

# **U.S. FIREFIGHTER INJURIES-2007**

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## **Abstract**

NFPA estimates that 80,100 firefighter injuries occurred in the line of duty in 2007, a decrease of 4% from the year before. Nearly half (47.9%) of the all firefighter injuries occurred during fireground operations. An estimated 13,665 occurring during other on duty activities, while 15,435 occurred at nonfire emergency incidents. The leading type of injury received during fireground operations was strain, sprain or muscular pain (45.1%), followed by wound, cut, bleeding, bruise (18.2%). Regionally, the Northeast had the highest fireground injury rate, more than twice the rate for the rest of the country.

Keywords: fire statistics, firefighter injuries, exposures, injury rates, fireground, non-fire emergencies, type of duty, cause of injury, collisions, community size

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## **Overview of 2007 Firefighter Injuries**

- 80,100 firefighter injuries occurred in the line of duty in 2007, a decrease of 4.0% from the year before.
- 38,340 or 47.9% of all firefighter injuries occurred during fireground operations. An estimated 15,435 occurred at nonfire emergency incidents, while 13,665 occurred during other on duty activities.
- Regionally, the Northeast had the highest fireground injury rate with 4.9 injuries occurring per 100 fires; this was more than twice the rate for the rest of the country.
- The major types of injuries received during fireground operations were: strain, sprain, muscular pain (45.1%); wound, cut, bleeding, bruise (18.2%); burns (6.9%); smoke or gas inhalation (5.6%). Strains, sprains, and muscular pain accounted for 57.8% of all nonfireground injuries.

## Background

Firefighters work in varied and complex environments that increase their risk of on-the-job death and injury. A better understanding of how these fatalities, nonfatal injuries, and illnesses occur can help identify corrective actions which, could help minimize the inherent risks.

Each year, the NFPA studies firefighter deaths and injuries to provide national statistics on their frequency, extent, and characteristics. Earlier this year, the NFPA reported 103 firefighters died on duty (See, "2007 Firefighter Fatalities ", NFPA Journal July/August).

This report addresses 2007 firefighter injuries in the United States. The results are based on data collected during the NFPA Survey of Fire Departments for U.S. Fire Experience (2007). An earlier report measured the national fire experience in terms of the number of fires that fire departments attended and the resulting civilian deaths, civilian injuries, and property losses that occurred<sup>1</sup>.

This year's report includes among its results:

- An estimate of the total number of 2007 firefighter injuries.
- Estimates of the number of injuries by type of duty.
- An estimate of the number of exposures to infectious diseases.
- Trends in firefighter injuries and rates.
- Fireground injuries by cause.
- Fire department vehicle accidents and resulting firefighter injuries.
- The average number of fires and fireground injuries per department by population of community protected.
- Descriptions of selected incidents that illustrate firefighter safety problems.

## **Overall Results**

Based on survey data reported by fire departments, the NFPA estimates that 80,100 firefighter injuries occurred in the line of duty in 2007. This is a decrease of 4.0% and back to the 2005 level. In recent years, the number of firefighter injuries have been considerably lower than they were in the 1980s and 1990s (Figure 1), but this is due in part to additional questions on exposures which allows us to place them in their own categories. Previously some of these exposures may have been included in total injuries under other categories.

The NFPA estimates that there were 13,450 exposures to infectious diseases (e.g., hepatitis, meningitis, HIV, others) in 2007. This amounts to 0.9 exposures per 1,000 emergency medical runs by fire departments in 2007.

The NFPA estimates that there were 28,300 exposures to hazardous conditions (e.g., asbestos, radioactive materials, chemicals, fumes, other) in 2007. This amounts to 26.2 exposures per 1,000 hazardous condition runs in 2007.

An estimated 16,350 injuries or 20.4% of all firefighter injuries resulted in lost time in 2007.

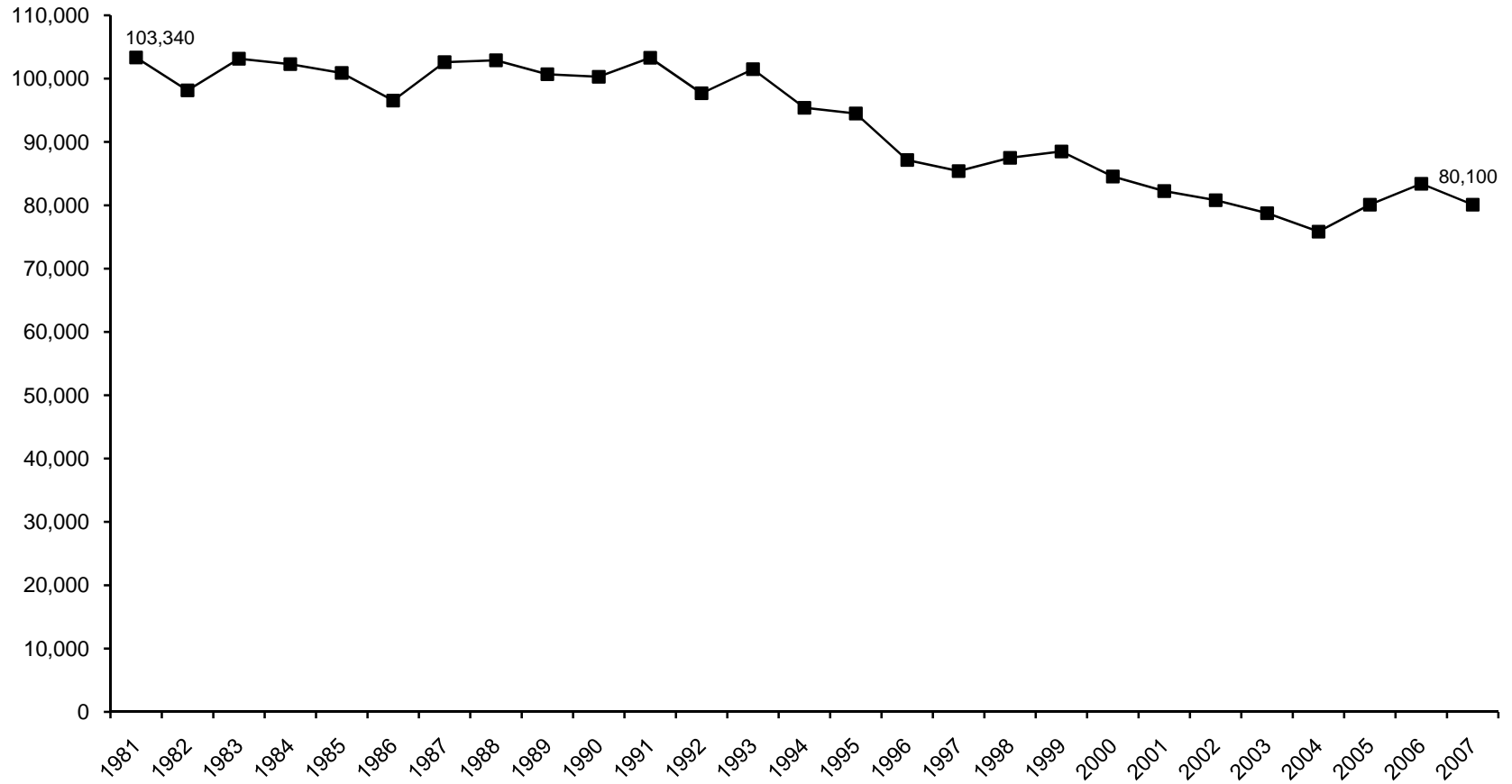
## **Injuries by Type of Duty**

Estimates of firefighter injuries by type of duty are displayed in Figure 2. As in past reports, type of duty is divided into five categories:

- Responding to or returning from an incident (includes fire and nonfire emergencies).
- Fireground (includes structure fires, vehicle fires, brush fires, etc.), and refers to all activities from the moment of arrival at the scene to departure time (e.g., setup, extinguishment, overhaul).
- Nonfire emergency (includes rescue calls, hazardous calls, such as spills, and natural disaster calls).
- Training
- Other on-duty activities (e.g., inspection or maintenance duties).

**Figure 1**  
**Total Firefighter Injuries by Year (1981-2007)**

**Number of Firefighter Injuries**

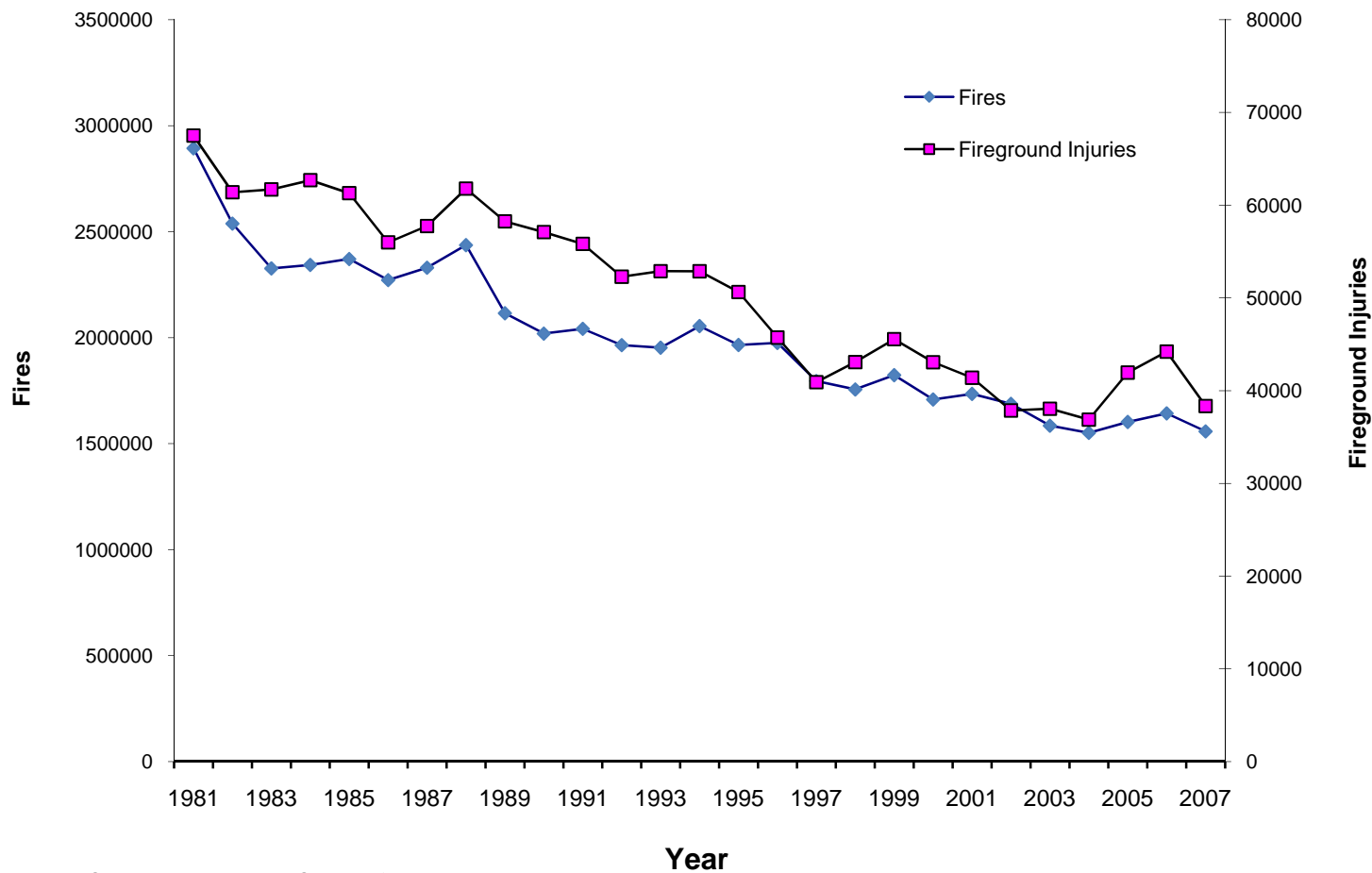


Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1981-2007)

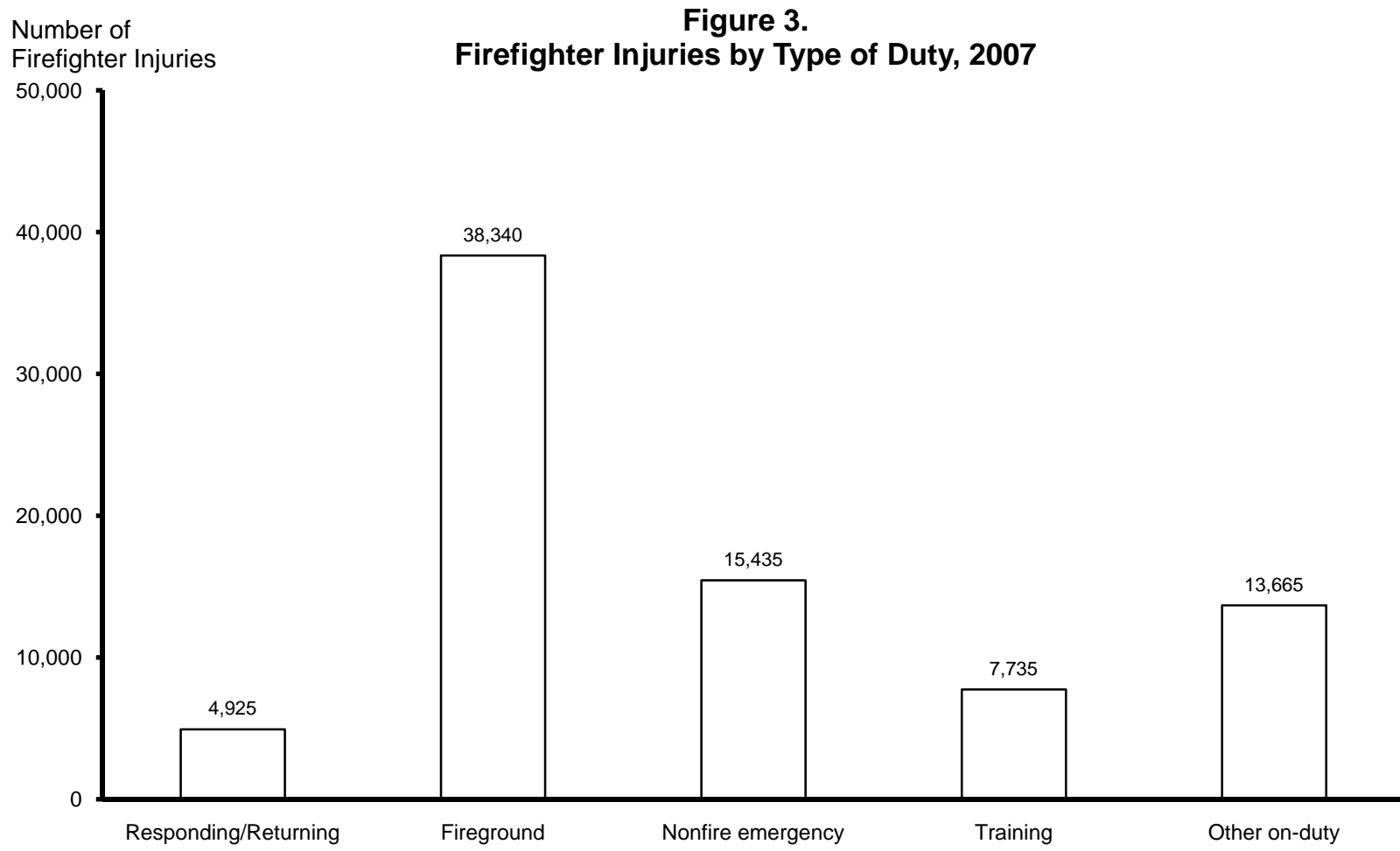
Year

From 1994 on, number of exposures was collected separately

**Figure 2**  
**The Decrease in Fireground Injuries**  
**is Similar to the Decrease in Fires**



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1981-2007)



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1981-2007)



Results by type of duty indicate not surprisingly that the largest share of injuries occur during fireground operations: 38,340 or 47.9% of all firefighter injuries in 2007 and similar to the 2002-2003 level. Table 1 displays firefighter injuries at the fireground and injury rates for the 1981-2007 period. Injuries at the fireground decreased from their high of 67,500 in 1981 to a low of 36,880 in 2004 for a decrease of 45.4%. The rate of injuries per 1,000 fires has generally decreased during the period except for 2005-06. This is because the number of fire incidents also decreased a considerable 46.4% for the 1981 to 2004 period (See Figure 2).

In addition to injuries at the fireground, an estimated 15,435 or 19.3% occurred at nonfire emergencies, while 13,665 or 17.1% occurred during other on duty activities.

### **Nature of Fireground Injuries**

Estimates of 2007 firefighter injuries by nature of injury and type of duty are displayed in Table 2. The nature of injury cause categories are based with modifications on NFPA 901, *Uniform Coding for Fire Protection*. Table 2 indicates that the four major types of injuries that occur during fireground operations are strain, sprain (45.1%); wound, cut, bleeding, bruise (18.2%); burns (6.9%); thermal stress (6.3%); smoke or gas inhalation (5.6%).

Results were fairly consistent during all non-fireground activities, with strains, sprains, and muscular pain accounting for 57.8% of all non-fireground injuries, and wound, cut, bleeding, bruise accounting for 17.7%.

### **Causes of Fireground Injuries**

Because fireground injuries are of particular concern their causes were examined (see Figure 4). The definition of cause here refers to the initial circumstance leading to the injury. The cause categories included on the survey were also based on NFPA 901, *Uniform Coding for Fire Protection*. Fall, slip, jump (27.3%), and overexertion, strain (24.4%) were the leading causes of fireground injuries. Other major causes were contact with object (11.9%); and exposure to fire products (8.8%), and struck by (8.8%).

**Table 1**  
**Firefighter Injuries at the Fireground, and**  
**at Nonfire Emergencies, 1981-2007**

Year	At the Fireground		At Nonfire Emergencies	
	Injuries	Injuries per 1000 Fires	Injuries	Injuries per 1,000 Incidents
1981	67,500	23.3	9,600	1.24
1982	61,400	24.2	9,385	1.17
1983	61,700	26.5	11,105	1.29
1984	62,700	26.8	10,600	1.21
1985	61,300	25.9	12,500	1.38
1986	55,900	24.7	12,545	1.30
1987	57,755	24.8	13,940	1.41
1988	61,790	25.4	12,325	1.13
1989	58,250	27.5	12,580	1.11
1990	57,100	28.3	14,200	1.28
1991	55,830	27.3	15,065	1.20
1992	52,290	26.6	18,140	1.43
1993	52,885	27.1	16,675	1.25
1994	52,875	25.7	11,810	0.84
1995	50,640	25.8	13,500	0.94
1996	45,725	23.1	12,630	0.81
1997	40,920	22.8	14,880	0.92
1998	43,080	24.5	13,960	0.82
1999	45,500	25.0	13,565	0.76
2000	43,065	25.2	13,660	0.73
2001	41,395	23.9	14,140	0.73
2002	37,860	22.4	15,095	0.77
2003	38,045	24.0	14,550	0.70
2004	36,880	22.1	13,150	0.62
2005	41,950	26.2	12,250	0.56
2006	44,210	26.9	13,090	0.57
2007	38,340	24.6	15,435	0.65

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1981-2007)

**Table 2**  
**Firefighter Injuries by Nature of Injury and Type of Duty, 2007**

Nature of Injury	Responding to or Returning from an Incident		Fireground		Nonfire Emergency		Training		Other on-duty		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Burns (Fire or Chemical)	55	1.1	2,650	6.9	80	0.5	215	2.8	255	1.9	3,255	4.1
Smoke or Gas Inhalation	195	4.0	2,150	5.6	130	0.8	90	1.2	110	0.8	2,675	3.3
Other Respiratory Distress	25	0.5	560	1.5	155	1.0	85	1.1	180	1.3	1,005	1.3
Burns and Smoke Inhalation	155	3.2	695	1.8	55	0.4	70	0.9	45	0.3	1,020	1.3
Wound, Cut, Bleeding Bruise	970	19.7	6,985	18.2	2,335	15.1	1,255	16.2	2,845	20.8	14,390	18.0
Dislocation, Fracture	230	4.7	1,210	3.2	310	2.0	400	5.2	435	3.2	2,585	3.2
Heart Attack or Stroke	65	1.3	395	1.0	120	0.8	125	1.6	295	2.2	1,000	1.3
Strain, Sprain Muscular Pain	2,775	56.4	17,280	45.1	9,705	62.9	4,555	58.9	7,095	51.9	41,410	51.7
Thermal Stress (frostbite, heat exhaustion)	70	1.4	2,410	6.3	75	0.5	340	4.4	135	1.0	3,030	3.8
Other	385	7.8	4,005	10.5	2,470	16.0	600	7.8	2,270	16.6	9,730	12.2
	4,925		38,340		15,435		7,735		13,665		80,100	

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2007

Note: If a firefighter sustained multiple injuries for the same incident, only the nature of the single most serious injury was tabulated.

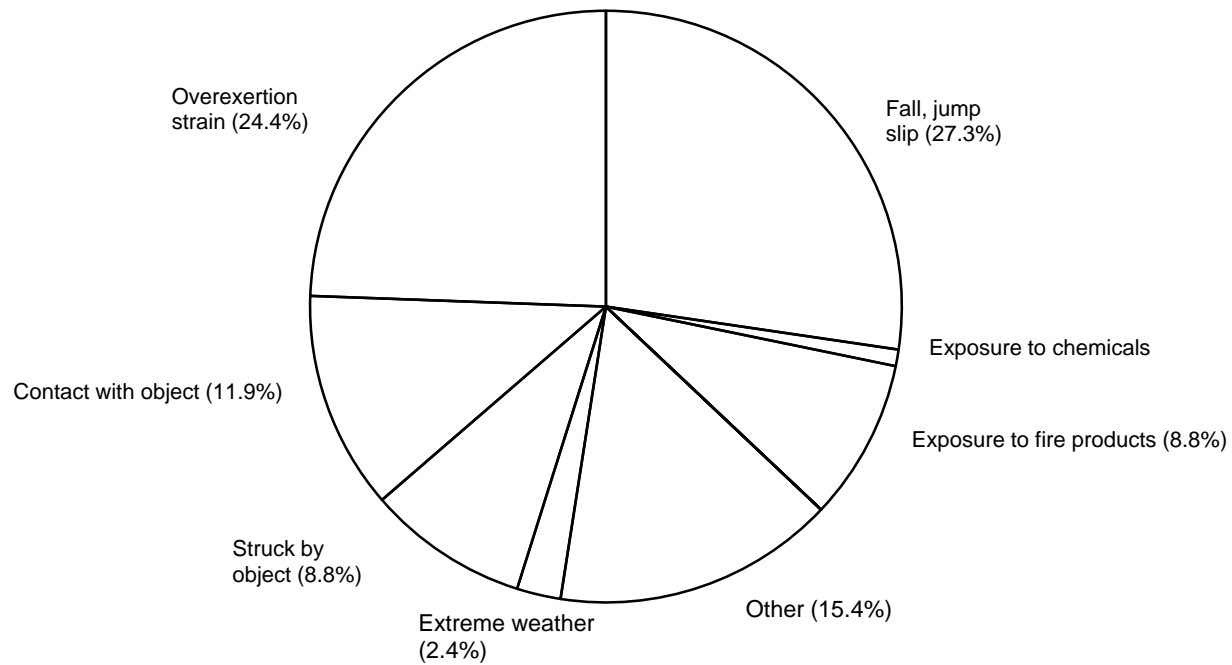
## **Fire Department Vehicle Collisions**

The NFPA reported earlier that 27 firefighters died in motor vehicle collisions in 2007. (See “2007 Firefighter Fatalities” July/August NFPA Journal).

In 2007, there were an estimated 14,650 collisions involving fire department emergency vehicles, where departments were responding to or returning from incidents (see Table 3). To put this number in perspective however, fire departments responded to over 25.3 million incidents in 2007 so that the number of collisions represents about one tenth of 1 percent of total responses. However, these collisions resulted in 915 firefighter injuries or 1.1% of all firefighter injuries.

Also, 665 collisions involving firefighters’ personal vehicles occurred in 2007 while departments were responding to or returning from incidents. These collisions resulted in an estimated 120 injuries.

**Figure 4.  
Fireground Injuries by Cause, 2007**



Source: NFPA Annual Survey of Fire Departments  
for U.S. Fire Experience (2007)

**Table 3**  
**Fire Department Vehicle Collisions and**  
**Resulting Firefighter Injuries**  
**While Responding to or Returning From Incidents, 1990-2007**

Year	Involving Fire Department Emergency Vehicles		Involving Fire Fighters' Personal Vehicles	
	Collisions	Fire Fighter Injuries	Collisions	Fire Fighter Injuries
1990	11,325	1,300	950	175
1991	12,125	1,075	1,375	125
1992	11,500	1,050	1,575	150
1993	12,250	900	1,675	200
1994	13,755	1,035	1,610	285
1995	14,670	950	1,690	190
1996	14,200	910	1,400	240
1997	14,950	1,350	1,300	180
1998	14,650	1,050	1,350	315
1999	15,450	875	1,080	90
2000	15,300	990	1,160	170
2001	14,900	960	1,325	140
2002	15,550	1,040	1,030	210
2003	15,900	850	980	85
2004	15,420	980	1,150	220
2005	15,885	1,120	1,080	125
2006	16,020	1,250	1,070	210
2007	14,650	915	665	120

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1990-2007)

## **Average Fires and Fireground Injuries per Department by Population Protected**

The average number of fires and fireground injuries per department by population of community protected in 2007 are displayed in Table 4. These tabulations show (1) that the number of fires a fire department responds to is directly related to the population protected, and (2) that the number of fireground injuries incurred by a department is directly related to its exposure to fire, i.e., and the number of fires attended by the department. The second point is clearly demonstrated when we examine the range of the statistic: from a high of 100.5 for departments that protect communities of 500,000 to 999,999 to a low of 0.2 for departments that protect communities of less than 2,500.

A useful way to look at firefighter injury experience and to obtain a reading on the relative risk that departments face is to examine the number of fireground injuries that occur for every 100 fires attended. This takes into account relative fire experience and allows more direct comparison between departments protecting communities of different sizes. The number of fireground injuries per 100 fires is displayed in column 4 of Table 4. The overall range of rates varied little from a high of 3.4 for departments that protect communities 250,000 to 499,999 to a low of 1.6 for departments that protect communities of less than 5,000 population. Thus, the wide range noted in average fireground injuries by population protected narrows when relative fire experience is taken into account. The overall injury rate for departments protecting communities of 50,000 population or more was 2.5 injuries per 100 fires or 39% higher than the injury rate for departments protecting communities of less than 50,000 population.

The risk of fireground injury per 100 firefighters by size of community protected was also calculated and is displayed in column 5 of Table 4. Larger departments generally had the highest rates with departments protecting communities of 250,000 to 499,999 having the highest rate with 9.4 injuries per 100 firefighters. As community size decreases, the rate drops quite steadily to a low of 1.0 for departments protecting less than 2,500 people. That is a more than a nine-to-one difference in risk of injury between communities of 250,000 to 499,999, and the smallest communities (less than 2,500).

An explanation for this difference is that although a department protecting a community with a population of 250,000 to 499,999 has, on average, more than 22 times as many firefighters than a department protecting a population of less than 2,500, the larger department attends more than 100 times as many fires, and as a result, it incurs considerably more fireground injuries.

**Table 4**  
**Average Number of Fires, Fireground Injuries and Injury Rates**  
**by Population of Community Protected, 2007**

<b>Population of Community Protected</b>	<b>Average Number of Fires</b>	<b>Average Number of Fireground Injuries</b>	<b>Number of Fireground Injuries Per 100 Fires</b>	<b>Number of Fireground Injuries Per 100 Firefighters</b>
500,000 to 999,999	3,217.7	100.5	3.1	8.8
250,000 to 499,999	1,273.9	43.4	3.4	9.4
100,000 to 249,999	643.6	14.5	2.3	6.3
50,000 to 99,999	265.5	4.8	1.8	4.5
25,000 to 49,999	148.0	3.5	2.4	5.8
10,000 to 24,999	72.3	1.2	1.7	2.8
5,000 to 9,999	41.4	0.7	1.7	2.0
2,500 to 4,999	24.8	0.4	1.6	1.4
Under 2,500	12.3	0.2	1.6	1.0

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2007



## **Average Fires and Fireground Injuries by Population Protected and Region**

Table 5 displays the average number of fires and fireground injuries per department by population of community protected and region of the country<sup>3</sup>. As in the nationwide results in Table 4, the results of each region of the country indicate that the number of fires a fire department responds to is directly related to the population protected, and the number of fireground injuries incurred by a department is directly related to the number of fires attended. The Northeast reported a substantially higher number of fireground injuries for most community sizes where all departments reported sufficient data by region.

**Table 5**

**Average Number of Fires and Fireground Injuries per Department and Injuries per 100 Fires, by Population of Community Protected, and Region, 2007**

**Column 1: Average Reported Number of Fires**  
**Column 2: Average Reported Number of Fireground Injuries**  
**Column 3: Number of Fireground Injuries per 100 Fires**

Population of Community Protected	Northeast			Midwest			South			West		
	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3
500,000 to 999,999	*	*	*	*	*	*	3,460.1	65.6	1.9	2,601.1	67.9	2.6
250,000 to 499,999	*	*	*	1,667.3	89.0	5.3	1,346.3	34.3	2.5	743.3	12.8	1.7
100,000 to 249,999	870.6	38.6	4.4	616.5	19.4	3.1	758.8	12.9	1.7	443.6	8.2	1.8
50,000 to 99,999	403.6	13.1	3.2	207.1	4.3	2.1	320.1	4.6	1.4	224.2	3.0	1.3
25,999 to 49,999	143.8	7.1	4.9	116.4	3.4	2.9	200.5	2.6	1.3	135.7	1.7	1.3
10,000 to 24,999	70.4	1.4	2.0	60.6	1.3	2.0	94.4	1.1	1.2	66.8	1.1	1.6
5,000 to 9,999	34.7	0.6	1.7	31.9	0.6	1.9	58.7	0.8	1.4	53.8	0.8	1.5
2,500 to 4,999	21.6	0.5	2.3	20.6	0.4	1.9	33.8	0.4	1.2	29.7	0.2	0.7
Under 2,500	10.1	0.3	3.0	11.1	0.2	1.8	17.7	0.2	1.1	10.5	0.1	1.0
Overall Regional Rate	57.3	2.8	4.9	41.5	1.1	2.7	70.5	1.0	1.4	76.8	1.3	1.7

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2007

\*Insufficient data

Note: The Midwest was formerly called the Northcentral.

## Improving Firefighter Safety

As the statistics in this report and previous reports attest, fire fighting presents great risks of personal injury to firefighters. Moreover, because of the kind of work performed and the hazards of the incident scene environment, it is unlikely that all firefighter injuries can be eliminated. A risk management system and the application of existing technology, however, can offer options to reduce present injury levels and bring about corresponding reductions that are recommended by NFPA that could be taken at the local level. The reference to the appropriate *NFPA Standard* is shown with the example in parenthesis:

- Commitment on the part of top fire service management to reducing injuries (*NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, Section 4.3*)
- Establishment of a safety committee headed by a safety officer to recommend a safety policy and the means of implementing it (*NFPA 1500, Section 4.5*).
- Develop and implement an investigation procedure that includes all accidents, near misses, injuries, fatalities, occupational illnesses, and exposures involving members. (*NFPA 1500, 4.4.4 and 4.4.5*)
- Provision of appropriate protective equipment and a mandate to use it. (*NFPA 1500, Section 7.1 through 7.8*)
- Development and enforcement of a program on the use and maintenance of SCBA (*NFPA 1500, Section 7.9 through 7.14*)
- Development and enforcement of policies on safe practices for drivers and passengers of fire apparatus (*NFPA 1500, Section 6.2 and 6.3*)
- Development of procedures to ensure response of sufficient personnel for both fire fighting and overhaul duties. (*NFPA 1500, 4.1.2; NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments; and NFPA 1720, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments*)
- Implementation of regular medical examinations and a physical fitness program (*NFPA 1500, Section 10.1 through 10.3; NFPA 1582, Standard on Comprehensive Occupational Medical Program for Fire Departments; and NFPA 1583, Standard on Health-Related Fitness Programs for Firefighters*)
- Adoption and implementation of an incident management system. (*NFPA 1500, Section 8.1; and NFPA 1561, Standard on Emergency Services Incident Management System*)

- Training and education for all members related to emergency operations  
(*NFPA 1500, Chapter 5*)
- Implementation of programs for the installation of private fire protection systems, so that fires are discovered at an earlier stage, exposing the firefighter to a less hostile environment  
(*NFPA 1, Uniform Fire Code<sup>TM</sup>; NFPA 101<sup>®</sup>, Life Safety Code<sup>®</sup>; NFPA 5000<sup>®</sup>, Building Construction and Safety Code<sup>®</sup>*)
- Increased efforts in the area of fire safety education programs, so that citizens are made aware of measures to prevent fires and of correct reactions to the fire situation  
(*NFPA 1201, Standard for Providing Emergency Services to the Public, Chapter 6*)

Efforts need to be made to recognize that firefighter injuries can be reduced. By addressing the priorities listed above Fire Service organizations can make significant strides towards reducing the number and impact of such injuries.

### **Definition of Terms**

**Fire:** Any instance of uncontrolled burning. Excludes combustion explosions and fires out on arrival (whether authorized or not), overpressure rupture without combustion; mutual aid responses, smoke scares, and hazardous materials responses, e.g., flammable gas, liquid, or chemical spills without fire.

**Incident:** The movement of a piece of fire service apparatus or equipment in response to an alarm.

**Injury:** Physical damage suffered by a person that requires (or should require) treatment by a practitioner of medicine (physician, nurse, paramedic, EMT) within one year of the incident (regardless of whether treatment was actually received), or that results in at least one day of restricted activity immediately following the incident.

## **Description of NFPA Survey and Data Collection Method**

The NFPA annually surveys a sample of departments in the United States to make national projections of the fire problem. The sample is stratified by the size of the community protected by the fire department. All U.S. fire departments that protect communities of 50,000 or more are included in the sample, because they constitute a small number of departments with a large share of the total population protected. For departments that protect less than 100,000 population, stratifying the sample by community size permits greater precision in the estimates. Survey returns in recent years have ranged from 2,560 to 3,500 departments annually. The national projections are made by weighting sample results according to the proportion of total U.S. population accounted for by communities of each size. Around any estimate based on a sample survey, there is a confidence interval that measures the statistical certainty (or uncertainty) of the estimate. We are very confident that the actual number of total firefighter injuries falls within 7.1% of the estimate.

The results in this report are based on injuries that occurred during incidents attended by public fire departments. No adjustments were made for injuries that occurred during fires attended solely by private fire brigades, e.g., industrial or military installations.

Data collection for the selected incident summaries was enhanced by a form that was sent to departments requesting information. The form included questions on type of protective equipment worn, age and rank of firefighters injured, and description of circumstances that led to injury.

## Footnotes

1. Michael J. Karter, Jr., "2007 Fire Loss in the United States", *NFPA Journal*, Vol. 102, No. 5 (November 2008).
2. Around any estimate based on a sample survey, there is a confidence interval that measures the statistical certainty (or uncertainty) of the estimate. Based on data reported by fire departments responding to the NFPA Survey for U.S. Fire Experience (2007), the NFPA is very confident that the actual number of firefighter injuries falls within the range of 75,100 to 85,100.
3. The four regions as defined by the U.S. Census Bureau include the following 50 states and the District of Columbia:
  - Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
  - Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
  - South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.
  - West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

## **SELECTED INDIVIDUAL INCIDENTS**

**(These incidents were Selected to Illustrate Typical Firefighter Safety Problems)**

### **Apparatus Injures Veteran Firefighter**

A 48-year-old firefighter with more than 30 years experience suffered extensive leg injuries when he was crushed between a fire apparatus and an ambulance. He can no longer perform firefighting duties and has been placed on permanent restricted duty after undergoing numerous surgeries.

The incident occurred when the fire department and a local ambulance were dispatched to a vehicle crash on a highway exit ramp. The ambulance arrived on the scene first and parked along the right shoulder facing up a 1.5 percent incline. The engine, carrying a five-person crew, arrived a few minutes later and entered the off-ramp from the opposite direction, parking in front of the ambulance facing down the incline. Once firefighters determined their services were not needed, they met between the fire apparatus and the ambulance to discuss the incident. As they talked, they heard the fire apparatus engine go into “high idle” and saw it begin moving towards them. All but the driver/operator were able to move to safety. He was struck and pinned between the fire apparatus and the front of the ambulance.

A comprehensive investigation performed by the department identified the probable sequence of events and causes leading to the accident. After arriving on scene and setting the parking brake, the driver left the cab, believing he had put the transmission in neutral. The parking brake held the vehicle in place while the engine idled, but an improperly installed load manager sensed a reduction in the electrical system’s voltage and increased the engine’s speed to compensate. The parking brake was unable to hold the vehicle, allowing it to lurch forward, striking the victim. All of the conditions except for the transmission being placed in neutral were proven through testing.

The investigation report also included several recommendations that addressed mechanical repairs, new equipment, and changes to standard operating procedures. All these recommendations have been adopted and implemented.

### **Captain Struck by Apparatus**

A 45-year-old captain with 18 years’ experience was struck and run over by a pumper while performing a size-up at a structure fire. When the pumper arrived on the scene, the captain and a firefighter stepped off the truck to the right and moved to the back of the apparatus. At the same time, a battalion chief ordered the operator to move the pumper for other trucks approaching the scene. The operator climbed into the cab, and began to move the pumper, he turned to the right to avoid a large tree, then turned quickly to the left into position in an alley. The captain, who was standing approximately 4 to 5 feet (1.2 to 1.5 meters) away from the pumper looking at the building and donning his helmet must have stepped back as the truck turned into the alley. He was pulled to the ground, and the driver’s side rear tire rolled up onto his right foot, along his leg, and over his hip.

The captain suffered crushing injuries to his legs and was hospitalized for 24 hours. He returned to duty nearly six months after the incident. At the time of the injury, he was wearing a complete protective ensemble, and his SCBA may have become caught on the side of the truck.

The department’s health and safety committee reviewed the incident and suggested several recommendations to prevent a similar injury. These recommendations include using scene lighting at night, increasing the use of spotters whenever apparatus is being moved, and using reflective vests if the protective ensemble is not being worn.



### **Two Injured During Training**

Two firefighters were injured during swift-water rescue recertification when they were thrown from their boat after it entered the roiling water just below the low-head dam.

The department was conducting training evolutions on the river and practicing a two-boat tether when the primary boat crossed over the crest of the boil into the backwash. The incident commander ordered the secondary boat to perform a peel out maneuver to pull the primary boat from trouble, but the maneuver was unsuccessful, and the secondary boat also crossed the crest into the backwash. The two firefighters in the secondary boat were thrown into the water.

The incident commander immediately called for a water rescue, and firefighters on shore threw a rope to the firefighters in the primary boat to pull themselves to shore. Although the rope got tangled between the motor and transom of the primary boat, the two firefighters in the primary boat pulled themselves hand over hand until they reached safety. Two other firefighters on shore were preparing to launch a third boat to assist the firefighters in the water when the first victim of the secondary boat emerged downstream wearing his personal floatation device. They quickly grabbed him from the water and brought him to shore to begin treating his injuries.

The second victim, a 32-year-old firefighter, was caught in a whirlpool in the backwash of the dam for four minutes before his personal floatation device and helmet came off and floated downstream. Several minutes later, he disappeared from sight under the water.

After some discussion, rescuers decided to pull the primary boat from the water using the rope that was entangled in the motor and harnessing the other end to a truck near the dam. While they were doing this, they found the second victim tangled in the rope. He had been submerged for nearly 25 minutes. They quickly cut him free and began CPR.

He returned to active duty in May 2008. His colleague in the secondary boat suffered extensive back injuries and was forced to retire.

### **Two Injured When Vehicle Hits Apparatus**

An engine company was operating at a vehicle crash on an interstate highway when their apparatus was struck in the rear, injuring two firefighters. The driver of the vehicle that struck the engine was pronounced dead at the hospital emergency room. Alcohol was a contributing factor in the crash.

One of the injured firefighters suffered a back sprain when he was struck by debris from the crash. He returned to work two days later. The second firefighter twisted his leg but returned to work for the next shift.

### **Apparatus Rolls Over Firefighter**

Two firefighters were returning to the fire station after refueling their fire apparatus when they decided to pull the apparatus over to the side of the road to check the water level. Parking on a grade, the 37-year-old driver put the transmission in neutral and engaged the parking brake. As he stepped out of the apparatus to set the wheel chocks, he slipped on the step and fell to the ground, landing next to the front driver's side tire.

The parking brake was unable to hold the apparatus and it crept forward, coming to rest on the driver's leg. He was able to extricate himself as his partner called for assistance and began treating his injury.

He was hospitalized for three days with knee, leg, and back injuries and was out of work for seven months. After working two months of restricted duty, he returned to full duty.

The department stated that the parking brake was not adjusted to hold the vehicle on a grade. There were no previous incidents or issues on file concerning the apparatus.

### **Firefighter Hurt When Airbag Deploys**

Firefighters responding to a high-speed crash of a single car into a tree arrived on the scene and found the car tipped onto the driver's side with its roof embedded in a tree, trapping the critically injured driver, who was the only occupant. With the passenger compartment compromised, crews began a lengthy extrication of the driver.

Nearly one and a half hours into the operation, the steering wheel airbag deployed, striking a 42-year-old firefighter in the right arm and face while he was performing patient care. The sheer force of the airbag ejected the six-year veteran from the vehicle and knocked him unconscious.

The firefighter returned to work six weeks after his injury. Nearly six months after returning to duty, he was still experiencing unspecified complications with his arm that required surgery. He is expected to fully recover and return to duty in several months.

### **Cardiac Event**

A 39-year-old firefighter collapsed in cardiac arrest while operating a handline at a dryer vent fire in a two-story, single-family residence. The two other firefighters working with him removed him from the structure and took him to an on-scene advanced life support unit, where EMTs began cardiopulmonary resuscitation and early defibrillation. They successfully defibrillated the victim approximately two minutes after his cardiac event and transported him to the hospital for further care.

At the time of the incident, the fire department had a rapid intervention team consisting of three firefighters, but they were not deployed due to the quick removal of the victim, who was wearing a full personal protective ensemble.

The victim, who had been a member of the department for nine years, had a 90-percent blockage of a coronary artery. He was hospitalized for seven days and unable to return to duty for nearly five months.

The department reports that it is developing a wellness and fitness program and indicated that annual physicals are performed.

### **Two Injured While Testing Hose**

A captain and a firefighter, both wearing station uniforms, were injured while service testing a 5-inch (125-milimeter) hose. They were walking alongside the hoseline looking for leaks and abnormalities when the hose suddenly ruptured just behind a coupling. The water pressure raised the hose off the ground, and it struck the two firefighters.

The department did not specify their injuries, but the 56-year-old captain was unable to perform firefighting activities for two months. The 22-year-old firefighter returned to fire suppression activities four months after the incident.

The department stated, in hindsight, that the use of head, eye, and hand protection could have possibly prevented the injuries.

### **Veteran Firefighter Falls from Structure**

A 49-year-old firefighter fractured his ankle and injured his shoulder when he fell from a balcony while working at a structure fire. He was leaning over the side of the balcony, overhauling the fascia board with a pike pole. He tried to avoid leaning against the railing, but when he pulled on the pike pole, the momentum pushed him against it. The railing, which was only designed to handle a 40-pound (18-kilogram) side load and suffered from years of neglect, failed as he pushed against it, and he fell three stories, landing on top of an air conditioning unit.

The 25-year veteran was wearing a complete protective ensemble when he was injured. He returned to firefighting duties nearly six months after his fall.

### **Wall Collapse Injures One**

A dedicated rapid intervention crew located and removed a 23-year-old firefighter from a burned structure after a wall around a chimney collapsed on him as he performed overhaul with another firefighter. Both men were wearing full protective ensembles.

The victim suffered minor sprains, strains, and contusions, and returned to firefighting activities in several weeks. The other firefighter was not injured.

The fire started in a void behind a vent pipe for a fireplace. The occupant had lit a fire the previous night, and at approximately 8:30 the following morning, he noticed smoke in the area of the chimney and exterior wall. He sprayed water on the area and never notified the fire department. Nearly 7 hours after he first saw the smoke and 17 hours after starting the fire, the occupant called 911 reporting the blaze. The fire resulted in an estimated loss of \$650,000.

### **Apparatus Crash Kills Three, Injures Four**

Three civilians were killed and four firefighters were injured when a fire apparatus responding to a fire struck a sports utility vehicle. After hitting the vehicle, the 2004 ladder truck jumped a sidewalk, went down an embankment, and stopped approximately 250 feet (76 meters) from the point of impact.

All four firefighters, who were wearing seat belts, suffered sprains, strains, and contusions but were able to return to duty within a few weeks.

### **Firefighter Falls from Station Roof**

While performing maintenance on the fire station's roof, a 25-year-old firefighter slipped and fell one story to the ground. He suffered a lower back injury but was able to return to firefighting activities nine days after his fall.

### **Structure Fire**

A section of ceiling suddenly collapsed, trapping and injuring two firefighters operating a handline inside a garage attached to an occupied single-family home.

A dedicated four-member rapid intervention team was immediately deployed to control the fire and remove the two victims with the support of other fire companies.

One of the victims received a first-degree burn but returned to full duty after losing one day of work. The second victim required a skin graft after suffering second- and third-degree burns and was unable to perform firefighting duties for 12 weeks. The department credits the proper use of protective ensembles and PASS devices for limiting their injuries.