MIFACE INVESTIGATION REPORT: #08MI037

SUBJECT: Lineman Electrocuted When He Contacted 7,200-volt Power Line

Summary

On June 2, 2008, a 47-year-old male journeyman lineman/foreman was electrocuted during the installation of a new 15 KV switch for a single phase, 7,200-volt overhead power line suspended from a wood pole. The decedent was working from an insulated aerial bucket. He had not de-energized the can arrestor fastened to the side of the transformer. He had removed his lineman's gloves prior to removing the first lower bolt of the arrestor. His coworkers believe the can arrestor tipped and the decedent attempted to catch it with his right hand. The current passed through his right hand, across his chest and exited his left hand, which was in contact with a second energized conductor. The decedent yelled to his ground man to lower the bucket. When the bucket was lowered, the decedent was still breathing, but unconscious. The ground man yelled to a two-person journeyman line crew working approximately 200 yards away to come over to help lift the decedent from the bucket. After taking the decedent out of the bucket, the crew began CPR while the ground man called his supervisor for assistance. The supervisor called for emergency response. Arriving six minutes later, the emergency response personnel took over medical care, and then transported him to a local hospital where he was declared dead.

Figure 1. Transformer/can arrestor involved in incident, looking north

RECOMMENDATIONS

- Employers should ensure that linemen follow established safe work procedures to de-energize, ground, and verify the work area is de-energized through testing prior to beginning maintenance and repair operations on power lines.
- Employers should ensure that linemen use all appropriate protective equipment, including insulated tools, before attempting any work on power lines with energized circuits.

- Employers should conduct both scheduled and unscheduled jobsite safety inspections on a regular basis.
- Employers should develop checklists of proper safety procedures and equipment for each job, which could be used to reinforce safe work practices.
- Employers should ensure communication devices are operational in all work locations or have alternate methods of communication developed.

INTRODUCTION

On June 2, 2008, a 47-year-old male journeyman lineman/foreman was electrocuted during the installation of a new 15KV switch for a single phase, 7,200-volt overhead power line suspended from a wood pole. On the same day, MIOSHA Construction Safety and Health division personnel notified MIFACE that the above incident had occurred. On September 4, 2008, the MIFACE researcher interviewed both the company owner and the firm's safety director. During the course of writing this report, the police report and pictures, death certificate, medical examiner report, and the MIOSHA file and citations were reviewed. All pictures used in this report are courtesy of the responding police department.

The company for whom the decedent worked constructed and repaired electrical overhead power lines. The firm had been in business for 11 years. At the time of the incident, the firm employed 20 individuals, 12 of whom were journeyman lineman. The firm hires only union journeyman linemen from the local union hall, who have successfully completed union training requirements. The decedent was an hourly, full time employee and was a member of the local union hall. The normal work shift was four 10-hour days. The work shift began at 7:30 a.m. and concluded at 5:30 p.m. The decedent had 15 years of experience as a journeyman lineman. He had worked for this employer for seven years.

The company owner stated he did "surprise inspections" in the field during storm repair, but had not kept written record of such inspections. Few surprise inspections were conducted for routine work. If any safety hazards were observed, they were addressed immediately with the crew and then with the entire company at the next safety meeting. If the company had any disciplinary actions, they would turn them over to the union hall for disciplinary action to be taken. The company would give a verbal warning first, and then time off. They had not had to do that with any of their employees. The decedent had never been disciplined by the union or the employer.

The company had a written safety program developed by a private consultant. The safety director had attended many MIOSHA-sponsored classes. The employees were required to wear eye/face protection, rubber sleeves and gloves, leather protectors for rubber insulating gloves, hard hat and fall protection. The decedent was wearing eye/face protection, rubber sleeves, hard hat and fall protection but no gloves at the time of the incident. Per company policy, the electrical personal protective equipment is sent for testing and certification every four months.

Both the company and the union hall provided safety training. The lineman/foreman held daily tailgate talks prior to beginning the assigned work for the day. Weekly safety meetings were held by the safety director. Although the company provided additional health and safety training, it relied on the union-sponsored health and safety training for linemen. For example, if there were new applications required for line work, the union hall would provide this training. Safety responsibilities on site were delegated to the designated lineman/foreman. The firm did not have a health and safety committee.

Both the company and the union policy mandated that when employees leave the ground they wear hot gloves and sleeves until they are back on the ground. Company policy also required the linemen to wear a hard hat, safety glasses and a fall harness; to use insulated tools; and to ensure that the truck was grounded. Employees were required to shut off power whenever possible. The company's procedure for changing out the switches on the transformers involved de-energizing the transformer, hanging the switch, changing out the arrester, making the appropriate connections, and then reenergizing the transformer. When working on a single phase line, the company required a two-person crew (journeyman and fourth-year apprentice) to work on the line/pole/transformer. A three-person crew was required to work on a three-phase line. Union policy was that two linemen should be in the aerial bucket at the stated voltage of the line. The union hall did not find fault with the company on this job.

MIOSHA Construction Safety and Health Division issued the following Serious citations at the conclusion of its investigation:

SERIOUS:

GENERAL RULES, PART 1, RULE 114(2)(c)
An accident prevention program shall, as a minimum, provide for the following: Inspections of the construction site, tools, materials, and equipment to assure that unsafe conditions which could create a hazard are eliminated.

There were not any on-site safety inspections being performed while the employees were performing switch upgrades on the power line. The employee not wearing his high voltage gloves was removing bolts from the energized can arrestor that was fastened to the side of the transformer on pole when he was electrocuted.

SERIOUS:

POWER TRANSMISSION AND DISTRIBUTION, PART 16, RULE 1627(1)(a)
An employee shall not be permitted to approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in table 1 unless the following is complied with:

(i) The employee is insulated or guarded from the energized part. Gloves or gloves with sleeves rated for the voltage involved, which are provided for pursuant to rules 617 and 641 of construction safety standard, Part 6 Personal Protective Equipment, being R408.41617 and R408.40641 of the Michigan Administrative Code, shall be considered insulation of the

(ii) The energized part is insulated or guarded from the employee and any other conductive object at a different potential.

(iii) The employee is isolated, insulated or guarded from any other conductive object, as during live-line, bare-hand work.

The employee, not wearing his high voltage gloves, was removing bolts from the 7200-volt energized can arrestor that was fastened to the side of the transformer on pole when he was electrocuted.

INVESTIGATION

The employer had been contracted to upgrade existing 7,200-volt power lines by installing new 15 KV switches and removing the old-style switch. The four-person work crew was divided into two-person teams. The decedent, who was also the crew foreman and his fourth-year apprentice ground man were at one pole and the other two-person crew was working at a pole approximately 200 yards away. The insulated bucket truck from which the decedent worked was positioned next to the pole's guy wire (Figure 2).

Figure 2. Location of bucket truck near guy wire, looking south

This was the first time the decedent had worked on this particular pole. The crew had been working for approximately four hours at the location prior to the incident.

The electrical line supplied power to a residence used as a summer home. The company owner stated that the electrical power should have been turned off because the home was not yet occupied. Therefore, the decedent may have assumed the line was de-energized. The decedent did not disconnect the stinger wire prior to working on the pole to install

the 15 KV switch. After installing the 15 KV switch above the existing transformer, the decedent began to remove the old-style switch.

Figure 3. Bucket decedent was working in and glove bag to hang tools

When the decedent was raised up to work, he was wearing cotton gloves under his lineman gloves and lineman sleeves. At some point during the switch change out, he removed his lineman gloves but still wore his cotton gloves and sleeves. The decedent began to remove the bolts holding the existing can arrestor to the transformer to remove the switch. The employer postulated that when the decedent removed the first bolt (bottom bolt) from the transformer, that this loosed the can arrestor and the can arrestor tipped over. The decedent might have instinctively grabbed the can arrestor (still energized) with his right hand. The electricity entrance was through the decedent's right hand, across his chest, exiting from his left hand.

The fourth-year apprentice (ground man) was near the truck standing on the ground assisting the decedent. He heard the line "burp" and then heard the decedent yell to bring him down to the ground. In the police report, the ground man indicated that when he initially lowered the bucket (Figure 3), the decedent was conscious, breathing and shaking. The ground man called to the other work crew, who ran to the scene and helped to lift the decedent from the bucket. After removing him from the bucket, the crew began CPR. In the police report, the ground man indicated he "was getting a very bad signal in the area with his cell phone," but he was able to connect with his supervisor. The supervisor called for emergency response. Emergency response arrived within six minutes, continued CPR and transported the decedent to a local hospital where he was declared dead. The cotton glove was still on the decedent's right hand and the left hand glove had been blown off (Figure 4).

Figure 4. Right hand cotton glove after electrical contact

The employer stated that the decedent was a very safety conscious person. He always wore all his safety equipment and had numerous pairs of safety glasses with different colored lens for the various light conditions he might encounter. Because of the decedent's experience, past work record and attention to safety, company management speculated that he may have been distracted due to personal problems that he had previously shared with company management.

The union hall filed disciplinary action against the other journeyman for disregarding union policy.

CAUSE OF DEATH

The cause of death as listed on the death certificate was high voltage electrocution. Toxicology was not performed.

RECOMMENDATIONS/DISCUSSION

- Employers should ensure that linemen follow established safe work procedures to de-energize, ground, and verify the work area is de-energized through testing prior to beginning maintenance and repair operations on power lines.

Section 507 (a) of the American Public Power Association (APPA) Safety Manual for an Electric Utility states, "All conductors and equipment shall be treated as energized until tested or otherwise determined to be de-energized and grounded." Additionally, MIOSHA Construction Safety and Health standard, Part 16, Power Transmission and Distribution Rule 1626(2) requires that electric equipment and lines be considered energized until determined to be de-energized by tests or other appropriate methods or means.

The importance of following established safety procedures was highlighted in this tragic incident. Although the decedent was an experienced lineman, he may have thought that the line he was working near was de-energized because the summer residence was not yet occupied. If the line had been tested, this verification method would have shown that the line was energized. If the decedent was distracted by personal issues, the importance of following established procedures (i.e. two linemen in the bucket) could have prevented this fatality by the coworker alerting the decedent that the stinger was still connected.

Formulating safe work procedures is only the first step in injury prevention. For safe work procedures to be effective, they must be clearly communicated to all employees and supervisors. The decedent, as the crew foreman, was responsible to ensure that established work procedures were followed at all times. Employers should continually stress the importance of adherence to safe work procedures and should re-affirm the necessity of following established safety procedures with all supervisors.

- Employers should ensure that linemen use all appropriate protective equipment, including insulated tools, before attempting any work on power lines with energized circuits.

At some point during the work, the decedent removed his protective gloves, which allowed him to become a path to ground. Employers should stress the need for and mandatory use of required personal protective equipment. Additionally, appropriate tools, such as insulated tools, should be utilized when appropriate.

- Employers should conduct both scheduled and unscheduled jobsite safety inspections on a regular basis.

In addition to the development and implementation of a comprehensive safety program, company management personnel should conduct (or appoint safety personnel to conduct) scheduled and unscheduled jobsite safety inspections on a regular basis to ensure that employees are following established safety procedures. Such inspections help demonstrate to workers that the company is committed to enforcing its safety policies and procedures. Although the company had a comprehensive safety program which included monthly employee safety meetings and weekly "tailgate" safety meetings, daily instead of weekly tool box safety talks orally given by each foreman may have improved the safety culture and may have prevented this tragic accident from occurring.

Admittedly, regular company safety inspections are no guarantee that worker fatalities will not occur. However, it does demonstrate to workers that the company is committed to enforcing its safety policies and procedures. The jobsite safety inspections would help to ensure that crew members use all appropriate protective equipment, including insulated tools, before attempting any work on power lines with energized circuits.

- Employers should develop checklists of proper safety procedures and equipment for each job, which could be used to reinforce safe work practices.

Developing a system in which coworkers jointly check safety procedures before each job might remind employees and reinforce the use of proper and effective safe work practices. The checklist could include items that identify the hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements. This may also encourage discussion of other possible hazard mitigation methods that could be used for particular tasks. The checklist may have identified the difficulty of bolt removal with the wearing of the lineman’s gloves. An easy-to-hold, non-conductive tool for bolt removal may have helped prevent this fatality by making the task more easily performed with insulating gloves on.

- Employers should ensure communication devices are operational in all work locations or have alternate methods of communication developed.

The ground man used his cell phone to call another supervisor to alert the firm of the electrocution. The use of cell phones has become an accepted method of communication

between workers in the field and the home office. A hazard in relying upon this type of communication are the "dead zones" that are present with this form of communication. Also present is the hazard of using older model cell phones that may not be equipped with global positioning system (GPS) capabilities. Employers should ensure that all locations where workers may be dispatched are cell phone compatible, i.e., a reliable signal strength in case of emergency can be achieved.

REFERENCES

MIOSHA standards cited in this report may be found at and downloaded from the MIOSHA, Michigan Department of Energy, Labor & Economic Growth (DELEG) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Energy, Labor & Economic Growth, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

- MIOSHA Construction Safety and Health Division Standard, Part 1, General Rules.
- MIOSHA Construction Safety and Health Division Standard, Part 16, Power Transmission and Distribution.
- NIOSH FACE Report #91-10. *Lineman Electrocuted After Contacting 7600-volt Powerline During Attempt To Restore Electrical Power in Tennessee.* www.cdc.gov/niosh/face/In-house/full9110.html
- NIOSH FACE Report #90-26. *Lineman Electrocuted After Contacting 7,200-Volt Cutout Switch on Utility Pole in Tennessee.* www.cdc.gov/niosh/face/In-house/full9026.html
- FACE Investigation MN9202. *Lineman Electrocuted by Contacting Energized 4160-Volt Power Line.* www.cdc.gov/niosh/face/stateface/mn/92mn002.html
- NIOSH FACE Report #92-12. *Power line Worker Electrocuted While Performing Maintenance on Overhead Power line—Alaska.* www.cdc.gov/niosh/face/In-house/full9212.html

Key Words: Electrocution, Lineman, Overhead Power Line

MIFACE
Investigation Report #08 MI 037
Evaluation

To improve the quality of the MIFACE program and our investigation reports, we would like to ask you a few questions about this report:

Please rate the report using a scale of:	Excellent	Good	Fair	Poor
	1	2	3	4

What was your general impression of this MIFACE investigation report?

Excellent	**Good**	**Fair**	**Poor**
1	2	3	4

Was the report…	**Excellent**	**Good**	**Fair**	**Poor**
Objective?	1	2	3	4
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How will you use this report? (Check all that apply)

- ❑ Distribute to employees/family members
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Thank You!

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Comments:

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