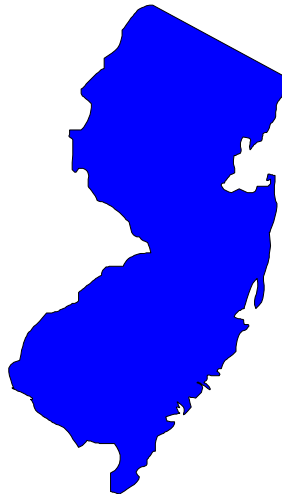


F.A.C.E. INVESTIGATION REPORT

Fatality Assessment and Control Evaluation Project

FACE #94-NJ-114-01
Groundman Electrocuted During Installation
of Pole Mounted Transformer



New Jersey Department of Health and Senior Services
Occupational Disease and Injury Services
P.O. Box 360
Trenton, New Jersey 08625-0360
(609) 984-1863

TO: Division of Safety Research
National Institute for Occupational Safety and Health
Morgantown, West Virginia

FROM: Fatality Assessment and Control Evaluation (FACE) Project
New Jersey Department of Health (NJDOH)

SUBJECT: FACE 94 NJ 114-01
Groundman Electrocuted During Testing of a Pole-mounted Transformer

DATE: June 8, 1995

SUMMARY

On August 23, 1994, a 32 year-old male groundman died when he contacted at least 1,000 volts of electricity as a newly installed transformer was temporarily energized for testing. He was part of a three-man crew that was upgrading an existing electrical distribution system. NJDOH FACE investigators concluded that, in order to prevent similar incidents, the following safety guidelines should be followed:

- o A job hazard analysis should be conducted;
- o Employers should develop and implement a comprehensive safety training program;
- o Standard operating procedures should be in writing and carefully followed.

INTRODUCTION

On August 24, 1994, NJDOH FACE personnel learned about this work-related fatality through a newspaper article. A site visit was conducted on September 30, 1994. Information for this report was derived from the OSHA file, medical examiner's report, testing company's analysis report, information from the employer, and discussions with the victim's co-workers.

The employer was a non-unionized electrical contracting company that had been subcontracted by the general contractor to upgrade the existing electrical distribution system in a residential development. The company was to replace a substation, aerial lines, poles, and distribution transformers. Other electrical work was being done by the general contractor. The employer had been in business for more than 38 years and employed 20 people at the time of the incident. Work on the contract began several months prior to the incident and was about 25 % complete. The deceased, a 32 year-old groundman, was employed by the company for six years, working as a groundman or a laborer.

A safety supervisor had originally been assigned full time to the project, spending approximately 25% of his time on safety, but he had been relocated to another site before this incident and had not been replaced. Safety rules and regulations were in writing but were general and not specific to tasks. The company provided on-the-job training for the workers.

Weekly safety discussions were held. The general contractor had a full time site safety representative for the project but his responsibilities did not include high voltage work.

INVESTIGATION

The incident site was a recently set utility pole on a street in a residential area. The crew started work at 7 a.m., when they met at the company yard. From there, they travelled to the work site. The day was sunny but the ground was wet from the previous day's rain. They had previously installed the new pole and transferred the primary lines from the old utility pole to the new one. The secondary lines were to be run underground from the pole to the houses by the general contractor.

A lineman and an apprentice lineman worked from truck-mounted, insulated aerial buckets. The victim worked on the ground. The apprentice lineman mounted the transformer to the pole and the lineman performed the wiring configuration of the transformer, working without dielectric gloves or sleeves. The transformer was a 75 KVA single phase, pole type distribution transformer. The transformer contained a dual voltage system for high voltage operation at 7200 volts or 2400 volts. The apprentice partially installed the ground rod and the groundman (the victim) finished it. They tightened the bolts to stabilize the transformer and installed the ground wire. The ground wire extended down the pole from the transformer and attached to the ground rod buried into the sandy soil. The lineman remained in the bucket while the apprentice came down to work on the ground. About 8:30 a.m., the lineman planned to test energize the transformer in order to determine the secondary voltage. This procedure usually lasts about one minute and the transformer is again deenergized.

The lineman stated that prior to the test energization he looked down from the bucket and saw no one under him. He yelled "going hot," a traditional warning to others that the transformer was going to be energized. It is the usual company work practice that no one remains under the pole when it is energized and shouting "going hot" is the alert to this. The apprentice, who was about 6 to 10 feet away working at a truck, heard the "going hot" call. When he heard the call, he turned and saw the groundman leaning against the pole holding the ground wire in his bare hand. He yelled "cut it." The lineman immediately pulled the cut out switch to deenergize and the victim fell to the ground. Cardio-pulmonary resuscitation (CPR) was initiated immediately by the victim's co-worker and a neighbor. Another neighbor called for help. Emergency responders arrived and transported the victim to a hospital where he was pronounced dead.

Immediately after the incident, in order to determine the cause of the fatality, the transformer was again energized by the company owner, working with investigative officials from several organizations, to check the grounding. An investigator on the ground placed an electrical probe on the ground lead when the circuit was closed. He received an electrical shock but was not injured. A reading of 1,000 volts was recorded from the ground wire to another ground rod driven about four feet away as electricity dissipated into the ground. An independent testing company tested the ground resistance on the ground rod and found that it was 267 ohms; it should have been less than 25 ohms.

The transformer was removed from the pole by the company two days after the fatality and examined by an independent testing company five months after the incident. The transformer was in the possession of an investigating agency until the testing. The testing company determined that the transformer was incorrectly configured during the installation. This increased the current flowing through the ground lead. The testers also noted that the ground resistance was too high (as determined at the time of the incident). This caused an increase in the voltage between the ground wire and the earth ground. The test engineers calculated that, given these two conditions, (incorrect configuration and high ground resistance) the victim may have received as much as 2332 volts of electricity. The exact voltage actually received is unknown.

CAUSE OF DEATH

The medical examiner determined that death was caused by electrocution. Burn marks were noted on the victim's left hand and left lower leg.

RECOMMENDATIONS/DISCUSSIONS

Recommendation #1: A job hazard analysis should be conducted.

Discussion: Due to the hazards of working around high voltage electricity, it is recommended that employers conduct a job hazard analysis of the project during the planning phase and each time there is a change in a job situation. The safety check may be more effective if done by the employer or safety officer with input from the employees. A job hazard analysis should examine all areas for electrical, chemical, confined space, fall, or other hazards the workers may encounter. After identifying potential hazards, the employees should be instructed on how to correct or avoid them.

Recommendation #2: Employers should develop and implement a comprehensive safety training program.

Discussion: The company had a written general safety policy in place but it was not specific for job functions and proper methods of completing specific tasks. All training was on-the-job. A training program should be systematic, in writing and designed specifically for jobs that are done by the workers. Before workers are allowed to perform important functions, they should first demonstrate that they are able to do so. The company has developed a formal standardized safety training program and has designated a safety officer. The new policy covers grounding, a drug and alcohol policy, equipment use, and personal protective equipment. Penalties for workers who fail to adhere to safety standards have also been implemented by the company.

Recommendation # 3: Standard operating procedures should be in writing and carefully followed.

Discussion: Although the company had operating standards, they were not in writing. Since this incident, the company has initiated written detailed instructions for transformer installations and other procedures. Included in this is the requirement that all grounding must be completed and tested before work is done. Also mandated is the use of an external electrical meter to check output voltages prior to hooking up the secondary conductors and recording the voltages. Previously, the ground meggers were used only after the transformer was installed and ready for permanent energization. An increased emphasis has been placed upon recording test results and improved communication between members of the crew.