The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research NIOSH

# Construction Laborer is Electrocuted When Crane Boom Contacts Overhead 7200-volt Powerline in Kentucky

FACE 91-21

## SUMMARY

A 37-year-old construction laborer (victim) was electrocuted while pulling a wire rope load choker attached to a crane cable toward a load. The choker was to be connected to a steel roof joist which was to be lifted 150 feet across the roof of a one-story school and set in place. The cab of the crane was positioned 11 feet 6 inches from a three-phase 7200-volt powerline. After a previous roof joist had been moved, the crane operator swung the crane boom and cable back toward the victim. The victim grasped the choker in his left hand and with his right hand held onto a steel rod that had been driven into the ground nearby. At this point, the crane cable contacted the powerline and the electrical current passed across the victim's chest and through the steel rod to ground, causing his electrocution. NIOSH investigators concluded that, in order to prevent future similar occurrences, employers should:

- **comply with existing regulations pertaining to clearance distances between cranes and powerlines**
- **use a designated signal person when necessary**
- **evaluate a jobsite prior to the start of work to determine the safest areas for material storage, machinery placement during operations, and the size and type of machinery to be used**
- **contact the local electric utility when work is to be performed in proximity to overhead powerlines**
- **instruct employees to use non-conductive links, chokers, or taglines when working in proximity to overhead powerlines.**

## INTRODUCTION

On June 24, 1991, a 37-year-old construction laborer was electrocuted when the crane cable connected to the wire rope choker he was holding contacted a 7200-volt powerline. On July 25, 1991, officials of the Kentucky Occupational Safety and Health Administration notified the Division of Safety Research (DSR) of the death, and requested technical assistance.

On July 31, 1991, a DSR safety specialist, safety engineer, and medical officer traveled to the incident site to conduct an investigation. The incident was reviewed with OSHA officials, employer representatives, and the county coroner's office. The autopsy report, medical records, and photographs of the incident site were obtained.

The employer in this incident was a crane rental service that also provided services in steel erection and demolition. The employer had been in business for 6 years and employed 15 workers. The company owner managed the safety function as a collateral duty. Meetings were conducted prior to the start of each project to discuss the safety considerations associated with that project. Additionally, monthly safety meetings for all employees were held at the company office and tailgate safety meetings were conducted at jobsites. Training was accomplished on-the-job. Company workers were aware of OSHA regulations regarding the clearance between cranes and powerlines.

## INVESTIGATION

The company had been subcontracted to install steel roof joists and roof decking above the existing roof of a one-story school building. Steel columns to support the joists had been installed through the roof by another contractor. The new roof would raise the height of the one-story structure by 4 feet. The prime contractor's 50-ton conventional crane with a 190-foot-long boom and jib was used to lift the joists and set them in place. The company had a 50-ton hydraulic crane with a 150-foot-long boom at the site. The owner felt that the conventional crane, because of its greater lifting capacity, would be the safer machine to use for this particular job. The crane was positioned between the school and a three-phase, 7200-volt powerline–11 feet from the powerline (Figure). The distance between the school and the powerline was 58.5 feet. Two stacks of joists had been placed between the powerline and school, one 14 feet from the powerline, and the other 32 feet from the first stack and 12 feet from the school. The lengths of joists ran parallel to the powerline.

The day before the incident, the crew had begun to set the joists on the far side of the roof, approximately 150 feet away from the crane. The crew consisted of a crane operator, three laborers on the roof setting the joists, and one laborer on the ground (victim) connecting the joists to the crane. The crew set the joists the entire day without incident.

On the day of the incident, the crew began setting the joists on the side of the roof away from the crane. The crane operator lifted a joist from the stack nearest the school, swung it across the roof, and began to set it in place when the laborers noticed that it was the wrong length. The operator returned the joist to the stack nearest the school, where the victim unhooked it. The operator then swung the boom toward the stack of joists nearest the powerline. The victim grabbed the choker (a short length of wire rope with eyes spliced into either end; it was designed to be wrapped around a load, threaded through itself, and hooked to a crane hook) with his left hand and began to pull the choker and crane cable toward the stack of joists and away from the powerline. As the victim grabbed a steel rod that had been driven into the ground with his right hand (possibly to steady himself), the crane cable contacted the powerline 36 feet above the end of the choker. The electrical current passed down the cable, across the victim's chest, and down the steel rod to ground, causing the victim's electrocution.

A worker on the roof was certified in cardiopulmonary resuscitation (CPR) and initiated CPR within a minute. The emergency medical service was summoned, and transported the victim to the hospital, where he was pronounced dead on arrival. The body displayed burn marks consistent with death by electrocution.

During interviews immediately following the incident, the crane operator stated that he did not know how close the boom of the crane was to the powerline, since he was watching the ball at the end of the crane cable. The operator was maneuvering the ball so as not to hit the victim, who was 97 feet from the body of the crane. The cable's length from the end of the boom to the cable hook was 142 feet. It is assumed that counter forces on the cable–the boom swinging the cable in one direction and the victim pulling the cable in the opposite direction–caused the cable to whip into the powerline. Although the victim was standing 10 feet from the power pole, a scale drawing of the area demonstrates that with the crane positioned 11 feet from the powerline and its 190-foot boom positioned at a 70-degree angle with 142 feet of cable extended, the ball would be 10 feet from the power pole but only 5 to 7 feet from the powerline at 33 feet above ground level–the height of powerline.

## CAUSE OF DEATH

The medical examiner ruled the cause of death as accidental electrocution with cardiorespiratory arrest.

## RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that employees comply with existing regulations pertaining to clearance distances between cranes and powerlines.

**Discussion:** OSHA regulations 29 CFR 1926.550 (a)(15) and 1910.180 (j) require that the minimum clearance between electric 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" at the point of work or physical contact between the lines, equipment, or machines is "prevented by the erection of insulating barriers which cannot be part of the crane."

Recommendation #2: Employers should designate a worker as a signal person if it is difficult for the crane operator to maintain clearance by visible means.

**Discussion:** OSHA regulation 29 CFR 1926.550 (a) (15) (IV) requires that a person be designated to observe clearance of the equipment and to give timely warning for "all" operations where it is difficult for the operator to maintain desired clearances by visual means. In this instance, the operator's attention was focused on the ball on the end of the crane and the victim 97 feet away, not the clearance between the crane boom and the powerline.

Recommendation #3: Employers should evaluate a jobsite prior to the start of any project involving the use of construction machinery, such as a crane, to identify the safest areas for the storage of materials, the placement of machinery during operations, and the type and size of machinery to be used.

**Discussion:** During the planning stages of a project, a comprehensive workplace assessment should be conducted by qualified professionals to identify the appropriate size and type of machinery, safest areas for material storage, and the proper position for machinery during operations. If the areas had been identified during the planning phases, it may have been possible to stack the steel roof joists on the opposite side of the school where the powerline hazard could have been eliminated. The joists could still have been lifted 150 feet across the top of the roof to the far side, but the powerline would have been 52 feet away. It might also have been possible to use a smaller crane on each side of the school to position the steel joists. The figure of the crane drawn to scale demonstrates that with the 190-foot-long boom of the crane at a 70-degree angle and 142 feet of cable extended, the ball and choker are 10 feet from the power pole at ground level but only 5 to 7 feet from the powerline at 33 feet above ground (height of powerline). In this instance, the crew may have believed that a 10-foot clearance was maintained. By evaluating the distance and height of the lift, given the crane boom angle and height, potential hazards associated with overhead powerlines can be identified and controlled.

Recommendation #4: Employers should contact the local electric utility when work is to be performed in proximity to overhead powerlines.

**Discussion:** When work is to be performed in close proximity to overhead powerlines, employers should contact the local electric utility to discuss the work that is to be performed and what safety measures, if any, need to be enacted. In this instance, covering the phase of the powerline nearest the crane with insulated line hoses would have reduced the severity of, and the exposure to, the electrical hazard.

Recommendation #5: Employers should instruct workers to use nonconductive links, chokers, and/or taglines when guiding or hooking loads near overhead powerlines.

**Discussion:** When cranes are scheduled for use in work areas where overhead powerlines are present, employers should consider installing nonconductive links between the lifting cable and the breaker ball/hook assembly. Nonconductive chokers wrapped around loads and connected to the hook assembly provide an additional measure of worker protection. Employers also should instruct workers that nonconductive taglines should be used when hooking or guiding loads near overhead powerlines. Dry polypropylene rope is an excellent material for use as a nonconductive tagline.

## REFERENCES

29 CFR 1926.550 (a)(15) Code of Federal Regulations, Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

29 CFR 1910.180 (j) Code of Federal Regulations, Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

29 CFR 1926.550 (a)(15)(IV) Code Of Federal Regulations, Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

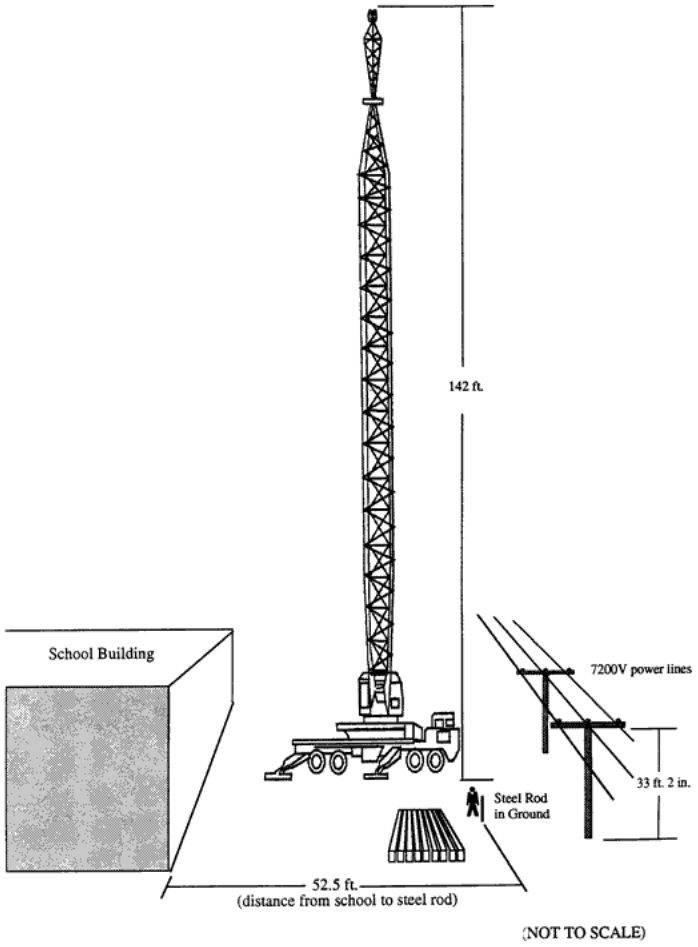


**Figure.** Configuration of the Incident Site

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Last Reviewed: November 18, 2015