TO: Director, National Institute for Occupational Safety and Health

FROM: California Fatality Assessment and Control Evaluation (FACE) Program

SUBJECT: Electrician apprentice dies when his neck is crushed by a scissor lift in California

SUMMARY
California FACE Report #98CA003

A 26-year old electrician apprentice (decedent) died when the scissor lift he was moving inadvertently raised causing his neck to be crushed between the top guard rail and the underside of the top of an opening in a concrete wall. The decedent was cleaning out bore holes in the concrete wall in anticipation of running conduit through them. The employee was given a ladder for the job, but obtained a scissor lift from another employer. He was moving the lift over a piece of plywood placed on top of bent-over reinforcing steel (rebar). As he was moving the scissor lift through an opening in the wall and over the plywood, the lift platform inadvertently raised and his neck became trapped. The CA/FACE investigator determined that, in order to prevent future occurrences, employers should:

- ensure working surfaces are stable and level when moving equipment over them.
- ensure instruction in equipment operation includes remote operation.
- ensure employees do not borrow and use equipment for which they are not authorized to use.

Additionally, manufacturers should:

- design equipment controls that are protected from inadvertent operation.

INTRODUCTION

On February 25, 1998, at 7:30 a.m., a 26-year old male apprentice electrician was fatally injured when his neck was crushed between the top guard rail of a scissor lift and the underside of the top of a door opening in a concrete wall. The decedent was moving the scissor lift through a rectangular hole in a concrete wall. The lift was moving over a piece of plywood which had been laid on top of bent-over reinforcing steel (rebar). As he moved the lift over the plywood, the lift platform inadvertently raised crushing his neck.

The CA/FACE investigator learned of this incident on March 10 from the local legal office of the California Occupational Safety & Health Administration (Cal/OSHA). On March 11, 1998, the CA/FACE investigator traveled to the incident site where he met with the site superintendent and the decedent's foreman, and photographed the area where the incident

happened. On March 13, 1998, the CA/FACE investigator visited the rental yard where the scissor lift was stored, spoke to the rental yard owner, and photographed the scissor lift. On March 16, 1998 the CA/FACE investigator returned to the site of the incident to perform an additional inspection. The CA/FACE investigator interviewed, by phone, the Vice President of the concrete contractor on March 20, 1998.

The employer, an electrical contractor and engineering company, had been in business for 30 years at the time of the incident. The company had 3500 employees with 6 working on site at the time of the incident. The decedent had worked for the company for the 2 years and had worked at the site of the incident for 3 months. Company safety responsibilities were well defined, with superintendents having site responsibility and, in their absence, the site foreman assumed responsibility. The company had a complete Injury and Illness Prevention Program (IIPP) and a code of safe practices. The decedent was trained in the use of scissor lifts, the last three times being January 19, 1998, January 5, 1998 and November 11, 1997 as verified by documentation. The company had written generic procedures for operating equipment, but not specifically for the use of scissor lifts. The specific information was passed on verbally in the training and safety sessions. Safety meetings were held every Monday morning.

INVESTIGATION

The scene of the incident is a very large, 10-story commercial building which had been vacant for many years. The building was undergoing seismic retrofitting and complete remodeling in preparation for new tenants. Many contractors and subcontractors were performing various types of work on the building on the day of the incident. The company who employed the decedent was performing electrical contracting services for the major contractor and had been at the site for approximately six months at the time of the incident.

On the day of the incident, the job foreman had assigned the decedent the task of cleaning concrete out of some of the circular conduit holes that had been bored in the interior walls of the building. The holes were approximately 10 feet above the floor level. The decedent was given a ladder to access the holes. Shortly after given his assignment, the decedent obtained, without permission, an electrically-operated scissor lift **(Exhibit 1**) which had been rented by the concrete contractor on the job. The scissor lift had been parked and plugged-in to charge after its last use. The decedent unplugged the lift and moved it to his job area.

The concrete wall through which the conduit holes had been bored was 24 inches thick. In order to properly clean the holes, the job had to be performed from each side of the wall. In order to access both sides of the wall, the decedent had to move the scissor lift through an opening. The opening he choose was one that had been blocked out, when the wall was poured, for a future door in the building (**Exhibit 2**). The concrete contractor used the same opening for moving the scissor lift through the wall. This was done remotely with the pendant control so employees did not have to ride on the platform of the lift. However, the decedent choose to ride the lift northbound through the opening. The opening measured 76 3/4 inches wide and 108 inches tall.

At floor level in the area of the opening were ten pieces of 5/8-inch reinforcing steel (rebar) (**Exhibit 3**), five of which had been bent over in a northerly direction and nailed at the

bend to a 2-inch by 4-inch piece of lumber. The 2X4 had been placed at the north end of the wall across the opening with the 2-inch (1 1/2-inch nominal) side up. The remaining five pieces of rebar were bent in a southerly direction without being nailed down. This allowed the ends of the rebar to stick up. The end of one piece of rebar measured 6 inches off the floor. The remaining pieces of rebar measured, in varying heights, less than 6 inches off the floor. It was necessary to leave the rebar in place since 3-inch topping slabs would be poured over the rebar at a later date.

Prior to the scissor lift moving through the opening in the wall, the rebar was covered with a piece of 1-inch thick plywood. It is unknown if the decedent placed the plywood over the rebar or if it was already in place. However, the plywood did not completely cover the rebar. As the decedent began to move the scissor lift over the plywood-covered rebar, one or more pieces of rebar struck against the scissor lift. This was evident upon later examination by newly-made scratches on a bottom plate on the front of the scissor lift (**Exhibit 4**) and corroborated by the investigating Cal/OSHA safety engineer and the equipment rental yard owner. The most likely scenario is that the decedent looked over the side of the scissor lift to see what was holding up the progress of the scissor lift. When he did so, he either inadvertently hit the "up" toggle switch, moved the toggle switch the wrong direction, or moved the wrong toggle switch.

Another possibility is that the since the floor level was unstable because of the plywood-covered rebar, the scissor lift lurched or rocked when it struck the exposed rebar causing the decedent to inadvertently hit the "up" toggle switch. This scenario is made feasible when one considers that the 15 1/2-inch tires on the scissor lift were hard rubber and, along with the scissor lift chassis offered virtually no shock absorption. When the scissor lift inadvertently raised up, it trapped the decedent's neck between the top guard rail and the underside of the top of the door opening (similar to a header).

The concrete contractor's foreman found the decedent and removed him with help from an employee of the general contractor on the job. The employee of the general contractor performed CPR and the paramedics took him to the hospital.

Subsequent investigation revealed that the scissor lift was operating properly. The lift involved in the incident measured 83 inches in height from the ground to the top of the top guard rail with the scissor lift in the fully lowered position. This allowed only 25 inches of clearance from the top guard rail to the underside of the top of the door opening if the ground was level. However, the plywood-covered rebar nailed to the 2x4 at the floor level accounted for approximately 4 1/2 inches above floor level. This left approximately 20 1/2 inches of clearance between the top guard rail of the scissor lift and the underside of the top of the door opening. A few feet to the east was an opening he could have moved through that was approximately 18 feet high and gave at least 67 inches of width clearance (**Exhibit 5**). The scissor lift measured 35 1/2 inches in width from wheel to wheel and would have fit easily.

The lift speed of the platform was calculated to be .46 feet or 5.52 inches per second. It would take 37 seconds to lift the platform 17 feet to full extension. The problem was that there was virtually no clearance between the top guard rail and the bottom of the door opening. The travel speed was also quite slow, 2.25 miles per hour with the toggle switch in the "fast" position, and .5 miles per hour with the toggle switch in the "slow" position.

The scissor lift was operated by toggle switches as a pendant (electrical cord connected to a metal control box containing the toggle switches) (**Exhibit 6)**. The toggle switches included, from top to bottom, "power shut off," "up/down," "left/right," forward/reverse," and "fast/slow." The toggle switches were fully exposed and, therefore, not protected from inadvertent operation.

The scissor lift had many signs warning users of potential dangers of using the scissor lift. On the rear frame of the lift a sign was visible that stated "Use on level ground only" (**Exhibit 7**). On the rear of the lift's platform just above the ladder used to gain access to the platform is a sign stating "DANGER--Do not operate this equipment until you have been properly instructed in the proper operation and care of same--failure to comply with this warning could result in injury or death" (**Exhibit 8**).

CAUSE OF DEATH

The death certificate stated the cause of death to be a crushing injury of the neck.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure working surfaces are stable and level when moving equipment over them.

Discussion: Floors over which pedestrians or equipment move need to be free of projections or obstructions and level to prevent injury incidents. A sign on the rear of the scissor lift warned users to use only on level ground. In this case, the floor had rebar sticking up to six inches above the level of the floor itself. When the plywood was placed over the rebar, the floor would not have been level because the south facing rebar was not nailed down. If the south facing rebar had been nailed down, the plywood nailed in place and made to fully cover the rebar, and small ramps placed on either end of the plywood, the floor would have been much safer for pedestrians and equipment.

Recommendation #2: Employers should ensure instruction in equipment operation includes remote operation.

Discussion: Although training in the operation of a scissor lift was documented on three occasions for the decedent, the type of training was not in written form. It is unknown if the instruction included the remote operation of equipment because of the lack of written instructions for equipment operation and specific written instructions for scissor lift operation. Formal, written and specific instructions should be developed and used as a training tool so all employees get the same full and complete training. These instructions should include the remote operation of the scissor lift. If the decedent had operated the scissor lift involved in this incident remotely, this incident would not have happened.

Recommendation #3: Employers should ensure employees do not borrow and use equipment for which they are not authorized to use.

Discussion: Strict rules should be developed and implemented regarding borrowing tools and equipment. Employees should be informed that borrowing tools or equipment from others is not permitted. Progressive measures including discipline should be used to insure employee

compliance. Tools and equipment differ from each other enough that unauthorized used could be dangerous. Not only brands, but models of the same brand may present danger to those not trained in their specific use. In this incident, the decedent obtained a scissor lift on which he had not been trained. A sign on the rear of the scissor lift's platform warned of the danger of injury or death if the user was not properly trained. The scissor lifts used for this job by the electrical contractor were operated by joy sticks. The scissor lift which the decedent obtained for his use was operated by dual-position toggle switches (move to the left for one operation and move to the right for the opposite operation, such as "up" and "down"). The decedent's unfamiliarity with toggle switch operation may have contributed to this incident. With only 20 1/2 inches of clearance between the top guard rail of the scissor lift and the bottom of the door opening, any activation of the "up" toggle would most likely not have allowed the decedent time to move his head back inside of the guard rails depending on how far over the side of the top guard rail the decedent was leaning.

Recommendation #4: Manufacturers should design equipment controls that are protected from inadvertent operation.

Discussion: The pendant control box on this particular scissor lift used exposed toggle switches for controlling the various operations of the lift. Inadvertent operation of the toggle switch could easily be executed by striking the toggle switch with a part of the body or against some object. There are pendant controls on the market where operations are performed by recessed buttons, the inadvertent operation of which would be difficult. This type of control box or one in which the controlling switches are similarly protected should be used on equipment which could present a crushing or pinching danger to employees using them.

References:

Barclays Official California Code of Regulations, Vol. 9, Title 8, Industrial Relations, South San Francisco, 1998

http.www.dir.ca.gov./title8/3638.html
/3642.html
/3646.html
/3648.html

For more information on equipment use, consult Title 8 of the California Code of Regulations, sections 3638, 3642, 3646,3648 and American National Standards Institute (ANSI) A92.3, and A92.6.

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FATALITY ASSESSMENT AND CONTROL EVALUATION PROGRAM

The California Department of Health Services, in cooperation with the California Public Health Foundation, and the National Institute for Occupational Safety and Health (NIOSH), conducts investigations on work-related fatalities. The goal of this program, known as the California Fatality Assessment and Control Evaluation (CA/FACE), is to prevent fatal work injuries in the future. CA/FACE aims to achieve this goal by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

NIOSH funded state-based FACE programs include: Alaska, California, Iowa, Kentucky, Maryland, Massachusetts, Maryland, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Washington, West Virginia, and Wisconsin.

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Additional information regarding the CA/FACE program is available from:

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