

# **U.S. FIREFIGHTER INJURIES - 2011**

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Joseph L Molis  
October 2012**



**National Fire Protection Association  
Fire Analysis and Research Division**

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## **Abstract**

NFPA estimates that 70,090 firefighter injuries occurred in the line of duty in 2011. An estimated 30,505 (43.5%) of the all firefighter injuries occurred during fireground operations. An estimated 13,295 occurred during other on duty activities, while 14,905 occurred at nonfire emergency incidents. The leading type of injury received during fireground operations was strain, sprain or muscular pain (50.7%), followed by wound, cut, bleeding, bruise (14.5%). Regionally, the Northeast had the highest fireground injury rate.

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

## **Acknowledgments**

The NFPA thanks the many fire departments that responded to the NFPA Survey for U.S. Fire Experience (2011) for their continuing efforts in providing in a timely manner the data so necessary to make national projections of firefighter injuries.

The authors gratefully thank the many NFPA staff members who worked on this year's survey, including Frank Deely, John Baldi, and John Conlon for editing and keying the survey forms and their follow-up calls to fire departments; and Norma Candeloro for handling the processing of survey forms and typing this report.

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## Overview of 2011 Firefighter Injuries

- 70,090 firefighter injuries occurred in the line of duty in 2011, a decrease of 2.5%.
- In addition to injuries, there were 9,000 exposures to infectious diseases, and 23,400 exposures to hazardous conditions.
- 30,505 or 43.5% of all firefighter injuries occurred during fireground operations. An estimated 14,905 occurred at nonfire emergency incidents, 3,870 while responding/returning from an incident, 7,515 during training activities, and 13,295 occurred during other on duty activities.
- The Northeast reported a higher number of fireground injuries per 100 fires than other regions of the country.
- The major types of injuries received during fireground operations were: strain, sprain, muscular pain (50.7%); wound, cut, bleeding, bruise (14.5%); thermal stress (6.9%) burns (6.2%). Strains, sprains, and muscular pain accounted for 61.1% of all nonfireground injuries.
- The leading causes of fireground injuries were overexertion, strain (28.4%) and fall, slip, jump (21.0%).

## 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 61 firefighters died on duty (See, "2011 Firefighter Fatalities ", NFPA Journal July/August).

This report addresses 2011 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 (2011). 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 2011 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 70,090 firefighter injuries occurred in the line of duty in 2011. This is a decrease of 2.5% from a year ago, and the lowest it's been since NFPA analyses began in 1981. 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 9,000 exposures to infectious diseases (e.g., hepatitis, meningitis, HIV, others) in 2011. This amounts to 0.5 exposures per 1,000 emergency medical runs by fire departments in 2011.

The NFPA estimates that there were 23,400 exposures to hazardous conditions (e.g., asbestos, radioactive materials, chemicals, fumes, other) in 2011. This amounts to 21.2 exposures per 1,000 hazardous condition runs in 2011.

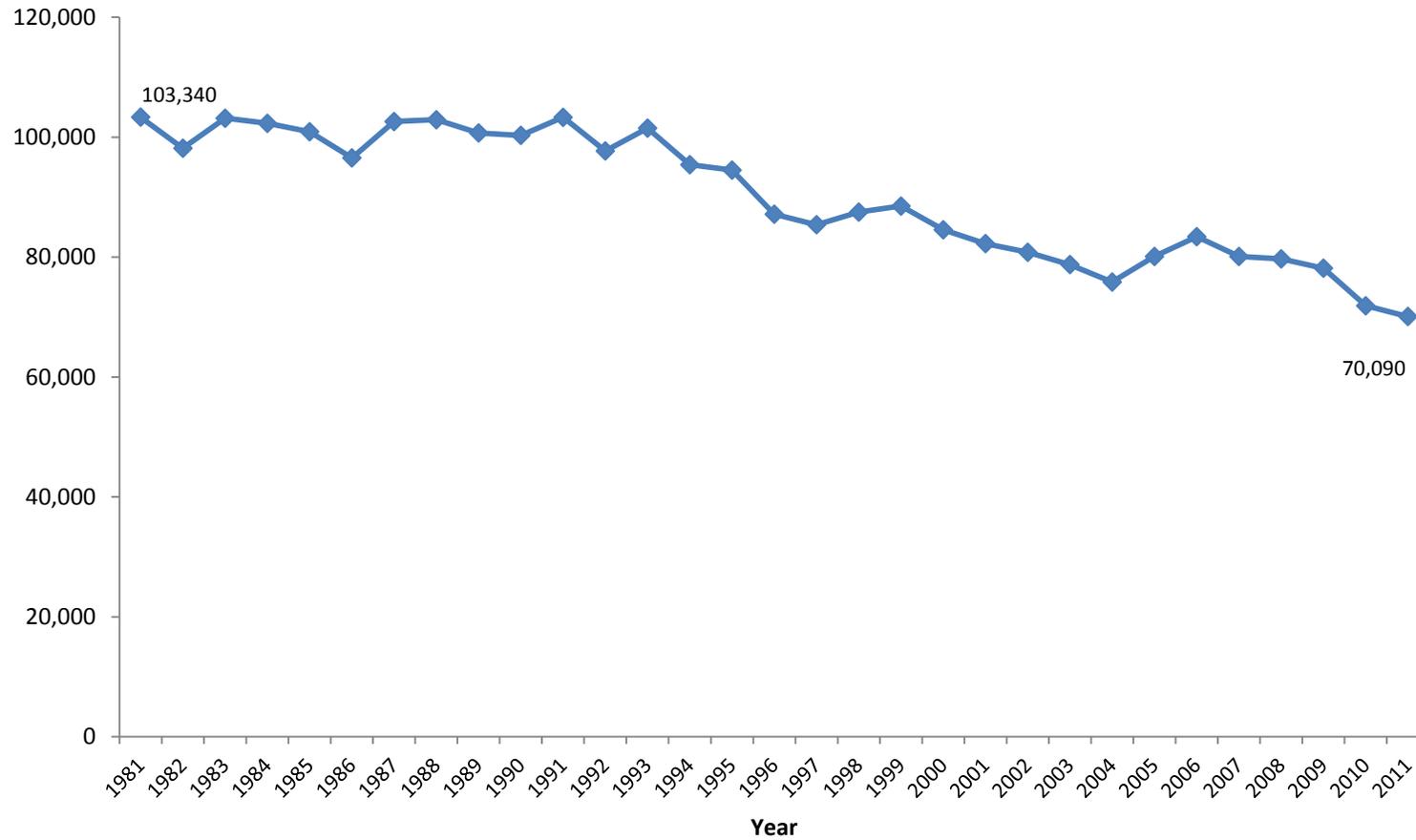
An estimated 13,650 injuries or 19.5% of all firefighter injuries resulted in lost time in 2011.

## 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 (1981-2011)**



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1981-2011)

From 1994 on, number of exposures was collected separately

Results by type of duty indicate not surprisingly that the largest share of injuries occurs during fireground operations: 30,505 or 43.5% of all firefighter injuries in 2011, a decrease of 6.6% from last year, and the lowest it's been since NFPA analyses began in 1981. Table 1 displays firefighter injuries at the fireground and injury rates for the 1981-2011 period. Injuries at the fireground decreased from their high of 67,500 in 1981 to 30,505 in 2011 for a decrease of 52.0%. The number of fires also declined steadily for an overall decrease of 54.8%. The rate of injuries per 1000 fires has not shown any consistent trend up or down for the period (Figure 2). These results suggest that even though the number of fires and fireground injuries declined similarly during the period, the injury rate did not, and when there is a fire, the fireground injury rate risk has not changed much for the period.

Overall for the 1981 to 2011 period, the number of injuries at nonfire emergencies increased from 9,600 in 1981 to 14,905 in 2011 for an overall increase of 55%. For the same period, the number of nonfire emergencies increased a substantial 274% due in large part to an increase in the number of medical aid incidents. When the injury rate per 1000 nonfire emergencies is examined, the rate has declined during the period from 1.24 in 1981 to 0.50 in 2011 (Figure 3), because the number of nonfire emergencies increased at a higher rate than the number of injuries at nonfire emergencies.

Also in 2011, 3,870 firefighter injuries occurred while responding or returning from an incident, 7,515 occurred during training activities, and 13,295 occurred during other on-duty activities.

### **Nature of Fireground Injuries**

Estimates of 2011 firefighter injuries by nature of injury and type of duty are displayed in Table 2. Table 2 indicates that the major types of injuries that occur during fireground operations are strain, sprain (50.7%); wound, cut, bleeding, bruise (14.5%); thermal stress (6.9%); burns (6.2%).

Results were fairly consistent during all non-fireground activities, with strains, sprains, and muscular pain accounting for 61.1% of all non-fireground injuries, and wound, cut, bleeding, bruise accounting for 14.6%.

### **Causes of Fireground Injuries**

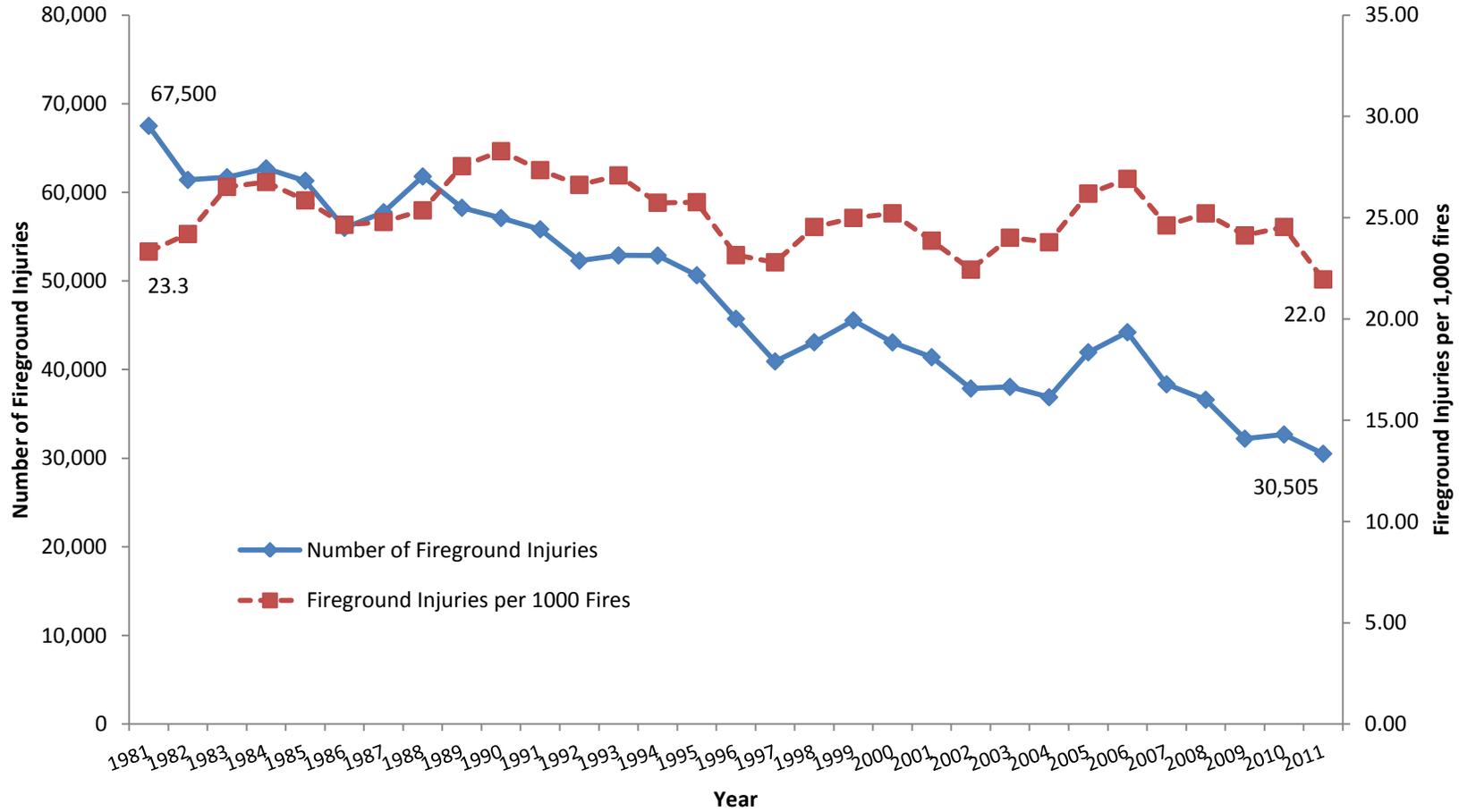
Because fireground injuries are of particular concern their causes were examined (see Figure 4). The definition of cause here refers to the initial circumstance leading to the injury.

**Table 1**  
**Firefighter Injuries at the Fireground, and**  
**at Nonfire Emergencies, 1981-2011**

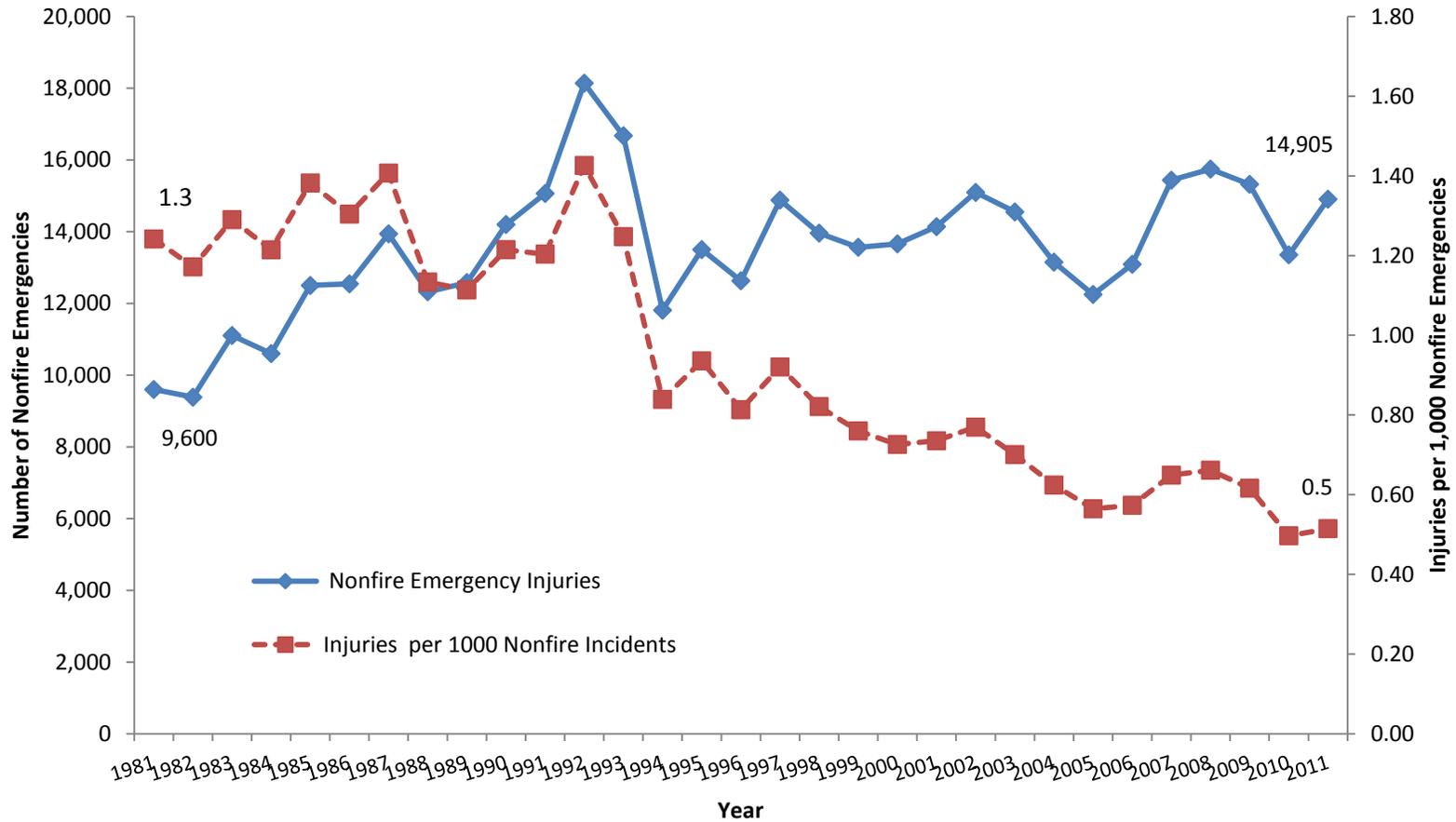
Year	At the Fireground		At Nonfire Emergencies	
	Injuries	Injuries per 1,000 Fires	Injuries	Injuries per 1,000 Incidents
1981	67,500	23.3	9,600	1.24
1982	61,400	24.2	9,385	1.17
1983	61,700	26.5	11,105	1.29
1984	62,700	26.8	10,600	1.21
1985	61,300	25.9	12,500	1.38
1986	55,900	24.7	12,545	1.30
1987	57,755	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
2008	36,595	25.2	15,745	0.66
2009	32,205	24.1	15,455	0.62
2010	32,675	24.5	13,355	0.50
2011	30,505	22.0	14,905	0.50

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1981-2011)

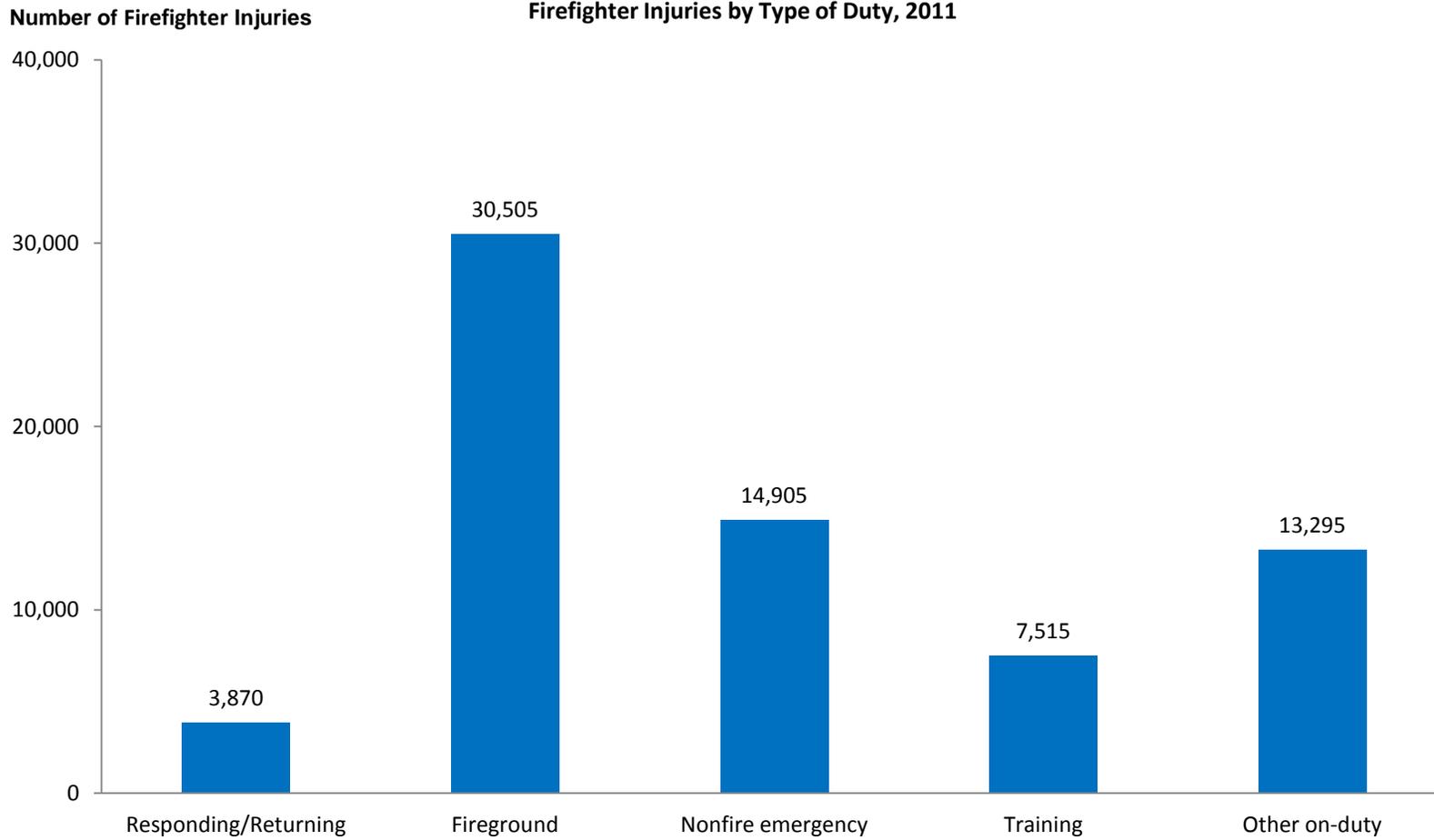
**Figure 2. The Number of Injuries at the Fireground and Fireground Injuries per 1,000 Fires**



**Figure 3. The Number of Injuries at Nonfire Emergencies and Injuries per 1,000 Nonfire Emergencies**



**Figure 4.**  
**Firefighter Injuries by Type of Duty, 2011**



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (2011)

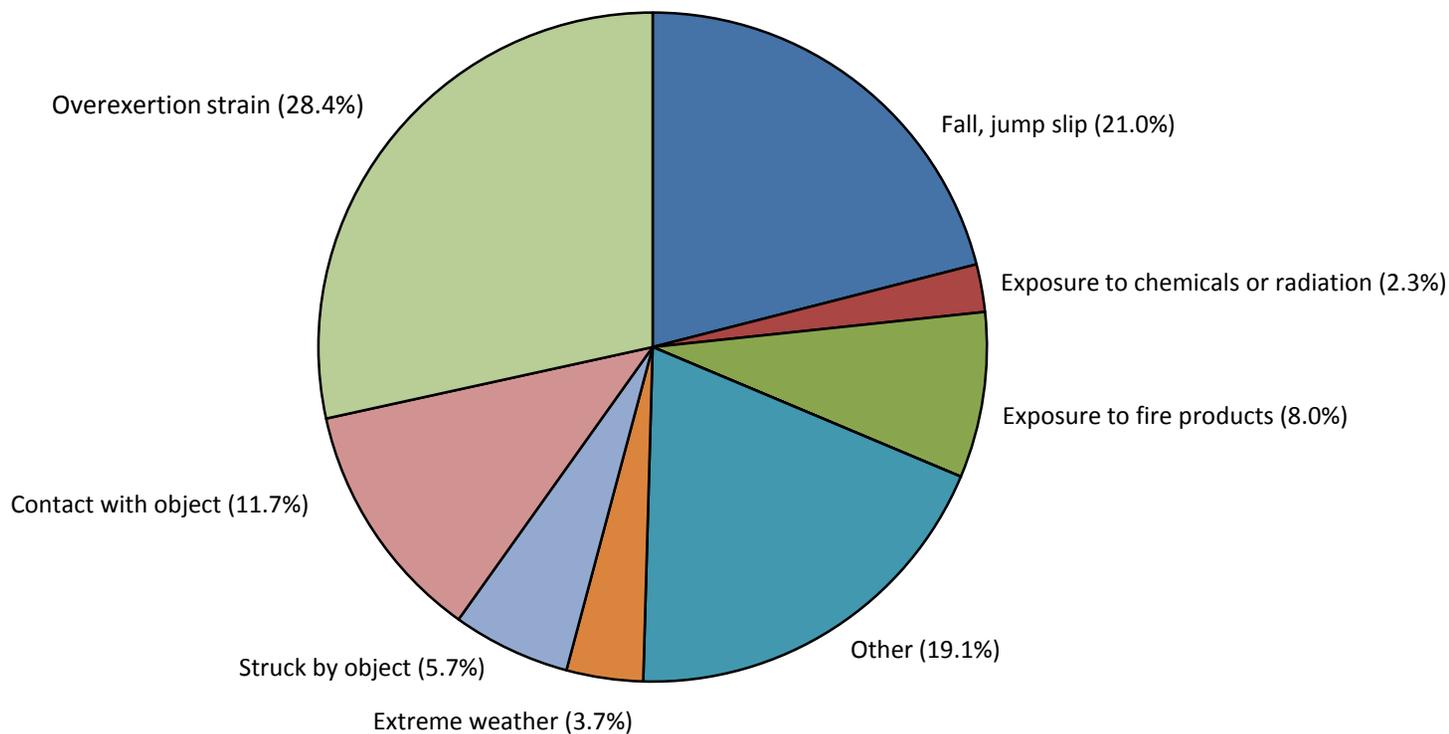
**Table 2. Firefighter Injuries by Nature of Injury and Type of Duty, 2011**

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)	30	0.8	1,905	6.2	60	0.4	165	2.2	225	1.7	2,385	3.4
Smoke or Gas Inhalation	80	2.1	1,430	4.7	190	1.3	5	0.1	55	0.4	1,760	2.5
Other Respiratory Distress	50	1.3	595	2.0	130	0.9	105	1.4	180	1.4	1,060	1.5
Burns and Smoke Inhalation	5	0.1	605	2.0	5	0.1	55	0.7	25	0.2	695	1.0
Wound, Cut, Bleeding, Bruise	515	13.3	4,435	14.5	1,865	12.5	1,115	14.8	2,280	17.2	10,210	14.6
Dislocation, Fracture	145	3.8	735	2.4	290	2.0	270	3.6	415	3.1	1,885	2.7
Heart Attack or Stroke	30	0.8	255	0.8	125	0.8	60	0.8	390	2.9	860	1.2
Strain, Sprain, Muscular Pain	2,485	64.2	15,460	50.7	9,545	64.0	4,680	62.3	7,490	56.3	39,960	56.6
Thermal Stress (frostbite, heat exhaustion)	140	3.6	2,115	6.9	135	0.9	375	5.0	180	1.4	2,945	4.2
Other	390	10.1	2,970	9.7	2,560	17.2	685	9.1	2,055	15.5	8,660	12.4
Total	3,870	100.0	30,505	100.0	14,905	100.0	7,515	100.0	13,295	100.0	70,090	100.0

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2011

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

**Figure 5.  
Fireground Injuries by Cause, 2011**



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (2011)

Overexertion, strain (28.4%) and fall, jump, slip (21.0%) were the leading causes of fireground injuries. Other major causes were contact with object (11.7%); and exposure to fire products (8.0%).

### **Fire Department Vehicle Collisions**

The NFPA reported earlier that 4 firefighters died in motor vehicle collisions in 2011. (See “2011 Firefighter Fatalities” July/August *NFPA Journal*).

In 2011, there were an estimated 14,850 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 30.1 million incidents in 2011 so that the number of collisions represents about one tenth of 1 percent of total responses. However, these collisions resulted in 970 firefighter injuries or 1.4% of all firefighter injuries.

Also, 790 collisions involving firefighters’ personal vehicles occurred in 2011 while departments were responding to or returning from incidents. These collisions resulted in an estimated 190 injuries.

**Table 3**  
**Fire Department Vehicle Collisions and**  
**Resulting Firefighter Injuries**  
**While Responding to or Returning From Incidents, 1990-2011**

Year	Involving Fire Department Emergency Vehicles		Involving Fire Fighters' Personal Vehicles	
	Collisions	Firefighter Injuries	Collisions	Firefighter 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
2008	14,950	670	1,000	70
2009	15,100	820	870	100
2010	14,200	775	1,000	75
2011	14,850	970	790	190

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1990-2011)

## **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 2010 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 120.1 for departments that protect communities of 1,000,000 or more 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 less from a high of 2.8 for departments that protect communities 250,000 to 499,999 to a low of 1.2 for departments that protect communities of 2,500 to 4,999 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 67% 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 6.9 injuries per 100 firefighters. As community size decreases, the rate drops quite steadily to a low of 0.9 for departments protecting less than 2,500 people. That is a more than a seven-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 86 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, 2011**

<b>Population of Community Protected</b>	<b>Average Number of Fires</b>	<b>Average Number of Fireground Injuries</b>	<b>Number of Fire-ground Injuries Per 100 Fires</b>	<b>Number of Fire-ground Injuries Per 100 Firefighters</b>
1,000,000 or more*	4,692.3	120.1	2.6	5.8
500,000 to 999,999	2,578.9	66.3	2.6	5.8
250,000 to 499,999	1,078.6	30.2	2.8	6.9
100,000 to 249,999	499.5	12.9	2.6	5.9
50,000 to 99,999	222.0	4.8	2.2	4.5
25,000 to 49,999	113.3	2.1	1.9	3.4
10,000 to 24,999	62.8	1.0	1.6	2.5
5,000 to 9,999	36.0	0.5	1.4	1.5
2,500 to 4,999	24.3	0.3	1.2	1.0
Under 2,500	12.5	0.2	1.6	0.9

\*Excludes New York City

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2011

## **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 higher number of fireground injuries per 100 fires 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, 2011

Population of Community Protected	Northeast			Midwest			South			West		
	Average Fires	Average of Fireground Injuries	Fireground Injuries per 100 Fires	Average Fires	Average of Fireground Injuries	Fireground Injuries per 100 Fires	Average Fires	Average of Fireground Injuries	Fireground Injuries per 100 Fires	Average Fires	Average of Fireground Injuries	Fireground Injuries per 100 Fires
250,000 or more	4,978.9	265.7	5.3	1,737.0	94.0	5.4	2,251.9	44.3	2.0	1,983.0	30.4	1.5
100,000 to 249,999	432.8	25.0	5.8	510.8	13.6	2.7	605.2	13.5	2.2	355.5	8.4	2.4
50,000 to 99,999	294.9	11.9	4.0	156.9	3.4	2.2	315.3	5.8	1.8	162.3	2.8	1.7
25,999 to 49,999	104.7	5.0	4.7	89.1	1.8	2.0	175.8	1.8	1.0	82.2	1.0	1.2
10,000 to 24,999	53.8	1.3	2.4	48.6	0.9	1.9	93.7	1.0	1.0	54.2	1.1	2.0
5,000 to 9,999	27.9	0.6	2.2	29.9	0.3	1.0	53.7	0.8	1.5	37.8	0.4	1.0
2,500 to 4,999	16.6	0.4	2.4	19.7	0.3	1.5	36.5	0.3	0.8	23.8	0.2	0.8
Under 2,500	9.4	0.2	2.1	11.0	0.1	0.9	19.9	0.2	1.0	10.2	0.2	2.0
Overall Regional Rate	31.1	1.1	3.5	37.0	0.8	2.2	61.9	0.9	1.5	59.1	1.0	0.7

Note that the results above do not include New York City. With New York the overall fireground injury rate for the Northeast would be 5.3.

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2011

## 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.

- 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 Department\)](#)
- Implementation of regular medical examinations and a physical fitness program [NFPA 1500, Section 10.1 through 10.3; NFPA1582, Standard on Comprehensive Occupational Medical Program for Fire Departments; NFPA1583, Standard on Health-Related Fitness Programs for Firefighters-](#)
- Adoption and implementation of an incident management system. [NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, 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](#) [NFPA 101 Life Safety Code](#),<sup>®</sup>; [NFPA 5000 Building Construction and Safety Code](#)
  - 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
- Other NFPA standards that may help in reducing firefighter injuries include:
- [NFPA 1584, Standard on the Rehabilitation Process for members During Emergency Operations and Training Exercises](#), 2008 Edition, Chapter 4 Preparedness and Chapter 6 Incident Scene and Training Rehabilitation
  - [NFPA 1002, Standard for Fire Apparatus Driver/Operator Professional Qualification Risk Management](#), 2010 Edition, Section 4.8 The Risk Management process
  - [NFPA 1620, Standard for Pre-Incident Planning](#), 2010 Edition, Chapter 4 Pre-Incident Planning Process, Chapter 5 Physical & Site Considerations, Chapter 7 Water supplies & Fire Protection Systems, Chapter 8 Special Hazards

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 50,000 population, stratifying the sample by community size permits greater precision in the estimates. A total of 2,790 departments responded to the 2011 fire experience survey. 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 5.0% 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., "2011 Fire Loss in the United States", *NFPA Journal*, Vol. 105, No. 5 (September 2012).
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 (2011), the NFPA is very confident that the actual number of firefighter injuries falls within the range of 66,290 to 73,890.
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)

### **Burned at Structure Fire**

Four firefighters were injured while fighting a fire that started in the kitchen of an 1,800-square-foot (167-square-meter), single-family, wood-frame home at approximately 1 a.m. The cause of the fire was listed as undetermined. The house had no operating smoke alarms.

The fire department responded with two pieces of apparatus and six firefighters, who asked for additional assistance as soon as they arrived. The first person they encountered was a woman who was leaning out of a second-floor window with thick black smoke billowing over her head. She was the last of the home's five occupants still in the house. To rescue her, the incident commander, a police officer, and neighbors placed a ladder to the second-floor window, while three firefighters advanced a hose line through the front door. Once they got her outside, the incident commander cared for the five fire victims, all of whom were suffering from smoke inhalation, while waiting for more help to arrive.

While the three-person entry team was operating inside the building 10 or 15 feet (4.5 meters) from the seat of the fire, the glass on the patio sliding door suddenly failed, causing rapid fire spread that forced the interior crew to retreat. As they neared the front door, the fire came roaring through the doorway, overtaking the last firefighter, who was unable to get out in time. The other two, who managed to escape, reached into the burning doorway, grabbed him, and dragged him to the front lawn, where they began treating his injuries.

One of the two firefighters who escaped suffered burns on his arm while reaching into the burning doorway, while the other burned his ungloved hand while turning off the rescued firefighter's SCBA cylinder. The rescued firefighter, who was wearing a full protective ensemble, suffered burns to his neck, face, arms, shoulders, and back. The 33-year veteran was hospitalized for three weeks and returned to full firefighting activities six months after the incident.

The fourth injured firefighter strained his back while pulling ceilings during overhaul operations.

### **Struck by Vehicle**

An ambulance staffed by two firefighters and a rescue company staffed by four was dispatched to a motor vehicle crash on a five-lane highway just after midnight. After placing the apparatus in a blocking position, they immediately began establishing a traffic control zone, consisting of signs and reflective cones, and assessing the scene. Due to recent rains, the pavement was wet and slippery.

Two firefighters, both of whom were wearing turnout pants, firefighting boots, fire helmets, gloves, and reflective vests, left the traffic control zone and approached a police cruiser parked nearby to check on the vehicle's driver, who was slightly injured in the crash. As they were walking toward the car, a vehicle drove through the crash scene, hitting them.

One of the men, who had three years' experience, fractured his ankle and was out of work for more than six weeks. The other, a 46-year-old with 24 years' experience, suffered a knee injury and could not perform firefighting duties for 15 weeks. Both were cleared to perform firefighting duties after their rehabilitation.

The department did not provide specific information on the location of the crash relative to the roadway, the size of the control zone, the location of the apparatus, or the way the response was coordinated with law enforcement.

### **Rollover While Responding**

Three firefighters were taken to local hospitals after they were involved in a crash while responding to a structure fire in a 3,500-gallon (13,249-liter) tanker with baffles. As they approached the scene, the driver began slowing down to turn into a driveway when the tanker lost traction on a patch of ice. It began to skid and then rolled over twice before coming to rest on its wheels.

The driver, who was wearing his seatbelt, suffered lacerations and contusions. A second firefighter, who was sitting in the middle of the front seat and also wearing a seatbelt, suffered lacerations. The third firefighter, who was sitting in the passenger seat, was not wearing a seatbelt and was fortunate to suffer only minor lacerations and contusions. All three were treated at the emergency room, released, and cleared for firefighting duties.

### **Injured While Responding**

The driver of a fire engine was seriously injured in a crash while responding in “emergency mode” to an unreported type of situation when an oncoming vehicle hit the apparatus, causing it to careen into a telephone pole.

Traffic on both sides of the road was yielding to the fire engine, which was traveling eastbound on a two-lane road, when a vehicle in the westbound lane began passing traffic stopped around a curve in the road and drove at the oncoming fire apparatus. The fire truck turned to the right in a defensive maneuver and a glancing collision occurred, sending the apparatus off the roadway and into a telephone pole, crushing the driver’s compartment and trapping the driver in the wreckage.

The fire department reports that all five firefighters in the engine were wearing seatbelts, which helped minimize the injuries of all but the driver, who suffered a severe, crushing leg injury and is unable to return to the fire service.

### **Training Demonstration**

A 35-year-old firefighter suffered severe head injuries when he slipped and fell 20 feet (6 meters) as he descended an aerial ladder, landing headfirst onto the turntable during a public relations demonstration. There was a mist and drizzle during the event when the victim was on the ladder, which the department reported was at an angle of approximately 30 degrees. The only protective clothing the 11-year-veteran was wearing was a pair of gloves. He was hospitalized for 10 days and is no longer able to perform firefighting duties.

### **Structure Fire**

A firefighter suffered a serious foot injury while fighting a fire in a vacant, single-family house that started at ground level on an exterior wall of the garage. By the time the fire department arrived, the fire had spread into a stairwell and compromised the attic. Due to the extent of the fire and the condition of the two-story, wood-frame house, the incident commander decided to conduct defensive operations, fighting the blaze mainly from the exterior of the structure using two aerial ladders and exterior water streams.

At one point during operations, the incident commander decided that crews should open part of the gable roof end and a portion of the roof to better access the burning structure. Two

firefighters and the aerial ladder operator discussed their new task on the turntable of the aerial, and the two firefighters began climbing the ladder. At some point, they turned around and it appeared as though they were talking to the ladder operator. As they continued climbing, the operator began to extend the ladder, crushing the foot of one of the firefighters between the rungs.

The 27-year-old victim, who was wearing a complete protective ensemble, suffered crushing injuries to his foot and toes. He was hospitalized for two months and has undergone several surgeries. He has been unable to perform firefighting duties since the incident, and it is uncertain if he will return to the fire service at all. The cause of the fire is undetermined.

### **Structure Fire**

A firefighter was knocked over by a 5-inch (12-centimeter) water supply hose while operating at a fire in a single-family home. The 47-year-old, who had two years' experience, was knocked over near the rear of the apparatus when the supply line was pulled after her feet became entangled in the hose. As the hose became taut, she fell over onto her right side, fracturing her arm and shoulder. She was wearing all protective clothing except self-contained breathing apparatus and is still undergoing therapy. She is unable to perform firefighting duties.

### **Roof Collapse**

The fire department received numerous calls around 7:30 p.m. reporting a house fire with children trapped inside. When firefighters arrived at the scene, they encountered a fire in the rear attic of the two-and-a-half-story, single-family home. Bystanders reported that the children were trapped on the top floor of the wood-frame house.

The first engine company, which consisted of a lieutenant and two firefighters, placed a 1.75-inch (4-centimeter) hand line into operation and headed towards the top floor to locate the children and the seat of the fire. When the incident commander arrived, the engine company reported that there was a medium smoke condition on the top floor with heat present and that they had not located the seat of the fire.

Several minutes later, neighbors told the incident commander that the children were safe at their home and that all occupants were out of the burning house. The crews on the top floor then began concentrating their efforts on locating the seat of the fire in the attic.

As they searched, a drywall ceiling collapsed onto the lieutenant and one of the firefighters, engulfing them in flames and toxic gases. The lieutenant sent two maydays, neither of which was acknowledged. The collapse debris blocked their means of escape, and they began scrambling to find a secondary means out. They crawled to the opposite end of the building where they found some windows and jumped out headfirst, landing on the roof of a porch 12 feet (3.6 meters) below.

A rapid intervention team was deployed to the porch roof, where they rescued the victims and transferred them to ambulances.

The lieutenant, a 41-year-old with 18 years' experience, fractured his hip when he jumped from the window. The 37-year-old firefighter, who had 17 years' experience, sustained second- and third-degree burns and musculoskeletal injuries to his hip and lower back. He was hospitalized for nearly a week. Both men, who were wearing a full protective ensemble, were eventually cleared for firefighting activities.

The other member of the three-man crew was in the stairwell leading into the top floor supporting hose line operations when the ceiling collapsed. He fell backwards down the stairs, spraining his knee and ankle. He was cleared for firefighting activities two weeks after the incident.

The origin and cause of the fire is reported as undetermined, and the house had no smoke alarms.

Although the fire department report did not explain why the lieutenant's maydays were missed, the fire department did outline in its investigation several ways to improve firefighter safety.

### **Structure Fire**

Three firefighters suffered injuries while fighting an incendiary fire that started in a back bedroom of a vacant, single-family, wood-frame house that covered 1,300 square feet (121 square meters).

A 25-year-old rookie suffered second-degree burns to the back of his neck while pulling ceilings, and a 28-year-old firefighter with four years' experience suffered steam and heat burns on his

wrist while operating a hose line inside the house. Both were cleared to resume firefighting activities after the incident.

The third man, a 47-year-old seasoned veteran with 25 years' experience, suffered burns to his head and face after falling through the roof and first-floor ceiling while performing vertical ventilation. He was found by the interior companies, who helped him outside to be checked by EMTs. The firefighter, who was not wearing self-contained breathing apparatus when he fell through the roof, returned to firefighting activities nearly a month after the incident.

Once the injured were removed from the building, the incident commander switched to a defensive stance and performed a personnel accountability roll call to account for all firefighters on scene.