



RESEARCH

**RESIDENTIAL STRUCTURE FIRES ORIGINATING
ON OUTER WALLS, SPREADING ON EXTERIOR WALLS OR
TRIM, AND BEGINNING ON AN OUTER WALL WITH PLASTIC**

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Methodology

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 or industrial fire brigades. The 2005-2015 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 National Fire Protection Association's (NFPA's) annual fire department experience survey. Except for property use and incident type, fires with unknown or unreported data were allocated proportionally in calculations of national estimates.

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 were rounded to the nearest hundred, civilian deaths were rounded to the nearest one and injuries were rounded to the nearest 10 and direct property damage is rounded to the nearest million dollars. Totals may not equal adding each individual cell due to rounding. Additional details on the methodology may be found in Appendix A.

This analysis is based on NFIRS data reporting on incidents between 2005 and 2015. The causal and fire characteristic data comes from NFIRS 5.0 reports in the NFIRS public release file, and these are scaled to national estimates based on NFPA's annual fire experience survey.

This dataset has the following filters:

Years: 2005-2015

NFIRS Version: 5.0

Incident Type: 111 (Building Fire, Excludes Confined Fires)

Property use: 400-499

Residential

419	1- or 2-family dwelling, detached, manufactured home, mobile home not in transit, duplex.
429	Multifamily dwelling. Includes apartments, condos, townhouses, rowhouses, tenements.
439	Boarding/Rooming house. Includes residential hotels and shelters.
449	Hotel/Motel, commercial.
459	Residential board and care. Includes long-term care facilities, halfway houses, and assisted-care housing facilities. Excludes nursing facilities (311).
460	Dormitory-type residence, other.
462	Sorority house, fraternity house.
464	Barracks, dormitory. Includes nurses' quarters, military barracks, monastery/convent dormitories, bunk houses, workers' barracks.
400	Residential, other.

Mutual Aid Given or Received: Not in 3, 4, or 5 (Mutual Aid Given, Auto Aid Given, Other Aid Given, or Errors)

Geography: United States (Texas and Florida excluded)

Building Height: Between 0 and 4 stories above grade

Incidents with 'unknown' or 'missing' field data:

Area of Origin: Unknown area of origin allocated proportionally across known values.

Type of Material first Ignited: Unknown type of material first ignited allocated proportionally across known values, AND multiplied by the Area of Origin allocation factor (due to the filter for area of origin).

Item Contributing most of Flame Spread: Item Contributing Most to Flame Spread are allocated for each of Extent of Flame Spread 2-5 separately, and then multiplied by the Extent of Flame Spread allocation factor. This is based on variability in reporting this field across different sizes of fires. This field is handled this way to mitigate the effect of the high number of unknown and missing values.

The fires originating on an exterior wall and where the item contributing most to flame spread is 12 or 13 are not to be added together, as there may be duplication (a fire may begin on an outer wall AND have an item contributing most to flame spread as exterior wall covering or exterior trim).

Additional information on Methodology can be found in Appendix A.

All dollar values are nominal and not adjusted for inflation.

Table 1.
Residential Fires, Injuries, Deaths, and Property Loss, (Excluding Texas and Florida)
that Started on an Exterior Wall Surface 2005-2015

Year	Fires	Civilian Deaths	Civilian Injuries	Reported Property Loss (in Millions)
2005	7,200	6	70	\$157
2006	8,000	9	70	\$175
2007	8,200	12	100	\$246
2008	8,100	0	100	\$171
2009	6,700	4	70	\$169
2010	7,600	13	130	\$163
2011	7,300	12	90	\$186
2012	8,600	4	100	\$219
2013	7,400	10	100	\$181
2014	7,500	7	100	\$200
2015	7,700	2	90	\$197

Source: NFIRS 5.0 and NFPA's fire experience survey.

Tables 2A-2D.
Residential Fires, Injuries, Deaths, and Property Loss (Excluding Texas and Florida)
where the Item Contributing Most to Flame Spread was Exterior Sidewall Covering,
Surface, Finish. Includes Eaves or Exterior Trim, Appurtenances.
Includes Doors, Porches, and Platforms. 2005-2015

2A. Fires					
Year	Fire Confined to Room of Origin	Fire Confined to Floor of Origin	Fire Confined to Building of Origin	Fire Spread Beyond Building of Origin	Total
2005	2,400	1,100	5,900	1,600	11,000
2006	1,900	1,100	5,300	1,700	10,100
2007	1,800	1,000	6,300	2,000	11,200
2008	1,800	1,100	5,900	1,600	10,500
2009	2,200	1,200	6,200	1,600	11,200
2010	2,300	1,300	6,900	1,800	12,200
2011	2,500	1,400	6,700	1,700	12,400
2012	2,900	1,600	8,800	2,100	15,300
2013	3,000	1,600	7,500	1,700	13,800
2014	3,000	1,600	8,100	2,000	14,700
2015	3,300	1,900	8,200	2,000	15,400

Source: NFIRS 5.0 and NFPA's fire experience survey.

Note: The number of fires where the item contributing most to flame spread was either exterior wall covering or exterior trim seems to be increasing, although this could just be temporary 'noise' in the dataset or a reflection of changes in coding incidents over time. The number of fires reported with this item contributing to flame spread has increased slightly over time while many other 'known' types have gone down. Additionally, during this time the overall proportion of 'known' values for this field has decreased somewhat, increasing the proportion of 'allocated' values.

Tables 2A-2D.
Residential Fires, Injuries, Deaths, and Property Loss (Excluding Texas and Florida)
where the Item Contributing Most to Flame Spread was Exterior Sidewall Covering,
Surface, Finish. Includes Eaves or Exterior Trim, Appurtenances.
Includes Doors, Porches, and Platforms. 2005-2015 (Continued)

2B. Civilian Deaths					
Year	Fire Confined to Room of Origin	Fire Confined to Floor of Origin	Fire Confined to Building of Origin	Fire Spread Beyond Building of Origin	Total
2005	7	0	29	0	36
2006	0	0	41	7	49
2007	0	0	43	12	55
2008	5	4	17	37	64
2009	0	0	28	7	35
2010	5	0	87	7	99
2011	0	0	7	5	12
2012	0	5	13	8	25
2013	0	0	30	36	67
2014	0	0	35	27	62
2015	0	0	31	15	46

Source: NFIRS 5.0 and NFPA's fire experience survey.

2C. Civilian Injuries					
Year	Fire Confined to Room of Origin	Fire Confined to Floor of Origin	Fire Confined to Building of Origin	Fire Spread Beyond Building of Origin	Total
2005	40	20	200	50	320
2006	30	30	190	50	300
2007	10	10	140	10	180
2008	40	40	300	90	460
2009	30	50	160	30	260
2010	20	50	280	60	410
2011	30	50	180	60	320
2012	40	70	220	70	390
2013	20	40	170	50	280
2014	30	50	270	90	440
2015	40	40	260	80	430

Source: NFIRS 5.0 and NFPA's fire experience survey.

**Tables 2A-2D.
Residential Fires, Injuries, Deaths, and Property Loss (Excluding Texas and Florida)
where the Item Contributing Most to Flame Spread was Exterior Sidewall Covering,
Surface, Finish. Includes Eaves or Exterior Trim, Appurtenances.
Includes Doors, Porches, and Platforms. 2005-2015 (Continued)**

Year	2D. Property Loss (in Millions)				Total
	Fire Confined to Room of Origin	Fire Confined to Floor of Origin	Fire Confined to Building of Origin	Fire Spread Beyond Building of Origin	
2005	\$17	\$20	\$303	\$70	\$411
2006	\$17	\$19	\$234	\$110	\$381
2007	\$17	\$19	\$320	\$199	\$556
2008	\$13	\$26	\$353	\$85	\$478
2009	\$20	\$29	\$375	\$144	\$569
2010	\$18	\$25	\$315	\$135	\$493
2011	\$23	\$25	\$339	\$130	\$518
2012	\$31	\$33	\$483	\$207	\$754
2013	\$18	\$30	\$309	\$91	\$448
2014	\$20	\$27	\$458	\$197	\$701
2015	\$25	\$33	\$401	\$158	\$617

Source: NFIRS 5.0 and NFPA's fire experience survey.

**Table 3.
Residential Fires, Injuries, Deaths, and Property Loss (Excluding Texas and Florida)
that Started on an Exterior Wall Surface and the Type of Material First Ignited is Plastic: 2005-2015**

Year	Fires	Civilian Deaths	Civilian Injuries	Reported Property Loss (in Millions)
2005	1,800	0	20	\$19
2006	2,200	0	10	\$23
2007	2,400	0	20	\$25
2008	2,400	0	10	\$26
2009	1,900	0	10	\$40
2010	2,200	3	20	\$31
2011	2,100	0	20	\$27
2012	2,500	0	10	\$30
2013	2,100	0	30	\$31
2014	2,100	2	30	\$32
2015	2,400	0	20	\$44

Source: NFIRS 5.0 and NFPA's fire experience 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 through 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 <https://www.usfa.fema.gov/data/nfirs/>.

NFIRS has a wide variety of data elements and codes. 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 not possible 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. From time to time, changes are made to methodologies or groupings. *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.* Readers should use the latest report available and contact us if clarification is needed.

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 5,000 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 serving 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](#).

PROJECTING NFIRS TO NATIONAL ESTIMATES

As noted, NFIRS is a voluntary reporting 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. But there is enough reason for concern so that a second database -- the NFPA's fire experience 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's fire experience 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.

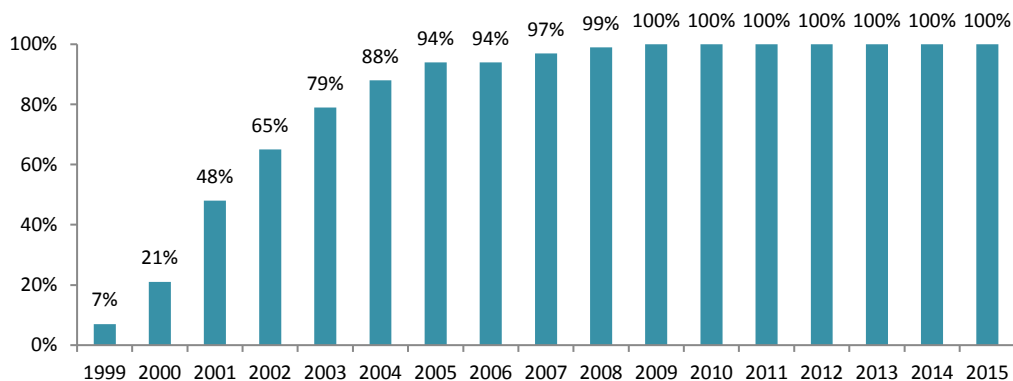
Analysts at the NFPA, the USFA and the Consumer Product Safety Commission developed the analytical rules used in analyzing data from the two data sets. ["The National Estimates Approach to U.S. Fire Statistics,"](#) by John R. Hall, Jr. and Beatrice Harwood, provides a more detailed explanation of national estimates.

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. For 2002 data on, analyses are based on scaling ratios using only data originally collected in NFIRS 5.0:

NFPA's fire experience 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.

Although causal and other detailed information is typically not required for these incidents, it is provided in some cases. Some analyses, particularly those that examine cooking equipment, heating equipment, fires caused by smoking materials, and fires started by playing with fire, may examine the confined fires in greater detail. Because the confined fire incident types describe certain scenarios, the distribution of unknown data differs from that of all fires. Consequently, allocation of unknowns must be done separately.

Some analyses of structure fires show only non-confined fires. In these tables, percentages shown are of non-confined structure fires rather than all structure fires. This approach has the advantage of showing the frequency of specific factors in fire causes, but the disadvantage of possibly overstating the percentage of factors that are seldom seen in the confined fire incident types and of understating the factors specifically associated with the confined fire incident types. Other analyses include entries for confined fire incident types in the causal tables and show percentages based on total structure fires. In these cases, the confined fire incident type is treated as a general causal factor.

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.*

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.

Inflation. Property damage estimates are not adjusted for inflation unless so indicated.