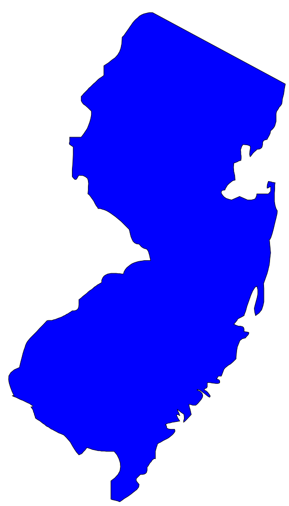
F.A.C.E.
INVESTIGATION REPORT

Fatality Assessment and Control Evaluation Project

FACE #96-NJ-042-01
Electrical Testing Laboratory Technician
Killed After Contacting 26,000 Volts and Falling



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

SUBJECT: Face Investigation #96-NJ-042-01
Electrical Testing Laboratory Technician Killed After Contacting 26,000 Volts and Falling From a Ladder

DATE: November 25, 1996

SUMMARY

On June 18, 1996, a 45-year-old laboratory technician was killed when he contacted 26,000 volts and fell from a rolling ladder while disassembling an experiment. The incident occurred at a cable testing laboratory that tested samples of high-voltage electrical cables. The laboratory had just completed artificially aging several samples of electrical cable by running a current through the cable while it was immersed in water. A technician was instructed to disassemble the experiment so the cables could be examined. Neglecting to first deenergize the experiment, the victim climbed a ten-foot metal rolling ladder to the cables and contacted the live 26,000 volt electrical circuit. The shock immediately threw him from the ladder, causing him to fall and strike his head on the concrete floor. NJ FACE investigators concluded that, to prevent similar incidents in the future, these safety guidelines should be followed:

* Employees must be throughly trained in the safe handling of electrical circuits.

* Employers should develop, implement, and enforce an electrical lock-out/ tag-out program.

* The laboratory should consider redesigning their electrical safety interlock system.

* Employers should be aware of educational and training resources for health and safety information.

INTRODUCTION

On June 20, 1996, NJ FACE personnel were notified by a county medical examiner of a work-related electrocution/fall that occurred on June 18, 1996. A FACE investigator contacted the employer and arranged to conduct a site visit, which was done on July 2, 1996. At that time, investigators interviewed the employer and witnesses and examined the incident site. Photos were not taken at the employer's request in order to protect proprietary information. Other information was obtained from OSHA, the police report, and the medical examiner's report.

The employer was a small, privately owned electrical cable testing laboratory that had been in business for 18 years. The company employed ten people at the time of the incident, including three engineers and a secretary. Technicians did not require specialized training (e.g., a college degree) for the job and were trained on-the-job by an engineer. Responsibility for safety was assigned to the engineer in charge of his particular section of the lab. The company did not have a written safety program.

The victim was a 45-year-old male general technician who had worked for the laboratory for one year and seven months. His job duties were to maintain and change the experiments, including the cables being aged for research. He had previously worked as a machine operator at an electrical cable manufacturer and as a maintenance person for a large university.

INVESTIGATION

The incident occurred at the cable testing laboratory that was located in a warehouse in an industrial park. The laboratory tested samples of high-voltage electrical cables submitted by electrical utilities, cable manufactures, and government agencies for quality-control purposes. The laboratory subjected the cables to a number of different tests that simulate aging, lightning strikes, and other conditions that would affect the high-voltage cables. The cables were then examined for faults and tested to see if they continued to meet the manufacturer's specifications.

All electrical testing was done inside several fenced-in areas constructed in the laboratory. Each area was surrounded by a six-foot high fence constructed of light gauge wire fencing mounted to two-by-four inch wood framing. Entry into the areas was through identically made doors built into the fencing. Each area was marked with danger signs and warning lights showing that the power was on. Safety devices included grounding the fence and doors and providing an interlock system that shut down the power whenever a door was opened. The interlocks were made of an ordinary household electrical extension cord stretched across each door. To enter the area, a worker needed to unplug the extension cord, which tripped an electrical relay and shut down all power to the area. The interlock cords were situated so that it was impossible to open the door without pulling and unplugging the cord.

The cable-aging experiment was located in one of the larger fenced in areas. In this process, samples of high-voltage electrical cable were artificially “aged” by placing them under an electrical load while immersed in water. The cables were mounted inside the fenced-in test area on supports made of plastic piping. The supports were built very close to the fence and reached over the top to a height of 12 feet. Attached to the top of the support was a test cable with a bottle of distilled water fixed to the end. The cable ran down into a water bath, soaking the insulation. The cable then ran up out of the water to a second support on the opposite side. The cables were mounted side-by-side on the supports, and the ends were electrically connected in series with a short length of bare copper jumper cable. Electricity was directed to the cables from an electrical transformer that stepped up the power to 26,000 volts at 300 amps.

The power to the experiment was controlled by turning a wheel leading to a large rheostat inside the test area. The main power switch was on the back wall inside the fenced in test area. The usual procedure for shutting down the power was to first turn the rheostat down until no power registered on a meter visible through the fencing. The extension-cord interlock was then disconnected, tripping the power relay and shutting down the power. Finally, the worker would enter the area and use a pole to connect a grounding wire to a transformer terminal. The area was then considered safe to work in.

The incident occurred Tuesday, June 18, 1996. The victim arrived for work at the laboratory at 8:30 a.m. and was instructed by his supervisor (an engineer) to remove three cable samples that had been aging for one year. The victim was familiar with the experiment, as he had to de-energize it every two weeks to changed the distilled water baths. At about 8:45 a.m., the victim moved a 12 foot high rolling metal ladder with handrails to the fence outside the test area. He connected a bonding wire from the ladder to the fence, electrically grounding the ladder. Apparently neglecting to deenergize the power, the victim climbed the ladder to where he could reach the plastic supports where the cables were connected. The victim started to use a wrench to disconnect the jumper wires from the cables, contacting the live 26,000 volt circuit. A co-worker who was working nearby heard the victim yell “Oh God!” and saw him fall off the ladder and land head first on the floor. He went to the victim and saw that the power was still on. As the co-worker disconnected the power, a second worker called 911 for help. The workers started cardio-pulmonary resuscitation until the police and EMS arrived. Rescue efforts succeeded in restoring a heart beat, and the victim was transported to the local trauma center where he was admitted with severe head injuries. He died of his injuries eight hours later.

CAUSE OF DEATH

The county medical examiner determined the cause of death to be from electrocution and fall from a height.

RECOMMENDATIONS AND DISCUSSIONS

Recommendation #1: Employees must be throughly trained in the safe handling of electrical circuits.

Discussion: In this situation, the victim's failure to deenergize the power suggests a lack of understanding in the dangers of live electrical circuits. FACE recommends that all employees should be throughly trained in electrical safety before being permitted to work in the testing areas. Employees should receive basic electrical safety training, including how to recognize energized circuits and the proper method to deenergize the circuit (see recommendation #2). Employees authorized to work on live electrical circuits should receive additional training. Electrical safety training is required under the OSHA standard 29 CFR 1910.332.

Recommendation #2: Employers should develop, implement, and enforce an electrical lock-out/ tag-out program.

Discussion: The laboratory did not have a lock-out/tag-out program for safely deenergizing the experiments. Their practice was to shut down the power by activating the safety interlocks, leaving a potential hazard if the interlock malfunctioned or if another worker inadvertently reconnected it. In this situation, the employee was able to reach the cables without entering the fenced in area, essentially bypassing the interlock system. The FACE program recommends that the employer immediately implement an effective electrical lock out, tag-out program that includes deenergizing and locking out all circuits at the breaker box. These procedures should be in writing and made part of the employee's training program. It should be noted that the locking out and tagging of electrical circuits is required under the OSHA standard 29 CFR 1910.333.

Recommendation #3: The laboratory should consider redesigning the electrical safety interlock system.

Discussion: The laboratory's electrical safety interlock system consisted of household extension cords stretched across the doorways. Although effective, this system may fail if the light gauge cords are damaged. The system could also be easily bypassed by using another extension cord to bridge the gap after the door is opened. FACE recommends that the employer install a hardwired interlock system activated by a switch installed directly on the doors. A locking system that prevents the doors from being opened until the power is disconnected is also recommended. This type of system may permit the installation of emergency power shut down buttons connected into the interlocks.

Recommendation #4: Employers should be aware of educational and training resources for health and safety information.

Discussion: It is important that employers obtain current information on OSHA regulations and methods of ensuring safe working conditions. Because obtaining this type of information is often difficult for a small business, the following sources may be helpful:

U.S. Department of Labor, OSHA: On request, the federal Occupational Safety and Health Administration (OSHA) will provide information on safety standards and requirements. OSHA has several offices in New Jersey which cover the following areas:

Hunterdon, Union, Middlesex, Warren and Somerset Counties..........(908) 750-3270
Essex, Sussex, Hudson and Morris Counties.......................................(201) 263-1003
Bergen and Passaic Counties...(201) 288-1700
Atlantic, Gloucester, Burlington, Mercer, Camden, Monmouth,
Cape May, Ocean, Cumberland and Salem Counties..........................(609) 757-5181

NJDOL OSHA Consultative Services: The New Jersey Department of Labor OSHA Consultative Service will provide free consultation to business owners on improving health and safety in the workplace and complying with OSHA standards. Their telephone number is (609) 292-3922.

New Jersey State Safety Council: The NJ Safety Council provides a variety of courses on work-related safety. There is a charge for the seminars. Their address and telephone number is 6 Commerce Drive, Cranford, New Jersey 07016, telephone (908) 272-7712

Other Sources: Local utility companies often offer seminars in avoiding electrical hazards. Trade organizations and labor unions are a good source of information on suppliers of safety equipment and training.

REFERENCES

Code of Federal Regulations 29 CFR 1910 and 29 CFR 1926. U.S. Government Printing Office, Office of the Federal Register, Washington DC.

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