**FULL REPORT**

# FIREFIGHTER FATALITIES IN THE UNITED STATES – 2003

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## Introduction

Each year, NFPA collects data on all firefighter fatalities in the U.S. that resulted from injuries or illnesses that occurred while the victims were on-duty. The victims include, besides members of local career and volunteer fire departments, those seasonal and full-time employees of state and federal agencies who have fire suppression responsibilities as part of their job description, prison inmates serving on firefighting crews, military personnel performing assigned fire suppression activities, civilian firefighters working at military installations and members of industrial fire brigades.

The term *on-duty* refers to being at the scene of an alarm, whether a fire or non-fire incident; being en route while responding to or returning from an alarm; performing other assigned duties such as training, maintenance, public education, inspection, investigations, court testimony and fund raising; and being on call, under orders or on stand-by duty other than at home or at the individual's place of business.

On-duty fatalities include any injury sustained in the line of duty that proves fatal, any illness that was incurred as a result of actions while on duty that proves fatal, and fatal mishaps involving non-emergency occupational hazards that occur while on duty. The types of injuries included in the first category are mainly those that occur at an incident scene, in training, or in accidents while responding to or returning from alarms.

Fatal injuries and illnesses are included even in cases where death is considerably delayed. When the onset of the condition and the death occur in different years, the incident is counted in the year of the condition's onset. The NFPA recognizes that a comprehensive study of firefighter on-duty fatalities should include chronic illnesses (such as cancer) that prove fatal and that arise from occupational factors. In practice, there is as yet no mechanism for identifying fatalities that are due to illnesses that develop over long periods of time. This creates an incomplete picture when comparing occupational illnesses to other factors as causes of firefighter deaths. This is recognized as a gap the size of which cannot be identified at this time because of the limitations in tracking the exposure of firefighters to toxic environments and substances and the potential long-term effects of such exposures.

## 2003 Experience

In 2003, a total of 105 on-duty firefighter deaths occurred in the U.S. This compares to the 97 firefighter fatalities that occurred in 2002.[1] Figure 1 shows firefighter deaths for the years 1977 through 2003, excluding the deaths at the World Trade Center in 2001. The sharp increase in deaths in 2003 (up

8.2 percent) was due in large part to a particularly bad wildland fire season. These incidents will be discussed in some detail throughout this study.

In 2003, there were seven multiple- fatality incidents, the most severe of which was a motor vehicle crash that killed eight firefighters returning from a wildland fire. In addition, there were six two-fatality incidents. Two of these occurred at structure fires: one where two firefighters died of burns after a store roof collapsed and one where two firefighters died of traumatic injuries suffered in a silo explosion at a lumber manufacturing plant. Three of the double-fatality incidents involved aircraft crashes -- a helicopter crashed while responding to a wildland fire, another helicopter struck a power line while scouting for water sources and an air tanker crashed while flying from one wildland fire to a staging area for another wildland fire. In the remaining two-fatality fire, two wildland firefighters were overrun and died of burns.

Analyses in this report will examine the types of duty associated with firefighter deaths, the cause and nature of fatal injuries to firefighters, and the ages of the firefighters who died. They will highlight deaths in incendiary or suspicious fires and in motor vehicle-related incidents.[2]

Finally, the study presents summaries of individual incidents that illustrate important problems or concerns in firefighter safety.

**Type of Duty**

Figure 2 shows the distribution of the 105 deaths by type of duty. The largest proportion of deaths (35 percent, or 37 deaths) occurred while responding to or returning from alarms. Another 29 deaths occurred on the fire ground. This is the lowest number of firefighter deaths to occur on the fire ground since NFPA began this annual study in 1977 and the first time that fire ground deaths accounted for less than 30 percent of the total. While over the past decade it has been typical for a fifth to a quarter to occur while responding to or returning from alarms, deaths in this category in 2003 reached their highest number since 1988 and their highest share ever.

Of the 37 deaths while responding to or returning from alarms, the largest share (24 deaths) were due to collisions or rollovers. Another eight deaths were due to heart attacks. Motor vehicle crashes and heart attacks are discussed in more detail later in this report. Three firefighters were struck by vehicles, one fell from the jump seat of an engine and one fell from a ladder while responding to a call from home. Twenty of the 37 victims were volunteer firefighters, four were career firefighters, 11 were contractors of federal land management agencies, one was a career member of a federal land

management agency and one was a prison inmate working on a wildland firefighting crew.

Just over a quarter of the deaths in 2003 occurred during fire ground operations. Of these 29 deaths, 15 were due to heart attacks, seven to burns, three to asphyxiation, three to internal trauma and one to crushing injuries. Fifteen of the victims were municipal volunteer firefighters, 10 were municipal career firefighters, three were employees of federal forestry agencies, and one was a contractor of a federal land management agency.[3]

Nineteen firefighter deaths occurred during the performance of non-emergency-related on-duty activities. Seven of them died of heart attacks while engaged in normal administrative or station activities. Two others suffered fatal heart attacks while working at parades, two had heart attacks at fire department fundraisers and another died of a heart attack while clearing brush from a training site. Two firefighters were killed when their helicopter crashed while they were scouting potential water sources for control of wildland fires and another died when his helicopter crashed during Columbia shuttle debris recovery. A firefighter was killed when the ambulance he was riding in while transporting a patient between medical facilities was rear-ended. A firefighter died in a crash while transporting supplies to crews on a wildland fire. Another died of injuries suffered when he fell from a riding lawn mower while working around the fire station. And finally, a firefighter fell from a ladder at the station while preparing for a fundraiser.

Eleven deaths occurred during training activities. Six firefighters suffered fatal heart attacks. One died of heat stroke at a live fire training exercise. One lost control of a tanker during driver training and was thrown from the vehicle as it crashed. Another fell from the back of a pickup truck at a training school. A firefighter was killed when his fire apparatus went off the road and crashed into a tree while enroute to a hazmat training program. And a firefighter was struck by a passing vehicle when he stopped to retrieve something that had fallen off the fire apparatus while the unit was returning from a training exercise.

Nine deaths occurred at non-fire emergencies. Six of these nine firefighters suffered fatal heart attacks at the scenes of medical calls, motor vehicle crashes or other non-fire emergencies. Two firefighters were struck and killed, one at the scene of an acid spill and the other at a motor vehicle crash. One firefighter collapsed due to cardiac arrhythmia and suffered fatal head injuries.

## Cause of Fatal Injury or Illness

Figure 3 shows the distribution of deaths by cause of fatal injury or illness. The term *cause* refers to the action, lack of action, or circumstances that resulted directly in the fatal injury.[4]

Stress and overexertion, which usually results in heart attacks, continued to be the leading cause of fatal injury, as it has been in almost all of the years of this study. All of the 47 stress-related deaths in 2003 resulted from heart attacks, which are discussed in more detail in the next section.

The second leading cause of fatal injury was struck by an object or contact with an object (37 percent). These 39 deaths included 33 killed in motor vehicle crashes and six struck by motor vehicles.

The next leading cause of fatal injury was caught or trapped, resulting in 13 deaths. Six firefighters were trapped by fire progress, four of them at three wildland fires. Three firefighters were killed inside structural collapses. Two firefighters were killed when a wood chip silo exploded while they attempted to extinguish a fire inside the silo from on and above the silo roof, respectively. Two firefighters became lost inside fire-involved structures and ran out of air.

Four firefighters were fatally injured in falls. Two fell from ladders, one while still at home preparing to respond to an alarm and the other while retrieving decorations for a fundraiser from a high shelf in the fire station. One fell from a fire apparatus while responding and the fourth fell from a pickup truck at a training facility.

In the remaining incidents, cardiac arrhythmia caused a firefighter to fall, striking his head on the ground and another firefighter was overcome by heat at a live fire training exercise on a shipboard training prop and died of heat stroke.

## Nature of Fatal Injury or Illness

The term *nature* refers to the medical process by which death occurred and is often referred to as *cause of death* on death certificates and in autopsy reports.

Figure 4 shows the distribution of deaths by nature of fatal injury or illness. The largest proportion of deaths (45 percent) was due to heart attacks. All of the heart attack deaths in 2003 were attributed to stress or overexertion. Heart attack is typically the leading nature of injury and usually accounts for close to half of the total deaths, but over the more than 25 years that NFPA has published this study, the number of heart attack deaths annually has dropped by a third. There was a sharp increase, however, in heart attack deaths from 37 in 2002 to 47 in 2003.

Of the 47 heart attack victims in 2003, eleven were known to have had prior heart problems -- usually prior heart attacks or bypass surgery -- and medical documentation showed that another nine had severe arteriosclerotic heart disease, two were hypertensive and one was diabetic. Over the past 25 years, medical documentation has been available for 670 of the 1,236 heart attack victims. Of those 670 victims, 49.1 percent had had prior heart attacks or bypass surgery and another 31.3 percent had severe arteriosclerotic heart disease. Another 12.7 percent had hypertension or diabetes.

For 2003, the other major categories were internal trauma (40 deaths), burns (seven deaths), asphyxiation (five deaths), and crushing injuries (four deaths). The remaining deaths included one each due to drowning and heat stroke.

**Ages of Firefighters**

The firefighters who died in 2003 ranged in age from 16 to 81, with a median age of 46 years. (Two 16-year-olds died in 2003. One was an explorer who was ejected when the tanker she was riding in overturned and the other was a junior firefighter who crashed in his own vehicle while responding to the scene of a motor vehicle crash.) Figure 5 shows the distribution of firefighter deaths by age and cause of death (heart attack versus other causes).

Heart attacks account for a higher proportion of the deaths among older firefighters, as might be expected. Two thirds of the firefighters over age 50 who died in 2003 died of heart attacks. The youngest heart attack victim was 35 years old.

Figure 6 shows death rates by age, using firefighter fatality data for the five-year period from 1999 through 2003 and estimates of the number of firefighters in each age group from the NFPA's 2001 profile of fire departments (the mid-year in the range).[5]

The lowest death rates are for firefighters in their 30s. Their death rate is a little more than half the all-age average. The rate for firefighters in their fifties is two thirds higher than the average and for firefighters age 60 and over, it is almost four times the average. Firefighters over age 50 accounted for two-fifths of all firefighter deaths over the five-year period although they account for less than one-sixth of all firefighters.

**Fire Ground Deaths**

Figure 7 shows the distribution of the 29 fire ground deaths by fixed property use. The largest proportion of deaths occurred in residential structures (34 percent). These 10 deaths included seven in one- and two-family dwellings and three in apartment buildings.

There were nine deaths in wildland fires including one at a controlled burn, four deaths at three fires in stores or repair businesses, three deaths at two fires in wood product plants, one death at a vehicle fire, one death at a storage facility and one death at a vacant building.

To put the hazards of firefighting in various types of structures into perspective, the authors examined the number of fire ground deaths per 100,000 structure fires by structural property use. Estimates of the fire experience in each type of property were obtained from the NFPA's annual fire loss studies from 1998 through 2002 (the 2003 results are not yet available) and from the updated firefighter fatality data for the corresponding years. The results are shown in Figure 8.

This figure illustrates that, although more firefighter deaths occur in residential structures than in any other type of structure, fires in some nonresidential structures, such as vacant buildings, mercantile and public assembly properties, are more hazardous to firefighters, on average. There were 8.7 fire ground deaths per 100,000 nonresidential structure fires from 1998 through 2002, compared to 4.2 deaths per 100,000 residential structure fires. The highest death rates over the five-year period occurred in special structures, the category that includes vacant buildings and buildings under construction. The low rate in health care/correctional and educational buildings may reflect the fact that these occupancies are among the most regulated and most-frequently inspected and that their occupants are among the most likely to call the fire department to report fires while the fires are still in their early stages. The low rate in that five-year period for manufacturing and storage properties is unusual -- in previous studies, these types of properties have also had death rates much higher than for residential properties.

**Vehicle-Related Incidents**

In 2003, 33 firefighters died in 23 vehicle crashes. This is the highest number of crash deaths reported in a single year in the 27 years that NFPA has been conducting this study. In addition to those deaths, six others were fatally struck by vehicles, one firefighter fell from the jump seat of an engine and another fell from the back of a pickup truck.

Twenty-four of the 33 firefighters killed in collisions or rollovers were responding to or returning from incidents when the crashes occurred. In the most catastrophic incident, eight firefighters returning

from a wildland fire were killed when their van crossed the centerline while passing another vehicle and collided head-on with a tractor trailer truck, bursting into flame. Alcohol was a factor in the crash. No information on seatbelt use was reported.

Six of the 24 victims killed while responding to incidents were driving their personal vehicles:

- One firefighter was struck at an intersection when he drove his vehicle into the path of another vehicle. He was not wearing a seatbelt.
- A firefighter was killed when his vehicle hydroplaned and struck a signpost as he was driving to the fire station to respond to a flooding emergency. He was driving at excessive speed for the poor weather conditions and was not wearing his seatbelt.
- A firefighter was driving his vehicle at approximately 80 mph when it went off the road and then overturned when he overcorrected the steering to return the vehicle to the road. He was not wearing a seatbelt and was ejected.
- A firefighter driving at approximately 70 mph lost control of his vehicle on a downhill curve and was killed when the vehicle struck trees and a fence. He was wearing his seatbelt.
- Careless driving was cited as the cause of a crash where the driver went off the road, overcorrected and was killed when the vehicle plunged down an embankment. He was not wearing his seatbelt.
- One of the victims drove off the road and crashed in a ravine. There was no information on seatbelt use or speed reported for that incident.

In the other crashes while firefighters were responding to or returning from emergency calls:

- Two firefighters ferrying crews to wildland fires were killed when their helicopter crashed. No cause for the crash has been released yet.
- Two firefighters were killed when their air tanker crashed while flying from one wildland fire to a staging area for a second fire. No cause for that crash has been released yet, either.
- A firefighter riding in an ambulance died when the ambulance was struck head-on by an oncoming vehicle that crossed the centerline at the top of a hill. The ambulance was traveling at 75 mph at the time of the crash. The victim was wearing his seatbelt.
- A tanker driver responding to a brush fire lost control of the vehicle after the wheels went off the right side of the road. He was not speeding but was traveling at an unsafe speed for the road conditions, and was not wearing his seatbelt.

- A firefighter was killed when the tanker she was riding in overturned when the driver, who was intoxicated, lost control. The victim, who was not wearing a seatbelt, was ejected, pinned beneath the vehicle and drowned in the water that spilled from the tanker.
- In another tanker crash, the driver lost control on a downhill curve and was killed when he was ejected and the vehicle rolled over him. Brake failure was a likely factor in the crash. There were no seatbelts installed in the almost 50-year-old vehicle.
- A fire officer responding to an alarm died when his department vehicle struck a utility pole after going off the road, striking a tree stump and overturning. Rain and wet leaves on the road were reported as factors in the crash. Although no speed was reported in this crash, the vehicle was traveling in a 30 mph zone. The victim was wearing his seatbelt.
- A firefighter was killed when his rescue vehicle was broadsided by a train at a level crossing. The crossing had no crossing gates or warning lights, but the train's horn was sounding. The rescue's siren was not sounding. The victim was wearing his seatbelt but was partially ejected.

There were three other aircraft crashes in 2003:

- Two firefighters died when their helicopter struck a power line while they were scouting for potential water sources for wildland firefighting. The power line was one of four lines that were not marked and did not appear on maps of the area.
- An apparent engine failure caused a helicopter to lose power and crash during operations to recovery debris from the Columbia shuttle disaster. One of the victims of the crash was a firefighter.
- "Loss of control in cruise" was listed as the cause of another helicopter crash, this one while dropping water at a wildland fire. One firefighter was killed in that crash.

The remaining five crashes all involved fire department vehicles during non-emergency activities.

- A firefighter riding as passenger enroute to hazmat training died when the vehicle went off the road and struck a tree. The driver had pulled over too far to make room for an oncoming vehicle on the narrow road. The victim was wearing his seatbelt.
- A firefighter mowing the lawn at the fire station died when he drove the lawnmower off a retaining wall and struck his head in the fall.

- A firefighter was killed while transporting a patient between medical facilities when the ambulance was rear ended by a tractor trailer that failed to slow down in a construction zone. The victim was wearing his seatbelt.
- A firefighter with a history of dizzy spells and blackouts died when his vehicle went off the road and crashed while he was shuttling supplies to fire crews at area wildland fires. He was wearing his seatbelt.
- During tanker driver training, a firefighter died when he was ejected from the tanker as it overturned. When the rear wheels of the tanker went off the road, he overcorrected and the vehicle rolled. He was not exceeding the speed limit, but a road sign cautioned drivers to slow down on this curve. Investigation showed that the brakes were defective, and the driver was not wearing his seatbelt.

Of the 24 deaths in road vehicles mentioned above, eight of the victims were not wearing seatbelts (four were ejected) and seven were wearing seatbelts (one was partially ejected). No information was available in two of the crashes, one of which killed eight firefighters. Excessive speed was a factor in at least six of the 16 crashes.

Six firefighters were struck by vehicles and killed. One firefighter was struck by a speeding driver who swerved around barriers at the site of a hazmat spill. Another firefighter arriving at the scene of a motor vehicle crash stepped onto the highway into the path of an oncoming tractor trailer. The driver of the truck had no time to react. The victim had left his reflective safety vest in his vehicle. A firefighter directing traffic in heavy fog was struck by a vehicle. He was wearing his safety vest; no other details were reported. A firefighter rolling hose at the station with another firefighter after an incident was run over by a fire truck that was backing into the station, in spite of the operating backup lights and alarm. A firefighter replacing road barriers at a construction site was struck by a passing vehicle that failed to negotiate the detour. And a firefighter returning from a training exercise got out of his vehicle to retrieve an object that fell from the truck and stepped into the other travel lane and was struck by a passing vehicle. He was not wearing a safety vest.

Two firefighters fell from moving vehicles. One fell from the jump seat of a responding pumper while reaching for ear protectors. The victim had indicated to the officer that she was seated and belted before the apparatus left the station. The other firefighter fell from the tailgate of a pickup truck as it moved between buildings at a training academy. He was not holding on while the vehicle accelerated.

## Other Findings

Five firefighters died in connection with incendiary and suspicious fires -- four at structure fires and one while responding to a structure fire. From 1994 through 2003, 88 firefighters (8.7 percent of all on-duty deaths) died in connection with incendiary and suspicious fires. The share of these deaths annually has been dropping fairly steadily since 1985, which is, in part, a reflection of the decline in incendiary and suspicious fires over the same period.

Five firefighters died as a result of false alarms in 2003. Over the past 10 years, 29 firefighter deaths have resulted from false calls, whether malicious or alarm malfunctions.

Of the 105 firefighters who died while on duty in 2003, 83 were members of local, municipal career and volunteer fire departments, 12 were contractors to federal land management agencies, four were employees of federal agencies, four were employees of state forestry agencies, one was a contractor to a state forestry agency and one was a member of a prison inmate crew.

The distribution of deaths of career and volunteer firefighters from local, municipal fire departments is shown in Figure 9. Firefighter fatalities among career firefighters reached their lowest level in 1993, but in spite of a rise in deaths from 1993 through 1999, there has been a general downward trend since 1985. For volunteer firefighters, there tends to be a great deal of fluctuation from year to year. Both groups seemed to have reached a new plateau in the past decade -- over the past 10 years, there have been an average of 60 volunteer firefighter deaths and 30 career firefighter deaths annually. A comparison of the fatality experience of the 83 career and volunteer firefighters killed in 2003 is shown in Table 1.

## Conclusions

At 105, the death toll in 2003 is slightly above the most recent 10-year average of 101 deaths per year. To assume that the increase in deaths over the 2002 total is fully explained by a single eight-fatality crash, however, masks some unusual patterns in fatalities in 2003. The number of crash deaths in 2003 was the highest ever reported, even when aircraft crashes are excluded, but it is important to note that there were more fatal crashes last year than in any year since 1988. In the past two years, there have been three crashes that killed three or more people. No such crashes had occurred between 1986 and 2002. Clearly, safe driving is an area deserving of more careful attention.

Obeying traffic laws, using seat belts, driving sober and controlling driving speeds would prevent most of the firefighter fatalities in road crashes each year. NFPA has developed two standards that are

available to help fire departments establish safe driving programs: NFPA 1002, *Standard on Fire Apparatus Driver/Operator Professional Qualifications,* and NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*. NFPA 1002 identifies the minimum job performance requirements for firefighters who drive and operate fire apparatus, in both emergency and nonemergency situations. NFPA 1451 provides for the development of a written vehicle operations training program, including the organizational procedures for training, vehicle maintenance, and identifying equipment deficiencies. In addition, *NFPA 1915, Standard Fire Apparatus Preventative Maintenance Program,* details a program to ensure that fire apparatus are serviced and maintained to keep them in safe operating condition.

Other unusual patterns appeared in 2003 for fire ground deaths. The number of fire ground deaths has never been so low (29 deaths), and fire ground deaths have never before made up such a small share of total on-duty deaths (28 percent). In spite of 2003's severe wildland fire season, there were only eight deaths of firefighters while operating on wildland fires, far lower than the 13 deaths per year average of the previous four years. (The large number of deaths occurring while the victims were responding to or returning from wildland fires, including that eight-fatality crash, contributed to the high number of wildland-fire-related deaths overall in 2003.) Firefighter deaths at structure fires have been declining steadily since 1978 and reached a new low in 2003. Although much of this decline can be credited to the reduction in the number of structure fires annually, and although the rate of deaths per 100,000 structure fires has not dropped as rapidly as might have been expected, this continued reduction in deaths is an important, positive trend.

In 2003, the number of heart attack deaths was quite a bit higher than in 2002, and almost 10 percent higher than the most recent 10-year average. Unfortunately, on-duty heart attacks appear to be at a plateau of approximately 43 per year. Although that is an improvement over the average 10 years ago (51 deaths per year), there hasn't been any sustained improvement since 1992. We consistently find that approximately half of the victims of fatal heart attacks had had prior heart attacks or bypass surgery, and another third had severe arteriosclerotic heart disease. Adopting and adhering to a comprehensive safety and health program could reduce these, and other, on-duty fatalities.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program,* requires the establishment of a health and fitness program for firefighters based on NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Fighters.* In addition, the standard requires firefighters to meet the medical requirements of NFPA 1582, *Standard on Comprehensive Occupational Medical*

*Program for Fire Departments.* Persons with certain health-related problems should not be allowed to become firefighters and those who develop problems after they are firefighters should be carefully evaluated to be sure they are capable of continuing to perform firefighting and other emergency duties. Persons not physically fit or medically qualified pose a danger not only to themselves but to their fellow firefighters and the public as their sudden incapacitation can affect the success of a mission.

Firefighting is a dangerous profession, but a large proportion of the on-duty deaths reported each year could be prevented.

**References**


1. The NFPA's files for firefighter on-duty fatal injuries are updated continually for all years.
2. For this report, the term *motor vehicle-related incident* refers to motor vehicle collisions (including aircraft and boats) and rollovers, as well as to incidents such as falls from or struck by vehicles where the involvement of the vehicle played an integral role in the death.
3. For this report, the term *volunteer* refers to any municipal firefighter who is not a full-time, paid member of a local, municipal fire department. The term *career* refers to full-time, paid local, municipal fire department members.
4. The categories for cause of injury and nature of injury are based on the 1981 edition of *NFPA 901, Uniform Coding for Fire Protection*.
5. Michael J. Karter, Jr., "U.S. Fire Department Profile Through 2001," NFPA Fire Analysis and Research Division, Quincy, Massachusetts, December 2002, unpublished. The analysis shown here assumes that the number of firefighters adequately estimates exposure and that the age distribution of career and volunteer firefighters is similar.


**Credits**


A study made possible by the cooperation and assistance of the United States fire service, the Public Safety Officers' Benefits Program of the Department of Justice, the United States Fire Administration, the National Institute for Occupational Safety and Health, the Forest Service of the U.S. Department of Agriculture, and the Bureau of Indian Affairs and the Bureau of Land Management of the U.S. Department of the Interior. The authors would also like to thank Carl E. Peterson, Jim Smalley and Michelle Steinberg of the Public Fire Protection Division for their assistance on the study.

**Resources are available from NFPA**
**to assist career and volunteer fire departments**
**in educating members in safe-driving practices**

The requirements for the safe operation of fire apparatus originate in NFPA 1500, *Fire Department Occupational Safety and Health Program*. Section 6.2, Drivers/Operators of Fire Department Apparatus, requires that the fire department develop standard operating procedures for the safe driving of fire apparatus under both emergency response and non-emergency travel conditions with emphasize on the safe arrival of fire apparatus at the emergency scene as the first priority. Drivers of fire apparatus are to be directly responsible for the safe and prudent operation of the vehicles under all conditions. Among the requirements in the section are that the apparatus only be operated by persons who have successfully completed an approved driver training program or by trainee drivers who are under the supervision of a qualified driver, all drivers have a valid driver's licenses, and that vehicles be operated in compliance with all traffic laws. In addition, the standard requires the fire department enact specific rules and regulations pertaining to the use of private vehicles for emergency response that are at least equal to the provisions regulating the operation of fire department vehicles.

NFPA has also developed two other standards to help fire departments establish safe driving programs: NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*, and NFPA 1002, *Standard on Fire Apparatus Driver/Operator Professional Qualifications*.

NFPA 1451 was initially developed in response to a request by the National Transportation Safety Board (NTSB) in 1991 that NFPA develop a standard for a training program for fire service vehicle operations, with emphasis on the safe arrival of the apparatus at the scene of the emergency as the first priority. The NFPA Fire Service Training Committee that was developing the standard also wanted to produce a standard to meet the intent of NFPA 1500 that requires fire department vehicles be operated only by members who have successfully completed an approved driver training program. Studies of firefighter fatalities during this period also showed a need for the standard as they were reporting approximately 25 percent of the firefighters who died each year died in motor vehicle accidents.

NFPA 1002 was developed under the direction of the National Professional Qualifications Board (NPQB) for the fire service using the NFPA standards-making system. The original concept of the professional qualifications standards was to develop an interrelated set of performance standards specifically for the uniformed fire service. The Technical Committee on Fire Fighter Professional Qualifications developed NFPA 1002 as the second in the series of firefighter professional qualifications standards.

**U.S. Department of Justice Death, Disability and Educational Benefits for Public Safety Officers and Survivors**

**Line of duty deaths:** The Public Safety Officers' Benefits (PSOB) Act, signed into law in 1976, provides a federal death benefit to the survivors of the nation's federal, state and local law enforcement officers, firefighters, and rescue and ambulance squad members, both career and volunteer, whose deaths are the direct and proximate result of a traumatic injury sustained in the line of duty. It was amended in 2000 to include FEMA employees performing official, hazardous duties related to a declared major disaster or emergency. Effective December 15, 2003, public safety officers are covered for line-on-duty deaths that are a direct and proximate result of a heart attack or stroke, as defined in the Hometown Heroes Survivors Benefits Act of 2003.

A 1988 amendment increased the amount of the benefit from $50,000 to $100,000 and included an annual cost-of-living escalator. On October 1 of each year, the benefit increases as a result. The enactment of the USA PATRIOT bill in 2001 increased the benefit to $250,000. The current benefit is $267,494, tax free.

A decedent's spouse and minor children usually are the eligible beneficiaries. As a result of the 2002 Mychal Judge Act, when there is no spouse or eligible children, the PSOB Act now provides the benefits to the individual(s) designated on the officer's most recently executed life insurance policy. Parents become eligible for the death benefit if they are named on the last executed policy or if there is no legitimate claim submitted by a life insurance policy beneficiary and the officer was not married and there are no eligible children.

**Line of duty disability:** In 1990, Congress amended the PSOB benefits program to include permanent and total disabilities that occur on or after November 29, 1990. The amendment covers public safety officers who are permanently unable to perform any gainful employment. PSOB is reserved for those few, tragic cases where an individual barely survives a traumatic, line of duty injury. Only then, in the presence of the program's statutory and regulatory qualifying criteria, will PSOB's disability benefit be awarded. The bill's supporters anticipated that PSOB would not approve more than a small number of cases annually.

**Public Safety Officers' Educational Assistance Program (PSOEA):** An additional benefit, signed into law in October 1996 and amended in 1998, provides an educational assistance allowance to the spouse and children of public safety officers whose deaths or permanent and total disabilities qualify under the PSOB Act. This benefit is provided directly to dependents who attend a program of education at an eligible education institution and are the children or spouses of covered public safety officers. It is retroactive to January 1, 1978, for beneficiaries who have received a portion of the primary PSOB benefit.

**Further benefits information:** To initiate a claim for death benefits, to receive additional information on filing a disability claim or to receive additional information about coverage, call or write the Public Safety Officers' Benefits Program, Bureau of Justice Assistance, U.S. Department of Justice, 810 7th Street, N.W., Washington DC 20531. The telephone number is (888) 744-6513.

*Public Safety Officers' Benefits Program*
*Bureau of Justice Assistance*
*U.S. Department of Justice*

**Table 1**
**Comparison of On-Duty Deaths Between**
**Career and Volunteer Municipal Firefighters, 2003***

| | Career Firefighters | | Volunteer Firefighters | |
|---|---|---|---|---|
| | **Number of Deaths** | **Percent of Deaths** | **Number of Deaths** | **Percent of Deaths** |
| **Type of duty** | | | | |
| Operating at fire ground | 10 | 40.0 | 15 | 25.9 |
| Responding to or returning from alarm | 4 | 16.0 | 20 | 34.5 |
| Training | 5 | 20.0 | 5 | 8.6 |
| Operating at non-fire emergencies | 1 | 4.0 | 8 | 13.8 |
| Other on-duty | 5 | 20.0 | 10 | 17.2 |
| TOTALS | 25 | 100.0 | 58 | 100.0 |
| **Cause of fatal injury** | | | | |
| Stress | 13 | 52.0 | 31 | 53.4 |
| Struck by or contact with object | 4 | 16.0 | 19 | 32.8 |
| Caught or trapped | 6 | 24.0 | 4 | 6.9 |
| Fell | 1 | 4.0 | 4 | 6.9 |
| Exposure to heat | 1 | 4.0 | 0 | 0.0 |
| TOTALS | 25 | 100.0 | 58 | 100.0 |
| **Nature of fatal injury** | | | | |
| Heart attack | 13 | 52.0 | 31 | 53.4 |
| Internal trauma | 5 | 20.0 | 21 | 36.2 |
| Burns | 3 | 12.0 | 1 | 1.7 |
| Crushing | 1 | 4.0 | 3 | 5.2 |
| Asphyxiation | 2 | 8.0 | 1 | 1.7 |
| Heat stroke | 1 | 4.0 | 0 | 0.0 |
| Drowning | 0 | 0.0 | 1 | 1.7 |
| TOTALS | 25 | 100.0 | 58 | 100.0 |
| **Rank** | | | | |
| Firefighter | 16 | 64.0 | 43 | 74.1 |
| Company officer | 8 | 32.0 | 7 | 12.1 |
| Chief officer | 1 | 4.0 | 8 | 13.8 |
| TOTALS | 25 | 100.0 | 58 | 100.0 |

**Table 1**
**Comparison of On-Duty Deaths Between**
**Career and Volunteer Municipal Firefighters, 2003*, (Continued)**

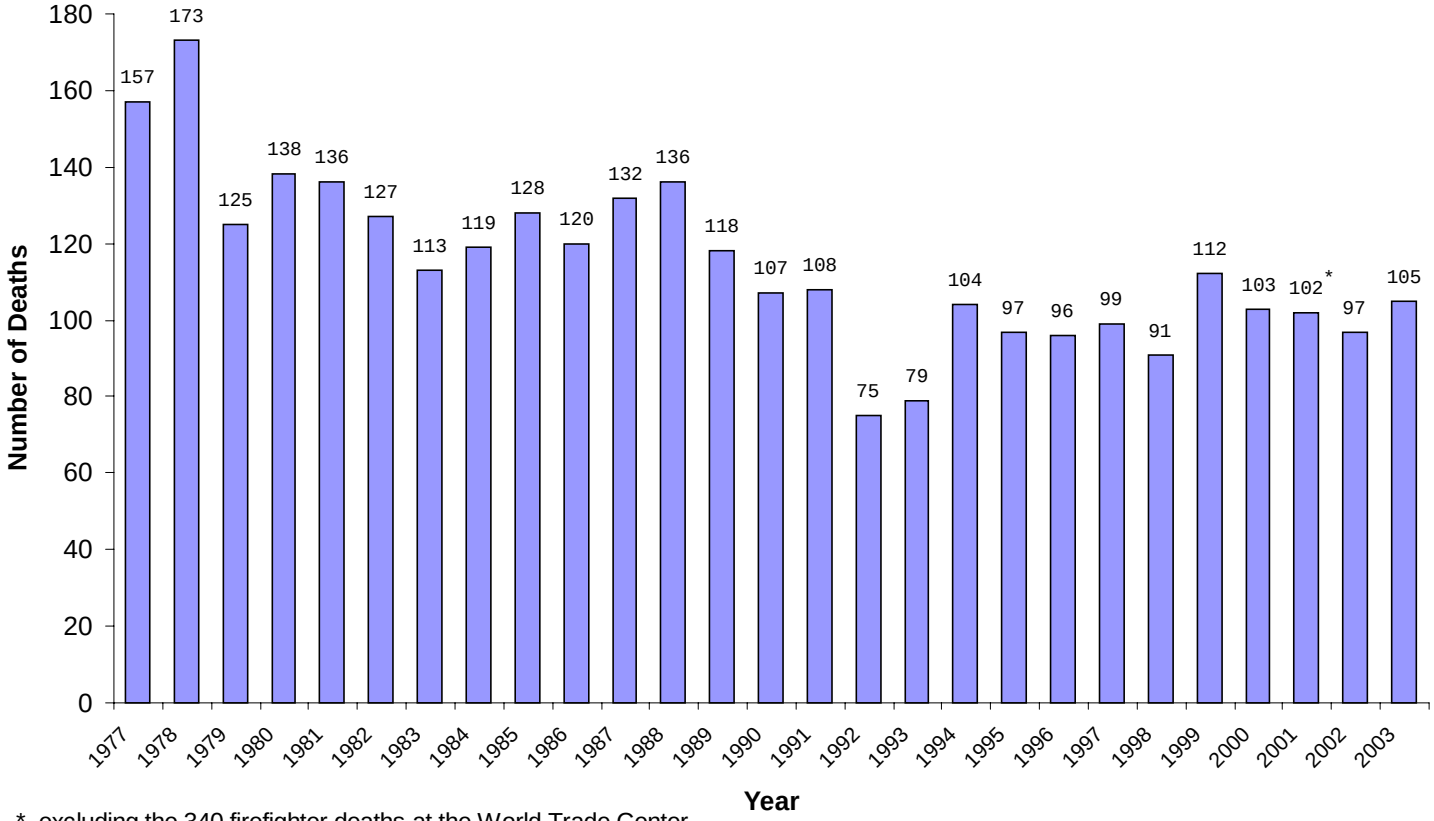
| | Career Firefighters | | Volunteer Firefighters | |
|---|---|---|---|---|
| | **Number of Deaths** | **Percent of Deaths** | **Number of Deaths** | **Percent of Deaths** |
| **Ages of Firefighters** **All deaths** | | | | |
| 20 and under | 0 | 0.0 | 4 | 6.9 |
| 21 to 25 | 3 | 12.0 | 2 | 3.4 |
| 26 to 30 | 2 | 8.0 | 2 | 3.4 |
| 31 to 35 | 1 | 4.0 | 2 | 3.4 |
| 36 to 40 | 5 | 20.0 | 4 | 6.9 |
| 41 to 45 | 2 | 8.0 | 8 | 13.8 |
| 46 to 50 | 6 | 24.0 | 7 | 12.1 |
| 51 to 55 | 6 | 24.0 | 10 | 17.2 |
| 56 to 60 | 0 | 0.0 | 7 | 12.1 |
| Over 60 | 0 | 0.0 | 12 | 37.9 |
| TOTALS | 25 | 100.0 | 58 | 100.0 |
| **Ages of Firefighters** **Deaths from heart attacks only** | | | | |
| 31 to 35 | 1 | 7.7 | 0 | 0.0 |
| 36 to 40 | 1 | 7.7 | 2 | 6.5 |
| 41 to 45 | 1 | 7.7 | 3 | 9.7 |
| 46 to 50 | 5 | 38.5 | 4 | 12.9 |
| 51 to 55 | 5 | 38.5 | 8 | 25.8 |
| 56 to 60 | 0 | 0.0 | 4 | 12.9 |
| over 60 | 0 | 0.0 | 10 | 32.3 |
| TOTALS | 13 | 100.0 | 31 | 100.0 |

**Table 1**
**Comparison of On-Duty Deaths Between**
**Career and Volunteer Municipal Firefighters, 2003*, (Continued)**

| | Career Firefighters | | Volunteer Firefighters | |
|---|---|---|---|---|
| | **Number of Deaths** | **Percent of Deaths** | **Number of Deaths** | **Percent of Deaths** |
| **Fire ground deaths by fixed property use** | | | | |
| Dwellings and apartments | 5 | 50.0 | 5 | 33.3 |
| Wildland | 1 | 10.0 | 4 | 26.7 |
| Mercantile | 3 | 30.0 | 1 | 6.7 |
| Manufacturing | 0 | 0.0 | 3 | 20.0 |
| Storage | 1 | 10.0 | 0 | 0.0 |
| Vacant | 0 | 0.0 | 1 | 6.7 |
| Road/highway | 0 | 0.0 | 1 | 6.7 |
| TOTALS | 10 | 100.0 | 15 | 100.0 |
| **Years of service** | | | | |
| 5 or less | 7 | 28.0 | 18 | 31.0 |
| 6 to 10 | 2 | 8.0 | 8 | 13.8 |
| 11 to 15 | 4 | 16.0 | 8 | 13.8 |
| 16 to 20 | 4 | 16.0 | 6 | 10.3 |
| 21 to 25 | 4 | 16.0 | 5 | 8.6 |
| 26 to 30 | 3 | 12.0 | 2 | 3.4 |
| over 30 | 1 | 4.0 | 10 | 17.2 |
| Not reported | 0 | 0.0 | 1 | 1.7 |
| TOTALS | 25 | 100.0 | 58 | 100.0 |
| **Attributes of fire ground deaths**** | | | | |
| Incendiary and suspicious fires | 4 | | 0 | |
| Search and rescue operations | 1 | | 0 | |
| **Motor vehicle crashes** | 4 | | 13 | |
| **False alarms** | 1 | | 3 | |

* This table does not include the 22 victims who were contractors for or employees of state or federal wildland agencies or worked on a prison inmate crew.
** Since these attributes are not mutually exclusive, totals and percentages are not shown.

**Figure 1**
**On-Duty Firefighter Deaths - 1977-2003**




* excluding the 340 firefighter deaths at the World Trade Center

**Figure 2**
**Firefighter Deaths by Type of Duty - 2003**

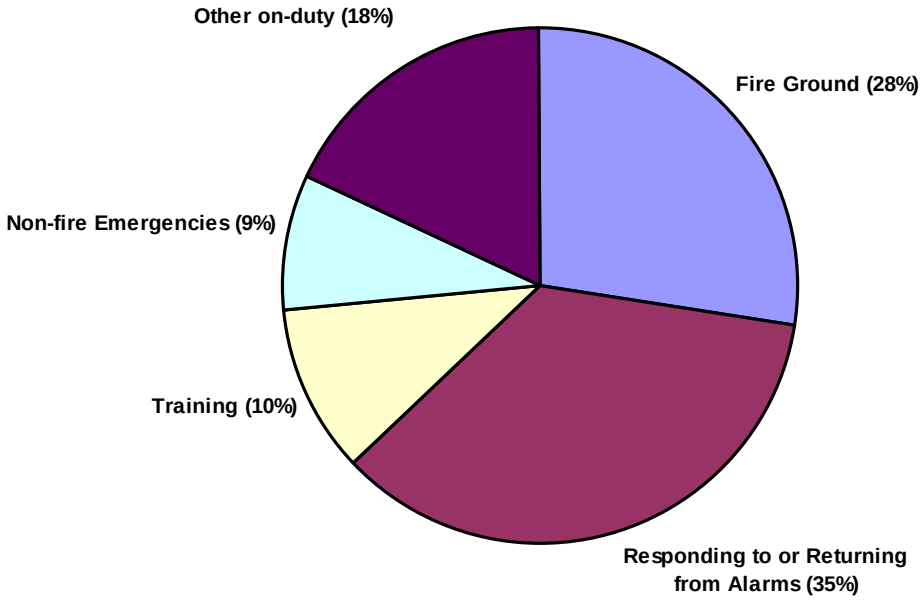


**Figure 3**
**Firefighter Deaths by Cause of Injury -- 2003**

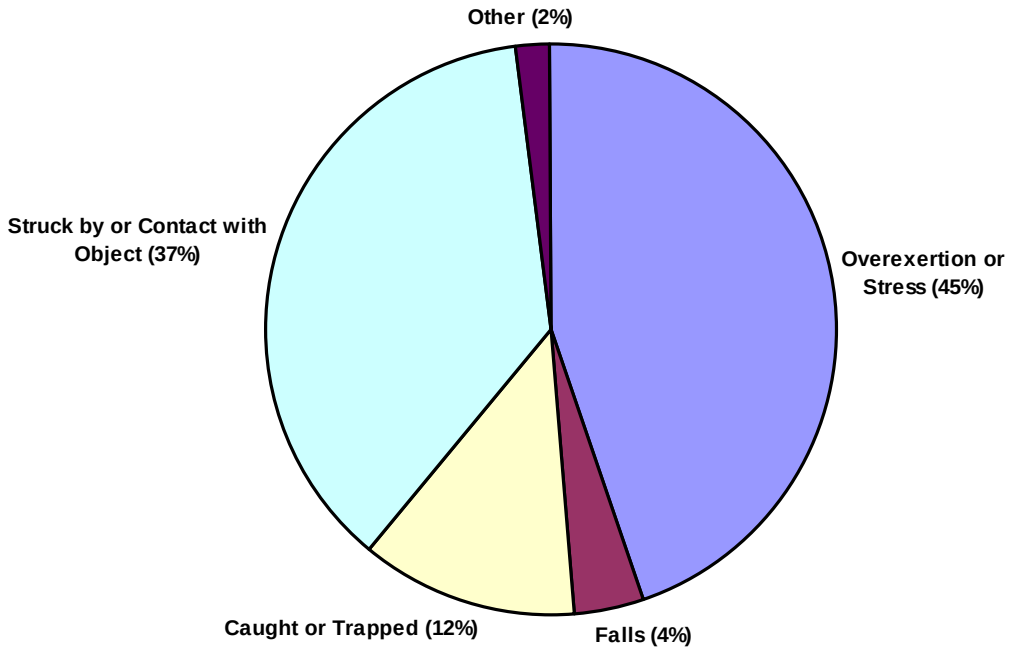


**Figure 4**
**Firefighter Deaths by Nature of Injury -- 2003**

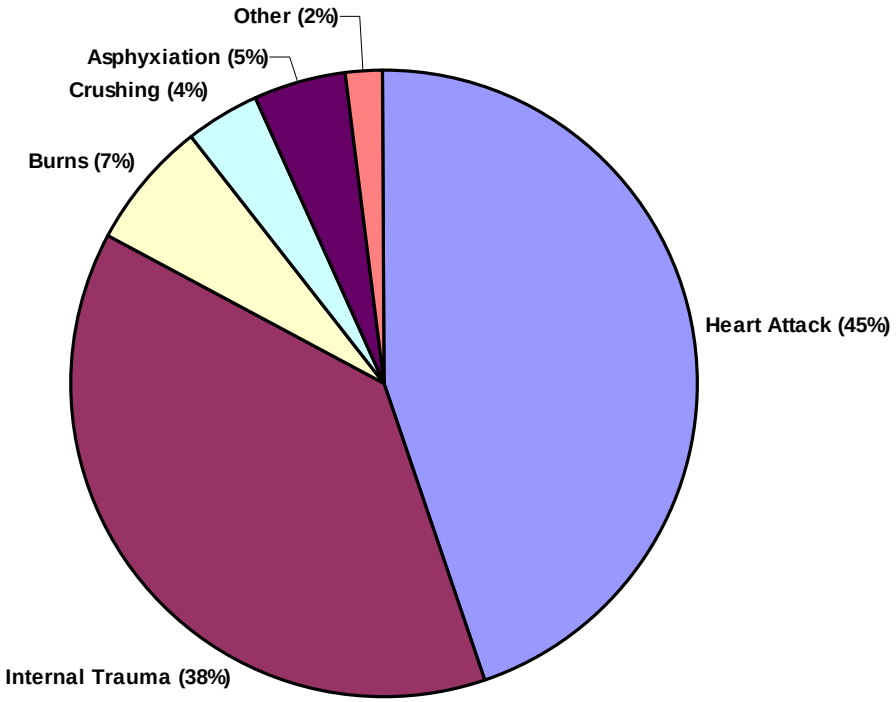


**Figure 5**
**On-Duty Firefighter Deaths**
**by Age and Cause of Death -- 2003**

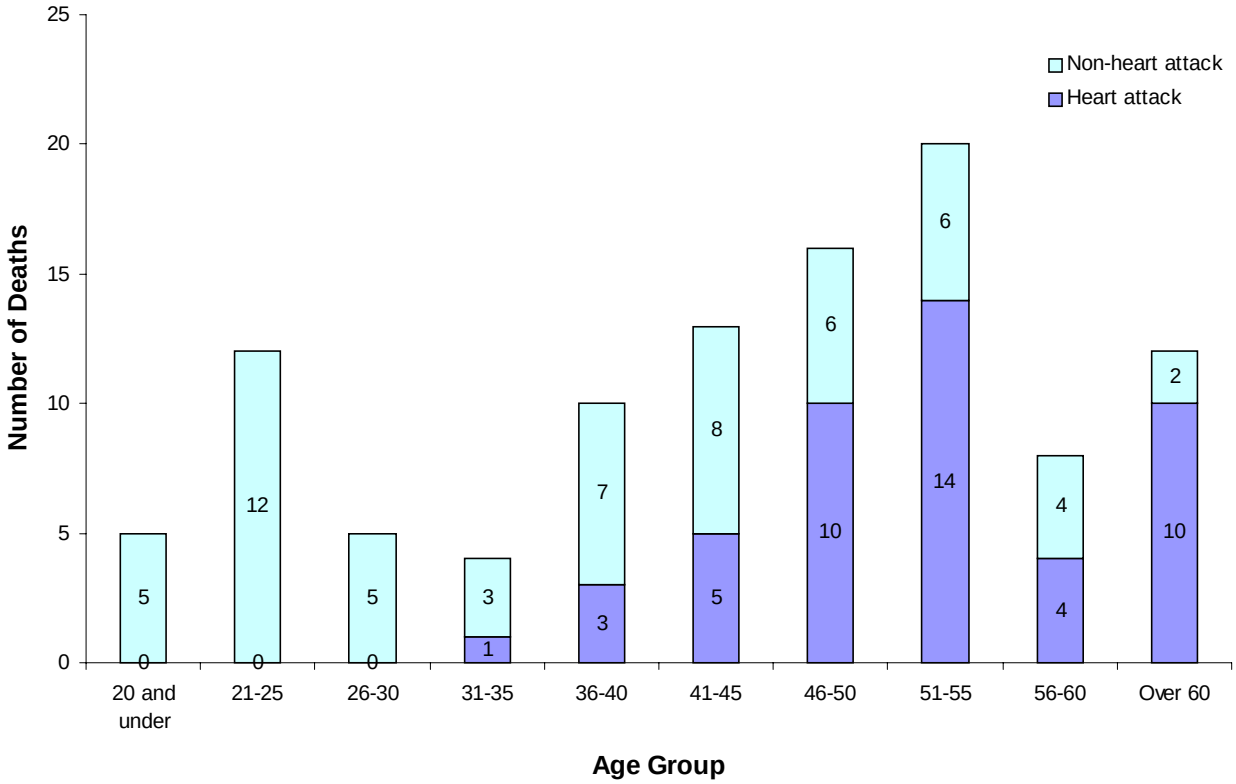
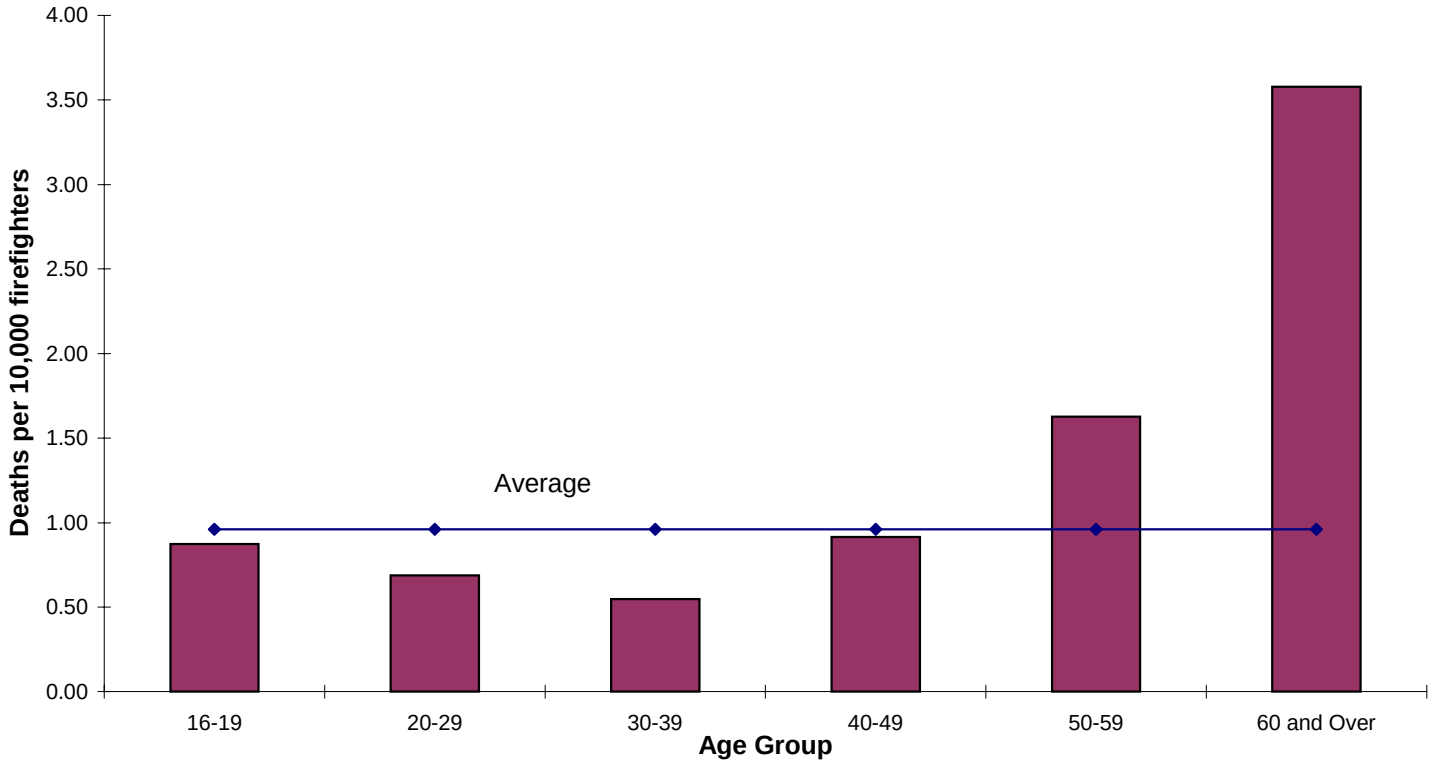
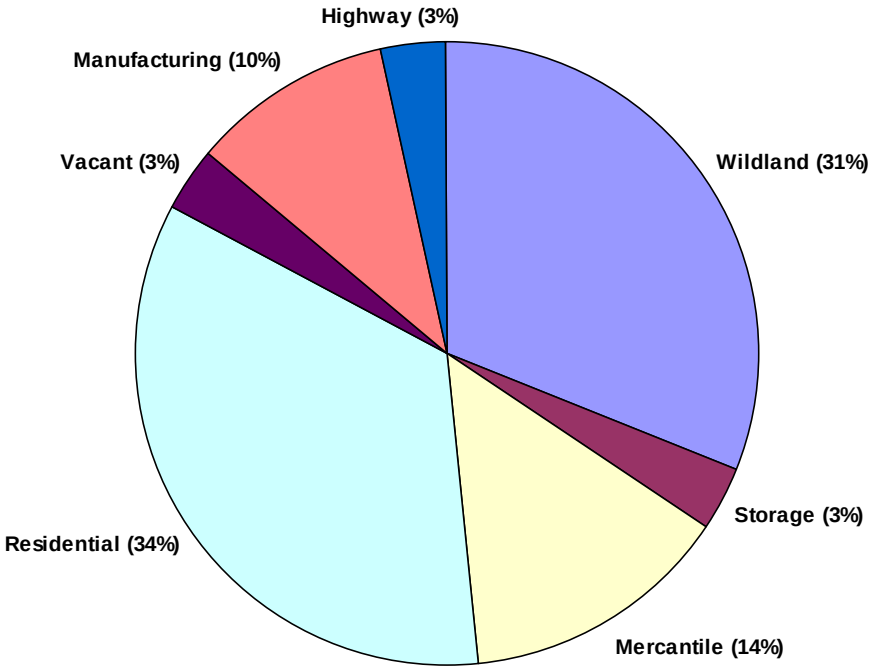


**Figure 6**
**On-Duty Deaths Rates per 10,000 Firefighters -- 1999-2003***



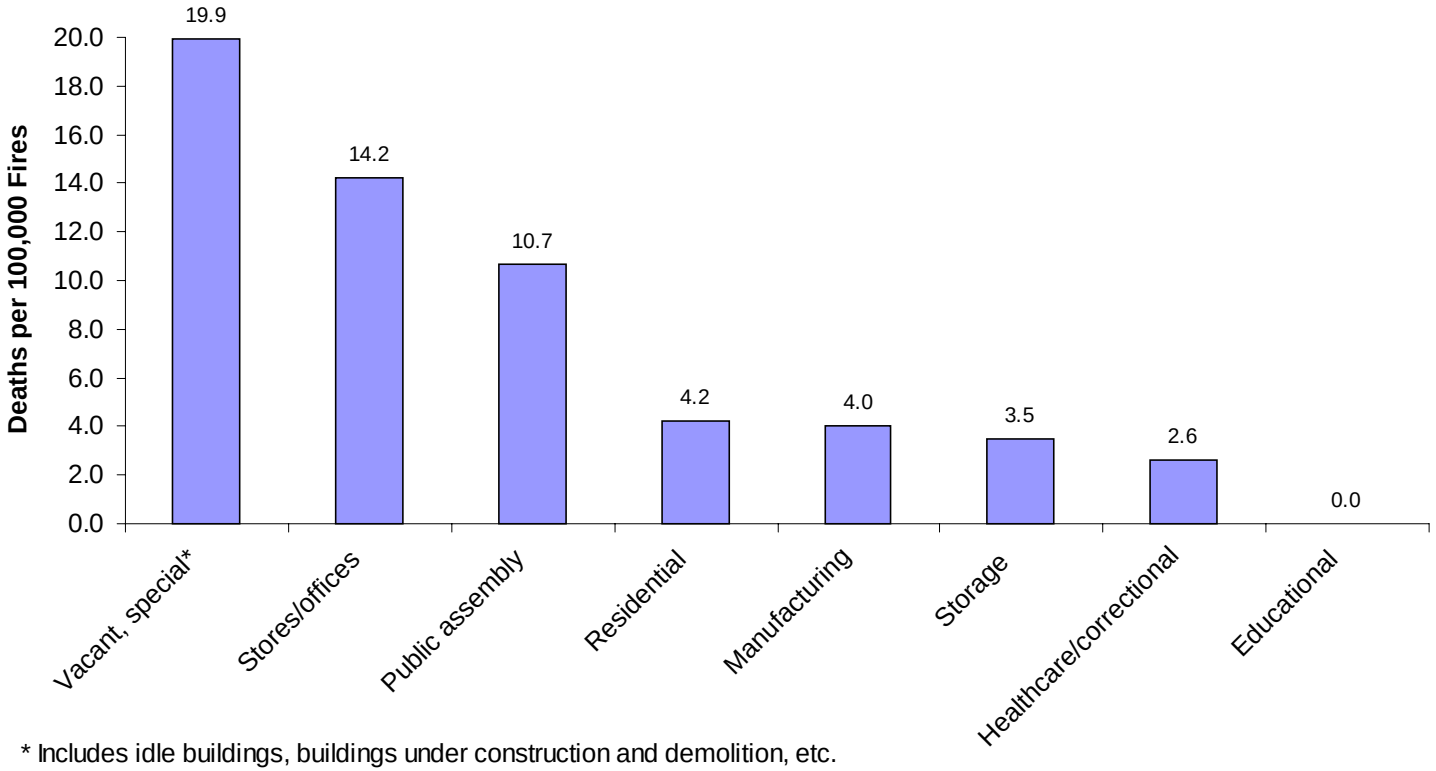

* excluding the 340 firefighter deaths at the World Trade Center in 2001

**Figure 7**
**Fireground Deaths by Fixed Property Use -- 2003***



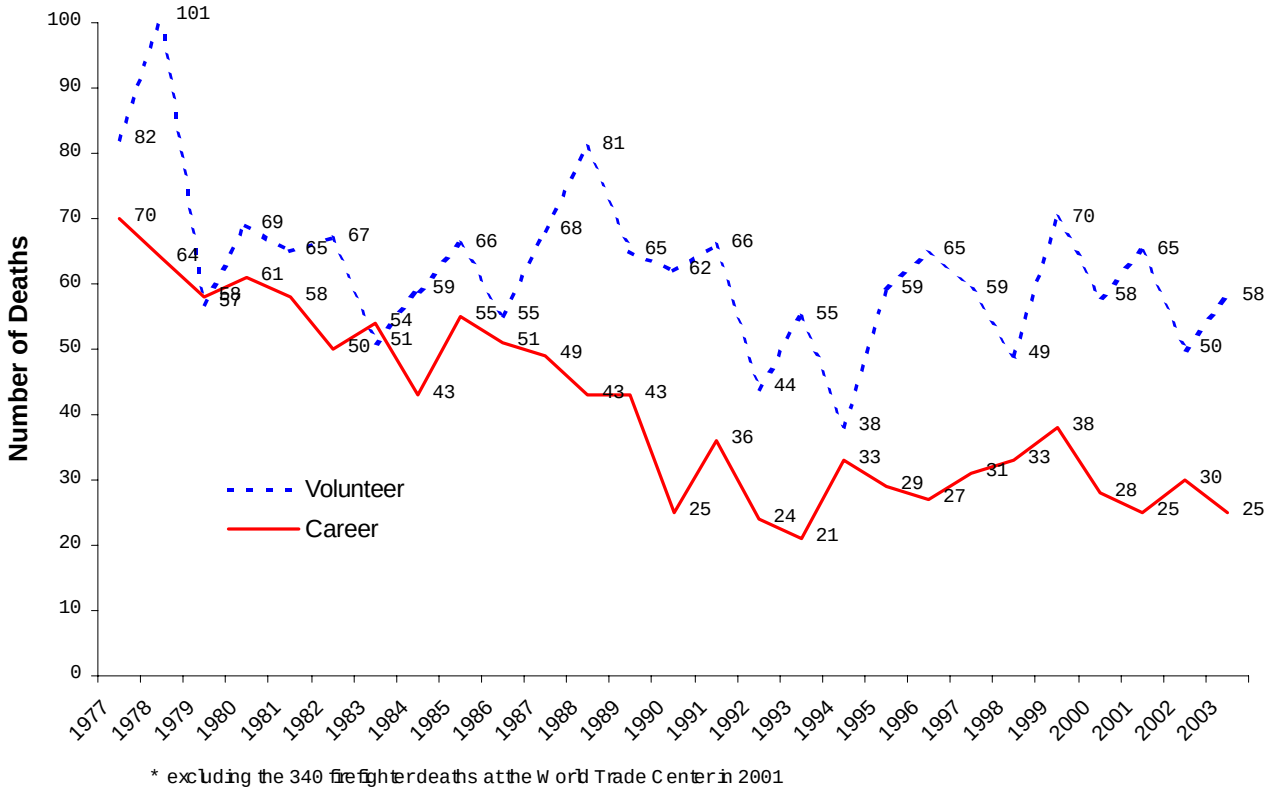

*** There were 29 deaths on the fire ground in 2003.**

**Figure 8**
**On-Duty Fireground Deaths**
**per 100,000 Structure Fires**
**1998-2002**
**(excluding the World Trade Center deaths in 2001)**




* Includes idle buildings, buildings under construction and demolition, etc.

**Figure 9**
**Firefighter Deaths - Local Career vs. Local Volunteer**
**1977 - 2003***




* excluding the 340 firefighter deaths at the World Trade Center in 2001

## FIREFIGHTER FATALITY INCIDENTS

**Fall from apparatus**

On January 8, at approximately 5 p.m., firefighters received an alarm to investigate the odor of smoke at a nearby airport. An engine company with an officer and three firefighters responded in a reserve engine. The reserve piece, which had a canopy cab design, was in use while their engine was in the shop for maintenance. Before leaving the station, the officer saw that the two firefighters were sitting in their jump seats. Both firefighters gave the all-set signal. The apparatus was equipped with operable seat belts but wasn't equipped with safety bars or gates.

The driver was negotiating a right-hand turn, the last of a sequence of turns to gain entrance to the highway, when the fall occurred. Investigators believe that the 40-year-old firefighter who was sitting behind the driver fell from the apparatus as she reached for her ear protection. The driver heard a loud sound and saw through his rear-side mirror that the firefighter was lying motionless on the street. The driver immediately stopped the engine and called for medical assistance as the crew went to her aid.

At the hospital, the firefighter underwent emergency surgery for traumatic head injuries. She remained in a coma for five weeks and then died from her multiple injuries. An examination of the apparatus found that her seat belt was intact and unfastened. A short circuit in an electrical vault caused the smoke odor.

**Firefighter dies in fall at station**

On October 24, a 60-year-old firefighter on standby assignment at his fire station used the time to prepare for an upcoming fundraiser. He climbed a short ground ladder to a shelf when he fell and struck his head on the floor.

Firefighters heard the fall and immediately went to his aid. After being transported to the hospital, he was put on life support. He was removed from life support on November 3 and died from his head injuries.

**Single motor vehicle crash**

At 12:15 p.m., a single-vehicle crash on December 3 killed a 40-year-old fire captain who was driving a 2000-gallon tanker in a driver-training exercise.

The captain failed to negotiate a left-hand curve and drove the tanker onto the shoulder of the road. He attempted to bring the tanker back onto the highway but couldn't overcome its momentum and the tanker rolled onto its side. The tank separated from the vehicle and the vehicle rolled over twice before coming to a stop. The rolling tanker ejected the captain. After being transported to the hospital, doctors pronounced him dead in the emergency room due to head trauma.

The captain, the only person in the tanker, wasn't wearing protective clothing or using his seat belt. Estimated speed of the tanker at the time of the crash was 55 mph in a 55 mph (89 kph) posted area.

An inspection of the apparatus revealed several defects. Three of the four brakes were either inoperative or contaminated from an oil leak from the engine. The right front shock was unattached to the frame on its upper mount and three of the six angle irons used to attach the tank to the frame had old breaks in them.

**Firefighter/recruit dies during training**

On August 8, at approximately 10a.m., a 37-year-old firefighter/recruit died in a live-burn exercise during his basic training at a privately owned training academy. Fire department training personnel used a structure resembling a ship with three decks to familiarize the recruits with shipboard firefighting.

Five recruits and three supervisors wearing full-protective ensembles, including self-contained breathing apparatus, entered the structure. Staying close together, the recruits communicated by radio. The 15-20 minute exercise called for firefighters to follow a hose line leading to the burn area and extinguish the fire.

Four of the five recruits and the three supervisors exited the structure. The three supervisors reentered to search for the recruit who failed to exit. On the second search, they found him in cardiac arrest. He had sustained burns to his hands and knees also. He was transported to the hospital, where he died. The cause of death was listed as cardiac arrhythmia due to exposure to heat. The other recruits were treated for burns and heat exhaustion and released from the hospital.

Local, state, and federal agencies are conducting investigations to determine the facts that led to the death of the recruit.

**Explosion kills two firefighters**

On October 1, at approximately 7 a.m., firefighters responded to a fire at a lumber manufacturing company in a neighboring community. Firefighters found a fire in a cement silo where sawdust and wood chips were stored and used to produce electricity at the lumber company and in two adjacent towns.

About 1-1/2 to 2 hours into the fire, two firefighters wearing full-personal protective clothing, including self-contained breathing apparatus, were on the roof of the silo, 75 feet (23 meters) above the ground. Another was working from the bucket of the aerial tower. They were attempting to wet down the sawdust and wood chips from above. As they worked, an explosion blew the roof off the silo and knocked the three to the ground. Cement fragments landed up to 900 feet (274 meters) away.

Two of the firefighters, 40 and 44 years old respectively, died of traumatic injuries suffered during the explosion and fall. One had been on the silo roof and the other in the aerial's bucket. The third firefighter, who had been on the roof, survived the fall and was hospitalized with broken bones. The explosion injured four other firefighters and two civilians. One of these firefighters and both civilians were also hospitalized.

Investigators believe that heat generated by friction between the belt and a pulley used to move the wood byproducts from the silo ignited combustibles in the silo's hopper. They believe the fire smoldered for hours and burned a cavity in the center of the filled silo. The cavity grew until the wood byproducts on top collapsed into the cavity, creating an atmosphere of dust particles. An explosion resulted when the suspended dust particles ignited.

**Fire department vehicle struck by train**

A 25-year-old firefighter was killed while responding as a back up on an emergency medical call for a woman in respiratory distress. On December 24, at 5:30 a.m., the firefighter, responding in the department rescue vehicle with emergency lights working and no siren, was struck on the driver's side by a freight train. The train was made up of three engines and 90 cars. According to the train's engineer, he saw the truck coming, knew that the truck wasn't going to stop, and sounded the train's horn. He further stated the truck erupted in flames on impact and was pushed 87 feet (27 meters) from the railroad crossing before coming to a rest. The train traveled 2,910 feet (887 meters) before coming to a stop.

The residential railroad crossing was equipped with stop signs only.

**Firefighter sustained fatal heart attack during dwelling fire**

On October 7, at 7:45 a.m. fire companies were dispatched for a structure fire. On arrival, firefighters encountered smoke in a two-story, wood-frame, single-family dwelling. The first engine company extended a hose line to a bedroom on the second level to extinguish the fire. Ladder company personnel performed search/rescue and ventilation duties.

A 43-year-old ladder company firefighter wearing full-protective clothing including a self-contained breathing apparatus carried a 16-foot (5-meter) ground ladder to the building and ascended it and another 16-foot ground ladder to the roof area. He broke windows on two sides of the building by reaching over the edge of the roof with a 6-foot (2-meter) ceiling hook, allowing smoke and toxic gases to escape. Shortly after he broke the windows, he collapsed on the roof. After he collapsed, he was able to push the distress button on his radio. At the same time a neighbor across the street called 911 after seeing him collapse.

On-scene firefighters rushed to the roof and began first aid. He was transported to the hospital where he died in the emergency room. Cause of death was listed as ischemic heart disease.

The fire was contained to the room of origin, where a 7-year-old playing with matches ignited a pile of clothes.

**Motor vehicle crash kills eight**

On August 8, at approximately 10 a.m., a crash killed eight contract firefighters who were returning home after fighting a wildland fire in a neighboring state for 14 days. The firefighters ranged in age from 19 to 38.

The crash occurred when the driver of their van attempted to pass a tractor-trailer truck on a curve. The van crossed the double yellow lines, collided head-on with another on-coming tractor-trailer truck, and burst into flames. The truck they were passing wasn't involved in the crash. The cause of death for six of the firefighters was traumatic injuries and the other two died of smoke inhalation. The two people in the tractor-trailer truck freed themselves from their vehicle and were taken to the hospital and admitted for burns and dislocations.

Alcohol was listed as a factor causing the crash.

**Firefighter crushed in collapse**

On January 20, at 3:01 p.m., a woman called 911 and notified the fire department of a fire in her home. She and her 3-year-old son evacuated when they saw flames in the living room. The structure was a large, two-story, wood-frame, single-family dwelling. The house wasn't equipped with a smoke detection or sprinkler system.

Arriving firefighters faced a well-involved fire. They attempted to make an interior attack and moved to an exterior attack when flames burned through the roof.

After the fire was extinguished, two crews went inside to overhaul hot spots. The crews wore full firefighting protective ensembles including self-contained breathing apparatus. As they worked, the center chimney collapsed, which caused the second story to collapse and trap three of the firefighters. Two firefighters were extricated with minor injuries and the third firefighter, who wasn't wearing his face piece when extricated, was immediately treated and transported to a hospital where he was pronounced dead. The cause of death was compressional asphyxiation.

The cause of the fire was electrical in nature, involving a receptacle in the first-story living room.

**Firefighter caught in explosion**

On January 19, at 9:59 a.m., the fire department was dispatched to a single-story, wood-frame commercial building containing 5,400 square feet (500 square meters) of floor area. The structure housed a new business that sold auto-racing supplies and displayed specialized vehicles. The building contained five automobiles, a pickup truck, a 21-foot (6.4-meter) fiberglass boat, a personal watercraft, and two golf carts. The business wasn't open to the public and minor renovations were underway.

At 10:07 a.m., the fire chief arrived and observed thick black smoke emitting from the building's rear. He requested a second alarm and asked for two additional tankers.

Four firefighters wearing full protective ensembles including self-contained breathing apparatus entered the building carrying a 1-3/4-inch (44 millimeter) pre-connected hose line using Class A compressed air foam at about 0. 6 percent. As they entered the structure through the front entrance, an adjacent overhead door was opened.

Shortly after they advanced the hose line, the fire intensified and rolled over the firefighters. The firefighter controlling the nozzle exited the building with his gloved hands on fire. As the remaining three firefighters moved up in position on the hose line, an evacuation alarm was sounded outside on an air horn. Two of the three firefighters found their way to the exit. The remaining firefighter became disoriented and lost in the building. As the two firefighters were exiting, a 10-pound (4.5-kilogram) nitrous oxide cylinder on a drag racer exploded.

It was immediately apparent that the firefighter was missing. Two rescue attempts by a rapid intervention crew failed due the volume and intensity of fire. The body of the firefighter was recovered 40 minutes later after the fire had been controlled. The firefighter was wearing a personal alert safety system device but its alarm sound wasn't audible due to his prone position.

The cause of death was listed as thermal burns with smoke inhalation and blast effect.

The cause of the fire was the ignition of lacquer thinner being used to prepare a section of concrete for the installation of ceramic tiles. The contractor tried to speed up the drying process by using a salamander-type heater. Vapors ignited instantaneously and flames spread throughout the area.

**Firefighter struck and killed at hazmat incident**

On March 15, at 7 a.m., firefighters, state police with their hazmat unit, and a clean-up crew were standing by at an ongoing recovery effort from a crash involving a truck pulling a tanker trailer loaded with acetic acid that overturned and leaked.

Fire and police emergency vehicles at the scene had their emergency lights on. Firefighters wore full protective ensembles with reflective material attached. Visibility was 30 to 40 feet (9 to 12 meters) due to thick fog. Witnesses on scene stated that they

heard squealing of tires and everyone started to run. One firefighter ran to the right side of the road and was struck by the right front side of a pickup truck.

The driver of the pickup truck stated he was driving at 50 to 55 mph (80 to 88 kph) when he saw the lights on the emergency vehicles. Trying to avoid a crash, he applied his brakes, locking them up, while he was steering to the right. His vehicle slid a total of 437 feet (133 meters) before coming to a stop in the ditch on the right side of the road. The firefighter was thrown 123 feet (37 meters) into the ditch from the point of impact. He was transported to the hospital where he was pronounced dead from the traumatic injuries he had sustained.

**Wildland pilot killed in crash**

On July 25, at 5:03 p.m. an experienced 44-year-old contract pilot and sole occupant was killed when his helicopter crashed while fighting a wildland fire. The crash occurred one hour after fueling and the pilot was on his fourth mission of the day. The pilot was flying the helicopter straight and level to refill the water for another drop when he radioed that he was going to crash. Witnesses heard a change in the sound of the motor before the crash. The helicopter was using a bambi bucket to drop water on the fire that had burned 2,200 acres (890 hectares) and was 70 percent contained.

The National Transportation Safety Board is investigating the crash to determine the cause.

**Wildland fire's rapid spread kills two firefighters**

On July 22, the third day of a wildland fire, two temporary forest technicians, ages 22 and 24, rappelled onto a rugged ridgeline above the fire to clear a helispot. The fire, ignited by a lightning strike, had grown from three acres (1.2 hectares) to 5,000 acres (2023 hectares). The technicians were clearing the helispot by cutting down trees with chain saws. Two helicopters assigned to the fire ferried firefighters to a helispot on the opposite side of the fire and made water drops.

At midday, a spot fire was reported developing a half-mile downhill from the area being cleared by the two technicians. The temperature was 91º F (33º C) with humidity at 18 percent and 6 mph (10 kph) winds. Firefighters working on the fire were pulled back from the fire line due to the increase in fire intensity.

Weather conditions changed and winds were gusting from 15 to 30 mph (24 to 48 kph). The technicians contacted the heli-base and asked to be picked up, stating that their location was getting very smoky. Before the arrival of the helicopter they sent another radio message stating, "Send them in a hurry." When the helicopter arrived, fire conditions didn't permit the pilot to land. A pilot in a spotter plane observed tall flames approaching the area where the helispot was being cleared. The fire overran the technicians' position in the next few minutes.

The fire continued to burn for the rest of the afternoon. Later in the day, two firefighters rappelled into the area to find the technicians. Guided by aerial observation from a helicopter the two firefighters found the bodies of the two technicians. The technicians had started to deploy their fire shelters, but were overrun by the rapid flame spread before the shelters were fully deployed.