



NIOSH
Fire Fighter Fatality Investigation
and Prevention Program

Death in the line of duty...

A Summary of a NIOSH fire fighter fatality investigation

May 16, 2000

Volunteer Fire Fighter Dies After Coming into Contact With a Downed Power Line - Arkansas

SUMMARY

On November 3, 1999, an 18-year-old male, volunteer fire fighter was electrocuted after responding to a call involving a brush fire located in a utility easement. A Captain from the fire department was the first to arrive on the scene and was unable to see any downed power lines during his initial size-up. Approximately 2 minutes after the Captain's initial size-up, a Lieutenant and a fire fighter arrived in their privately owned vehicles (POVs). At approximately the same time, the victim arrived with the Assistant Chief in Brush Truck 911, followed by the Chief in Engine 912. The victim, the Chief, the Captain, the Lieutenant, and a fire fighter proceeded to the utility easement. They noted a tree had fallen and was leaning against the overhead power lines but did not see any downed lines. They found a small patch of smoldering debris between the base of an oak tree and woody bush. The victim, standing approximately 2 feet from the oak tree, was directed by the Chief to stomp out the embers in the smoldering brush. The victim came into contact with a downed, single-phase, 7,200-volt power line when he stepped on the smoldering pile. He first screamed and then fell

to the ground. Fire fighters radioed dispatch for an ambulance. Approximately 4 minutes later, the other fire fighters were able to remove him from the line with a pike pole. They began cardiopulmonary resuscitation (CPR) just as the ambulance arrived on the scene. NIOSH investigators concluded that, to minimize the risk of similar occurrences, fire departments should:

- ***ensure that fire fighters are kept away from downed power lines at a distance equal to at least one span between poles until the line is de-energized***
- ***ensure that fire fighters always do the following when they encounter downed power lines: assume that all lines are energized, call for the power provider to respond, and control the scene***
- ***establish, implement, and enforce standard operating procedures (SOPs) that address fire fighter safety when working near downed power lines***



Incident Site

The **Fire Fighter Fatality Investigation and Prevention Program** is conducted by the National Institute for Occupational Safety and Health (NIOSH). The purpose of the program is to determine factors that cause or contribute to fire fighter deaths suffered in the line of duty. Identification of causal and contributing factors enable researchers and safety specialists to develop strategies for preventing future similar incidents. To request additional copies of this report (specify the case number shown in the shield above), other fatality investigation reports, or further information, visit the Program Website at:

<http://www.cdc.gov/niosh/firehome.html>

or call toll free **1-800-35-NIOSH**



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- *ensure protective shields, barriers, or alerting techniques are used to protect fire fighters from contacting energized electrical conductors*
- *ensure fire fighters are aware of the hazards when working around energized parts or equipment*

INTRODUCTION

On November 3, 1999, an 18-year-old male, volunteer fire fighter was killed when he came into contact with a downed, single-phase, 7,200-volt power line. The victim had responded to a reported brush fire located in a utility easement. The victim, the Chief, the Captain, the Lieutenant, and a fire fighter proceeded to the utility easement and were searching for the fire when they noticed a small patch of smoldering brush. The victim was stomping out embers in the smoldering brush when he was electrocuted by a downed power line. The National Institute for Occupational Safety and Health (NIOSH) learned of this incident from the Firehouse Line-of-Duty notification system (FIREHOUSE.COM) on November 5, 1999. On November 18, 1999, two Safety and Occupational Health Specialists from NIOSH investigated this incident. Meetings and interviews were conducted with the City Fire Marshal, the Chief of Police, and the fire department's Chief, Assistant Chief, Captain, Lieutenant, and fire fighters involved in the incident. NIOSH investigators obtained from the fire department copies of photographs, training records, standard operating procedures, witness statements, and incident reports completed by the City Fire Marshal and the fire department's investigator. NIOSH investigators conducted a site visit and photographed the site. The volunteer fire department involved in this incident consists of three fire stations with a total of 50 volunteer fire fighters. The department serves a population of approximately 6,500 in a geographic area of 100 square miles. The

victim was a fire fighter trainee with 6 months of experience. The State requires that fire fighters have 28 hours of training on the following topics prior to engaging in fire ground activities: Introduction to Fire Protection (12 hours), Introduction to Protective Equipment (12 hours), and Wildland training (4 hours). The victim had not received this training.

INVESTIGATION

On November 3, 1999, an 18-year-old male, volunteer fire fighter (the victim) was killed after coming into contact with a downed, single-phase, 7,200-volt power line. At 0400 hours a call came into Central Dispatch reporting a brush fire. A Captain, Lieutenant, and a fire fighter responded to the scene in privately owned vehicles (POVs). The Captain was first to arrive on the scene at approximately 0405 hours and noticed a small fire located behind a house in a utility easement, approximately 60 yards north of the road. The power poles within the utility easement have the following lines: a single-phase, 7,200-volt power line (that runs along the top of the poles) that is gray in color and very small in diameter (see Diagram 1 and Photo 1), three 120/240-volt power lines installed on the poles directly below the 7,200-volt line (see Diagram 1), and cable and telephone lines installed below the 120/240-volt power lines. (Note: cable and telephone lines are not shown on Diagram 1.) The utility easement runs through the edge of a wooded lot, parallel to the roadway, and behind a residential area (see Diagram 2). The Captain proceeded toward the easement to conduct an initial size-up of the scene and noticed to the east a small-diameter tree leaning against the overhead power lines. To the west, he noticed a small, smoldering fire in the brush. The Captain reported to the Chief that it was a small electrical fire. The Captain believed that a power line was down because the fire department had responded in the past to brush fires in the area that had involved downed power lines. With only the aid of a flashlight, he was unable to see any downed



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power lines. The victim responded to the scene at 0410 hours with the Assistant Chief in Brush Truck 911 while the Chief responded in Engine 912. As the Captain returned to his vehicle, the Lieutenant and a fire fighter arrived on the scene in their POVs. Within 2 minutes of their arrival, the victim and the Assistant Chief in Brush Truck 911 and the Chief in Engine 912 arrived on the scene. The Assistant Chief drove the Brush Truck to a road north of the scene in an attempt to locate any other fires (see Diagram 2). The victim, the Chief, the Captain, the Lieutenant, and a fire fighter proceeded to the utility easement. They noted a tree that had fallen and was leaning against the power lines but did not see any downed lines. (Note: The fire fighters were unaware of a fourth, higher-voltage power line that was originally located above the three lower-voltage power lines.) Each of the fire fighters saw that the three power lines were still intact. The fire fighters believed that hot embers from the tree leaning against the power lines—not a downed power line—may have started the brush fire. The fire fighters found a small patch of smoldering debris between the base of an oak tree and a woody bush. The victim, standing approximately 2 feet from the oak tree, was directed by the Chief to stomp out the embers in the smoldering brush. Leaning against the tree with his left hand, the victim placed his right foot on the smoldering brush. He then yelled, his knees buckled, and he fell to the ground. The victim was lying on his right side in a fetal position. The other fire fighters realized that the victim had come in contact with a downed power line. As the Lieutenant reached for the victim, the Chief and Captain yelled, “Don’t touch him!” to prevent any other electrocutions. The Chief radioed dispatch requesting that the power company be notified that they needed the line to be de-energized. The Lieutenant yelled for someone to get a pike pole from the Engine. The Chief also ran to the Engine to retrieve a fire extinguisher because the victim’s clothing had caught fire. The Assistant Chief, on the north side of the scene in the Brush

Truck, saw a flash and heard the victim yell. The Lieutenant remained motionless in fear of stepping on the downed power line that had not yet been located. The Chief returned with the fire extinguisher and extinguished the victim’s clothing. A fire fighter returned with the pike pole approximately 1 minute later. The Lieutenant then used the pike pole to hook the victim’s bunker coat at the collar but was unable to pull the victim free because his legs were straddled around the trunk of the woody bush. The Assistant Chief drove back to the south side of the scene, grabbed a pike pole, and proceeded to the incident site. The Lieutenant attempted a second time to pull the victim off the downed power line. Using the hook of the pike pole to bunch up the victim’s shirt, the Lieutenant hooked the victim’s belt and again attempted to pull him off the downed power line. Seeing that the Lieutenant was having difficulty pulling the victim free, the Assistant Chief grabbed the pike pole, and the two of them lifted the victim by his belt, pulling him free. After dragging him several feet away from the downed line, they were able to cut his clothing off his body and begin cardiopulmonary resuscitation (CPR). The ambulance arrived on the scene as the fire fighters were beginning CPR. The emergency medical service personnel then defibrillated the victim, began CPR, and then intubated him. The victim was transported to a regional hospital where he was pronounced dead at 0510 hours.

CAUSE OF DEATH

The Death Certificate lists the cause of death as accidental electrocution.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Fire departments should ensure that fire fighters are kept away from downed power lines at a distance equal to at least one span between poles until the line is de-energized.^{1,2}



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Discussion: As stated in the Fundamentals of Wildland Fire Fighting, when downed power lines come in contact with the ground, current flows outward in all directions from the point of contact (ground gradient). The energized area can extend several feet from the point of contact; therefore, fire fighters could be electrocuted by walking into this area (Step Potential). To avoid this hazard, fire fighters should keep an ample distance away from the downed power line (equal to one span between poles) until the power is de-energized. If, upon arrival, the fire has not burned past the distance equal to one span between poles, fire departments should delay their attack until the fire has burned past this recommended span. Based upon past experiences involving this utility easement and downed power lines within their area, the fire fighters believed that the fire may have been caused by a downed power line. However, not seeing a downed power line during the initial size-up or during subsequent searches, the fire fighters believed the brush fire was started by hot embers falling from the tree that was leaning against the three power lines. The single-phase, 7,200-volt line—gray in color and fairly small diameter—blended with the dead brush and leaves found at the incident site (see Photo 1). The occurrence of the incident at night also made it difficult to see.

Recommendation #2: Fire departments should ensure that fire fighters always do the following when they encounter downed power lines: assume that all lines are energized, call for the power provider to respond, and control the scene.²

Discussion: As stated in the Fundamentals of Wildland Fire Fighting, there are three general guidelines for dealing with downed power lines when there is no fire: assume that all lines are energized, call for the power provider to respond, and control the scene. Control of the scene can be established with standard

operating procedures; for example, keeping fire fighters away from downed power lines at a distance equal to or at least one span between poles until the line is de-energized by utilizing protective shields, barriers, or alerting techniques. Based upon past experiences involving this utility easement and downed power lines within their area, the fire fighters believed that the initial brush fire may have been caused by a downed power line. Upon arrival, the fire fighters found smoldering debris. With the initial belief that there may have been a downed power line, the implementation of these three guidelines would have substantially reduced the fire fighters risk of exposure to a downed power line.

Recommendation #3: Fire departments should establish, implement, and enforce standard operating procedures (SOPs) that address fire fighter safety when working near downed power lines.³

Discussion: A standard operating procedure (SOP) should be developed addressing all safety aspects regarding downed power lines that pose an electrocution hazard. SOPs should include but not be limited to the following: (1) notify the authority that operates or controls the electric circuit to de-energize the downed power line, (2) keep fire fighters away from downed power lines at a distance equal to at least one span between poles until the line is de-energized, and (3) ensure protective shields, barriers, or alerting techniques are used to protect fire fighters from shock, burns, or other electrically related injuries. At the time of the incident, the fire department did not have SOPs regarding fire fighter safety at scenes involving downed power lines.

Recommendation #4: Fire departments should ensure protective shields, barriers, or alerting techniques are used to protect fire fighters from contacting energized electrical conductors.⁴



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Discussion: Fire departments should comply with OSHA safety standard 29 CFR 1910.335(b) which would provide additional guidelines to a fire department's Standard Operating Procedures (SOPs). Alerting techniques should include safety signs and tags, barricades, or if no other means are available, an attendant stationed to warn and protect fire fighters. The Captain did search for a suspected downed power line but was unable to locate it. When the other fire fighters arrived on the scene, they too looked for a downed power line and were unsuccessful. Because the fire fighters were unable to locate the downed power line, a barrier should have been established to limit access to the utility easement.

Recommendation #5: Fire departments should ensure fire fighters are aware of the hazards when working around energized parts or equipment.⁵

Discussion: Fire departments should comply with OSHA safety standard 29 CFR 1910.332(b) by providing training to fire fighters who face the risk of electrical shock. The training should include safe work practices to avoid the risk of being injured or killed while working in areas with energized parts. The victim was a volunteer fire fighter and was not covered by OSHA regulation. However, OSHA guidelines would provide additional protection for fire fighters who face the risk of electrical shock.

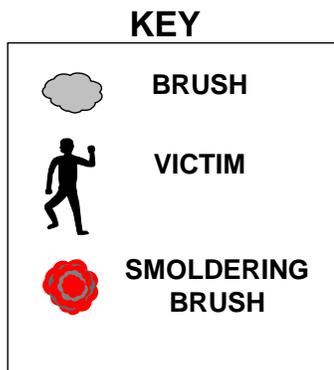
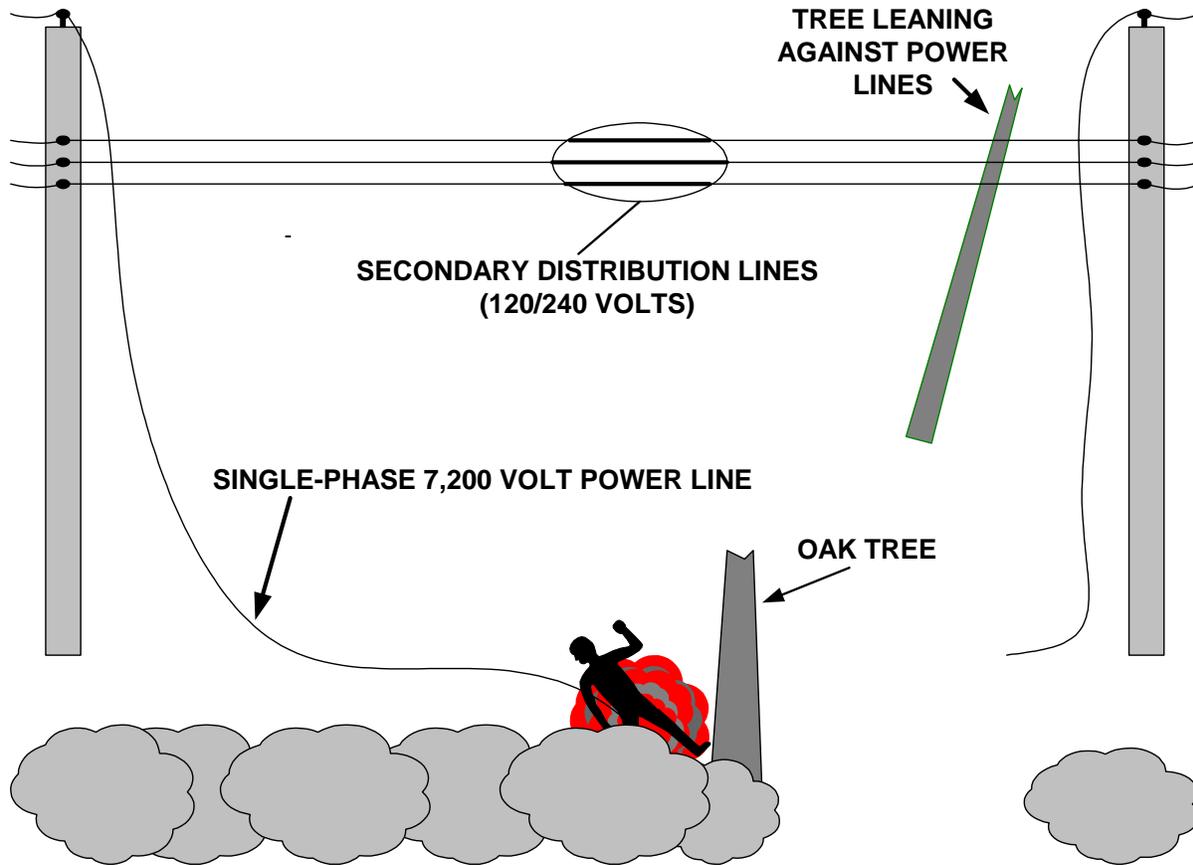
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1. International Fire Service Training Association [1998]. Essentials of fire fighting. 3rd ed. Stillwater, OK: Oklahoma State University, Fire Protection Publications.
2. International Fire Service Training Association [1998]. Fundamentals of wildland fire fighting. 3rd ed. Stillwater, OK: Oklahoma State University, Fire Protection Publications.
3. International Fire Service Training Association [1998]. Essentials of fire fighting. 4th ed. Stillwater, OK: Oklahoma State University, Fire Protection Publications.
4. 29 Code of Federal Regulations 1910.335(b), Safeguards for personnel protection. Electrical Safety-Related Work Practices.
5. 29 Code of Federal Regulations 1910.332(b), Training. Electrical Safety-Related Work Practices.

INVESTIGATOR INFORMATION

This investigation was conducted by Kimberly Cortez and Mark F. McFall, Safety and Occupational Health Specialists from the Surveillance and Field Investigations Branch, Division of Safety Research, NIOSH.

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(NOT TO SCALE)

Diagram 1. Profile of Incident Site

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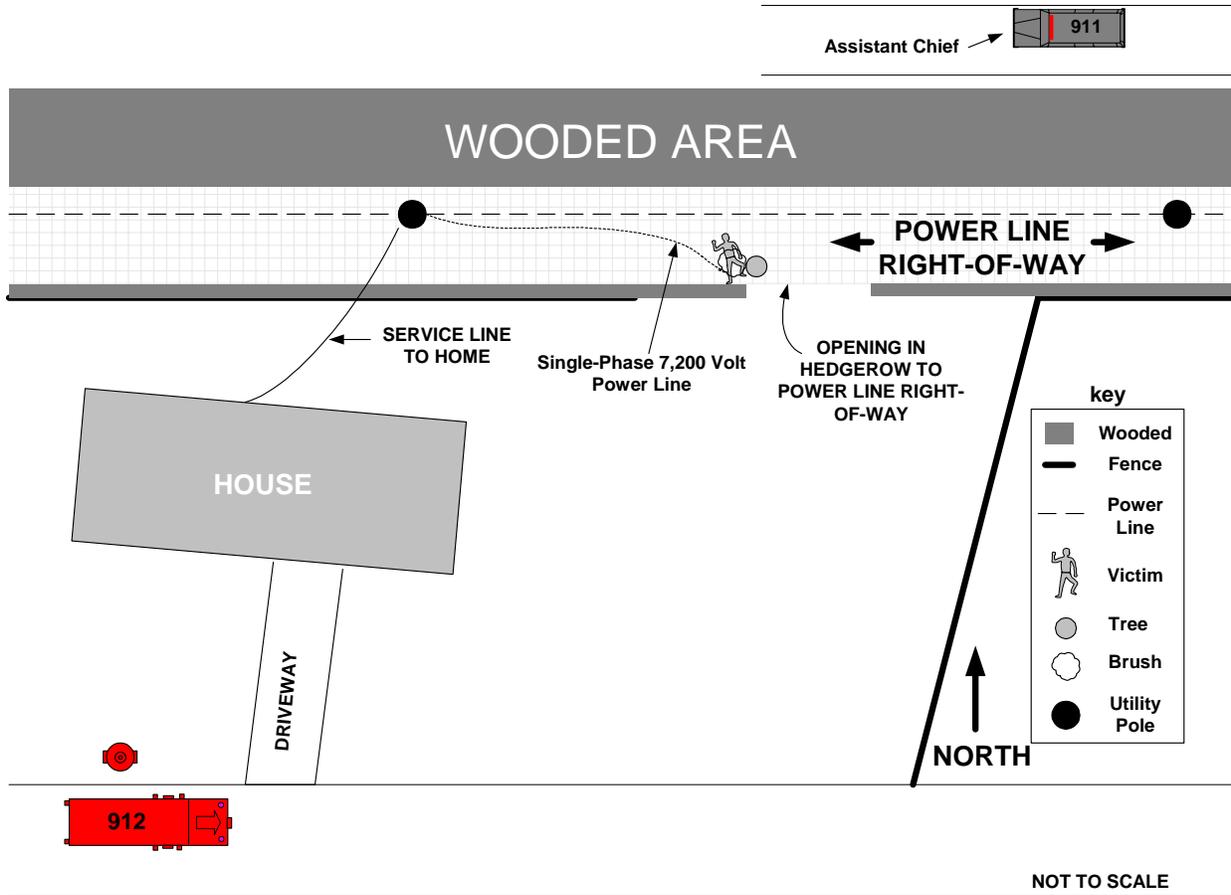


Diagram 2. Aerial View of Incident Site

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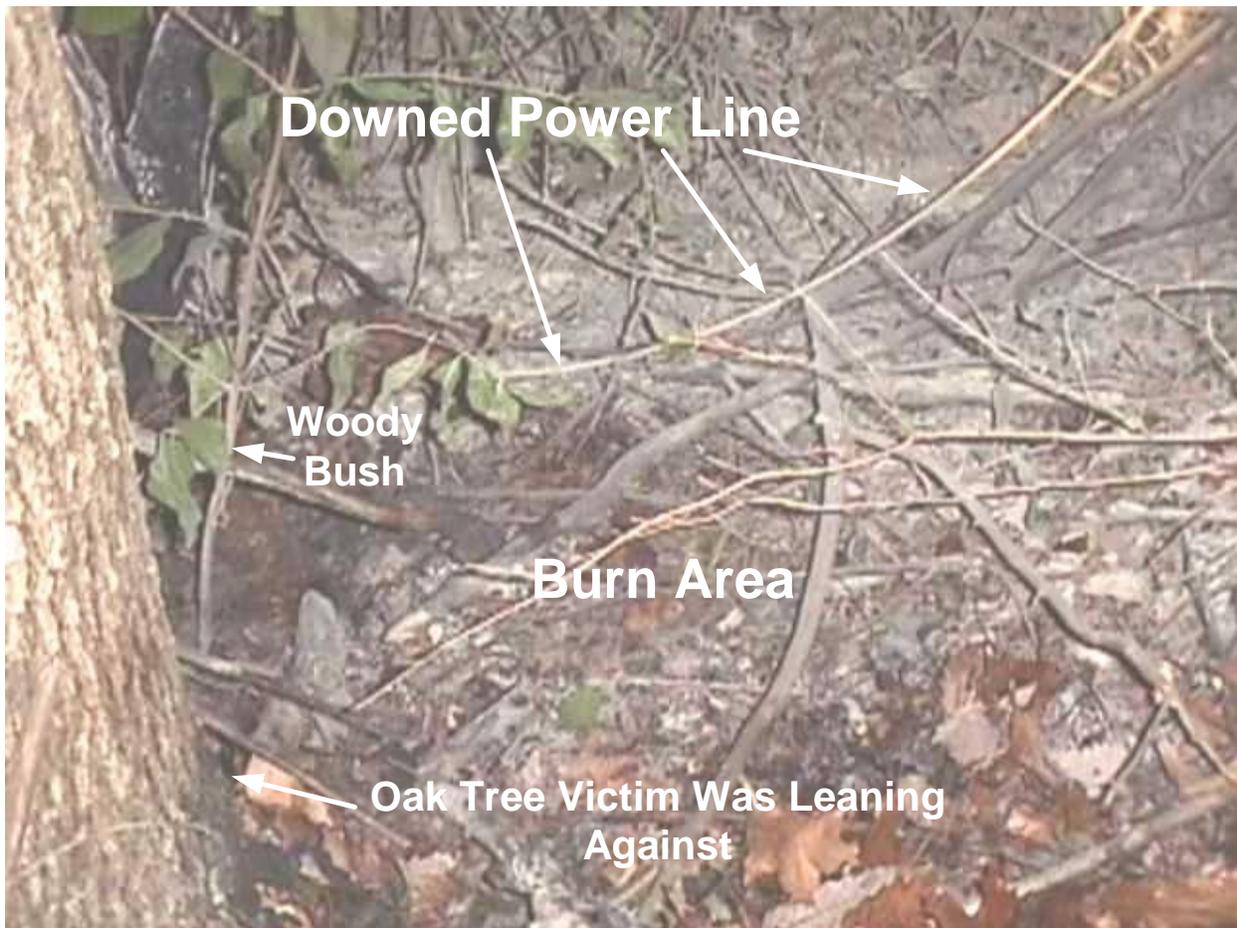


Photo 1. Incident Site Immediately After Victim Was Removed