FACE 92-16

Textile Worker (Machine Operator) Electrocuted After Contacting an Energized Conductor--South Carolina

SUMMARY

A 19-year-old machine operator (the victim) was electrocuted at a textile plant when he contacted an energized electrical conductor inside the 570-volt control panel of a sueder machine. Prior to the incident, the victim had been operating two sueder machines for approximately 9 to 10 hours. The 5- and 10-horsepower motors in the two machines had a regular tendency to overheat when heavy cloth was processed; heavier-weight material increased the tension on the machines' rollers, producing added friction and heat. Overheating of the motors would trip the overload relays and shut down the machines. The control panel covers on the two machines had previously been modified to increase heat dissipation; however, on the day preceding the incident, the cover had been removed altogether on machine #7, without authorization. On the day of the incident, the victim apparently attempted to cool the uncovered electrical equipment inside the control panel of machine #7 with a stream of compressed air from an air hose. The metal nozzle of the hose contacted an energized conductor inside the control panel. Current successively passed through the nozzle, the victim's hand, chest, and other hand to ground, through one of the other machines that the victim was touching. This caused his electrocution. NIOSH investigators concluded that, in order to prevent future similar occurrences, employers should:

- ensure that all electrical control panel covers are secured (locked) against unauthorized removal, and only qualified/designated personnel have access to the control panel

- evaluate their current safety program and incorporate specific procedures and training designed to enable workers to recognize, report, and avoid hazards, especially electrical hazards (e.g., exposed energized conductors)

- review and implement engineering controls designed to prevent electrical motors from overheating, thereby eliminating the need for hand-held metal air nozzles to cool electrical conductors.

INTRODUCTION

On April 4, 1992, a 19-year-old male sueder machine operator (the victim) was electrocuted when he contacted an energized conductor inside the electrical control panel of a sueder machine. On April 9, 1992, 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 April 23, 1992, a safety

specialist from DSR conducted an investigation of this incident. The investigator reviewed the incident with the company's plant and personnel manager, and the SCOSHA compliance officer assigned to the case. The investigator visited and photographed the incident site, and obtained the medical examiner's report.

The employer in this incident was a textile manufacturer that had been in operation for 4 years. The company employed 900 workers at this plant, of whom 20 were sueder machine operators. The company had a written safety program with written safety procedures administered by the plant's safety officer. The company held monthly safety meetings with company and labor representatives attending. All department managers were responsible for safety within their departments. On-the-job and classroom training was provided to the employees, and drug screening was part of the pre-employment physical required of all new employees. The victim had received 3 weeks training on sueder machine operation, and had worked for this employer for 15 months, 6 months of which he worked as a sueder machine operator. This incident was the first fatality the company had experienced.

INVESTIGATION

On the day of the incident, the victim arrived at the plant before the start of the production shift (8:00 a.m. to 4:00 p.m.). He was scheduled to operate two sueder machines, #7 and #8, as he had done on previous shifts. Sueder machines, which process (sand) cloth to a plush finish (e.g., corduroy), are run in tandem.

The victim completed an 8-hour shift and was asked to work overtime (4:00 p.m. to 12:00 a.m.). The victim agreed and continued operating the machines normally until approximately 6:00 p.m. The 5- and 10-horsepower motors in the two machines had a regular tendency to overheat when heavy cloth was processed; heavier-weight material increased the tension on the machines' rollers, producing added friction and heat. Overheating of the motors would trip the overload relays and shut down the machines. The control panel covers on the two machines had previously been modified to increase heat dissipation; a number of holes had been drilled in the covers, to increase air flow and to vent heated air. However, this measure was apparently insufficient in itself to prevent overheating, because on the day preceding the incident, the cover had been removed altogether on machine #7. This had been done by another worker, acting without authorization from his supervisors. A consequence of this action was the exposure of numerous electrical conductors within the control panel. On the day of the incident, the victim apparently attempted to cool the uncovered electrical equipment within the control panel of machine #7 with a stream of compressed air from an air hose. The machine was adjacent to machine #8; the control panel was located at the bottom left front between the two machines. Inside the control panel there were numerous energized electrical conductors--transformers, relays, fuse holders, contacts, and so forth, carrying electrical charges between 12 and 575 volts. Access to the control panel could only be made from the front between the two machines; access was obstructed by a device located between

the machines, which guided the cloth from one machine to the other. The opening between the control panel and the cloth guidance assembly was about 2 feet (Figure).

Although the incident was unwitnessed, evidence suggests that the victim obtained a 1/2" pressurized air hose equipped with an aluminum 23-inch-long trigger operated nozzle, to cool the electrical conductors. He crawled between the two machines with the air hose in hand. At some point, he supported himself with one hand on either the grounded frame of the sueder machine or the grounded cloth guidance assembly, and directed a stream of air into the control panel. The aluminum nozzle contacted an energized conductor inside the panel. The current successively passed through the nozzle, the victim's hand, chest, and other hand to ground, through one of the pieces of grounded equipment. The victim collapsed, face down, on the nozzle and pressurized hose.

A co-worker walking through the area noticed that machine #7 was not running, then saw the victim lying face down between the machines, with the pressurized air hose beneath him. He shut off power to the machine, pulled the victim away from the equipment, and contacted the department manager. The co-worker began cardiopulmonary resuscitation (CPR), while the manager called the emergency medical service (EMS). The EMS arrived in about 30 minutes, continued CPR, and transported the victim to the local hospital emergency room. The victim was pronounced dead about 65 minutes after the incident. The medical examiner's report did not identify entry or exit wounds but noted that both hands had electrical burns.

CAUSE OF DEATH

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

RECOMMENDATIONS/DISCUSSION:

Recommendation #1: Employers should ensure that all electrical control panel covers are secured (locked) against unauthorized removal, and only qualified/designated personnel have access to the control panel.

Discussion: The control panel was located between the two sueder machines at the bottom left front of machine # 7. The control panel, equipped with two covers that could not be locked, were accessible to anyone within the building. When the control panel covers were removed by an unauthorized person (another operator) and not replaced, the victim may have assumed that using the aluminum nozzle to cool the conductors was a safe and accepted practice. If the covers had been locked the unauthorized worker or victim could not have accessed the energized components of the control panel enclosure. Qualified/designated personnel would be more likely to understand the hazards of

working inside an energized control panel in tight quarters and more likely to exercise special precautions such as de-energizing the control panel prior to working on it.

Recommendation #2: Employers should evaluate their current safety program and incorporate specific procedures and training designed to enable workers to recognize, report, and avoid hazards, especially electrical hazards (e.g., exposed energized conductors).

Discussion: OSHA standard 29 CFR 1926.21(b)(2) states that "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." Employers should provide employees with adequate training to ensure that they can recognize potential hazardous exposures. Evidence suggests that the victim did not realize the hazard created by using a metal object (aluminum air nozzle), in proximity to exposed energized electrical conductors. The safety program should be evaluated with particular emphasis on the development of detailed safety procedures (specific for all tasks and job categories) that are designed to recognize, report, and avoid potential hazards. For these procedures to be effective, they must be clearly communicated and fully understood by the affected employees and supervisors. All workers must believe the company genuinely expects compliance with the procedures, and is committed to preventing occupational injury.

Recommendation #3: Employees should review and implement engineering controls designed to prevent electrical motors from overheating, thereby eliminating the need for hand-held metal air nozzles to cool electrical conductors.

Discussion: The sueder machines' 5- and 10-horsepower electrical motors had a history of overheating and shutting down while processing heavy cloth material. The tension applied to the rollers by the heavy cloth (overloading) caused the motors to overheat, which resulted in the electrical relays opening and the machines shutting down. An overload condition on a motor may cause it to draw more current than it is designed to use, causing the windings to overheat. Excessive current will flow to the motor if the load is too heavy (e.g., the driven machine becomes jammed or locked, a belt-driven machine has a belt that is too tight, the sheave on the motor is out of line with the sheave on the equipment, bearings are worn or in need of lubrication, electrical feeder wires from the service entrance to the motor are too small, resulting in low voltage, or the power supplier has trouble providing proper voltage), and eventual machine shutdown may be expected. Engineers should analyze and determine the factors associated with machine shutdowns, and provide applicable interventions (e.g., cooling fans), thereby eliminating the use of hand-held metal air nozzles to cool down electrical conductors.

REFERENCES

Office of the Federal Register: Code of Federal Regulations, Labor 29 Part 1926. p. 294. July 1, 1989.

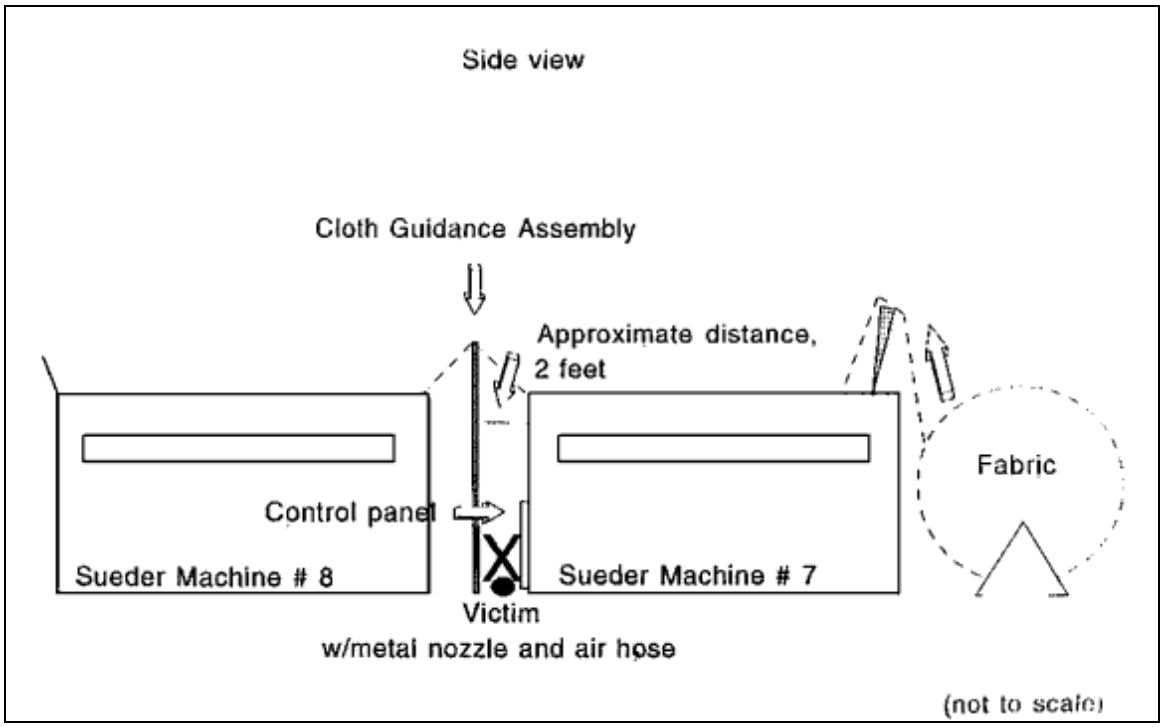

Figure.