DATE: November 4, 1993

FROM: Minnesota Fatality Assessment and Control Evaluation (MN FACE) Program
Minnesota Department of Health

SUBJECT: MN FACE Investigation 93MN01001
Electrician Dies from Electrocution

SUMMARY

A 42-year-old male journeyman electrician (victim) was fatally injured when he made direct contact with a bare section of an energized 240V electrical conductor in the base of a street light pole. He was not using any electrical personal protective equipment at the time of the incident. He was part of a two-person crew replacing lamp heads on the poles. The victim, working at the base of poles, would remove a fuse to disconnect power to the lamp head, prepare and splice together wires to bypass a ballast located in the base, and reinsert the fuse when work by the other crew member, at the lamp head, was complete. Electrical power from feeder boxes to the base of poles was not shut down during the replacement process so that new lamp heads could be checked for operation immediately after installation. At the time of the incident, work had proceeded to the point where the fuse had been removed and the ballast had been removed from the base of a pole. The victim reached inside the pole to retrieve the now deenergized wire that went to the lamp head to prepare it for splicing. He inadvertently contacted the 240V lead conductor from the feeder box, on the energized side of the fuse, and was electrocuted. Inspection of this conductor showed that approximately two inches of insulation had been gnawed away by rodents. MN FACE investigators concluded that, in

order to prevent similar occurrences, the following guidelines should be followed:

> perform electrical work with electrical power off, if possible;
> install barriers made of fiberglass or other non-conductive materials where maintenance may be required at fuses which would separate energized and deenergized conductors during such maintenance;
> wear protective electrical work gloves at all times during work around energized electrical conductors; and
> thoroughly examine and ensure the integrity of conductor insulation prior to work near them.

INTRODUCTION

MN FACE was notified of an August 24, 1993, work-related electrocution within hours of the incident. The MN FACE investigation began the next day. MN OSHA and the county coroner's office were contacted and releasable information was taken. A police report of the incident was requested and received. An employer interview with the company safety director was conducted on September 10, 1993. A site investigation was not conducted because work crews were no longer on site, but photos and the incident pole's ballast and electrical conductors were made available to the MN FACE investigator for inspection during the employer interview.

The victim, a foreman of a two-person work crew, worked for an electrical construction company contracted by a state agency to replace existing mercury vapor lamp heads with high pressure sodium lamp heads on city street light poles. A two-person day crew and a two-person night crew had been working on the 1800-pole job for about six weeks prior to the incident. About 400-450 lamp heads had been replaced.

The 50-year-old company employed an average of 100-125 electricians, depending on job availability. The victim, a journeyman electrician for 20 years, was employed continuously for the last 3.5 years performing almost entirely street work.

INVESTIGATION

The victim was the foreman of the two-person day crew. They were changing lamp heads on metal, 50-foot tall, single lamp, street light poles along a busy city roadway. Hazards associated with heavy traffic along the work site was a major concern. Cones and directional traffic signs for barricading workers were in place and the workers were wearing full reflective suits on site. It was hot and humid with dew on the grass late into the morning; there had been recent rains in the area as well. High voltage and leather work gloves were on site but not in use at the time of the incident. A state line inspector, in a vehicle about 100 yards ahead of the incident pole, was also on site. The incident occurred at 11:00 am.

Ballasts for the existing mercury vapor lamp heads were located at the base of each pole. Ballasts for the new, replacement sodium lamp heads were in the heads themselves. The job for each pole, therefore, consisted of replacing the lamp head and, at the same time, by-passing the existing ballast by splicing together the wires leading to the pole from the feeder box with those leading up the pole to the new head. The victim, working at the base of the pole, would disconnect a fuse on the line-side of the ballast to kill power in the pole to the lamp head, disconnect the ballast, and prepare wires for splicing at that location. The other crew member, at the top of the pole in an aerial bucket, would disconnect the old head and install the new one. After splicing and reinsertion of the fuse, the work would be complete. Power from feeder boxes typically lighted 10-100

poles and was not shut off during the procedure so that new lamp heads could be checked for operation immediately after installation. The lead wire entering the base of the incident pole from the feeder box was 240V .

Before the incident, the victim had proceeded with the base work to the point where the fuse had been disconnected, the ballast had been removed from the base of the pole, and the black wire from the ballast to the fuse had been cut and trimmed in preparation for the splice. The next step would have been to cut the wire from the lamp and splice it to the black wire with the fuse retainer. Evidence suggests that as the victim reached for the wire that went to the lamp he contacted a bare section of the 240V lead wire on the energized side of the fuse and was electrocuted.

Inspection of this conductor showed that about two inches of the insulation on it had been damaged, presumably from rodents gnawing on it. Nesting materials, fur, and debris were observed inside the pole's base; some had been partially dragged out of the base when the ballast was removed. Insulation on the pole's neutral white wire was similarly damaged. Nesting materials and snakes had been found in other poles by workers, but damaged insulation had never before been encountered. Animals apparently gained access into poles by crawling between the bottom of the poles and the concrete in a drainage groove in the concrete.

The victim's coworker heard him moan and, after descending in the bucket, found the victim lying unconscious on his back between the pole and a chain link fence behind it, with the pole at his waist. A wire was lying on the victim's leg and, not knowing whether it was energized or not, the coworker used a wooden outrigger landing pad to remove it from him. He pulled the victim four to six feet from the pole, called 911 from a mobile phone, and began CPR. Because he was somewhat confused as to whether the 911 call

had been dispatched, the coworker stopped CPR momentarily to flag down a passing motorist, who solicited help from a police station about 300 yards away. The line inspector, who was parked ahead of the workers, did not realize the incident had occurred until police arrived at the site five minutes later. The coworker continued CPR until he was relieved by other first responders. The victim could not be resuscitated and was pronounced dead at the hospital emergency room. Burns were found on the victim's right thumb, middle, and ring fingers; no exit wounds were observed.

CAUSE OF DEATH

The cause of death reported by the county coroner's office was electrocution.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Perform electrical work with electrical power off, if possible.

Discussion: A two-person day crew and two-person night crew were replacing lamp heads for this project. Leaving power on to the street lights allowed immediate assessment and repair of new replacement heads which were not functional after installation. It was also considered necessary for street lights to remain on at night for both worker and road traffic safety. Power to the street lights could have been disconnected during the day when lights for traffic were not necessary. After head replacement on all poles was complete, power could be reconnected to determine which heads, if any, required repair. A work procedure such as this, even though is may require more time, may be warranted when conductor condition inside poles is unknown.

Recommendation #2: Install barriers made of fiberglass or other nonconductive materials

where maintenance may be required at fuses which would separate energized and deenergized conductors during such maintenance. This recommendation is in accordance with 29 CFR 1926.403(i)(2)(i).

Discussion: When poles are initially installed, barriers to separate energized and deenergized conductors at fuses which are likely to require later maintenance could be put in place. If it is necessary to work near the conductors with electrical power on, then the barrier would provide protection for the worker.

Recommendation #3: Wear protective electrical work gloves at all times during work around energized electrical conductors.

Discussion: High voltage and leather work gloves were at the incident site, but were not being used by the victim. It is sometimes difficult for workers to perform fine, manipulative electrical work with heavy gloves on, but when conductors are exposed to damaging environments and/or cannot readily be seen by workers, gloves should be worn at all times to ensure worker protection. Supple leather work gloves that provide protection up to 750V are available. According to the safety director, the company intends to provide all workers with this type of glove for use during work near energized conductors.

Recommendation #4: Thoroughly examine and ensure the integrity of conductor insulation prior to work near them. This recommendation is in accordance with 29 CFR 1926.403(b)(1).

Discussion: When it is absolutely necessary to work near energized conductors, examination of conductor insulation is essential to ensure worker safety. This practice

could be especially important when conductors exist under damaging environmental conditions. If damage to the insulation is observed, proper protective equipment (gloves) and/or measures (disconnect power) should be used to prevent injury to workers.

REFERENCES

1. Office of the Federal Register, Code of Federal Regulations, Labor, 29 CFR Part 1926.403(b)(1) and 1926.403(i)(2), U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C., July 1, 1992.

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