

**One Firefighter Electrocuted and One Seriously Injured When An Aluminum Extension Ladder
Contacts a 7,600 Volt Overhead Power Line**

June 24, 1993

SUMMARY

On March 20, 1993, a 47 year-old male firefighter was electrocuted and a second firefighter was seriously injured while positioning a 35 foot aluminum extension ladder at a fire scene. The incident occurred outside a three story building that had an active working fire on the third floor. The victim, who was off duty and in the area when the fire was discovered, was placed on duty by the Chief in charge of the fire scene and was ordered to assist in raising a ladder to the third floor window of the structure. As the victim (who was not wearing firefighter's turn-out gear) and two other firefighters positioned the ladder near the building, two of them apparently slipped on ice and snow on the sidewalk and lost control of the ladder. The ladder fell back and contacted a 7,600 volt overhead power line, electrocuting the victim and critically injuring a second firefighter. The third firefighter received a minor electric shock but was not injured. NJDOH FACE investigators concluded that, in order to prevent similar incidents in the future, employers should follow these safety guidelines:

- *Fire Departments should ensure that all firefighters are trained in the recognition and avoidance of electrical hazards.*
- *Fire Departments should have a written standard operating procedure for operating near electrical hazards.*
- *Fire Departments should consider equipping each ladder truck with a non-conductive fiberglass ladder.*
- *Fire Departments should require an observer to watch the placement of ladders near power lines.*

INTRODUCTION

On March 21, 1993, NJDOH FACE personnel were notified of this work- related fatality through a newspaper article. On March 29, 1993, FACE investigators accompanied representatives from the NJ Department of Labor (NJDOL) Public Employees Occupational Safety and Health (PEOSH) program and the NJ Department of Community Affairs (NJDCA) Bureau of Fire Safety on a joint investigation of the incident. After meeting with employer and union representatives, we examined the victim's clothing and injured firefighter's protective turn-out gear. We also visited and photographed the incident site and extension ladder. On May 11, 1993 investigators from FACE, NJDCA, and NJDOL met with the Chief in command at the time of the incident. We also interviewed one of the firefighters involved with the incident and a witnessing firefighter. Additional information on the incident was obtained from the fire department's internal incident reports, transcribed witness statements, and the medical examiner's report.

The employer was a large municipal, paid fire department that covered an urban-industrialized area of 15.6 square miles with a population of 228,000 people. The department's 450 active firefighters were divided into 15 engine companies, 10 truck companies, and 1 heavy rescue unit that were assigned to 16 fire stations. Firefighter recruits receive an eight week (320 hour) training course at the department's fire academy. Ongoing training consists of weekly drills run by the company Captains using the International Fire Service Training Association (IFSTA) manual as a guideline. Although the department had extensive written standard operating procedures, there was no SOP for raising ladders. The department had four safety officers (who held the rank of Captain) to maintain continuous 24 hour, 7 day a week coverage. The safety officers, who respond to all multiple alarm fires, have the authority to cease fire ground operations if they feel a safety hazard exists. These officers were appointed and trained by the Chief of the department.

The victim was a 47 year-old male firefighter of 12 years. He had received all his training through the department, including the recruit training course. For the past 10 years he had been on "light duty" administrative assignments due to an unspecified physical condition. At the time of the incident he was assigned to the department hose shop, a maintenance facility for hoses and other equipment that is not an active firefighting unit.

The severely injured firefighter (firefighter #1) was a 29 year-old male with eight years of experience, and the firefighter who was shocked but not injured (firefighter #2) was a 23 year-old male probationary firefighter with seven months of experience.

INVESTIGATION

The incident occurred outside of a building located in a commercial- residential section of the city. The building was a three-story wood frame structure directly attached to similar buildings on either side. The ground floor of the building contained a business that was secured with metal gates and a entrance leading to the second and third floor residences. Running along the street directly in front of the building were utility poles holding three phase, 7,600 volt (phase to ground) power lines located 32 feet 9 inches above the sidewalk, with the closest phase located about eight feet from the building. The utility poles also held an electrically insulated, three phase 27,000 volt transmission line along with telephone and cable television lines. The area in front of the building was restricted by a tree, a large sign on the building, and piles of icy snow on the sidewalk. The rear of the building was inaccessible from the street due to the connecting buildings.

The weather the morning of the incident was clear and cold. At about 8:20 a.m., the victim (who lived in the neighborhood) was off duty and in a nearby store when he heard noise from the street. Neighbors told him of the fire and said that there was a man trapped on the third floor of the building. The victim called 911 to report the fire and then attempted to enter the building with a civilian to rescue the trapped man. Entering without any protective gear, they were able to get to the third floor before being forced back outside by the intensity of the fire.

At 8:26 a.m., the fire department dispatched the first alarm, sending four engine companies and two truck companies to the fire. (Each engine company consisted of one pumper truck manned by an officer and three firefighters, each truck company consisted of one ladder truck with three firefighters). The first engine arrived on the scene at 8:29 a.m. and reported a heavy fire condition at the building. On arriving, the Chief began to direct the fire ground operations and ordered two hoselines into the building. A

woman holding a child then approached the Chief and told him that her father was trapped on the top floor. With firefighters starting to search the third floor, the Chief put his attention to ventilating the smoke out of the building. Unable to raise an aerial ladder because to the powerlines, he ordered a firefighter to open the roof of the burning building by climbing to the roof of the adjoining building and crossing over to the burning building. He then ordered another firefighter (FF #1) to raise a ladder to the front of the building and break out the windows on the fire floor (this would provide secondary ventilation and a second exit for the firefighters inside the building). At this point, the victim reported to the Chief and asked if they needed help. The Chief put him on duty and ordered him to help FF #1 with the ladder.

While the victim was talking to the Chief, FF #1 was pulling a 35 foot aluminum extension ladder off a truck. He was assisted by another firefighter (FF #2) who helped him carry the ladder and raise it against the building. (Both FF #1 and #2 were fully geared in Nomex coats and bunker pants, helmets, rubber boots, and leather gloves). At this point the victim (who was wearing street cloths) joined them. The three took up positions and extended the ladder: FF #1 in front (facing the building) footing the ladder, FF #2 behind (back to building) working the extension rope, and the victim on the south side holding the beam. The crew extended the ladder, positioned it in front of the center window, and pushed it against the window to break it. They then pulled the ladder away from the building and pushed it against the window a second time. On the third try, the crew was pulling the ladder away from the building when the victim and FF #1 apparently lost their footing on the ice and snow, causing the ladder to fall against the power line.

The ladder contacted the power line at 8:34 a.m., about four minutes after the Chief reported on scene. The power passed through the ladder, entered the victim through his bare hands, and exited through both his shoes. The power apparently burned holes through FF #1's leather gloves and exited through his left boot. FF #2 reported feeling a slight tingling in his hands and arms and let go of the ladder. He then saw sparks from the contact, and saw the victim and FF #1 fall on each other as the ladder fell. Several nearby firefighters immediately went to their aid, but were ordered by the Chief to get a pike pole to pull the two injured firefighters away from the ladder. Both were unconscious, at that moment the victim was breathing and FF #1 was in respiratory arrest. As the rescuers started first aid and resuscitation, both firefighters went into full arrest. The paramedics arrived and took over resuscitation and were able to revive FF #1, who was transported to the local hospital and burn center and survived. Efforts to revive the victim were unsuccessful, and he was pronounced dead at the local hospital. FF #2, who had returned to fighting the fire after the incident, was examined at the local hospital and released.

Marks on the ladder and power lines indicate that the ladder struck the 7,500 volt power line and partly grounded out against the power and utility lines beneath it. It is not known for certain why FF #2 was not injured in the incident. It was noted that he was wearing dry leather gloves and rubber boots and was standing on dry pavement, which may have provided enough electrical resistance to prevent him from being seriously injured. (NOTE: firefighter turnout gear is not designed to be electrically insulating and should never be used for protection against electrical hazards). He may have also released the ladder before it made full contact with the power line.

During the employer interviews, it was stated that it was not unusual for off-duty firefighters to be put on duty at the scene. Off-duty firefighters are required by department regulations to report to the Chief in charge and are only assigned to assist with exterior work since they have no protective gear. The Chief stated that this was the first time he had pressed an off-duty firefighter into service and only did so because of the circumstances of the fire and rescue. This fire spread to three alarms, requiring 75 firefighters and 19 fire trucks and other vehicles to respond. The safety officer also responded to the fire,

but was en route at the time of the incident. The woman's report of her father being trapped was in error; all the residents escaped from the building and there were no civilian injuries.

CAUSE OF DEATH

The county medical examiner determined that the cause of death was electrocution. Electrical marks were found on both lower extremities corresponding to burns on the victim's socks and shoes.

RECOMMENDATIONS AND DISCUSSION

Recommendation #1: Fire Departments should ensure that all firefighters are trained in the recognition and avoidance of electrical hazards.

Discussion: In this case, the officers at the fire ground were aware of the power lines near the building. However, due to the demands of the fire and the rescue attempt, it was necessary to raise the ladder near them. The firefighters method of ventilating the windows placed the ladder even closer to the power line, and an otherwise minor slip caused the ladder to contact it. To prevent these incidents, it is recommended that all firefighters should receive regular training in the recognition and avoidance of electrical hazards. These hazards are covered in the IFSTA training manual 209, "Firefighter Occupational Safety". It may also be useful to duplicate the circumstances of the incident at the department's fire training academy using a "dummy" powerline as a training exercise. Many electrical utilities also provide training for fire departments in working near power lines.

Recommendation #2: Fire Departments should have a written standard operating procedure for operating near electrical hazards.

Discussion: Although the department had extensive written SOPs, none existed for electrical hazards or ladder raising. As per recommendation #1, the general safety practices for operating near power lines and other potential electrical hazards should be outlined in a written SOP. This should include prohibiting the use of ladders to ventilate windows or in other uses that could potentially put the ladder in contact with powerlines. The SOP should also outline safe rescue procedures of persons who contact electrical energy.

Recommendation #3: Fire Departments should consider equipping each ladder truck with a non-conductive fiberglass ladder.

Discussion: During the FACE investigation of the incident site, it was apparent that the many powerlines located near the buildings in the city present a constant hazard. In the NIOSH Alert "Preventing Electrocutions of Workers Using Portable Metal Ladders Near Overhead Power Lines", NIOSH recommends the use of non-conductive ladders in locations where they may contact electrical

conductors. Although a fiberglass ladder may be too heavy to be practical in most fire ground operations, it would provide a safety option when working near powerlines.

Recommendation #4: Fire Departments should require an observer to watch the placement of ladders near power lines.

Discussion: In this case, the firefighters may have been too preoccupied with the urgency of the rescue to realize the danger presented by the nearby power lines. To prevent contact with power lines, a firefighter should be assigned to watch the movement of the ladder when working near them. The firefighter should be positioned where he can clearly see the power lines and instruct the crew when the ladder is near them. This may be done by the firefighter working the ladder extension rope (halyard).

REFERENCES

1. IFSTA 209, Firefighter Occupational Safety. International Fire Service Training Association, Oklahoma State University, Stillwater OK, 1979.
2. NIOSH ALERT: Preventing Electrocutions of Workers Using Portable Metal Ladders Near Overhead Power Lines. DHHS (NIOSH) Publication #89-110, 1989. NIOSH Publications Dissemination, Cincinnati OH (513) 533-8287

ATTACHMENTS

[NIOSH ALERT: Preventing Electrocutions of Workers Using Portable Metal Ladders Near Overhead Power Lines.](#) DHHS (NIOSH) Publication #89-110, 1989. NIOSH Publications Dissemination, Cincinnati OH (513) 533-8287.

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