The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

Electrician Electrocuted in South Carolina

FACE 87-70

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 on selected work-related fatalities.

On July 19, 1987, a 29-year-old electrician was electrocuted when he contacted the energized metal frame of an electrically powered foundry stoker that he was attempting to repair.

Contacts/Activities:

Officials of the Occupational Safety and Health Program for the State of South Carolina notified DSR concerning this fatality and requested technical assistance. This case has been included in the FACE Project. On October 14, 1987, a DSR research team (a research industrial hygienist and an epidemiologist) met with a company representative, conducted a site visit, collected incident data, and interviewed comparison workers.

Overview of Employer's Safety Program:

The employer in this incident is a foundry which smelts iron ore to make ferrous alloys and chrome by-products. At the facility where the fatality occurred there are approximately 300 employees, consisting mainly of laborers and maintenance personnel.

The employer has a written safety program and safety policy and employs a full-time plant safety manager. New employees receive safety instruction from the safety manager and hazardous areas of the operation are pointed out during a plant tour. They also receive on-the-job training from supervisors and co-workers.

The company has two safety committees which meet on a monthly basis: a Supervisor Safety Committee (composed of department managers), and a union-Management Safety Committee (composed of labor, union representatives, plant supervisors, and the safety manager). The Supervisor Safety Committee is responsible for keeping employees within each department informed of changes in the safety policy, accident rates, and safety training. Members of this committee are also required to evaluate safety practices within each department. The Union-Management Safety Committee is responsible for promoting all aspects of company safety and health, assisting in conducting safety inspections, accident investigations, and implementing accident prevention measures.

The company safety policy requires each department and shift to have at least one five minute safety talk each week (usually conducted by the department supervisor) for the purpose of informing employees concerning safety and health requirements and to encourage worker participation in the safety program. Each employee is required to sign a statement certifying that they have received and read a copy of the company safety policy.

Synopsis of Events:

The foundry where the fatality occurred uses electrical stokers, located on the second floor of the foundry, to add raw materials to the furnace. The stokers are modified industrial trucks, each powered by a 40 horsepower electric motor. Power to each stoker is supplied by a reinforced flexible cord (440 volt, three phase, four wire, 60 cycle system) on a retractable overhead reel.

At 8:00 a.m. on July 19, 1987, the victim began his shift by attempting to repair the No. 5 stoker which had been reported as being electrically inoperable. Although the victim had not been formally trained to do this type of work, he had worked as a maintenance electrician for the company for seven years and, according to co-workers, had successfully performed similar repair procedures “dozens of times.” Using an electrical continuity tester, the victim identified an internal break within the last four feet of the flexible power cord that plugged into a receptacle mounted on the stoker. The victim disconnected the power and locked the “on/off” switch into the “off” position. He then unplugged the flexible power cord to the stoker. The plug and four feet of the flexible power cord which contained the internal break were cut off and the defective section of the cord was discarded. The victim then re-wired the plug back onto the newly cut end of the flexible power cord. During this process the victim inadvertently crossed the wires and connected the ground wire to the hot plug terminal and a hot wire to the ground plug terminal. After reinserting the plug, the victim turned the power switch on. The reversed wiring caused a fuse to blow in the fuse box (located one floor above). When a co-worker (stoker operator) reported the stoker was still inoperable, the victim turned the power switch off, replaced the blown fuse, and turned the power on again. There were no eyewitnesses but evidence (approximately six discarded fuses beside the fuse box) suggests the victim repeated this process several times. Eventually, the ground wire melted off from the lug where it was connected at the fuse box. This interrupted the continuous path to ground and resulted in the frame of the stoker remaining energized. Presumably, in an attempt to check if the stoker was operational, the victim touched the metal foot pedal on the stoker with his left hand. Current entered his left hand and exited to ground potential through both legs. The victim collapsed, breaking contact with the stoker.

A co-worker in the general area of the stoker observed the victim lying beside the stoker on the cement floor approximately 3-4 minutes after the victim was last seen working on the stoker. This co-worker called for help, and several other co-workers carried the victim downstairs and outside of the building, where cardiopulmonary resuscitation (CPR) was initiated. Because it was a hot day with high humidity and the victim and his clothes were wet with perspiration, the co-workers assumed that he had collapsed due to heat exhaustion. It was not until the paramedics arrived (approximately ten minutes after the victim was observed down) that electrical burns were noted on the left arm. CPR was continued by paramedics, who also initiated advanced cardiac life support (ACLS) measures on-site and during transport to a local hospital. The victim arrived at the hospital emergency room approximately 45 minutes from the time that the victim was first observed unconscious beside the stoker. Attempts to resuscitate the victim continued for a short time in the emergency room, but proved unsuccessful and the victim was pronounced dead at 11:26 a.m. by the attending physician.

Cause of Death:

The medical examiner’s report stated that the victim died as a result of cardiac arrest due to a low voltage electrocution. An autopsy which was performed noted electrical burns on both shoulders, the left arm, and both thighs. A urine drug screen indicated the presence of marijuana. This, however, does not necessarily imply that the victim’s judgement was impaired when the accident occurred, since trace amounts of marijuana can be present in the urine for several days after marijuana is smoked.

Recommendations/Discussion

Recommendation #1: Employers should assure that personnel assigned to perform electrical maintenance are trained sufficiently in the recognition and control of the hazards they may encounter in the performance of their daily duties.

Discussion: Fuses are safety features, but they are designed primarily to protect the electrical system rather than the worker. A worker who had been properly trained would have realized a malfunction existed in the electrical system as fuses were repeatedly blown when power was restored to the stoker. Testing devices (ohm meter, continuity tester, etc.) could then have been used to pinpoint the problem (in this case the improper connections). Once the problem was identified, it could have been corrected. Although the victim had a testing device present that would have identified the problem, he instead continued to replace the fuses. This led to the disruption of the grounding path and the creation of a hazardous situation. Had the victim been trained in the recognition of electrical hazards, this fatality might have been prevented.

Recommendation #2: All electrical equipment should be inspected regularly to identify potentially hazardous conditions requiring preventive maintenance.

Discussion: The flexible cord/reel retractor system that provides electrical power to each stoker should be: 1) inspected regularly by qualified personnel to identify the development of potentially hazardous conditions arising from normal use, and 2) re-evaluated to identify possible electrical safety design modifications that may be incorporated into the facility's electrical system (i.e., a means of minimizing stress on the flexible power cord during stoker use).

Return to In-house FACE reports

Last Reviewed: November 18, 2015