



Career Captain Electrocuted at the Scene of a Residential Structure Fire - California

SUMMARY

On February 13, 2005, a 36-year-old male career Captain (the victim) was electrocuted while working at the scene of a three alarm residential structure fire. The Captain was checking on one of his crew members when he walked under a tree and came in contact with a 12kv^a power line. The line had burned through early in the fire with one section landing on the ground to the south and the other lodged in a tree near the northwest corner of the fire building. It is believed the victim knew of the downed power line that had fallen to the south. However, it appeared to witnesses that he was unaware of the power line that was hanging in the tree, and possibly did not see the caution tape or hear the warning of a fire fighter who was in the

vicinity. He walked directly into the power line and collapsed to the ground. A nearby fire fighter used an ax handle to secure and hold the power line off of the victim while fire fighters pulled him away from the line to a safe area. Advanced life support was administered immediately by emergency medical personnel who were at the scene. The victim was transported to a local hospital where he was pronounced dead.

NIOSH investigators concluded that to minimize the risk of similar occurrences, fire departments should:

- **establish, implement, and enforce standard operating procedures/guidelines (SOPs/SOGs) that address the safety of fire fighters when working near downed power lines**
- **ensure that fire fighters maintain a safe distance from energized electrical hazards, such as downed power lines, until the conductor is de-energized**



Photo courtesy of the fire department.

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. The program does not seek to determine fault or place blame on fire departments or individual fire fighters. 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

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^a Voltage is the fundamental force or pressure that causes electricity to flow through a conductor and is measured in volts. A kilovolt (kv) is a unit of electrical potential equal to 1000 volts.¹



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- *ensure that fire fighters are aware of the hazard when working around energized electrical conductors and provide barriers or alerting techniques, which are effective and distinguishable under the conditions, to prevent fire fighters from entering an identified danger zone*
- *ensure that fire fighter training includes procedures for recognizing and dealing safely with electrical hazards on the fireground*
- *ensure that all fireground safety broadcasts are acknowledged and repeated*
- *ensure that team continuity is maintained on the fireground during fire suppression operations*

Although there is no evidence that the following recommendations could have specifically prevented this fatality, NIOSH investigators recommend that fire departments:

- *ensure that a personnel accountability system is in place and that it includes provisions for, and training on, personnel accountability reporting (PAR) procedures*
- *ensure that a clearly marked and monitored collapse zone is established once a defensive fire fighting strategy has been called and a structure has been identified at risk of collapsing*

INTRODUCTION

On February 13, 2005, a 36-year-old male Captain (the victim) was electrocuted after coming into contact with an energized 12kv power line that had burned through and fallen into a tree during a residential structure fire. On February 14, 2005, the United States Fire Administration (USFA)

notified the National Institute for Occupational Safety and Health (NIOSH) of this fatality. On March 14, 2005, a Safety and Occupational Health Specialist and the Senior Investigator for the NIOSH Fire Fighter Fatality Investigation and Prevention Program investigated the incident. The NIOSH team met with the Chief, Assistant Chief, Captain, Department Safety Officer, and fire fighters who were present at the incident scene. The investigators reviewed the department's standard operating guidelines (SOGs), fire department and police photographs, incident reports, dispatch transcripts, training records of the victim, the medical examiner's report, and information from the investigation conducted by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF). The incident site was visited and photographed.

Department

The career department is staffed by approximately 250 uniformed fire fighters, many of whom hold Emergency Medical Technician or Paramedic credentials. There are 16 fire stations that serve a population of approximately 210,000 in an area of about 100 square miles.

Training and Experience

The State where the incident occurred requires all fire fighters to successfully complete National Fire Protection Association (NFPA) Fire Fighter levels I and II. The department conducts ten weeks of training that is followed by 18 months of in-service probation. In addition to fulfilling state and department requirements, the victim had completed hundreds of hours of training, including over 360 hours of specialized training the year prior to the incident. The courses he successfully completed included arson investigation, hazardous materials, apparatus/engine operator, fire command, rescue systems and wildland fire fighting. The victim was

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a certified Fire Officer, Fire Instructor, and Paramedic.

The 36-year-old victim had served as a fire fighter for 16 years and had been with this department for the previous six years. He was promoted to Captain two months prior to his death. He had received numerous awards and commendations for his actions at emergency scenes.

Timeline – Equipment, Personnel, and Pertinent Activities

0220 hours, Initial Alarm –

- o Engine 6 (E6), Rescue 3 (R3), Engine 8 (E8), Engine 10 (E10), Battalion 7 (B7) were dispatched

0226 hours,

- o Engine 6 (Officer and two fire fighters) arrived on the scene
- o E6 officer assumed Incident Command (IC1)

0227 hours,

- o Rescue 3 (Officer and three fire fighters) arrived on the scene

0228 hours,

- o IC1 called for second alarm
- o Engine 11, Engine 9, Engine 30, and Rescue 30 were dispatched
- o IC1 requested County Command call the power company (communication was not acknowledged)
- o Fire fighters on the scene heard the sound of electrical arcing

0229 hours,

- o Engine 10 (Victim, Firefighter 1 [FF1] and Firefighter 2 [FF2]) arrived on the scene
- o IC1 declared the fire defensive

0231 hours,

- o Engine 8 (Officer and two fire fighters) arrived on the scene
- o County Command notified the power

company (in accordance with second alarm automatic response protocol)

0234 hours,

- o Battalion Chief 7 (BC7) arrived on the scene
- o Fire scene was divided into Branch 1 and Branch 2

0239 hours,

- o Engine 11 (Officer and 2 fire fighters) arrived on the scene

0240 hours,

- o BC7 assumed Incident Command (IC2)
- o IC1 assumed Operations (OPS1)
- o E11 Officer assigned as Branch 1 Director
- o E10 Officer (Victim) assigned as Branch 2 Director

0242 hours,

- o E9 Officer replaced Victim as Branch 2 Director

0243 hours,

- o IC2 requested County Command call the power company

0253 hours,

- o Battalion Chief 3 and the Safety Officer arrived on the scene
- o Branch 1 Director discussed the downed power line with the Safety Officer and caution tape was placed around the wire
- o OPS1 requested a third alarm

0304 hours,

- o OPS1 requested a personnel accountability report from both branches. No responses were recorded

0306 hours,

- o Battalion Chief 3 assumed Operations (OPS2) and OPS1 was assigned to replace Branch 2 Director

0308 hours,

- o Truck 5 (Officer and three fire fighters) arrived on the scene

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0309 hours,

- o OPS2 requested County Command broadcast that the fire was defensive; an alert tone was broadcast
- o OPS2 assigned T5 to assist Branch 1 Director with forcing doors in Branch 1

0310 hours,

- o County Command notified IC2 that the power company estimated time of arrival (ETA) was 20 minutes

0315 hours,

- o FF1 (from the victim's crew) went to E10 to turn on telescoping lights to illuminate operations in Branch 1

0322 hours,

- o Victim left Branch 2 to go to Branch 1 and check on FF1

0325 hours,

- o Victim traveled eastward up the driveway on A side of Branch 1 and made contact with the downed power line

~0345 hours, power company arrived

~0405 hours, electric power was disconnected

Weather

At the time of the incident there was minimal cloud cover with no precipitation. The ambient air temperature was approximately 47° with humidity at 94% and a wind speed of zero.

INVESTIGATION

On February 13, 2005, at 0220 hours a career department was dispatched to a reported structure fire. At 0226 hours Engine 6 arrived on the scene and staged in the road on side D of the fire building (Diagram 1). The Captain on-board assumed Incident Command (IC1) and reported to dispatch that approximately 70 – 80% of the second floor was on fire with smoke and flames visible through the roof. At 0229 hours he declared the fire defensive.

It was reported to fire fighters that a large number of oriental artifacts were stored in the building located on side C of the main fire building. A decision was made to protect this building as the primary exposure while attempting to extinguish flames in the main fire building. The scene was divided into two branches with Branch 1 being the main fire building, and Branch 2 the storage building located on side C. Fire fighters were assigned to Branch 1 to extinguish flames in the main fire building and Branch 2 personnel were told to concentrate large volumes of water onto the fire providing a water curtain in the breezeway to prevent fire spread to the storage building (Photo 1). At 0227 hours, Rescue 3 (R3) manned by an officer and three fire fighters, arrived on the scene and staged near the northwest side of the roadway intersection in front of the structure. Fire fighters from R3 established a water supply to E6 and assisted the E6 fire fighter in pulling two 1 3/4" pre-connected hose lines up the driveway on side A.

At 0228 hours, IC1 called for a second alarm and requested dispatch to call the power company. He stated "We need (the utility company), the fire is endangering the power line above" (Photo 2). At this point, it appears there was some confusion with the communication as the request was not acknowledged, and when dispatch called for a repeat the IC gave an "all clear". Because of the miscommunication, it is believed that County Command was unaware of the imminent danger created by the fire-impinged power lines and did not relay a sense of urgency to the power company. The call to the electric company was processed as a routine function of the second alarm protocol. At approximately 0228 hours, the officer from R3 reported that he heard an arcing sound and saw a bright flash of light above him as he walked under the tree where the downed power line ultimately lodged. A fire fighter who



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was standing near the front of E6 also reported hearing the sound of arcing electrical wires at about the same time.

The crew from R3 was using two 1¾” pre-connects from E6 to direct a hose stream from the driveway on side A of Branch 1. A wooden privacy fence, approximately eight feet high, surrounded the property. Fire fighters on side A determined that the fence left them with no means of quick egress if the structure collapsed, so they used an ax to cut an escape hole through the fence. The R3 officer and IC1 met in the driveway on side A and decided to re-deploy one of the 1¾” hose lines to side C of Branch 2 for exposure protection. As they proceeded west out of the driveway, several fire fighters reported that they felt a sensation indicating that they may have made brief contact with the downed wire as they passed under the tree where it had lodged. Proceeding south up the secondary road, the fire fighters established a position on a hillside near the C/D corner of Branch 2. As the crew of R3 arrived at the C/D corner of Branch 2, a member of the R3 crew took note of the southern end of the downed 12kv power line, nearly tripping over it. Based on the behavior of the wire, he assumed it was not energized.

At 0229 hours, E10 with the victim and two fire fighters (FF1 and FF2) arrived on the scene. The victim assigned FF1 from his crew to back up a fire fighter from E6 who was operating a handline near the A/B corner of Branch 1. The victim, FF2, and the crew from E8 advanced a 3” leader line and deployed two 100’, 1½” bundles to Branch 2. At 0231 hours, E8 with three firefighters arrived and were instructed to assist E10 on the B side for exposure protection. It is believed that during this activity, the victim saw the downed power line lying near side C of Branch 2 and went to E6 to request lights to illuminate the

hazard. He asked the driver/operator of E6 if the wires were hot. The driver reported having seen the wires arcing and pointed to the utility company truck at the corner of the property near the intersection of the main and secondary roads. (It was later determined that the truck they saw was attending to the natural gas supply line). The victim returned to Branch 2 and placed flash lights around the downed power line on side C. He continued onto the B side of Branch 1 where he advanced one of the 1½” lines into the fire building through a door on side B of Branch 1.

At approximately the same time, a fire fighter from E11 was walking eastward up the driveway on side A of Branch 1. He reported seeing an electrical arc from the downed wire that was hanging in a tree located on the south side of the driveway. The fire fighter returned to the Branch 1 Director and called attention to the wire before retrieving a hose bundle off of E11. While returning to Branch 1 with the hose bundle, the E11 fire fighter felt a slight electrical shock as he passed under the tree where the power line was hanging, but did not report the incident. At 0243 hours, the IC made a second request for the electric utility company. County Command broadcast that the utility company had been notified and they would get an estimated time of arrival. The E9 crew met the victim on the B side of Branch 1. The Officer from E9 advised him that he would be relieved by the E9 crew.

At 0253 hours, the Safety Officer, who had been attending to another structure fire, arrived on the scene. The Branch 1 Director discussed the hazards of the downed power line with the Safety Officer and they considered their options for alerting personnel to the danger. A decision was made to place yellow caution tape around the area under the tree where the wire was located. Later, the Branch 1 Director made an effort to



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further reduce the hazard by using a pike pole to re-position the wire so it would not be hanging in the path of personnel working in Branch 1. The Branch 1 Director reported feeling no electrical shock, nor witnessed arcing during this action. The attempt to re-position the wire was unsuccessful.

At 0304 hours, the Operations Officer made a request for personnel accountability reports (PAR) from all Branch 1 and 2 personnel. There is no record of response to the PAR given via radio communication. At 0309 hours, the Operations Officer (OPS2) requested that County Command sound an alert tone and announce that the fire had been declared a defensive operation for a second time. The tone and information was broadcast. OPS2 then assigned fire fighters from Truck 5 into Branch 1 to force open the doors on side A. The Branch 1 Director met with the crew, advised them of the downed power line, and led them up the driveway directing them to stay to the right to avoid contact with the line. All crew members complied and reported seeing the power line as they passed the tree. The crew completed the forcible entry assignment and took up positions supporting hose lines that were already in place in Branch 1. At 0310 hours, County Command notified the IC that the electric company's ETA was 20 minutes. At approximately 0315 hours, the victim met with the officer from E2. They discussed the strategy for Branch 2 and agreed to continue efforts to confine the fire to the Branch 1 structure while protecting the artifacts in the exposure building in Branch 2. The victim directed the crew of E2 to place their line at the B/C corner of Branch 2 and to direct the hose stream onto the roof of Branch 1. At the same time FF1, who was working in the area, realized that smoke was beginning to bank down and visibility was rapidly deteriorating. He decided

to go to E10 and turn on the telescoping lights to better illuminate the operations in Branch 1.

At approximately 0322 hours, the victim was seen walking west along side C of Branch 2. He stopped briefly when a fire fighter who was operating from atop the C/D corner of the exposure building asked him where he was going. The victim replied that he was going to check on his fire fighter and then proceeded to turn the corner and head north, down the secondary road toward Branch 1. As the victim turned the corner into the driveway on the A side of Branch 1, he was briefly visible to the Branch 1 Director who was standing near the rear of E6. After turning the corner into the driveway, he proceeded east toward the location where fire fighters were operating in Branch 1. As the victim came into view, one of the fire fighters saw that he was walking directly toward the tree where the downed power line was hanging. He shouted to the victim to "watch out for the wire." However, the victim made no indication that he heard the warning or saw the caution tape, and walked directly into the power line. He collapsed onto the driveway and the wire landed on top of him (Photo 3). The Branch 1 Director witnessed the incident while standing near the tailboard of E6 and immediately broadcast that there was a fire fighter down. A fire fighter, who was working in the area, retrieved a flat head ax that had been placed near the privacy fence and attempted to pull the wire off of the victim by wrapping it around the head of the ax. The first attempt failed and the wire slipped off of the ax and landed back onto the victim. He wrapped the wire a second time and was able to hold the wire off long enough for fire fighters to pull the victim to safety behind E6. Advanced life support was administered immediately by on-site emergency medical personnel. However, attempts to revive the victim were unsuccessful



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and he was transported to a local hospital where he was pronounced dead.

CAUSE OF DEATH

The Medical Examiner's report listed electrocution as the official cause of death.

RECOMMENDATIONS / DISCUSSIONS

Recommendation #1: Fire departments should establish, implement, and enforce standard operating procedures/guidelines (SOPs/SOGs) that address the safety of fire fighters when working near downed power lines.

Discussion: SOPs/SOGs provide specific information and instructions on how a task or assignment is to be accomplished and are usually tactical in nature. SOPs/SOGs are developed so all members of a department will perform the same function with uniformity on the fire scene. Properly implemented SOPs/SOGs ensure that all resources are used in a coordinated effort to ensure fire fighter safety, stabilize the incident, rescue victims, and conserve property. Operational procedures that are standardized, clearly written, and enforced, establish accountability and increase command and control effectiveness. Duplication of efforts and uncoordinated operations will be lessened because all positions are assigned and covered. Fire fighters will understand their duties and require a minimum of supervision when they are trained on, and follow, established SOPs/SOGs.²

The Firefighters Handbook ³ lists the following guidelines for developing standard operating procedures/guidelines:

1. All SOPs/SOGs should include a subject, date, purpose and scope.
2. SOPs/SOGs should address the who, what, when, where, and how of a topic.

3. Fire fighter safety should be the first consideration for all procedures.
4. SOPs/SOGs should be brief, clear, and concise.
5. Lengthy SOPs/SOGs should be broken down into smaller sections.
6. SOPs/SOGs should be reviewed often, at least every three years.

Some topics that may be included in a Standard Operating Procedure/Guideline for dealing with electricity at an incident scene include:

- Fire fighters should keep a minimum distance from a downed power line until the line is de-energized, and always function under the premise that a line is hot.
- The Incident Commander should convey, and continually re-evaluate, strategic decisions related to fireground electrical hazards to all personnel on the scene.
- Procedures should be developed for isolating personnel from the energized conductor. Examples include, protective shields, mechanical / human barriers, or alerting techniques that are distinguishable and effective under the conditions.
- All fire fighters should be made aware of the increased danger involving downed power lines when working in areas of dense smoke.
- All fire fighters should be made aware of the hazards of applying a solid-stream water application around energized electrical conductors.
- All fire fighters should be repeatedly trained in safety-related practices for working around electrical energy.⁴
- Fire department personnel should never be permitted to move or cut electrical wires under any circumstances.

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- Fire fighters should locate and isolate downed electrical wires and wait for utility company personnel to disconnect the power to those wires.⁵

The department in this incident had written standard operating guidelines, and following the incident implemented a detailed SOG for dealing with electrical hazards on the fireground.

Recommendation #2: Fire departments should ensure that fire fighters maintain a safe distance from energized electrical hazards, such as downed power lines, until the conductor is de-energized.

Discussion: Chapter 10 of IFSTA Fireground Support Operations, 1st edition,⁵ states that in most cases involving downed electrical wires, fire fighters should do nothing more than establish a perimeter and deny entry to all except utility company personnel. However, in some cases it is necessary for fire fighters to do some basic hazard assessment in order to decide where the perimeter should be established. Denying unauthorized entry into an emergency scene while waiting for utility company personnel to arrive is a very important and a potentially lifesaving action. In some incidents involving downed electrical wires, establishing and controlling the perimeter is relatively easy, but there are times when circumstances make the task very complicated. For example, if a single strand power line has been severed, as happened in this case when flames burned through the line, it can be relatively easy to see where the break is and where the perimeter should be established to isolate the hazard. On the other hand, if an energized electrical wire falls across a metal fence (chain link, barbed wire, etc.) the entire length of the fence can become energized. If the fence is enclosing a large institutional, industrial, or

agricultural property, it may be miles in length, and anyone who touches the fence may complete the circuit to ground and suffer a severe electrical shock, or even electrocution. Similarly, if innocuous looking telephone wires or cable TV lines are down, even though these are normally low-voltage wires, they may be energized with the full electrical potential of power lines if, at any point, they are in direct contact with those lines.

A common error is establishing a safety perimeter that is too small.⁵ The recommended isolation distance is equal to one full span between the adjacent poles or towers in all directions from a break in the wire, or the point of contact with the ground (see Diagram 2). While the aforementioned rule for perimeter placement can be used in most downed wire incidents, in other situations such as following an explosion or structural collapse, it may be necessary to more clearly define the hazard area. For example, if a downed wire is obscured by building debris, smoke, or darkness, it may be necessary for fire fighters to use various forms of technology to identify the hazard area. There are several useful devices available to fire departments for this purpose. Two of the most common are the *alternating current detector* and *thermal imaging camera*.⁵

Alternating current detectors can detect unshielded AC current through many solid objects. They are a battery-operated, handheld wand that is similar in size and shape to a police officer's baton. In the presence of an alternating current, they emit an intermittent beep. The more rapid the detector beeps, the closer the source of the current. The detection range (distance from the source at which the wand detects the current) varies with the situation. In general, the higher the voltage, the greater the range of detection will be.



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Under ideal conditions, these devices may be able to detect AC current in a single 120-volt line from as far as 15 feet away. However, if the conductor is lying on wet soil, the range may be reduced to as little as one foot. With higher potentials, such as those in distribution and transmission lines, the detection range can increase to more than 500 feet.

Thermal imaging cameras can also be used to detect hidden wires. Electrical current creates heat whenever it encounters resistance in a circuit. The heat is created at the point of resistance but not throughout the circuit. This phenomenon is seen in the operation of an electric hot plate or an electric space heater. Resistance occurs when an un-insulated conductor (wire) is in contact with the ground or there is a kink in, or damage to, a conductor whether insulated or not. This resistance creates the heat that the thermal imaging cameras can detect.

Another important fact to remember when dealing with electric hazards on the fireground is the danger of assuming that a power line is dead before the power company verifies that it has been de-energized. Because power outages often result from very temporary causes, such as a tree limb being blown against a wire, most electrical distribution systems are programmed to automatically reenergize a few seconds after the circuit breaker in the substation trips. If the breaker trips again, many of these programs reenergize the system one more time before remaining off line. Therefore, even if a handheld detector fails to activate near a downed wire, it only means that the line is dead at that given moment, but the line may not be completely or permanently de-energized. In addition, when power from the normal utility source fails, some emergency generators may start automatically. If these units are not disconnected from the system,

the power lines can be reenergized with as much as 240 volts from the generators. Also, many overhead power lines are supplied from both directions; therefore, a single line break can still be energized on both sides of the break.

Even though the electrical hazard in this incident was identified early in the fire by the initial Incident Commander, because of the missed communication the power company was not called until part of the second alarm protocol. Therefore no sense of urgency was conveyed. Normal fire suppression activities continued and the power company did not arrive to disconnect the electricity until approximately 20 minutes after the electrocution occurred.

Recommendation #3: Fire departments should ensure that fire fighters are aware of the hazard when working around energized electrical conductors and provide barriers or alerting techniques, which are effective and distinguishable under the conditions, to prevent fire fighters from entering an identified danger zone.

Discussion: In the case of downed power lines, establishing an effective barrier that warns of the specific danger is equally as important as identifying and locating the line.⁵ The Occupational Safety and Health Administration (OSHA) requires that alerting techniques be used to warn and protect employees from hazards which could cause injury due to electric shock or burns. OSHA recommends that safety signs, symbols, or barricades, possibly in conjunction with attendants, be used to provide sufficient warning to protect employees from electrical hazards.⁶ Fire departments should ensure that protective barriers (human or mechanical), or alerting techniques that are distinguishable under the conditions, are in place to prevent entry into



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an area where an electrical hazard has been identified.

In this incident, attempts were made to warn fire fighters of the downed power line that was hanging in the tree near the driveway by placing yellow caution tape around the area immediately under the tree, and relaying information on the hazard by word-of-mouth. Interviews reveal that the gravity of the situation was not completely understood as fire fighters were permitted to freely traverse the driveway and continue fire suppression activities in proximity to the wire. It also appears that the victim was aware of the downed power line that fell near the C/D corner of Branch 2, and may have considered it the only electrical hazard on the scene. It is believed that he did not see the yellow caution tape, or hear the warning of the fellow fire fighter, before he came in contact with the wire.

Recommendation #4: Fire departments should ensure that fire fighter training includes procedures for recognizing and dealing safely with electrical hazards on the fireground.

Discussion: Fire fighters should be trained in recognizing electrical hazards when entering an emergency scene. Training protocols should be established that teach how to recognize electrical dangers and what measures to take to avoid the hazard. This training should be conducted upon initial hire, and routinely thereafter. Applicable safety protocols should be taught, and the training repeated if necessary, until understood by all members. These safety rules and procedures should be continually enforced by on-scene officers.⁵

In some areas, local utility companies have developed training programs and will assist fire departments in a joint training effort. The

department involved in this fatality has enhanced their existing training program for responding to emergencies that involve downed power lines or energized electrical equipment to include lessons learned from this incident.

Recommendation #5: Fire departments should ensure that all fireground safety broadcasts are acknowledged and repeated.

Discussion: Communication is one of the most important safety behaviors on every emergency scene. At times it may be necessary to broadcast emergency traffic over the radio. When an emergency communication is necessary, the person transmitting the message should make the urgency clear to the dispatch center. Dispatch should advise all other units to stand by, and tell the caller to proceed with the emergency message. An emergency message that broadcasts details of a safety hazard should be repeated several times.²

In this incident, a safety broadcast regarding the power lines was never made and there was confusion as to the gravity of the situation. It is believed that the victim and other fire fighters on the scene knew of the wire that was down in Branch 2, but had no knowledge of the danger presented by the wire hanging in the tree in Branch 1.

Recommendation #6: Fire departments should ensure that team continuity is maintained on the fireground during fire suppression operations.

Discussion: Team continuity means knowing your team members, staying in contact at all times, communicating needs and observations to the team leader, rotating to rehabilitation, staging as a team, and watching out for your team members.² Teams that enter a hazardous

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environment together should leave together to ensure that team continuity is maintained. Fire fighters should always work and remain in teams whenever they are operating in a hazardous environment.⁷

In this incident, the victim had assigned one of his crew members to assist fire fighters in Branch 1 on side A while he and another crew member worked in Branch 2. After approximately 50 minutes had passed the victim left his work area in Branch 2 to check on his crew member. The victim was unfamiliar with Branch 1 as he had spent his entire time on the scene working in Branch 2. There is no indication that he had knowledge of the location of the downed power line in Branch 1 and he was fatally injured when he came in contact with the wire as he was looking for his crew member.

Although there is no evidence that the following recommendations could have specifically prevented this fatality, NIOSH investigators suggest that fire departments implement these fireground safety recommendations.

Recommendation #7: Fire departments should ensure that a personnel accountability system is in place and that it includes provisions for, and training on, personnel accountability reporting (PAR) procedures.

Discussion: A critically important facet of an accountability system is the personnel accountability report (PAR). A PAR is an organized on-scene roll call in which each supervisor reports the status of his crew when requested. The use of an accountability system is required by NFPA 1500, *Fire Department Occupational Safety and Health Program*,⁸ and NFPA 1561, *Emergency Services Incident Management System*.² A properly operating

Personnel Accountability System requires the following:

- Development of a departmental SOP
- Training all personnel
- Strict enforcement during emergency incidents

In this incident, the Operations Officer called for a PAR at 0304 hours and no responses were recorded. A positive response would have provided information to the officers on the scene of the location, and possibly the condition, of their crew members.

When a properly enforced accountability system is made part of the culture of the department, fireground command and control is improved and fire fighter safety is enhanced.²

Recommendation #8: Fire departments should ensure that a clearly marked and monitored collapse zone is established once a defensive fire fighting strategy has been called and a structure has been identified at risk of collapsing.

Discussion: If at any time during a structure fire, size-up determines that structural integrity is questionable, a collapse zone should be established.¹⁰ A collapse zone is an area around and away from a structure in which debris might land if the structure fails. This area should be equal to 1½ times the height of the building. For example, if the wall were 20 feet high, the collapse zone boundary should be established at least 30 feet away from the wall.¹¹

In this incident, fire fighters who were operating in Branch 1 were concerned early on about a collapse because at approximately 0228 hours they cut a hole in the privacy fence for a means of egress from the area. Many of the fire fighters on the scene had been to a fire at the same location

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several years before and discussed the structural integrity of the building. The fire was confined mostly to the C/D corner area of Branch 1, and the structure was built on a sloping hillside with side A being on the lower level. At 0229 hours the fire was originally declared defensive. At 0309 hours it was broadcast as defensive for a second time. Shortly thereafter, a truck crew was sent into Branch 1 for forcible entry while other fire fighters remained in the area performing suppression activities.

If manual fire suppression activities are being conducted within the boundaries of a collapse zone, the attack cannot be considered defensive. In this case, the danger presented by the potential of a structure collapse and the presence of the 12kv power line would have been eliminated by enforcement of an established collapse zone.

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The NIOSH Safety and Health Topic Page on Electrical Safety is available at: <http://www.cdc.gov/niosh/injury/traumaelec.html>.

INVESTIGATOR INFORMATION

This incident was investigated by Virginia Lutz, Safety and Occupational Health Specialist, and Richard Braddee, Senior Investigator, with the Fire Fighter Fatality Investigation and Prevention Program, Division of Safety Research, NIOSH. The report was authored by Virginia Lutz.



MIOSH
Fire Fighter Fatality Investigation
and Prevention Program

Fatality Assessment and Control Evaluation
Investigative Report #F2005-07

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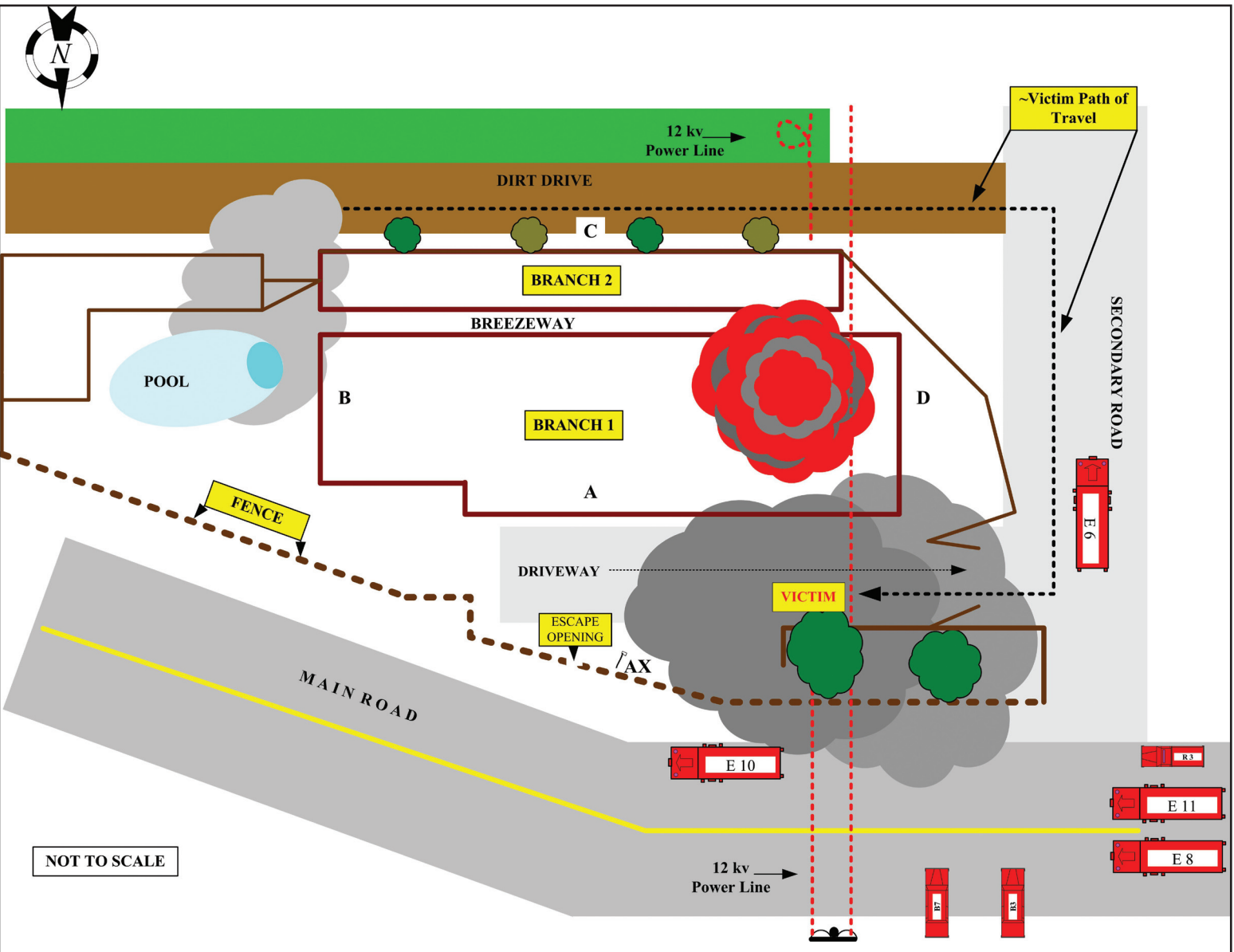


Diagram 1. Incident Scene



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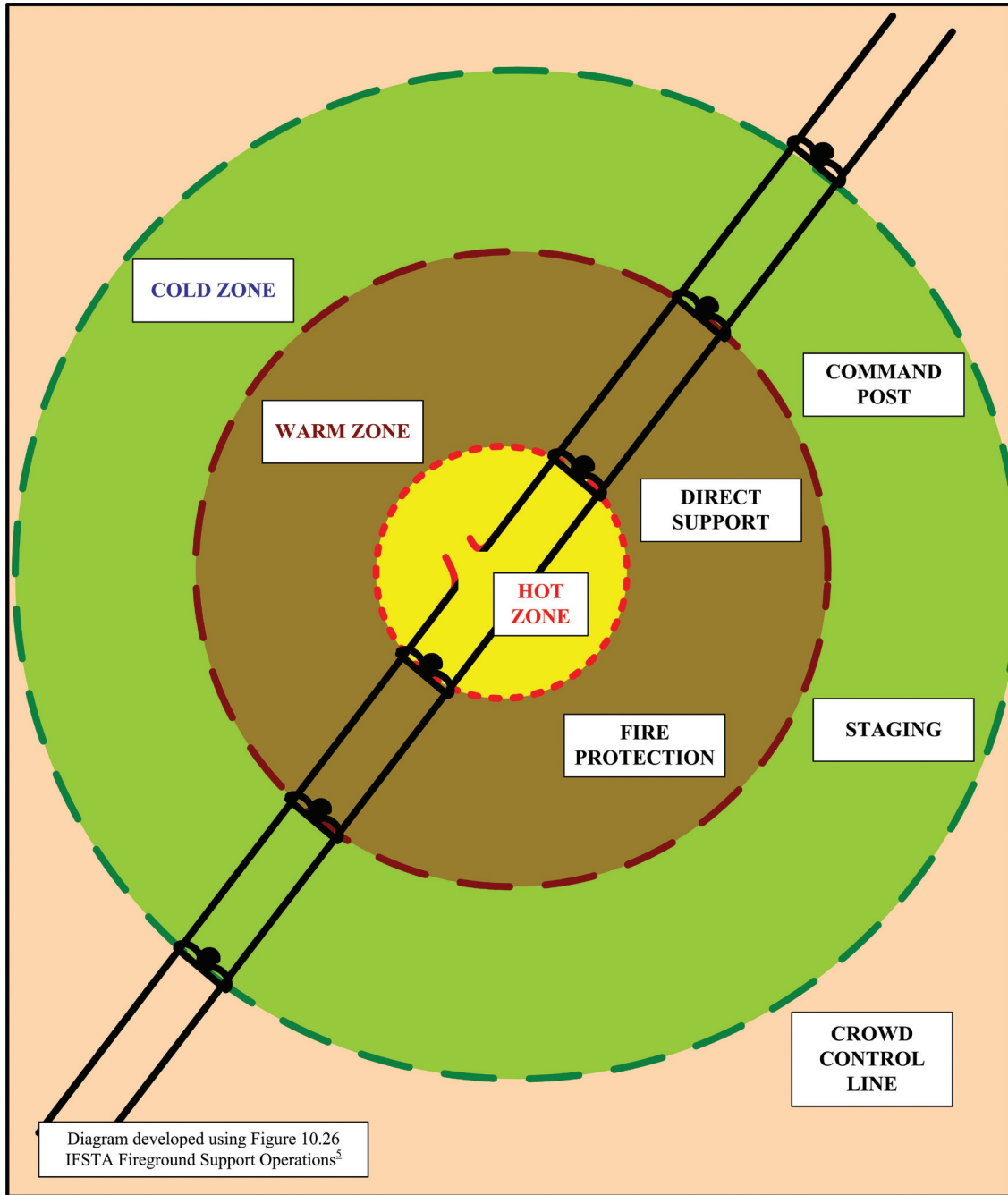


Diagram 2. Perimeter Control



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*Photo 1. Photo showing Branch 1 and Branch 2
Photo courtesy of the fire department*



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*Photo 2. Photo showing flames impinging on power line
Photo courtesy of the fire department*



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*Photo 3. Incident scene
Photo courtesy of the fire department*

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