THE CENTER TO PROTECT WORKERS' RIGHTS

CPWR

# Deaths and Injuries Involving Elevators and Escalators

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This report updates one originally issued in 2001 and updated in 2004.

## Acknowledgment

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## 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 Control and 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 17,000 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. Elevators cause almost 90% of the deaths and 60% of serious injuries. Injuries to people working on or near elevators – including those installing, repairing, and maintaining elevators, and working in or near elevator shafts – account for 14 (almost half) of the annual deaths. Half of the deaths of workers working in or near elevator shafts were due to falls into the shaft. Incidents where workers were caught in/between moving parts of elevators and escalators, are in or on elevators or platforms that collapse, or are struck by elevators or counterweights 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.

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

# Introduction

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) Research File for the 12 years 1992-2003. 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. This 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 occurred while working on or near elevators or escalators, while others occurred to people *using* elevators or escalators while at work – such as an attorney in a court building. (Deaths involving material hoists, dumbwaiters, and industrial machinery were excluded from this analysis.)

In addition, the analysis summarizes deaths of passengers documented in escalator and elevator incident investigations, incident reports and death certificate files compiled by the National Injury Information Clearinghouse, Consumer Product Safety Commission (CPSC), 1997 through May 25, 2006. In a few cases, where CPSC and CFOI reports overlapped, duplicates were removed from the analysis.

# Deaths Involving Work On or Near Elevators or Escalators

The Census of Fatal Occupational Injuries reported 244 deaths in the 12 years 1992-2003 – about 20 per year – related to elevators and escalators. (Deaths in this period involving injuries prior to 1992 were excluded from the study.) Of these, 173 involved work on or near elevators and 68 of those killed were elevator *passengers* – people entering or riding in elevators while at work.

The 173 deaths related to work on or near elevators – about 14 per year – were most often caused by falls into elevator shafts (49%) (*see* fig.1).

### Elevator Installers and Repairers

Elevator installers and repairers, also called elevator constructors or elevator mechanics, were by far the largest occupation affected, accounting for 36% of the deaths during work on or near elevators (*see* fig. 2). The main causes of death for elevator installers and repairers was being caught in/between elevators and elevator shafts or other elevators, followed by falls, being struck by objects (mostly elevators), and collapses (also mostly of elevators) (*see* fig. 1).

Although elevator installers and repairers are divided roughly equally between construction and general industry, about 80% of the deaths in this group affected employees of construction contractors.

In fact, construction elevator installers and repairers have the sixth-highest rate of work-related deaths of all construction trades (*see* fig. 3). The average death rate for elevator installers and repairers in construction was 29.1 per 100,000 full-time-equivalent workers (FTE) in 1992-2002, more than twice the death rate for all construction workers combined. The rate for elevator installers and repairers, however, is based on small numbers of deaths 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 54% of the deaths involving installation or repair of elevators (fig. 4; table 1; annex 1).

**Table 1. Work-related deaths among construction workers involving elevators, by cause and activity, 1992-2003**

| | Activity | | | Total | |
|---|---|---|---|---|---|
| *Cause* | *Installing & repairing* | *Working in elevator shaft/car* | *Working near elevators* | *No.* | *Percent* |
| Falls | 26 | 11 | 47 | 84 | 49% |
| Caught in/between | 28 | 6 | – | 36 | 21% |
| Struck by | 15 | 8 | – | 26 | 15% |
| Collapse | 14 | – | – | 16 | 9% |
| Other | 10* | – | – | 11 | 6% |
| **Total** | 93 | 28 | 52 | 173 | 100% |

– Data do not meet BLS publication criteria.
* Includes 8 electrocutions
*Source:* U.S. Bureau of Labor Statistics CFOI Research File

***Installing and repairing elevators.*** Almost 70% of these 93 deaths involved elevator installers and repairers. The remainder included industrial machinery repairers, engineers, construction supervisors, electricians, janitors, and maintenance workers. At least 10 of the deaths involved workers who were unqualified – not trained in elevator repair – trying to fix jammed elevators.

Falls caused over one-quarter of the deaths of workers installing and repairing elevators; 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 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 retrieving keys and other objects that had dropped into a shaft, cleaning inside an elevator shaft, stuck elevators, and collapses of platforms over elevator shafts.

***Working near elevator shafts.*** Almost all of these deaths involved construction workers. Thirty-five of the deaths (32 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* annex 1). These include investigations by NIOSH in-house and in state programs. The reports program identified 43 elevator-related deaths since the FACE program started in 1982 (Paul Moore, personal communication, 2000). These included:

- 25 falls down elevator shafts (58%), with seven during construction, eight 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.

In addition, the California FACE program investigated the 2001 death of an elevator mechanic helper who was crushed in an escalator while performing maintenance (California Department of Health Services, 2001), and the Oregon FACE program investigated the 2003 death of a 41-year-old worker who fell 23 feet down an unguarded elevator shaft during construction of a new home (Center for Research on Occupational and Environmental Toxicology, Oregon Health & Science University, 2003).

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 for construction, the injury rate is lower. According to BLS data for 1992-2001, the occupational injury and illness rate for elevator installers and repairers was 244 per 10,000 full-time equivalents (FTE), compared with 349 per 10,000 FTE for all construction workers (calculations by Sue Dong, CPWR, December 2003). 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 seven-year 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 installers, repairers and mechanics (Hunting, Anderson, and Welch 2004). The two most frequent causes of the traumatic injuries were cuts and sprains and overexertion. The most serious injuries were crushing of the fingers or hands (resulting from "caught in" injuries) and head injuries (falls).

## Deaths and Injuries Involving Elevator and Escalator Passengers

In addition to endangering people working on or near elevators and escalators, these devices are potential sources of injuries and deaths for people using them as passengers.

The Bureau of Labor Statistics reported 68 elevator-related deaths from 1992-2003 among people using elevators while at work, an average of six passenger deaths per year (*see* fig. 5). These included supervisors/managers, clerks/stock handlers, janitors/cleaners and their supervisors, plus a wide variety of other occupations.

Almost all the fall deaths involved falls into elevator shafts, including 18 deaths where an elevator door opened and there was no elevator car. The "caught in/between" and "struck by" deaths often involved getting caught in the elevator door or between the 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 nearly 10 years covered, the CPSC reported 56 non-work related deaths of elevator passengers – about six per year – in 21 states and the District of Columbia: California (2 deaths), District of Columbia (5), Florida (4), Illinois (3), Indiana (1), Louisiana (1), Maine (1), Michigan (3), Minnesota (3), Missouri (1), North Carolina (2), New Jersey (4), New York (12), Ohio (2), Pennsylvania (4), Rhode Island (1), South Dakota (1), Tennessee (1), Texas (2), Virginia (1), West Virginia (1), and Wisconsin (1). Thirteen of the deaths involved children age 10 or younger.

During this same period, the CPSC reported 24 non-work related deaths of escalator passengers in 12 states and the District of Columbia – about two per year. The states were Alabama (1 death), California (2), District of Columbia (3), Florida (1), Illinois (3), Maryland (1), Minnesota (3), Nevada (1), New York (3), Ohio (1), Virginia (1), Washington (2), and Wisconsin (2). The eight "caught in/between" deaths usually resulted after clothing became trapped at the bottom or top of an escalator or between a stair and escalator sidewall; seven of the 16 fall deaths were from head injury. Four of the fall deaths occurred due to falling off the escalator while riding the escalator siderails.

In 1994, the Consumer Product Safety Commission estimated that there were 7,300 escalator and 9,800 elevator injuries requiring hospitalization (CPSC 1998, Cooper 1997). The 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." 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* annex 2).

In 2001, the CPSC estimated that there are 6,000 hospital emergency room-treated injuries associated with escalators each year (CPSC 2001).

## 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, 1992-2003**

| | *Elevator related* | *Escalator related* | *Total* |
|---|---|---|---|
| Working on or near elevator or escalator | 14 | – | 15 |
| Passenger while at work* | 6 | – | 6 |
| Passenger not at work | 6 | 2 | 8 |
| **Total** | 26 | 3 | 29 |

*Note:* When BLS and CPSC data overlapped for this category, BLS cases were not counted.
*Source:* Data from U.S. Bureau of Labor Statistics CFOI Research File (*) 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 elevator deaths, especially electrocutions and "caught in/between" and "struck by" deaths, were caused by failure to de-energize elevator electrical circuits or failure to ensure that elevator parts could not move while maintenance or repairs were under way. These causes resulted also in four of the seven 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. The 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**

Forty-nine percent of the deaths during work on or near elevators resulted from lack of fall protection. Provision of adequate fall protection – scaffolding, guardrails in front of open shafts, or personal fall protection systems – could have prevented these deaths. Fall hazards during new elevator 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).[a]* If engineering controls are not practical, personal fall protection systems are required. Adequate anchorage points for personal fall protection 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, and 1060 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 32 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 (Nebraska Department of Labor, 1995) 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**

Over one-quarter 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)

[a] Fall protection is required at heights over 10 feet when a scaffold is used in construction.

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).

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 as well as 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 (Texas Workers' Compensation Commission, 1998) 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; *see* annexes 1, 2).

One recommendation in a California FACE investigation of the fall death of a manufacturing supervisor was that employers have all elevators inspected and serviced regularly by a licensed elevator technician (California Department of Health Services 1993).

Improper elevator controller wiring is another problem. OSHA issued a Safety and Health Information Bulletin on the hazards of improper elevator controller wiring after a 2003 death when an employee at a Houston hospital was decapitated when caught between the hoistway and elevator car as the car continued to move (OSHA 2004).

Many fatal falls into elevator shafts occurred when an elevator call button was pushed and elevator doors opened – 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), to take steps to ensure that disabled elevators remain out of service, and ensure that warning signs and/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 sped up or reversed its direction of movement (Armstrong 1996a, annex 2).

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). The revised ASME *Safety Code for Elevators and Escalators (ANSI/ASME A17.1)*, which became effective in March 2002, mandates that new escalators meet more demanding escalator skirt safety requirements. The CPSC has some recommendations to help prevent escalator injuries, especially to young children (CPSC 2001).

**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 report of the death of an elevator maintenance worker (California Department of Health Services 1994) included recommendations that employers:

- 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) that gives specific safety instructions on accomplishing hazardous tasks such as hoisting pistons.

In 2002, the National Elevator Industry Education Program (NEIEP) received formal approval from the U.S. Department of Labor Office of Apprenticeship Training, Employer and Labor Services for its four-year elevator constructor apprenticeship program. The NEIEP is a labor/management trust of the International Union of Elevator Constructors and the National Elevator Industry, Inc.

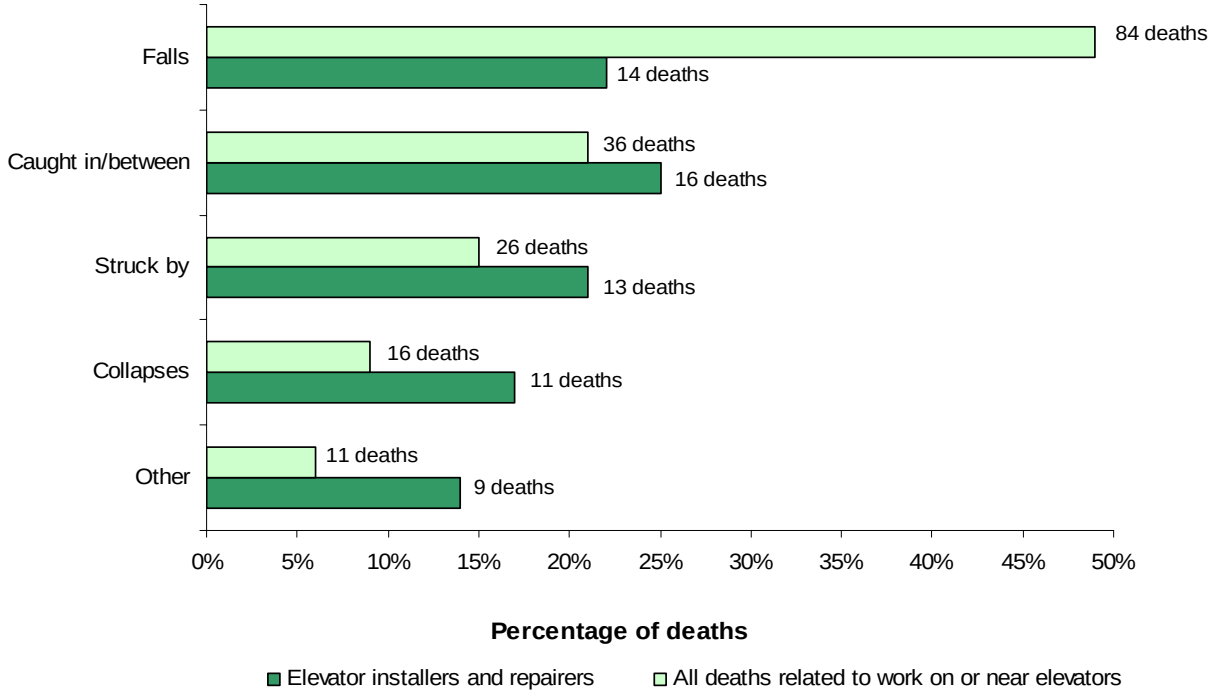
Twenty-five states – Alabama, Arkansas, California, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska (three counties with 80% of elevators), Nevada, New Hampshire, Oklahoma, Oregon, Rhode Island, Vermont, Virginia, Washington, and Wisconsin – presently require that elevator mechanics, inspectors, and contractors (except Vermont) 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. License renewal 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.

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

The 2002 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 standard 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.

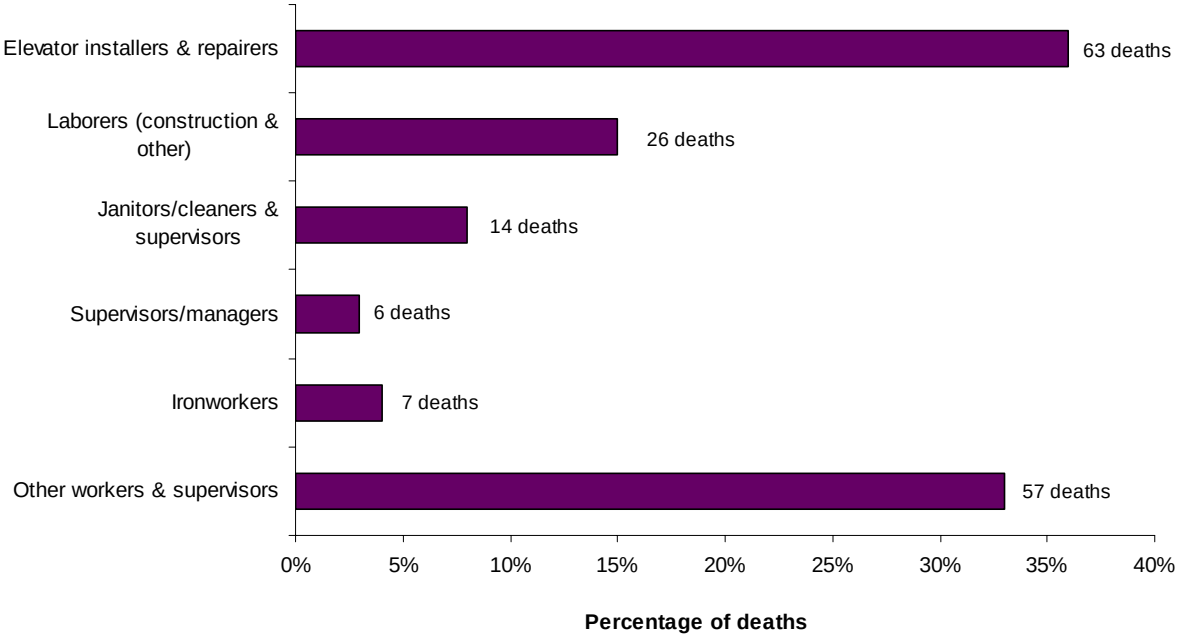
OSHA has training requirements in many of its standards that would affect elevator and escalator safety. Examples include fall protection (29 CFR 1926.503, 1910.23), lockout/tagout (29 CFR 1910.147(c)(7)), electrical (29 CFR 1926.21, 1910.332) and confined space regulations (29 CFR 1910.146(g)).

**Figure 1. Deaths related to work on or near elevators, by cause, 1992-2003.**



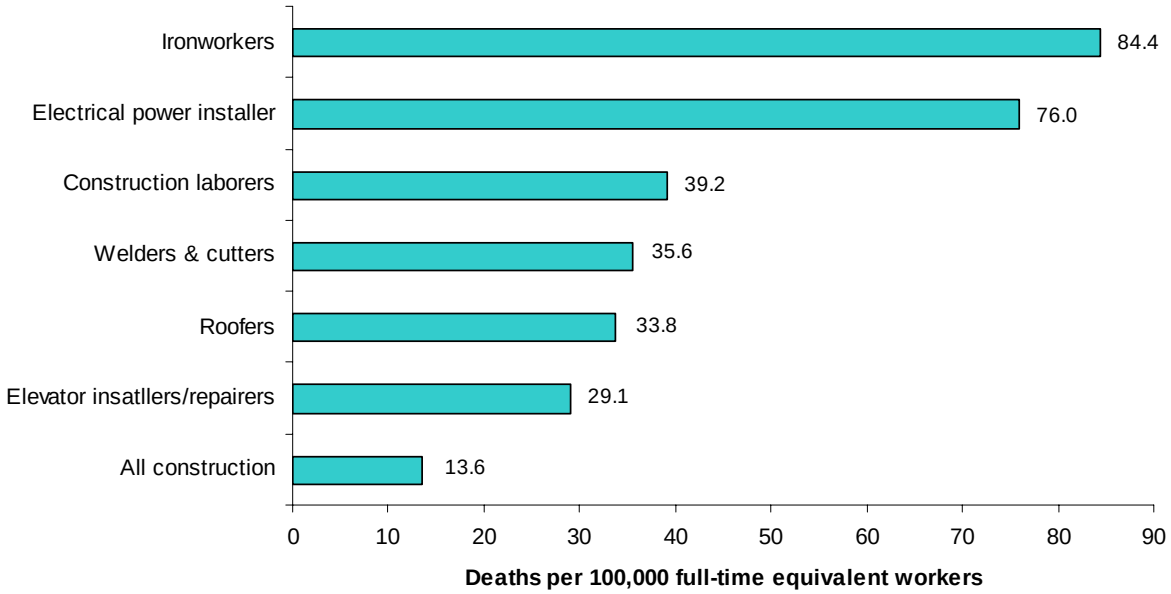

*Note:* The 173 deaths include 63 elevator repairers and installers.
*Source:* U.S. Bureau of Labor Statistics CFOI Research File.

**Figure 2. Deaths related to work on or near elevators, by occupation, 1992-2003.**




*Note:* Total of 173 deaths.
*Source:* U.S. Bureau of Labor Statistics CFOI Research File.

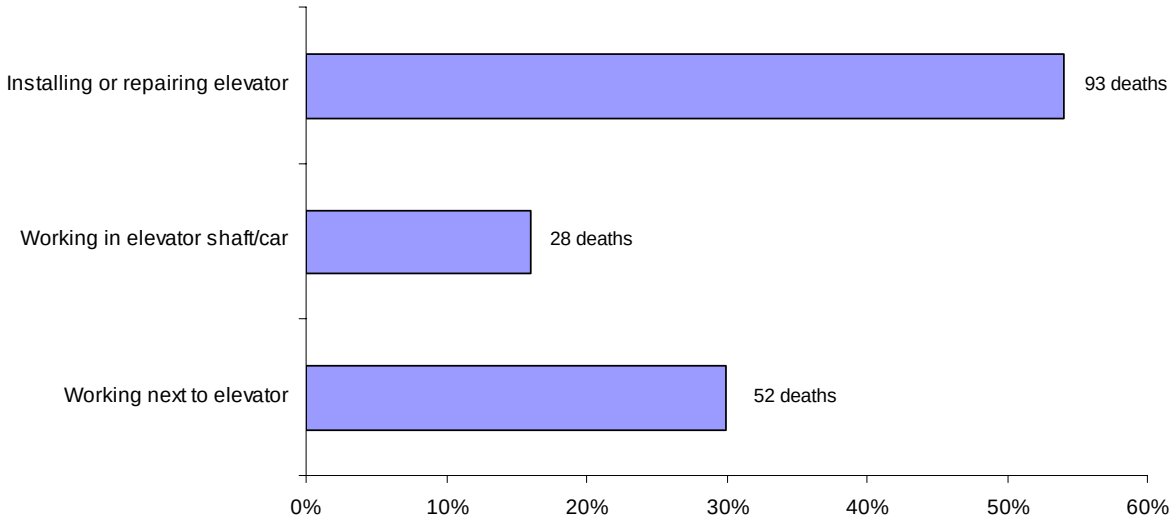
**Figure 3. Construction occupations with the highest death rates for work-related injuries, 1992-2002.**




*Notes:* To compare death rates for construction with other industries, rates are calculated as full-time equivalents for 2,000 hours per worker (50 weeks time, 40 hours). This is because some construction workers do not work full time at construction.
Given substantial changes between the occupational classification systems used through 2002 and after that year, we could not include 2003 data in this data analysis by occupation.

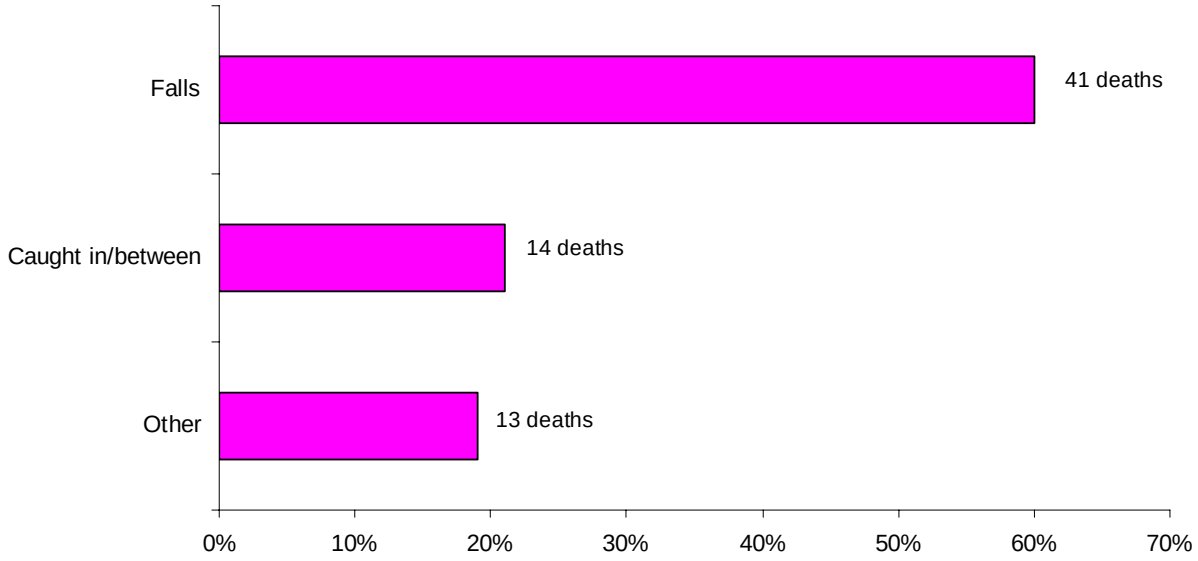
*Source:* Death rate calculations by Xiuwen Dong, CPWR, based on data from the U.S. Bureau of Labor Statistics Census of Fatal Occupational Injuries Research File, and Bureau of Census Current Population Survey, as tabulated by BLS.

**Figure 4. Deaths related to work on or near elevators, by activity, 1992-2003.**




*Note:* Total of 173 deaths.
*Source:* U.S. Bureau of Labor Statistics CFOI Research File.

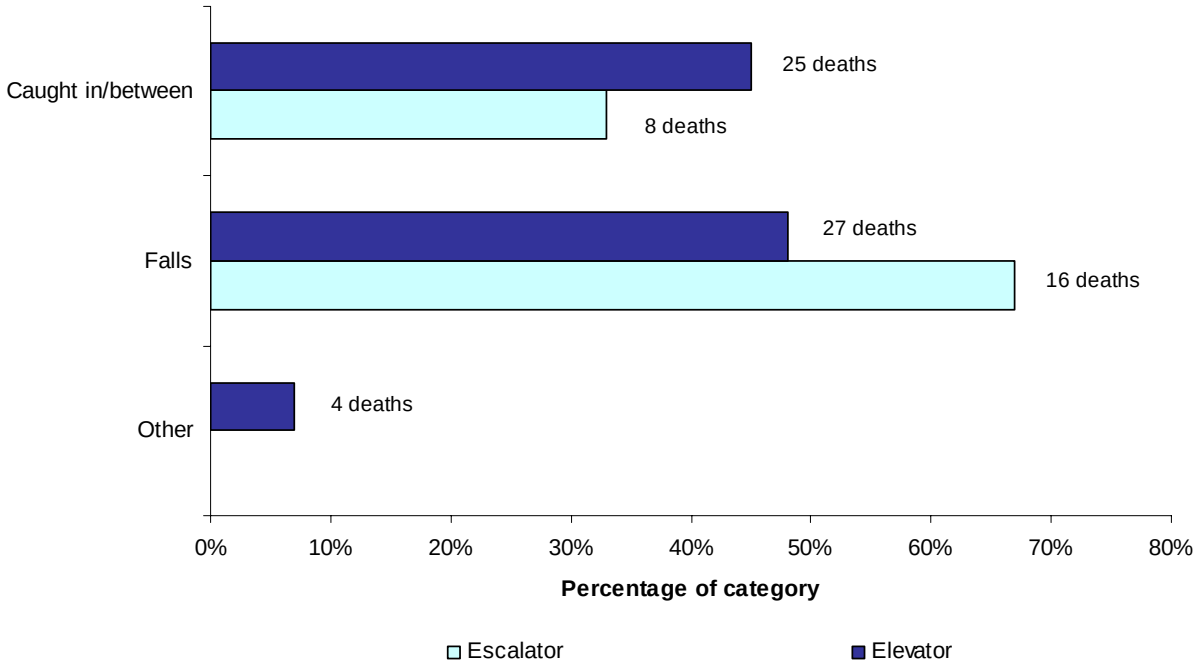
**Figure 5. Deaths among elevator passengers while at work, by cause, 1992-2003.**




*Note:* Total of 68 deaths. An example of a passenger death while at work is a salesman in a warehouse or a messenger in an office building. "Others" includes being struck by an elevator or closing elevator doors.

*Source:* U.S. Bureau of Labor Statistics CFOI Research File.

**Figure 6. Deaths among elevator or escalator passengers while not at work, by cause, 1997-2006.**




*Note:* Data through 5/25/2006. Total of 56 elevator and 24 escalator deaths.
*Source:* Consumer Product Safety Commission data.

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## Annex 1. Examples of NIOSH FACE Summaries of Elevator- and Escalator-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.

**California Department of Health Services**
**FACE Report 01CA009**
**An Elevator Mechanic Helper Died When He Was Crushed in an Escalator While Performing Maintenance**

SUMMARY

A 37-year-old male elevator mechanic helper died when he was crushed in an escalator as he was performing maintenance. The victim had removed the escalator stairs and was standing inside the

mechanism of the escalator when the power suddenly came on. The stairs began moving before the victim could get out and before the power could be turned off. There were no locks or tags on the controls that supply the electrical power to the escalator. The disconnect switch at the circuit panel that fed power to the elevator had not been locked and tagged out. The power came on when a co-worker dropped the electrical circuit box, triggering a relay that started the escalator's movement. There was a mechanical blocking device on the escalator to stop movement during maintenance, but it was not used.

The CA/FACE investigator determined that, in order to prevent future occurrences, employers, as part of their Injury and Illness Prevention Program (IIPP) should:

- ensure employees follow company policy and procedures on lockout/tagout.
- ensure workers do not move electrical escalator equipment when all or part of someone is inside the escalator mechanism.
- ensure employees block mechanisms from moving prior to performing repairs or maintenance.

## Annex 2. Examples of Elevator and Escalator Passenger Injuries and Deaths (OSHA, Consumer Product Safety Commission)

### 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 Injuries and 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 female, age 85, lost her balance and fell onto the escalator at a store. Cause of death blunt impact to head, trunk and extremities sustained in the fall. (9/11/00, Richmond Heights, OH)
- A 12-year old male was riding an escalator down (egress) from a baseball game when his right shoe got stuck between the stationary left side of the escalator. The victim sustained injury to his right big toe. The extent of the injury was not determined. (7/6/02, Anaheim, CA)
- A 5-year-old female was on the bottom step of a down escalator when her shoe got caught in the comb plate. She reached down to get her shoe when her hand also got caught in the comb plate. Her three middle fingers and part of her hand were amputated. (2/19/03, St. Petersburg, FL)
- An escalator incident at a theatre caused 71 children to suffer minor injuries. The escalator was heading up when it abruptly stopped and shifted slightly backwards causing the kids to fall down. (1/13/05, New York, NY).
- A 16 month old girl was injured when her hand slipped between the moving stairs and the escalator wall and she became lodged. She may have been in a stroller when the incident happened. She was flown to the hospital for surgery (03/13/06, Glendale AZ)

### CPSC Reports: Elevator Passenger Injuries and 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 female, age 88, was exiting the elevator when she tripped and fell at a medical clinic. The floor and the elevator were not level. Cause of death complications of pelvic fracture due to fall. (7/31/01, Edina, MN)
- A boy, age 8, deceased when he was crushed by a hotel elevator. He had become wedged between the elevator doors and a folding metal gate. (8/23/01, Bethel, ME)

- A man, age 35, was hospitalized in critical condition after he apparently pried open elevator doors and fell four floors (5/8/02, Mobile, AL)
- Two sisters, ages 6 and 7, were killed in a moving residential elevator. The elevator's safety feature was disabled, allowing it to ascend while the girls heads stuck out past the gate. (7/31/02, Monmouth County, NJ)
- Man, age 54, fell from elevator that stopped 5 inches short of level floor, contusing both knees (2/14/03).

**Workers' Compensation Board of British Columbia**
www.worksafebc.com
**Hazard Alert 03-05: Young worker injured in elevator shaft**
Industry: Service
Age: 20 years
Area: Lower Mainland
A first-year elevator apprentice was working inside an elevator shaft of a building under construction. This young worker was not aware that an elevator in this shaft was still being tested for operation by an elevator mechanic working in the elevator machinery room. The young worker was squeezed into a 6-inch space when the elevator car moved from one floor to another. He sustained bruising to the back and front of his torso. An accident investigation revealed that the workers did not communicate with each other and did not follow lockout procedures. The young worker had not received adequate instruction and training. The activities of the workers had not been adequately supervised.

**Safe work practices:**
- The employer must ensure that all workers are adequately trained, instructed, and supervised in the safe performance of their duties.
- Lockout procedures must be followed when working inside an elevator shaft.