# An Analysis of Volunteer Firefighter Injuries, 2010-2012

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**Acknowledgements**

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An analysis of volunteer firefighter injuries was undertaken to compare their experience to all firefighter injuries. 'All firefighter injuries' refers to the firefighter injuries that are estimated based on the NFPA National Fire Experience Survey and reported in the NFPA Annual Firefighter Injury Report. (*U.S. Firefighter Injuries, 2012*,). The injury statistics in that report combine career and volunteer firefighters.

Volunteer fire departments are highly related to the size of community protected. Departments that protect communities of less than 10,000 population are comprised mostly of volunteer firefighters. (See Table A-1 in the Appendix.)

Three years of data were used in this analysis because the estimates for some of the breakdown categories are small and can vary considerably from year to year.

The estimated number of volunteer firefighter injuries that occurred by type of duty and nature of injury for the 2010-12 period are shown in Table 1. A comparison showing the breakdown of injuries to all firefighters is also displayed in Table 1 and Figure 1.

From Table 1, several observations are worth noting. For injuries by type of duty, volunteers (53.5%) were more likely to receive injuries at the fireground than all firefighters combined (44.8%), and volunteers (12.0%) were less apt to be injured at nonfire emergencies than for all firefighters (19.4%). This is due to the fact that many smaller departments do not provide EMS service, so nonfire emergencies are a smaller component of their overall incidents, while fires are a larger component. ( see Table A-2 in the appendix).

For injuries at the fireground, the leading types of injuries were strain, sprains, muscular pain, accounting for 1,980 injuries; wound, cut, bleeding, bruise, accounting for 1,325 injuries; frostbite, heat stroke, accounting for 1,110 injuries; and smoke or gas inhalation, accounting for 535 injuries. For all types of duty, wound, cut, bleeding, bruise and strain, sprains, muscular pain accounted for the largest shares of injuries.

Table 2 and Figure 2 show a comparison by nature of injury and type of duty for all firefighter injuries and volunteers only. Wound, cut, bleeding, bruise injuries were often more likely to occur for volunteers across all types of duty (16.2% to 30.3%) than for all firefighters (13.6% to 18.0%). Also from Table 2, injuries due to frostbite, or heat stroke were often more likely to occur for volunteers across all types of duty (1.3% to 16.8%) than for all firefighters (0.9% to 6.6%).

A factor contributing to the wound, cut, etc. injuries and the injuries due to frostbite, or heat stroke is that departments protecting smaller communities were less likely to have adequate or up to date personal protective equipment than departments protecting larger communities.[1]

Also at the fireground, smoke or gas inhalation accounted for a higher percentage of injuries for volunteers (8.1%) than for all firefighters combined (4.3%). Again, departments protecting smaller communities were less likely to have adequate or up to date SCBA equipment than departments protecting larger communities. [2]

Causes of volunteer firefighter and all firefighter injuries at the fireground can be seen in Table 3. The major causes of volunteer firefighter injuries were fall, jump, slip, trip accounting for 1,585 or 23.9%, overexertion, strain accounting for 1,620 or 24.2%, and contact with object accounting for 945 or 14.2%. Comparison of volunteer firefighter injuries to all firefighter injuries showed fairly similar results. One major difference was extreme weather, which accounted for a higher percentage of volunteer firefighter injuries (9.3%) than for all firefighter injuries (4.0%). Again departments protecting smaller communities were less likely to have adequate or up to date personal protective equipment than departments protecting larger communities.

[1] Third Needs Assessment of U.S. Fire service, Quincy, MA :National Fire Protection Association, June 10, 2011, pp 82-86. Or available online: www.nfpa.org/needsassessment

[2] Same reference as 1, pp 77-80.

**Table 1. Firefighter Injuries by Type of Duty and Nature of Injury For Volunteers, 2010-2012 Average**

| Nature of Injury | Responding/ Returning | At the Fireground | Type of duty At Non-Fire Emergencies | Training | Other On-Duty | Total |
|---|---|---|---|---|---|---|
| Burns | 10 | 380 | 15 | 20 | 45 | 470 |
| Smoke or gas inhalation | 60 | 535 | 15 | 15 | 20 | 645 |
| Other respiratory distress | 30 | 190 | 20 | 55 | 5 | 295 |
| Burns & smoke inhalation | 0 | 150 | 0 | 15 | 0 | 165 |
| Wound, cut, bleeding, bruise | 175 | 1,325 | 255 | 440 | 440 | 2,635 |
| Dislocation, fracture | 110 | 295 | 100 | 90 | 85 | 680 |
| Heart attack or stroke | 20 | 85 | 15 | 20 | 55 | 195 |
| Strain, sprain, muscular pain | 475 | 1,980 | 740 | 770 | 610 | 4,575 |
| Frostbite, heat stroke | 120 | 1,110 | 20 | 185 | 15 | 1,450 |
| Other | 85 | 570 | 305 | 140 | 180 | 1,280 |
| Total | 1,080 | 6,630 | 1,485 | 1,745 | 1,455 | 12,390 |
| % for Volunteers only | 8.7 | 53.5 | 12.0 | 14.1 | 11.7 | 100.0% |
| % for All firefighters | 6.8 | 44.8 | 19.4 | 10.4 | 19.5 | 100.0% |

Volunteer firefighters injuries are based on results for departments that protect communities of less than 10,000 population which are comprised mostly of volunteer firefighters.

Source: NFPA Annual Fire Experience Survey, 2010-2012

**Table 2. Firefighter Injuries by Type of Duty and Nature of Injury for All Firefighters and Volunteers Only, 2010-2012 Average**

| | Type of Duty | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Responding/Returning | | At the Fireground | | At Nonfire Emergencies | | Training | | Other on-Duty | | Total | |
| Nature of Injury | All Firefighters | Volunteer Only | All Firefighters | Volunteer Only | All Firefighters | Volunteer Only | All Firefighters | Volunteer Only | All Firefighters | Volunteer Only | All Firefighters | Volunteer Only |
| Burns | 0.9% | 0.9% | 6.0% | 5.8% | 0.5% | 1.1% | 2.2% | 1.1% | 1.8% | 3.0% | 3.4% | 3.8% |
| Smoke or gas inhalation | 1.9% | 5.6% | 4.3% | 8.1% | 0.9% | 1.0% | 0.3% | 0.8% | 0.5% | 1.3% | 2.3% | 5.2% |
| Other respiratory distress | 1.4% | 2.6% | 1.6% | 2.9% | 0.8% | 1.4% | 1.5% | 3.1% | 1.3% | 0.2% | 1.4% | 2.4% |
| Burns & smoke inhalation | 0.1% | 0.0% | 1.5% | 2.3% | 0.0% | 0.0% | 0.5% | 0.9% | 0.2% | 0.0% | 0.85 | 1.4% |
| Wound, cut, bleeding, bruise | 14.4% | 16.2% | 13.6% | 20.0% | 13.1% | 17.2% | 16.9% | 25.1% | 18.0% | 30.3% | 14.8% | 21.3% |
| Dislocation, fracture | 4.5% | 10.2% | 2.4% | 4.5% | 1.8% | 6.6% | 3.7% | 5.1% | 2.5% | 5.8% | 2.5% | 5.5% |
| Heart attack or stroke | 1.3% | 1.7% | 0.7% | 1.3% | 0.7% | 0.9% | 1.1% | 1.2% | 2.5% | 3.8% | 1.2% | 1.6% |
| Strain, sprain, muscular pain | 61.1% | 44.0% | 52.9% | 29.8% | 63.6% | 49.9% | 60.6% | 44.0% | 54.5% | 42.0% | 56.6% | 36.9% |
| Frostbite, heat stroke | 3.9% | 11.0% | 6.6% | 16.8% | 1.0% | 1.3% | 4.9% | 10.6% | 0.9% | 1.0% | 4.1% | 11.7% |
| Other | 10.6% | 7.8% | 10.3% | 8.6% | 17.5% | 20.6% | 8.2% | 7.9% | 17.8% | 12.5% | 13.0% | 10.3% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

Volunteer firefighters injuries are based on results for departments that protect communities of less than 10,000 population which are comprised mostly of volunteer firefighters.

Source: NFPA Annual Fire Experience Survey, 2010-2012

**Table 3. Causes of Volunteer Firefighter Injuries at the Fireground, 2010-2012 Average**

| | Volunteer Only | | All Firefighters | |
|---|---|---|---|---|
| **Cause of Injury** | **Number** | **Percent** | **Number** | **Percent** |
| Exposure to fire products | 705 | 10.7% | 2,810 | 8.9% |
| Exposure to chemicals, etc. | 55 | 0.9% | 520 | 1.6% |
| Fall, jump, slip, trip | 1,585 | 23.9% | 7,025 | 22.3% |
| Overexertion, strain | 1,620 | 24.2% | 8,585 | 27.2% |
| Contact with object | 945 | 14.2% | 3,680 | 11.7% |
| Struck by | 285 | 4.3% | 1,900 | 6.0% |
| Extreme weather | 615 | 9.3% | 1,250 | 4.0% |
| Other | 820 | 12.5% | 5,785 | 18.3% |
| Total | 6,630 | 100.0% | 31,555 | 100.0% |

Volunteer firefighter injuries are based on results for departments that protect communities of less than 10,000 population which are comprised mostly of volunteer firefighters.

Source: NFPA Fire Experience Survey, 2010-2012

**Figure 1. Firefighter Injuries by Type of Duty for all Firefighters and Volunteers Only**

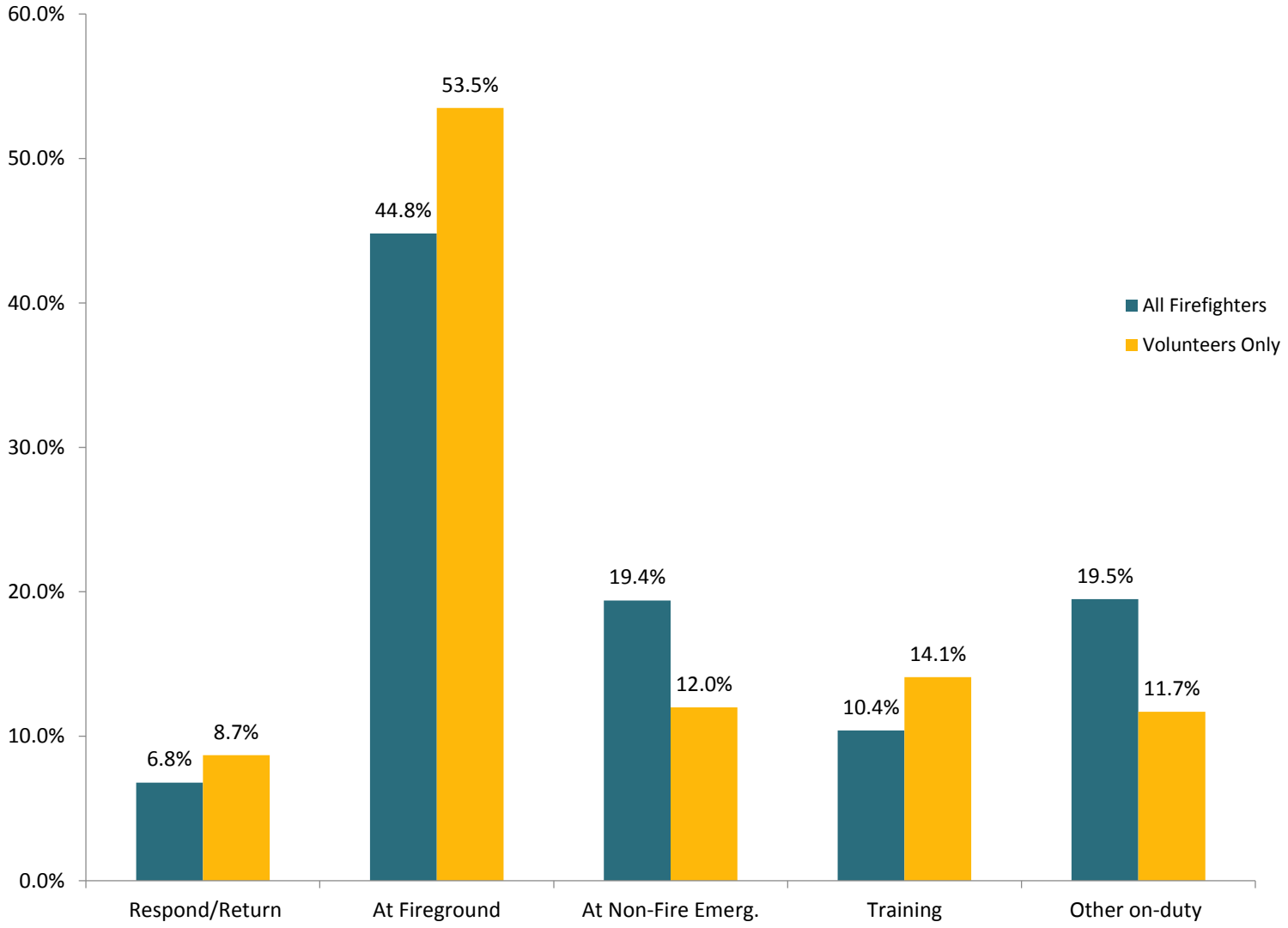
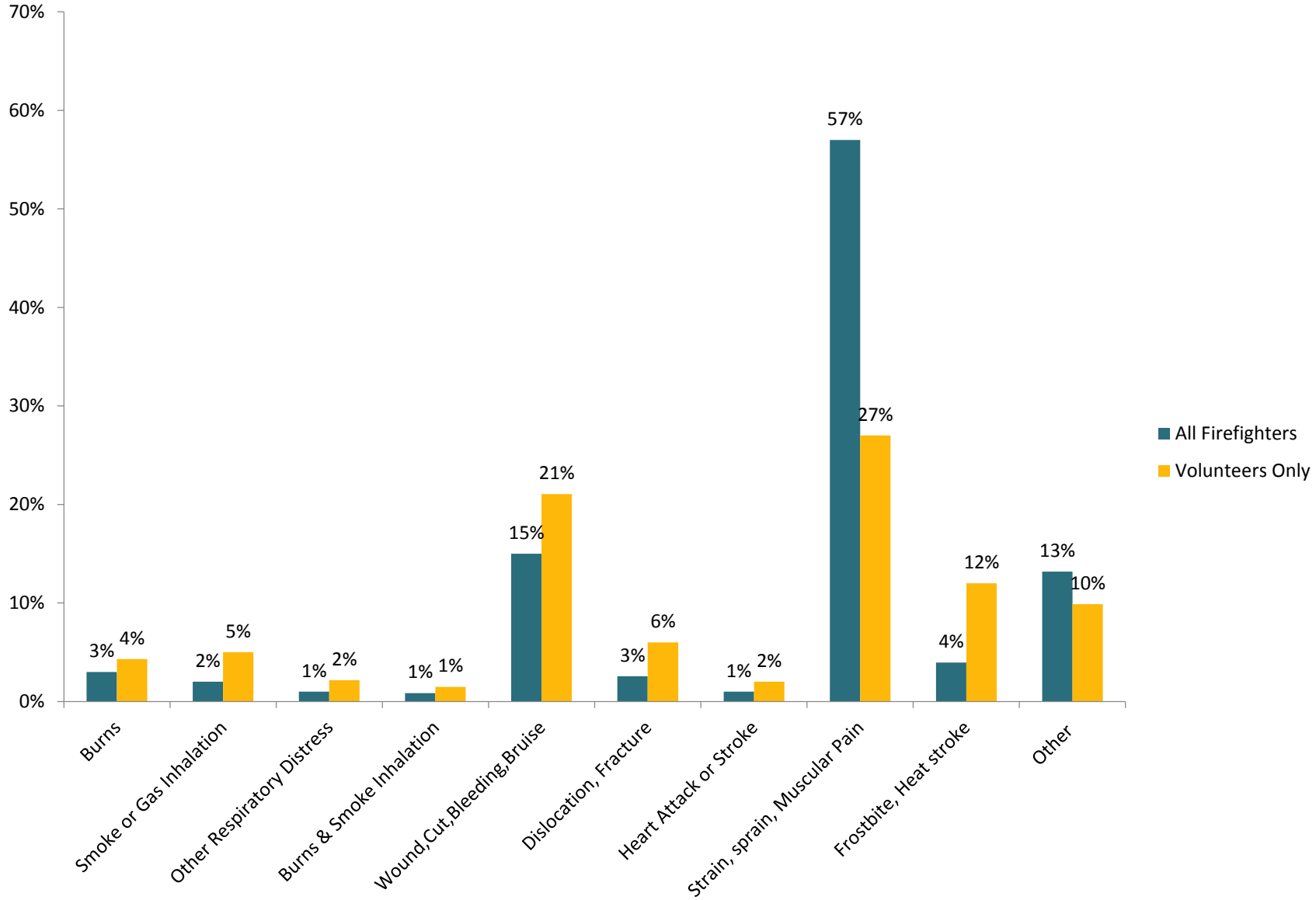


**Figure 2. Nature of Injury for all Firefighters and Volunteers Only**



**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 2,795 departments responded to the 2012 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.

# Appendix

**Table A1**
**Department Type by Population Protected, 2012**
**Type of Department (Percent)**

| Population Protected | All Career | Mostly Career | Mostly Volunteer | All Volunteer | Total |
|---|---|---|---|---|---|
| 1,000,000 or more | 81.8% | 18.2% | 0.0% | 0.0% | 100.0% |
| 500,000 to 999,999 | 71.4 | 21.4 | 7.1 | 0.0 | 100.0 |
| 250,000 to 499,999 | 85.3 | 11.8 | 2.9 | 0.0 | 100.0 |
| 100,000 to 249,999 | 81.8 | 18.2 | 0.0 | 0.0 | 100.0 |
| 50,000 to 99,999 | 70.3 | 18.9 | 10.8 | 0.0 | 100.0 |
| 25,000 to 49,999 | 47.1 | 24.2 | 24.5 | 4.2 | 100.0 |
| 10,000 to 24,999 | 23.2 | 26.3 | 37.4 | 13.0 | 100.0 |
| 5,000 to 9,999 | 5.9 | 6.7 | 41.6 | 45.7 | 100.0 |
| 2,500 to 4,999 | 1.3 | 2.6 | 21.1 | 75.0 | 100.0 |
| Under 2,500 | 1.0 | 0.9 | 4.8 | 93.3 | 100.0 |
| All Departments | 8.7 | 6.6 | 18.1 | 66.6 | 100.0 |

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2012

Type of department is broken into four categories. All career departments are comprised of 100% career firefighters. Mostly career is comprised of 51 to 99% career firefighters, while mostly volunteer is comprised of 1 to 50% career firefighters. All volunteer departments are comprised of 100% volunteer firefighters.

**Table A2**
**Number of Fires and Nonfire Incidents by Community size, 2010-2012 Average**

| | Community Size | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1,000,000 or more** | **500,000 to 999,999** | **250,000 to 499,999** | **100,000 to 249,999** | **50,000 to 99,999** | **25,000 to 49,999** | **10,0000 to 24,999** | **5,000 to 9,999** | **2500 to 4,999** | **under 2,500** |
| Fires | 4,300 | 2,525 | 1,113 | 509 | 222 | 114 | 65 | 35 | 24 | 12 |
| Rescue, EMS etc., | 137,341 | 78,484 | 23,461 | 11,443 | 4,643 | 1,895 | 879 | 320 | 129 | 42 |
| False alarm responses | 15,998 | 5,563 | 2,328 | 1,150 | 554 | 276 | 120 | 53 | 16 | 7 |
| Mutual aid responses | 3,517 | 992 | 564 | 333 | 191 | 126 | 87 | 55 | 29 | 13 |
| Hazardous materials | 1,268 | 855 | 324 | 169 | 82 | 50 | 25 | 10 | 3 | 1 |
| Other hazardous | 2,067 | 1,271 | 710 | 298 | 154 | 85 | 45 | 20 | 8 | 3 |
| All other responses | 19,561 | 12,698 | 6,704 | 2,542 | 1,051 | 427 | 182 | 78 | 29 | 7 |
| Total for all incidents | 184,051 | 102,388 | 35,203 | 16,444 | 6,897 | 2,973 | 1,403 | 571 | 240 | 84 |

| | **1,000,000 or more** | **500,000 to 999,999** | **250,000 to 499,999** | **100,000 to 249,999** | **50,000 to 99,999** | **25,000 to 49,999** | **10,0000 to 24,999** | **5,000 to 9,999** | **2500 to 4,999** | **under 2,500** |
|---|---|---|---|---|---|---|---|---|---|---|
| Fires | 2.3% | 2.5% | 3.2% | 3.1% | 3.2% | 3.8% | 4.6% | 6.2% | 10.1% | 14.5% |
| Rescue, EMS etc., | 74.6% | 76.7% | 66.6% | 69.6% | 67.3% | 63.7% | 62.7% | 56.1% | 53.9% | 49.8% |
| False alarm responses | 8.7% | 5.4% | 6.6% | 7.0% | 8.0% | 9.3% | 8.5% | 9.3% | 6.8% | 8.0% |
| Mutual aid responses | 1.9% | 1.0% | 1.6% | 2.0% | 2.8% | 4.2% | 6.2% | 9.6% | 12.2% | 15.4% |
| Hazardous materials | 0.7% | 0.8% | 0.9% | 1.0% | 1.2% | 1.7% | 1.8% | 1.8% | 1.3% | 1.2% |
| Other hazardous | 1.1% | 1.2% | 2.0% | 1.8% | 2.2% | 2.8% | 3.2% | 3.4% | 3.4% | 3.4% |
| All other responses | 10.6% | 12.4% | 19.0% | 15.5% | 15.2% | 14.3% | 13.0% | 13.6% | 12.2% | 7.8% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |