June 22, 1997

FACE 97-AK-013

To: **Ted Pettit, NIOSH, Division of Safety Research**

From: **Deborah Choromanski**
Occupational Injury Prevention Program

Subject: **Concrete pump truck operator electrocuted when boom contacts overhead power line -- Alaska**

SUMMARY

On May 5, 1997, a 21 year old, male concrete pump truck operator (the victim) was electrocuted when the boom of the truck he was operating contacted a 14.4 kilovolt (kV) overhead power line. The victim had completed the process of cleaning the pump line with the two lower sections of the boom elevated, in an oblique position relative to the truck. As he collapsed the boom, the end of the middle section touched an overhead high voltage power line. The concrete truck driver (the witness) who was standing in rear of the pump truck and facing the victim, heard a zapping noise. The victim collapsed still holding the remote control box. The witness lifted the remote control box from the victim's hands using a 2x4 wood stud and then checked the victim for a pulse. Emergency medical services were called. The victim was airlifted to the nearest medical center but was pronounced dead on arrival.

Based on the findings of the investigation, to prevent similar occurrences, employers should:

- ensure that all operators receive adequate training to recognize and avoid hazardous conditions;
- do not operate equipment where any part is within the prescribed distance of electrical power lines unless the line has been de-energized and visually grounded or unless insulated barriers are installed;
- consider offering training options for first aid and basic life support to employees.

Additionally, manufacturers and owners of early model pumping equipment should:

- consider upgrading cable-attached remote controls to radio remote controls.

INTRODUCTION

At 5:45 PM on May 5, 1997, a 21 year old male concrete pump truck operator (the victim) was electrocuted when the boom of the truck he was operating contacted a 14.4 kilovolt (kV) overhead power line. On May 6, 1997, Alaska Department of Labor (AK-DOL) notified the Alaska Division of Public Health, Section of Epidemiology. An investigation involving an Injury Prevention Specialist for the Alaska Department of Health and Social Services, Section of Epidemiology ensued on May 6, 1997. The incident was reviewed with AK-DOL officials. Alaska State Troopers and Medical Examiner reports, as well as AK-DOL reports, were requested.

The concrete pumping operation in this incident was privately owned and employed two permanent, full-time operators. The company had been in business for 13 years. The victim had been employed by the company for 3 years and had worked as a boom pump truck operator for the previous 18 months. At the time of the incident, the victim and three workers from the concrete company responsible for the foundation construction had completed the pour and were in the process of cleaning-up.

The owner/operator did not have a written safety program. The victim had attended a 5-day concrete pumping conference in 1996. However, he was not an American Concrete Pumping Association (ACPA) certified operator.

INVESTIGATION

The company had been subcontracted to pump concrete for a new foundation at a residential construction site. The site was located in a heavily wood area and was generally wet and muddy. The west side of the foundation was approximately 20 feet from an adjacent overhead power line. The height of the line at the pole was 32 feet. Due to the close proximity of the overhead power line, the general contractor had cleared an access route to the foundation site from the street to accommodate a concrete line pump truck. The concrete truck was parked in the access approximately 26 feet from the power line (Figure 1a). The ground for the rear outriggers was noticeably wet with active drainage and puddling of water.

The equipment involved in the incident was a truck-mounted Thomsen HP 845 Series concrete pump with an articulating boom. The HP 845 boom has three hydraulic-powered joints allowing the boom to fold into three sections. The first section at the mast can be raised 67 degrees while the second and third sections can be opened 180 degrees. The boom has a maximum rotation of 90 degrees from the front center position of the truck (Figure 1b). The maximum horizontal reach with the boom fully extended is 72 feet. All boom movements and pump control can be accomplished using a remote control box connected to the main control apparatus by a 100-foot control cord. The remote control is contained in a metal box with six toggle switches, four switches on the front panel and two switches on the top panel, to control boom and pump actions.

On the afternoon of the incident, the subcontracted concrete company responsible for installing the forms called the pumping company to request a boom pump truck. The boom line on the pump truck would be less cumbersome and more time efficient. The general contractor was not present at the construction site. The pump truck operator (the victim) was using the remote control box to direct the boom movements and pump action. Upon completion of the pour, workers were talking and cleaning-up near the rear of the pump truck. The victim had cleaned the boom pump line by rotating the raised boom approximately 45^{o} counter-clockwise to dump

excess material from the line in an area outside of the foundation perimeter. He was standing on top of the adjacent, wet dirt and debris pile approximately 20 feet from the power line in back of him. The first (lowest) section of the boom was elevated at approximately 60°. It is surmised the victim had positioned himself on top of the dirt pile between the truck and the power line to have a clear view of the work site and the cleaning process. Furthermore, he may have chosen this position to be able to monitor any encroachment of the boom into a 10-foot safety zone. Occupational Safety and Health Administration (OSHA) standards for the construction industry require a minimum 10-foot safety zone when operating equipment near energized overhead lines.[1] Rather than realign the boom with the truck, the operator began to collapse the boom, causing the posterior end of the second section to contact the power line during its decent (Figure 2). The electrical current passed down the boom, through the truck, and down the cable to the remote control box held by the victim.

The concrete truck driver (the witness) was standing at the rear of the pump truck with two other workers who were talking and cleaning-up after completion of the pour when he heard a zapping noise. Upon the victim's collapse, the witness lifted the remote control from his hands. A faint pulse was located. At 5:52 PM, a co-worker called 911 via a cellular phone. Rescue breathing was initiated as described by the emergency response operator. An emergency medical crew arrived at 6:03 PM. The victim was taken to a staging area where he was transported by air ambulance to the medical center where he was pronounced dead.

CAUSE OF DEATH

The medical examiner's report listed the cause of death as high voltage electrocution.

[1] 29 CFR Part 1926.416(g)(2)(iii)(A), Code of Federal Regulations, Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that all operators receive adequate training to recognize and avoid hazardous conditions.

Discussion: In this case, the operator apparently did not consider the rotation circumference of the boom when assessing the presence of any hazards during operation of the pump truck boom. The three boom sections form a "Z" shape when closed. The overall horizontal extension may be altered through various combinations of elevation and opening of the individual boom sections. The victim could have maintained the 10 foot safety zone during rotation with the first and second boom sections opened and elevated, minimizing the diameter of the rotation path. However, as the second section of the boom was closed with the first section elevated, the horizontal rearward shift of the boom sections increased the diameter of the rotation path, causing the junction of the second and third sections to enter the safety zone. Operators and spotters should maintain continuous sight of all potentially energized power sources when maneuvering the boom sections.

Recommendation #2: Do not operate equipment where any part is within the prescribed distance of electrical power lines unless the line has been de-energized and visually grounded or unless insulated barriers are installed.

Discussion: In accordance with 29 CFR 1926.416(g)(2)(iii)(A), "Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 feet is maintained." While the position of the truck was in excess of 20 feet from an overhead power line, the boom entered the safety zone. Manufacturers and the ACPA recommend a 17-foot clearance while Canadian occupational safety and health regulations prescribe 25 feet (7 meters).

Recommendation #3: Employers should consider offering training options for basic first aid and life support to employees.

Discussion: In the event of an emergency (before appropriate emergency medical responders can arrive), basic skills in first aid and life support can reduce suffering and introduce measures to retard degenerative health condition(s) of a seriously injured person. In addition, first aid training is thought to reduce the number and severity of injuries at the work site due to increased knowledge of unsafe working conditions and improper working procedures.[2]

Recommendation #4: Manufacturers and owners of early model pumping equipment should consider upgrading cable-attached remote controls to radio remote controls.
Discussion: In this case, the equipment involved was an early model pump with a cord-attached remote control box. Manufacturers and the ACPA have recognized the increased risk for fatal injury by electrical current in these early models. The incorporation of radio remote controls has significantly reduced the risk of electrical shock in later model boom pump apparatus.

Michael Beller, MD, MPH
Medical Epidemiologist
Division of Public Health
Alaska Department of Health and Social Services

Deborah Choromanski, MPH
Occupational Injury Prevention Program Manager
Section of Epidemiology
Division of Public Health
Alaska Department of Health and Social Services

[2] Accident Prevention Manual for Business and Industry, Administration and Programs. Tenth Edition. National Safety Council, 1992.