Power Substation Worker Falls 12 Feet to His Death After Contacting a 26,000 Volt Power Line.

DATE: July 23, 1991

SUMMARY

On February 15, 1991, a 53-year-old electrical substation mechanic suffered a fatal fall after making contact with an energized 26,000 volt power line. The incident occurred when the victim climbed a ladder and attempted to free a jammed switching device. Thinking that the lines were de-energized, the worker was shocked after touching a live electrical conductor, causing him to fall 12 feet to the ground. NJDOH FACE investigators concluded that, in order to prevent similar incidents in the future, the following safety guidelines should be followed:

- ***All electrical lines and conductors should be tested to ensure that they are de-energized prior to working on or near them.***
- ***Adequate clearance must be maintained between the worker and energized lines to prevent inadvertent contact. If this is not possible, physical guards (barriers) should be placed between the worker and the hazard.***
- ***Employers should ensure that established company safety procedures are followed at all times.***

INTRODUCTION

On February 19, 1991, NJDOH FACE personnel were notified by the OSHA area safety supervisor of a work-related fatality that occurred on February 15, 1991. On February 21, 1991, FACE personnel visited the site with the OSHA compliance officer to interview the employer and photograph the scene. A witness was also interviewed in the presence of his union representative. Other information was derived from the OSHA file, police report, and medical examiner's report. We were denied access to the utility company's investigative report.

The employer is a large electrical utility company that has been in business since early in this century. The company employs 13,000 workers in all divisions and is unionized. Each division has a safety supervisor and provides an organized training program for employees. Safety rules and procedures are extensive and in writing. As part of their training, employees are certified yearly in CPR.

The deceased was a 53-year-old male who had been working for the company for 20 years. He had been trained entirely by the company, starting as a helper but soon becoming an apprentice. After completing his apprenticeship, he worked his way up to substation mechanic, a position he held for nearly 10 years. The deceased had no known physical disabilities and was apparently in good health at the time of the incident.

INVESTIGATION

The incident occurred at an outdoor electrical substation that is surrounded by a chain-link fence. The substation supplies power to a large metal foundry that also owns and maintains the station. The station receives power through one of two 26,000 volt transmission lines, a primary line and a secondary back-up line. The primary line normally supplies the power while the secondary is available if the primary line fails or needs servicing. The lines are controlled with manually operated line and ground disconnect switches. When opened, the line switch disconnects the transmission line from the substation, while closing the ground switch connects the line to ground. These switches are operated by pulling levers at ground level that mechanically engage or disengage knife switches located approximately 10 feet overhead. The nature of the foundry processes require the substation to be energized at all times.

On the day of the incident, a cold day with occasional snow showers, the victim and a co-worker (employee #2) were summoned to the substation by an employee (employee #1) who needed assistance. Employee #1 had been assigned the task of returning power to the primary transmission lines which had been de-energized for maintenance by the power company. For safety reasons, the de-energized primary lines had been grounded by closing the ground disconnect switch. Employee #1 had attempted to open the ground disconnect by pulling at the switch lever, found that it was jammed, and requested help. On arriving, the victim and employee #2 were also unable to move the switch, even when they used an extension handle for increased leverage. The victim saw that a knife switch blade was binding and stated that it could be released if tapped with a hammer. He had initially asked a co-worker "is the line out and grounded?", and was told that it was. Although a neon tube test stick was available, neither the victim nor the other workers had tested the circuits to see if they were energized. (A neon tube test stick consists of a neon light mounted on an insulated pole. The light glows when brought in the proximity of high voltage current).

Employee #2 carried a wooden ladder from the truck and positioned it below the jammed switch. The victim repositioned the ladder to be sure the feet were set into the gravel (see diagram). He then instructed the other two workers to put pressure on the ground disconnect lever but not to push so hard that the switch would fly open. Wearing short leather gloves, he climbed the ladder and tapped the knife switch of the disconnect with a wood-handled hammer. Almost immediately, witnesses saw a flash and the victim falling backwards off the ladder. His co-workers attempted to catch him but he fell approximately 12 feet to the ground.

One worker immediately ran to summon help on the truck radio while the second started CPR. The worker returned from the truck and helped with CPR until the police arrived and took over. The rescue squad arrived and transported the victim to the regional trauma center, which was also the closest hospital to the site. The victim was stabilized in the emergency room and transferred by helicopter to a hospital burn center in a neighboring state. He died at the hospital the next day.

The victim suffered severe burns to his forearms, upper extremities, and chest muscles. Burn marks found on the substation indicate that he apparently contacted an energized conductor mounted on an insulator, the ground being completed through the substation framing. An examination of the substation wiring diagram found that the primary and secondary transmission lines are not fully isolated from one another, i.e., both lines share many of the same switching components and conductors within the substation. This design allowed current from the secondary line to be fed back into some of the components of the primary line, components that the victim had assumed to be de-energized. A schematic wiring diagram of the substation is included in this report.

CAUSE OF DEATH

The cause of death was attributed to severe hemorrhage due to multiple vertebral and rib fractures resulting from a fall following an electrical shock.

RECOMMENDATIONS AND DISCUSSION

Recommendation #1: All electrical lines and conductors should be tested to ensure that they are de-energized prior to working on or near them.

Discussion: Although a neon tube test pole was available, the victim only asked if the circuits were safe. Before any work is done on or near electrical systems, all components of the system that may be contacted should be tested to ensure that they are de-energized. Testing the circuits would have indicated that they were live and prevented the fatality.

Recommendation #2: Adequate clearance must be maintained between the worker and energized lines to prevent unintentional contact. If this is not possible, physical guards (barriers) should be placed between the worker and the hazard.

Discussion: In placing the ladder near the switch, the worker was in close proximity to energized conductors and was electrocuted when he contacted one. Proper physical clearance between the worker and energized conductors must be maintained to prevent casual contact. If this is not possible, then guards such as insulating sleeves and barriers should be placed on the conductors.

Recommendation #3: Employers should ensure that established company safety procedures are followed at all times.

Discussion: In this incident, the victim acted against several established company safety policies. The company's written procedures require that all high voltage circuits should be considered live and must be tested before they can be accepted as de-energized. Procedures also require that ladders must be tied off and placed so that it is impossible for anyone to touch live equipment while working from them. Additionally, employees must use safety belts that are tied off to structures during operations that require the use of two hands while on the ladder. Management should re-affirm the necessity of following established safety procedures with all supervisors and workers.

FATAL ACCIDENT CIRCUMSTANCES AND EPIDEMIOLOGY (FACE) PROJECT

Staff members of the FACE project of the New Jersey Department of Health, Occupational Health Service, perform FACE investigations when there is a work-related fatal fall or electrocution reported.

The goal of these investigations is to prevent fatal work injuries in the future by studying: the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

To contact New Jersey State FACE program personnel regarding State-based FACE reports, please use information listed on the Contact Sheet on the NIOSH FACE web site. Please contact In-house FACE program personnel regarding In-house FACE reports and to gain assistance when State-FACE program personnel cannot be reached.