of hazards related to ground gradients.
- Ensure that fire fighters are equipped with the proper personal protective equipment (Nomex<sup>®</sup> clothing compliant with NFPA standard 1500 [NFPA 1997], leather boots, leather gloves, etc.) and that it is maintained in good condition.
- Ensure that rubber gloves and dielectric overshoes and tools (insulated sticks and cable cutters) for handling energized equipment are used by properly trained and qualified personnel.

***Fire fighters should do the following:***

- Assume all power lines are energized and call the power provider to de-energize the line(s).
- Wear appropriate personal protective equipment for the task at hand—Nomex<sup>®</sup> clothing compliant with NFPA standard 1500, rubber gloves, and dielectric overshoes and tools (insulated sticks and cable cutters).
- Do not stand or work in areas of dense smoke. Dense smoke can obscure energized electrical lines or equipment and can become charged and conduct electrical current.

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**NIOSH**  
Publications Dissemination  
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NIOSH is the Federal agency responsible for conducting research and making recommendations to prevent work-related illness and injuries. NIOSH conducts the Fire Fighter Fatality Investigation and Prevention Program to determine factors that cause or contribute to fire fighter fatalities suffered in the line of duty and to develop strategies for preventing similar incidents in the future. More information is available at [www.cdc.gov/niosh/firehome.html](http://www.cdc.gov/niosh/firehome.html)



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Department of Health and Human Services  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health  
4676 Columbia Parkway  
Cincinnati, OH 45226-1998



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