The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

Electrician Apprentice Electrocuted after Contacting a 480-volt Conductor in South Carolina

FACE 93-18

SUMMARY

A 42-year-old male electrician apprentice (the victim) was electrocuted when he contacted an unguarded energized 480-volt overhead crane contact conductor. The victim and two co-workers had just performed electrical maintenance on the hoisting motor of the overhead crane, and the crane was moved approximately 200 feet in order to access another overhead crane. The two co-workers were positioned on top of the bridge of the crane, while the victim operated the controls inside the operator's cab to move the crane. After the crane was stopped alongside the second overhead crane, the victim exited the cab and proceeded to climb a metal ladder attached to the cab, which led to the top of the bridge where the other workers were located. Approximately halfway up the 7-foot metal ladder, the victim apparently partially lost his footing and grip on the ladder. As he began to fall, he extended his left arm to catch himself and his left hand contacted one conductor of the energized, three-phase, 480-volt overhead crane contact conductors. The electrical current passed through the victim's body to ground through his right hand, which was grasping the metal ladder. When the victim's hard hat fell to the ground, another worker located on the ground beneath the crane looked up and saw the victim dangling from the ladder. He alerted the workers on the bridge, and they moved to assist the victim. One of the workers administered cardiopulmonary resuscitation (CPR), while another worker ran to call for medical assistance. An ambulance arrived in about 15 minutes and paramedics continued CPR and transported the victim to a local hospital where he was pronounced dead on arrival. NIOSH investigators concluded that, in order to prevent similar occurrences, employers should:

- **implement Article 610-21(a) of the National Electrical Code entitled "Locating or Guarding Contact Conductors"**
- **identify potential hazards and appropriate safety interventions in the planning phase of maintenance projects**
- **routinely conduct plant surveys to identify potential and/or existing hazards and develop and implement appropriate intervention measures for these hazards.**

INTRODUCTION

On June 21, 1993, a 42-year-old male electrician apprentice (the victim) was electrocuted when he inadvertently contacted an unguarded energized overhead crane contact conductor. On June 24, 1993, officials of the South Carolina Occupational Safety and Health Administration (SCOSHA) notified the Division of Safety Research (DSR) of this fatality, and requested

technical assistance. On July 26, 1993, a safety specialist from DSR conducted an investigation of this incident. The safety specialist reviewed the incident with a company representative and the SCOSHA compliance officer assigned to the case. Photographs of the incident site were taken, and the medical examiner's report was requested.

The employer in this incident was a steel-alloy rolling mill that had been in operation for 31 years. The company had 300 employees, including 4 electrician apprentices who helped install and maintain the plant's electrical systems and equipment. The company had a full-time director of safety and a comprehensive safety program including written safety policies and procedures. Monthly employee and supervisor safety meetings were held, and CPR and first aid training were provided to all supervisors. The victim had worked for this employer for 4 months prior to the incident, but had about 4 years' experience as an electrician apprentice. This was the second fatality the company had experienced.

INVESTIGATION

The steel-alloy rolling mill was conducting normal operations on the day of the incident. The mill operates 24 hours a day producing steel bars, plates, and billets from recycled materials, such as motor vehicles and appliances. At the time of the incident, the victim had completed his normal work shift (3 a.m. to 11 a.m.), and was working overtime. He was helping to repair the hoisting motor located on a 10-ton overhead cab-operated crane in a building that was being used to warehouse the steel products.

The victim and two co-workers (one foreman and another electrician apprentice) proceeded to the warehouse and accessed the overhead crane by climbing a permanent metal stairway. The crane was one of two rail-mounted, cab-operated, overhead-traveling cranes which ran the length of the 800-foot building.

Power for the cranes was provided, via collector leads, by a three-phase, 480-volt circuit composed of three bare steel contact conductors which ran adjacent to the operator's cab/crane bridge (Figure) for the entire length of the building.

After repairing the speed controls on the crane's hoist motor, the foreman instructed the victim to move the crane down the warehouse and park it alongside the other overhead crane in preparation to check the brakes on the other crane. The co-workers were located on top of the bridge of the crane, while the victim operated the controls inside the operator's cab to move the crane. After stopping the crane, the victim exited the cab and started to climb a 7-foot steel ladder attached to the outside of the cab and adjacent to the unguarded energized contact conductors. Approximately halfway up the ladder, the victim apparently lost his footing and grip on the ladder. As he began to fall, he extended his left arm to catch himself and his left hand contacted one conductor of the energized, three-phase, 480-volt overhead crane contact conductors. The current (277 volts phase-to-ground) passed through the victim's left arm and chest, and exited to ground through the victim's right hand, which was grasping the metal ladder. The victim slumped over backwards with his foot and leg still hanging over the rung of the ladder. When his hard hat fell to the ground, another employee working on the ground beneath the crane looked up and saw the victim dangling from the ladder. He alerted the workers on the bridge and they moved to assist the victim. One of the workers administered CPR, while the worker on the ground ran to call for medical assistance. The co-workers moved the victim to ground level, and an ambulance arrived in about 15 minutes. Paramedics continued CPR and transported the victim to a local hospital where he was pronounced dead on arrival.

CAUSE OF DEATH

The medical examiner reported the cause of death as electrocution.

RECOMMENDATIONS/DISCUSSION

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

Discussion: This article states that “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.” The crane runway conductors were not guarded when this incident occurred. [Note: Subsequent to the incident, metal screen guards were welded around the operator’s cab/bridge area that is in proximity to the contact conductors.]

Recommendation #2: Employers should identify potential hazards and appropriate safety interventions in the planning phase of maintenance projects.

Discussion: Worker safety should be addressed and incorporated into all maintenance projects during both the planning and operational phases of a project. The planning phase should identify all hazards that may be encountered, and implement procedures and safety interventions to control or eliminate such hazards. These procedures should include, but not be limited to, inspecting the work environment prior to initiating work, developing safe work practices and procedures, selecting qualified personnel, providing training in hazard recognition and abatement, and identifying and addressing personal protective equipment needs.

Recommendation #3: Employers should routinely conduct plant surveys to identify potential and/or existing hazards and develop and implement appropriate intervention measures for these hazards.

Discussion: The building where the incident occurred was the previous site of the melt shop/rolling mill. The melting furnaces and rolling mill had been shut down and the building partially abandoned. At the time of the incident, the building was used to warehouse the steel products, and was accessed on a limited basis for operation and maintenance of the overhead cranes. Employers should routinely conduct plant surveys throughout all work areas, including those areas of limited usage, to identify any hazards and develop and implement appropriate measures to control or eliminate these hazards. [Note: The contact conductors used to power the newer overhead cranes in the new melt shop/rolling mill were installed on the opposite side of the crane bridge, thus eliminating operator exposure to the conductors during entry to, or egress from, the crane cab.]

REFERENCES

National Fire Protection Association: National Electrical Code Handbook, p. 740, 1993.

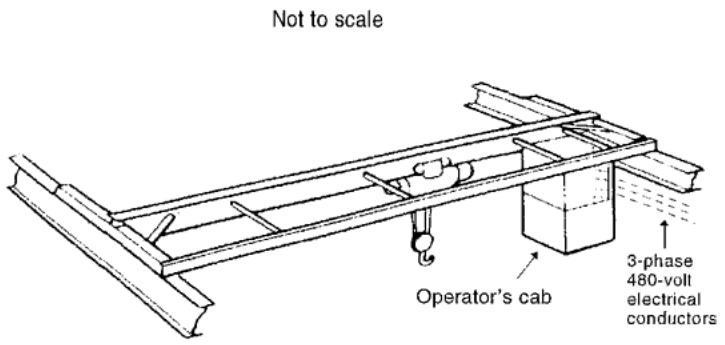

Figure. Overhead Cab-operated Crane

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Last Reviewed: November 18, 2015