The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research

Laborer Dies from Electrical Injuries Sustained in an Electrical Distribution System Substation in Virginia

FACE 90-31

SUMMARY

A laborer died 15 days after a 10.5-foot-long galvanized pipe he was carrying contacted an energized 12,500-volt jumper wire at an electrical distribution system substation. One end of the jumper wire, was attached to a step-down transformer at a position approximately 11 feet above ground level. The other end of the jumper wire was attached to an overhead powerline. The victim was part of a two-person crew assigned to pull wire through a newly installed underground conduit. The victim positioned a truck containing reels of wire, a reel rack, and a galvanized pipe that was going to be used as a reel rack spindle, inside the substation approximately 8 feet from a transformer. While his co-worker (the crew leader) was working on a separate task approximately 40 feet away, the victim apparently lifted the pipe from the back of the truck and turned toward the transformer with the pipe in a vertical position. The pipe contacted the jumper wire, and the current passed through the pipe and the victim to ground, injuring the victim. NIOSH investigators concluded that in order to prevent future similar occurrences, employers should:

- **evaluate their existing safety program to ensure that appropriate procedures to reduce worker exposures to hazards, especially electrical hazards, have been developed and implemented**
- **provide employees with adequate training to ensure that they can recognize potential hazardous exposures**
- **conduct initial jobsite surveys to identify hazards associated with each jobsite and develop job specific methods of controlling these hazards.**

INTRODUCTION

On April 23, 1990, a 21-year-old male laborer was injured when the galvanized pipe he was carrying contacted a 12,500-volt jumper wire. He died as a result of those injuries on May 8, 1990. On May 16, 1990, officials of the Virginia Occupational Safety and Health Administration notified the Division of Safety Research (DSR) of this fatality and requested technical assistance. On May 24, 1990, a safety specialist from DSR conducted an investigation of this incident. The investigator reviewed the incident with a company representative and the OSHA compliance officer assigned to the case. Photographs of the incident site and the victim's death certificate were obtained during the investigation.

The employer in this incident is a public electric cooperative company that has been in operation for 52 years and employs 31 workers. The company maintains an electrical power distribution system that serves a six-county area. The company has written safety procedures and the general manager administers the safety program. On-the-job and classroom training are provided to the employees, and safety tailgate meetings are held prior to the start of all new projects. Pre-employment physicals are required of all new employees. The victim worked for this employer for 8 months prior to this incident.

INVESTIGATION

The company was in the process of installing an energy conservation control system at one of their nine substations. Work on the project had begun on April 1, 1990. At the time of the incident, construction had been completed on an 8-foot-wide by 8-foot-long by 8-foot-high wooden building. Remote control electronic equipment had been installed inside the building to enable operation of the substation voltage regulators from the main office. Conduit had been installed underground from the building to the regulators, a distance of approximately 30 feet.

On the day of the incident, a two-man crew consisting of a crew leader and a laborer (the victim), arrived at the substation to pull wire from the voltage regulators, through the buried conduit, to the electronic equipment in the wooden building. The substation consisted of three step-down transformers; three voltage regulators; incoming overhead powerlines (34,500 volts); outgoing overhead powerlines (12,500 volts); and the newly constructed building, equipment, and conduit.

The crew arrived at the substation in two vehicles. One vehicle, containing reels of wire, a reel rack, and a 10.5-foot-long galvanized pipe that was going to be used as a reel rack spindle, was driven into the substation by the victim. The victim positioned the back of the truck approximately 8 feet from the transformers, unloaded the reel rack and placed it near the regulators. Although no one witnessed the incident, it is assumed that the victim lifted the galvanized pipe from the back of the truck and turned toward the transformers. As the victim turned holding the pipe in a vertical position, the pipe contacted a 12,500-volt energized jumper wire, which was attached between a step-down transformer and an overhead powerline (approximately 11 feet from ground level). The current passed through the pipe and victim to ground seriously injuring the victim (Figure).

The victim's co-worker (the crew leader) had parked the vehicle he was driving and walked to the wooden building. He was preparing to pull a piece of wire through the conduit when he noticed a bright flash. He turned toward the victim and saw him fall to the ground. The co-worker ran to the victim and found him conscious. The co-worker then ran to the truck and radioed the company office to report what had occurred. The emergency medical service (EMS) was summoned and arrived at the incident site within 5 minutes after being contacted. The EMS transported the victim to the local hospital where he died 15 days later.

CAUSE OF DEATH

The certificate of death listed the cause of death as sepsis due to complications from electrical injury.

RECOMMENDATIONS/DISCUSSION:

Recommendation #1: Employers should evaluate their existing safety program to ensure that appropriate procedures to reduce worker exposures to hazards have been developed and implemented.

Discussion: Employers should ensure that existing safety programs include specific written procedures and guidelines for workers to follow pertaining to hazardous exposures likely to be encountered. Particular emphasis should be given to electrical hazards (e.g., energized jumper wires), and the need for and proper use of personal protective equipment. For example, employers should require that any employee entering a substation be provided and required to wear hardhat, gloves, and boots suitable for the maximum voltage of the equipment in the installation. Adherence to employers' safe working procedures and guidelines should be enforced at all times.

[Note: The company has instituted the following revision to their current safety program: All personnel entering substations will be required to wear insulated footwear.]

Recommendation #2: Employers should provide employees with adequate training to ensure that they can recognize potential hazardous exposures.

Discussion: OSHA standard 1926.21(b)(2)(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 to 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. When new company procedures or guidelines are developed or existing ones modified, employers should ensure that workers are provided with appropriate supplemental training.

Recommendation #3: Employers should conduct an initial jobsite survey to identify all hazards associated with each specific jobsite, and implement, where applicable, additional methods of safeguarding employees in those working areas.

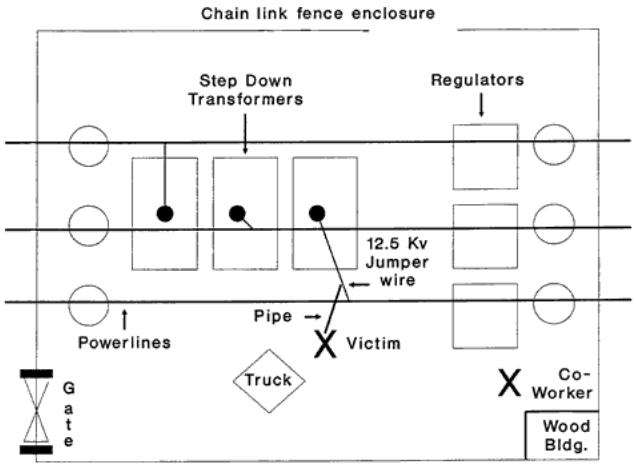
Discussion: Employers should conduct jobsite surveys to identify potential worker hazards so that appropriate preventive measures (e.g., subsequent training to employees specific to identified site hazards), to control these hazards can be applied prior to the start of any work. Two characteristics of this jobsite combined to produce a very serious hazard: 1) an energized jumper wire located 11 feet above ground level, and 2) the use of a conductive 10.5-foot galvanized pipe in the vicinity of the energized jumper wire. Such potential hazards can be minimized by ensuring that employees maintain a safe distance from energized conductors, by providing employees with non-conductive tools and materials, and/or by de-energizing or covering electrical conductors with insulating material (e.g., line hoses). [Note: The conductive galvanized pipe involved in this incident was to be used as a spindle to support the reels of wire on the reel rack. A spindle made of wood, fiberglass, plastic, or other nonconductive material, may have been substituted for the galvanized pipe.] Additionally, when work needs to be completed within a substation, employers should consider isolating the substation and de-energizing all circuits in the installation before work begins. To minimize disruption of service to customers, employers could schedule such work inside substations during periods when customers are minimally affected or consider providing service through alternate paths in area electrical networks.

REFERENCES

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

2. Office of the Federal Register: Code of Federal Regulations, Labor 29 Part 1926. p.20. July 1, 1989.

(Top View)



(not to scale)

Figure. Electrical Distribution System Substation

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Last Reviewed: November 18, 2015