



RESEARCH

Home Structure Fires Involving Christmas Trees

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Abstract

Christmas trees are a traditional part of the Christmas holiday. They can also be a major source of fuel in a fire.

National estimates of reported home structure fires derived from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS) and NFPA's annual fire department experience survey show that in 2009-2013, Christmas trees were the item first ignited in an estimated average of 210 reported home structure fires per year, resulting in an annual average of seven civilian fire deaths, 19 civilian fire injuries, and \$17.5 million in direct property damage.

On average, one of every 31 reported home Christmas tree fires resulted in a death, compared to an average of one death per 144 total reported home fires.

This fact sheet and accompanying table describe the common causes and circumstances of these fires. These findings identify issues that should be highlighted for Christmas tree safety.

Keywords: fire statistics, home fires, Christmas tree

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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HOME CHRISTMAS TREE FIRES FACT SHEET

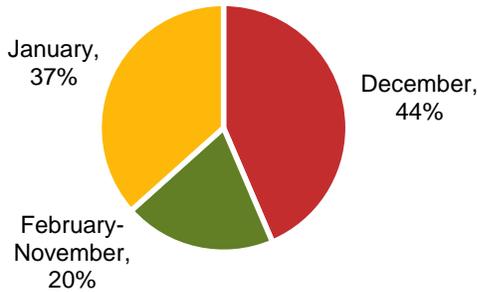
U.S. fire departments responded to an estimated average of 210 home¹ structure fires per year that began with Christmas trees in 2009-2013. These fires caused an annual average of seven civilian deaths, 19 civilian injuries, and \$17.5 million in direct property damage.

On average, one of every 31 reported home Christmas tree fires resulted in a death, compared to an average of one death per 144 total reported home fires. When these fires occur, they are much more likely to be deadly than most other fires.

Electrical failures or malfunctions were factors in 30% of Christmas tree fires.

In one-quarter (24%) of the Christmas tree fires and two-thirds (67%) of the deaths, some type of heat source, such as a candle or equipment, was too close to the tree.

Home structure fires in which Christmas trees were first ignited by month: 2009-2013



Four of every five Christmas tree fires occurred in December and January.

Almost half (44%) were in December. More than one-third (37%) were in January.

Leading causes of Christmas tree fires

Electrical distribution or lighting equipment was involved in 38% of home Christmas tree fires.

- Eighteen percent of home Christmas tree fires involved decorative lights.
- Wiring or related equipment was involved in 12%.
- Cords or plugs were involved in 5%.

Twenty-two percent of Christmas tree fires were intentional.

- Only 9% of the intentional fires occurred in December.

Nine percent of Christmas tree fires were started by someone, usually a child, playing with fire.

Candles started 8% of home Christmas tree structure fires.

Leading areas of origin

Two of every five (39%) home Christmas tree fires started in the living room, family room, or den.

Seven percent were chimney fires.

To learn more about holiday safety, see NFPA's [Winter Holiday Safety Tips](#).

¹ Homes include one- or two-family homes and apartments or other multi-family housing.

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Table 1.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Year

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions)	Direct Property Damage (in Millions (in 2013 Dollars))
1980	850	80	\$11.1	\$31.4
1981	750	72	\$7.0	\$17.9
1982	600	56	\$7.9	\$19.1
1983	590	66	\$9.8	\$22.9
1984	520	64	\$10.9	\$24.4
1985	580	72	\$13.3	\$28.8
1986	460	70	\$9.2	\$19.6
1987	550	67	\$11.2	\$23.0
1988	540	125	\$10.4	\$20.5
1989	520	102	\$14.1	\$26.5
1990	550	109	\$19.4	\$34.6
1991	500	139	\$18.0	\$30.8
1992	410	93	\$20.9	\$34.7
1993	550	119	\$33.4	\$53.9
1994	410	125	\$11.4	\$17.9
1995	430	63	\$19.1	\$29.2
1996	430	64	\$13.2	\$19.6
1997	360	24	\$10.3	\$15.0
1998	270	11	\$8.0	\$11.4
1999	380 (380)	58 (58)	\$26.9 (\$26.9)	\$37.6
2000	380 (380)	55 (55)	\$36.8 (\$36.8)	\$49.8
2001	290 (290)	0 (0)	\$20.5 (\$20.5)	\$27.0
2002	270 (270)	15 (15)	\$15.3 (\$15.3)	\$19.8
2003	210 (210)	31 (31)	\$10.4 (\$10.4)	\$13.2
2004	270 (180)	16 (16)	\$15.9 (\$15.9)	\$19.6
2005	230 (210)	42 (42)	\$12.0 (\$12.0)	\$14.3
2006	260 (150)	10 (10)	\$14.1 (\$14.1)	\$16.3
2007	280 (200)	33 (33)	\$15.0 (\$15.0)	\$16.9
2008	240 (150)	18 (18)	\$25.2 (\$25.2)	\$27.3
2009	190 (170)	30 (30)	\$17.6 (\$17.6)	\$19.1
2010	210 (160)	15 (15)	\$14.4 (\$14.4)	\$15.4
2011	250 (160)	13 (13)	\$18.7 (\$18.7)	\$19.4
2012	220 (190)	25 (25)	\$22.7 (\$22.7)	\$23.1
2013	180 (120)	14 (14)	\$14.4 (\$14.4)	\$14.4

Note: Estimates for 1999-2013 are based on data collected originally in NFIRS 5.0 only. The 1999-2013 estimates shown without parentheses are sums of the non-confined (shown in parentheses) and the confined fire (not shown) estimates. Confined fires are reported as confined to cooking vessel, chimney or flue, boiler or burner, incinerator, compactor, or trash. No injuries and very minimal property damage resulted from these confined fires. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Source: Data from NFIRS Version 4.1 (1980-1998) and Version 5.0 (1999-2013) and from NFPA survey. Inflation adjustments were based on the consumer price index.

Table 2.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Extent of Flame Damage
2009-2013 Annual Averages

Extent of Flame Damage	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	50	(24%)	0	(24%)	0	(0%)	\$0.0	(0%)
Confined to object of origin	20	(10%)	0	(10%)	1	(0%)	\$0.2	(3%)
Confined to room of origin	70	(31%)	0	(33%)	8	(0%)	\$3.7	(41%)
Confined to floor of origin	20	(8%)	1	(10%)	4	(13%)	\$1.5	(19%)
Confined to building of origin	50	(24%)	5	(24%)	6	(75%)	\$9.8	(33%)
Extended beyond building of origin	10	(3%)	1	(5%)	1	(12%)	\$2.3	(5%)
Total	210	(100%)	7	(100%)	19	(100%)	\$17.5	(100%)
Extended beyond room of origin	70	(35%)	7	(38%)	11	(100%)	\$13.6	(57%)

Note: Sums may not equal totals due to rounding errors

Source: NFIRS 5.0 and NFPA survey.

Table 3.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Factor Contributing to Ignition
2009-2013 Annual Averages

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Electrical failure or malfunction	60	(30%)	1	(16%)	7	(37%)	\$8.3	(47%)
Non-confined	60	(30%)	1	(16%)	7	(37%)	\$8.3	(47%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Heat source too close to combustibles	50	(24%)	5	(67%)	7	(35%)	\$6.4	(37%)
Non-confined	40	(21%)	5	(67%)	7	(35%)	\$6.4	(37%)
Confined	10	(3%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified misuse of material or product	20	(12%)	0	(0%)	0	(0%)	\$0.2	(1%)
Non-confined	10	(5%)	0	(0%)	0	(0%)	\$0.2	(1%)
Confined	10	(7%)	0	(0%)	0	(0%)	\$0.0	(0%)
Playing with heat source	20	(9%)	0	(0%)	3	(14%)	\$0.4	(2%)
Non-confined	10	(6%)	0	(0%)	3	(14%)	\$0.4	(2%)
Confined	10	(3%)	0	(0%)	0	(0%)	\$0.0	(0%)
Abandoned or discarded material or product	20	(8%)	0	(0%)	0	(0%)	\$0.1	(1%)
Non-confined	10	(2%)	0	(0%)	0	(0%)	\$0.1	(1%)
Confined	10	(5%)	0	(0%)	0	(0%)	\$0.0	(0%)
Outside or open fire for debris or waste disposal	10	(6%)	0	(0%)	0	(0%)	\$0.0	(0%)
Non-confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Confined	10	(5%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified factor contributed to ignition	10	(6%)	0	(0%)	0	(0%)	\$0.4	(3%)
Non-confined	10	(4%)	0	(0%)	0	(0%)	\$0.4	(3%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Mechanical failure or malfunction	10	(3%)	0	(0%)	0	(0%)	\$0.4	(2%)
Non-confined	0	(2%)	0	(0%)	0	(0%)	\$0.4	(2%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Equipment unattended	10	(3%)	0	(0%)	0	(0%)	\$0.8	(4%)
Non-confined	10	(3%)	0	(0%)	0	(0%)	\$0.8	(4%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Other known factor contributing to ignition	10	(6%)	0	(0%)	1	(3%)	\$1.9	(11%)
Non-confined	10	(6%)	0	(0%)	1	(3%)	\$1.9	(11%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Total fires	210	(100%)	7	(100%)	19	(100%)	\$17.5	(100%)
Non-confined	160	(76%)	7	(100%)	19	(100%)	\$17.5	(100%)
Confined	50	(24%)	0	(0%)	0	(0%)	\$0.0	(0%)
Total factors*	240	(113%)	7	(100%)	19	(100%)	\$20.5	(117%)
Non-confined	180	(84%)	7	(100%)	19	(100%)	\$20.5	(117%)
Confined	60	(29%)	0	(0%)	0	(0%)	\$0.0	(0%)

Table 3.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Factor Contributing to Ignition
2009-2013 Annual Averages (Continued)

* Multiple entries are allowed which can result in sums higher than totals.

Note: Sums may not equal totals due to rounding errors. Fires in which the factor contributing to ignition was coded as “none,” unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 4.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Leading Cause
2009-2013 Annual Averages

Leading Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical distribution and lighting equipment	80	(38%)	4	(64%)	10	(54%)	\$11.0	(63%)
Intentional	50	(22%)	0	(0%)	1	(6%)	\$0.5	(3%)
Heating equipment	30	(15%)	2	(36%)	0	(0%)	\$1.3	(7%)
Playing with heat source	20	(9%)	0	(0%)	3	(14%)	\$0.4	(2%)
Candles	20	(8%)	3	(41%)	0	(0%)	\$2.9	(17%)
Cooking equipment	10	(3%)	0	(0%)	2	(9%)	\$0.4	(2%)

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 5.0 and NFPA fire department experience survey.

Table 5.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Cause of Ignition
2009-2013 Annual Averages

Cause of Ignition	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	120	(57%)	4	(51%)	16	(83%)	\$12.0	(68%)
Non-confined	110	(51%)	4	(51%)	16	(83%)	\$12.0	(68%)
Confined	10	(6%)	0	(0%)	0	(0%)	\$0.0	(0%)
Intentional	50	(22%)	0	(0%)	1	(6%)	\$0.5	(3%)
Non-confined	20	(7%)	0	(0%)	1	(6%)	\$0.5	(3%)
Confined	30	(15%)	0	(0%)	0	(0%)	\$0.0	(0%)
Failure of equipment or heat source	30	(16%)	1	(12%)	2	(10%)	\$4.9	(28%)
Non-confined	30	(16%)	1	(12%)	2	(10%)	\$4.9	(28%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Act of nature	10	(3%)	0	(0%)	0	(0%)	\$0.0	(0%)
Non-confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Confined	0	(2%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified cause	0	(2%)	2	(36%)	0	(0%)	\$0.1	(0%)
Non-confined	0	(1%)	2	(36%)	0	(0%)	\$0.1	(0%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Total	210	(100%)	7	(100%)	19	(100%)	\$17.5	(100%)
Non-confined	160	(76%)	7	(100%)	19	(100%)	\$17.5	(100%)
Confined	50	(24%)	0	(0%)	0	(0%)	\$0.0	(0%)

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 6.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Equipment Involved in Ignition
2009-2013 Annual Averages

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical distribution and lighting equipment	80	(38%)	4	(64%)	10	(54%)	\$11.0	(63%)
Decorative lights	40	(18%)	2	(31%)	3	(18%)	\$3.7	(21%)
Wiring or related equipment	30	(12%)	0	(0%)	2	(9%)	\$5.6	(32%)
Cord or plug	10	(5%)	2	(33%)	5	(27%)	\$1.3	(8%)
Unclassified lamp or lighting	10	(3%)	0	(0%)	0	(0%)	\$0.4	(2%)
Other known electrical equipment	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
No equipment involved in ignition	50	(24%)	0	(0%)	4	(18%)	\$4.5	(26%)
Contained trash or rubbish fire	30	(16%)	0	(0%)	0	(0%)	\$0.0	(0%)
Heating equipment	30	(15%)	2	(36%)	0	(0%)	\$1.3	(7%)
Fireplace or chimney, including confined chimney or flue fires	20	(7%)	0	(0%)	0	(0%)	\$0.0	(0%)
Fixed or portable space heater	10	(4%)	2	(36%)	0	(0%)	\$0.4	(2%)
Other known heating equipment	10	(4%)	0	(0%)	0	(0%)	\$0.8	(5%)
Cooking equipment	10	(3%)	0	(0%)	2	(9%)	\$0.4	(2%)
Other known equipment involved in ignition	10	(5%)	0	(0%)	4	(19%)	\$0.3	(2%)
Total	210	(100%)	7	(100%)	19	(100%)	\$17.5	(100%)

*The estimates for equipment involved in ignition did not break out the confined fires further.

Note: Non-confined fires in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among fires with known equipment involved. Fires in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Non-confined fires in which the equipment was partially unclassified (i.e., unclassified kitchen or cooking equipment, unclassified heating, cooling or air condition equipment, etc.) were allocated proportionally among fires that grouping (kitchen or cooking equipment; heating, cooling or air conditioning equipment, etc.). Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 7.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Heat Source
2009-2013 Annual Averages

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Arcing	40	(19%)	1	(14%)	6	(33%)	\$4.4	(25%)
Non-confined	40	(18%)	1	(14%)	6	(33%)	\$4.4	(25%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Match	30	(13%)	0	(0%)	0	(0%)	\$0.2	(1%)
Non-confined	0	(2%)	0	(0%)	0	(0%)	\$0.2	(1%)
Confined	20	(10%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified heat from powered equipment	20	(10%)	1	(15%)	3	(13%)	\$2.1	(12%)
Non-confined	20	(9%)	1	(15%)	3	(13%)	\$2.1	(12%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Radiated or conducted heat from operating equipment	20	(9%)	2	(30%)	1	(7%)	\$2.1	(12%)
Non-confined	20	(9%)	2	(30%)	1	(7%)	\$2.1	(12%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Hot ember or ash	20	(8%)	0	(0%)	1	(3%)	\$0.6	(3%)
Non-confined	10	(4%)	0	(0%)	1	(3%)	\$0.6	(3%)
Confined	10	(5%)	0	(0%)	0	(0%)	\$0.0	(0%)
Candle	20	(8%)	3	(41%)	0	(0%)	\$2.9	(17%)
Non-confined	20	(8%)	3	(41%)	0	(0%)	\$2.9	(17%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified hot or smoldering object	10	(6%)	0	(0%)	0	(0%)	\$1.0	(6%)
Non-confined	10	(4%)	0	(0%)	0	(0%)	\$1.0	(6%)
Confined	0	(2%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified heat source	10	(6%)	0	(0%)	1	(7%)	\$1.5	(9%)
Non-confined	10	(6%)	0	(0%)	1	(7%)	\$1.5	(9%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Lighter	10	(5%)	0	(0%)	3	(18%)	\$0.3	(2%)
Non-confined	10	(4%)	0	(0%)	3	(18%)	\$0.3	(2%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Spark, ember or flame from operating equipment	10	(3%)	0	(0%)	1	(6%)	\$1.2	(7%)
Non-confined	10	(3%)	0	(0%)	1	(6%)	\$1.2	(7%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Flame or torch used for lighting	10	(3%)	0	(0%)	0	(0%)	\$0.1	(0%)
Non-confined	0	(0%)	0	(0%)	0	(0%)	\$0.1	(0%)
Confined	10	(2%)	0	(0%)	0	(0%)	\$0.0	(0%)
Other known heat source	20	(10%)	0	(0%)	2	(12%)	\$1.2	(7%)
Non-confined	20	(9%)	0	(0%)	2	(12%)	\$1.2	(7%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)

Table 7.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Heat Source
2009-2013 Annual Averages (Continued)

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Total	210	(100%)	7	(100%)	19	(100%)	\$17.5	(100%)
Non-confined	160	(76%)	7	(100%)	19	(100%)	\$17.5	(100%)
Confined	50	(24%)	0	(0%)	0	(0%)	\$0.0	(0%)

Note: Sums may not equal totals due to rounding errors. The statistics on matches, lighters, smoking materials and candles include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 8.
U.S. Home Structure Fires
in Which Christmas Trees Were the Item First Ignited, by Area of Origin
2009-2013 Annual Averages

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Living room, family room or den	80	(39%)	7	(100%)	13	(67%)	\$11.3	(64%)
Non-confined	80	(39%)	7	(100%)	13	(67%)	\$11.3	(64%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified function area	20	(8%)	0	(0%)	2	(11%)	\$1.0	(6%)
Non-confined	20	(8%)	0	(0%)	2	(11%)	\$1.0	(6%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Confined chimney or flue fire	10	(7%)	0	(0%)	0	(0%)	\$0.0	(0%)
Non-confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Confined	10	(7%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified outside area	10	(6%)	0	(0%)	0	(0%)	\$0.0	(0%)
Non-confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Confined	10	(6%)	0	(0%)	0	(0%)	\$0.0	(0%)
Dining room, bar or beverage area, or cafeteria	10	(4%)	0	(0%)	0	(0%)	\$0.3	(2%)
Non-confined	10	(4%)	0	(0%)	0	(0%)	\$0.3	(2%)
Confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified area of origin	10	(4%)	0	(0%)	0	(0%)	\$0.1	(0%)
Non-confined	0	(2%)	0	(0%)	0	(0%)	\$0.1	(0%)
Confined	0	(2%)	0	(0%)	0	(0%)	\$0.0	(0%)
Kitchen or cooking area	10	(3%)	0	(0%)	2	(8%)	\$0.4	(3%)
Non-confined	10	(3%)	0	(0%)	2	(8%)	\$0.4	(3%)
Confined	0	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Interior stairway or ramp	10	(3%)	0	(0%)	0	(0%)	\$0.0	(0%)
Non-confined	0	(0%)	0	(0%)	0	(0%)	\$0.0	(0%)
Confined	10	(2%)	0	(0%)	0	(0%)	\$0.0	(0%)
Other known area of origin	50	(26%)	0	(0%)	3	(14%)	\$4.4	(25%)
Non-confined	40	(19%)	0	(0%)	3	(14%)	\$4.4	(25%)
Confined	10	(6%)	0	(0%)	0	(0%)	\$0.0	(0%)
Total	210	(100%)	7	(100%)	19	(100%)	\$17.5	(100%)
Non-confined	160	(76%)	7	(100%)	19	(100%)	\$17.5	(100%)
Confined	50	(24%)	0	(0%)	0	(0%)	\$0.0	(0%)

* Chimney is no longer a valid area of origin for non-confined fires.

Note: Sums may not equal totals due to rounding errors. All fires with the confined chimney or flue incident type (NFIRS incident type 114) are shown separately. Chimney is no longer an area of origin choice for non-confined fires. Other confined structure fires (NFIRS incident type 113, and 115-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

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 https://www.nfirs.fema.gov/documentation/design/NFIRS_Paper_Forms_2012.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.

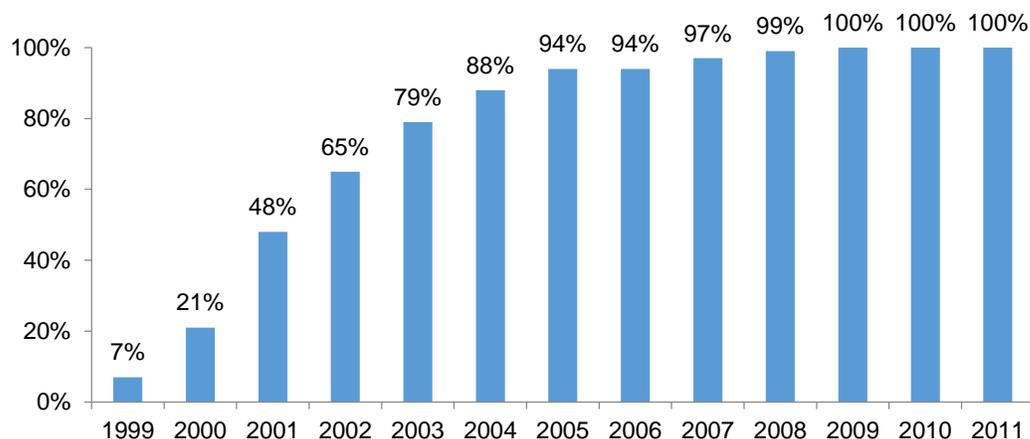
Figure A.1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

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

NFPA survey projections
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

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

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

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
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 ignition factor 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 unknown share, 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.

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.

Mobile property (vehicle) describes fires in which some type of mobile property was involved in ignition, regardless of whether the mobile property itself burned (mobile property involved codes 2 and 3).

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.