



The National Institute for Occupational Safety and Health (NIOSH)

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Foreman Electrocuted and Lineman Injured After Truck-mounted Crane Boom Contacts 7,200-volt Overhead Powerline in Virginia

FACE 90-39

SUMMARY

A foreman for a telecommunications company was electrocuted when he grabbed the door handle on a truck-mounted crane whose boom was in contact with a three-phase, 7,200-volt overhead powerline. The foreman (victim) and three other workers (lineman, cable splicer, and laborer) were attempting to remove four poles that had previously supported an advertisement billboard. The poles stood 20 feet high, were buried 5 feet in the ground, and were located 15 feet away from and parallel to the powerline. To remove the poles, the lineman positioned the truck-mounted crane directly under the powerline. While standing on the ground, the lineman maneuvered the crane boom using the rubber-coated hand control levers mounted at the back of the truck. The poles were removed by hooking the crane boom cable around the middle of each pole and vertically hoisting each pole out of the ground. While the workers were pulling out the third pole, the end of the boom contacted the overhead powerline. The laborer, working in the back of the truck, noticed the lineman being shocked. He further noticed that the lineman was unable to let go of the “boom up” hand control. The laborer kicked the lineman in the chest and the lineman collapsed unconscious to the ground. He revived without assistance about 3 minutes later, with apparent electrical burns to his left hand. The crane boom remained in contact with the powerline, the truck tires ignited, and the truck began to burn. When the foreman (victim) saw this he tried to open one of the truck doors. When his left hand contacted the door handle he was electrocuted. NIOSH investigators concluded that, in order to prevent future similar occurrences, employers should:

- **conduct a jobsite survey to identify potential hazards before starting any job, and implement appropriate control measures**
- **ensure that cranes are not operated within 10 feet of energized powerlines as required by current OSHA regulations**
- **ensure that boomed vehicle operators are trained in the safe operation of these vehicles**
- **contact the local utility company to de-energize or insulate the powerlines when circumstances require operating a crane in close proximity to a powerline**
- **develop and implement a safety program to help workers recognize and control hazards**
- **consider retrofitting truck-mounted cranes with electrically isolated crane control systems.**

INTRODUCTION

On August 22, 1990, a 24-year-old male lineman foreman was electrocuted when he grabbed the door handle on a crane truck whose boom was in contact with a three-phase, 7,200-volt, 24-foot-high overhead powerline. On September 10, 1990, officials of the Virginia Occupational Safety and Health Administration (OSHA) notified the Division of Safety Research (DSR) of the death and requested technical assistance. On September 28, 1990, a research industrial hygienist from DSR traveled to the incident site and conducted an investigation. The DSR investigator reviewed the incident with company representatives and employees, the medical examiner, and the Virginia OSHA compliance officer assigned to this case. Photographs and diagrams of the incident site were obtained during the investigation.

The employer in this incident is a telecommunications company that has been in business for 8 years. Most of the work performed by the company involves telecommunication line installation and repair. The company employs 50 full-time employees. Most of the employees are linemen, cable splicers, and line construction/repair laborers. The victim had been employed by the company for 7 years. The company has no safety program, and no written safety policy or safety procedures.

INVESTIGATION

The company had assigned a foreman (victim) and a crew of three other workers (lineman, cable splicer, and laborer) the task of removing four poles that supported an advertisement billboard. The poles were each 25 feet long and were set vertically, 5 feet deep in the ground, with the top of each pole 20 feet above the ground. The four poles were located 15 feet laterally from a 7,200-volt, three-phase, 24-foot-high overhead powerline and about 150 feet from an interstate highway. The poles ran parallel with and between the powerline and highway (Figures 1-3).

At 1:00 p.m. on the day of the incident, the work crew arrived at the site to remove the poles. To accomplish the task, the crew used a 3-ton, truck-mounted, hydraulic derrick crane. The lineman maneuvered the crane boom for the entire task while standing on the ground and operating rubber-coated hand control levers mounted at the back end of the truck (Figures 1-4). While the crew was setting up to remove the first pole, the victim walked to a business about 200 feet away to make a phone call. During his absence, the workers removed three of the poles in the following manner:

- The lineman positioned the truck directly under and parallel to the powerline
- The other workers lowered the outriggers to stabilize the truck
- The lineman raised the end of the boom to about 22 feet above the ground, directly above the pole to be removed
- The other workers hooked the boom cable around the middle of the pole
- The lineman hoisted the boom cable with the “boom up” control lever, pulling the pole vertically out of the ground
- The lineman lowered the pole to the ground with the “boom down” control lever and the other workers unhooked it.

While the lineman was hoisting the third pole with the “boom up” control lever, he became distracted and looked away. As a result, the end of the boom continued moving in a vertical direction until it contacted the overhead powerline phase nearest the highway, energizing the crane and truck (Figures 3-5).

When the crane boom contacted the powerline, the lineman saw a flash of light but did not remember anything from that moment until several minutes later. The cable splicer was standing near the pole that was being lifted, guiding its removal, while the laborer was working in the crane truck bed. At first, the laborer and cable splicer were not aware that the end of the boom had contacted the overhead powerline. However, when the laborer saw the lineman “gasping and grunting” and unable to let go of the “boom up” control lever, he realized that the lineman was being electrically shocked.

The laborer immediately kicked the lineman in the chest. As a result, the “boom up” control lever broke off and the lineman fell to the ground (Figure 4). The laborer jumped off the truck and tried to drag the injured lineman away from the truck. However, when he grabbed the lineman by his bare arm he received an electrical shock (presumably the effect of ground gradient current from the energized crane truck). The crane boom remained in contact with the powerline, causing three of the truck’s tires to ignite (Figures 2 & 3). The cable splicer, noticing the downed lineman, ran over to the laborer to assist

him. The two workers dragged the injured lineman away from the truck by his pant legs and received no electric shock in doing so. At this time they noted that the injured lineman was unconscious, yet breathing. He regained consciousness 2 or 3 minutes later.

The crane truck was now on fire. The foreman, who had been making a phone call nearby, saw the commotion and came running up to the truck. The three workers did not notice the foreman until he was within a few feet of the truck. The laborer yelled, "Don't touch the truck!" However, the foreman reached for the door handle. It is presumed that he was attempting to either move the truck, turn the truck engine off or look for a fire extinguisher inside the truck cab. When the foreman grabbed the door handle with his left hand a "path to ground" was established through the victim's body. The victim slumped unconscious with his hand gripping the door handle (Figures 2 & 6). The electric current entered his left hand and exited his feet to ground, causing his electrocution. The laborer ran up to the victim in a rescue effort and kicked him loose from the door handle. When the victim fell to the ground, all three workers dragged the victim about 15 feet away from the truck by his pant legs. The workers began cardiopulmonary resuscitation (CPR) on the victim. At the same time, a worker from the business 200 feet away called the emergency medical service (EMS) on 911. EMS and fire department personnel arrived at the scene about 20 minutes after receiving the call. They continued CPR on the victim and started advanced cardiac life support. The victim was transported to a local hospital where he was pronounced dead on arrival by the attending physician. The injured lineman was also transported to the same hospital where he was treated for minor burns on his left hand.

Fifteen minutes after the arrival of fire department personnel, power company workers arrived at the scene and de-energized the powerline. Fire fighters then extinguished the fire that had engulfed the crane truck.

CAUSE OF DEATH

The medical examiner listed the cause of death as electrocution.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should conduct a jobsite survey before starting any job to identify potential hazards and implement appropriate control measures.

Discussion: Employers should conduct initial jobsite surveys to identify potential worker hazards. Once potential hazards have been identified, appropriate control measures can be implemented prior to the start of any work. Control measures in this incident include: 1) de-energizing the powerline, 2) insulating ("sleeving") the powerline phases with line hoses, 3) positioning the crane-mounted truck so the crane boom will not come within 10 feet of the powerline, or posting an observer to ensure the crane operator does not move the boom within 10 feet of the powerline.

Recommendation #2: Employers should ensure adherence to existing OSHA regulations concerning crane operations.

Discussion: OSHA standards 1926.550(a)(15) and 1910.180(j) require that the minimum clearance between electrical lines rated 50 kV or below and any part of the crane or load shall be 10 feet, unless the electrical lines have been "de-energized and visibly grounded." Additionally, 29 CFR 1926.550(a)(15)(iv) requires that a person be designated to observe clearance of the equipment and to provide timely warning for all operations where it is difficult for the operator to maintain desired clearances by visual means. A NIOSH alert entitled "Request for Assistance in Preventing Electrocutions from Contact Between Cranes and Power Lines" provides additional recommendations pertaining to work with boomed vehicles near energized overhead powerlines.

Recommendation #3: Employers should ensure that boomed vehicle drivers/operators are trained in the safe operation of these vehicles.

Discussion: All workers who are required to operate boomed vehicles should be provided with appropriate training. At minimum, such training should address:

1. all OSHA standards applicable to cranes
2. recognition of hazards associated with hoisting of equipment and materials, especially near overhead powerlines
3. positioning of the crane boom to maintain a 10-foot minimum clearance from overhead powerlines
4. proper use of outriggers according to the manufacturer's recommendations
5. use of established procedures in emergency situations.

Recommendation #4: When circumstances offer no alternative to operating a crane or other boomed vehicle close to a powerline, the employer should contact the local utility company to de-energize or insulate the powerline before the start of work.

Discussion: De-energizing or insulating powerlines in work areas serves to provide a measure of protection to crane operators should contact with powerlines occur. When there is no alternative to operating a crane near a powerline, this procedure provides a viable option.

Recommendation #5: Employers should develop and implement a safety program designed to help workers recognize, understand, and control hazards.

Discussion: OSHA Standard 29 CFR 1926.21(b)(2) states, "The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury." Companies should evaluate the tasks performed by workers, identify potential hazards, develop and implement a safety program addressing these hazards, and provide worker training in safe work procedures. For example, employers should instruct workers that if a vehicle contacts an electrical powerline, they should not contact the vehicle or allow anyone else to contact the vehicle. Employers should also instruct workers to keep all unauthorized personnel away from the area.

Recommendation #6: Employers and crane manufacturers should consider retrofitting truck-mounted cranes with electrically isolated crane control systems.

Discussion: A crane control system that is electrically isolated would provide protection to a worker operating the crane if contact with an energized overhead powerline occurs. Electrically isolating truck-mounted controls could be accomplished by an electrical hazard protection platform mounted near the crane controls. With this system the crane cannot be operated unless the operator is standing on the platform. Since the platform is mounted on the truck above ground level, it is electrically isolated. Therefore, if any part of the crane boom contacts a powerline, the electrical current would go to ground through the tires or outriggers instead of through the operator. Electrical isolation for remote control devices could be accomplished by radio controls, fuse-equipped control lines, fiber optic controls, insulated control boxes, etc. Manufacturers of crane systems should evaluate these options and incorporate an electrically isolated crane control system in the design of newly manufactured truck-mounted cranes. Manufacturers and their customers should consider retrofitting existing truck-mounted cranes with these systems, as well.

REFERENCES

1. Office of the Federal Register, Code of Federal Regulations, Labor, 29 CFR Part 1926, pages 20 & 204, U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C., July 1989.
2. National Institute for Occupational Safety and Health, Request for Assistance in Preventing Electrocutions from Contact Between Cranes and Power Lines, DHHS (NIOSH) Publication Number 85-111, July 1985.

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