



The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces
through safety and health research



Laborer Electrocuted in Ohio

FACE 87-11

Introduction:

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR) is currently conducting the Fatal Accident Circumstances and Epidemiology (FACE) Project, which is focusing primarily upon selected electrical-related and confined space-related fatalities. The purpose of the FACE program is to identify and rank factors that influence the risk of fatal injuries for selected employees.

On November 4, 1986, an 18-year-old laborer in an oil recycling plant was electrocuted when he contacted a pump casing that was energized due to faulty wiring.

Contacts/Activities:

Officials of the Industrial Commission of Ohio notified DSR concerning this fatality and requested technical assistance. This case has been included in the FACE Project. On November 13, 1986, a DSR researcher (a safety specialist) conducted a site visit, met with representatives of the company and officials of the industrial Commission of Ohio, photographed the accident site, and conducted interviews with comparison workers.

Background/Overview of Employer's Safety Program:

The victim was employed at a chemical service plant that recycled industrial and synthetic oils. The company has been in operation since 1980 and employs 17 workers. In 1983 the company was moved into the present facility because of expanding operations. Used oil is treated at 200° F to remove all oxidized by-products and is then filtered and analyzed to determine what additives are required so that the recycled oil meets appropriate standards. Chemicals are then added and the filtering and analysis process is repeated.

The company has no written safety policy or safety program. The safety function at the plant is managed by the President on a collateral-duty basis. The job supervisor and the plant manager are responsible for safety at the facility. All new employees undergo a three month probationary period during which time they receive on-the-job training. At the time of the incident several new workers were being trained so that a second production shift could be added at the plant.

Synopsis of Events:

On the day of the incident the victim began his shift at 4:30 p.m. His first assignment was to change the filter elements on a filtering tank. The task required approximately one-half hour for completion. The victim and a co-worker were then to pump the oil from a filtering tank into a kettle where it could be analyzed to determine what additives were needed for the oil to meet customer specifications.

The victim and co-worker used a standard 7.5 horsepower, portable bane pump and a two inch, steel-reinforced hose to accomplish this task. (Due to the type of substances being pumped, the pumps need to be rebuilt approximately every six months.) Shortly after the pumping process had begun, the co-worker saw the victim standing with one hand on the pump and “shaking.” The co-worker stated that the victim was “shaking” for five to seven seconds. As the co-worker approached the victim, the victim fell away from the pump. The co-worker momentarily attempted to administer CPR to the victim, then ran to the office area of the plant and summoned a fellow worker. Both men tried to revive the victim until the rescue squad arrived approximately five minutes after the co-worker noticed that the victim had contacted the energized pump. After defibrillation was attempted at the scene, the victim was transported to a hospital where he was pronounced dead.

Upon examination of the pump, it was found that the portable pump frame was not grounded and the insulation on one of the conductors entering the motor connection box had been damaged, allowing a live conductor to become exposed. The live conductor energized the metal pump frame. The victim provided a path to ground and was electrocuted when he contacted the pump frame. No strain relief device was present where the power cable entered the motor connection box. Without the strain relief device any force exerted on the power cable could have contributed to the damaged conductor insulation.

The electrical installation in the plant is known as a three-wire, three-phase Delta system. This system differs from other three-phase installations in that it lacks a grounded neutral (white conductor) as part of its circuit. Circuits in these installations can operate without a grounded neutral because an electrical potential difference exists phase to phase.

The plant ground system in this case was provided by electrical conduit which was connected to the structural steel of the building and the water pipes (i.e., to ground). Resistance measurements and a visual inspection by a professional engineering firm determined the ground system to be continuous with grounding values that were acceptable per the National Electrical Code (NEC). However, a grounding conductor (equipment ground or protective ground) connecting the non-current carrying metal parts of the pump to the ground system was not present on the pump. The purpose of the grounding conductor is to protect people from electrical shock by carrying the fault current to ground. The absence of the grounding conductor allowed the pump frame to become energized when the damaged conductor contacted the motor connection box.

Cause of Death:

Although the coroner’s office labeled the incident as apparent electrocution, no official ruling has been given at the time.

Recommendations/Discussion:

Recommendation #1: Electrical equipment (such as portable pumps) should be designed and maintained to comply with applicable requirements of the National Electrical Code (NEC).

Discussion: The frame of the portable pump involved in this incident was not connected to a grounding conductor and did not have strain relief provided for the power cable at the motor connection box. All plugs and power cables connected to the portable pumps were changed to a four-wire, grounded system. The fourth wire was connected to the pump frame, thus assuring adequate grounds for the portable pumps. Additionally, all electrical receptacles used with the pumps have been changed from three-pole to four-pole receptacles. The fourth pole has been grounded to the conduit system. These modifications bring the pumps into compliance with article 250-45 of the National Electrical Code (NEC).

Recommendation #2: The employer should develop and implement formal safety training.

Discussion: The employer should develop and implement a formal safety program that specifies work procedures for the various tasks a worker might be required to perform while on the job. Employees should receive safety training that would allow them to recognize and control safety hazards. Management of the plant and consultants from the Industrial Commission of Ohio are working together to accomplish these goals.

Recommendation #3: The employer should develop and implement a comprehensive preventive maintenance program for electrical equipment.

Discussion: Although the portable pumps are rebuilt approximately every six months, more frequent inspections of electrical equipment by qualified personnel should be performed to assure worker safety. Any hazards discovered should be promptly corrected. Additionally, daily inspections should be performed by users of the equipment. These daily inspections should minimally identify such hazards as damaged plugs or receptacles, damaged insulation on conductors, missing guardplates, poor or loose connections, etc. Management of the plant is working together with consultants from the Industrial Commission of Ohio to establish a preventive maintenance program at the plant.

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