

MISSOURI OCCUPATIONAL FATALITY ASSESSMENT AND CONTROL EVALUATION (MO FACE)

Journeyman Lineman Electrocuted Following Contact With Energized Lightning Arrestor

MO FACE Investigation: # 98MO101

Type: Electrocution

Date: September 2, 2005

SUMMARY

On October 6, 1998, a 39-year-old male journeyman lineman (victim) working for an electrical contracting company sustained a fatal electrical contact with an energized lightning arrestor. The victim, coworker, and foreman were working at an electrical substation, which serves a town of approximately 3,500. The city was in the process of switching their electrical service over from a three-phase 4 kV system to a 12 kV system. The victim and co-worker were on the steel framework of the substation tightening up nuts and bolts on the conductors they had installed. The victim worked his way over to the incident point where he sat down on the structure next to the energized lightning arrestor. He then contacted the arrestor with his left hand and forearm. He fell backward breaking contact with the electricity. The co-worker, foreman, and a city worker climbed up to the victim and immediately started CPR. Emergency personnel were summoned to the scene. The victim was transported to a local hospital where he was pronounced dead.

The purpose of the FACE Program is to identify risk factors that contribute to worker injury and death, and to make recommendations to employers and individuals on how similar events can be avoided. From the information collected about this incident, the MO FACE investigator concluded that employers should:

- ✧ **ensure that all energized conductors are covered by line hoses or line blankets while employees are working in the vicinity of the energized conductors;**
- ✧ **ensure that comprehensive hazardous energy control measures, including proper lockout/tagout procedures, are fully implemented and enforced.**

INTRODUCTION

On October 6, 1998, the MO FACE investigator was notified of an occupational fatality at a city electrical substation in Missouri. The city's safety officer requested the assistance of the FACE Program. The next day the investigator traveled to the incident site. On site were OSHA, the company vice president/safety officer, the consulting engineer on the project, and city safety officer who was on-site at the time of the incident. Site photographs were taken.

The employer in this incident was an electrical contractor who specializes in all types of electrical construction. They had contracted with the city to reconstruct their current electrical system. They have been in business for approximately 35 years. They have 19 employees, nine of which have the same job title as the victim, four-apprentice lineman, and one groundman. The company had and enforced a written company safety and health program. The victim was a certified journeyman lineman with the local electrician's union, and had been employed by the company for approximately six years.

The city has utilized this company for their electrical construction needs for many years. The victim had worked at this incident site on several occasions during the entire length of his employment. The company had started this project in the spring of the year, but completion was postponed due to an unusually warm spring. The employer had resumed work on the project for seven days when the incident occurred.

INVESTIGATION

The city involved in this incident was in the process of reconstructing their current electrical distribution system. They had a three-phase 4,160-volt system that served

most of the city, and a 12,470-volt system that served an expansion area and a large shopping center. Due to increased electrical demands from the city's expansion projects, they needed to upgrade the entire system to three-phase 12,470-volts. The project was started in May 1998, but due to an unusually hot spring, and the associated high demand for electricity, the completion of the project was postponed until late September 1998.

To change the system over to the higher voltage service, the substation and most of its components had to be de-energized and replaced. In May 1998, in preparation for this changeover, and to maintain electrical service to the city, two temporary service lines were established from the incoming power source to two existing outgoing circuits. These temporary lines ran through two separate conduits buried under a layer of crushed limestone. These two circuits were to remain energized during the remainder of the reconstruction. Both of these circuits had lightning arrestors associated with them attached and grounded to the substation's structure. The lightning arrestor provides over-current protection in the event of a lightning strike or other source of extremely high voltage on the line. This protects electrical appliances in the homes and businesses from being damaged by the electrical surge. The victim was responsible for setting up and making these temporary electrical connections. This is relevant because it was the electricity from this temporary service that he contacted.

On the day prior to the incident, in coordination with the city, they began isolating the substation from all incoming and outgoing electricity. The city's electrical engineer first opened the outgoing three-phase gang buss bar. He then locked-out the bus bar in the open position. The city safety officer and company foreman visually confirmed it was in the open position. They then went to the incoming line and again opened this three-phase gang bus bar. The city engineer also locked-out this bus bar in the open position. It also was visually confirmed. The company then verified the lines were de-energized and clamped grounding cables to each of the three phases on both the outgoing and incoming lines. Except for the two temporary services that were serving the city, the substation was isolated from both energy sources, and the workers could begin replacing the 4 kV components with the 12 kV components.

The day of the incident the workers continued to reconstruct the system for 12kV. After lunch they worked on some re-routing of the bus bar copper tubing. They used a company bucket truck to ascend onto the structure. The victim and coworker climbed out onto the structure and began the process of checking over the work they had done that day and ensuring that all nuts and bolts were tightened up. The co-worker was working over the western half of the structure while the victim worked over the eastern half. The foreman was on the ground working with the consulting engineer, and the city safety officer was operating a skid-steer loader nearby.

Though the following events were unwitnessed, it is believed that the victim worked his way over to where the 4 kV temporary service circuit was on the structure. His intent for being there is unknown. He sat down on the structure next to the energized lightning arrestor. He then contacted the conductor with his left hand and forearm. The victim was electrocuted and fell backward breaking the contact from the electricity. With his legs down through the structure angle iron, he was hanging backward. The coworker and foreman immediately came to his aid. They lifted him back up onto the structure away from the energy source and started CPR. In order to protect the rescuers, the consulting engineer ran to the switch energizing the temporary circuit and opened it. The city safety officer ran and opened the switch that sends the electricity out to the city. Then the safety officer climbed up onto the structure and assisted giving CPR. Emergency personnel were also immediately notified and responded. Also the life-flight emergency helicopter was dispatched to the scene. Emergency Medical Services arrived and the victim was placed on a backboard while still on the structure. The bucket truck was positioned and raised up to the where they could transfer him over to it so they could lower him to the ground. CPR continued on the victim. He was taken by ambulance to a local trauma center where he was pronounced dead.

CAUSE OF DEATH

Electrocution

RECOMMENDATIONS / DISCUSSION

Recommendation # 1: **Employers should ensure that all energized conductors are covered by line hoses or line blankets while employees are working in the vicinity of the energized conductors.**

Discussion: In this incident the victim and co-worker were doing non-energized electrical work in the vicinity of energized conductors. When electrical work is conducted in the vicinity of energized electrical conductors, line hoses, blankets or other appropriate insulating devices should be incorporated to prevent inadvertent contact with energized conductors.

Recommendation # 2: **Employers should ensure that comprehensive hazardous energy control procedures, including proper lockout/tagout procedures, are fully implemented and enforced.**

Discussion: Though not directly related to the fatality, the importance of a properly designed and implemented lockout/tagout policy is essential to ensure the safety of all workers exposed to hazardous energy sources.

In this incident the city took the responsibility to lockout the incoming and outgoing electrical service to the substation. The process was observed and verified by the employer. The employer tested the lines for voltage and grounding clamps were applied to both incoming and outgoing service lines.

Employers whose workers are exposed to hazardous energy sources should take 100 percent responsibility for the lockout/tagout process. When working at host facilities they should place their locks and tags on the hazardous energy control mechanism in addition to those from other contractors and the host facility. Employers should ensure 100 percent control of hazardous energy sources by identifying the sources and by conducting a proper lockout/tagout procedure.

The Missouri Department of Health, in co-operation with the National Institute for Occupational Safety and Health (NIOSH), is conducting a research project on work-related fatalities in Missouri. The goal of this project, known as the Missouri Occupational Fatality Assessment and Control Evaluation Program (MO FACE), is to show a measurable reduction in traumatic occupational fatalities in the state of Missouri. This goal is being met by identifying causal and risk factors that contribute to work-related fatalities. Identifying these factors will enable more effective intervention strategies to be developed and implemented by employers and employees. This project does not determine fault or legal liability associated with a fatal incident or with current regulations. All MO FACE data will be reported to NIOSH for trend analysis on a national basis. This will help NIOSH provide employers with effective recommendations for injury prevention. All personal and company identifiers are removed from all reports sent to NIOSH to protect the confidentiality of those who voluntarily participate with the program.

SIGNATURES:

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Chief Investigator

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Chief
Office of Surveillance

MO FACE Dissemination List

NIOSH
Alaska Department of Health and Social Services
California Public Health Foundation
University of Iowa
Kentucky Injury Prevention and Research Center
Massachusetts Department of Public Health
Maryland Division of Labor & Industry
Minnesota Department of Health
Nebraska Department of Labor
State of New Jersey Department of Health
Ohio Department of Health
Oklahoma State Department of Health
Texas Worker's Compensation Commission
Washington Department of Labor & Industries
Wisconsin Division of Health
WVU School of Medicine
Wyoming Department of Health
Missouri Southern State College
Missouri Department of Public Safety
Cuivre River Electric Company
University of Missouri
OSHA Kansas City Area Office
MIRMA
OSHA St. Louis Area Office
St. Joseph Safety Council
Missouri Safety Council
St. Louis County Department of Community Health
41st Judicial Circuit of Missouri
Cape Girardeau County Community Traffic Safety
St. Louis County Medical Examiner Office
AMEC
Missouri Police Chiefs Association
Children's Mercy Hospital
St. Louis City Medical Examiner Office
St. Charles Police Department
Grundy Electric Company
Jackson County, Office of the Medical Examiner
Shelter Insurance Companies
Missouri Hospital Association
Safety Council of Greater St. Louis
MO Department of Elementary & Secondary Education
Missouri Farm Bureau
Missouri State Labor Council
Empire District Electric Company
Mine Safety and Health Administration
Safety Council of the Ozarks
Missouri Department of Mental Health
Missouri Department of Labor and Industrial Relations
Empire District Electric Company
North Central Missouri Safety Council
Safety and Health Council of Western Missouri & Kansas

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