www.cpwr.com • www.elcosh.org

CPWR

THE CENTER FOR CONSTRUCTION
RESEARCH AND TRAINING

Deaths and Injuries Involving Elevators and Escalators

Michael McCann, PhD, CIH

September 2013

8484 Georgia Avenue
Suite 1000
Silver Spring, MD 20910

PHONE: 301.578.8500
FAX: 301.578.8572

This research and report was produced by CPWR – The Center for Construction Research and Training as part of a cooperative agreement with the National Institute for Occupational Safety and Health, NIOSH (OH009762). The research is solely the responsibility of the authors and does not necessarily represent the official views of NIOSH. CPWR, the research and training arm of the Building and Construction Trades Department, AFL-CIO, is uniquely situated to serve workers, contractors, and the scientific community. For more information, visit www.cpwr.com.

This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS.

This 2013 report updates one originally issued in 2001 and updated in 2004 and 2006.

Acknowledgment

Paul Moore, Safety Engineer, Division of Safety Research, NIOSH, provided FACE reports to assist with preparation of this report. Janie Gittleman, former Associate Director for Safety and Health Research, CPWR, and Mark Mullins, National Coordinator, Elevator Industry Work Preservation Fund, provided reviewer comments. Sue Dong, Data Center Director, CPWR, provided death and injury rate information.

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)
NEISS	National Electronic Injury Surveillance System
NIOSH	National Institute for Occupational Safety and Health, CDC

Deaths and Injuries Involving Elevators or Escalators

Michael McCann, PhD, CIH

September 2013

Contents

Executive Summary

This report is an update of a 2006 CPWR report; it uses the most recent data available from the U.S. Bureau of Labor Statistics (BLS) from 2007-2009 and the Consumer Product Safety Commission (CPSC) from 2006-2010.

Incidents involving elevators and escalators each year kill 31 people and seriously injure about 17,000 people in the United States, according to CPWR analysis of data provided by the BLS (1992-2009) and the CPSC (1997-2010). Elevators are the prime culprit, causing about 90% of the deaths and 60% of the serious injuries. Half of the annual deaths are to people working in or near elevators – including those installing, repairing, and maintaining elevators, and working in or near elevator shafts. Fifty-six percent 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 caused 18% of deaths, and incidents where workers are struck by elevators or counterweights caused 16% of deaths. Deaths related to escalators are much less frequent; of those deaths, 75% involve falls.

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 on safety practices for work in elevator shafts; and

  providing fall protection during work in or near elevator shafts.

- Employers have an adequate inspection and maintenance program.

- Escalator entrapment hazards are eliminated.

- Employers use only qualified workers for escalator and elevator repair and maintenance established by proper training such as an approved apprenticeship program.

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 also at risk 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 (ASME 2000, 2002, 2007).

This report contains information from the Census of Fatal Occupational Injuries (CFOI) Research File for 1992-2009 (the most recent data available). 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 47-4021), also called elevator constructors, and other deaths related directly to escalators, hoists, and personnel elevators (this also included freight elevators intended for people). Some of these deaths occurred to individuals 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, 2010. The CPSC data was only used as supplement when data categories were not available in the CFOI data.

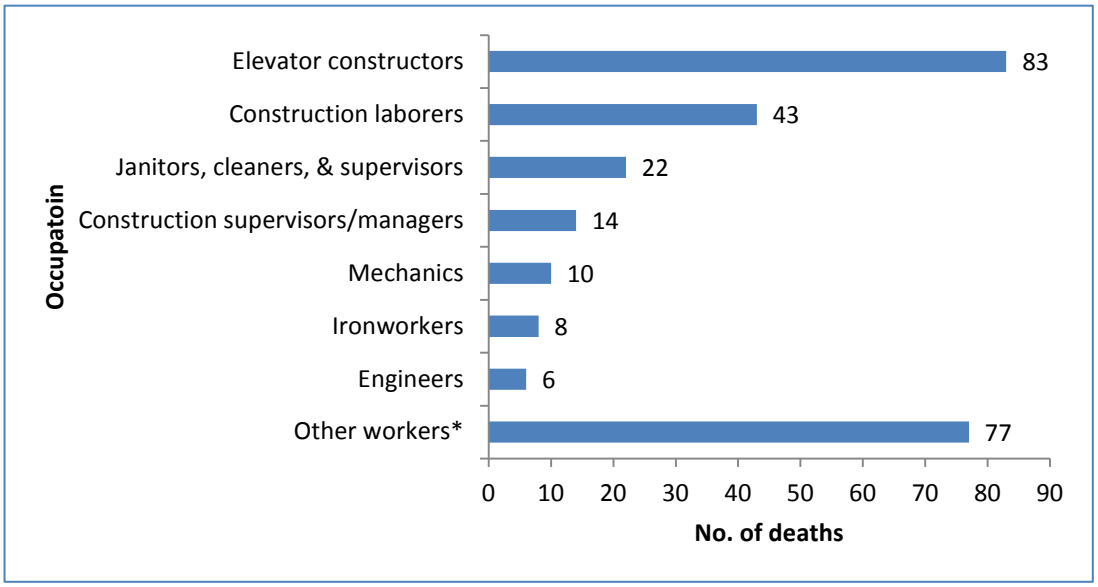
Deaths Involving Work In or Near Elevators and Escalators

CPWR analysis of the Census of Fatal Occupational Injuries showed 263 elevator-related deaths while working in or near elevator shafts and elevators in the 17 years from 1992-2009 – about 15 deaths per year. (Deaths due to injuries incurred prior to 1992 were excluded from the study.) During this same period, 8 escalator-related deaths occurred while working on escalators; most involved installing or repairing the escalator.

Elevator Constructors

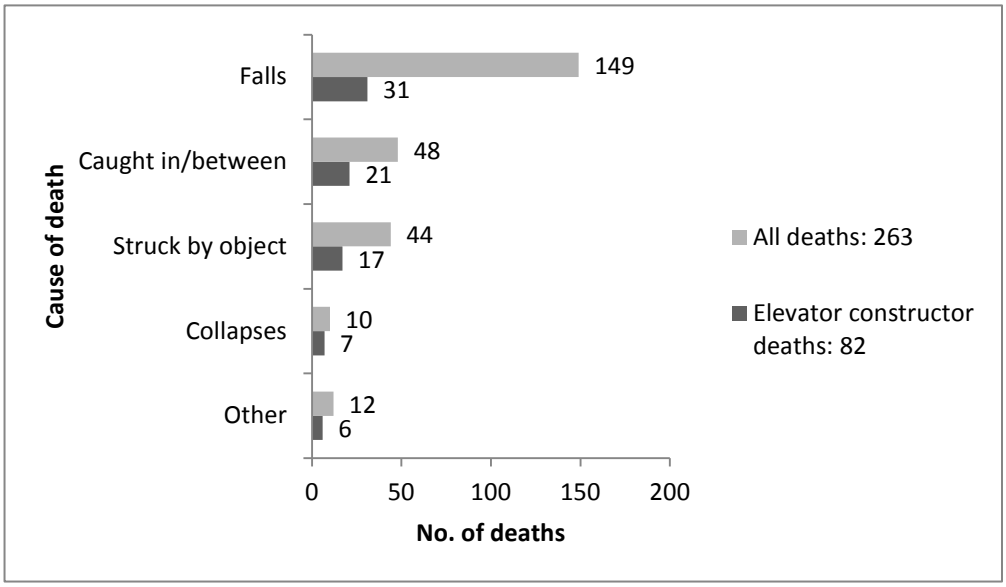
Elevator installers and repairers, also called elevator constructors or elevator mechanics, were by far the largest occupation affected, accounting for one-third of the deaths during work on or near elevators (*see* fig. 1). The most common cause of death for elevator constructors was falling to a lower level, followed by being caught in/between elevators and elevator shafts or other elevators, being struck by objects (mostly elevators), and collapses (also mostly of elevators) (*see* fig. 2).

Figure 1. Deaths related to work on or near elevators, by occupation, 1992-2009.



*Includes 35 other construction workers and 42 additional workers not in the construction trades
Total number of deaths: 263
Source: Fatal injury data were generated by CPWR with restricted access to the U.S. Bureau of Labor Statistics CFOI Research File, 1992-2009.

Figure 2. Deaths related to work on or near elevators, by cause, 1992-2009.



Source: Fatal injury data were generated by CPWR with restricted access to the U.S. Bureau of Labor Statistics CFOI Research File, 1992-2009.

Although elevator constructors are divided roughly equally between construction and general industry, the majority (80%) of the deaths in this group affected employees of construction contractors.

The rate of deaths of elevator constructors appears to have decreased in recent years. From 1992-2002, elevator constructors working in the construction sector had a work-related death rate that was more than double the rate of all construction workers: 29.1 deaths per 100,000 full-time employees (FTEs) compared to 13.6 deaths for all construction workers. Recent statistics from 2006-2008 show that construction elevator constructors had a slightly higher rate of work-related deaths compared to all construction workers (13.4 deaths per 100,000 FTEs compared to 10.4). The rate for elevator constructors is based on small numbers of deaths and may not be statistically reliable.

Activities and Causes of Deaths

Workers killed while working in or near elevators or elevator shafts were involved in three types of activities. These activity types were: installing or repairing the elevator, working in the elevator shaft/car, and working near the elevator shaft/car. (fig. 3; table 1; annex 1).

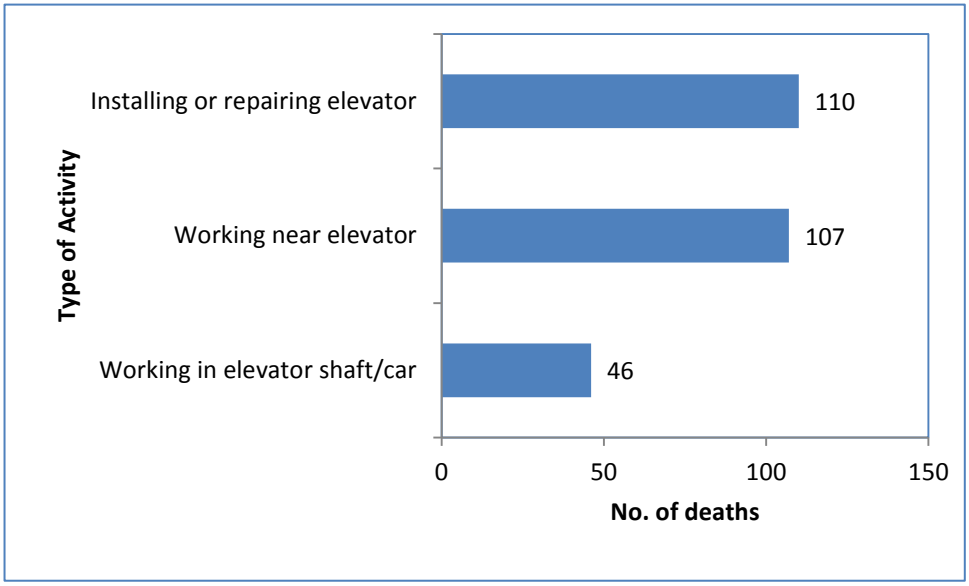
Table 1. Work-related deaths among construction workers involving elevators, by cause and activity, 1992-2009

	Activity			Total	
Cause	**Installing & repairing**	**Other work in elevator shaft/car**	**Working near elevators**	**No.**	**Percent**
Falls	38	23	88	149	57%
Caught in/between	32	8	8	48	18%
Struck by object	24	10	10	44	17%
Collapse	8	--	--	10	4%
Other causes	8	--	--	12	5%
Total	110	46	107	263	*

-- Data do not meet BLS publication criteria.
** Does not add to 100% due to rounding*

Source: Fatal injury data were generated by CPWR with restricted access to the U.S. Bureau of Labor Statistics CFOI Research File, 1992-2009

Figure 3. Deaths related to work on or near elevators, by activity, 1992-2009.



Total number of deaths: 263
Source: Fatal injury data were generated by CPWR with restricted access to the U.S. Bureau of Labor Statistics CFOI Research File, 1992-2009

Installing and repairing elevators. Almost three-quarters of these 110 deaths involved elevator constructors. The remainder included industrial machinery repairers, engineers, construction supervisors, electricians, janitors, and maintenance workers. At least 13 of the deaths involved workers who were unqualified – not trained in elevator repair – trying to fix jammed elevators.

Falls caused over one-third of the deaths of workers installing and repairing elevators; many of the fatal falls were of workers who were not classified by the Bureau of Labor Statistics as elevator installers or repairers. "Caught in/between" incidents caused less than one-third of the deaths, and included being caught in elevator machinery (such as counterweights), caught between two cars, caught between the elevator shaft and the doorway, or caught between the elevator shaft and a car.

Being struck by objects caused one-fifth of the deaths and usually involved an elevator descending while someone was working in an elevator shaft.

Working in elevator shafts/cars. The 46 deaths in this category involved such activities as retrieving keys and other objects that had dropped into a shaft, cleaning inside an elevator shaft or elevator, fixing stuck elevators, and collapses of platforms over elevator shafts. Occupations included elevator constructors, janitors/cleaners, building managers and supervisors, and elevator inspectors.

Working near elevator shafts/cars. Almost all of the 107 deaths involved construction workers, none of them elevator constructors. Forty-nine of these deaths (45 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 work-related deaths through its Fatality Assessment and Control Evaluation (FACE) reports (http://www.cdc.gov/niosh/face/). These reports are produced through investigations conducted by NIOSH researchers at the federal level of government and by state health department personnel tasked with investigating and assessing work-related fatalities at the state level. FACE reports include 45 elevator-related deaths from 1982, the year the FACE program began, until 2010. These deaths are consistent with BLS guidelines for inclusion in the BLS Census of Fatal Occupational Injuries reports and are included in the CFOI narratives. NIOSH FACE reports included:

- 26 falls down elevator shafts (57%), with 8 during construction, 8 during maintenance/inspection, and 10 during routine use
- 8 deaths (17%) 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 to the elevator-related deaths, 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). Annex 1 has examples of different types of elevator and escalator-related fatalities.

Injuries Involving Work in or near Elevators or Escalators

Although the death rate for elevator constructors is higher than average for all construction, the injury rate is lower. According to CPWR analysis of BLS data for 1992-2001, the occupational injury and illness rate for elevator constructors was 244 per 10,000 FTEs, compared with 349 per 10,000 FTEs for all construction workers (calculations by Sue Dong, CPWR, December 2003). The major causes of lost-time injuries to elevator constructors were being struck by an object, overexertion (especially in lifting), falls, and being caught in/between (such as between the elevator shaft and the elevator).

One seven-year study (1990-1997) by Hunting et al, 2004 documented visits of injured construction workers to the George Washington University Hospital Emergency Department in downtown Washington, D.C. The study data included 24 elevator constructors. The two most frequent causes of the traumatic injuries were cuts and sprains/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

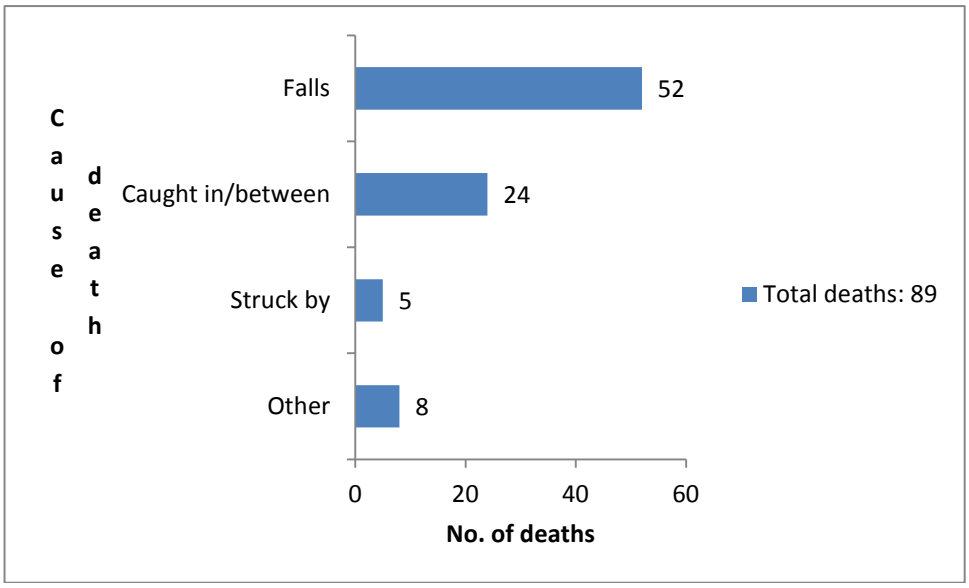
In addition to endangering people working on or near elevators and escalators, these devices are potential sources of injury and death for people using them as passengers. Information on “working passenger” deaths (people using elevators while at work) was obtained from Bureau of

Labor Statistics data. Information on non-occupational passenger-related injuries and deaths (e.g. children, or people using elevators at home or in a store) was obtained from CPSC National Electronic Injury Surveillance System data.

Elevator Passenger Deaths

Working passengers: CPWR analysis of data from the Bureau of Labor Statistics showed 89 elevator-related passenger deaths from 1992-2009 among people using elevators while at work, an average of five deaths per year (*see* fig. 4). These included supervisors/managers, clerks/stock handlers, janitors/cleaners and their supervisors, plus a wide variety of other occupations. Three-fifths of these deaths involved falls, almost all the falls into elevator shafts, including 30 deaths occurred when an elevator door opened and there was no elevator car due to the car leaving the floor in question and the hoistway interlock or door closer failed mechanically or electrically. The "caught in/between" and "struck by" deaths mostly involved people getting caught in the elevator door or between the elevator and door or shaft. The "other" category included 6 elevator collapses.

Figure 4. Deaths among elevator passengers while at work, by cause, 1992-2009.

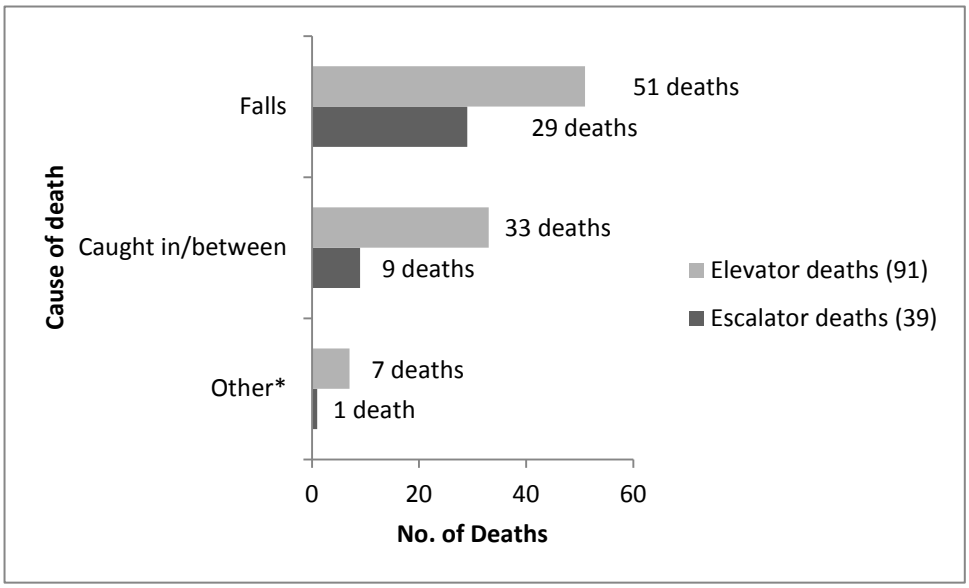


Source: Fatal injury data were generated by CPWR with restricted access to the U.S. Bureau of Labor Statistics CFOI Research File, 1992-2009

Passengers not at work: From 1997 to 2010, the CPSC reported 91 non-work related deaths of elevator passengers, about five deaths per year. Falls caused over half the deaths *(see* fig. 5). About half the falls were to the same level (e.g. slips and trips), especially while exiting from the elevator, and the rest occurred from falls down elevator shafts. These deaths occurred in 23 states and the District of Columbia: California (4 deaths), District of Columbia (9), Florida (11), Illinois (8), Indiana (1), Kentucky (1), Louisiana (1), Maine (1), Michigan (3), Minnesota (6), Missouri (1), North Carolina (3), New Jersey (5), New York (13), Ohio (6), Pennsylvania (4),

Rhode Island (1), South Dakota (1), Tennessee (1), Texas (3), Virginia (1), Washington (1), West Virginia (1), and Wisconsin (3). The location/state of 2 passenger deaths was not recorded. Sixteen of the 91 deaths involved children of age 10 or younger.

Figure 5. Deaths among elevator and escalator passengers while not at work, by cause, 1997 to June 2010.



**Other: Elevator deaths include 4 struck by deaths, 2 deaths due to elevator collapses, and 1 due to heart attack after the elevator shook. The escalator death was due to infection after striking leg on escalator side. Source: Consumer Product Safety Commission data, 1997-2010.*

Escalator Passenger Deaths

Working passengers: The number of deaths of working escalator passengers does not meet BLS publication criteria. CPSC data identified 4 working passenger deaths from 1997 to 2010: 2 falls, 1 caught in/between death, and 1electrocution.

Passengers not at work: During this same period, the CPSC reported 39 non-work related deaths of escalator passengers in 15 states and the District of Columbia – about two per year (*see* fig. 5). Seven of the 29 fall-related deaths occurred due to falling off the escalator while riding the escalator side rails. Nine "caught in/between" deaths resulted after clothing or articles became trapped at the bottom or top of an escalator or between a stair and escalator sidewall. These deaths occurred in Alabama (1 death), California (4), District of Columbia (4), Florida (3), Hawaii (1), Illinois (6), Maryland (1), Massachusetts (1), Minnesota (4), Nevada (1), New Jersey (2), New York (5), Ohio (1), Virginia (1), Washington (2), and Wisconsin (2).

Elevator and Escalator Passenger Injuries

In one study, the Consumer Product Safety Commission estimated there were 7,300 escalator and 9,800 elevator injuries requiring hospitalization in 1994 (Cooper 1997). The data were based on a nationwide survey of 90 hospitals in 1994. 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. In 2001, the CPSC estimated that there are 6,000 hospital emergency room-treated injuries associated with escalators each year (CPSC 2001).

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% of the incidents were categorized as "other," including sudden stops of the escalator and reversal of direction. 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).
Two recent studies (O'Neill et al 2008, Steele et al 2010) examined elevator- and escalator-related injuries among adults age 65 and older using data from the Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS), which collects injury data on consumer products from selected hospitals nationwide. The 2008 study found an estimated 39,500 escalator-related injuries and no deaths to people over age 65 from 1991-2005, which is an average of 2,633 injuries per year. Almost all of the injuries were caused by a slip, trip or fall. During this study period, the rate of escalator injuries doubled. The second study found an estimated 44,870 elevator-related injuries from 1990-2006, an average of 2,639 injuries per year. More than half of the injuries were caused by a slip, trip or fall. Three-quarters of the injuries in both studies involved women.

A third study, also using the NEISS data, examined elevator-related injuries among children from 1990 to 2004 (O'Neill et al 2007). They found an estimated 29,030 elevator-related injuries in children age 19 and younger, or an average of 1,935 injuries per year. The most frequent cause of injury was an elevator door closing on a body part.

Summary of Elevator and Escalator Deaths

Table 2 summarizes the average number of elevator and escalator deaths each year.

Table 2. Average estimated annual deaths involving elevators and escalators

	Elevator related	***Escalator related***	***Total***
Working on or near elevator or escalator	15[1]	0.4[1]	15
Passenger while at work	5[1]	0.2[2]	5
Passenger not at work	5[2]	2[2]	7
Total	25	3	28*

1. Fatal injury data were generated by CPWR with restricted access to the U.S. Bureau of Labor Statistics CFOI Research File, 1992-2009.
2. Additional fatality data were from the Consumer Product Safety Commission, 1997-June 2010.

** Does not add to 28 due to rounding*

Recommendations

The findings from this analysis of the major causes of elevator and escalator deaths and injuries resulted in the following recommendations.

1. Use Adequate Lockout/Tagout Procedures

More than half of the work-related elevator deaths were caused by either failure to ensure that elevator parts could not move while maintenance or repairs were underway or failure to de-energize elevator electrical circuits. Many caught in/between, struck by and some fall deaths resulted from the inadvertent movement of elevator parts. These three types of failures also caused most of the work-related escalator deaths.

Safe work practices mandate lockout/tagout when repairing and renovating elevators and escalators. Lockout procedures are part of OSHA's standard for control of hazardous energy (lockout/tagout) (29 CFR 1910.147) for general industry. Elevator and escalator maintenance comes under the general industry standard. New construction and repair normally come under OSHA's construction standard (29 CFR 1926), which does not have a lockout/tagout standard. However, OSHA can use the general duty clause to cite violations under the general industry standard.

The OSHA lockout/tagout standard requires written safety 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. Each worker should keep a key to their own lock used in the lockout/tagout system.

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. These precautions are described in the National Fire Prevention Association (NFPA) standard 70E "*Standard for Electrical Safety in the Workplace"* and include institution of a permit system. The permit should describe appropriate engineering controls and safe work practices, including wearing adequate personal protective equipment.

2. Ensure Adequate Fall Protection

About three-fifths of the deaths during work in or near elevators resulted from falls to a lower level. 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 are regulated under the OSHA construction standard (29 CFR 1926.500-503). Fall hazard during elevator maintenance are regulated in section 29 CFR 1910.22(b) of the Code of Federal Regulations.

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 must be established, and workers must be tied off to them while working. OSHA also has requirements for the use of ladders (29 CFR 1926.1050, 1051, 1053, and 1060 and 29 CFR 1910.25 and 26).

Temporary structures must be stable and strong enough to support the weight and activity of the worker(s). These structures must meet the requirements for scaffolds (29 CFR 1926.451 and 29 CFR 1910.28).

Falling into an open shaft lacking adequate guardrails was a frequent but avoidable occurrence in many of the deaths of construction workers working near elevator shafts. Guardrails and signage should be used to reduce the incidents of workers and/or the general public falling to their death.

Case reports illustrate the importance of appropriate fall protection, as in Nebraska FACE report #95NE017 that investigated the fall of a worker that resulted from the collapse of a work platform over an elevator shaft (Nebraska Department of Labor, 1995). The report recommended that the employers provide appropriate fall protection equipment to all workers who may be exposed to a fall hazard and ensure that holes in walking/working surfaces are protected by covers.

3. Treat Elevator Shafts as Confined Spaces

Over one-quarter of the work-related deaths associated with elevators 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 (for new construction) states, in part, that:
"Employees 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(b)(6)(i)

Although OSHA's current construction standard does not include detailed requirements for confined spaces, construction contractors are required to comply with OSHA's general industry standard for confined spaces when working in a building where the owner must comply with OSHA's confined space standard (Miles, 1994). OSHA's definition of a confined space is a space 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 should be considered confined spaces (Miles 1994).

OSHA's General Industry Standard designates a confined space with a safety and health hazard as a *permit-required* confined space (29 CFR 1910.146). An elevator shaft with a working elevator is clearly hazardous to workers in the shaft, as is shown by the numerous elevator shaft-

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

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. This standard requires informing employees – including contractors – about permit-required confined spaces. The standard also requires employers to have a written (safety) program with rescue procedures, as well as elimination of, or protection against, hazards before entry into a confined space.

An alternative approach is for employers such as building managers or contractors to not allow employees 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 report of a 1998 Texas FACE investigation that illustrated the hazards of confined space safety (Texas Workers' Compensation Commission, 1998) recommended that 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.

- Ensure that the elevator service company develops 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 the counterweights opposite the elevator's car.

4. Provide Adequate Maintenance and Inspections

Many of the elevator- and escalator-related deaths (work-related or non-work-related) could have been prevented if adequate maintenance and inspection procedures had been in place (Boston Globe 1996; *see* annexes 1, 2).

A 1993 California FACE investigation on the fall-related death of a manufacturing supervisor recommended 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 yet another problem associated with elevator fatalities. In 2004, OSHA issued a Safety and Health Information Bulletin on the hazards of improper elevator controller wiring, after the death of an employee at a Houston hospital who 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 the 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

a) quickly identify malfunctioning elevators (including elevator call buttons), b) take steps to ensure that disabled elevators remain out of service, and c) ensure that warning signs and/or tape are placed on all elevator doors.

Malfunctioning escalators are also a cause of deaths or injuries due to lack of adequate inspections and maintenance. Several instances of multiple injuries were caused when an escalator suddenly sped up or reversed its direction of movement (Armstrong 1996a, annex 2).

5. Eliminate Escalator Entrapment Hazards

The high number of injuries involving trapping children's hands and feet or adults' clothing 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, Annex 3). A warning about entrapment of clothing should be posted at escalators.

6. Use Qualified Personnel

Many of the deaths described in the state and federal FACE reports indicate that unqualified/untrained personnel were performing elevator repair and maintenance.

Recommendations in a 1994 California FACE report on the death of an elevator maintenance worker (California Department of Health Services 1994) focused on:

- Having properly licensed employees working at the site performing complicated operations.
- Only allow the presence of qualified employees whose duties are required during elevator repair work.
- Standard operating procedures (SOP) that give specific safety instructions on accomplishing hazardous tasks such as hoisting pistons.

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

As of October, 2011, 18 states (Alabama, Arkansas, California, Colorado, Florida, Illinois, Indiana, Kentucky, Maine, Maryland, Montana, Nebraska, Oklahoma, Utah, Vermont, Virginia, Washington, West Virginia, and Wisconsin) and New York City require that elevator mechanics, inspectors, and contractors be licensed. 7 states, (Connecticut, Massachusetts, Michigan, Nevada, New Hampshire, Oregon, and Rhode Island) requires that elevator mechanics only be licensed. Licensing is a common requirement in professions that ensures both adequate

skills and training to carry out a job, but also incorporates elements to ensure the adequate safety and health of the worker engaged in the activity. Licensing for elevator-related professions 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.

The 2002 revision of ASME 17.1, *Safety Code for Elevators and Escalators*, required employers to use elevator personnel for repair and maintenance of elevators and escalators. This standard also requires training for employees who perform cleaning of hoistway enclosures such as elevator shafts, startup of escalators, and emergency evacuation of elevators. Use of qualified personnel and training procedures is recommended and might have prevented many of the deaths described in this report. ASME 17.1/CSA B44 combines A17.1 with the Canada Standards Association B44-07 *Safety Code for Elevators*.

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.

OSHA has training requirements in many of its standards that would affect elevator and escalator safety. Incorporation of these into standard elevator personnel training would enhance 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)).

If industry and government adopt and utilize these six recommendations – adequate lockout/tagout procedures, provision of adequate fall protection, treating elevator shafts as confined spaces, providing adequate maintenance and inspections, only using qualified personnel for elevator repair, maintenance and inspection, and eliminating escalator entrapment hazards – U.S. passengers and workers would enjoy a major step forward in reducing elevator and escalator deaths and injuries.

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.

ASME Standards Committee on Elevators and Escalators. 2000. *ASME 17.1 Safety Code for Elevators and Escalators.* New York, NY: ASME.

ASME Standards Committee on Elevators and Escalators. 2002. *ASME 17.3 Safety Code for Existing Elevators and Escalators.* New York, NY: ASME.

ASME Standards Committee on Elevators and Escalators. 2007. ASME 17.1/CSA B44 *Safety Code for Elevators and Escalators.* New York, NY: ASME.

The Boston Globe. 1996. Risky ride: A special report on elevator and escalator safety. Various articles published December 3, 1994 through July 21, 1996.

California Department of Health Services. 1993. FACE Report 93CA01001: Elevator Service Technician Dies After Being Crushed by an Elevator Counter-Weight in California. Oakland, CA.

California Department of Health Services. 1993. FACE Report 93CA00301: Manufacturing Supervisor Falls and Dies in an Elevator Shaft in California. Oakland, CA.

California Department of Health Services. 1994. FACE Report 94CA01401: Elevator Maintenance Worker Dies from Fall in an Elevator Shaft in California. Oakland, CA.

California Department of Health Services. 2001. FACE Report 01CA009: An Elevator Mechanic Helper Died When He Was Crushed in an Escalator While Performing Maintenance. Oakland, CA.

California Department of Health Services. 2005. FACE Report 05CA009: A Construction Elevator Operator Died When He Was Struck by the Counterweights of a Construction Elevator in Motion. Oakland, CA.

Cooper David. 1997. Escalator Side-of-Step Entrapment. Presented at International Association of Electrical Engineers Elevcon '96, Barcelona, Spain. http://www.elevator-world.com/magazine/archive01/9803-002.HTML-SSI. (Accessed 4/8/2011.)

CPSC. 2001. Consumer Product Safety Alert: Escalator Safety. Document 5111. http://www.cpsc.gov/CPSCPUB/PUBS/5111.pdf. (Accessed 4/8/2011.)

Dawson, Carol. 1999. Will CPSC Seek Jurisdiction over Escalators? *CPSC Monitor,* 4(1):1-3. http://www.thefreelibrary.com/Phthalates Back in the News.-a066107640 (Accessed 4/8/2011.)

Hunting, Katherine L., Judith T. L. Anderson, and Laura S. Welch. 2004. Occupational Injuries among Construction Workers: Results from Seven Years of Surveillance at the George Washington University Emergency Department. The Center to Protect Workers' Rights, January.

Maryland Division of Labor and Industry. 1996. 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. Baltimore, MD.

Miles, John. 1994. Elevator Industry Employees Working In and Around Pits and Equipment. 9/19/94. OSHA Standards Interpretations and Compliance Letters. OSHA.

National Fire Protection Association (NFPA). 2009. NFPA 70E: *Standard for Electrical Safety in the Workplace.* Quincy, MA: NFPA.

Nebraska Department of Labor. 1995. Nebraska FACE Investigation 95NE017: Worker Falls 33 Feet While Constructing Elevator Shaft. Omaha, NB.

New Jersey Department of Health. 1994. Face Investigation #94-NJ-028-01: Company Owner Dies After Falling 15 Feet Down a Freight Elevator Shaft. Trenton, NJ.

O'Neill J, Steele GK, Hulsingh C, and Smith GA. 2007. Elevator-related injuries to children in the United States, 1990 through 2004. *Clin. Pediatr.* 46(7): 619-625.

O'Neill J, Steele GK, Hulsingh C, and Smith GA. 2008. Escalator-related injuries among older adults in the United States, 1991-2005. *Accident Analysis & Prevention* 40(2): 527-533.

OSHA. 2004. Hazards of Improper Elevator Controller Wiring. Safety and Health Information Bulletin 08-16-2004. www.osha.gov/dts/shib/shib081604.html. (Accessed 10/14/2011.)

OSHA. 2000. Fatal Injuries. *OSHA Aurora Office News*. Aurora, IL. 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.

Steele GK, O'Neill J, Huisingh C, and Smith G. 2010. Elevator-related injuries to older adults in the United States, 1990 to 2006. *Journal of Trauma-Injury Infection and Critical Care* 68(1): 1880-192.

Texas Workers' Compensation Commission. 1998. FACE Investigation 98TX14601: A Hotel Maintenance Engineer Died When Struck by the Counter Weights of an Elevator in Texas. Austin, TX.

Workers Compensation Board of British Columbia. 2003. Hazard Alert 03-05: Young worker injured in elevator shaft. www.healthandsafetycenter.org/i/posters/2003/ha0305_elevator.html. (Accessed 4/9/2011.)

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

These examples are included to give detailed examples of the types of fatal incidents involving elevators and escalators, and recommended precautions.

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 a 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) that 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.
- Ensure walking/working surfaces have sufficient strength and structural integrity to support workers.
- Thoroughly address worker safety in the planning phase of all construction projects.
- Develop, implement and enforce a comprehensive safety program that includes, but is not limited to, training in all hazard recognition and the use of fall protection devices.

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 pocket 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 05CA009
A Construction Elevator Operator Died When He Was Struck by the Counterweights of a Construction Elevator in Motion

SUMMARY

A 49-year-old Hispanic male elevator operator died when he was struck by the counterweights of a construction elevator in motion as he was making adjustments to the elevator system. The victim was not authorized to perform any adjustments or repairs on the elevator system. His duties consisted of inspecting the elevator before his shift started and then operating the elevator. According to the victim's employer, he was the only authorized elevator operator onsite when the incident occurred.

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 do not perform work outside their original scope of work.
- ...Ensure employees only have access to areas for which they have authorization.

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 moving step and 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.

Annex 3. Consumer Product Safety Alert on Escalator Safety

The following is excerpted from a CPSC Alert (Consumer Product Safety Commission Document 5111 (2001)).

The U.S. Consumer Product Safety Commission (CPSC) wants you and your family to be safe when riding escalators. The CPSC estimates that there are 6,000 hospital emergency room-treated injuries associated with escalators each year. Seventy-five percent of these injuries are due to falls, another 20 percent occur when hands, feet or shoes are trapped in escalators.

Here are some steps you can take to help prevent escalator injuries, especially injuries to young children:
• Be aware that loose shoe laces, drawstrings, scarves, and mittens can get trapped in escalators. In the past year*, CPSC reached an agreement with a number of children's clothing manufacturers to remove drawstrings from the necks and hoods of children's garments. If your child's clothing still has drawstrings, remove them.
• Always hold children's hands on escalators and do not permit children to sit or play on the steps.
• Do not bring children onto escalators in strollers, walkers, or carts.
• Always face forward and hold the handrail.
• Avoid the edges of steps where entrapment can occur.
• Learn where the emergency shutoff buttons are in case you need to stop the escalator.

The American Society of Mechanical Engineers/American National Standards Institute Escalator Committee set a voluntary standard for escalators. The standard requires:
• That the emergency shutoff buttons be at the top and bottom of each escalator. The button should be on the right side of the escalator when facing the stairs.
• That sidewalls be made of low-friction material so soft-soled shoes cannot get caught easily.
• That "skirt obstruction devices" (which sense the presence of a foreign object and automatically shut off the escalator) be at the top and bottom of the escalator.
• That side clearance at the edges of steps be no more than 3/16 inch.
• That warning signs be placed on escalators reminding parents to hold children's hands and face forward.
• That each step have painted foot prints or brightly colored borders.

** Note on "in the past year." The CPSC produced the agreement in 2001, which is the year this CPSC document was produced.*

CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

www.cpwr.com • www.elcosh.org