The National Institute for Occupational Safety and Health (NIOSH)

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Concrete Worker Electrocuted after Grabbing an Energized 440-Volt Conductor in Virginia

FACE 90-36

SUMMARY

A 21-year-old male concrete worker was electrocuted at a precast concrete manufacturing plant when he climbed a steel column, stepped onto a steam pipe, and grabbed one phase of an energized 3-phase, 440-volt conductor that supplied electrical power to a wall crane. Just prior to the electrocution, the victim was moving an overhead crane with a hand-held pendant controller, when two hoist chains suspended from the crane load block hook tangled around an I-beam that supported the runway of the wall crane. He succeeded in freeing one chain by using the pendant controller to maneuver the load block hook up and down. Intending to free the other chain by hand, the victim climbed a steel support column, stepped onto the steam pipe, and reached out (apparently to support himself) and grabbed the bare conductor. As the current passed through him and the steel column to ground, he fell to the floor. He was pronounced dead on arrival at the local hospital. NIOSH investigators concluded that, in order to prevent future similar occurrences, employers should:

- **guard crane runway conductors to reduce the likelihood of contact by persons or objects**
- **affix warning signs (e.g., Danger–High Voltage) at conspicuous places along crane runways**
- **ensure that workers follow crane manufacturer recommendations regarding the operation of overhead cranes**
- **develop, implement, and enforce a comprehensive safety program that includes worker training in recognizing and avoiding hazards including electrical hazards.**

INTRODUCTION

On July 16, 1990, a 21-year-old male concrete worker was electrocuted at a precast concrete manufacturing plant when he climbed a steel column, stepped onto a steam pipe, and grabbed one phase of an energized 3-phase, 440-volt conductor that supplied electrical power to a wall crane. On July 30, 1990, officials of the Virginia Occupational Safety and Health Administration notified the Division of Safety Research (DSR) of this fatality, and requested technical assistance. On August 15, 1990, a safety specialist from DSR conducted an investigation of the incident. The investigator reviewed the incident with the company plant manager, the company safety consultant, a police department investigator, and the OSHA compliance officer assigned to the case. Photographs of the incident site and a copy of the police report were obtained.

The employer in this incident manufactures precast concrete structures such as box culverts, manholes, and pipes. The company has been in operation for 22 years and employs 115 workers, including 34 concrete workers. The company has written general safety rules that are administered by the plant manager. On-the-job training is provided to the employees.

In addition, a part-time safety consultant conducts weekly walk-around safety audits. The victim worked for this employer for 3 months prior to the incident.

INVESTIGATION

The company manufactures precast concrete structures in a rectangular building approximately 50 feet high by 125 feet wide by 250 feet long. The building contains five floor-operated overhead cranes and one wall crane that are used to move manufactured products within the building. The overhead crane runway (i.e., an assembly of rails, beams, guides, baskets, and framework in which the cranes travel) is located approximately 40 feet above the floor. The wall crane runway is attached to the building's steel support columns (H-beams) and runs parallel to the inside wall, approximately 20 feet above the ground. The wall crane services approximately one-fourth of the building; whereas, the overhead cranes run the entire length of the building. Electrical power is supplied to the overhead cranes and the wall crane by 3-phase, 440-volt conductors that run parallel and adjacent to each runway.

On the day of the incident, two three-man crews were building box culvert forms in separate areas. The victim and two co-workers had just completed the form work for a box culvert and were breaking for lunch. One co-worker walked to the lunchroom. The victim and the other co-worker discussed moving the box culvert to the next work area. Using a hand-held pendant controller, the victim moved a 5-ton overhead crane down the runway toward the box culvert. As the overhead crane approached the culvert, two hoist chains suspended from the load block hook tangled around an I-beam supporting the runway of the wall crane. The victim moved the load block up and down, dislodging one chain. Unable to free the second chain, he told his co-worker that he was going to climb a steel support column (H-beam) to free the chain by hand. The co-worker remarked, "use a stick to knock it down; you might fall." Climbing the H-beam to approximately the 16-foot level, he was able to step onto a steam pipe located approximately 4 feet below the wall crane runway conductors (See Figure). In his attempt to free the hoist chain, he reached out (possibly to support himself) and grabbed the energized conductor. As the current passed through the victim to the grounded H-beam, he screamed, his body became limp, and he fell to the ground.

The co-worker notified the floor supervisor of the incident. The supervisor ran to the victim, checked for vital signs, radioed the office for an ambulance, and started cardiopulmonary resuscitation (CPR). A volunteer emergency medical service (EMS) rescue squad arrived about 30 minutes after being contacted and continued CPR. The EMS transported the victim to the local hospital, where he was pronounced dead on arrival.

CAUSE OF DEATH

The medical examiner listed the cause of death as electrocution.

RECOMMENDATIONS/DISCUSSION:

Recommendation #1: Employers should implement Article 610-21(a) of the National Electrical Code, "Locating or Guarding Contact Conductors."

Discussion: This Article states: "Runway contact conductors shall be guarded and bridge contact conductors shall be located or guarded in a manner that persons cannot inadvertently touch energized current-carrying parts." The National Electrical Code defines guarded as "covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger."

Recommendation #2: Employers should affix warning signs (e.g., Danger–High Voltage) at conspicuous places along crane runways.

Discussion: Posted warning signs alert workers to exercise caution and use appropriate personal protective equipment when working in the area of the identified hazards. [Note: The employer has since affixed “Danger–High Voltage” signs at locations where crane runways are attached to steel support columns (H-beams).]

Recommendation #3: Employers should ensure that workers follow crane manufacturer recommendations regarding operation of overhead cranes.

Discussion: According to the operating manual, the crane manufacturer recommends that, when moving an overhead crane without a load, the load block should be in the uppermost (raised) position. The crane involved in this incident was being moved with the load block in a lowered position. This allowed the hoisting chains to tangle around the I-beam. Workers who operate or maintain overhead cranes, or any other machinery, should receive training in the manufacturer’s recommended methods for safe operation of such equipment.

Recommendation #4: Employers should develop, implement, and enforce a comprehensive safety program that includes worker training in recognizing and avoiding electrical hazards.

Discussion: The victim and at least one other employee were apparently unaware of the hazard created by the uninsulated energized wall crane runway conductors.

REFERENCES

1. National Fire Protection Association: National Electrical Code 1990, NFPA 70 p. 593.

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