KENTUCKY State FACE Program
Fatality Assessment & Control Evaluation

Kentucky Injury Prevention and Research Center
Bona fide agent for Kentucky Department for Public Health
333 Waller Avenue, Suite 242 • Lexington, KY 40504 • 859-257-5839

INCIDENT HIGHLIGHTS

DATE:
September 10, 2018

TIME:
12:15 pm

VICTIM:
16-year old roofer

INDUSTRY/NAICS CODE:
Roofing contractor/238160

EMPLOYER:
Roofing contractor

SAFETY & TRAINING:
No safety programs

SCENE:
Private residence

LOCATION:
Kentucky

EVENT TYPE:
Electrocution

REPORT#: 18KY054 **REPORT DATE: 1-16-2019**

Teen Roofer Electrocuted when Ladder Contacts High Voltage Power Line

SUMMARY

On Monday, September 10, 2018, a 16-year-old male roofer (the victim) attempted to maneuver a fully extended 25-foot ladder when he lost control, causing the ladder to fall backwards and contact a 7200-volt electric power line, electrocuting him.

READ THE FULL REPORT> (p.4)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Work performed outside youth employment regulations
- Lack of hazard recognition and safety training
- Use of a conductive ladder around high voltage lines
- Transporting an extension ladder in the vertical position

RECOMMENDATIONS

FACE investigators concluded that, to help prevent similar occurrences, employers should:

- Perform a job hazard analysis of the worksite
- Become familiar with and comply with all federal, state, and local regulations associated with youth employment
- Use non-conductive ladders around power lines
- Lower the extension ladder and transport it horizontally
- LEARN MORE> (p.7)

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Fatality Assessment and Control Evaluation (FACE) Program

This case report was developed to draw the attention of employers and employees to a serious safety hazard and is based on preliminary data only. This publication does not represent final determinations regarding the nature of the incident, cause of the injury, or fault of employer, employee, or any party involved.

This case report was developed by the Kentucky Fatality Assessment and Control Evaluation (FACE) Program. Kentucky FACE is a NIOSH-funded occupational fatality surveillance program with the goal of preventing fatal work injuries by studying the worker, the work environment, and the role of management, engineering, and behavioral changes in preventing future injuries. The FACE program is located in the Kentucky Injury Prevention and Research Center (KIPRC). KIPRC is a bona fide agent for the Kentucky Department for Public Health.

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INTRODUCTION

At 12:15 pm on Monday, September 10, 2018, a 16-year-old male roofer (the victim) was killed when the metal ladder he was holding while on the ground contacted a high voltage line above him. On October 1, 2018, the Kentucky Fatality Assessment and Control Evaluation Program was notified of the incident via an online news source. On October 2, 2018, the Kentucky FACE investigator conducted a site visit. Photographs of the incident site and witness statements were taken at that time.

EMPLOYER

- The prime contractor, a small business who specialized in residential and commercial roofing, remodeling, and new construction, had been in business since 2005 and employed six workers. In an interview with the owner of the business, he stated that he often took jobs and hired subcontractors to complete the work. The prime contractor had no employees on site the day of the incident.
- The subcontractor, for whom the victim worked, had been in business since 2012 and had a total staff number of four employees, including himself and the victim, all of whom were on site the day of the incident. The owner of the subcontracting company had taken and completed jobs from the prime contractor in the past.

WRITTEN SAFETY PROGRAMS and TRAINING

The subcontractor had no written safety programs nor verbal safety training provided to the employees. The employees learned on the job how to perform their duties.

WORKER INFORMATION

The victim was a 16-year-old Hispanic male who had been employed with the subcontractor roofing company since July 2018. He had some high school education, but was not enrolled in school at the time of the incident. The employee spoke English primarily, but was bilingual, and would communicate with his coworkers in Spanish. The co-workers did not speak English. At the time of the incident, the victim was wearing khaki workpants with a gray pocket tee shirt, and tan work boots. The victim was not wearing any personal protective equipment nor was there any on site.

INCIDENT SCENE

The incident scene was a single family, private residence located on a rural highway, 3.5 miles from the nearest town. The two-story brick home measured 4,022 square feet and sat on a 57-acre parcel of land. On the home's exterior was a 600 square foot garage and several decorative boxwood shrubs that circled the perimeter of the house.

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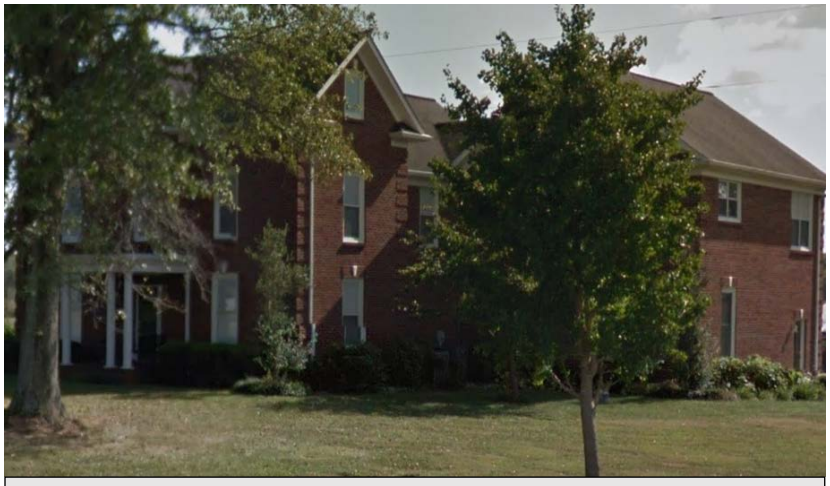

Image 1. Residence the victim was working on at the time of the incident.
Photo property of KY FACE.

WEATHER

The temperature was 61°F at the time of the incident. Wind was west 3 mph and clear. Weather was not considered a factor in this incident[1].

INVESTIGATION

On Monday, September 10, 2018, at 8:00 am, the victim arrived at the worksite to begin roofing work on a private residential home. The homeowners, a husband and wife, contacted a local general contractor to replace the roof on their home. The owner of the general contracting company hired a subcontractor to perform the work, a process he informed authorities that he performs regularly. The crew began work on the back of the house and quickly worked together to complete the task.

At approximately 12:00 pm, the victim gathered a model D1828-2EQ Werner aluminum extension ladder and moved to the front of the house to begin work there while the other three men moved on to the side of the house. At the front of the house, there were two 4 feet x 4 feet boxwood bushes planted 3 feet from the home's exterior wall at the point where the victim was attempting to access the roof. There were no witnesses, but it is believed that because of the bushes, the victim was having trouble accessing the roof. With the ladder still fully extended, the victim attempted to move it closer by lifting the ladder and walking between the bushes to find a suitable base. The ladder became unstable, causing the victim to lose his balance falling backwards. As the victim and ladder were falling, the ladder fell into a top phase power line carrying 7.2 kilovolts (7,200 volts). Because the victim was still in contact with the highly conductive aluminum ladder when it struck the power line, electricity was able to travel through the metal and into the young worker. He was immediately electrocuted.

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After hearing a noise from the front of the home, the owner of the subcontracting company went to investigate and found the victim lying unresponsive on the ground. He immediately knocked on the home's front door and frantically tried to communicate to the wife what had happened and asked for help. The homeowner called 911 at 12:15 pm. When EMS arrived eight minutes later, they observed the victim lying on the ground facing upwards. Both of the worker's boots had burn holes near the fifth toe; burn marks were also present on the stomach area. He was pronounced dead by the county coroner minutes later.

In an interview with the county sheriff's office with the help of a translator, the coworkers stated that they were on the side of the home and did not observe this incident. The owner of the subcontracting company acknowledged that he had instructed the victim to move to the front of the house to continue work there. Both coworkers were aware that the victim was putting up a ladder to access the front roof and that the victim had not asked for assistance.

Photo 2. Front of the residence and power line that employee contacted with ladder.
Photo property of KY FACE Program.

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Photo 3. The ladder used by the victim.
Photo property of KY FACE.

Photo 4. The box wood bush the victim was attempting to work around.
Photo property of KY FACE.

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CAUSE OF DEATH

The cause of death was high voltage electrocution.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. Kentucky FACE investigator identified the following unrecognized hazards as key contributing factors in this incident:

- Work performed outside youth employment regulations
- Lack of hazard recognition and safety training
- Use of a conductive ladder around high voltage lines
- Transporting an extension ladder in the vertical position

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should perform a job hazard analysis prior to performing a new task.
Discussion: A job hazard analysis (JHA) is a technique employed by site supervisors, experienced employees, and safety personnel that focuses on job tasks as a way of identifying what potential hazards workers may encounter when performing each task. The Occupational Safety Health Association (OSHA) states that JHAs should take priority on the following types of jobs: jobs with the highest injury or illness rates; jobs with the potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents; jobs in which one simple human error could lead to a severe accident or injury; jobs that are new to your operation or have undergone changes in processes and procedures; and jobs complex enough to require written instructions[2].
In this incident, the employees were exposed to working at heights, working from ladders, and close proximity to high voltage power lines. A job hazard analysis would recognize the numerous hazards that the roofing workforce was being exposed to so that necessary safety precautions could be undertaken.

Recommendation #2: Employers should become familiar with and comply with all federal, state, and local regulations associated with youth employment, including safety training and hazard recognition.
Discussion: According to the Center for Disease Control (CDC), approximately 1.5 million youth under the age of 18 are employed during the school year[3], with a majority of high school students working at some point before they graduate. Due to their age and inexperience, these workers are more vulnerable to work-related injury and death. In 2014, the rate of work-related injuries treated in emergency departments for workers, ages 15–19, was 2.18 times greater than the rate for workers 25 years of age and older[4].

Due to the high injury rate of minors in the workplace, the Commonwealth of Kentucky has very specific child labor laws, providing guidelines on how many hours per week young workers are permitted to work, what

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times of the day they are allowed to work, and what occupations are prohibited for minors under the age of 18[5]. The Kentucky Labor Cabinet lists 19 occupations that are prohibited for minors, including ***#16: "Roofing operations and all work on or about a roof."*** Subcontractors and contractors should familiarize themselves with Kentucky child labor laws and Federal child labor laws before employing youths in specific occupations. In addition federal laws apply Hazardous Occupations from the US department of labor: Eighteen is the minimum age for employment in non-agricultural occupations declared hazardous by the Secretary of Labor. The rules prohibiting working in hazardous occupations (HO) apply either on an industry basis, or on an occupational basis no matter what industry the job is in. Parents employing their own children are subject to these same rules. General exemptions apply to all of these occupations, while limited apprentice/student-learner exemptions apply to those occupations marked with an *.

These rules prohibit work in, or with the following:

HO 16.

Roofing operations and all work on or about a roof.

Recommendation #3: Employers should consider using non-conductive ladders when working near electrical lines.

Discussion: At the time of the incident, the victim was using an aluminum ladder to access the roof. Aluminum has an electrical resistivity (ρ (Ω•m)) – the measure of how strongly a material opposes the flow of electric current – of 2.82×10^{-8} at 20°C. Inversely, aluminum has an electrical conductivity (σ (S/m)) – the measure of how well a material conducts an electrical current – of 3.5×10^{7} at 20°C. Because of its extremely low resistivity and extremely high conductivity, aluminum is one of the best electrical conducting metals, behind only silver, copper, annealed copper, and gold[6]. As the ladder contacted the overhead power line, 7,200 volts and 16 amperes (amps) travelled through ladder, into the victim, and exited his body via the stomach and each foot's fifth (pinky) toe. At values as low as 100 milliamps (.1 amps), death can occur[7]. Due to the high amount of amperes that entered the victim's body, cardiac arrest occurred instantly.

In order to prevent similar incidents, the employer should consider using a non-conductive ladder, such as those made of a fiberglass-reinforced polymer, when working around live power lines. Due to its low electrical conductivity and high resistance to corrosion, these ladders would make a safe and practical choice when working outdoors around electricity. However, employers should ensure that these fiberglass ladders are maintained properly as required by 29 CFR 1926.1053. Unmaintained ladders may accumulate excess dirt or moisture that can conduct electricity in the event it encounters a high voltage line.

Recommendation #4: Employees should always lower the extended section and transport ladders horizontally.

Discussion: The victim was moving a model D1828-2EQ Werner aluminum extension ladder that weighed approximately 56 pounds. When collapsed, the ladder was 14 feet tall and had a maximum open extended length of 25 feet. At the time of the incident, the victim, who measured 5'10" tall and weighed 165 pounds,

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was moving the ladder, which was extended to the maximum length of 25 feet. As the ladder became unstable and began to fall, the victim may have been unable to support the ladder's top-heavy design while standing on uneven terrain, which allowed it to contact the power line.

In instances where an extension ladder needs to be relocated, employees should lower the extended portion of the ladder until it is appropriately collapsed, carefully lay the ladder down, and transport it horizontally while grasping the ladder's middle section with both hands in order to safety manage its weight. Once the ladder is placed in the necessary area, ensure the base is secure and re-extend the ladder to the appropriate height. Had the ladder been lowered and transported horizontally, the high voltage line could have been avoided.

DISCLAIMER

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PROGRAM FUNDING

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INVESTIGATOR INFORMATION

This investigation was conducted by DeAnna McIntosh, Safety Specialist, Fatality Assessment and Control Evaluation, Kentucky Injury Prevention and Research Center, University of Kentucky, College of Public Health.

ACKNOWLEDGEMENTS

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