The National Institute for Occupational Safety and Health (NIOSH)

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Electrical Lineman Dies After Falling 35 Feet to the Ground from a Burning Aerial Bucket in South Carolina

FACE 9035

SUMMARY

An electrical lineman died 5 days after attempting to jump from a burning aerial bucket and falling 35 feet to the ground. The lineman was adjusting the slack in the middle phase of a three-phase, 14,200-volt powerline. The hydraulic hose attached to the impact wrench he was using burst. Hydraulic fluid spraying from the hose ignited, covering part of the aerial bucket in flames. As the lineman was rotating the aerial bucket away from the powerlines, he lost power to the controls. He attempted to escape the intensifying fire by jumping laterally from the bucket's edge to an adjacent earthen bank approximately 15 feet away. However, his foot caught on the lip of the bucket, and he fell 35 feet straight down to the ground. The investigation revealed that the metal-reinforced hydraulic hose used for the impact wrench attachment was simultaneously in contact with two phases of the powerline. The heat generated in the hose caused it to melt and burst at one of the points of contact with the powerlines. NIOSH investigators concluded that, to prevent future similar occurrences, employers and/or equipment, tool, and hose manufacturers, should:

- ensure that metal-reinforced hydraulic hoses are not installed on any part of the boom, aerial bucket, or hydraulic attachments on aerial bucket trucks that may be used near powerlines
- ensure that fluids used to power hydraulic hand tools are fire resistant
- install all hydraulic hoses for impact attachments in such a manner that the flow of hydraulic oil can be stopped by the worker in the aerial bucket during an emergency
- label or color code hydraulic hoses to identify hoses that may be used on an aerial bucket
- design a hydraulic coupling system that would ensure that any hydraulic hoses unsuitable for use on booms, aerial buckets, or aerial bucket attachments, could not be connected to these components of aerial bucket systems
- provide task-specific training to workers that includes training in the identification and control of potential hazards
- stress the importance of adherence to established safe work procedures.

INTRODUCTION

On June 30, 1990, a 37-year-old lineman died of injuries sustained on June 25, 1990, when he attempted to jump from a burning aerial bucket, and fell 35 feet to the ground. On July 16, 1990, officials of the South Carolina Occupational Safety and Health Administration notified the Division of Safety Research (DSR) of the death, and requested technical assistance.

On August 9, 1990, a safety specialist and a public health intern traveled to the incident site to conduct an investigation. The incident was reviewed with employer representatives, the county sheriff's office, and the county coroner. Photographs of the incident site were obtained.

The employer in this incident is an electrical contractor who has been in business for 44 years and employs 550 workers, including 100 electrical lineman. The contractor employs three full-time safety officers and has a written safety policy, a comprehensive written safety program, and a worker training program. A comprehensive safety manual is provided to each employee. Daily safety tailgate meetings are held at the jobsite, and weekly safety meetings are held at the office. During weekly safety meetings, a section of the safety manual is read and discussed and all personnel are required to sign a statement documenting their attendance. The employer maintains a video library of safety films dealing with all aspects of powerline construction. These films are shown in the field, and in the office on days that operations are canceled due to inclement weather. Supervisors are required to complete a daily safety checklist for each job completed.

INVESTIGATION

The employer was contracted to upgrade an existing electrical system by installing new utility poles parallel to an existing three-phase electrical system, and transferring the 12,400-volt powerlines to the new utility poles.

On the day of the incident, the victim and a co-worker were transferring the energized powerlines to the last new utility pole in the system. As each phase was transferred, it was "dead-ended" (attached at the pole without further connection to the rest of the power system). Once all three phases were attached, they were "sagged" (the slack was adjusted) by the lineman. The center phase was sagged first, then the two outside phases. The center phase was sagged a second time to take out additional slack. The conductor was held in place by a come-along during attachment to the insulators on the utility pole. A hydraulic impact wrench was used to tighten connectors around the powerline and insulator.

As the lineman was tightening the center phase connectors, the hydraulic hose supplying fluid to the impact wrench burst. The hydraulic fluid spraying from the ruptured hose ignited, covering part of the aerial bucket with flames. The lineman rotated the aerial bucket away from the utility pole. When the bucket was approximately 12 feet away from the utility pole, the lineman lost power to the controls as additional hydraulic hoses burst and burned. The lineman attempted to jump laterally to an earthen bank approximately 15 feet away. However, his foot caught on the lip of the bucket and he fell 35 feet to the ground, landing on his head and chest. The victim rose to his feet but was lowered back to the ground by the co-worker. The co-worker radioed the company dispatcher from the truck and requested the emergency medical squad (EMS). The victim was transported to the hospital where he died 5 days later from injuries sustained in the fall. The bucket burned for approximately 20 minutes until a second line crew de-energized the powerlines and the fire department extinguished the fire.

Investigation revealed that a field mechanic had installed a metal-reinforced hydraulic hose on the impact wrench 5 months prior to the incident. When the hose simultaneously contacted two of the energized phases, electrical continuity was established through the hose's metal reinforcement. The heat generated by the resistance to the phase-to-phase current melted the hose, and partially melted the metal in the hose. When the hose ruptured, the spraying hydraulic fluid contacted the hot metal and ignited.

Standard employer practice required the use of common hydraulic hoses (without metal reinforcement) on any area of the boom or aerial bucket that might be placed near energized powerlines. The mechanic told investigators that he knew he was installing the wrong type of hose, but did not understand the potential hazards involved. The electrical contractor had the hydraulic hoses on all aerial bucket trucks inspected and no other metal-reinforced hoses were found in the bucket area. However, when informed of the cause of the fire, the local electric utility company inspected its aerial bucket trucks and found metal-reinforced hydraulic hoses on several.

CAUSE OF DEATH

The attending physician listed trauma-closed head injury as the cause of death.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should instruct maintenance and mechanical personnel not to install metal-reinforced rubber hydraulic hoses on any part of the boom, aerial bucket, or hydraulic attachments of aerial bucket trucks that may be used to work on or near energized high-voltage powerlines.

Discussion: As seen in this case, electrical continuity established between two powerline phases or powerline phase-to-ground through a metal-reinforced hydraulic hose, can generate heat sufficient to rupture the hose and cause a fire. Current flowing through the metal reinforcement could also be conducted to the truck chassis, creating an electrocution hazard. All hydraulic tools used on or near energized lines or equipment must be equipped with nonconducting hoses, according to 29 CFR 1926.951(f)(3).

Recommendation #2: Employers should ensure that fire-resistant hydraulic fluid is used to power hand tools that may be exposed to ignition sources.

Discussion: Fluids used in hydraulic-powered tools must be approved, fire-resistant fluids according to 29 CFR 1926.302(d)(1). In this case, use of a fire-resistant hydraulic fluid could have prevented the ensuing fire.

Recommendation #3: Employers should ensure that hydraulic hoses for impact attachments are installed so that the flow of hydraulic fluid can be stopped by the worker in an aerial bucket during an emergency.

Discussion: A control valve incorporated into the hydraulic system of the aerial bucket would allow a worker in the bucket to immediately stop the flow of hydraulic fluid to any attachment. In the event of a fire, the control valve would enable a worker in a bucket to shut off the supply of hydraulic fluid fueling the fire. Although use of a metal-reinforced hose was a primary cause of fire in this instance, this safeguard should be incorporated for all hydraulic hoses due to the potential that any type of hydraulic hose could burst.

Recommendation #4: Employers should label or color code hydraulic hoses to identify those that are appropriate for specific applications on certain areas of machinery (such as aerial buckets).

Discussion: A method or system for labeling or color coding hydraulic hoses might prevent the hazards introduced when different types of hoses, designed for use in different applications, are used interchangeably.

Recommendation #5: Equipment and tool manufacturers should cooperatively design an independent coupling system, utilizing a new variation of matched connection components, that could be incorporated into aerial bucket system designs.

Discussion: Such an independent coupling system would ensure that any hydraulic hoses unsuitable for use on booms, aerial buckets, or aerial bucket attachments could not be connected to these components of aerial bucket systems.

Recommendation #6: Employers should provide task-specific training to workers that correlates steps in the task with control of the identified potential hazards.

Discussion: In this instance, the field mechanic was aware that he was installing the incorrect type of hose; however, he was not aware of the fire hazard associated with the use of a metal-reinforced rubber hose near energized high-voltage powerlines.

Recommendation #7: Employers should ensure that workers are aware of the importance of adherence to established safe work procedures.

Discussion: Employers should continually stress the importance of adherence to established safe work procedures. Established safe work procedures required covering energized powerlines in the immediate work area with insulated line hoses prior to the start of any work. It is not known, however, if insulated line hoses would have prevented the ignition of the hydraulic fluid in this case.

REFERENCES

1. 29 CFR 1926.951(f)(3) Code of Federal Regulations, Washington, D.C.: U.S. Government Printing Office, Office of the Federal Register. pg. 286.

2. 29 CFR 1926.302(d)(1) Code of Federal Regulations, Washington, D.C.: U.S. Government Printing Office, Office of the Federal Register. pg. 133.

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