

Electrician Electrocuted When He Contacts Energized Conductor in a Manhole in Virginia

SUMMARY

A 24-year-old male electrician was electrocuted when he inadvertently contacted a 2,300-volt, 6.6-amp conductor. The incident occurred while the victim was working inside a manhole splicing a conductor. The victim and a co-worker were part of a six-person crew assigned to install a new lighting system at an airport. The system consisted of three circuits: 1) an energized 2,300-volt, 6.6-amp runway lighting circuit; 2) an energized 700-volt temporary taxiway lighting circuit; and 3) a de-energized taxiway lighting circuit. The victim entered the manhole through a 24-inch-diameter manway opening and descended a metal ladder attached to the inside of the 5-foot-square by 7-foot-deep concrete manhole. The victim removed a pair of insulated side (wire) cutters from his tool belt to prepare the de-energized taxiway lighting conductor for splicing. He cut a size 8 AWG conductor which was hanging over a rung of the metal ladder without determining whether or not the circuit was energized. The conductor, which was part of the energized runway lighting circuit, separated into two pieces. The energized end came in contact with the back of the victim's right hand. Current passed through the victim's right hand and exited his right thigh at the point where it was in contact with the grounded metal ladder. NIOSH investigators concluded that, in order to prevent future occurrences, employers should:

- *establish required procedures for the protection of employees exposed to electrical hazards and provide worker training in the recognition and avoidance of hazards that addresses procedures for identifying, testing and de-energizing circuits*
- *conduct initial jobsite surveys to identify electrical hazards and apply job specific methods for controlling these hazards.*

INTRODUCTION

On May 1, 1990, a 24-year-old male electrician was electrocuted when he inadvertently contacted an energized conductor in a manhole. 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, and photographed the incident site. Copies of the police report, autopsy report, and death certificate were obtained during the investigation.

The employer in this incident is an electrical contractor, engaged primarily in commercial and industrial electrical construction. The company has been in operation for 22 years and employs 97 workers, including 51 electricians. The company has a written safety policy and safety rules which are administered by the loss control/personnel manager. In addition, weekly safety toolbox meetings are held. The employer also uses a safety incentive program and a stepped (graduated) disciplinary system which consists of: 1) first incident - verbal counseling, 2) second incident - a written warning, and 3) third incident - discharge. The victim worked for this employer for 3 years and 9 months prior to the incident.

INVESTIGATION

The company had been contracted to install a lighting system for the taxiway and runway at a local airport. Work had been intermittent since September 5, 1989. At the time of the incident, the job was within 3 weeks of completion. Pre-formed concrete manholes 5-feet-square by 7-feet-deep with 24-

inch-diameter openings (manways), which provided access to the underground circuitry for the three lighting systems, had been previously installed (Figure). An existing, energized 2,300-volt, 6.6-amp, runway lighting circuit was operating during twilight and night hours each day. Additionally, each manhole contained an energized, 700-volt temporary taxiway lighting circuit, and a de-energized permanent taxiway lighting circuit. Work was in progress to complete the wiring for the permanent taxiway lights. Temporary work area lighting (vapor lights) had been installed.

On the evening of the incident, a crew of six employees (i.e., one equipment operator, two apprentice electricians, two journeyman electricians, and one electrician/foreman) arrived at the incident site to continue work on the lighting systems. The victim and a co-worker were assigned the task of splicing the temporary taxiway lighting circuit conductors into the new conductor for the permanent taxiway lighting circuit, and making the appropriate connections. All the conductors were buried underground and the manholes provided access to the conductor junctions. Standard company procedure involved testing each circuit in the manhole by using an amp probe (i.e., a device used to detect current in a conductor) prior to working on that circuit, identifying the energized runway and temporary taxiway circuits, cutting the de-energized circuit (permanent taxiway circuit), and splicing together the appropriate conductors.

Prior to the incident, the victim and co-worker had completed connections for the permanent taxiway lights in four separate manholes. The victim entered the fifth manhole via a 24-inch-diameter manway, descended a metal ladder attached to the inside of the manhole, and positioned himself on the ladder facing the circuit conductors. He removed a pair of insulated side (wire) cutters from his tool belt and, without using the amp probe to test for current in the conductors, cut a hanging conductor. The conductor, which was part of the energized runway lighting circuit, came in contact with the back of the victim's right hand after being cut in half. Current passed through the victim's right hand and exited his right thigh at the point of contact with the grounded ladder.

The co-worker was standing near the top of the manhole observing the victim. After realizing what had occurred, he knocked the victim off the ladder away from the energized conductor. He entered the manhole and carried the victim out. The co-worker then notified the electrician/foreman, who was in the area but working on a separate task. The foreman summoned airport emergency rescue personnel who arrived within 3 minutes after being contacted. The rescue squad provided advanced cardiac life support and transported the victim to the local hospital where he was pronounced dead 45 minutes after the incident occurred.

CAUSE OF DEATH

The medical examiner listed the cause of death as electrocution.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should establish required procedures for the protection of employees exposed to electrical hazards and provide worker training in the recognition and avoidance of such hazards.

Discussion: Employers should comply with OSHA construction safety standard 29 CFR 1926.416 (a) (1) by prohibiting employees from working in close proximity to energized electrical circuits where the employee could make contact in the course of work, unless the employee is protected against electric shock by de-energizing and grounding the circuit and/or by effective guarding. Employers should provide worker training in recognizing electrical hazards and in safe work procedures, including

identifying circuits, testing circuits, de-energizing circuits, locking/tagging de-energized circuits, and verifying de-energization.

Recommendation #2: Employers should conduct initial jobsite surveys to identify all hazards associated with each specific jobsite, and develop specific methods of controlling the identified hazards.

Discussion: Employers should comply with OSHA construction safety standard 29 CFR 1926.416 (a) (3) by conducting initial jobsite surveys prior to the start of any work to identify potential situations for employee contact with energized electrical circuits, and by providing subsequent employee notification about protective measures (i.e., identification, testing, de-energization, locking/tagging of energized conductors, verification, and sufficient work area lighting) to be implemented to control the hazards.

REFERENCES

1. Office of the Federal Register: Code of Federal Regulations, Labor 29 Part 1926. p.162. July 1, 1989.