Deaths and Injuries Involving Elevators or Escalators

A Report of
The Center to Protect Workers' Rights

July 2001

This research was produced by the Center to Protect Workers' Rights (CPWR), as part of a research agreement with the National Institute for Occupational Safety and Health, NIOSH (grant CCU310982). The research is solely the responsibility of the authors and does not necessarily represent the official views of NIOSH. CPWR — the research and development arm of the Building and Construction Trades Department, AFL-CIO — is uniquely situated to serve workers, contractors, and the scientific community. A major CPWR activity is to improve safety and health in the U.S. construction industry.

Acknowledgment

Paul Moore, Safety Engineer, Division of Safety Research, NIOSH, provided FACE reports to assist with preparation of this report.

Abbreviations

ASME	American Society of Mechanical Engineers
BLS	U.S. Bureau of Labor Statistics
CFOI	Census of Fatal Occupational Injuries (BLS)
CPSC	Consumer Product Safety Commission
FACE	Fatality Assessment and Control Evaluation (NIOSH)
NIOSH	National Institute for Occupational Safety and Health, CDC

Contents

Summary

Incidents involving elevators and escalators kill about 30 and seriously injure about 17,100 people each year in the United States, according to data provided by the U.S. Bureau of Labor Statistics and the Consumer Product Safety Commission. Injuries to people working on or near elevators – including those installing, repairing, and maintaining elevators, and working in or near elevator shafts – account for 15 to 16 (about 62%) of the deaths. The two major causes of death are falls and being caught in/between moving parts of elevators/escalators. Incidents where workers are struck by elevators or counterweights, electrocuted, or are in or on elevators or platforms that collapse are also numerous.

Recommendations to prevent elevator- and escalator-related deaths and injuries include ensuring that:

• Workplace protective practices and training are adequate. In particular:

De-energizing and locking out electrical circuits and mechanical equipment when elevators and escalators are out of service or being repaired

Establishing a permit-required confined-space program for elevator shafts

Providing fall protection during work in or near elevator shafts.

• Employers have an adequate inspection and maintenance program, and

• Employers use only qualified workers for escalator and elevator repair and maintenance.

Introduction

At the request of President Edward C. Sullivan, Building and Construction Trades Department, AFL-CIO, the Center to Protect Workers' Rights has analyzed causes of injuries and deaths (resulting from injuries) involving elevators and escalators in the United States.

Elevators and escalators are potential sources of serious injuries and deaths to the general public and to workers installing, repairing, and maintaining them (Staal and Quackenbush 1998). Workers are at risk also, for instance, when cleaning elevator shafts, conducting emergency evacuations of stalled elevators, or doing construction near open shafts. State and local authorities recognize such hazards and require periodic inspections of elevators and escalators. Organizations such as the American Society of Mechanical Engineers (ASME) have set standards for the construction and maintenance of elevators and escalators and for their safe operation.

This report contains information from the Census of Fatal Occupational Injuries (CFOI) for the seven years 1992-98. CFOI is compiled by the U.S. Bureau of Labor Statistics using reports on work-related deaths that are collected (and confirmed) by state agencies for the federal survey. The report covers all construction and general industry deaths of "elevator installers and repairers" (Standard Occupational Classification code 543) and other deaths related directly to escalators, hoists, and personnel elevators (including freight elevators intended for people). Some of these deaths occur while working on or near elevators or escalators, while others occur to people using elevators or escalators while at work – say, a lawyer in a court building. (Deaths involving material hoists, dumbwaiters, and industrial machinery were excluded from this analysis.)

In addition, the analysis summarizes risks to passengers documented in escalator and elevator death and injury investigations compiled by the National Injury Information Clearinghouse, Consumer Product Safety Commission (CPSC), 1997 through August 23, 2000.

Deaths Involving Work On or Near Elevators or Escalators

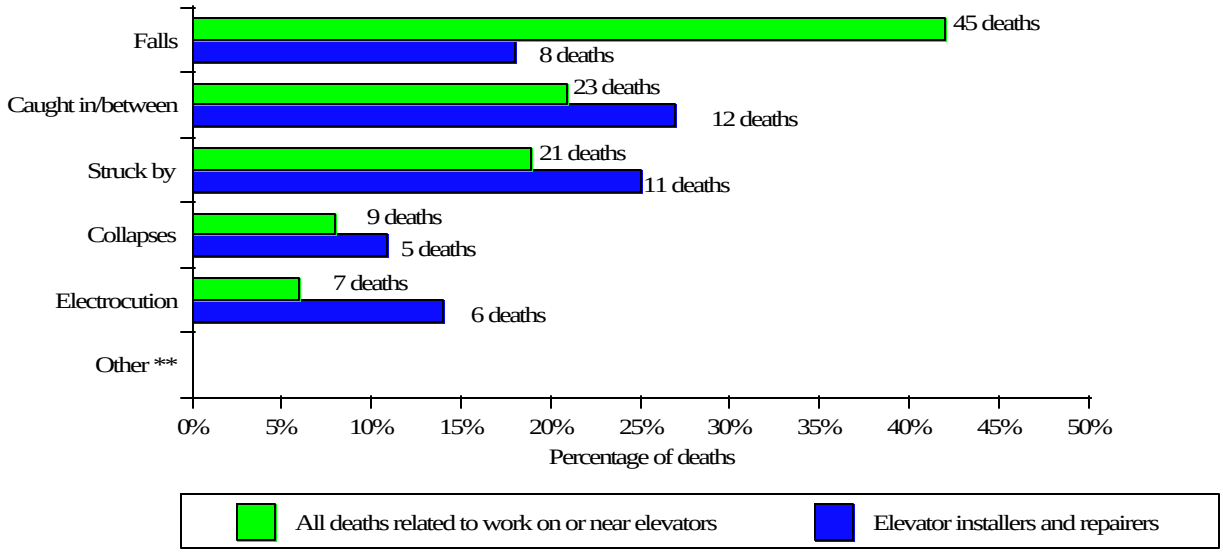
The Census of Fatal Occupational Injuries reported 152 deaths in the seven years 1992-98 – about 22 per year – related to elevators and escalators. Of these, 108 involved work on or near elevators and 44 of those killed were elevator or escalator *passengers* – people entering or riding in elevators and escalators while at work.

The 108 deaths related to work on or near elevators or escalators – about 15 per year – were most often caused by falls into elevator shafts (42%) (fig.1).

Elevator Installers and Repairers

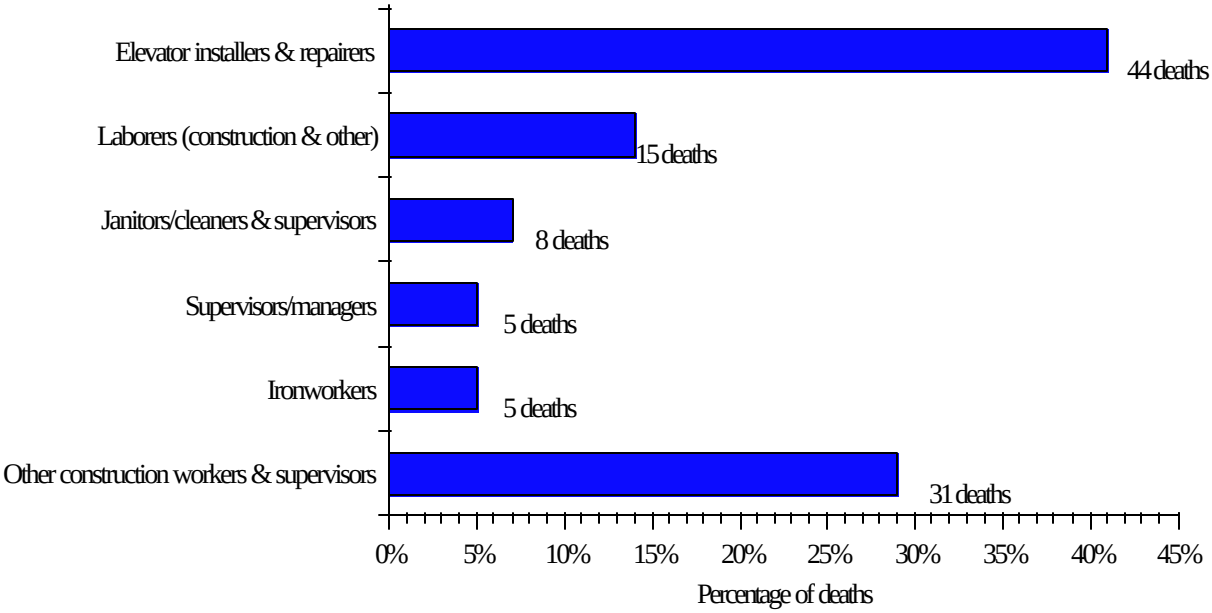
Elevator installers and repairers – also called elevator constructors or elevator mechanics – were by far the largest occupation affected, 41% of the deaths during work on or near elevators (fig. 2).

Figure 1. Deaths related to work on or near elevators or escalators by cause, 1992-98. (108 deaths)



** Data do not meet BLS publication criteria.
Note: The 108 deaths include 44 elevator repairers and installers.
Source: U.S. Bureau of Labor Statistics data.

Figure 2. Deaths related to work on or near elevators or escalators, by occupation, 1992-98



Note: Total of 108 deaths
Source: U.S. Bureau of Labor Statistics

The two main causes of death for elevator installers and repairers were being caught in/between (elevators and elevator shafts or other elevators) and being struck by objects, mostly elevators (see fig. 1).

Although elevator installers and repairers are divided roughly equally between construction and general industry, three-quarters of the deaths in this group affected employees of construction contractors.

In fact, construction elevator installers and repairers have the fourth-highest rate of work-related deaths of all construction trades (fig. 3). The average death rate for elevator installers and repairers in construction was 31.6 per 100,000 full-time-equivalent workers (FTE) in 1992-98, more than twice the death rate for all construction workers combined. The rate for elevator installers and repairers, however, is based on small numbers and thus may not be statistically reliable.

Activities and Causes of Deaths

Those killed working on or near elevators were involved in three types of activities, with 60% of the deaths involving installation or repair of elevators (fig. 4; table 1).

Table 1. Deaths involving work on or near elevators or escalators, by cause and activity, 1992-98

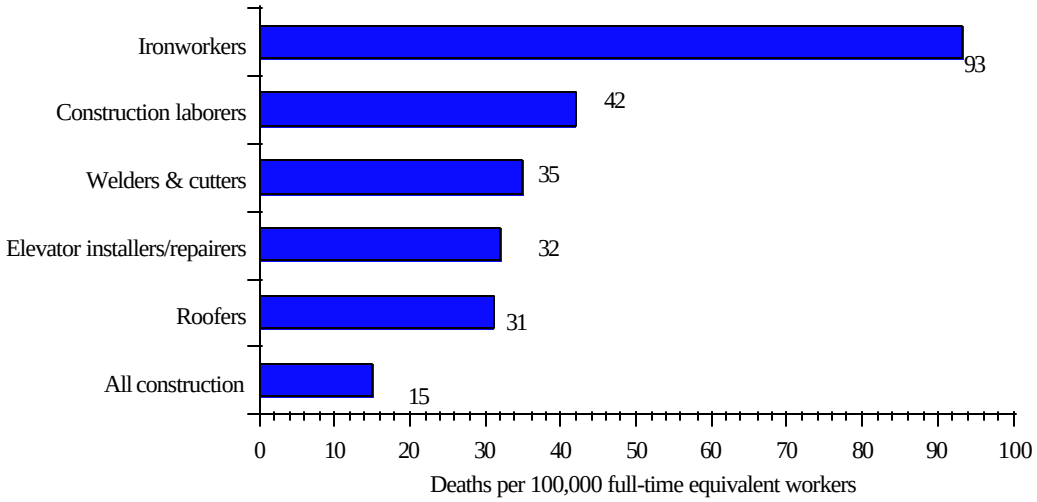
	Activity			Total	
Cause	Installing & repairing	Working in elevator shaft/car	Working near elevators	No.	Percent
Falls	18	10	17	45	42%
Caught in/between	18	--	--	23	22%
Struck by	13	7	--	21	19%
Collapse	7	--	--	9	8%
Electrocution	7	--	--	7	6%
Other	--	--	--	--	3%
Total	65	23	20	108	100%

-- Data do not meet BLS publications criteria.
Source: U.S. Bureau of Labor Statistics data

Installing and repairing elevators/escalators. Two-thirds of these 65 deaths involved elevator installers and repairers. The remainder included industrial machinery repairers, engineers, construction supervisors, electricians, janitors, maintenance workers, and a parking lot attendant. Seven of the deaths involved workers who were unqualified – not trained in elevator repair – trying to fix jammed elevators.

Falls caused about 25% of the deaths of workers installing and repairing elevators and escalators; most of the fatal falls, however, were by workers who were not classified by the Bureau of Labor Statistics as elevator installers or repairers. “Caught in” deaths included being caught in elevator

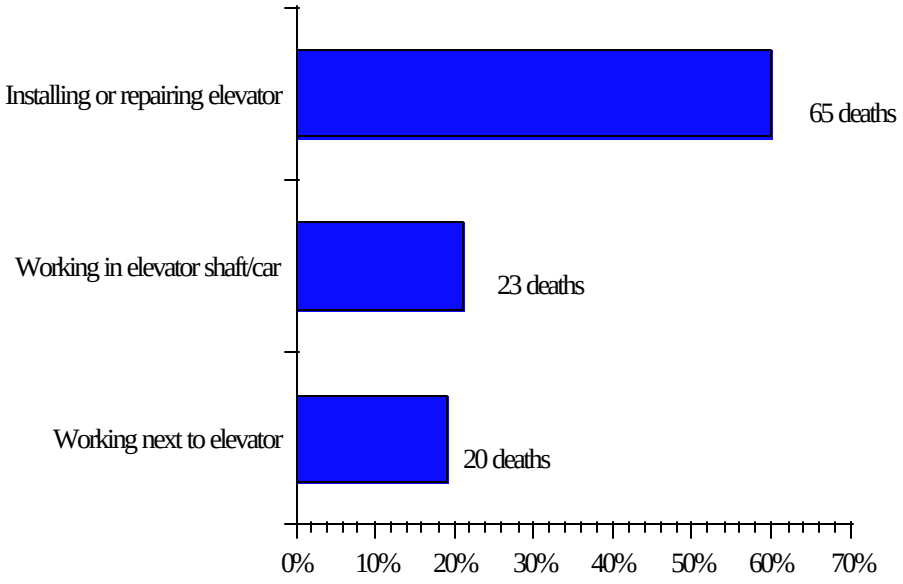
Figure 3. Construction occupations having the five highest death rates for work-related injuries, 1992-98



Note: To compare death rates for construction with other industries, rates are calculated for 2,000 hours per worker (50 weeks time 40 hours). This is because many construction workers do not work full time at construction as a result of project completions, bad weather, and other factors.

Source: Death rate calculations by Risana Chowdhury, CPWR, based on data from the Census of Fatal Occupational Injuries and Current Population Survey, both U.S. Bureau of Labor Statistics.

Figure 4. Deaths related to work on or near elevators or escalators by activity, 1992-98



Note: Total of 108 deaths.

Source: U.S. Bureau of Labor Statistics data.

machinery (such as counterweights) or between two cars or between the elevator shaft or doorway and a car.

Being struck by objects usually involved an elevator descending while someone was working in an elevator shaft. All but one of the electrocutions involved elevator installers and repairers.

Working in elevator shafts/cars. Deaths in this category involved cleaning inside an elevator shaft, retrieving keys and other objects that had dropped into a shaft, stuck elevators, and collapses of platforms over elevator shafts.

Working near elevator shafts. Almost all of these deaths involved construction workers. Ten of the deaths (nine of them falls) occurred during work next to unguarded or improperly guarded elevator shafts.

Additional Data Sources

The National Institute for Occupational Safety and Health (NIOSH) investigates deaths through its Fatality Assessment and Control Evaluation (FACE) reports (see appendix 1). These include investigations by NIOSH in house and in the states. The reports program identified 43 deaths since the FACE program started in 1982 (Moore 2000). These included:

25 falls down elevator shafts (58%), with 7 during construction, 8 during maintenance/inspection, and 10 routine use

7 deaths (16%) involving being struck by an elevator car, caught in an elevator mechanism, or struck by a counterweight

4 deaths (9%) from elevator collapses with a worker in or on the elevator

3 electrocutions (7%) during maintenance.

4 deaths (9%) from other causes, including explosion, falling material and unknown circumstances.

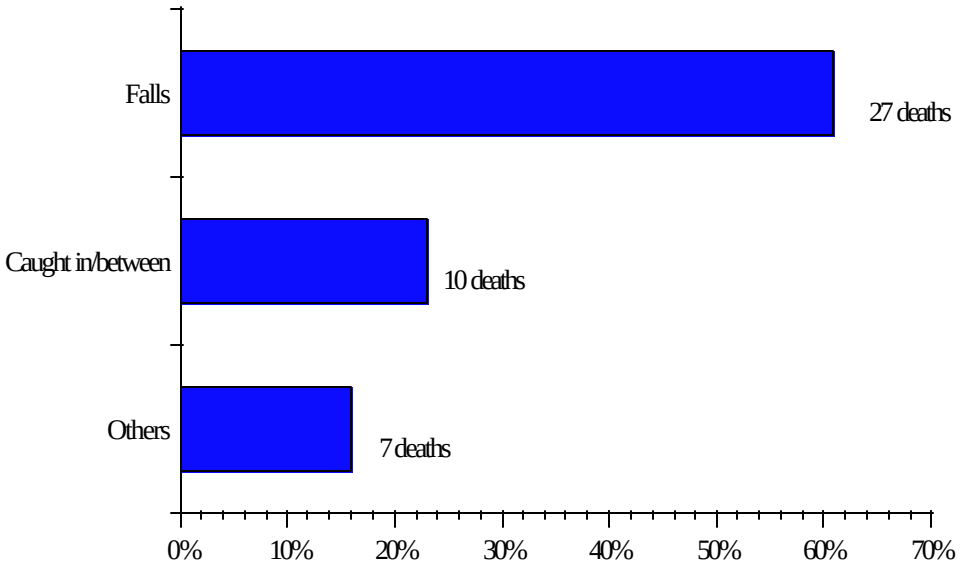
The deaths occurred in 15 states: California, Colorado, Iowa, Indiana, Kentucky, Maryland, Massachusetts, Missouri, Nebraska, New Jersey, North Carolina, Ohio, Texas, Washington, and Wisconsin. The data are incomplete, however, because they cover only the 20 states that participate – or have participated – in the program..

Injuries Involving Work on or near Elevators or Escalators

Although the death rate for elevator installers and repairers is higher than average, the injury rate is lower. According to BLS data for 1992-98, the occupational injury and illness rate for elevator installers and repairers was 209 per 10,000 full-time equivalents, compared with 381 per 10,000 for all construction workers (calculations by Risana Chowdhury, CPWR, August 2000). (Injuries are some 98% of the category.) The major causes of lost-time injuries to elevator installers and repairers were being struck by an object, overexertion (especially in lifting), falls, and being caught in/between – in that order.

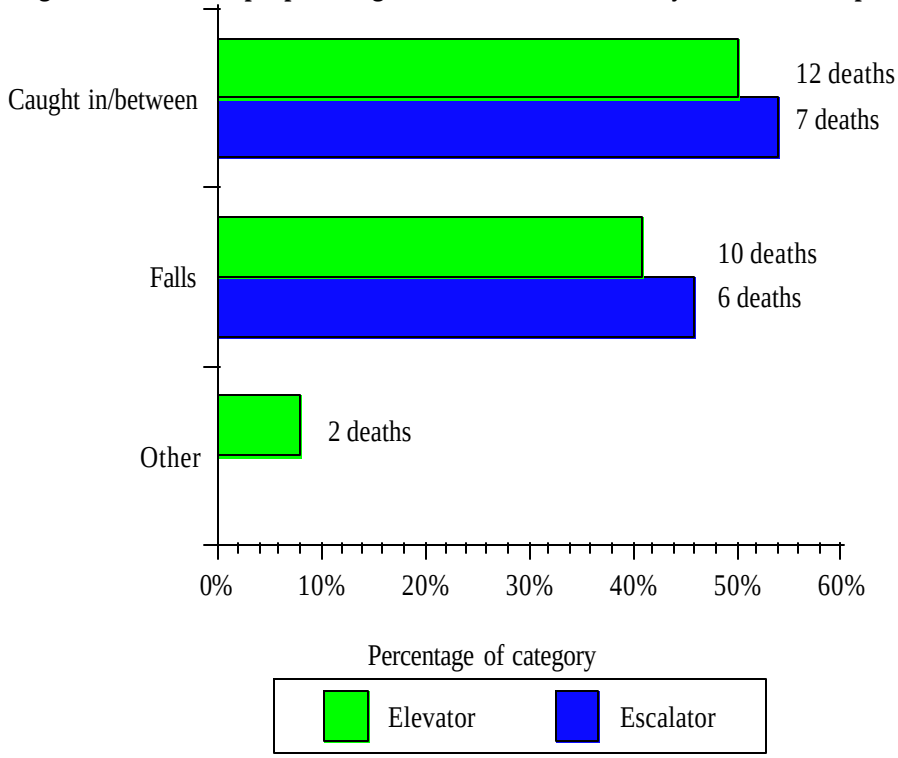
One study of visits to the George Washington University Emergency Department, in downtown Washington, D.C., by construction workers from 1990 through 1997 included 24 elevator

Figure 5. Deaths of people using elevators while at work, by cause, 1992-98.



Note: Total of 44 deaths. An example of a passenger death while at work is a salesman in a warehouse or a messenger in an office building. Most of the others involved being struck by elevator or closing elevator doors.
Source: U.S. Bureau of Labor Statistics data.

Figure 6. Deaths of people using elevators or escalators, by cause, 1997 to present



Note: Data through 8/23/00. Total of 37 deaths includes incidents while at work and away from work.
Source: Consumer Product Safety Commission data.

installers and repairers and mechanics (Hunting, Anderson, and Welch 2000). The two most frequent causes of the traumatic injuries were cuts and sprains and strains. The most serious injuries were crushing of the fingers or hands (resulting from "caught in" injuries) and head injuries (falls).

Deaths Involving Elevator and Escalator Passengers

In addition to endangering people working on or near them, elevators and escalators are potential sources of injuries and deaths for people using them as passengers. (The Bureau of Labor Statistics and the Consumer Product Safety Commission, CPSC, report such deaths.)

The Bureau of Labor Statistics reported 44 elevator-related deaths among people using elevators while at work, an average of 6 passenger deaths per year. These included supervisors/managers, clerks/stock handlers, janitors/cleaners and their supervisors, plus a wide variety of other occupations.

Other fall deaths included falls into elevator shafts, such as 8 deaths where an elevator door opened or was forced open and there was no elevator car (fig. 5). The "caught in/between" deaths often involved getting caught in an elevator door or between an elevator and door or shaft.

Information on passenger injuries and deaths is reported through the CPSC National Electronic Injury Surveillance System (fig. 6). During the (roughly) four years covered, the CPSC reported 13 deaths of escalator passengers in 7 states and the District of Columbia, about 3 per year. The states (with number of deaths) were Alabama (1), California (1), District of Columbia (3), Florida (1), Illinois (3), New York (2), Washington (1), and Wisconsin (1).The "caught in/between" deaths usually resulted after clothing became trapped, usually at the bottom or top of an escalator or between a stair and escalator sidewall; three of the six fall deaths were from head injury.

During this same period, the CPSC reported 24 deaths of elevator passengers – about 6 per year – in 13 states: California (1 death), District of Columbia (1), Florida (1), Illinois (3), Indiana (1), Michigan (1), Missouri (1), North Carolina (2), New Jersey (2), New York (8), Ohio (1), Pennsylvania (1), and Rhode Island (1). Four of the deaths involved children under age ten.

In 1994, the Consumer Product Safety Commission estimated that there were 7,300 escalator and 9,800 elevator injuries requiring hospitalization (Cooper 1997). This data were based on a nationwide survey of 90 hospitals. Based on the number of elevators and escalators in the United States, the CPSC estimated that there were 0.221 accidents per escalator and 0.015 accidents per elevator annually.

The CPSC estimated that 75% of the escalator injuries resulted from falls, 20% from entrapment at the bottom or top of an escalator or between a moving stair and escalator sidewall, and 5% "other" (CPSC 1998). The "caught-in" incidents generally resulted in more serious injuries than did falls. Of particular concern is the fact that half of the approximately 1,000 sidewall-entrapment injuries involved children under age five (Armstrong 1996b). The children's injuries were mostly caused when a child's hands or footwear (including dangling shoelaces) became caught in an escalator comb plate at the top or bottom of an escalator or in the space between moving stairs and an escalator sidewall (see appendix 2).

Discussion and Recommendations

Elevators and escalators cause substantial numbers of deaths and injuries each year (table 2).

Table 2. Average estimated annual deaths involving elevators and escalators, 1992-98

	Elevator related	Escalator related	Total
Working on or near elevator or escalator*	15 - 16	–	15 - 16
Passenger while at work*	6	–	6
Passenger not at work	6	3	9
Total	27 - 28	3	30 - 31

Source: Data from U.S. Bureau of Labor Statistics (*) and Consumer Product Safety Commission.

The findings about the major causes of elevator and escalator deaths and injuries lead to five sets of recommendations.

Use Adequate Lockout/Tagout Procedures

More than half of the work-related deaths – especially electrocutions and "caught in/between" and "struck by" deaths — were caused by failure to de-energize elevator electrical circuits and failure to ensure that elevator parts could not move while maintenance or repairs were under way. The latter cause resulted also in one of the two work-related escalator deaths.

Lockout procedures are part of OSHA's standard for control of hazardous energy (lockout/ tagout) (29 CFR 1910.147) for general industry. New construction and repair normally come under OSHA's construction standard (29 CFR 1926),which does not have a lockout/tagout standard. Nonetheless, safe work practices mandate lockout/tagout when repairing and renovating elevators and escalators.

The OSHA lockout/tagout standard requires written procedures and training of personnel. The procedures require that personnel working on electrical circuits or machinery turn off the power and lock out the circuits so that no one else can turn the power on while people are working on the elevator or escalator. A worker should keep the key to the lock. If it is necessary to work "live" on electrical systems – for instance, while taking meter readings, using jumpers, or turning power off and on – or to move an elevator to test repairs, special precautions should be followed. One recommendation would be to institute a permit system. A permit should describe appropriate engineering controls and safe work practices, including wearing adequate personal protective equipment.

Ensure Adequate Fall Protection

More than 40% of the deaths during work on or near elevators or escalators resulted from lack of fall protection. Provision of adequate fall protection – scaffolding, guardrails in front of open shafts, or personal fall-arrest systems – could have prevented these deaths. Fall hazards during new elevator or escalator construction and repair comes under 29 CFR 1926.500-503, part of OSHA's construction standard. Fall hazards during elevator maintenance would come under 29 CFR 1910.22(b).

Proper fall protection must always be used if there is a fall hazard (4 feet for general industry and 6 feet for construction).* If engineering controls are not practical, personal fall-arrest systems are required. Safe anchorage points for personal fall-arrest equipment need to be chosen and workers tied off to them while working. OSHA also has standards for use of ladders (29 CFR 1926.1050, 1051, 1053, and1060 and 29 CFR 1910.25 and 26)

Temporary structures on which workers are standing must be stable and strong enough for the weight of the worker and should meet OSHA standards for scaffolds (29 CFR 1926.451 and 29 CFR 1910.28). A fall into an open shaft lacking adequate guardrails was an important factor in at least 9 of the deaths of construction workers working near elevator shafts.

A Nebraska FACE investigation of the fall of a worker that resulted from the collapse of a work platform over an elevator shaft recommended that the employers:

• Provide appropriate fall protection equipment to all workers who may be exposed to a fall hazard.

• Insure holes in walking/working surfaces are protected by covers.

Treat Elevator Shafts as Confined Spaces

Almost one-third of the work-related deaths occurred when workers entered elevator shafts to repair or maintain elevators, or to perform activities such as cleaning, welding, and retrieving fallen objects.

OSHA's construction standard states, in part (for new construction), that:

[E]mployees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. §1926.21(6)(i)

Although OSHA's construction standard does not have a confined space standard, construction contractors come under OSHA's general industry confined space standard when working in a building where the owner comes under OSHA's confined space standard (Miles 1994).

---

*Fall protection is required at more 10 feet when a scaffold is used in construction.

OSHA's definition of a confined space is one that has limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designated for continuous occupancy by an employee (29 CFR 1910.146). Elevator shafts and pits meet that definition. In 1994, OSHA issued a letter of interpretation stating that elevator pits are usually confined spaces (Miles 1994).

If a confined space contains a hazard, it is classified as a *permit-required* confined space. An elevator shaft with a working elevator is clearly hazardous to workers in the shaft, as is shown by the numerous elevator-shaft-related deaths. Therefore elevator shafts with working elevators should be classified as permit-required confined spaces and employers should follow all the requirements of 29 CFR 1910.146. OSHA's permit-required confined space standard requires informing employees – including contractors – about the existence, location, and danger of permit-required confined spaces; and also providing a written (safety) program; elimination of, or protection against, hazards before entry; and rescue procedures.

An alternative approach is to declare that employees are not allowed to enter an elevator shaft or pit, and prevent such entrance by locks or other effective means. If work is required in a shaft or pit, it can be reclassified as a non-permit required confined space by eliminating the hazards (for example by locking out the elevator so it can't move).

A Texas FACE investigation of the death of a worker entering an elevator pit to find keys recommended the following:

• Include the elevator repair company in an initial evaluation of the pit spaces for compliance with permit-required confined space standard 29 CFR 1910.146.

• Establish a procedure that prevents unauthorized access to the pit areas of elevators.

• Have the elevator service company develop procedures for isolating the power source of elevators that protects employees from contact with hazardous energy when entering pit areas.

Provide Adequate Maintenance and Inspections

Many of the elevator- and escalator related deaths – work-related and not – could have been prevented if adequate maintenance and inspection procedures had been in place in the involved buildings (Boston Globe 1996).

A California FACE investigation of the fall death of a manufacturing supervisor recommended that employers:

• Have all elevators inspected and serviced regularly by a licensed elevator technician.

• Evaluate their current safety program (s) and incorporate specific training procedures emphasizing the importance of recognizing and controlling hazards in the workplace. The procedures should include, but not be limited to, conducting hazard evaluations before initiating

work at a job site and implementing appropriate controls.

• Identify areas that may be hazardous to personnel, and restrict or prohibit the use of or access to these areas.

Many fatal falls into elevator shafts occurred when elevator doors opened when an elevator call button was pushed – even though the elevator car was not at that floor. Interlocks are intended to prevent such occurrences, but clearly do not always work. Procedures are needed to quickly identify malfunctioning elevators (including elevator call buttons) and take steps to ensure that disabled elevators remain out of service and that warning signs or tape are placed on all elevator doors.

Malfunctioning escalators were also a cause of deaths or injuries. Several instances of multiple injuries were caused when an escalator suddenly reversed its direction of movement (Armstrong 1996a).

The high number of injuries involving trapping the hands and feet of children and the trapping of clothing of adults at the bottom or top of an escalator and in the gap between moving stairs and sidewalls raises the question of whether escalators are adjusted or designed properly (Dawson 1999).

Use Only Qualified Personnel

Many of the deaths described in the FACE reports indicate unqualified – untrained – personnel were performing elevator repair and maintenance. A California FACE investigation of the death of an elevator maintenance worker recommended that employers:

• Have only properly licensed employees working at a site performing complicated operations that require licensed personnel.

• Allow only qualified employees whose duties are required to be present during elevator repair work.

• Have a standard operating procedure that gives specific safety instructions on accomplishing hazardous tasks such as hoisting pistons.

At present, elevator personnel are trained by the elevator industry in conjunction with the International Union of Elevator Constructors through the National Elevator Industry Education Program. However, this program does not have a mandatory continuing education program for elevator installers and repairers. Nor does the program have the status of a state- approved apprenticeship program, as is common with other construction trades.

The states of Connecticut, Hawaii, Massachusetts, Michigan, Oregon, and Rhode Island require that elevator mechanics, inspectors, and contractors be licensed. Licensing is a common requirement in professions that affect worker safety and health. Licensing usually involves both

education and documented work experience requirements or passing a written examination. Renewal of a license usually requires passing a written examination or participating in a continuing education program on established Elevator Safety Codes of the American Society of Mechanical Engineers (ASME 2000).

Most states – except Kansas, Mississippi, North Dakota, Oklahoma, South Dakota, and Vermont – have adopted the ASME codes for elevators and escalators. However, many states do not automatically adopt the most recent revisions of the codes.

A recent proposed revision of ASME 17.1, Safety Code for Elevators and Escalators, requires employers to use elevator personnel for repair and maintenance of elevators and escalators. This document also provides for training of employees who perform cleaning of hoistway enclosures such as elevator shafts, startup of escalators, and emergency evacuation of elevators. Such use of qualified personnel and training procedures might have prevented many of the deaths described above.

OSHA has training requirements in many of its standards that would affect elevator and escalator safety. Examples include fall protection (29 CFR 1926.503, 1910.23), lockout/tagout (29 CFR 1910.147(c)(7)), electrical (29 CFR 1926.21, 1910.332) and confined space regulations (29 CFR 1910.146(g)).

References

Armstrong, David. 1996a. Escalator accident injures 22. *The Boston Globe***,** February 22.

Armstrong, David. 1996b. US Urges Upgrade in Elevator Safety. *The Boston Globe,* July 21. http://www.globe.com/globe/specialreports/1996/jul/elevator/escalator721.htm.

ASME. 2000. ASME Safety Code for Elevators and Escalators. http://www.asme.org/cns/departments/Safety/Public/A17/index.html

The Boston Globe. 1996. Risky ride: A special report on elevator and escalator safety. Various articles published December 3, 1994 through July 21, 1996. http://www.globe.com/globe/specialreports/1996/jul/elevator/home.htm.

Cooper David. 1997. Escalator Side-of-Step Entrapment. Presented at International Association of Electrical Engineers Elevcon '96, Barcelona, Spain. http://www.elevator-expert.com/escalato.htm.

CPSC. (1998). Escalator Safety. CPSC Document #5111. http://www.cpsc.gov/cpscpub/pubs/5111.html.

Dawson, Carol. 1999. Will CPSC Seek Jurisdiction over Escalators? *CPSC Monitor,* 4(1):1-3. http://www.consumeralert.org/pubs/monitor/1999/Jan99.htm.

Hunting, Katherine, Judith Anderson, and Laura Welch. 2000. Occupational Injuries among Construction Workers: Results from Seven Years of Surveillance at the George Washington University Emergency Department. Washington, D.C., manuscript.

Miles, John. 1994. Elevator Industry Employees working in and around pits and equipment. 9/19/94. OSHA Standards Interpretations and Compliance Letters. OSHA.

Moore, Paul. Elevator Fatality Information. NIOSH. Private communication, 8/25/2000.

OSHA. 2000. Fatal Injuries. *OSHA Aurora Office News*. Aurora, Illinois. Spring: p. 3.

Staal J and John Quackenbush. 1998. Elevators, Escalators and Hoists. In: Stellman, Jeanne Mager, ed. *Encyclopaedia of Occupational Health and Safety, Fourth Edition.* Geneva: International Labour Office., Volume III, chapter 93, pp. 40-44.

Appendix 1
Examples of NIOSH FACE Summaries of Elevator-Related Deaths

Maryland Division of Labor and Industry
FACE Report 96MD05501
An elevator construction foreman was caught under an elevator car and died of injuries to the head and neck and compression asphyxia.

SUMMARY

On September 24, 1996, 53-year-old male elevator construction foreman (the victim) was killed and his helper, an elevator constructor (employed by another subcontractor) was injured, when the hydraulic elevator car they were working under fell on them. The two were adjusting the hydraulic cylinder when the car fell, trapping them in the elevator pit. Two wooden poles (4x4 by approximately twelve-feet long) used to keep the elevator from falling were placed leaning against the guide rails. The car was approximately fifteen inches above the poles, which they did not tie in place. The poles were knocked out of position when the car fell due to the sudden loss of hydraulic pressure and trapped the two workers under the car. The elevator apparently did not fall evenly to the bottom of the pit. This permitted the rescue team to enter the pit area and extract the injured. However, rescuers had to use air bags to help raise the car to remove the victim.

The MD/FACE Field Investigator concluded that to prevent similar future occurrences, employers should:

- Train employees in the recognition of hazards, and methods to control hazards.

- Develop, set up and enforce comprehensive written instructions for making adjustments to hydraulic elevators.

New Jersey Department of Health
Face Investigation #94-NJ-028-01
Company Owner Dies After Falling 15 Feet Down an Freight Elevator Shaft

SUMMARY

On December 1, 1993, the 46 year-old owner of a clothing manufacturing company was killed after falling 15 feet down a freight elevator shaft. The incident occurred in a large three-story warehouse where the victim was renting space for his clothing manufacturing business. At about 5 p.m., the owner was trying to move a customer order from his second floor work shop to the loading dock on the first floor. Because the call buttons on the freight elevator were not functioning, the victim went to the first floor to raise the elevator to the second floor. Not realizing that the elevator was on the second floor, the victim opened the elevator door in the dark vestibule and stepped into the empty elevator shaft, falling 15 feet into the warehouse basement. NIOSH FACE investigators concluded that, in order to prevent similar incidents in the future, these safety guidelines should be followed:

- Building owners and employers should insure that elevators are maintained in proper working order.

- Building owners and employers should insure that entrances, exits, and work areas are properly lit.

California Department of Health Services
FACE Report 93CA01001
Elevator Service Technician Dies After Being Crushed by an Elevator Counter-Weight in California

SUMMARY

A 42-year-old, white, non-Hispanic, male elevator service technician (the victim) died after being crushed by an elevator counter-weight while at work. The victim was an employee of an elevator repair company and was doing general maintenance contract work for a hotel. He was working alone at the time of the incident. The service dispatcher at his company had tried to reach him (via his pager) on several occasions earlier on the afternoon of the incident. When the dispatcher was unable to reach the victim, another service technician (co-worker) was sent to the hotel to find him. The co-worker met with the hotel's chief engineer and together they looked in the area where the victim had last been seen working. The victim was found in an elevator lying over counterweights and pinned between spreader beams on the second floor of the hotel. The victim may have been using the spreader beam between car #1 and #2 as a work station. The co- worker stated that the victim was obviously already deceased. The hotel engineer called 911 and police and paramedics arrived a short time later. The CA/FACE investigator concluded that, in order to prevent similar future occurrences, employers should:

- require rigid screens or walls between adjacent hoistways with side-mounted counterweights; and

- have signs posted between the elevator spreader beams stating that caution should be taken due to the position of the counterweights.

California Department of Health Services
FACE Report 93CA00301
Manufacturing Supervisor Falls and Dies in an Elevator Shaft in California.

SUMMARY

A 34-year-old Hispanic male manufacturing supervisor (the victim) died after falling approximately 35 feet into an elevator shaft. The victim had been showing his family members his place of employment. The incident occurred when the victim tried to prevent the elevator from going up a level. He attempted to detain the elevator by grabbing the elevator platform's edge and lost his grip. The victim had to be removed by firefighters from the shaft bottom. He was pronounced dead by a paramedic at the scene.

The CA/FACE investigator concluded, that in order to prevent similar future occurrences employers should:

•have all elevators inspected and serviced on a regular basis by a licensed elevator technician.

•evaluate their current safety program and incorporate specific training procedures emphasizing the importance of recognizing and controlling hazards in the workplace. These procedures should include, but not be limited to, conducting hazard evaluations before initiating work at a job site and implementing appropriate controls.

- identify areas that may be hazardous to personnel, and restrict or prohibit the use of or access to these areas.

California Department of Health Services
FACE Report 94CA01401
Elevator Maintenance Worker Dies from Fall in an Elevator Shaft in California

SUMMARY

A 34-year-old white, non-Hispanic, male elevator maintenance worker (the victim) died after falling approximately 30 feet into an elevator shaft. At the time of the incident, the decedent and two coworkers were pulling a hydraulic piston out from the bottom of the elevator shaft so that a new liner could be installed. Prior to performing this operation, the workers had installed an electrically powered, base mounted capstan (a revolving barrel on a vertical axis for winding cable) or cathead in the bottom of the elevator shaft which was to be used as a hoist to lift the piston up to the top of the shaft. Co-worker #2 had been sent to the fourth floor so that he could inform the other workers when the piston reached the top of the shaft. The victim was working from the first floor and co-worker #1 was at the bottom of the shaft. Co-worker #2 yelled when the piston hit the top of the elevator shaft but his co-workers apparently did not hear him. Co-worker #1 continued in his efforts to raise the piston which resulted in the capstan being pulled out from the floor of the shaft where it had been anchored. It flew up into the shaft and the piston fell back down to the bottom of shaft. Co-worker #1 became entangled in the hoisting ropes and was pulled up into the air. The victim, stationed on the first floor, apparently looked into the shaft to help and was hit in the head by the capstan. The victim then fell to the bottom of the shaft. Both co-workers pulled the victim out from the elevator shaft and began First Aid. The security guard called 911 and fire department paramedics were summoned to the scene. An on-site examination revealed multiple fractures of the skull and jaw. The decedent was pronounced dead at the scene by fire department paramedics.

The CA/FACE investigator concluded that in order to prevent similar future occurrences employers should:

•mount capstans (catheads) into the sidewall of elevator shafts, and not the floor, in order to create a shearing effect to insure that the capstan does not pull out during hoisting operations.

•allow elevator doors to be opened only enough to permit workers to observe work being performed in the shaft or, if kept in a fully open position, should have all hatchways or openings in the elevator shaft protected by guardrails or their equivalent.

•only have properly licensed employees working at the site performing complicated operations that require licensed personnel.

•only allow qualified employees whose duties are required to be present during elevator repair work.

•have a standard operating procedure (SOP) which gives specific safety instructions on accomplishing hazardous tasks such as hoisting pistons.

•instruct employees and have a standard operating procedure (SOP) in standardized communication signals to use when voice contact is not adequate or provide employees with control devices that allow employees to ascertain the position of hoisted equipment.

Nebraska Department of Labor
Nebraska FACE Investigation 95NE017
Worker Falls 33 Feet While Constructing Elevator Shaft.

SUMMARY

A 51-year old construction superintendent fell 33 feet to his death while constructing an elevator shaft. He was in the process of setting up a work platform at the time of the incident. A 4x8 foot sheet of plywood had just been set down over two 2"x12" boards which were resting on two 2"x6" boards nailed to the frame of the elevator shaft. When the victim stepped on the sheet of plywood one of the 2"x6" boards broke. The platform gave way and he fell 33 feet to the concrete floor at the bottom of the elevator shaft.

The Nebraska Department of Labor (NDOL) investigator concluded that to prevent future similar occurrences, employers should:

Provide appropriate fall protection equipment to all workers who may be exposed to a fall hazard.

Insure holes in walking/working surfaces are protected by covers.

Texas
FACE Investigation 98TX14601
A Hotel Maintenance Engineer Died When Struck by the Counter Weights of an Elevator in Texas

SUMMARY

A 51-year-old male hotel maintenance engineer (the victim) died when he was struck by the descending elevator counter weights in a three-car hoist way enclosure. The victim was responding to a work request to locate keys that had fallen out of the pocked of another employee and through the opening in the elevator landing sill. Without reporting the work request to the superintendent, the victim entered the pit area of the elevator. When he did not see the keys in the immediate area, he walked through the pit of one elevator into an adjacent pit one floor lower. While the victim looked down into the pit, the counterweights from the elevator struck the victim on the back of the head and pinned him to the floor.

The TX FACE Investigator determined that to reduce the likelihood of similar occurrences, employers should:

Include the elevator repair company in an initial evaluation of the pit spaces for compliance with permit-required confined space standard 29 CFR 1910.146.

Establish a procedure that prevents unauthorized access to the pit areas of elevators.

The elevator service company should develop procedures for isolating the power source of elevators that protects employees from contact with hazardous energy when entering pit areas.

Install guards to cover the face of counterweights opposite the elevator's car.

Appendix 2
Examples of Elevator and Escalator Passenger Deaths (OSHA, CPSC, *The Washington Post*)

OSHA Report of Elevator Passenger Death

In 2000, a metal tradesman was killed when his head was caught between the elevator car window and the descending elevator. The call buttons on the elevator weren't working, so he looked through the elevator door (the windows had been removed) to see where the elevator car was. The elevator car came down and decapitated him. (OSHA 2000)

CPSC Reports: Escalator Passenger Deaths

A 37 year old male died from asphyxiation when his clothing became entrapped in the downward moving steps and stationary bottom comb plate of an escalator at a subway station. He was found, on his back, with the coat wrapped tightly around his chest, because part of the coat was dragged into the comb plate. There were no witnesses as to how the coat became entangled. (3/11/97, Washington, DC)

A woman, age 76, died of closed head injury four days after she fell and struck head on the escalator at a store. (2/9/99, Dunedin, FL)

A man, age 84, died from closed head injury several days later received when he apparently fell down an escalator at a mall. (4/12/99, Edmonds, WA)

A 50 year old male died after his sweater became entangled in an escalator sidewall. As a result, the victim's arm was pulled across his neck and choked him. (4/24/00, Hicksville, NY)

CPSC Reports: Elevator Passenger Deaths

A girl, age 4, was killed when caught between floors and an elevator in a residential building. Her mother had gotten off before her and other children pressed the call button. (5/1/97, Chicago, IL)

A male, age 45, was killed when he entered an elevator in a store and fell four floors onto the moving elevator and then became wedged between the elevator and a wall. He had just bought several hand-bags to export and the safety catch on the door failed. (9/13/97, Manhattan, NY)

A 46 year old male died of asphyxia due to compression of his neck and torso when he became trapped inside an elevator with his body partially between floors. (2/22/98, Washington, DC)

87 year old female died when she fell getting into an elevator due to the car not stopping evenly with the floor. She died of head trauma and internal injuries. (2/23/98, Cincinnati, OH)

A woman, age 56, died of injuries received in a hospital elevator that started moving while her gurney was only partly aboard. (5/7/99, St. Joseph, MI)

From *The Washington Post,* Sept. 1, 2000, B-1

Va. Woman Was Crushed By Elevator, Police Say

By. MICHAEL D. SHEAR Washington Post Staff Writer

The woman who died Wednesday in an elevator shaft at the Fairfax County Government Center Complex was crushed in a freak accident when the, elevator car shift ed as she walked in, causing her to fall and become wedged between the shaft wall and the car itself, police said yesterday.

When the car began to move down, Linda A,. Kline, of Prince William County, was killed instantly by massive internal injuries to her upper body, according to an autopsy completed yesterday. The elevator car stopped about a floor lower, leaving Kline's body pinned between the shaft wall and the top of the car.

"It appears that the elevator when it opened, it was there for her, said police spokeswoman Jayne Woolf. "It appears she was distracted and was not looking as she stepped on. By that time, the elevator had shifted."

Police and sources said Kline. 46, may have been focusing on conversations with friends or co-workers when she stepped into elevator Car No. 6 in the Pennino Building.

A county source familiar with the" investigation said police and other officials believe an elevator repair mechanic may have inadvertently disarmed the fail-safe mechanism that prevents doors from opening inappropriately, or may have suddenly moved the car without realizing someone was heading inside.

County officials said an employee with Allied Fox Elevators Inc., a company with offices in Fairfax County and Bowie that .has a contract to maintain the county's 4,500 elevators, was working on Car No. 6 when Kline fell. Mechanics also were working on Cars 2 and 3 at the time. All three elevators have been locked down during the investigation. The source said witnesses told police the mechanic working on Car. No. 6 was "absolutely distraught", moments after the incident.

Officials could not say what work was being performed on the elevators or whether there had been problems that needed fixing. Several employees who work in the building -said yesterday that the elevators had been trouble some for weeks. People have been getting stuck for brief periods, they said.

County officials confirmed that employees have complained since Kline's death. But they said there has been only one documented complaint about the elevators in the building in the last six months.

Representatives with Allied Fox Elevators did not return four phone calls left with an answering service. The address listed for the company in the Franconia section is a private home where the company president, Ronald McGuin, lives. A woman who answered the door said McGuin wasn't available.

Jay Marchack, president of National Elevator Inspection Services Inc., which has been hired by Fairfax to inspect its elevators since 1988, said his employees inspected Car No. 6 on May 24 and found it to be in working order.

He called the accident "a freak situation" and said deaths in elevators occur only two or three times a year nationwide.

"Usually they are few and far between," he said. "There are certain things that an elevator maintenance company can do to make sure the doors don't open. Most of them follow some strict safety precautions. It was a very horrible thing."

Bob Farley, executive director of the National Association of Elevator Safety Authorities, said the police explanation is mysterious because "electrically, for the car to move, the doors have to be closed and locked."

Farley said that he was not familiar with the circumstances of Wednesday's accident but that he could not understand how a person could fall between the elevator and the shaft wall. "A person's body is much bigger than that opening," he said.

County officials are also trying to determine why rescue crews arrived about six minutes late to the scene of Kline's death. Police said the county's 911 system displayed the incorrect address on the screen that dispatchers see when a call comes in. Dispatchers are instructed to confirm the address with the caller, but police officials said the dispatcher may have failed to do that.

As a result, emergency crews headed to the North County Government Center in Reston, miles from where Kline lay, until other calls started coming into the 911 center. When dispatchers realized their mistake, they sent another crew toward the Pennino Building, the correct site of the accident at the main government complex.

"The failure to verify may have caused us to go to the wrong address," said Michael B. Fischel, director of the police communications center. "But between the efforts of the firefighters and the fire dispatchers, they noticed the discrepancy. I doubt very seriously it had any effect."

Kline, a supervisor for the county's FasTran bus system, had been named driver of the year for 1999 and was well liked among many of the 1,000 employees who work in the Pennino Building, a 10-story glass and marble tower that houses the county's social service agencies.

Staff writers Tom Jackman and William Branigin and researcher Bobbye Pratt contributed to this report.

From *The Washington Post,* Sept. 17, 2000, C-3

METRO, In Brief, MARYLAND

Girl Severely Hurt in Elevator Accident

A 10-year-old girl was severely injured when she fell two floors to the bottom of an elevator shaft in a Temple Hills condominium complex yesterday afternoon, authorities said.

A Prince George's fire department spokesman said the girl fell while trying to escape an elevator car that was stuck between floors. She suffered head injuries and a possible hip fracture. At the Lynhill condos, in the 3 100 block of Good Hope Avenue, it took rescuers 15 minutes to stabilize the car and extricate the girl, who was taken to Children's Hospital and listed in serious condition.

The Maryland Occupational Safety and Health Administration will investigate the incident.