



RESEARCH

Structure Fires in Dormitories Fraternities Sororities and Barracks

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Abstract

In 2009-2013, U.S. fire departments responded to an estimated annual average of 3,870 structure fires in dormitories, fraternities, sororities, and barracks. These fires caused an annual average of one civilian death, 32 civilian fire injuries and \$14 million in direct property damage. Cooking equipment was involved in 86% of reported structure fires. Only 7% of fires in these properties began in the bedroom, but these fires accounted 15% of civilian fire injuries. Fires in dormitories, fraternities, sororities, and barracks are more common during the evening hours, between 5 p.m. and 11 p.m., and on weekends. These estimates are based on data from the U.S. Fire Administration's (USFA) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA) annual fire department experience survey.

Keywords: fire statistics, dormitory fires, fraternity fires, sorority fires, barrack fires

Acknowledgements

The National Fire Protection Association thanks all the fire departments and state fire authorities who participate in the National Fire Incident Reporting System (NFIRS) and the annual NFPA fire experience survey. These firefighters are the original sources of the detailed data that make this analysis possible. Their contributions allow us to estimate the size of the fire problem.

We are also grateful to the U.S. Fire Administration for its work in developing, coordinating, and maintaining NFIRS.

For more information about the National Fire Protection Association, visit www.nfpa.org or call 617-770-3000. To learn more about the One-Stop Data Shop go to www.nfpa.org/osds or call 617-984-7451.

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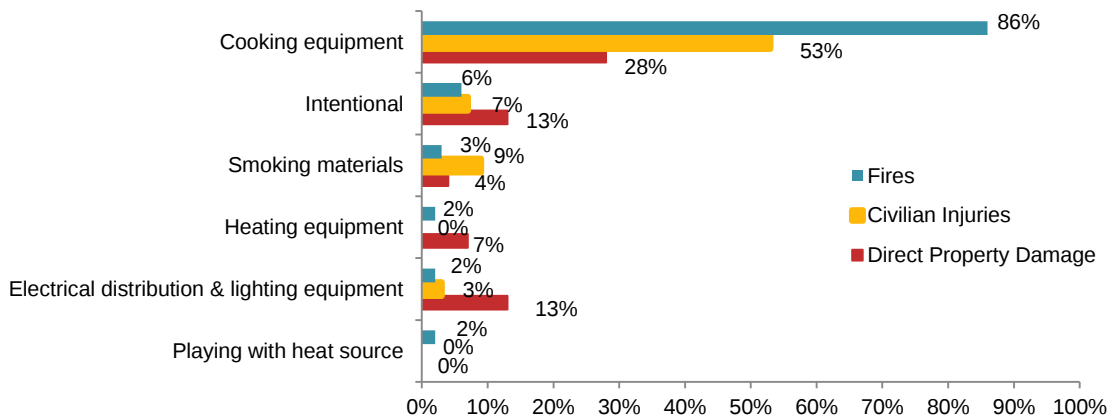
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DORMITORY, FRATERNITY, SORORITY AND BARRACK STRUCTURE FIRES FACT SHEET

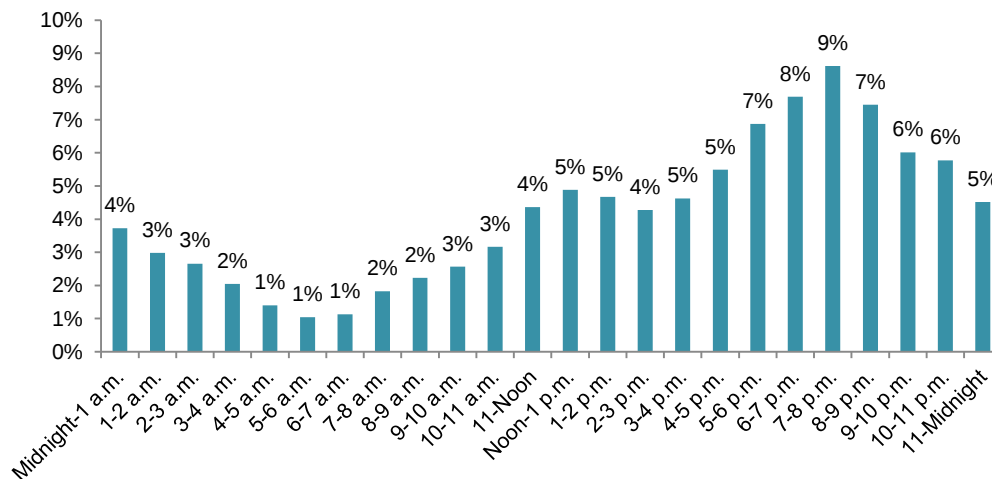
In 2009-2013, U.S. fire departments responded to an estimated annual average of 3,870 structure fires in dormitories, fraternities, sororities, and barracks. These fires caused an annual average of one civilian death, 32 civilian injuries, and \$14 million in direct property damage.

Leading Causes of Fires, Civilian Injuries, and Direct Property Damage in Dormitory Properties 2009-2013 Annual Averages



- 86% of the reported structure fires involved cooking equipment. 83% of fires were specifically reported as contained or confined to cooking equipment.
- Structure fires in dormitories, fraternities, sororities, and barracks are more common during the evening hours between 5 p.m. and 11 p.m., and on weekends.

Structure Fires in Dormitory Properties, by Time of Day 2009-2013 Annual Averages



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Data Sources, Definitions and Conventions Used in this Report

Unless otherwise specified, the statistics in this analysis are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to federal or state agencies of industrial fire brigades. These estimates are projections based on the detailed information collected in Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS 5.0) and the annual fire department experience survey conducted by the National Fire Protection Association. Except for calculations involving property use and incident type, fires with unknown or unreported data were allocated proportionally in calculations of national estimates. In general, any fire that occurs in or on a structure is considered a structure fire, even if the fire was limited to contents and the building itself was not damaged. Properties included in this analysis were identified by NFIRS property use codes in the 460-469 range.

NFIRS 5.0 includes a category of structure fires collectively referred to as "confined fires," identified by incident type. These include confined cooking fires, confined chimney or flue fires, confined trash fires, confined fuel burner or boiler fires, confined commercial compactor fires, and confined incinerator fires (incident type 113-118). Losses are generally minimal in these fires, which by definition, are assumed to have been limited to the object of origin. Although causal data is not required for these fires, it is sometimes present.

Confined and non-confined fires were analyzed separately and summed for Cause of Ignition, Heat Source, Factor Contributing to Ignition, Area of Origin, and Item First Ignited, as well as for the Detection and Automatic Suppression estimates. Non-confined fires were analyzed for Equipment Involved in Ignition. Other types of confined fires were not broken out further and were grouped by incident type with the non-confined fires.

Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Property damage has not been adjusted for inflation. Fires are rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million. Due to the very small number of deaths, they have been omitted from trend and cause tables. Additional details on the methodology may be found in Appendix A and B.

Structure Fires in Dormitories, Fraternities, Sororities, and Barracks

This report reviews data over the five-year period from 2009 through 2013 for structure fires reported to local fire departments in dormitory-type residences, fraternity and sorority houses, monasteries, bunk houses, barracks, and nurses quarters. The statistics used in this report about fires and associated losses are national estimates of fires reported to U.S. municipal fire departments. These national estimates are projections based on the detailed information collected by the U.S. Fire Administration's National Fire Incident Reporting System, version 5.0 and NFPA's annual fire department experience survey. In general, any fire in or on a structure is considered a structure fire, including incidents in which only contents were damaged.

On average, there were 3,870 structure fires reported in these properties per year during this period. These fires caused an annual average of one civilian death, 32 civilian injuries, and \$14 million in direct property damage. (Due to low numbers, the data on civilian deaths is excluded from the analysis in this report.) The vast majority of the fires (82%) took place in dormitory-type residences, as indicated in the table below. Fires in unclassified dormitory-type residences also caused 76% of civilian injuries and 69% of direct property damage. Fires in barracks or dormitories accounted for 13% of fires, 12% of civilian injuries, and 10% of direct property damage. While just 5% of fires occurred in fraternity or sorority houses, they were responsible for 21% of direct property damage, as well as 12% of civilian injuries. It should be noted that many students live in off-campus housing not owned by their educational institutions or any fraternal organization. Fires in these housing environments are not captured in this report.

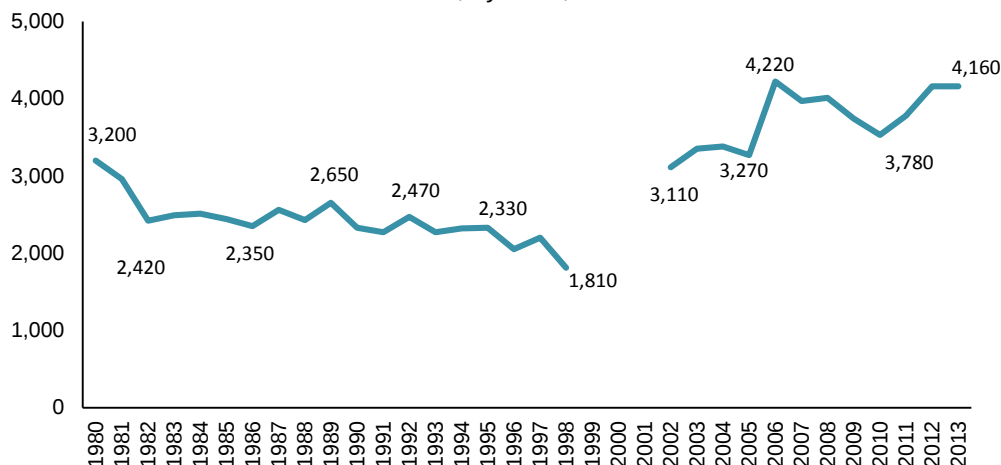
Table A. Structure Fires in Dormitory Properties, by Property Use, 2009-2013 Annual Averages

Property Use	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified dormitory type residence	3,160	(82%)	24	(76%)	\$9	(69%)
Barracks, dormitory	500	(13%)	4	(12%)	\$1	(10%)
Sorority house, fraternity house	210	(5%)	4	(12%)	\$3	(21%)
Total	3,870	(100%)	32	(100%)	\$14	(100%)

The number of fires reported in this property group increased from 3,200 in 1980 to 4,160 in 2013, an increase of 23%. Fires ranged from 2,300 to 2,700 from 1982 through 1995, then declined from 1996 to 1998, as shown in the figure on the following page. Since 2003, annual estimates have ranged from 3,350 to 4,220 fires per year. At least some of the increase is likely to be due to changes in NFIRS Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System, first introduced in 1999. NFIRS 5.0 makes it much easier for fire

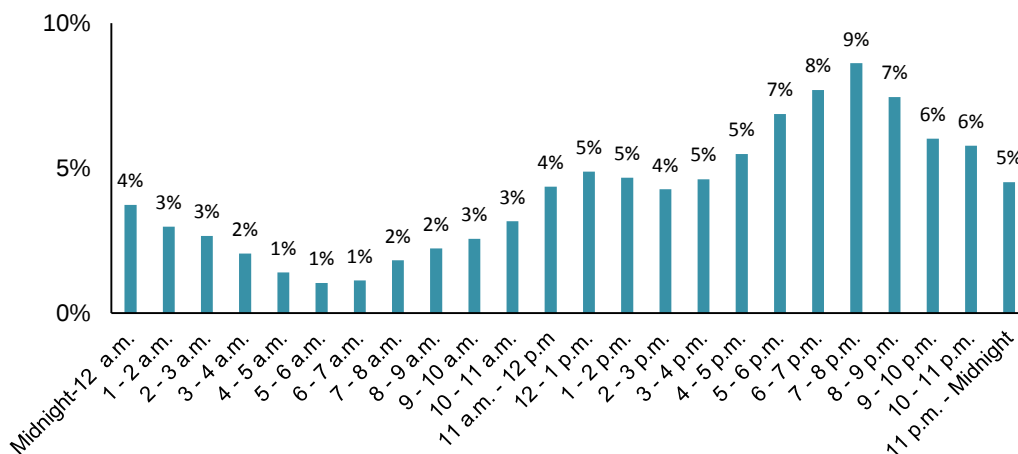
departments to document and report certain kinds of fires, including confined cooking fires, which are quite common in this occupancy type.

Figure 1. Structure Fires in Dormitories, Fraternities, Sororities, and Barracks, by Year, 1980-2013



Approximately three in ten fires (31%) occurred in the four-hour period between 5:00 p.m. and 9:00 p.m. These fires also accounted for 31% of civilian injuries and 44% of direct property damage. By contrast, 17% of fires occurred in the overnight hours between midnight and 8:00 a.m. These fires caused 24% of civilian injuries and 24% of direct property damage.

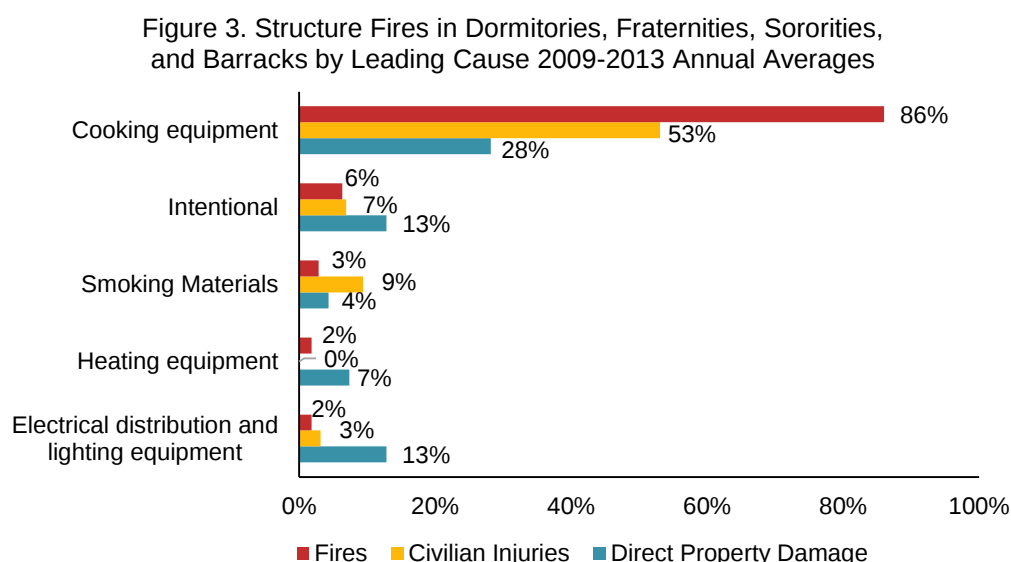
Figure 2. Structure Fires in Dormitories, Fraternities, Sororities, and Barracks, by Time of Day, 2009-2013 Annual Averages



September (11%) and October (12%) were the peak months for fires in these properties, while June (5%), July (5%), and August (6%) recorded the fewest. Fires in March (9%) accounted for 33% of direct property damage, with fires in May also accounting for a disproportionate share of direct property damage (7% of fires, 15% of direct property damage.) By day of week, Sunday had the largest share of fires (17%) and civilian injuries (23%), while Saturdays accounted for

15% of fires and 20% of injuries. The remaining days of the week each accounted for 13% to 14% of fires.

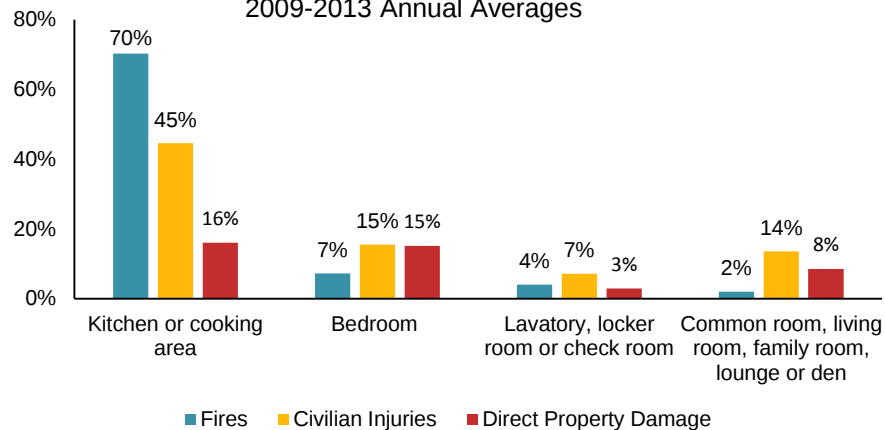
Cooking equipment was the leading cause of fires in these properties, accounting for nearly 6 out of 7 fires (86%). As shown in the figure below, these fires were also responsible for 53% of civilian injuries and 28% of direct property damage. Most cooking fires are confined fires. In analysis of equipment involved in confined fires only, ranges (38%) and microwaves (29%) are the equipment most often involved in fires, with ovens or rotisseries accounting for 9% of total. Fires that were intentionally set accounted for 6% of fires, but 13% of direct property damage, and fires caused by electrical distribution and lighting equipment caused 2% of fires, but 13% of direct property damage. Just 3% of fires were caused by smoking materials, but these fires caused 9% of civilian injuries. (Note that because this figure draws causal information from several NFIRS fields, the causes are not mutually exclusive).



Unattended equipment was the most common factor contributing to the ignition of these fires (27% of total). These fires were also responsible for 12% of civilian injuries and 7% of direct property damage. Other leading factors contributing to ignition were unclassified misuse of material or product (15%), abandoned or discarded material or product (14%), and heat source too close to combustibles (11%). Fires in which a heat source was too close to combustibles caused nearly one-third (32%) of civilian injuries.

The kitchen was the area of origin in 70% of fires in dormitory properties. These fires were associated with 45% of civilian injuries and 16% of direct property damage, as shown in the figure below. Bedrooms were the leading area of origin in 7% of fires, but accounted for 15% of civilian injuries and 15% of direct property damage. A lavatory or locker room was the area of origin in 4% of fires, causing 7% of civilian injuries and 3% of direct property damage, while just 2% of fires began in a common room, living room, lounge, or den, but these caused 14% of civilian injuries and 8% of direct property damage.

Figure 4. Structure Fires in Dormitories, Fraternities, Sororities and Barracks by Area of Origin
2009-2013 Annual Averages



Most of the fires in dormitories, fraternities, sororities, or barracks were small. More than nine of 10 fires (92%) did not cause damage that spread beyond the object of origin. Only 2% of fires had flame damage that spread beyond the room of origin, although these fires were responsible for 76% of direct property damage.

Automatic suppression systems limit fire impact in dormitory type properties. In the most recent NFPA report on the U.S. experience with sprinklers, John Hall estimated that more than half (53%) of structure fires in these properties occurred in structures with sprinklers present.¹ Property damage was 65% lower in the properties with wet pipe sprinklers present than in those with no automatic extinguishing equipment.

Additional information

The NFPA has additional resources available for those interested in safety issues in these properties. NFPA has combined information about fire incidents, safety tips, related articles, and links to other organizations at: www.nfpa.org/campussafety.

¹ John R. Hall, Jr., [U.S. Experience with Sprinklers](http://www.nfpa.org/campussafety), Division of Fire Analysis and Research, June 2013.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, 11/15

Table 1. Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Year

Year	Fires	Injuries	Direct Property Damage (in Millions) As Reported In 2013 Dollars)	
			As Reported	In 2013 Dollars)
1980	3,200	122	\$9	\$25
1981	2,960	118	\$13	\$33
1982	2,420	103	\$9	\$22
1983	2,490	156	\$24	\$56
1984	2,510	50	\$11	\$25
1985	2,440	68	\$8	\$17
1986	2,350	55	\$47	\$100
1987	2,560	76	\$11	\$23
1988	2,430	91	\$8	\$16
1989	2,650	109	\$17	\$32
1990	2,330	80	\$25	\$45
1991	2,270	61	\$37	\$63
1992	2,470	147	\$7	\$12
1993	2,270	73	\$9	\$15
1994	2,320	75	\$13	\$20
1995	2,330	143	\$20	\$31
1996	2,050	78	\$10	\$15
1997	2,200	73	\$12	\$17
1998	1,810	143	\$10	\$14
1999	1,380	190	\$5	\$7
2000	1,780	168	\$23	\$31
2001	2,940	67	\$104	\$137
2002	3,110	19	\$20	\$26
2003	3,350	50	\$23	\$29
2004	3,380	48	\$18	\$22
2005	3,270	59	\$37	\$44
2006	4,220	58	\$39	\$45
2007	3,970	16	\$9	\$10
2008	4,010	35	\$12	\$13
2009	3,740	23	\$7	\$8
2010	3,530	29	\$8	\$9
2011	3,780	47	\$11	\$11
2012	4,160	25	\$9	\$9
2013	4,160	36	\$33	\$33

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

**Table 2. Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Month
2009-2013 Annual Averages**

Month	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
January	340	(9%)	2	(6%)	\$0	(3%)
February	390	(10%)	5	(15%)	\$1	(5%)
March	360	(9%)	2	(5%)	\$5	(33%)
April	370	(10%)	3	(10%)	\$1	(9%)
May	280	(7%)	1	(4%)	\$2	(15%)
June	190	(5%)	2	(6%)	\$1	(4%)
July	190	(5%)	2	(6%)	\$1	(6%)
August	220	(6%)	4	(11%)	\$1	(6%)
September	430	(11%)	1	(4%)	\$0	(3%)
October	450	(12%)	2	(8%)	\$1	(4%)
November	360	(9%)	5	(14%)	\$1	(7%)
December	300	(8%)	4	(11%)	\$1	(5%)
Totals	3,870	(100%)	32	(100%)	\$14	(100%)

**Table 3. Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Day of Week
2009-2013 Annual Averages**

Day of Week	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	660	(17%)	7	(23%)	\$1	(10%)
Monday	520	(13%)	3	(10%)	\$2	(14%)
Tuesday	530	(14%)	4	(11%)	\$1	(11%)
Wednesday	520	(13%)	6	(19%)	\$1	(8%)
Thursday	510	(13%)	3	(10%)	\$5	(39%)
Friday	540	(14%)	2	(8%)	\$1	(5%)
Saturday	600	(15%)	6	(20%)	\$2	(14%)
Totals	3,870	(100%)	32	(100%)	\$14	(100%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

**Table 4. Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Time of Day
2009-2013 Annual Averages**

Alarm Time	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Midnight-12:59 a.m.	140	(4%)	0	(1%)	\$1	(7%)
1:00-1:59 a.m.	120	(3%)	1	(4%)	\$1	(4%)
2:00-2:59 a.m.	100	(3%)	1	(2%)	\$0	(1%)
3:00-3:59 a.m.	80	(2%)	2	(5%)	\$0	(2%)
4:00-4:59 a.m.	50	(1%)	2	(6%)	\$0	(3%)
5:00-5:59 a.m.	40	(1%)	1	(2%)	\$0	(2%)
6:00-6:59 a.m.	40	(1%)	0	(1%)	\$0	(0%)
7:00-7:59 a.m.	70	(2%)	1	(2%)	\$1	(4%)
8:00-8:59 a.m.	90	(2%)	1	(2%)	\$0	(1%)
9:00-9:59 a.m.	100	(3%)	1	(2%)	\$0	(1%)
10:00-10:59 a.m.	120	(3%)	2	(7%)	\$0	(1%)
11:00-11:59 a.m.	170	(4%)	1	(2%)	\$0	(1%)
12:00-12:59 p.m.	190	(5%)	0	(1%)	\$0	(2%)
1:00-1:59 p.m.	180	(5%)	2	(5%)	\$0	(2%)
2:00-2:59 p.m.	170	(4%)	1	(3%)	\$0	(4%)
3:00-3:59 p.m.	180	(5%)	3	(9%)	\$0	(3%)
4:00-4:59 p.m.	210	(5%)	0	(1%)	\$2	(11%)
5:00-5:59 p.m.	270	(7%)	2	(8%)	\$0	(2%)
6:00-6:59 p.m.	300	(8%)	2	(6%)	\$0	(2%)
7:00-7:59 p.m.	330	(9%)	2	(8%)	\$1	(7%)
8:00-8:59 p.m.	290	(7%)	3	(10%)	\$5	(33%)
9:00-9:59 p.m.	230	(6%)	2	(8%)	\$1	(4%)
10:00-10:59 p.m.	220	(6%)	1	(2%)	\$0	(1%)
11:00-11:59 p.m.	170	(5%)	1	(2%)	\$0	(1%)
Totals	3,870	(100%)	32	(100%)	\$14	(100%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 5.
Leading Causes of Structure Fires in Dormitories, Fraternities, Sororities and Barracks
2009-2013 Annual Averages

Leading Causes	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	3,330	(86%)	17	(53%)	\$4	(28%)
Intentional	245	(6%)	2	(7%)	\$2	(13%)
Smoking Materials	110	(3%)	3	(9%)	\$1	(4%)
Heating equipment	70	(2%)	0	(0%)	\$1	(7%)
Electrical distribution and lighting equipment	70	(2%)	1	(3%)	\$2	(13%)
Playing with heat source	60	(2%)	0	(0%)	\$0	(0%)
Total	3,870	(100%)	32	(100%)	\$14	(100%)

Note: This table summarizes findings from multiple fields, meaning that the same fire may be listed under multiple causes. The methodology used is described in Appendix B.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 6.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Equipment Involved
2009-2013 Annual Averages

Equipment Involved	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	3,330	(86%)	17	(52%)	\$4	(28%)
Confined cooking fire	3,210	(83%)	12	(37%)	\$0	(1%)
Range with or without oven, cooking surface	80	(2%)	3	(8%)	\$4	(26%)
Other known cooking equipment	40	(1%)	3	(8%)	\$0	(1%)
Contained trash or rubbish fire	170	(4%)	2	(6%)	\$0	(0%)
No equipment involved in ignition	100	(2%)	5	(15%)	\$1	(10%)
Heating equipment	70	(2%)	0	(1%)	\$1	(7%)
Confined fuel burner or boiler fire	30	(1%)	0	(1%)	\$0	(0%)
Fixed or portable space heater	30	(1%)	0	(0%)	\$1	(6%)
Other known heating equipment	20	(0%)	0	(0%)	\$0	(1%)
Electrical distribution and lighting equipment	70	(2%)	1	(3%)	\$2	(13%)
Lamp, bulb or lighting	30	(1%)	1	(3%)	\$0	(3%)
Wiring and related equipment	30	(1%)	0	(0%)	\$1	(8%)
Other known electrical distribution or lighting equipment	10	(0%)	0	(0%)	\$0	(2%)
Clothes dryer	40	(1%)	0	(0%)	\$1	(8%)
Fan	20	(1%)	2	(5%)	\$1	(4%)
Other known Equipment involved in ignition	70	(2%)	5	(15%)	\$4	(28%)
Total	3,870	(100%)	32	(97%)	\$14	(100%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the equipment involved was unknown or not reported have been allocated proportionally among fires with known equipment involved. Confined fires, incident type 113-118 are listed by incident type and were not analyzed separately. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 7.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Cause of Ignition
2009-2013 Annual Averages

Cause of Ignition	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cause, other	110	(3%)	0	(0%)	\$0	(0%)
Non-confined	9	(0%)	0	(0%)	\$0	(0%)
Confined	102	(3%)	0	(0%)	\$0	(0%)
Intentional	245	(6%)	2	(7%)	\$2	(13%)
Non-confined	69	(2%)	1	(2%)	\$2	(13%)
Confined	176	(5%)	2	(5%)	\$0	(0%)
Unintentional	3402	(88%)	28	(86%)	\$9	(65%)
Non-confined	299	(8%)	15	(48%)	\$9	(63%)
Confined	3103	(80%)	12	(38%)	\$0	(1%)
Failure of equipment or heat source	108	(3%)	1	(3%)	\$3	(22%)
Non-confined	71	(2%)	1	(3%)	\$3	(22%)
Confined	37	(1%)	0	(0%)	\$0	(0%)
Act of nature	9	(0%)	1	(3%)	\$0	(0%)
Non-confined	6	(0%)	1	(3%)	\$0	(0%)
Confined	2	(0%)	0	(0%)	\$0	(0%)
Total	3,870	(100%)	32	(100%)	\$14	(100%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 8.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks
by Factors Contributing to Ignition
2009-2013 Annual Averages

Factor Contributing to Ignition	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Equipment unattended	1,040	(27%)	4	(12%)	\$1	(7%)
Non-Confined	40	(1%)	4	(12%)	\$1	(7%)
Confined	1,000	(26%)	0	(0%)	\$0	(0%)
Unclassified misuse of material or product	570	(15%)	6	(19%)	\$1	(4%)
Non-Confined	50	(1%)	1	(2%)	\$1	(4%)
Confined	510	(13%)	6	(17%)	\$0	(0%)
Abandoned or discarded material or product	550	(14%)	3	(9%)	\$1	(9%)
Non-Confined	60	(1%)	2	(5%)	\$1	(9%)
Confined	500	(13%)	1	(4%)	\$0	(1%)
Heat source too close to combustibles	430	(11%)	10	(32%)	\$2	(13%)
Non-Confined	70	(2%)	7	(23%)	\$2	(12%)
Confined	360	(9%)	3	(9%)	\$0	(0%)
Unclassified factor contributed to ignition	270	(7%)	3	(10%)	\$2	(12%)
Non-Confined	30	(1%)	2	(5%)	\$2	(12%)
Confined	240	(6%)	1	(4%)	\$0	(0%)
Failure to clean	210	(5%)	0	(0%)	\$0	(0%)
Non-Confined	10	(0%)	0	(0%)	\$0	(0%)
Confined	200	(5%)	0	(0%)	\$0	(0%)
Equipment not being operated properly	180	(5%)	0	(0%)	\$0	(0%)
Non-Confined	0	(0%)	0	(0%)	\$0	(0%)
Confined	180	(5%)	0	(0%)	\$0	(0%)
Accidentally turned on, not turned off	130	(3%)	3	(10%)	\$0	(3%)
Non-Confined	10	(0%)	1	(2%)	\$0	(3%)
Confined	110	(3%)	3	(9%)	\$0	(0%)
Mechanical failure or malfunction	120	(3%)	1	(2%)	\$2	(14%)
Non-Confined	40	(1%)	1	(2%)	\$2	(14%)
Confined	90	(2%)	0	(0%)	\$0	(0%)
Unclassified operational deficiency	120	(3%)	0	(0%)	\$0	(1%)
Non-Confined	10	(0%)	0	(0%)	\$0	(1%)
Confined	110	(3%)	0	(0%)	\$0	(0%)
Electrical failure or malfunction	100	(3%)	2	(6%)	\$2	(17%)
Non-Confined	80	(2%)	1	(2%)	\$2	(17%)
Confined	20	(1%)	1	(4%)	\$0	(0%)

Table 8.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks
by Factors Contributing to Ignition
2009-2013 Annual Averages (Continued)

Factor Contributing to Ignition	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Improper container or storage	70	(2%)	0	(0%)	\$0	(1%)
Non-Confined	10	(0%)	0	(0%)	\$0	(1%)
Confined	60	(2%)	0	(0%)	\$0	(0%)
Playing with heat source	60	(2%)	0	(0%)	\$0	(0%)
Non-Confined	20	(0%)	0	(0%)	\$0	(0%)
Confined	40	(1%)	0	(0%)	\$0	(0%)
Other known factor contributing to ignition	130	(3%)	0	(9%)	\$3	(22%)
Non-Confined	50	(1%)	0	(9%)	\$3	(22%)
Confined	80	(2%)	0	(0%)	\$0	(0%)
Total Fires	3,870	(100%)	32	(100%)	\$14	(100%)
Non-Confined	450	(12%)	18	(57%)	\$13	(98%)
Confined	3,420	(88%)	14	(43%)	\$0	(2%)
Total Factors	3,990	(103%)	35	(108%)	\$14	(104%)
Non-Confined	480	(12%)	19	(60%)	\$14	(102%)
Confined	3,510	(91%)	15	(48%)	\$0	(2%)

*Multiple entries allowed in this field, so total factors add up to more than total fires

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the heat source was unknown or not reported have been allocated proportionally among fires with known heat source. Confined fires, incident type 113-118 are analyzed separately and included in the table. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 9.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Heat Source
2009-2013 Annual Averages

Heat Source	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Radiated or conducted heat from operating equipment	1,250	(32%)	7	(21%)	\$3	(23%)
Non-confined	80	(2%)	2	(7%)	\$3	(23%)
Confined	1,170	(30%)	5	(15%)	\$0	(0%)
Unclassified heat from powered equipment	1,030	(26%)	7	(23%)	\$2	(18%)
Non-confined	80	(2%)	4	(12%)	\$2	(18%)
Confined	940	(24%)	4	(11%)	\$0	(0%)
Unclassified heat source	450	(12%)	4	(13%)	\$1	(5%)
Non-confined	30	(1%)	1	(4%)	\$1	(5%)
Confined	420	(11%)	3	(9%)	\$0	(0%)
Unclassified hot or smoldering object	280	(7%)	0	(1%)	\$2	(12%)
Non-confined	30	(1%)	0	(1%)	\$2	(11%)
Confined	250	(6%)	0	(0%)	\$0	(0%)
Spark, ember or flame from operating equipment	210	(5%)	0	(1%)	\$0	(3%)
Non-confined	20	(0%)	0	(1%)	\$0	(2%)
Confined	190	(5%)	0	(0%)	\$0	(0%)
Smoking Materials	110	(3%)	3	(9%)	\$1	(4%)
Non-confined	30	(1%)	3	(9%)	\$1	(4%)
Confined	80	(2%)	0	(0%)	\$0	(0%)
Lighter	100	(3%)	1	(3%)	\$0	(2%)
Non-confined	40	(1%)	1	(3%)	\$0	(2%)
Confined	60	(2%)	0	(0%)	\$0	(0%)
Heat from direct flame or convection currents	80	(2%)	0	(0%)	\$0	(0%)
Non-confined	10	(0%)	0	(0%)	\$0	(0%)
Confined	80	(2%)	0	(0%)	\$0	(0%)
Hot ember or ash	70	(2%)	0	(1%)	\$1	(4%)
Non-confined	20	(0%)	0	(1%)	\$1	(4%)
Confined	50	(1%)	0	(0%)	\$0	(0%)
Arcing	70	(2%)	0	(1%)	\$1	(6%)
Non-confined	50	(1%)	0	(1%)	\$1	(6%)
Confined	20	(1%)	0	(0%)	\$0	(0%)

Table 9.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Heat Source
2009-2013 Annual Averages (Continued)

Heat Source	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Other known heat source	220	(6%)	10	(22%)	\$3	(22%)
Non-confined	70	(2%)	10	(17%)	\$3	(21%)
Confined	150	(4%)	0	(6%)	\$0	(0%)
Total	3,870	(100%)	32	(100%)	\$14	(100%)
Non-confined	450	(12%)	18	(57%)	\$13	(98%)
Confined	3,420	(88%)	14	(43%)	\$0	(2%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Totals may not equal sums due to rounding errors. Estimates of matches, lighters, smoking materials, and candles included a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 10.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Area of Origin
2009-2013 Annual Averages

Area of Origin	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	2720	70%	14	45%	\$2	16%
Non-confined	100	3%	4	11%	\$2	15%
Confined	2,620	68%	11	33%	\$0	1%
Bedroom	280	7%	5	15%	\$2	15%
Non-confined	90	2%	5	15%	\$2	15%
Confined	190	5%	0	0%	\$0	0%
Lavatory, locker room or check room	160	4%	2	7%	\$0	3%
Non-confined	30	1%	0	0%	\$0	3%
Confined	120	3%	2	7%	\$0	0%
Common room, living room, family room, lounge or den	80	2%	4	14%	\$1	8%
Non-confined	20	1%	4	14%	\$1	8%
Confined	60	2%	0	0%	\$0	0%
Trash or rubbish chute, area or container	0	0%	0	0%	\$0	0%
Non-confined	0	0%	0	0%	\$0	0%
Confined	70	2%	0	0%	\$0	0%
Hallway, corridor, mall	60	2%	0	1%	\$0	0%
Non-confined	20	1%	0	1%	\$0	0%
Confined	40	1%	0	0%	\$0	0%
Other known area of origin	0	0%		0%	\$0	0%
Non-confined	190	5%	5	16%	\$8	57%
Confined	320	8%	1	2%	\$0	0%
Total	3,870	100%	32	100%	\$14	100%
Non-confined	450	12%	18	56%	\$13	98%
Confined	3,420	88%	14	44%	\$0	2%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the area or origin was unknown or not reported have been allocated proportionally among fires with known area of origin. Confined fires, incident type 113-118 are analyzed separately and included in the table. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 11.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Item First Ignited
2009-2013 Annual Averages

Item First Ignited	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking materials, including food	2,430	(63%)	7	(23%)	\$2	(14%)
Non-Confined	50	(1%)	1	(4%)	\$2	(13%)
Confined	2,380	(61%)	6	(19%)	\$0	(1%)
Rubbish, trash, or waste	260	(7%)	3	(10%)	\$0	(1%)
Non-Confined	20	(0%)	1	(3%)	\$0	(1%)
Confined	240	(6%)	2	(7%)	\$0	(0%)
Unclassified item first ignited	190	(5%)	2	(5%)	\$1	(4%)
Non-Confined	30	(1%)	1	(3%)	\$1	(4%)
Confined	160	(4%)	1	(2%)	\$0	(0%)
Household utensils	110	(3%)	2	(5%)	\$0	(0%)
Non-Confined	10	(0%)	0	(0%)	\$0	(0%)
Confined	110	(3%)	2	(5%)	\$0	(0%)
Magazine, newspaper, or writing paper	100	(3%)	0	(0%)	\$0	(1%)
Non-Confined	20	(1%)	0	(0%)	\$0	(1%)
Confined	80	(2%)	0	(0%)	\$0	(0%)
Appliance housing or casing	90	(2%)	1	(2%)	\$0	(1%)
Non-Confined	20	(1%)	0	(0%)	\$0	(1%)
Confined	70	(2%)	1	(2%)	\$0	(0%)
Box, carton, bag, basket, or barrel	60	(2%)	0	(0%)	\$0	(1%)
Non-Confined	10	(0%)	0	(0%)	\$0	(1%)
Confined	60	(1%)	0	(0%)	\$0	(0%)
Other known item first ignited	630	(16%)	17	(54%)	\$10	(77%)
Non-Confined	290	(8%)	15	(47%)	\$10	(77%)
Confined	340	(9%)	2	(7%)	\$0	(0%)
Total	3,870	(100%)	32	(100%)	\$14	(100%)
Non-Confined	450	(12%)	18	(57%)	\$13	(98%)
Confined	3,420	(88%)	14	(43%)	\$0	(2%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the item first ignited was unknown or not reported have been allocated proportionally among fires with known item first ignited. Confined fires, incident type 113-118 are analyzed separately and included in the table. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Table 12.
Structure Fires in Dormitories, Fraternities, Sororities and Barracks, by Extent of Flame Damage
2009-2013 Annual Averages

Extent of Flame Damage	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Confined or contained fire identified by incident type	3,420	88%	14	44%	\$0	2%
Confined to object of origin	150	4%	4	12%	1	6%
Confined to room of origin	230	6%	11	34%	2	17%
Confined to floor of origin	30	1%	1	3%	2	14%
Confined to building of origin	50	1%	2	7%	8	60%
Beyond building of origin	10	0%	0	1%	0	2%
Total	3,870	100%	32	100%	\$14	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest million dollars. Property damage has not been adjusted for inflation. Confined fires, incident type 113-118 are analyzed separately and included in the table. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA Fire Experience Survey, 2009-2013.

Appendix A.

How National Estimates Statistics Are Calculated

The statistics in this analysis are estimates derived from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual survey of U.S. fire departments. NFIRS is a voluntary system by which participating fire departments report detailed factors about the fires to which they respond. Roughly two-thirds of U.S. fire departments participate, although not all of these departments provide data every year. Fires reported to federal or state fire departments or industrial fire brigades are not included in these estimates.

NFIRS provides the most detailed incident information of any national database not limited to large fires. NFIRS is the only database capable of addressing national patterns for fires of all sizes by specific property use and specific fire cause. NFIRS also captures information on the extent of flame spread, and automatic detection and suppression equipment. For more information about NFIRS visit <http://www.nfirs.fema.gov/>. Copies of the paper forms may be downloaded from http://www.nfirs.fema.gov/documentation/design/NFIRS_Paper_Forms_2008.pdf.

NFIRS has a wide variety of data elements and code choices. The NFIRS database contains coded information. Many code choices describe several conditions. These cannot be broken down further. For example, area of origin code 83 captures fires starting in vehicle engine areas, running gear areas or wheel areas. It is impossible to tell the portion of each from the coded data.

Methodology may change slightly from year to year.

NFPA is continually examining its methodology to provide the best possible answers to specific questions, methodological and definitional changes can occur. *Earlier editions of the same report may have used different methodologies to produce the same analysis, meaning that the estimates are not directly comparable from year to year.*

NFPA's fire department experience survey provides estimates of the big picture.

Each year, NFPA conducts an annual survey of fire departments which enables us to capture a summary of fire department experience on a larger scale. Surveys are sent to all municipal departments protecting populations of 50,000 or more and a random sample, stratified by community size, of the smaller departments. Typically, a total of roughly 3,000 surveys are returned, representing about one of every ten U.S. municipal fire departments and about one third of the U.S. population.

The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities have fewer people protected per department and are less likely to respond to the survey. A larger number must be surveyed to obtain an adequate sample of those departments. (NFPA also makes follow-up calls to a sample of the smaller fire departments that do not respond, to confirm that those that did respond are truly representative of fire departments their size.) On the other hand, large city departments are so few in number and protect such a large proportion of the total U.S. population that it makes sense to survey all of them. Most respond, resulting in excellent precision for their part of the final estimate.

The survey includes the following information: (1) the total number of fire incidents, civilian deaths, and civilian injuries, and the total estimated property damage (in dollars), for each of the major property use classes defined in NFIRS; (2) the number of on-duty firefighter injuries, by type of duty and nature of illness; 3) the number and nature of non-fire incidents; and (4) information on the type of community protected (e.g., county versus township versus city) and

the size of the population protected, which is used in the statistical formula for projecting national totals from sample results. The results of the survey are published in the annual report *Fire Loss in the United States*. To download a free copy of the report, visit <http://www.nfpa.org/assets/files/PDF/OS.fireloss.pdf>.

Projecting NFIRS to National Estimates

As noted, NFIRS is a voluntary system. Different states and jurisdictions have different reporting requirements and practices. Participation rates in NFIRS are not necessarily uniform across regions and community sizes, both factors correlated with frequency and severity of fires. This means NFIRS may be susceptible to systematic biases. No one at present can quantify the size of these deviations from the ideal, representative sample, so no one can say with confidence that they are or are not serious problems. But there is enough reason for concern so that a second database -- the NFPA survey -- is needed to project NFIRS to national estimates and to project different parts of NFIRS separately. This multiple calibration approach makes use of the annual NFPA survey where its statistical design advantages are strongest.

Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific fire problems and circumstances are obtained by multiplying the NFIRS data by the scaling ratios. Reports for incidents in which mutual aid was given are excluded from NFPA's analyses.

Analysts at the NFPA, the USFA and the Consumer Product Safety Commission developed the specific basic analytical rules used for this procedure. "The National Estimates Approach to U.S. Fire Statistics," by John R. Hall, Jr. and Beatrice Harwood, provides a more detailed explanation of national estimates. A copy of the article is available online at <http://www.nfpa.org/osds> or through NFPA's One-Stop Data Shop.

Version 5.0 of NFIRS, first introduced in 1999, used a different coding structure for many data elements, added some property use codes, and dropped others. The essentials of the approach described by Hall and Harwood are still used, but some modifications have been necessary to accommodate the changes in NFIRS 5.0.

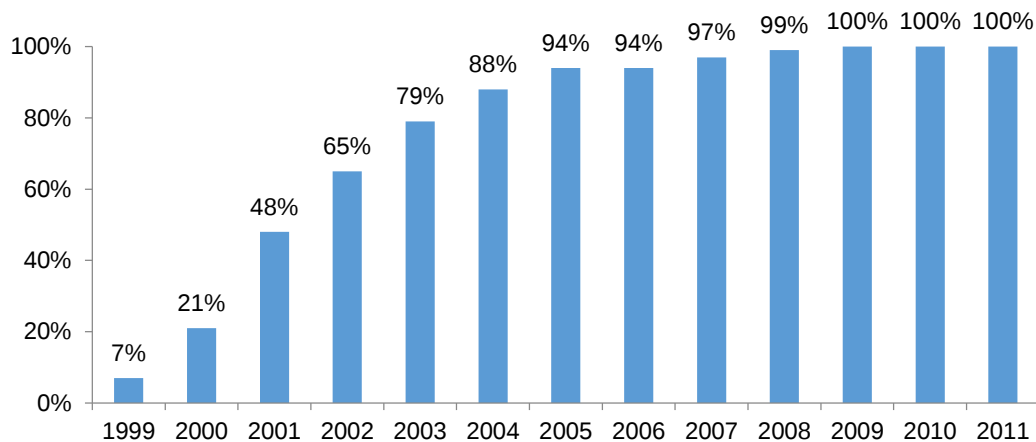
Figure A.1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

From 1999 data on, analyses are based on scaling ratios using only data originally collected in NFIRS 5.0:

$$\frac{\text{NFPA survey projections}}{\text{NFIRS totals (Version 5.0)}}$$

For 1999 to 2001, the same rules may be applied, but estimates for these years in this form will be less reliable due to the smaller amount of data originally collected in NFIRS 5.0; they should be viewed with extreme caution.

Figure A.1. Fires Originally Collected in NFIRS 5.0 by Year



NFIRS 5.0 introduced six categories of confined structure fires, including:

- cooking fires confined to the cooking vessel,
- confined chimney or flue fires,
- confined incinerator fire,
- confined fuel burner or boiler fire or delayed ignition,
- confined commercial compactor fire, and
- trash or rubbish fires in a structure with no flame damage to the structure or its contents.

Because this analysis focused on fatalities only, no distinction was made between confined and non-confined fires.

For most fields other than Property Use and Incident Type, NFPA allocates unknown data proportionally among known data. This approach assumes that if the missing data were known, it would be distributed in the same manner as the known data. NFPA makes additional adjustments to several fields. *Casualty and loss projections can be heavily influenced by the inclusion or exclusion of unusually serious fire.*

In the formulas that follow, the term “all fires” refers to all fires in NFIRS on the dimension studied. The percentages of fires with known or unknown data are provided for non-confined fires and associated losses, and for confined fires only.

Rounding and percentages. The data shown are estimates and generally rounded. An entry of zero may be a true zero or it may mean that the value rounds to zero. Percentages are calculated from unrounded values. It is quite possible to have a percentage entry of up to 100% even if the rounded number entry is zero. The same rounded value may account for a slightly different percentage share. Because percentages are expressed in integers and not carried out to several decimal places, percentages that appear identical may be associated with slightly different values.

In the formulas that follow, the term “all fires” refers to all fires in NFIRS on the dimension studied. The percentages of fires with known or unknown data are provided for non-confined fires and associated losses, and for confined fires only.

Cause of Ignition: This field is used chiefly to identify intentional fires. “Unintentional” in *Structure Fires in Dormitories, Fraternities, Sororities and Barracks*, 11/15

this field is a specific entry and does not include other fires that were not intentionally set: failure of equipment or heat source, act of nature, or “other” (unclassified).” The last should be used for exposures but has been used for other situations as well. Fires that were coded as under investigation and those that were coded as undetermined after investigation were treated as unknown.

Factor Contributing to Ignition: In this field, the code “none” is treated as an unknown and allocated proportionally. For Human Factor Contributing to Ignition, NFPA enters a code for “not reported” when no factors are recorded. “Not reported” is treated as an unknown, but the code “none” is treated as a known code and not allocated. Multiple entries are allowed in both of these fields. Percentages are calculated on the total number of fires, not entries, resulting in sums greater than 100%. Although Factor Contributing to Ignition is only required when the cause of ignition was coded as: 2) unintentional, 3) failure of equipment or heat source; or 4) act of nature, data is often present when not required. Consequently, any fire in which no factor contributing to ignition was entered was treated as unknown.

In some analyses, all entries in the category of mechanical failure, malfunction (factor contributing to ignition 20-29) are combined and shown as one entry, “mechanical failure or malfunction.” This category includes:

- 21. Automatic control failure;
- 22. Manual control failure;
- 23. Leak or break. Includes leaks or breaks from containers or pipes. Excludes operational deficiencies and spill mishaps;
- 25. Worn out;
- 26. Backfire. Excludes fires originating as a result of hot catalytic converters;
- 27. Improper fuel used; Includes the use of gasoline in a kerosene heater and the like; and
- 20. Mechanical failure or malfunction, other.

Entries in “electrical failure, malfunction” (factor contributing to ignition 30-39) may also be combined into one entry, “electrical failure or malfunction.” This category includes:

- 31. Water-caused short circuit arc;
- 32. Short-circuit arc from mechanical damage;
- 33. Short-circuit arc from defective or worn insulation;
- 34. Unspecified short circuit arc;
- 35. Arc from faulty contact or broken connector, including broken power lines and loose connections;
- 36. Arc or spark from operating equipment, switch, or electric fence;
- 37. Fluorescent light ballast; and
- 30. Electrical failure or malfunction, other.

Heat Source. In NFIRS 5.0, one grouping of codes encompasses various types of open flames and smoking materials. In the past, these had been two separate groupings. A new code was added to NFIRS 5.0, which is code 60: “Heat from open flame or smoking material, other.” NFPA treats this code as a partial unknown and allocates it proportionally across the codes in the

61-69 range, shown below.

- 61. Cigarette;
- 62. Pipe or cigar;
- 63. Heat from undetermined smoking material;
- 64. Match;
- 65. Lighter: cigarette lighter, cigar lighter;
- 66. Candle;
- 67. Warning or road flare, fuse;
- 68. Backfire from internal combustion engine. Excludes flames and sparks from an exhaust system, (11); and
- 69. Flame/torch used for lighting. Includes gas light and gas-/liquid-fueled lantern.

In addition to the conventional allocation of missing and undetermined fires, NFPA multiplies fires with codes in the 61-69 range by

$$\frac{\text{All fires in range 60-69}}{\text{All fires in range 61-69}}$$

The downside of this approach is that heat sources that are truly a different type of open flame or smoking material are erroneously assigned to other categories. The grouping “smoking materials” includes codes 61-63 (cigarettes, pipes or cigars, and heat from undetermined smoking material, with a proportional share of the code 60s and true unknown data.

Equipment Involved in Ignition (EII). NFIRS 5.0 originally defined EII as the piece of equipment that provided the principal heat source to cause ignition if the equipment malfunctioned or was used improperly. In 2006, the definition was modified to “the piece of equipment that provided the principal heat source to cause ignition.” However, much of the data predates the change. Individuals who have already been trained with the older definition may not change their practices. To compensate, NFPA treats fires in which EII = NNN and heat source is not in the range of 40-99 as an additional unknown.

To allocate unknown data for EII, the known data is multiplied by

$$\frac{\text{All fires}}{(\text{All fires} - \text{blank} - \text{undetermined} - [\text{fires in which EII = NNN and heat source } \leq 40-99])}$$

In addition, the partially unclassified codes for broad equipment groupings (i.e., code 100 - heating, ventilation, and air conditioning, other; code 200 - electrical distribution, lighting and power transfer, other; etc.) were allocated proportionally across the individual code choices in their respective broad groupings (heating, ventilation, and air conditioning; electrical distribution, lighting and power transfer, other; etc.). Equipment that is totally unclassified is not allocated further. This approach has the same downside as the allocation of heat source 60 described above. Equipment that is truly different is erroneously assigned to other categories.

In some analyses, various types of equipment are grouped together.

Code Grouping	EII Code	NFIRS definitions
Central heat	132	Furnace or central heating unit
	133	Boiler (power, process or heating)
Fixed or portable space heater	131	Furnace, local heating unit, built-in
	123	Fireplace with insert or stove
	124	Heating stove
	141	Heater, excluding catalytic and oil-filled
	142	Catalytic heater
	143	Oil-filled heater
Fireplace or chimney	120	Fireplace or chimney
	121	Fireplace, masonry
	122	Fireplace, factory-built
	125	Chimney connector or vent connector
	126	Chimney – brick, stone or masonry
	127	Chimney-metal, including stovepipe or flue
Fixed wiring and related equipment	210	Unclassified electrical wiring
	211	Electrical power or utility line
	212	Electrical service supply wires from utility
	213	Electric meter or meter box
	214	Wiring from meter box to circuit breaker
	215	Panel board, switch board or circuit breaker board
	216	Electrical branch circuit
	217	Outlet or receptacle
	218	Wall switch
	219	Ground fault interrupter
Transformers and power supplies	221	Distribution-type transformer
	222	Overcurrent, disconnect equipment
	223	Low-voltage transformer
	224	Generator
	225	Inverter
	226	Uninterrupted power supply (UPS)
	227	Surge protector
	228	Battery charger or rectifier
	229	Battery (all types)

Code Grouping	EII Code	NFIRS definitions
Lamp, bulb or lighting	230	Unclassified lamp or lighting
	231	Lamp-tabletop, floor or desk
	232	Lantern or flashlight
	233	Incandescent lighting fixture
	234	Fluorescent light fixture or ballast
	235	Halogen light fixture or lamp
	236	Sodium or mercury vapor light fixture or lamp
	237	Work or trouble light
	238	Light bulb
	241	Nightlight
	242	Decorative lights – line voltage
	243	Decorative or landscape lighting – low voltage
	244	Sign
Cord or plug	260	Unclassified cord or plug
	261	Power cord or plug, detachable from appliance
	262	Power cord or plug- permanently attached
	263	Extension cord
Torch, burner or soldering iron	331	Welding torch
	332	Cutting torch
	333	Burner, including Bunsen burners
	334	Soldering equipment
Portable cooking or warming equipment	631	Coffee maker or teapot
	632	Food warmer or hot plate
	633	Kettle
	634	Popcorn popper
	635	Pressure cooker or canner
	636	Slow cooker
	637	Toaster, toaster oven, counter-top broiler
	638	Waffle iron, griddle
	639	Wok, frying pan, skillet
	641	Breadmaking machine

Equipment was not analyzed separately for confined fires. Instead, each confined fire incident type was listed with the equipment or as other known equipment.

Item First Ignited. In most analyses, mattress and pillows (item first ignited 31) and bedding, blankets, sheets, and comforters (item first ignited 32) are combined and shown as “mattresses and bedding.” In many analyses, wearing apparel not on a person (code 34) and wearing apparel on a person (code 35) are combined and shown as “clothing.” In some analyses, flammable and

combustible liquids and gases, piping and filters (item first ignited 60-69) are combined and shown together.

Area of Origin. Two areas of origin: bedroom for more than five people (code 21) and bedroom for less than five people (code 22) are combined and shown as simply “bedroom.” Chimney is no longer a valid area of origin code for non-confined fires.

Rounding and percentages. The data shown are estimates and generally rounded. An entry of zero may be a true zero or it may mean that the value rounds to zero. Percentages are calculated from unrounded values. It is quite possible to have a percentage entry of up to 100% even if the rounded number entry is zero. The same rounded value may account for a slightly different percentage share. Because percentages are expressed in integers and not carried out to several decimal places, percentages that appear identical may be associated with slightly different values.

Appendix B.

Methodology and Definitions Used in “Leading Cause” Tables

The cause table reflects relevant causal factors that accounted for at least 2% of the fires in a given occupancy. Only those causes that seemed to describe a scenario are included. Because the causal factors are taken from different fields, some double counting is possible. Percentages are calculated against the total number of structure fires, including both confined and non-confined fires. Bear in mind that every fire has at least three “causes” in the sense that it could have been prevented by changing behavior, heat source, or ignitability of first fuel, the last an aspect not reflected in any of the major cause categories. For example, several of the cause categories in this system refer to types of equipment (cooking, heating, electrical distribution and lighting, clothes dryers and washers, torches). However, the problem may be not with the equipment but with the way it is used. The details in national estimates are derived from the U.S. Fire Administration’s National Fire Incident Reporting System (NFIRS). This methodology is based on the coding system used in Version 5.0 of NFIRS. The *NFIRS 5.0 Reference Guide*, containing all of the codes, can be downloaded from <http://www.nfirs.fema.gov/documentation/reference/>.

Cooking equipment and heating equipment are calculated by summing fires identified by equipment involved in ignition and relevant confined fires. Confined fires will be shown if they account for at least 2% of the incidents. **Confined cooking fires** (cooking fires involving the contents of a cooking vessel without fire extension beyond the vessel) are identified by NFIRS incident type 113.

Confined heating equipment fires include **confined chimney or flue fires** (incident type 114) and **confined fuel burner or boiler** fires (incident type 116). The latter includes delayed ignitions and incidents where flames caused no damage outside the fire box. The two types of confined heating fires may be combined or listed separately, depending on the numbers involved.

Intentional fires are identified by fires with a “1” (intentional) in the field “cause.” The estimate includes a proportional share of fires in which the cause was undetermined after investigation, under investigation, or not reported. All fires with intentional causes are included in this category regardless of the age of the person involved. Earlier versions of NFIRS included codes for incendiary and suspicious. Intentional fires were deliberately set; they may or may not be incendiary in a legal sense. No age restriction is applied.

Fires caused by **playing with heat source** (typically matches or lighters) are identified by code 19 in the field “factor contributing to ignition.” Fires in which the factor contribution to ignition was undetermined (UU), entered as none (NN) or left blank are considered unknown and allocated proportionally. Because factor contributing to ignition is not required for intentional fires, the share unknown, by these definitions, is somewhat larger than it should be.

The heat source field is used to identify fires started by: **smoking materials** (cigarette, code 61; pipe or cigar, code 62; and heat from undetermined smoking material, code 63); **candles** (code 66), **lightning** (code 73); and **spontaneous combustion or chemical reaction** (code 72). Fires started by heat from unclassified open flame or smoking materials (code 60) are allocated proportionally among the “other open flame or smoking material” codes (codes 61-69) in an

allocation of partial unknown data. This includes smoking materials and candles. This approach results in any true unclassified smoking or open flame heat sources such as incense being inappropriately allocated. However, in many fires, this code was used as an unknown.

The equipment involved in ignition field is used to find several cause categories. This category includes equipment that functioned properly and equipment that malfunctioned.

Cooking equipment Non-confined fire refers to equipment used to cook, heat or warm food (codes 620-649 and 654). Fire in which ranges, ovens or microwave ovens, food warming appliances, fixed or portable cooking appliances, deep fat fryers, open fired charcoal or gas grills, grease hoods or ducts, or other cooking appliances) were involved in the ignition are said to be caused by cooking equipment. Food preparation devices that do not involve heating, such as can openers or food processors, are not included here. As noted in Appendix A, a proportional share of unclassified kitchen and cooking equipment (code 600) is included here.

Heating equipment Non-confined fire (codes 120-199) includes central heat, portable and fixed heaters (including wood stoves), fireplaces, chimneys, hot water heaters, and heat transfer equipment such as hot air ducts or hot water pipes. Heat pumps are not included. As noted in Appendix A, a proportional share of unclassified heating, ventilation and air condition equipment (code 100) is included here.

Confined fires are excluded from the tallies of the remaining categories of fires involving equipment.

Electrical distribution and lighting equipment (codes 200-299) include: fixed wiring; transformers; associated overcurrent or disconnect equipment such as fuses or circuit breakers; meters; meter boxes; power switch gear; switches, receptacles and outlets; light fixtures, lamps, bulbs or lighting; signs; cords and plugs; generators, transformers, inverters, batteries and battery charges.

Torch, burner or soldering iron (codes 331-334) includes welding torches, cutting torches, Bunsen burners, plumber furnaces, blowtorches, and soldering equipment. As noted in Appendix A, a proportional share of shop tools and industrial equipment (code 300) is included here.

Clothes dryer or washer (codes 811, 813 and 814) includes clothes dryers alone, washer and dryer combinations within one frame, and washing machines for clothes. As noted in Appendix A, a proportional share of unclassified personal and household equipment (code 800) is included here.

Electronic, office or entertainment equipment (codes 700-799) includes: computers and related equipment; calculators and adding machines; telephones or answering machines; copiers; fax machines; paper shredders; typewriters; postage meters; other office equipment; musical instruments; stereo systems and/or components; televisions and cable TV converter boxes,, cameras, excluding professional television studio cameras, video equipment and other

electronic equipment. Older versions of NFIRS had a code for electronic equipment that included radar, X-rays, computers, telephones, and transmitter equipment.

Shop tools and industrial equipment excluding torches, burners or soldering irons (codes 300-330, 335-399) includes power tools; painting equipment; compressors; atomizing equipment; pumps; wet/dry vacuums; hoists, lifts or cranes; powered jacking equipment; water or gas drilling equipment; unclassified hydraulic equipment; heat-treating equipment; incinerators, industrial furnaces, ovens or kilns; pumps; compressors; internal combustion engines; conveyors; printing presses; casting, molding; or forging equipment; heat treating equipment; tar kettles; working or shaping machines; coating machines; chemical process equipment; waste recovery equipment; power transfer equipment; power takeoff; powered valves; bearings or brakes; picking, carding or weaving machines; testing equipment; gas regulators; separate motors; non-vehicular internal combustion engines; and unclassified shop tools and industrial equipment. . As noted in Appendix A, a proportional share of shop tools and industrial equipment (code 300) is included here.

Medical equipment (codes 410-419) includes: dental, medical or other powered bed, chair or wheelchair; dental equipment; dialysis equipment; medical monitoring and imaging equipment; oxygen administration equipment; radiological equipment; medical sterilizers, therapeutic equipment and unclassified medical equipment. As noted in Appendix A, a proportional share of commercial and medical equipment (code 400) is included here.

Exposures are fires that are caused by the spread of or from another fire. These were identified by factor contributing to ignition code 71. This code is automatically applied when the exposure number is greater than zero.