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NIOSH > Workplace Safety and Health Topics  
> Fatality Assessment and Control Evaluation(FACE) Program > State FACE Reports



# Massachusetts Public Utility Electrician Electrocuted During Routine Operations and Maintenance

**Investigation # 94-MA-068**  
**Release Date: October 17, 1995**

## SUMMARY

On October 24, 1994, a 53 year-old municipal public utility electrician was electrocuted while performing triennial maintenance at a utility-owned electrical substation. Following the removal of a circuit breaker from its cabinet enclosure, the victim entered the enclosure, and came into contact with one of three live electrical conductors carrying 2,400 volts. Discovered by a co-worker, the victim was removed from the enclosure and administered CPR until emergency medical services responded and transported the victim to the regional hospital where he was officially pronounced dead less than one hour later. The Massachusetts FACE Program concluded that to prevent similar occurrences in the future, employers should:

- schedule maintenance activities, both as to tasks and timing, so that circuits may be isolated or shutdown.
- retrain all employees on safety hazards and proper procedures before they perform infrequent maintenance tasks on high-voltage equipment.
- control electrical hazards during equipment maintenance by de-energizing and testing, and/or by the use of appropriately rated personal protective equipment
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- develop, implement, and enforce a comprehensive safety program that includes standards and procedures for all employees at all skill levels.

## INTRODUCTION

On October 28, 1994 the MA FACE Program's Director and Field Investigator traveled to the incident scene and interviewed multiple company representatives including the manager, assistant manager and supervising electrical engineer for the utility. A co-worker of the victim and an employee union representative were also interviewed. On January 18, 1995, additional witness and co-worker interviews were conducted. The police report, death certificate and multiple witness interviews, photographs and newspaper clippings were obtained during the course of the investigation.

The company was a public electric utility in business for over one hundred years and employed seventy-eight persons in various public utility titles. The victim was the sole licensed master electrician employed by the company. The utility did not employ a designated safety person. It did, however, have a joint labor/management safety and health committee which periodically met to review and/or update company policies and procedures. It also utilized a generic "Safety Manual For an Electric Utility" published by the American Public Power Association (APPA) which it required utility personnel to follow. There were no written company safety rules and procedures in place for the specific task being performed by the victim.

## INVESTIGATION

On October 24, 1994, a public electric utility crew was scheduled to perform routine triennial operations and maintenance at a utility-owned substation. Specifically, the crew of four was assigned to perform hi-pot testing (the process of testing insulated cable for current leakage), and circuit breaker and relay maintenance.

Arriving at the substation site between 8:00 a.m. and 9:45 a.m., crew members went about their appointed business. At 10:30 a.m., the crew members assembled in the yard to help unload a truck and set up equipment to perform the hi-pot testing. At approximately 10:45 a.m., the victim commented to one of his co-workers that the conductors were isolated and that the hi-pot testing would not affect his work inside the substation. Having removed and serviced the substation circuit breakers earlier, he left his co-workers and went back inside the substation to perform relay cleaning maintenance.

The substation was a building approximately 20 feet by 40 feet with a bare concrete block wall on one side and a series of cabinet enclosures on the other. Each cabinet contained a 3' high by 2' wide by 2' deep circuit breaker of the slide out type. Behind the circuit breakers in the cabinet was the main buss area, guarded from access by a red bakelite safety barrier panel, which slides up to allow access to the buss area. When the circuit breaker is in its working position, the weight and configuration of the circuit breaker engages the lever which raises the panel allowing the circuit breaker to connect to the conductors. When the circuit breaker is removed, the panel is lowered covering the main buss area, thus eliminating potential exposure to the usually live electrical conductors.

The relay maintenance operation did not require a person to enter the cabinet. The relays were located at the rear of the circuit breaker which had already been removed from the cabinet for cleaning.

Standing outside and behind the substation, a co-worker heard the safety barrier panel located inside a cabinet being opened and/or closed. He immediately entered the substation to check on the victim. Upon entering the substation, the co-worker saw the circuit breaker in the middle of the room, which had been removed from the cabinet, and the victim, inside the cabinet and partially obstructed by its door. He walked around the cabinet door to speak to the victim. He then saw the victim with his hand in an area behind the raised safety barrier panel in close proximity to three energized conductors (main buss). These conductors carried 2,400 volts.

At the same moment, the victim voiced an expletive and collapsed to the floor as the result of apparent electric shock. The crew foreman heard a loud sizzling/arcing sound and was immediately summoned by the co-worker into the substation where he saw the victim lying face down inside the cabinet. The foreman quickly instructed the co-worker to radio a code blue (man down-need immediate assistance) which would activate emergency response. As the foreman approached the victim, the co-worker reminded the foreman that he needed protective high voltage gloves before touching the victim. The co-worker retrieved the gloves from his truck outside and the crew foreman pulled the victim out of the cabinet. The two men turned the victim over and administered CPR until police and emergency medical services took over several minutes later. The victim was transported to the area hospital where he was officially pronounced dead approximately fifty minutes following the incident.

The investigation revealed that once the circuit breaker was removed from its cabinet, the victim may have decided that one or more of the conductor ports in the main buss area were soiled and in need of cleaning. To access the main buss area, the victim apparently pushed down the lever to raise the red bakelite panel which covered the three energized conductors.

Following the incident, a blue-green rag was found lodged in the upper middle port region of the main buss. It was reported that the victim had been using this rag and that he was seen with his left hand in the upper left port region of the main buss at the time of the incident. Autopsy results listing electrical current entry and exit wounds as the left third fingertip and right knee appear to confirm this. The victim may have engaged the panel door lever with his right knee or hand to raise the protective panel while reaching into the main buss with his left hand.

## CAUSE OF DEATH

The medical examiner listed the cause of death as electrocution.

**Recommendation #1: Employers should schedule maintenance activities, both as to tasks and timing, so that circuits may be isolated or shutdown.**

**Discussion:** Although the victim's tasks of cleaning the circuit breakers and relays were not expected to involve encountering live equipment, it is recommended that circuits and equipment being worked on be isolated during all maintenance activities. In many cases it is possible to jumper circuits in substations so that customers do not lose power and the equipment being maintained is isolated. While circuit breakers are being removed, it is still possible that electricity may arc, causing shock. Also, it is not unreasonable to think that an employee working on the equipment would want to clean off dust, dirt or corrosion from the buss area before re-installing the circuit breakers. Returning to do this piece of the job would require removing the circuit breakers again. In this case, had the maintenance schedule allowed for de-energizing or isolating this circuit, then performing all necessary maintenance on it, the victim may not have been electrocuted.

The investigation revealed that the public electric utility scheduled different operations and maintenance programs each year. Apparently, it would shut down the substation one year to do some operations and maintenance and then shut down again the next year to perform other operations and maintenance. Some company employees felt a one-time complete triennial shutdown over a full weekend would permit total system maintenance to be carried out.

**Recommendation #2: Employers should retrain all employees on safety hazards and proper procedures before they perform infrequent maintenance tasks on high-voltage equipment.**

Although publicly-owned utilities in Massachusetts are not covered by the OSHA regulations, these standards represent an integration of various industry consensus standards and research of good safety practices. Publicly-owned utilities should use the OSHA standards as guidelines for their safety programs. If these training practices had been in place, the incident may not have occurred.

**Recommendation #3: Employers should control electrical hazards during equipment maintenance by de-energizing and testing, and/or by the use of appropriately rated personal protective equipment.**

**Discussion:** In general, when working on high-voltage electrical equipment, employers should ensure that equipment is de-energized during maintenance procedures whenever possible. After circuits or equipment are de-energized, they should be tested using proper procedures and testing equipment. Workers should be trained to never assume that a circuit is de-energized, or that electricity is not stored in equipment without proper testing. Sufficiently rated high-voltage gloves and other personal protective equipment should be provided and used in situations where work on any live equipment or circuits is necessary or should be anticipated. If the circuit had been de-energized, or protective equipment been worn, this incident may not have occurred.

**Recommendation #4: Employers should develop, implement, and enforce a comprehensive safety program that includes standards and procedures for all employees at all skill levels.**

**Discussion:** The company did not have a comprehensive written safety, health and/or training programs in effect at the time of the incident. Employers should not leave safety responsibilities and decisions completely to employees. Even with highly skilled and trained electricians, it is important that standard operating procedures be written up and enforced. Employees need reinforcement that the utility is committed to safety and will not allow shortcuts in performance of dangerous tasks.

Employers, with the participation of employees, should conduct frequent inspections and evaluations of worksites to identify all hazardous conditions. These inspections/evaluations should be scheduled while work is being performed to ensure that tasks are being carried out in a safe and effective manner. As much as possible, barriers to safe work practices, due to equipment limitations or lack of proper procedures, should be eliminated by engineering and administrative controls. In the absence of these controls, appropriate personal protective equipment should be provided and used.

In this case the victim was most likely taking an opportunity to do a little extra while the circuit breaker was removed. He obviously believed that he would not contact the conductors while dusting inside the buss area, or perhaps believed that the circuit was isolated. His status as a master electrician did not protect him from high-voltage electricity. Through a comprehensive health and safety program, it is the employer's responsibility to discourage overconfident attitudes toward working on live equipment and in fact counter them with training and applied policies.

## REFERENCES

U. S. Department of Labor, OSHA, 29 CFR 1910.269 Electric Power Generation, Transmission and Distribution and 59 FR 4320, OSHA Final Rule on Protective Equipment for Electric Power Generation, Transmission and Distribution

[Back to Massachusetts FACE reports \(http://www.cdc.gov/NIOSH-FACE/Default.cshtml?Category=0000&Category2=ALL&State=MA&Submit=Submit\)](http://www.cdc.gov/NIOSH-FACE/Default.cshtml?Category=0000&Category2=ALL&State=MA&Submit=Submit)

[Back to NIOSH FACE Web](#)

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