The National Institute for Occupational Safety and Health (NIOSH)

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Well Driller Electrocuted When Pipe on Crane Cable Contacts 12,000-Volt Overhead Powerline in Virginia

FACE 90-38

SUMMARY

A well driller was electrocuted when a metal pipe that was being hoisted by a truck-mounted crane contacted one phase of a three-phase, 12,000-volt overhead powerline. The victim and a co-worker had been assigned the task of repairing a submersible pump for a water well at a private residence. The two workers began the repair work the day before the incident. The day of the incident they used a truck-mounted crane to pull piping and the submersible pump from the well. The well was located in a pasture that is intersected by three separate and parallel overhead powerlines. A phase from one of the powerlines passes directly over the well, 31 feet, 6 inches above the ground. On the day of the incident, the victim positioned the truck-mounted crane beneath the powerline. Using a hand-held remote control pendant, the victim fully extended the end of the boom 36 feet above the ground. The crane cable was attached to a 1-inch diameter galvanized pipe that ran to the pump inside the well. As the victim raised the pipe it contacted the powerline phase directly above the well. This action energized the crane, including the hand-held remote control pendant. The victim provided a “path to ground” and 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 according to 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 11, 1990, a 33-year-old male well driller was electrocuted when a metal pipe that was being hoisted with a truck-mounted crane contacted a three-phase, 12,000-volt overhead powerline. On August 21, 1990, officials of the Virginia Occupational Safety and Health Administration notified the Division of Safety Research (DSR) of the death and

requested technical assistance. On September 27, 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 well drilling company that has been in business for about 50 years. The work performed by the company involves water well drilling and repair. The company employs 16 full-time employees, most of whom perform water well drilling and well repair work. The victim had been performing this type of work for the company for 15 years. The company has no safety program, and no written safety policy or procedures.

INVESTIGATION

Two well drillers (victim and co-worker) had been assigned the task of repairing a submersible pump and other electrical-related equipment for an existing water well at a private residence. Other company employees, including one of the company owners, had made repairs on the well on previous occasions. None of those repairs required the use of a crane.

The well was about 100 feet from an interstate highway and inside a fenced pasture. The pasture is intersected by three separate and parallel overhead powerlines, one of which is a three-phase, 12,000-volt powerline that crosses directly above the well head, 31 feet 6 inches above the ground. The well head is surrounded by a concrete enclosure, 6 feet long by 6 feet wide by 3 feet high, with a removable corrugated steel cover (Figures 1 & 2).

At 5:00 p.m. on the day before the incident, the victim and co-worker arrived at the site and worked on the well for about 2 hours. They returned the following day at 8:15 a.m. and continued the repair work for about 30 minutes. At that time, they decided they needed a truck-mounted crane to pull the submersible pump out of the well. The two workers drove to the company office in their service truck and returned to the site in a 5-ton hydraulic derrick crane truck.

The victim positioned the crane truck near the well, and the outriggers of the truck were lowered to stabilize it. The victim stood near the side of the truck and operated the crane with a hand-held remote control pendant while the co-worker stood near the back of the truck. The victim fully extended the end of the boom 36 feet above the ground.

With the end of the boom approximately 33 feet above the top of the well enclosure, a steel cable with a hook at the end was lowered. The co-worker then attached the cable and hook to the end of a 1-inch diameter galvanized pipe protruding from the well head. The end of the pipe included an elbow fitting that extended 4.5 inches horizontally. The rest of the pipe extended down vertically to the submersible pump, about 100 feet below the surface, inside a 4-inch diameter well casing.

With the pendant control in his left hand, the victim began hoisting the pipe out of the well. The co-worker stated that the victim yelled for him to “get out of the way.” In response, the co-worker began running away from the crane. While running, the co-worker heard a loud noise “like a shotgun going off.” A motorist driving along the highway at that same time reported later that he saw a ball of fire rising from the well enclosure.

The co-worker did not see the galvanized pipe contact the overhead powerline. However, a solidified molten drip at the end of the galvanized pipe suggests contact at that point (Figures 1, 3 & 4). When contact occurred, the truck-mounted crane, the remote control cable, and the hand-held pendant became energized. A “path to ground” was established through the victim’s body. The electric current entered the victim’s left hand (holding the pendant) and exited his feet to the ground. The powerline phase, directly over the well head, melted in two at a point where the galvanized pipe made contact. This caused the non-energized end (load end) of the powerline phase to fall to the ground. The energized end (line end) of the phase also fell, dangling about 12 feet above the ground from a utility pole 17 feet from the well (Figure 1).

After hearing the noise, the co-worker looked back and saw the victim lying face down about 10 feet from the well enclosure. The co-worker immediately ran to the victim and noted that he was still conscious. The hand-held pendant was lying on the ground nearby.

The co-worker called the company office on a two-way radio inside the crane truck, and the secretary who answered called the emergency medical service (EMS) on 911. The co-worker returned to the victim, who was now unconscious, and attempted cardiopulmonary resuscitation (CPR) but was unsuccessful in reviving the victim. A police officer and an emergency rescue squad from the local fire department arrived at the scene 2 and 8 minutes, respectively, after the 911 emergency call was received. The police officer and rescue squad personnel continued CPR on the victim, including advanced cardiac life support. The victim was transported to a local hospital where he was pronounced dead on arrival by the attending physician.

CAUSE OF DEATH

The medical examiner listed the cause of death as electrical injury.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should conduct a jobsite survey to identify potential hazards before starting any job, 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 could have included de-energizing the powerline or insulating or “sleeving” the powerline phases with line hoses.

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 a 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 (Example-In the event of vehicle contact with an electrical powerline, never contact the vehicle or allow anyone else to contact the vehicle. Also, keep all unauthorized personnel away from the area).

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." Even small 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.

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

Discussion: The remote control system (hand-held pendant) used on this crane was electrically connected to the crane. This system provided the "path to ground" in this incident. A crane control system that is electrically isolated would provide protection to anyone operating the crane in the event of contact with an energized overhead powerline. Electrical isolation for remote control devices could be accomplished by radio-frequency controls, fuse-equipped control lines, fiber optic controls, insulated control boxes, etc. Another approach for electrical isolation of 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 above ground on the truck, it is electrically isolated. 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. 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 also consider retrofitting existing truck-mounted cranes with these systems.

REFERENCES

1. Office of the Federal Register, Code of Federal Regulations, Labor, 29 CFR Part 1910.180(j), 29 CFR Part 1926.21(b) (2) and 29 CFR Part 1926.550(a) (15), 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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