RESEARCH

Home Fires That Began With Upholstered Furniture

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Abstract

Upholstered furniture has long been the leading item first ignited in terms of home fire deaths. Based on data 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 fire department experience survey, NFPA estimates that during 2010-2014, upholstered furniture was the item first ignited in an average of 5,630 reported home structure fires per year. (Homes include one- and two-family homes, apartments or other multiple family homes, and manufactured housing.) These fires caused an estimated annual average of 440 civilian deaths, 700 civilian injuries, and $269 million in direct property damage. Overall, fires beginning with upholstered furniture accounted for 2% of reported home fires but 18% of home fire deaths. Smoking materials remain the leading cause of these fires and associated losses.

Keywords: upholstered furniture; small open flame; fires; home fires, fire causes, fire statistics; smoking materials

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.

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In 2010-2014, U.S. fire departments responded to an average of 5,630 home structure fires per year in which upholstered furniture was the first item ignited. These fires caused an annual average of 440 civilian fire deaths, 700 civilian fire injuries, and $269 million in direct property damage.

On average, one of every 13 reported upholstered furniture fires resulted in death.

Overall, fires beginning with upholstered furniture accounted for 2% of reported home fires but 18% of home fire deaths.

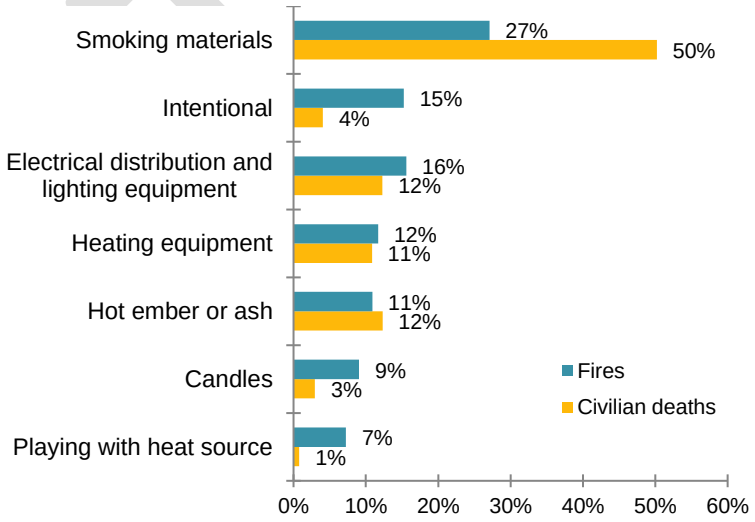
Leading Causes of Upholstered Furniture Fires: 2010-2014

Smoking materials remain the leading cause of upholstered furniture fires and losses. One of every 6.6 such fires started by smoking materials resulted in death.

Portable and fixed space heaters were involved in 11% of the upholstered furniture fires and associated deaths.

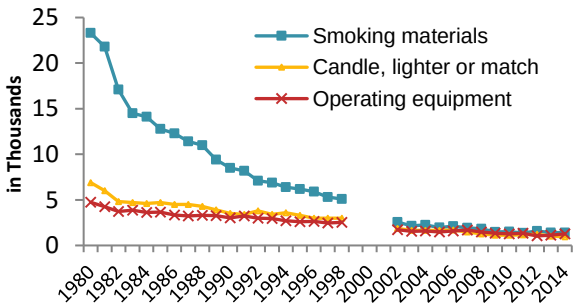
Together, candles, matches and lighters were involved in 20% of the fires and 12% of the deaths.

Electrical failures or malfunctions were factors in 14% of the home upholstered furniture fires and 12% of the deaths. These failures were in all types of electrical appliances, not just electrical distribution or lighting equipment.

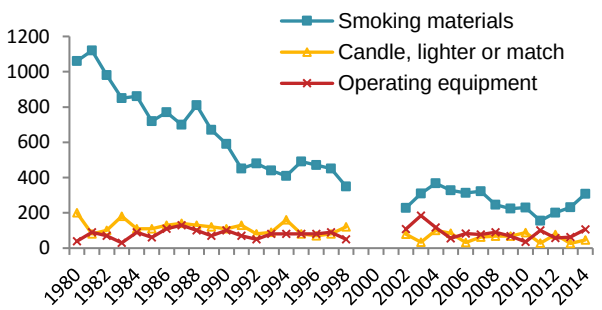


Upholstered furniture fires started by smoking materials and associated deaths fell sharply since 1980 despite an increase in deaths in the past few years. The declines in upholstered furniture fires started by candles, matches or lighters and by operating equipment were not as sharp. No clear trend was seen for upholstered furniture deaths from candles, matches and lighters or operating equipment.

Home upholstered furniture fires started by: smoking materials; candles, lighters and matches; or operating equipment; by year 1980-2014



Civilian deaths from home upholstered furniture fires started by: smoking materials; candles, lighters and matches; or operating equipment; by year 1980-2014

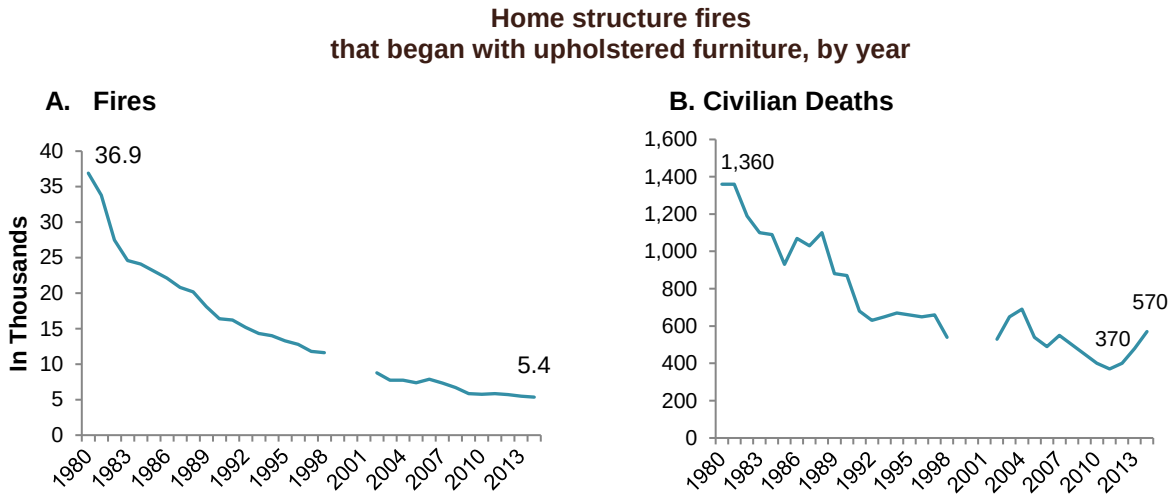


Executive Summary

During 2010-2014, U.S. fire departments responded to an average of 5,630 home structure fires per year in which upholstered furniture was the first item ignited. These fires caused an annual average of 440 civilian fire deaths, 700 civilian fire injuries, and $269 million in direct property damage. Overall, fires beginning with upholstered furniture accounted for 2% of reported home fires but 18% of home fire deaths. Upholstered furniture remains the leading item first ignited in home fire deaths. One of every 6.6 such fires started by smoking materials resulted in death.

The estimates in this analysis were derived from the detailed information collected by the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual fire department experience survey.

Upholstered furniture fires in the home environment have fallen sharply, dropping 85% from an estimated high of 36,900 in 1980, the first year of usable data, to a record low of 5,400 in 2014. Associated deaths fell 58% from highs of 1,360 in 1980 and 1981 to 570 in 2014. Upholstered furniture deaths hit their lowest point of 370 in 2011 and have increased in each of the years since then.

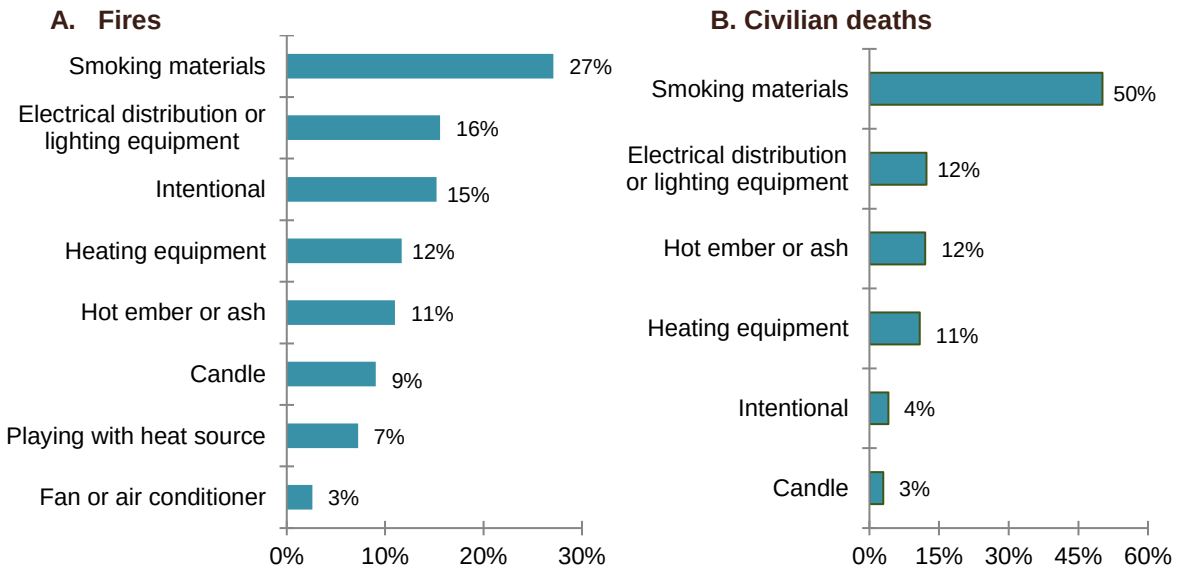


The extent of upholstered furniture's role as a secondary fuel source was estimated in NFPA's 2013 *White Paper on Upholstered Furniture Flammability*. During 2006-2010, upholstered furniture was estimated to have been the main item contributing to fire or flame spread but *not* the item first ignited in an average of 2,200 home fires per year. These fires caused an average of 130 civilian deaths, 280 civilian injuries, and $138 million in direct property damage. When combined, the deaths resulting from either primary or secondary ignitions of upholstered furniture accounted for 24% of home fire deaths during that period.

Smoking materials remain the leading heat source in upholstered furniture fires (27%). Half (50%) of the upholstered furniture fire deaths were caused by smoking materials. Electrical distribution or lighting equipment was involved in 16% of the fires and 12% of the deaths. The 15% of fires that were intentionally set caused 4% of the deaths. Heating equipment was

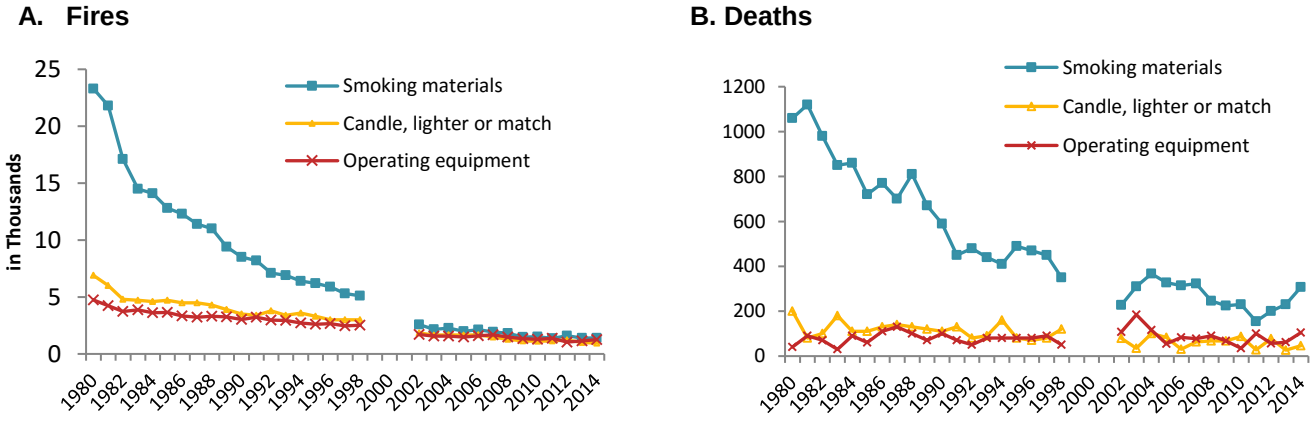
involved in 12% of these fires and 11% of the fatalities. Hot embers or ashes started 11% of the fires, resulting in 12% of the associated deaths. Candles started 9% of the fires caused 3% of the deaths.

Leading causes of home structure fires that began with upholstered furniture: 2010-2014



Flammability requirements (enacted or proposed) for upholstered furniture have focused on fires started by either cigarettes or small open flames. As the graphs above show, various types of operating equipment are also involved in a substantial share of these fires and deaths. Even though smoking materials remain the leading cause of these incidents, twelve times as many upholstered furniture fires were started by smoking materials in 1980-1984 as in 2010-2014. In 1980-1984, smoking materials started three of every five (62%) home upholstered furniture fires and four of every five (80%) deaths associated with fires starting with upholstered furniture.

Home upholstered furniture fires started by: smoking materials; candles, lighters and matches; or operating equipment by year: 1980-2014



The percentage of fires started by operating equipment increased from 14% in 1980-1984 to 23% in 2010-2014 while the percentage of deaths associated with operating equipment increased from 5% to 16%. There was little change in the percentage of upholstered furniture fires and fire deaths associated with candles, lighters, or matches.

Assessing the probable impact of any one approach to fire safety is challenging. New materials enter the marketplace. Upholstered furniture is a durable product. Newer furniture is likely to have been manufactured to current flammability standards. Over time, things get spilled on the furniture, the fabric may wear out, and the furniture may pass to a different household. It is important to remember that these statistics are based on all upholstered furniture, some of which may be very old.

Changes in the environment also complicate the issue. Homes are much more likely to have smoke alarms today than they were in 1980. This means that more fires may be discovered before fire department assistance is required. Fewer people are smoking. The Consumer Product Safety Commission (CPSC) required lighters to be child-resistant beginning in 1994, resulting in a drop in fires started by children playing. The increase in candle sales in the 1990s was accompanied by an increase in candle fires that began to fall in the early 2000s.

Home Fires Beginning with Upholstered Furniture

During 2010-2014, U.S. fire departments responded to an average of 5,630 home structure fires per year in which upholstered furniture was the first item ignited. These fires caused an annual average of 440 civilian fire deaths, 700 civilian fire injuries, and $269 million in direct property damage. On average, one of every 13 reported upholstered furniture fires resulted in death.

Upholstered furniture plays two major roles in fire scenarios. It may either be the item first ignited, or it may contribute substantially to the growth of a fire that began with the ignition of something else, such as a newspaper, pillow, blanket, or trash. This report focuses on fires beginning with upholstered furniture.

Roughly one of every six home structure fire deaths resulted from fires that began with upholstered furniture. The 5,630 fires that began with upholstered furniture accounted for an average of 2% of the 358,300 reported home structure fires, 18% of the 2,520 civilian home structure fire deaths, 6% of the 12,720 civilian fire injuries, and 4% of the $6.7 billion in home fire direct property loss per year. Although upholstered furniture was the 18th most common item first ignited in reported home fires, it was the leading item first ignited in home fire deaths.[1]

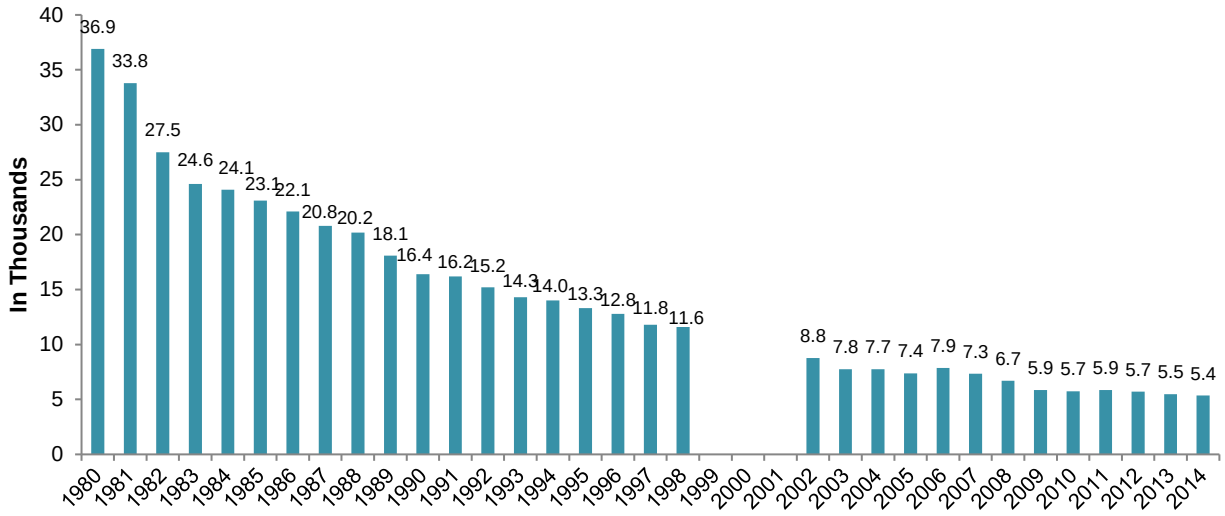
Trends

Since 1980, home upholstered furniture fires have fallen 85%. As shown in Table 1 and Figure 1, home structure fires beginning with upholstered furniture fell 85% from a high of 36,900 in 1980 to a low of 5,400 in 2014, the lowest point since 1980. This is a much larger decrease than the 50% drop seen for total home structure fires over the same period. From 2013 to 2014, upholstered furniture fires fell 2% while total home fires fell 1%.

Details collected in NFIRS 5.0 were used to derive the estimates from 1999 on. Due to the small portion of fires originally collected in NFIRS 5.0 during 1999-2001, estimates for these years are omitted from the trend graphs.

[1] Marty Ahrens. *Home Structure Fires*, Quincy, MA: NFPA 2016, p. 23.

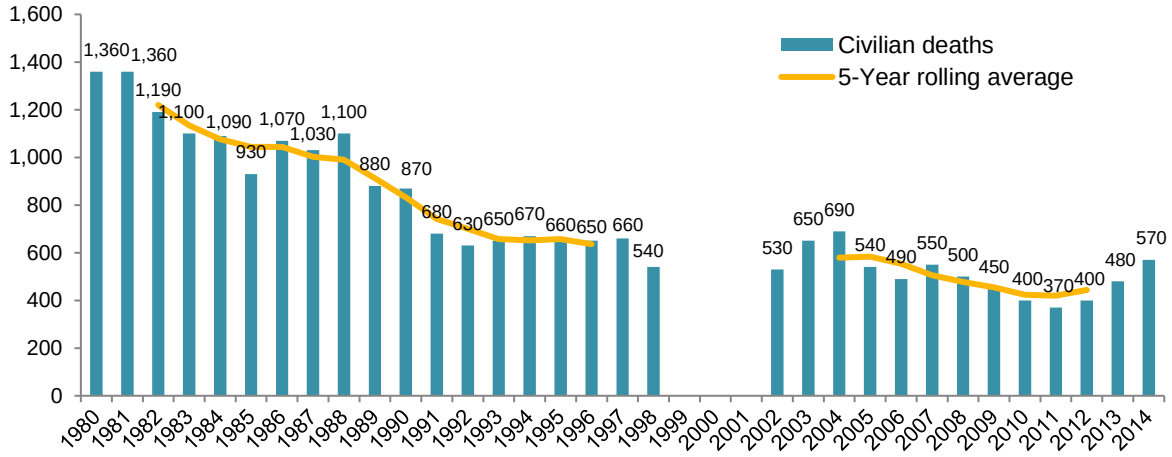
Figure 1. Home Structure Fires that Began with Upholstered Furniture, by Year



Upholstered furniture fire deaths declined sharply in the 1980s. Deaths resulting from home structure fires beginning with upholstered furniture were at their highest in 1980 and 1981, with an estimated 1,360 such deaths each year. Figure 2 shows that deaths hit a plateau in the 1990s at roughly half the 1980 and 1981 highs. Deaths fell to the lowest point of 370 in 2011. The death toll from these fires was 58% lower in 2014 than in 1980. From 2013 to 2014, upholstered furniture fire deaths increased 17%. The solid line in Figure 2 shows the five-year rolling averages, with the first point above 1982, showing the average for 1980-1984 while the last point, above 2012, shows the 2010-2014 average. Averages including the years 1999, 2000, and 2001 are not shown.

Civilian fire deaths from all home structure fires fell 47% from 1980 to 2014 and less than 1% from 2014 to 2015.

Figure 2. Civilian Fire Deaths Resulting from Home Structure Fires that Began with Upholstered Furniture, by Year



Methodology

Statistics are derived from NFIRS and NFPA's annual fire department survey. 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. 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 National Fire Protection Association's (NFPA's) annual fire department experience survey. Earlier versions of NFIRS were used to calculate estimates for 1980-1998.

Upholstered furniture was identified by NFIRS item first ignited code 21, which captures upholstered sofas, chairs, and vehicle seats.[2] Structure fires were identified by NFIRS incident types in the110-129 series and homes were identified by NFIRS property use codes 419 and 429. In the analysis that follows, fires and losses with missing or unknown data were generally allocated proportionally among fires with known data.

NFIRS 5.0 includes six categories of *confined* structure fires, identified by incident types 113-118. These include cooking fires confined to the cooking vessel, confined chimney or flue fires, confined incinerator fires, confined fuel burner or boiler fires or delayed ignitions, confined commercial compactor fires, and trash or rubbish fires in a structure with no flame damage to the structure or contents. Little more than basic dispatch data and property use is required by the NFIRS 5.0 system for these fires, although full reports are sometimes completed. Other types of structure fires are described as *non-confined fires,* regardless of the extent of flame damage. *Confined fires are included in the estimates of total upholstered furniture fires, overall trends, and extent of flame damage, but due to the small number of fires with known data, excluded from further analysis.* For more details on the methodology used, see Appendix A. Tables supporting the text are provided at the end of this analysis.

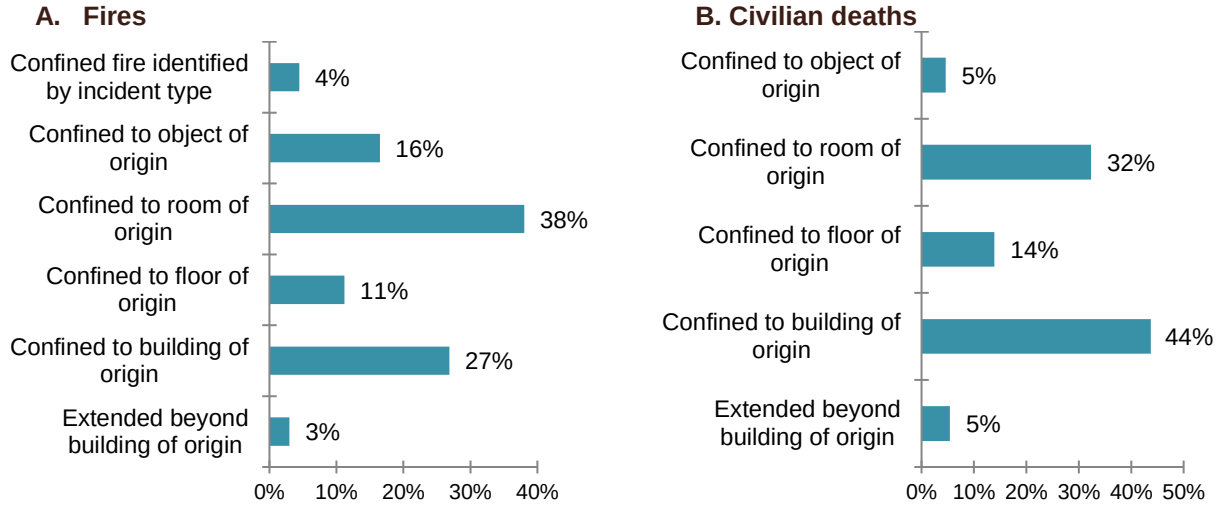
Rounding
It is important to remember that the statistics presented are estimates, not actual counts. Rounding is a reminder that the estimates are not precise. However, less rounding was sometimes needed to avoid having too many entries of zero. Property damage was always rounded to the nearest million, and except for trend tables, was not adjusted for inflation. In trend tables, fires were rounded to the nearest hundred. Fires were rounded to the nearest ten in all non-trend tables. Civilian deaths and injuries were rounded to the nearest ten in tables on upholstered furniture fires in general and on trends by different heat sources or groups of heat sources.

[2] U.S. Fire Administration National Fire Data Center. National Fire Incident Reporting System 5.0, Complete Reference Guide, January 2015, accessed February 3, 2017.

Causes and Circumstances of Home Upholstered Furniture Fires

Fire spread was limited to the room of origin in three of every five home upholstered furniture fire deaths. Figure 3 and Table 2 show that that in 59% of home structure fires that began with upholstered furniture, fire spread was confined to the object or room of origin or had an incident type indicating a confined fire. Thirty-seven percent of upholstered furniture fire deaths were caused by fires that were limited to the object or room of origin.

Figure 3. Home Structure Fires that Began with Upholstered Furniture By Extent of Fire Spread: 2010-2014



The extent of upholstered furniture's role as a secondary fuel source was estimated in NFPA's 2013 *White Paper on Upholstered Furniture Flammability*.[3] During 2006-2010, upholstered furniture was estimated to have been the main item contributing to fire or flame spread but *not* the item first ignited in an average of 2,200 home fires per year. These fires caused an average of 130 civilian deaths, 280 civilian injuries, and $138 million in direct property damage. When combined, the deaths resulting from either primary or secondary ignitions of upholstered furniture accounted for 24% of home fire deaths during that period.

Confined fires were omitted from the rest of this analysis. *Only non-confined fires were included in the analysis of fire causes and circumstances beyond trends and extent of fire spread. During 2010-2014, an average of 5,380 fires with non-confined fire incident types began with upholstered furniture per year, resulting in an average of 440 civilian deaths 700 civilian injuries, and $269 million in direct property damage. Non-confined fires accounted for 96% of reported upholstered furniture fires and 100% of the associated losses. An estimated average of 250 fires with confined fire incident types began with upholstered furniture per year, resulting in an average of three injuries and roughly $62,000 in direct property damage annually. Confined fires were omitted from the remaining analyses. See the previous box and Appendix A for more details about confined fires.*

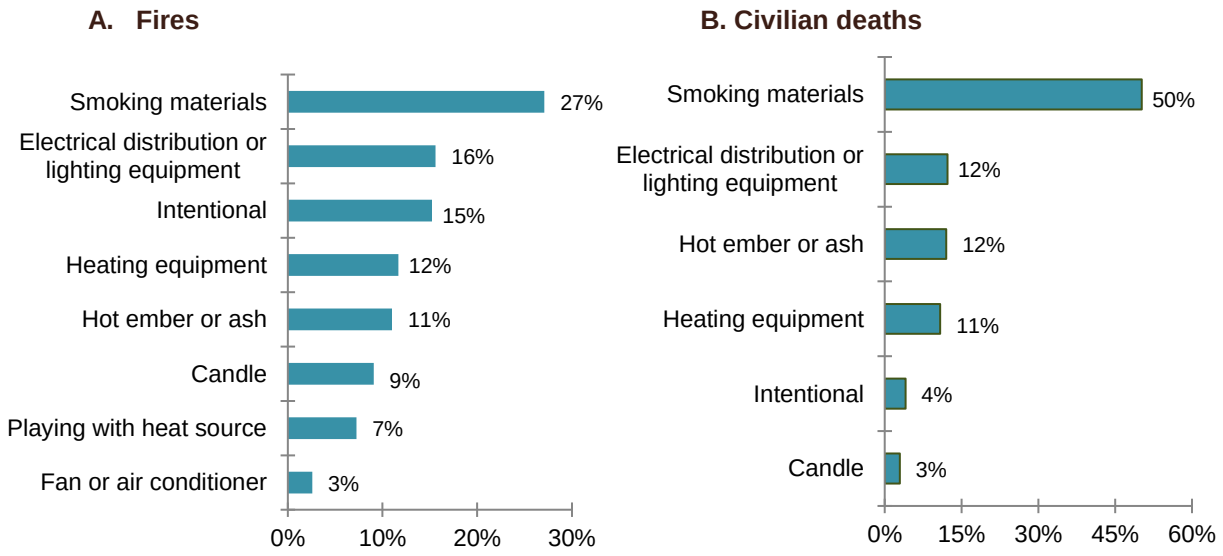
[3] National Fire Protection Association, *White Paper on Upholstered Furniture Flammability*, Quincy, MA: NFPA. p.8.

Almost two-thirds of home upholstered furniture fire deaths resulted from fires in the living room, family room, or den. Table 3 shows that 41% of these fires started in the living room, family room, or den. These fires caused 63% of the associated civilian deaths, 56% of the civilian injuries, and 45% of the direct property damage. Roughly one-fifth to one-sixth of the fires and associated losses began in an unclassified function area. The 15% that started in a bedroom caused 6% of the deaths.

Smoking materials were the leading cause of upholstered furniture fires and associated losses. Smoking materials have historically caused the largest number of upholstered furniture fires and associated losses. This was still the case in 2010-2014. Smoking materials were the heat source in an average of 1,460, or 27%, of the home structure fires that began with upholstered furniture per year. These fires resulted in an annual average of 220 (50%) civilian deaths, 240 (35%) of the civilian injuries, and $73 million (27%) in direct property damage. Smoking materials include cigarettes, cigars or pipes, and undetermined smoking material.[4] Matches and lighters are not included in this category. Trends in upholstered furniture fires started by smoking materials are examined in more detail later in this report.

Table 5 and Figure 4 show the leading causes of home structure fires that began with upholstered furniture with data summarized from several NFIRS fields. In some cases, the equipment involved in ignition is most relevant; heat source, the field "cause of ignition" (as opposed to this summary of "major causes" from multiple fields) and factor contributing to ignition also provide relevant information. The causal factors shown in this graph are not mutually exclusive when they have been pulled from different fields. When some type of equipment is shown as a cause, it means the equipment was involved in the ignition. It need not mean that the equipment was defective or malfunctioned. In many cases, the equipment was used improperly. See Appendix B for details on how the different categories were calculated.

Figure 4. Leading Causes of Home Structure Fires that Began with Upholstered Furniture: 2010-2014



[4] Estimates for smoking materials, candles, matches and lighters include a proportional source of fires and losses with heat source code 60 "heat from open flame or smoking materials, other."

Electrical distribution or lighting equipment was involved in 16% of the home upholstered furniture fires. Electrical distribution or lighting equipment was involved in an annual average of 840 (16%) reported home fires that began with upholstered furniture. These fires caused an average of 50 (12%) civilian deaths, 100 (15%) civilian injuries, and $43 million (16%) in direct property damage. Wiring or related equipment was involved in an average of 300 fires per year and 10 deaths per year. Cords and plugs were involved in an average of 240 of these fires and 30 of the associated deaths per year. Lamps, bulbs or lighting were involved in 230 such incidents per year and 20 associated deaths annually.

Fifteen percent of the home upholstered fires were intentionally set. On average, 820 (15%) of the home upholstered furniture fires were intentionally set per year. These incidents caused an average of 20 (4%) of the associated civilian deaths, 50 (7%) of the civilian injuries, and $34 million (13%) in direct property damage.

Portable or fixed space heaters were involved in 11% of the home upholstered furniture fire deaths. Some type of heating equipment was involved in an estimated average of 630 (12%) home upholstered furniture fires per year. These fires caused an average of 50 (11%) civilian deaths, 60 (9%) civilian injuries, and $32 million (12%) in direct property damage. Portable and fixed space heaters, including wood stoves, were the most common type of heating equipment involved. These heaters were involved in an annual average of 570 (11%) upholstered furniture fires. Space heaters were involved in almost all of the deaths and injuries from upholstered furniture fires started by heating equipment.

Hot embers or ashes also started 11% of these fires. Hot embers or ashes were the heat source in an average of 590 (11%) home upholstered furniture fires per year, resulting in an average of 50 (12%) civilian deaths, 80 (11%) of the civilian injuries, and $27 million (10%) in direct property damage per year. The source of these embers or ashes is not specified.

Candles started 9% of these fires. Candles were the heat source in an average of 490 (9%) home upholstered furniture fires per year, resulting in an average of 10 (3%) civilian deaths, 70 (11%) of the civilian injuries, and $28 million (10%) in direct property damage per year.

Someone playing with fire started 7% of the home upholstered furniture fires. Someone, generally a child, playing with fire or other heat source started an average of 390 (7%) home upholstered furniture fires per year. These fires caused an average of less than 10 (1%) civilian deaths, 60 (8%) civilian injuries, and $16 million (6%) in direct property damage per year. As mentioned earlier, factors from different fields overlap.

SPECIFIC CAUSAL FACTORS

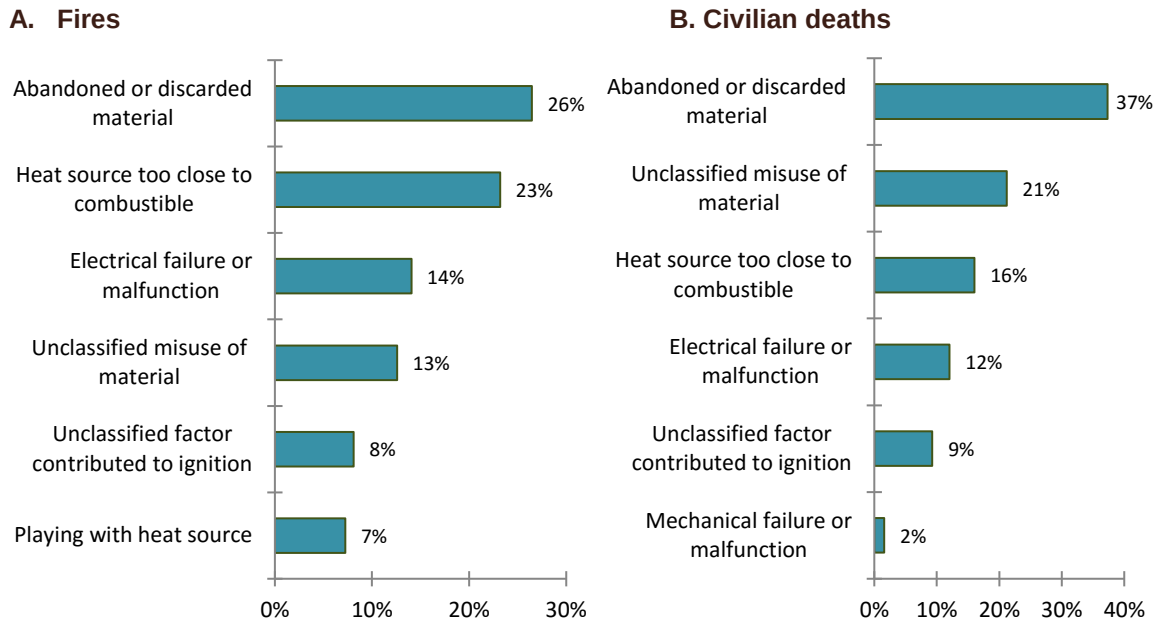
The previous discussion focused on causal factors that by themselves almost describe general scenarios. In this part of the report, results from specific NFIRS causal data elements are examined. The broad categories of cause of ignition, a field in NFIRS, are shown in Table 5. Factors contributing to ignition are shown in Table 6 and human factors contributing to ignition

are shown in Table 7. Table 8 provides more information on heat sources while more detailed information on equipment involved in ignition may be found in Table 9.

Abandoned or discarded material was the leading factor contributing to ignition. The field "factor contributing to ignition" explains how the heat source interacted with the fuel source to start a fire. Figure 5 and Table 6 show that abandoned or discarded material, the leading factor contributing to home upholstered furniture fires, contributed to one-quarter (26%) of the fires and more than one-third (37%) of the deaths.

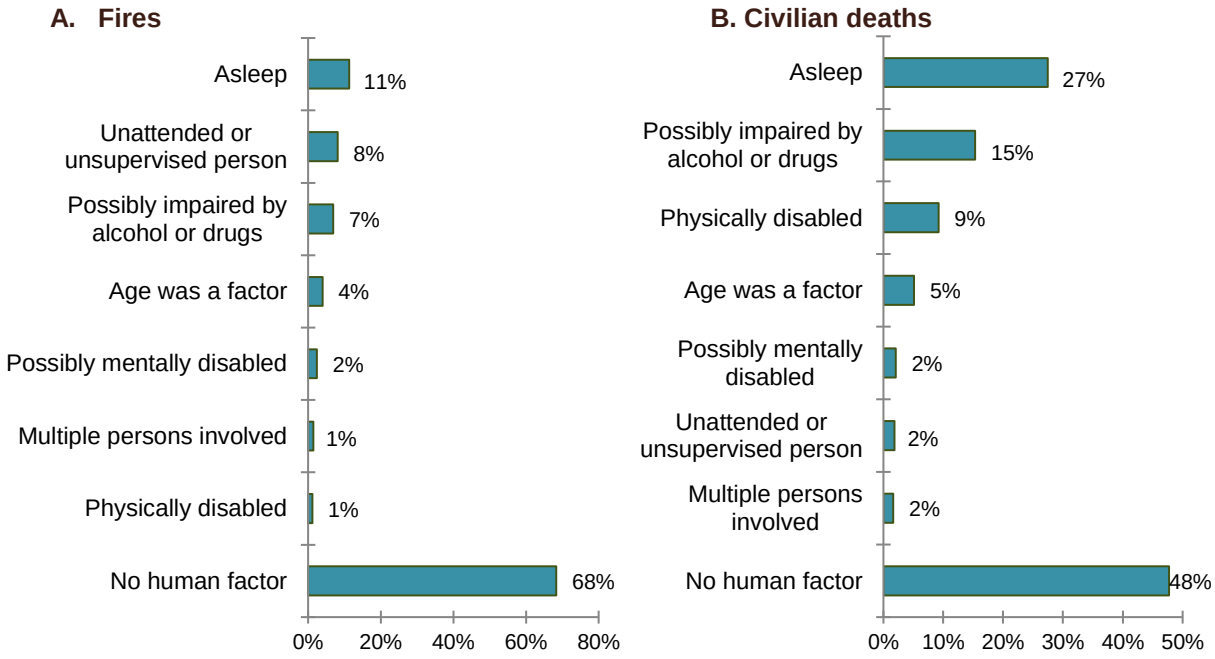
Upholstered furniture was too close to a heat source, such as a candle, lamp, or heater, in almost one-quarter (23%) of the fires and 16% of deaths. Electrical failures or malfunctions from all types of equipment powered by electricity, not just electrical distribution or lighting equipment, were factors in 14% of home structure fires that began with upholstered furniture per year as well as 12% of the associated civilian deaths.

Figure 5. Home Structure Fires that Began with Upholstered Furniture By Factor Contributing to Ignition: 2010-2014



Sleep was a factor in 11% of the upholstered furniture fires and 27% of the associated deaths. Figure 6 and Table 7 show that sleep was a human factor contributing to ignition in 11% of these fires and roughly one-quarter of the associated death and injuries. Possible impairment by alcohol or drugs was a factor in 7% of the fires and 15% of the deaths. Physical disability was a factor in 1% of the fires and 9% of the deaths.

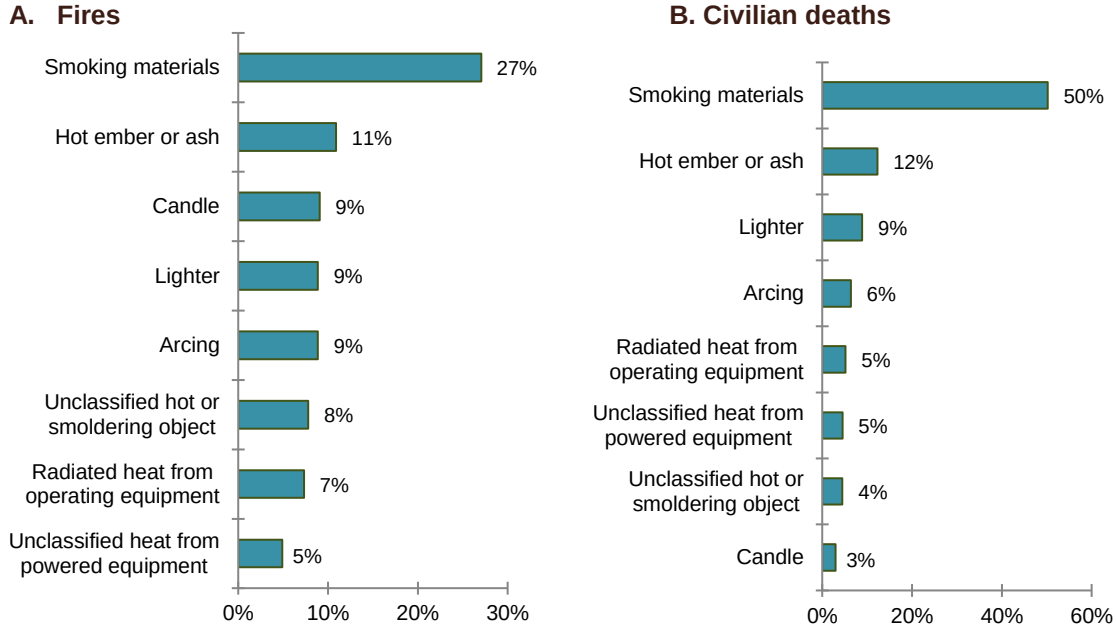
Figure 6. Home Structure Fires that Began with Upholstered Furniture by Human Factor Contributing to Ignition: 2010-2014



A wide variety of heat sources started these fires.

Figure 7 and Table 8 show that a wide variety of heat sources are involved in home upholstered furniture fires. Smoking materials, candles, and hot embers or ashes, the three leading heat sources, were discussed earlier.

Figure 7. Home Structure Fires that Began with Upholstered Furniture by Leading Heat Sources: 2010-2014



Small open flames (candles, lighters, and matches) started 20% of the fires that resulted in 12% of the deaths. Operating equipment, including: arcing equipment; radiated or conducted heat from operating equipment; spark, ember or flame from operating equipment; and unclassified heat from powered equipment; together caused 23% of the fires and 17% of the deaths. Both categories are discussed in greater detail in the next section.

Upholstered Furniture Fires Started by: Smoking Materials; Candles, Matches or Lighters; and Operating Equipment

Fires and associated losses can be prevented in a variety of ways. The furniture can be made harder to ignite or it can be modified so that if it does ignite, it does not release as much heat or toxic fumes. Heat sources can be modified to reduce the likelihood of ignition. Behavioral changes, such as limiting smoking, can reduce the likelihood that the heat source will come in contact with the furniture. Existing and proposed flammability requirements for upholstered furniture focus on fires started by either smoking materials or small open flames. This part of the analysis focuses on fire and death trends for upholstered furniture fires started by three categories of heat sources: smoking materials; candles, matches or lighters (small open flames); and operating equipment. Trends for fires and deaths, respectively, for these heat sources are shown in Tables 10 and 11.

Because the number and percentage of upholstered furniture fires started by embers or ashes has increased markedly since the introduction of NFIRS 5.0 in 1999, these have been included in the trend tables. In earlier versions of NFIRS, smoking materials were identified by form of heat of ignition 30-39 and embers or ashes were identified by form of heat of ignition 53. In Version 5.0 of NFIRS, embers or ashes are identified by heat source 43, and consequently seen before the smoking material choices of heat source 61-63. Additional information on upholstered furniture fires started by hot embers or ashes compared to and combined with smoking materials is provided in Appendix C.

Tables 12-15 show fire and associated loss trends for each of the four heat source categories.

When considering the impact of new approaches to fire safety, it is important to consider how long it will take for new requirements to be widely adopted. In a 2006 report, CPSC's Charles Smith noted that discussions with officials from the upholstered furniture industry and the Department of Commerce reported that a piece of upholstered furniture is expected to last about 16 years.[5] Note that this is an average and that some households have furniture that is much older. Second hand furniture may also be older.

As noted earlier, the 1,460 home upholstered furniture fires started by smoking materials per year resulted in an annual average of 220 deaths in 2010-2014. On average, one of every 6.6 such fires resulted in death.

[5] Charles L. Smith. *Preliminary Regulatory Analysis of a Draft Proposed Rule to Address Cigarette and Small Open Flame Ignitions of Upholstered Furniture.*, CPSC, 2005, p. 12, accessed February 2, 2017.

Candles, lighters, and matches started an estimated average of 1,090 home upholstered furniture fires annually, resulting in an average of 50 deaths per year. On average, one of every 20 such fires resulted in death.

During this period,

- Candles caused an annual average of 490 (9%) fires and 10 (3%) associated deaths;
- Lighters caused 480 (9%) fires and 40 (9%) deaths per year; and
- Matches caused an average of 130 (2%) upholstered furniture fires and less than 10 (less than 1%) deaths annually.

Table 16 shows that almost one-third (31%) of the upholstered furniture fires started by candles, lighters or matches were intentionally set. These fires caused 26% of the associated deaths and 16% of the injuries.

Table 17 shows that playing was a factor in one-third (32%) of the upholstered furniture fires started by candles, lighters or matches as well as 7% of the associated deaths and 34% of the injuries. The small open flame was too close to the furniture in 30% of these fires, 18% of the associated deaths and 36% of the injuries. An unclassified misuse of material or product was a factor in 13% of the fires, and abandoned or discarded materials or products played a role in 11%.

Operating equipment was the heat source in an average of 1,220 upholstered furniture fires per year, resulting in an average of 70 deaths annually. On average, one of every 16 such fires resulted in death. The term "operating equipment" includes four heat sources:

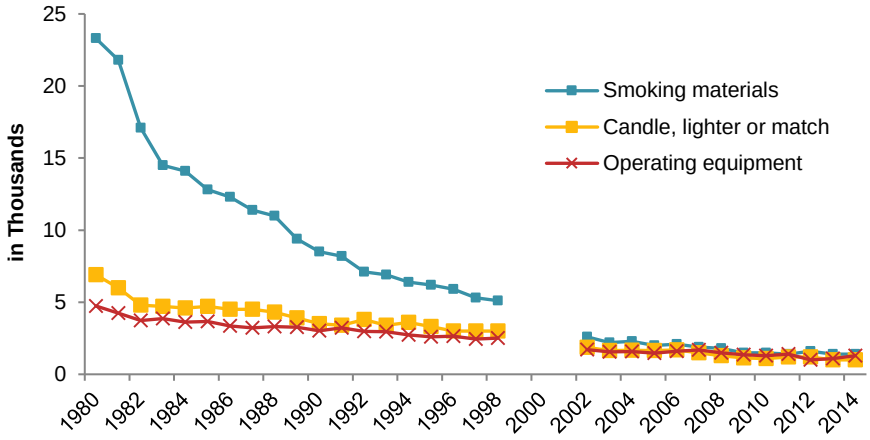
- Arcing, which caused an average of 480 (9%) fires and 30 (6%) associated deaths annually;
- Radiated or conducted heat from operating equipment, which caused an average of 390 (7%) fires per year and 20 (5%) deaths;
- Spark, ember, or flame from operating equipment, which caused an average of 80 (2%) fires per year and less than 10 associated deaths (1%); and
- Unclassified heat from powered equipment, which caused 260 (5%) fires and 20 (5%) associated deaths per year.

Twelve times as many upholstered furniture fires were started by smoking materials in 1980-1984 as in 2010-2014. Figure 9 and Table 12 show that home upholstered furniture fires started by smoking materials fell 94% from a high of 23,300 in 1980 to a low of 1,400 in 2013 and 2014. Table 10 shows that in 1980-1984, smoking materials started three of every five (62%) home upholstered furniture fires. In 2010-2014, smoking materials caused one-quarter (27%) of these fires. Several factors played a role in this decrease.

The Upholstered Furniture Action Council (UFAC) developed voluntary flammability standards to prevent cigarette ignitions of the product. Vytenis Babrauskas noted that beginning in the early 1980s, a hangtag on the product told consumers that the item was manufactured according to these standards. Babrauskas also cited a Consumer Product Safety Commission (CPSC) report noting that that 86% of the furniture being sold in the retail market by the mid-1990s met

these requirements and that there was an 85% probability that a cigarette placed on furniture from that period would not ignite it.[6]

Figure 8. Home Upholstered Furniture Fires Started by: Smoking Materials; Candles, Lighters, or Matches; and Operating Equipment; by Year



Roughly one-third of the adult population smoked in 1979. From 1990 to 2000, roughly one-quarter smoked,[7] while in 2011-2015, one in five (19%) adults were current smokers.[8]

CPSC's Charles Smith also noted that upholstered furniture coverings varied over time. Thermoplastics, such as polyester, polyolefin, and nylon, are less prone to cigarette ignition than cellulosics, such as cotton and rayon. He also noted that in 1999-2002, roughly half of the upholstered furniture in use had thermoplastic upholstery, roughly one-third had cellulosic upholstery, and 16% had leather, wool, or vinyl-coated upholstery. The limited laboratory data indicated that leather, wool, and vinyl-coated fabrics were more resistant to cigarette ignition. He cited survey data indicating that the use of ignition-resistant materials such as leather had increased to about 30% of the upholstered furniture manufactured in 2001.[9]

Home upholstered furniture fires started by candles, lighters, or matches fell 86% from a high of 6,900 in 1980 to lows of 1,000 in 2013 and 2014. See Table 13. Table 10 shows that since 1980, small open flames have generally started roughly one-fifth to one-quarter of the upholstered furniture fires. It is worth noting that home candle fires increased through the 1990s before falling in the early 2000s,[10] while fires and associated losses from children playing with

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6 Vytenis Babrauskas. "Upholstered Furniture and Mattresses," *Fire Protection Handbook®, 20th Edition*, Quincy, MA: National Fire Protection Association, 2008, Section 6, Chapter 6.

7 National Center for Health Statistics. Table 58. "Current Cigarette Smoking among Adults 18 Years of Age and Over, by Sex, Race, and Age: United States, Selected Years, 1965-2009," *Health, United States*, Hyattsville, MD. 2011. Online at https://www.cdc.gov/nchs/data/hus/2010/058.pdf, accessed February 2, 2017.

8 Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Population Health. BRFSS Prevalence & Trends Data [online]. 2015. "Adults who are current smokers in all states and the District of Columbia: accessed at http://www.cdc.gov/brfss/brfssprevalence/ on February 2, 2017.

9 Smith, 2005, p. 21.

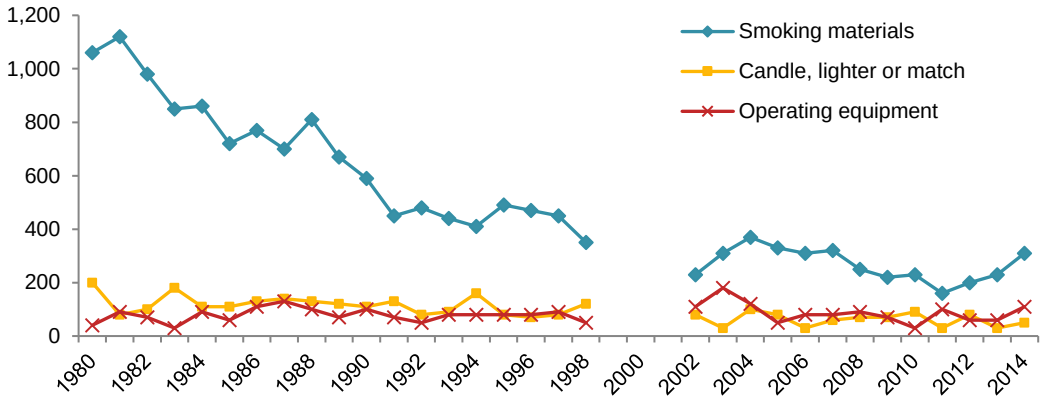
10 Marty Ahrens. *Home Candle Fires*", Quincy, MA: NFPA, 2015, p. 6.

fire declined sharply after CPSC set a mandatory standard for child-resistant lighters. Interestingly, reductions were seen in fires started by both matches and lighters in 1994.[11] CPSC developed a draft flammability standard to address small open flame ignitions of upholstered furniture in 2001 and a second draft standard to address both cigarette and small open flame ignitions. The latter is described in detail in Smith's 2006 CPSC report.[12]

Three times as many upholstered furniture fires were started by operating equipment in 1980-1984 as in 2010-2014. Table 14 shows that upholstered furniture fires started by operating equipment fell 72% from a high of 4,700 in 1980 to a low of 1,300 in 2014. Table 10 shows that in 1980 and 1981, roughly one of every eight upholstered furniture fires was started by operating equipment. This increased to roughly one in four in recent years.

In 1980-1984, four out of five (80%) of the upholstered furniture fire deaths resulted from fires started by smoking materials. This fell to 50% in 2010-2014. Figure 9 shows that the 310 deaths resulting from home upholstered furniture fires started by smoking materials in 2014 was 71% lower than the 1,060 such deaths in 1980. In both 1980-1984 and 2010-2014, 11% percent of the deaths from upholstered furniture fires were caused by fires started by candles, lighters, or matches. The portion of deaths resulting from fires started by operating equipment increased from 5% in 1980-1984 to 16% in 2010-2014.

Figure 9. Civilian Deaths Resulting from Home Upholstered Furniture Fires Started by Smoking Materials; Candles, Lighters, or Matches; and Operating Equipment; by Year



Upholstered furniture fires started by embers or ashes more than doubled from 1980-1984 while associated deaths increased fivefold. As noted earlier, the code choice for embers or ashes is earlier in the list of NFIRS heat source code choices than smoking materials, a reversal from earlier versions of NFIRS. This has been accompanied by a sharp increase in fires and deaths from embers or ashes. In 1980-1984, an average of 260 upholstered furniture fires caused an average of 10 deaths per year. In 2010-2014, and average of 590 such fires caused an average of 50 deaths per year. It is likely that some portion of embers or ashes were related to smoking materials. For more information, see Appendix C.

[11] Richard Campbell. *Playing With Fire*, Quincy, MA: NFPA, 2014, p. 11.
[12] Smith, 2006.

Additional information
Vytenis Babrauskas' chapter "Upholstered Furniture and Mattresses" in the 20th edition of NFPA's *Fire Protection Handbook* provides information on materials used in upholstered furniture, flammability standards, smoldering vs. flaming heat sources, and testing.

NFPA has two standards related to flammability testing of upholstered furniture:

* NFPA *260*, *Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture,* and

* NFPA 261, *Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes.*

For safety tip sheets on a variety of topics, go to www.nfpa.org/safetytips. For all EMAC tips, go to www.nfpa.org/emac.

Incident descriptions show how these fires can happen.
Appendix D includes a collection of previously published incident descriptions grouped by scenario. Examples are included of fires started by smoking materials, open flames, heating equipment, electrical distribution or lighting equipment, and other causes. In most of these cases, upholstered furniture was the item first ignited. In others, the fire spread to upholstered furniture. These incidents are included to show what *can* happen, not what is typical. The incidents that are included are more likely to be serious than the typical fire. However, narratives can provide more detailed information about how different heat sources actually ignite the furniture.

Table 1.
Home Structure Fires that Began with Upholstered Furniture
by Year 1980-2014

Year	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)		Adjusted Loss in Millions of 2014 Dollars
1980	36,900		1,360		2,970		$220		$633
1981	33,800		1,360		2,630		$218		$567
1982	27,500		1,190		2,530		$272		$667
1983	24,600		1,100		2,700		$200		$475
1984	24,100		1,090		2,310		$217		$494
1985	23,100		930		2,330		$225		$495
1986	22,100		1,070		2,200		$234		$506
1987	20,800		1,030		2,150		$196		$409
1988	20,200		1,100		2,290		$223		$447
1989	18,100		880		2,120		$229		$438
1990	16,400		870		2,050		$257		$466
1991	16,200		680		2,050		$290		$504
1992	15,200		630		1,660		$188		$318
1993	14,300		650		1,960		$231		$379
1994	14,000		670		1,710		$234		$374
1995	13,300		660		1,680		$239		$372
1996	12,800		650		1,610		$249		$376
1997	11,800		660		1,440		$213		$314
1998	11,600		540		1,430		$225		$327
1999	8,200	(8,200)	480	(480)	880	(880)	$217	($217)	$308
2000	9,300	(9,100)	580	(580)	1,390	(1,390)	$376	($376)	$517
2001	9,700	(9,500)	620	(620)	1,100	(1,100)	$328	($328)	$439
2002	8,800	(8,600)	530	(530)	980	(980)	$291	($291)	$384
2003	7,800	(7,500)	650	(650)	960	(960)	$295	($295)	$380
2004	7,700	(7,600)	690	(690)	810	(810)	$289	($289)	$363
2005	7,400	(7,100)	540	(540)	940	(940)	$364	($364)	$442
2006	7,900	(7,500)	490	(490)	890	(890)	$714	($714)	$839
2007	7,300	(7,000)	550	(550)	820	(810)	$366	($366)	$418
2008	6,700	(6,500)	500	(500)	960	(960)	$387	($387)	$426
2009	5,900	(5,600)	450	(450)	830	(830)	$339	($339)	$375
2010	5,700	(5,600)	400	(400)	710	(710)	$279	($279)	$304
2011	5,900	(5,600)	370	(370)	740	(740)	$298	($298)	$314
2012	5,700	(5,500)	400	(400)	700	(700)	$255	($255)	$264

Table 1.
Home Structure Fires that Began with Upholstered Furniture
by Year 1980-2014 (Continued)

Year	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)		Adjusted Loss in Millions of 2014 Dollars
2013	5,500	(5,200)	480	(480)	670	(660)	$258	($258)	$262
2014	5,400	(5,100)	570	(570)	690	(690)	$255	($255)	$255

Note: Numbers in parentheses exclude fires with confined structure fire incident types. Confined fires were first introduced in Version 5.0 of NFIRS in 1999. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Sources: Source: NFIRS and NFPA Fire Experience Survey. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 2. Home Structure Fires that Began with Upholstered Furniture by Extent of Fire Spread 2010-2014 Annual Averages

Extent of Fire Spread	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	250	(4%)	0	(0%)	0	(0%)	$0	(0%)
Confined to object of origin	930	(16%)	20	(5%)	90	(13%)	$10	(4%)
Confined to room of origin	2,140	(38%)	140	(32%)	250	(35%)	$60	(22%)
Confined to floor of origin	630	(11%)	60	(14%)	110	(16%)	$38	(14%)
Confined to building of origin	1,510	(27%)	190	(44%)	220	(31%)	$141	(52%)
Extended beyond building of origin	170	(3%)	20	(5%)	40	(5%)	$19	(7%)
Total	5,630	(100%)	440	(100%)	700	(100%)	$269	(100%)
Extended beyond room of origin	2,310	(41%)	280	(63%)	360	(52%)	$199	(74%)

Note: Sums may not equal due to rounding errors. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Confined fires were omitted from the rest of the tables in this analysis. *Only non-confined fires were included in the analysis of fire causes and circumstances beyond trends and extent of fire spread. During 2010-2014, an average of 5,380 fires with non-confined fire incident types began with upholstered furniture per year, resulting in an average of 440 civilian deaths 700 civilian injuries, and $269 million in direct property damage. Non-confined fires accounted for 96% of reported upholstered furniture fires and 100% of the associated losses. An estimated average of 250 fires with confined fire incident types began with upholstered furniture per year, resulting in an average of three injuries and roughly $62,000 in direct property damage annually. Confined fires were omitted from the remaining analyses. See the previous box and Appendix A for more details about confined fires.*

Table 3.
Home Structure Fires that Began with Upholstered Furniture
by Area of Origin
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Living room, family room, or den	2,180	(41%)	280	(63%)	390	(56%)	$120	(45%)
Unclassified function area	860	(16%)	80	(19%)	120	(17%)	$44	(17%)
Bedroom	800	(15%)	30	(6%)	80	(11%)	$31	(11%)
Exterior balcony or unenclosed porch	190	(4%)	10	(2%)	20	(2%)	$14	(5%)
Garage or vehicle storage area*	180	(3%)	0	(0%)	10	(2%)	$10	(4%)
Dining room, bar or beverage area, cafeteria	140	(3%)	10	(3%)	10	(2%)	$6	(2%)
Unclassified structural area	100	(2%)	10	(2%)	10	(1%)	$7	(3%)
Unclassified area of origin	100	(2%)	0	(1%)	10	(1%)	$5	(2%)
Courtyard, terrace, or patio	100	(2%)	0	(0%)	0	(1%)	$5	(2%)
Other known area of origin	720	(13%)	20	(4%)	40	(6%)	$28	(10%)
Total	5,380	(100%)	440	(100%)	700	(100%)	$269	(100%)

* Does not include dwelling garages coded as a separate property.

Note: Sums may not equal due to rounding errors. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 4.
Home Structure Fires that Began with Upholstered Furniture, by Major Cause
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Major Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Smoking materials	1,460	(27%)	220	(50%)	240	(35%)	$73	(27%)
Electrical distribution or lighting equipment	840	(16%)	50	(12%)	100	(15%)	$43	(16%)
Intentional	820	(15%)	20	(4%)	50	(7%)	$34	(13%)
Heating equipment	630	(12%)	50	(11%)	60	(9%)	$32	(12%)
Hot ember or ash	590	(11%)	50	(12%)	80	(11%)	$27	(10%)
Candle	490	(9%)	10	(3%)	70	(11%)	$28	(10%)
Playing with heat source	390	(7%)	0	(1%)	60	(8%)	$16	(6%)
Fan or air conditioner	140	(3%)	0	(0%)	20	(2%)	$5	(2%)
Electronic, office or entertainment equipment	110	(2%)	0	(0%)	0	(0%)	$6	(2%)

Note: The major cause table summarizes causal factors pulled from several fields. In some cases, the equipment involved in ignition is most relevant; heat source, the field "cause," and factor contributing to ignition also provide relevant information. The causes shown here are not mutually exclusive when they have been pulled from different fields. Causal factors that lack detail (such as unintentional or failure of equipment or heat source in the cause field, or heat from operating or powered equipment or arcing in the heat source field) were not included in this summary table. The causes shown are those that are well defined, account for at least 2% of the fires, and have clear prevention strategies or have historically been of interest. Sums may not equal due to rounding errors. See Appendix B for details on how these causes are calculated.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 5.
Home Structure Fires that Began with Upholstered Furniture
by Cause of Ignition
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	4,050	(75%)	400	(90%)	600	(87%)	$210	(78%)
Intentional	820	(15%)	20	(4%)	50	(7%)	$34	(13%)
Failure of equipment or heat source	440	(8%)	30	(6%)	40	(6%)	$22	(8%)
Unclassified cause	60	(1%)	0	(0%)	0	(0%)	$1	(1%)
Act of nature	10	(0%)	0	(0%)	0	(0%)	$2	(1%)
Total	5,380	(100%)	440	(100%)	700	(100%)	$269	(100%)

Note: Sums may not equal due to rounding errors. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 6.
Home Structure Fires that Began with Upholstered Furniture
by Factor Contributing to Ignition
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Abandoned or discarded material or product	1,420	(26%)	160	(37%)	200	(28%)	$75	(28%)
Heat source too close to combustibles	1,250	(23%)	70	(16%)	170	(24%)	$62	(23%)
Electrical failure or malfunction	760	(14%)	50	(12%)	70	(10%)	$43	(16%)
Unclassified misuse of material or product	680	(13%)	90	(21%)	110	(15%)	$34	(13%)
Unclassified factor contributed to ignition	440	(8%)	40	(9%)	60	(9%)	$19	(7%)
Playing with heat source	390	(7%)	0	(1%)	60	(8%)	$16	(6%)
Mechanical failure or malfunction	100	(2%)	10	(2%)	10	(2%)	$6	(2%)
Equipment unattended	100	(2%)	0	(1%)	9	(1%)	$4	(2%)
Other known factor contributing to ignition	530	(10%)	20	(5%)	50	(8%)	$26	(10%)
Total Fires	5,380	(100%)	440	(100%)	700	(100%)	$269	(100%)
Total Factors	5,660	(105%)	460	(105%)	730	(105%)	$285	(106%)

Note: Multiple entries are allowed, resulting in more factor entries than fires. Sums may not equal 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. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 7.
Home Structure Fires that Began with Upholstered Furniture
by Human Factor Contributing to Ignition
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Human Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Asleep	610	(11%)	120	(27%)	170	(24%)	$35	(13%)
Unattended or unsupervised person	440	(8%)	10	(2%)	40	(6%)	$17	(6%)
Possibly impaired by alcohol or drugs	370	(7%)	70	(15%)	100	(14%)	$20	(8%)
Age was a factor	220	(4%)	20	(5%)	50	(7%)	$12	(4%)
Possibly mentally disabled	130	(2%)	10	(2%)	30	(4%)	$9	(3%)
Multiple persons involved	80	(1%)	10	(2%)	10	(1%)	$3	(1%)
Physically disabled	60	(1%)	40	(9%)	20	(3%)	$4	(2%)
No human factor	3,680	(68%)	210	(48%)	350	(51%)	$183	(68%)
Total fires	5,380	(100%)	440	(100%)	700	(100%)	$269	(100%)
Total human factors	5,580	(104%)	490	(110%)	760	(109%)	$284	(105%)

Note: Multiple entries are allowed, resulting in more factor entries than fires. Sums may not equal due to rounding errors.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 8.
Home Structure Fires That Began with Upholstered Furniture, by Heat Source
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Smoking materials	1,460	(27%)	220	(50%)	240	(35%)	$73	(27%)
Hot ember or ash	590	(11%)	50	(12%)	80	(11%)	$27	(10%)
Candle	490	(9%)	10	(3%)	70	(11%)	$28	(10%)
Arcing	480	(9%)	30	(6%)	50	(8%)	$26	(10%)
Lighter	480	(9%)	40	(9%)	60	(9%)	$20	(8%)
Unclassified hot or smoldering object	420	(8%)	20	(4%)	40	(6%)	$19	(7%)
Radiated or conducted heat from operating equipment	390	(7%)	20	(5%)	40	(6%)	$19	(7%)
Unclassified heat from powered equipment	260	(5%)	20	(5%)	40	(5%)	$14	(5%)
Unclassified heat source	190	(4%)	10	(3%)	20	(3%)	$9	(3%)
Match	130	(2%)	0	(0%)	10	(2%)	$9	(3%)
Spark, ember or flame from operating equipment	80	(2%)	0	(1%)	10	(1%)	$4	(1%)
Other known heat source	420	(8%)	0	(1%)	30	(4%)	$21	(8%)
Total	5,380	(100%)	440	(100%)	700	(100%)	$269	(100%)

Note: Sums may not equal 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. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 9.
Home Structure Fires That Began with Upholstered Furniture, by Equipment Involved in Ignition
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
No equipment involved in ignition	3,210	(60%)	300	(68%)	450	(64%)	$164	(61%)
Electrical distribution and lighting equipment	840	(16%)	50	(12%)	100	(15%)	$43	(16%)
Wiring and related equipment	*300*	*(6%)*	*10*	*(3%)*	*30*	*(4%)*	*$16*	*(6%)*
Cord or plug	*240*	*(4%)*	*30*	*(6%)*	*50*	*(7%)*	*$10*	*(4%)*
Lamp, bulb or lighting	*230*	*(4%)*	*20*	*(3%)*	*20*	*(3%)*	*$12*	*(4%)*
Transformers and power supplies	*60*	*(1%)*	*0*	*(0%)*	*0*	*(0%)*	*$5*	*(2%)*
Heating equipment	630	(12%)	50	(11%)	60	(9%)	$32	(12%)
Fixed or portable space heater	*570*	*(11%)*	*50*	*(11%)*	*60*	*(8%)*	*$28*	*(10%)*
Other known heating equipment	*60*	*(1%)*	*0*	*(0%)*	*10*	*(1%)*	*$4*	*(1%)*
Air conditioner	90	(2%)	0	(0%)	10	(2%)	$3	(1%)
Lighter*	80	(2%)	10	(2%)	20	(2%)	$5	(2%)
Unclassified equipment involved in ignition	70	(1%)	10	(1%)	0	(1%)	$2	(1%)
Unclassified portable appliance designed to produce heat	70	(1%)	0	(1%)	20	(3%)	$5	(2%)
Computer	50	(1%)	0	(0%)	0	(0%)	$3	(1%)
Fan	50	(1%)	0	(0%)	10	(1%)	$2	(1%)
Cooking equipment	40	(1%)	10	(3%)	0	(0%)	$0	(0%)
Heating pad	30	(1%)	0	(0%)	0	(0%)	$1	(0%)
Other known equipment involved in ignition	230	(4%)	10	(2%)	20	(2%)	$9	(3%)
Total	5,380	(100%)	440	(100%)	700	(100%)	$269	(100%)

* Estimates of home upholstered furniture fires involving lighters captured under heat source (Table 8) are much higher

Note: 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. 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 due to rounding errors. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 10.
Home Structure Fires That Began with Upholstered Furniture, by Leading Heat Source and Year
(Excluding fires with confined structure fire incident types)

Year	Smoking Materials		Candle, Lighter or Match		Operating Equipment		Ember or Ash		Subtotal		Total	
1980	23,300	(63%)	6,900	(19%)	4,700	(13%)	400	(1%)	35,300	(96%)	36,900	(100%)
1981	21,800	(64%)	6,000	(18%)	4,200	(13%)	300	(1%)	32,400	(96%)	33,800	(100%)
1982	17,100	(62%)	4,800	(17%)	3,700	(14%)	200	(1%)	25,900	(94%)	27,500	(100%)
1983	14,500	(59%)	4,700	(19%)	3,900	(16%)	200	(1%)	23,300	(95%)	24,600	(100%)
1984	14,100	(59%)	4,600	(19%)	3,600	(15%)	200	(1%)	22,500	(93%)	24,100	(100%)
1985	12,800	(55%)	4,700	(20%)	3,700	(16%)	200	(1%)	21,400	(93%)	23,100	(100%)
1986	12,300	(56%)	4,500	(20%)	3,300	(15%)	300	(1%)	20,400	(92%)	22,100	(100%)
1987	11,400	(55%)	4,500	(22%)	3,200	(16%)	300	(1%)	19,400	(93%)	20,800	(100%)
1988	11,000	(54%)	4,300	(21%)	3,300	(16%)	300	(1%)	18,900	(93%)	20,200	(100%)
1989	9,400	(52%)	3,900	(22%)	3,300	(18%)	200	(1%)	16,800	(93%)	18,100	(100%)
1990	8,500	(52%)	3,500	(21%)	3,000	(18%)	200	(1%)	15,200	(93%)	16,400	(100%)
1991	8,200	(51%)	3,400	(21%)	3,200	(20%)	200	(1%)	15,000	(93%)	16,200	(100%)
1992	7,100	(47%)	3,800	(25%)	3,000	(20%)	200	(1%)	14,100	(93%)	15,200	(100%)
1993	6,900	(48%)	3,400	(24%)	2,900	(21%)	200	(1%)	13,400	(94%)	14,300	(100%)
1994	6,400	(46%)	3,600	(26%)	2,700	(19%)	200	(2%)	12,900	(92%)	14,000	(100%)
1995	6,200	(47%)	3,300	(25%)	2,600	(20%)	200	(2%)	12,300	(93%)	13,300	(100%)
1996	5,900	(46%)	3,000	(23%)	2,600	(21%)	200	(1%)	11,700	(92%)	12,800	(100%)
1997	5,300	(45%)	3,000	(25%)	2,500	(21%)	200	(1%)	10,900	(93%)	11,800	(100%)
1998	5,100	(44%)	3,000	(26%)	2,500	(22%)	200	(2%)	10,800	(93%)	11,600	(100%)
1999	*3,100*	*(38%)*	*2,500*	*(30%)*	*1,500*	*(19%)*	*400*	*(5%)*	*7,600*	*(92%)*	*8,200*	*(100%)*
2000	*3,100*	*(35%)*	*1,900*	*(21%)*	*1,600*	*(18%)*	*800*	*(9%)*	*7,500*	*(82%)*	*9,100*	*(100%)*
2001	*3,100*	*(33%)*	*2,100*	*(22%)*	*1,900*	*(20%)*	*900*	*(10%)*	*8,000*	*(84%)*	*9,500*	*(100%)*
2002	2,600	(30%)	1,900	(22%)	1,700	(20%)	900	(10%)	7,000	(82%)	8,600	(100%)
2003	2,200	(29%)	1,600	(22%)	1,600	(21%)	700	(9%)	6,100	(81%)	7,500	(100%)
2004	2,300	(30%)	1,700	(22%)	1,600	(21%)	700	(10%)	6,300	(83%)	7,600	(100%)
2005	2,000	(28%)	1,600	(23%)	1,500	(21%)	700	(10%)	5,800	(81%)	7,100	(100%)
2006	2,100	(28%)	1,700	(22%)	1,600	(21%)	800	(10%)	6,200	(82%)	7,500	(100%)
2007	1,900	(28%)	1,500	(21%)	1,700	(24%)	600	(9%)	5,800	(82%)	7,000	(100%)
2008	1,800	(28%)	1,300	(20%)	1,500	(23%)	600	(10%)	5,200	(80%)	6,500	(100%)
2009	1,500	(27%)	1,100	(20%)	1,400	(24%)	600	(10%)	4,500	(81%)	5,600	(100%)
2010	1,500	(27%)	1,100	(20%)	1,300	(23%)	600	(11%)	4,500	(81%)	5,600	(100%)
2011	1,400	(25%)	1,200	(21%)	1,400	(24%)	700	(12%)	4,500	(81%)	5,600	(100%)
2012	1,600	(29%)	1,200	(23%)	1,000	(19%)	600	(10%)	4,400	(81%)	5,500	(100%)
2013	1,400	(27%)	1,000	(19%)	1,100	(22%)	500	(10%)	4,100	(79%)	5,200	(100%)
2014	1,400	(27%)	1,000	(19%)	1,300	(24%)	600	(11%)	4,200	(82%)	5,100	(100%)

Table 10.
Home Structure Fires That Began with Upholstered Furniture, by Leading Heat Source and Year
(Excluding fires with confined structure fire incident types) (Continued)

Year	Smoking Materials		Candle, Lighter or Match		Operating Equipment		Ember or Ash		Subtotal		Total	
1980-1984 Annual averages	18,160	(62%)	5,400	(18%)	4,020	(14%)	260	(1%)	27,880	(95%)	29,380	(100%)
2010-2014 Annual averages	1,460	(27%)	1,090	(20%)	1,220	(23%)	590	(11%)	4,360	(81%)	5,380	(100%)
Change from 1980-1984 to 2010-2014	-16,700	(-92%)	-4,310	(-80%)	-2,800	(-70%)	330	(127%)	-23,520	(-84%)	-24,000	(-82%)

Note: Sums may not equal due to rounding errors. The statistics on smoking materials and candles, lighters, or matches include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. The category "operating equipment" includes fires with four heat sources: arcing; radiated or conducted heat from operating equipment; spark, ember or flame from operating equipment; and unclassified heat from operating equipment. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution. The subtotal column shows the sum of the fires started by: smoking materials; candles, lighters or matches; operating equipment; and ember or ash. Fires with confined fire incident types were excluded from the totals and percent calculation.

Source: NFIRS and NFPA Fire Experience Survey.

Table 11.
Home Structure Fire Deaths That Began with Upholstered Furniture, by Leading Heat Source and Year
(Excluding fires with confined structure fire incident types)

Year	Smoking Materials		Candle, Lighter or Match		Operating Equipment		Ember or Ash		Subtotal		Total	
1980	1,060	(78%)	200	(15%)	39	(3%)	0	(0%)	1,300	(96%)	1,360	(100%)
1981	1,120	(82%)	80	(6%)	91	(7%)	30	(2%)	1,320	(97%)	1,360	(100%)
1982	980	(82%)	100	(8%)	66	(6%)	10	(1%)	1,160	(97%)	1,190	(100%)
1983	850	(77%)	180	(16%)	33	(3%)	0	(0%)	1,060	(97%)	1,100	(100%)
1984	860	(79%)	110	(10%)	95	(9%)	20	(2%)	1,080	(99%)	1,090	(100%)
1985	720	(77%)	110	(12%)	62	(7%)	0	(0%)	890	(96%)	930	(100%)
1986	770	(72%)	130	(12%)	107	(10%)	0	(0%)	1,010	(94%)	1,070	(100%)
1987	700	(68%)	140	(14%)	128	(12%)	20	(2%)	990	(96%)	1,030	(100%)
1988	810	(74%)	130	(12%)	100	(9%)	10	(1%)	1,050	(96%)	1,100	(100%)
1989	670	(76%)	120	(14%)	68	(8%)	0	(0%)	860	(98%)	880	(100%)
1990	590	(68%)	110	(13%)	103	(12%)	0	(0%)	810	(93%)	870	(100%)
1991	450	(66%)	130	(19%)	66	(10%)	0	(0%)	650	(95%)	680	(100%)
1992	480	(76%)	80	(13%)	49	(8%)	0	(1%)	610	(97%)	630	(100%)
1993	440	(68%)	90	(14%)	84	(13%)	10	(2%)	630	(96%)	650	(100%)
1994	410	(61%)	160	(24%)	84	(13%)	10	(2%)	670	(100%)	670	(100%)
1995	490	(74%)	80	(12%)	82	(12%)	0	(0%)	650	(99%)	660	(100%)
1996	470	(72%)	70	(11%)	82	(13%)	0	(0%)	620	(96%)	650	(100%)
1997	450	(68%)	80	(12%)	92	(14%)	10	(2%)	630	(96%)	660	(100%)
1998	350	(65%)	120	(22%)	46	(9%)	10	(1%)	520	(97%)	540	(100%)
1999	*360*	*(75%)*	*0*	*(0%)*	*60*	*(13%)*	*60*	*(13%)*	*480*	*(100%)*	*480*	*(100%)*
2000	*330*	*(58%)*	*40*	*(7%)*	*140*	*(24%)*	*30*	*(6%)*	*540*	*(94%)*	*580*	*(100%)*
2001	*380*	*(62%)*	*90*	*(15%)*	*130*	*(21%)*	*0*	*(0%)*	*600*	*(97%)*	*620*	*(100%)*
2002	230	(43%)	80	(15%)	110	(20%)	50	(10%)	470	(88%)	530	(100%)
2003	310	(47%)	30	(5%)	180	(28%)	20	(3%)	550	(83%)	650	(100%)
2004	370	(53%)	100	(14%)	120	(17%)	30	(4%)	620	(89%)	690	(100%)
2005	330	(61%)	80	(16%)	50	(10%)	30	(6%)	500	(93%)	540	(100%)
2006	310	(64%)	30	(6%)	80	(17%)	20	(5%)	450	(92%)	490	(100%)
2007	320	(59%)	60	(12%)	80	(14%)	30	(5%)	490	(89%)	550	(100%)
2008	250	(50%)	70	(14%)	90	(18%)	30	(7%)	440	(89%)	500	(100%)
2009	220	(49%)	70	(15%)	70	(15%)	60	(12%)	420	(92%)	450	(100%)
2010	230	(57%)	90	(22%)	30	(9%)	40	(10%)	390	(97%)	400	(100%)
2011	160	(42%)	30	(8%)	100	(28%)	50	(13%)	330	(91%)	370	(100%)
2012	200	(50%)	80	(19%)	60	(14%)	70	(17%)	400	(100%)	400	(100%)
2013	230	(48%)	30	(6%)	60	(13%)	50	(10%)	370	(76%)	480	(100%)
2014	310	(54%)	50	(8%)	110	(19%)	70	(12%)	530	(93%)	570	(100%)

Table 11.
Home Structure Fire Deaths That Began with Upholstered Furniture, by Leading Heat Source and Year
(Excluding fires with confined structure fire incident types) (Continued)

Year	Smoking Materials		Candle, Lighter or Match		Operating Equipment		Ember or Ash		Subtotal		Total	
1980-1984 Annual averages	970	(80%)	130	(11%)	60	(5%)	10	(1%)	1,180	(97%)	1,220	(100%)
2010-2014 Annual averages	220	(50%)	50	(11%)	70	(16%)	50	(11%)	390	(89%)	440	(100%)
Change from 1980-1984 to 2010-2014	-750	(-77%)	-80	(-62%)	10	(17%)	40	(400%)	-790	(-67%)	-780	(-64%)

Note: Sums may not equal due to rounding errors. The statistics on smoking materials and candles, lighters, or matches include a proportional share of fire deaths in which the heat source was heat from an unclassified open flame or smoking material. The category "operating equipment" includes deaths from fires with four heat sources: arcing; radiated or conducted heat from operating equipment; spark, ember or flame from operating equipment; and unclassified heat from operating equipment. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution. The subtotal column shows the sum of the deaths from fires started by: smoking materials; candles, lighters or matches; operating equipment; and ember or ash.

Source: NFIRS and NFPA Fire Experience Survey.

Table 12.
Home Upholstered Furniture Fires Started by Smoking Materials, by Year
(Excluding fires with confined structure fire incident types)

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	
				As Reported	In 2014 Dollars
1980	23,300	1,060	2,050	$127	$366
1981	21,800	1,120	1,890	$136	$354
1982	17,100	980	1,710	$187	$459
1983	14,500	850	1,800	$110	$261
1984	14,100	860	1,480	$124	$282
1985	12,800	720	1,470	$122	$268
1986	12,300	770	1,320	$120	$260
1987	11,400	700	1,370	$100	$209
1988	11,000	810	1,420	$114	$229
1989	9,400	670	1,170	$112	$214
1990	8,500	590	1,220	$141	$256
1991	8,200	450	1,140	$131	$228
1992	7,100	480	850	$74	$125
1993	6,900	440	1,060	$107	$175
1994	6,400	410	920	$103	$165
1995	6,200	490	860	$109	$169
1996	5,900	470	920	$95	$144
1997	5,300	450	740	$90	$133
1998	5,100	350	750	$89	$129
1999	3,100	360	190	$96	$136
2000	3,100	330	500	$127	$174
2001	3,100	380	480	$128	$171
2002	2,600	230	280	$72	$95
2003	2,200	310	390	$77	$100
2004	2,300	370	300	$79	$99
2005	2,000	330	360	$112	$136
2006	2,100	310	350	$95	$111
2007	1,900	320	330	$117	$133
2008	1,800	250	320	$119	$131
2009	1,500	220	310	$90	$99
2010	1,500	230	270	$77	$84
2011	1,400	160	230	$74	$78
2012	1,600	200	240	$82	$84
2013	1,400	230	250	$65	$66
2014	1,400	310	250	$69	$69

Note: The statistics include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Sources: Source: NFIRS and NFPA Fire Experience Survey. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 13.
Home Upholstered Furniture Fires Started by Candles, Lighters, or Matches, by Year
(Excluding fires with confined structure fire incident types)

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	
				As Reported	In 2014 Dollars
1980	6,900	200	570	$36	$104
1981	6,000	80	460	$35	$91
1982	4,800	100	430	$29	$71
1983	4,700	180	500	$36	$86
1984	4,600	110	480	$39	$89
1985	4,700	110	450	$44	$97
1986	4,500	130	500	$47	$102
1987	4,500	140	450	$45	$94
1988	4,300	130	430	$43	$86
1989	3,900	120	480	$46	$88
1990	3,500	110	520	$48	$87
1991	3,400	130	560	$63	$110
1992	3,800	80	480	$43	$73
1993	3,400	90	470	$53	$87
1994	3,600	160	510	$64	$102
1995	3,300	80	460	$59	$92
1996	3,000	70	390	$58	$88
1997	3,000	80	520	$63	$93
1998	3,000	120	390	$59	$86
1999	2,500	0	630	$68	$96
2000	1,900	40	470	$92	$127
2001	2,100	90	290	$81	$108
2002	1,900	80	330	$75	$99
2003	1,600	30	220	$71	$92
2004	1,700	100	210	$75	$95
2005	1,600	80	240	$95	$115
2006	1,700	30	240	$83	$97
2007	1,500	60	220	$59	$67
2008	1,300	70	280	$80	$88
2009	1,100	70	200	$65	$72
2010	1,100	90	160	$58	$63
2011	1,200	30	220	$59	$62
2012	1,200	80	160	$60	$62
2013	1,000	30	90	$60	$61
2014	1,000	50	100	$50	$50

Note: The statistics include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Sources: NFIRS and NFPA Fire Experience Survey. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 14.
Home Upholstered Furniture Fires Started by Operating Equipment, by Year
(Excluding fires with confined structure fire incident types)

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	
				As Reported	In 2014 Dollars
1980	4,700	40	280	$46	$132
1981	4,200	90	240	$36	$94
1982	3,700	70	300	$35	$86
1983	3,900	30	320	$39	$93
1984	3,600	90	270	$39	$89
1985	3,700	60	270	$41	$90
1986	3,300	110	240	$49	$106
1987	3,200	130	270	$39	$81
1988	3,300	100	240	$48	$96
1989	3,300	70	320	$50	$96
1990	3,000	100	180	$46	$83
1991	3,200	70	260	$76	$132
1992	3,000	50	260	$58	$98
1993	2,900	80	360	$50	$82
1994	2,700	80	200	$48	$77
1995	2,600	80	240	$54	$84
1996	2,600	80	210	$65	$98
1997	2,500	90	160	$42	$62
1998	2,500	50	210	$57	$83
1999	1,500	60	0	$30	$42
2000	1,600	140	100	$59	$81
2001	1,900	130	150	$68	$91
2002	1,700	110	100	$66	$87
2003	1,600	180	130	$74	$96
2004	1,600	120	140	$63	$79
2005	1,500	50	160	$74	$90
2006	1,600	80	150	$65	$77
2007	1,700	80	130	$91	$104
2008	1,500	90	110	$103	$114
2009	1,400	70	190	$85	$93
2010	1,300	30	130	$70	$77
2011	1,400	100	150	$72	$76
2012	1,000	60	100	$48	$49
2013	1,100	60	120	$56	$56
2014	1,300	110	170	$66	$66

Note: The category "operating equipment" includes fires with four heat sources: arcing; radiated or conducted heat from operating equipment; spark, ember, or flame from operating equipment; and unclassified heat from operating equipment. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Sources: NFIRS and NFPA Fire Experience Survey. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 15.
Home Upholstered Furniture Fires Started by Hot Embers or Ashes, by Year
(Excluding fires with confined structure fire incident types)

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	
				As Reported	In 2014 Dollars
1980	400	0	30	$2	$6
1981	300	30	10	$2	$5
1982	200	10	10	$6	$15
1983	200	0	30	$3	$7
1984	200	20	10	$1	$2
1985	200	0	0	$2	$4
1986	300	0	20	$2	$4
1987	300	20	20	$3	$6
1988	300	10	70	$2	$4
1989	200	0	80	$3	$6
1990	200	0	30	$3	$5
1991	200	0	30	$3	$5
1992	200	0	20	$3	$5
1993	200	10	20	$2	$3
1994	200	10	10	$2	$3
1995	200	0	30	$3	$5
1996	200	0	20	$3	$5
1997	200	10	0	$3	$4
1998	200	10	20	$3	$4
1999	400	60	60	$5	$8
2000	800	30	160	$18	$24
2001	900	0	80	$14	$18
2002	900	50	80	$24	$31
2003	700	20	120	$20	$26
2004	700	30	70	$19	$24
2005	700	30	100	$26	$32
2006	800	20	80	$20	$23
2007	600	30	60	$35	$39
2008	600	30	140	$20	$22
2009	600	60	60	$48	$53
2010	600	40	60	$27	$29
2011	700	50	50	$34	$36
2012	600	70	100	$22	$22
2013	500	50	90	$27	$27
2014	600	70	90	$23	$23

Note: Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Sources: NFIRS and NFPA Fire Experience Survey. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 16.
Home Upholstered Furniture Fires Started by Candles, Lighters, or Matches
by Cause of Ignition
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	740	(67%)	40	(74%)	122	(82%)	$40	(71%)
Intentional	340	(31%)	14	(26%)	24	(16%)	$16	(27%)
Unclassified cause of ignition	10	(1%)	0	(0%)	2	(1%)	$1	(1%)
Failure of equipment or heat source	10	(1%)	0	(0%)	2	(1%)	$1	(1%)
Act of nature	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Total	1,090	(100%)	54	(100%)	150	(100%)	$57	(100%)

Note: Sums may not equal due to rounding errors. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA Fire Experience Survey.

Table 17.
Home Upholstered Furniture Fires Started by Candles, Lighters, or Matches
by Factor Contributing to Ignition
2010-2014 Annual Averages
(Excluding fires with confined structure fire incident types)

Factor Contributing to Ignition	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Playing with heat source	350	(32%)	4	(7%)	50	(34%)	$17	(30%)
Heat source too close to combustibles.	330	(30%)	10	(18%)	54	(36%)	$18	(31%)
Unclassified misuse of material or product	140	(13%)	21	(39%)	14	(9%)	$9	(15%)
Abandoned or discarded material	120	(11%)	10	(18%)	12	(8%)	$5	(9%)
Unclassified factor	70	(7%)	3	(6%)	11	(7%)	$2	(8%)
Collision, knock down or overturn	30	(2%)	0	(0%)	3	(2%)	$1	(3%)
Equipment unattended	20	(2%)	3	(6%)	2	(1%)	$1	(1%)
Flammable liquid used to kindle fire	20	(2%)	3	(6%)	1	(1%)	$4	(1%)
Other known factor	60	(5%)	0	(0%)	8	(5%)	$0	(7%)
Total fires	1,090	(100%)	54	(100%)	150	(100%)	$57	(100%)
Total factors	1,130	(104%)	51	(100%)	155	(104%)	$60	(104%)

Note: Multiple entries are allowed, resulting in more factor entries than fires Sums may not equal 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. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS 5.0 and NFPA 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 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.

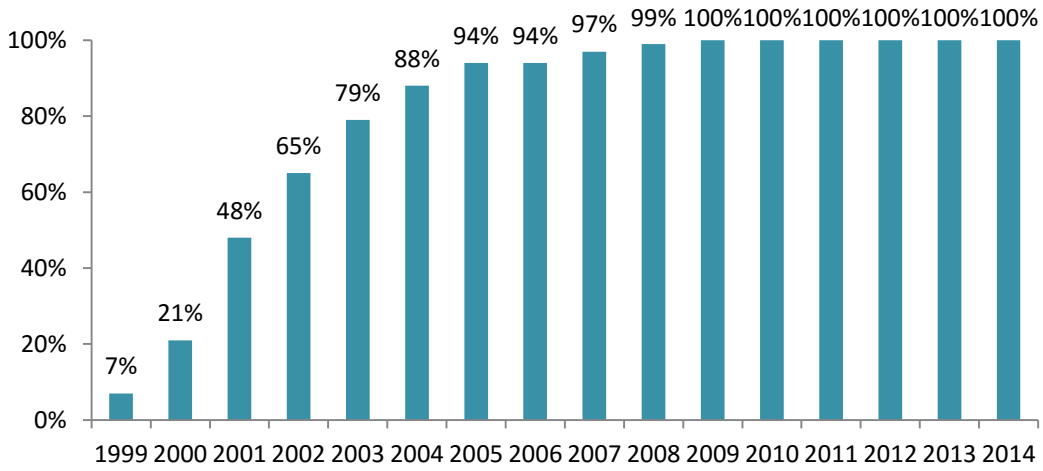
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific 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.

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



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.

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. 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.

Fires with unknown data are allocated proportionally.
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.

Estimates of upholstered furniture fires were created using scaling ratios and allocation of unknowns or missing data.
Over the five-year period of 2010-2014, a *total* of 12,118 raw non-confined home structure fires that began with upholstered furniture were reported to NFIRS 5.0. These fires resulted in raw totals of 481 civilian deaths, 1,330 civilian injuries, and $390 million in direct property damage. These totals were multiplied by

a) the residential scaling ratios derived from NFPA fire experience survey totals divided by NFIRS totals, and then
b) total non-confined home structure fires divided by the total such fires with known item first ignited,

to obtain estimated five-year averages of 5,630 home upholstered furniture fires per year, resulting in average of 440 civilian deaths, 700 civilian injuries and $270 million in direct property damage annually.

The same procedures were applied to confined fires. During 2010-2014, 142 confined upholstered furniture fires were reported to the raw NFIRS database per year, resulting in no deaths, three civilian injuries, and $54,000 direct property damage. With unknowns and missing data allocated proportionally and scaling from the NFPA fire experience survey, confined upholstered furniture fires averaged 250 per year with minimal associated losses. These confined fires were included in trend estimates and extent of fire spread. but excluded from all further analyses.

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. The cause of ignition was known in 71% of the non-confined upholstered furniture fires, 61% of the civilian deaths, 70% of the civilian injuries, and 69% of the direct property damage.

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. Factor contributing to ignition was unknown or not reported in 42% of the non-confined upholstered furniture fires, 45% of the civilian deaths, 39% of the civilian injuries, and 43% of the direct property damage.

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:

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. Heat source code 60 was used with 5% of the non-confined upholstered furniture fires, 6% of the deaths and injuries, and 7% of the direct property damage. The heat source was completely unknown or not reported in 27% of the non-confined upholstered furniture fires, 28% of the civilian deaths, 21% of the civilian injuries, and 20% of the direct property damage.

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

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

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)
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

The equipment involved in ignition was known in 32% of the non-confined upholstered furniture fires, 33% of the civilian deaths, 37% of the civilian injuries, and 33% of the direct property damage.

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. The area of origin was known in 99% or more of the non-confined upholstered furniture fires and associated losses.

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 in 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 in 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.

Appendix C:
Home Upholstered Furniture Fires Started by Hot Embers or Ashes

Frequency of fires started by hot embers or ashes increased in NFIRS 5.0.
During 2010-2014, hot embers or ashes started an average of 590 (11%) home upholstered furniture fires per year, causing an average of 54 (12%) deaths annually. On average, one of every 11 such fires resulted in death. The *NFIRS 5.0 Complete Reference Guide* notes that the category of hot ember or ash includes hot coals, coke and charcoal as well as sparks or embers from a chimney that ignite the roof of the same structure. It excludes flying brands, embers, sand sparks, and embers accidentally escaping from operating equipment. Unfortunately, we do not know the source of these sparks or embers.

In earlier versions of NFIRS, cigarettes and other smoking materials (form of heat of ignition 30-39) occurred in the code choice list before embers or ashes (form of heat of ignition 53). Through most of the 1980s and 1990s, hot embers or ashes started 1-2% of the home upholstered furniture fires and were the heat source in 0-2% of the associated deaths. These percentages increased at about the same time that NFIRS 5.0 was adopted. In NFIRS 5.0, hot ember or ash is heat source 43 while smoking materials are captured by heat source 61-63.

It is possible that some portion of the embers or ashes in these fires were from smoking materials, whether directly off a cigarette or coming from an ashtray, wastebasket or related receptacle. Figure A.C-1 and A.C.-2 show the trend for home upholstered furniture fires started by embers or ashes and associated deaths. Table A.C.-1 and A.C.-2 show fire and death trends for upholstered furniture fires started by a) smoking materials and b) embers or ashes. The totals in both tables represent the sum of the two categories. The percentages are the percent of the upholstered furniture fires started by these heat sources.

Figure A.C.-1 Home Structure Fires Started by Embers or Ashes, by Year: 1980-2014

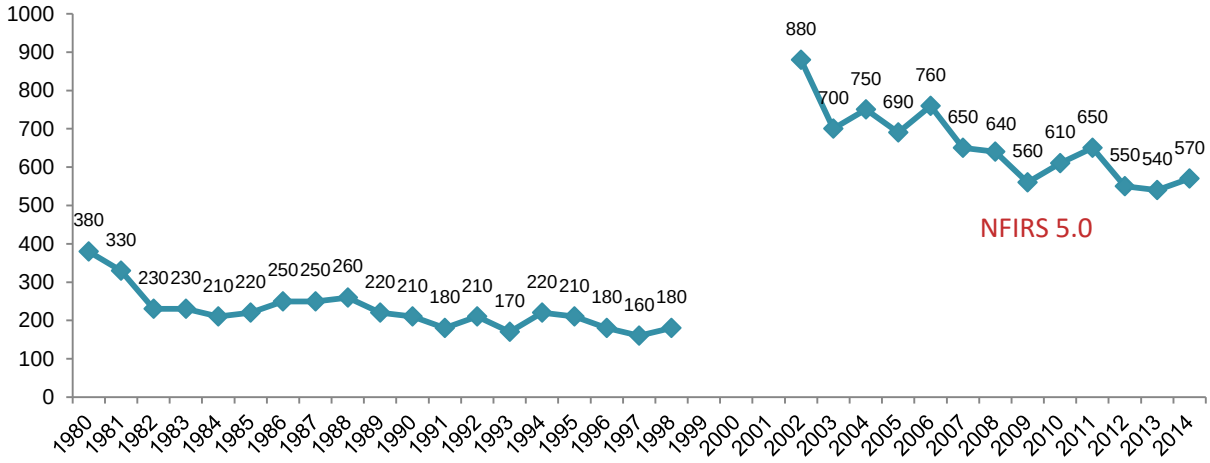
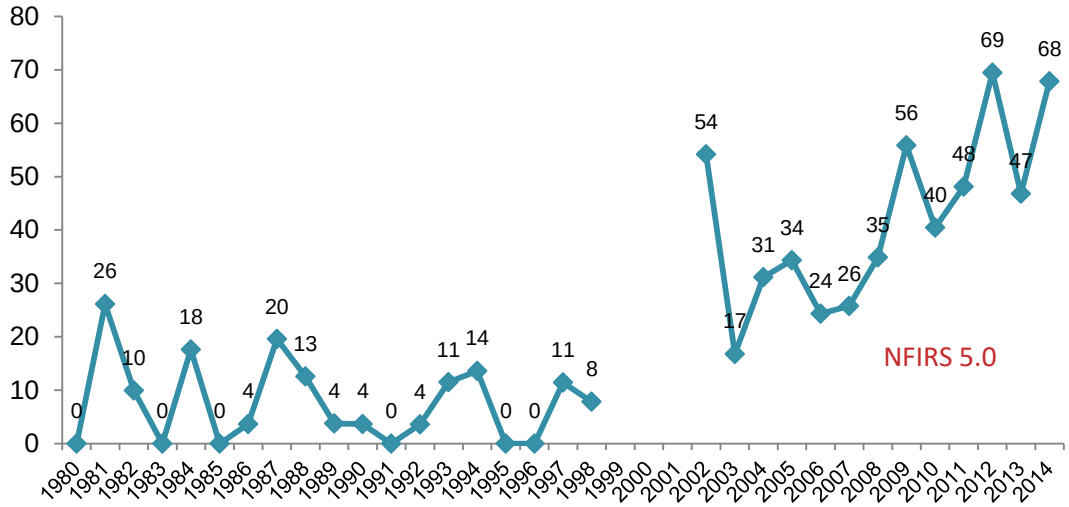


Figure A.C.-2. Civilian Deaths from Home Structure Fires Started by Embers or Ashes by Year: 1980-2014



If fires started by embers or ashes are added to fires started by smoking materials, the total number of home upholstered furniture fire started by these heat sources fell by 92% from 23,700 in 1980 to 2,000 in 2014. Upholstered furniture fire deaths from the combination of smoking materials and embers or ashes fell 64% from an estimated 1,060 in 1980, to 380 in 2014.

If hot embers or ashes do frequently come from smoking materials, the totals in Tables A.C.-1 and A.C.-2 could be considered upper bounds for fires started by smoking materials, including *all* embers or ashes. This is almost certainly an overestimate.

Table A.C.-1.
Home Upholstered Furniture Fires Started by Smoking Materials and Embers or Ashes
by Year 1980-2014
(Excluding fires with confined structure fire incident types)

Year	Smoking Materials		Embers or Ashes		Total	
1980	23,300	(63%)	400	(1%)	23,700	(64%)
1981	21,800	(64%)	300	(1%)	22,100	(65%)
1982	17,100	(62%)	200	(1%)	17,300	(63%)
1983	14,500	(59%)	200	(1%)	14,700	(60%)
1984	14,100	(59%)	200	(1%)	14,300	(59%)
1985	12,800	(55%)	200	(1%)	13,000	(56%)
1986	12,300	(56%)	300	(1%)	12,600	(57%)
1987	11,400	(55%)	300	(1%)	11,700	(56%)
1988	11,000	(54%)	300	(1%)	11,300	(56%)
1989	9,400	(52%)	200	(1%)	9,600	(53%)
1990	8,500	(52%)	200	(1%)	8,700	(53%)
1991	8,200	(51%)	200	(1%)	8,400	(52%)
1992	7,100	(47%)	200	(1%)	7,300	(48%)
1993	6,900	(48%)	200	(1%)	7,100	(49%)
1994	6,400	(46%)	200	(2%)	6,600	(47%)
1995	6,200	(47%)	200	(2%)	6,400	(48%)
1996	5,900	(46%)	200	(1%)	6,100	(48%)
1997	5,300	(45%)	200	(1%)	5,500	(46%)
1998	5,100	(44%)	200	(2%)	5,300	(46%)
1999	*3,100*	*(38%)*	*400*	*(5%)*	*3,600*	*(43%)*
2000	*3,100*	*(34%)*	*800*	*(9%)*	*4,000*	*(43%)*
2001	*3,100*	*(32%)*	*900*	*(10%)*	*4,100*	*(42%)*
2002	2,600	(29%)	900	(10%)	3,400	(39%)
2003	2,200	(28%)	700	(9%)	2,900	(37%)
2004	2,300	(29%)	700	(10%)	3,000	(38%)
2005	2,000	(26%)	700	(9%)	2,700	(36%)
2006	2,100	(27%)	800	(10%)	2,900	(36%)
2007	1,900	(27%)	600	(9%)	2,600	(36%)
2008	1,800	(27%)	600	(9%)	2,500	(36%)
2009	1,500	(27%)	600	(10%)	2,100	(37%)
2010	1,500	(27%)	600	(11%)	2,100	(38%)
2011	1,400	(25%)	700	(12%)	2,000	(36%)
2012	1,600	(29%)	600	(10%)	2,200	(39%)
2013	1,400	(27%)	500	(10%)	1,900	(38%)
2014	1,400	(27%)	600	(11%)	2,000	(39%)

Table A.C.-1.
Home Upholstered Furniture Fires Started by Smoking Materials and Embers or Ashes
by Year 1980-2014
(Excluding fires with confined structure fire incident types) (Continued)

Year	Smoking Materials	Embers or Ashes	Total

Note: Percentages are based on non-confined home upholstered furniture fires of all causes. Sums may not equal due to rounding errors. The statistics on smoking materials include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Source: NFIRS and NFPA Fire Experience Survey.

Table A.C.-2
Deaths from Home Upholstered Furniture Fires Started by Smoking Materials and Embers or Ashes by Year 1980-2014
(Excluding fires with confined structure fire incident types)

Year	Smoking Materials		Embers or Ashes		Total	
1980	1,060	(78%)	0	(0%)	1,060	(78%)
1981	1,120	(82%)	30	(2%)	1,150	(84%)
1982	980	(82%)	10	(1%)	990	(83%)
1983	850	(77%)	0	(0%)	850	(77%)
1984	860	(79%)	20	(2%)	880	(81%)
1985	720	(77%)	0	(0%)	720	(77%)
1986	770	(72%)	0	(0%)	770	(72%)
1987	700	(68%)	20	(2%)	720	(70%)
1988	810	(74%)	10	(1%)	820	(75%)
1989	670	(76%)	0	(0%)	670	(77%)
1990	590	(68%)	0	(0%)	590	(68%)
1991	450	(66%)	0	(0%)	450	(66%)
1992	480	(76%)	0	(1%)	480	(77%)
1993	440	(68%)	10	(2%)	450	(69%)
1994	410	(61%)	10	(2%)	420	(63%)
1995	490	(74%)	0	(0%)	490	(74%)
1996	470	(72%)	0	(0%)	470	(72%)
1997	450	(68%)	10	(2%)	460	(70%)
1998	350	(65%)	10	(1%)	360	(66%)
1999	*360*	*(75%)*	*60*	*(13%)*	*420*	*(88%)*
2000	*330*	*(58%)*	*30*	*(6%)*	*360*	*(63%)*
2001	*380*	*(62%)*	*0*	*(0%)*	*380*	*(62%)*
2002	230	(43%)	50	(10%)	280	(53%)
2003	310	(47%)	20	(3%)	330	(50%)
2004	370	(53%)	30	(4%)	400	(57%)
2005	330	(61%)	30	(6%)	360	(68%)
2006	310	(64%)	20	(5%)	340	(69%)
2007	320	(59%)	30	(5%)	350	(64%)
2008	250	(50%)	30	(7%)	280	(57%)
2009	220	(49%)	60	(12%)	280	(62%)
2010	230	(57%)	40	(10%)	270	(67%)
2011	160	(42%)	50	(13%)	200	(56%)
2012	200	(50%)	70	(17%)	270	(67%)
2013	230	(48%)	50	(10%)	280	(57%)
2014	310	(54%)	70	(12%)	380	(66%)

Table A.C.-2
Deaths from Home Upholstered Furniture Fires Started by Smoking Materials and Embers or Ashes by Year 1980-2014
(Excluding fires with confined structure fire incident types) (Continued)

Note: Percentages are based on deaths from home upholstered furniture fires of all causes. Sums may not equal due to rounding errors. The statistics on smoking materials include a proportional share of fire deaths in which the heat source was heat from an unclassified open flame or smoking material. Estimates for 1999-2014 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution.

Source: NFIRS and NFPA Fire Experience Survey.

Appendix D:
Previously Published Upholstered Furniture Fire Incident

Published incidents provide information about what can happen, not what is typical. Articles from NFPA publications about specific incidents illustrate some of the ways in which upholstered fire catches fire or is involved in fire. These incidents were taken from the "Firewatch" Columns and annual studies of catastrophic fires in *NFPA Journal*. These incidents tend to be more serious than the typical fire.

Smoking Materials

A man died in a home fire when he apparently fell asleep on a couch while smoking, Kansas.

The two-story, split-level ranch-style house was constructed of wood framing. A melted smoke alarm was found on the hallway of the second floor outside the bedrooms with a battery tested at 7 volts. Occupants stated they had purchased a new smoke alarm, but that the man who died had disabled it because it was frequently going off. There were no sprinklers.

The fire was discovered by a neighbor who observed smoke and called 911 at 9:01 a.m. Firefighters arrived six minutes later to find smoke coming from the dwelling and heavy smoke from floor to ceiling in the interior. The engine crew was met at the front door with heavy fire rolling out of the top of the door. They entered and began to extinguish the fire in the entryway and living room, where the 55-year-old male occupant was sleeping on a couch. The man was removed from the house, but died the following day of burns and smoke inhalation.

Fire investigators found discarded cigarette butts, lighters, and burn holes in blankets and upholstered furniture throughout the home, especially in the first-floor living room where the fire started. Investigators indicated that consumption of prescribed medication was suspected of making the victim drowsy and unable to respond quickly to the emergency.

The home was valued at $200,000 with contents of $50,000. Structural losses were $70,000 and contents losses were $35,000.

Richard Campbell, "Firewatch," *NFPA Journal*, March/April 2016.

Smoking materials cause fatal fire, Florida
A 58-year-old woman who had a history of mental and physical disabilities died in a fire in her duplex that began when she dropped a lit cigarette on the floor.

The single-story duplex, which had concrete block walls and a wooden roof covered by asphalt shingles, had hardwired smoke alarms with battery back-up in each unit just outside the bedroom door. There were no sprinklers.

A neighbor discovered the fire when he heard the smoke alarm operating and called 911 at 9:04 a.m. Firefighters arriving four minutes later found that the fire had nearly self-extinguished due to a lack of ventilation, although heavy smoke lingered in the apartment. They found the woman's body on the floor between the bed and a chair in her bedroom.

Investigators determined that a cigarette dropped on the bedroom floor between an upholstered chair and a drawer was the most likely cause of ignition.

Damage to the home and its contents was estimated at $5,500.

Kenneth J. Tremblay, 2014," Firewatch", *NFPA Journal*, September/October 31-32.

Woman dies in smoking-related fire, Tennessee

A 54-year-old woman died of smoke inhalation in a fire that began when she dropped an ashtray containing a burning cigarette on the seat cushion of an upholstered chair and the chair ignited.

The multi-unit, wood-frame apartment building in which she lived had exterior block walls and a wooden roof covered by asphalt shingles. The victim's apartment had a local, battery-operated smoke alarm in the bedroom, but there was no battery in the alarm. The apartment was not equipped with sprinklers.

The fire department received a 911 call from an adjacent unit reporting the fire at 2:09 a.m. Investigators determined that after the victim dropped the ashtray on the cushion, she took the cushion into the kitchen and doused it in the sink. Thinking she had extinguished the fire, she then went to bed. Unfortunately, the chair itself was still smoldering and went to a free burning state.

Structural damage to the building, which was valued at $200,000, was estimated at $20,000. The apartment's contents, which were valued at $5,000, were destroyed.

Kenneth J. Tremblay, 2014," Firewatch", *NFPA Journal*, July/August, 31.

Fatal fire caused by smoking materials, Texas

A 51-year-old man and his 54-year-old wife died of burns and smoke inhalation in a fire that they inadvertently started when they dropped their lit smoking materials when they fell asleep.

The victims lived in a two-story, eight-unit, wood-frame apartment building, which was 80 feet (24 meters) long and 40 feet (12 meters) wide. The apartment had hardwired smoke alarms with battery backup in the bedrooms and hallways. There were no sprinklers.

A neighbor who heard the smoke alarm sounding in the first-floor apartment below his reported the fire at 4 a.m. Firefighters responded to the call with a single engine, but the call was upgraded to a full first alarm assignment and then a second alarm after they found fire blowing out a patio door and window.

Crews knocked down the fire and discovered the body of the woman between the bedroom and living room, where she had succumbed to her burn injuries. They eventually found the second victim in a neighbor's apartment, where he had taken shelter after he escaped from the burning unit. He had second-and third-degree burns over 40 percent of his body and was transported to a hospital, then to a burn center, where he died the following week.

Investigators determined that the man fell asleep while smoking on an upholstered recliner in the living room, while his wife fell asleep on a nearby couch. Both of them were later found to have been under the influence of alcohol and prescription medication. The man awoke to find his chair and clothing burning. Investigators believe that his escape may have been delayed by efforts to locate his wife, who had apparently moved to the bedroom. After failing to escape out the front door, he exited through the patio door, which he left open, allowing fresh air to enter the apartment and intensify the blaze. Firefighters found his wife's body in the living room.

The apartment, which was valued at $250,000, sustained $60,000 in damage. Its contents sustained $6,000 in damage. The fire department had responded to the same apartment two days before the fatal fire to extinguish another fire that was also caused by smoking materials.

Kenneth J. Tremblay, 2014," Firewatch", *NFPA Journal*, March/April 31-32.

Sprinklers control smoking material fire in apartment, Michigan

A woman who lived on the top floor of a three-story apartment building managed to evacuate her unit after discarded smoking material set fire to an upholstered chair.

The three-story building, which contained several apartments on each floor, had a wet-pipe sprinkler system throughout and a fire alarm system, including smoke detectors, which operated as designed.

The fire department received the fire alarm from the building and dispatched an engine and ladder company at 9:17 p.m. After additional calls from the alarm company told the dispatcher that multiple activations were coming from the building, a full assignment and additional resources were sent to the scene.

When the first-arriving company reached the building about five minutes after the alarm, firefighters saw smoke and water coming from a third-floor balcony. Inside the building, they found smoke in the third-floor corridor and saw the occupants evacuating. Crews entering the apartment of origin found that two sidewall sprinklers in the living room had already confined the fire to a leather recliner and a small area of carpet.

Officers spoke with the occupant, who initially said she had been cooking and that she thought the fire started in the kitchen. However, investigators determined that it started in the living room when smoking materials were dropped onto the chair. The woman then acknowledged that she had been smoking in the chair. Medical personnel confirmed that she was on a number of different medications at the time of the fire.

The apartment building, valued at $769,800, sustained damage estimated at $7,500. Its contents, valued at $300,000, sustained $2,000 worth of damage.

Kenneth J. Tremblay, 2013," Firewatch", *NFPA Journal*, November/December-22.

Discarded cigarette starts fire that kills one, Michigan

A 31-year-old man died of smoke inhalation in a fire that burned undetected on the first floor of his two-story house until the family dog woke his parents, who were asleep in a first-floor bedroom.

The exterior or the one-and-a-half-story, single-family, wood-frame house, which covered an area of 900 square feet (84 square meters), was covered with vinyl siding. The roof was covered in asphalt shingles. One smoke alarm had been installed in the basement, and investigators found another on a shelf in the dining room. However, neither had a battery. They also found a smoke alarm mounting plate on the wall above the bathroom door on the first floor. There were no smoke alarms on the second floor, and the house was unsprinklered.

The victim's parents, who were both in their 60s, were awoken by the family dog. When the father went to see what was bothering the animal, he found the living room couch on fire. He called to his wife, then tried unsuccessfully to put the fire out using a pan of water. She, too, tried to extinguish the fire using more water. She, too, tried to extinguish the fire using more water. When that didn't work, the couple yelled to their son, who was sleeping upstairs, and left the house. They called 911 to report the fire at 3:01 a.m.

By the time firefighters arrived just over five minutes later, flames were coming from the front door and the front window, and there was heavy smoke throughout house. Police officers already on the scene told them someone was still in the building, probably on the second floor. Using two 1 3/4-inch hose lines to knock down the heavy fire, one crew began advancing into the house while another placed aground ladder to a second-floor window in an attempt to rescue the victim. Unfortunately, the window was too small to enter.

When firefighters reached the second floor, they found the victim's body lying on the floor of the bedroom near his bed. They left him in place for investigators.

The investigators followed the burn patterns directly to the upholstered couch in the from-facing living room where, according to the man's mother, she had seen her son smoking and using a laptop computer before she went to bed. They determined that the unintentional fire started when smoking materials ignited the couch. The man's parents told the investigators that their son had a history of discarding or dropping cigarettes and had once set the very same couch on fire. The victim also had a history of drinking alcohol, and his autopsy showed that he had been drinking on the evening of the fire, which may have contributed to his death.

The fire completely destroyed both the house, which was valued at $50,000, and its contents, which were valued at $20,000.

Kenneth J. Tremblay, 2012, “Firewatch,” *NFPA Journal*, May/June, 36-37.

Improper disposal of smoking materials leads to fatal fire, California
An intoxicated 58-year-old woman died in a fire that was started by a cigarette she unintentionally dropped on the upholstered couch in her two-family home. Excessive amounts of paper, videos, records, and books provided additional fuel for the spreading flames.

Each unit of the one-story, wood-frame house was 35 feet (11 meters) wide and 30 feet (9 meters) long. The exterior walls of the house were made of stucco, and the roof was covered with asphalt shingles. The remains of a smoke detector mounting bracket were found in the hallway, but investigators could not determine whether the detector was mounted or operational at the time of the fire. There were no sprinklers.

A neighbor discovered the fire and called 911 at 5:20 a.m. By the time firefighters arrived, smoke and flames were venting out the windows, and the living room and kitchen were filled with fire.

After extinguishing the blaze, fire crews found the woman lying on the bed in a bedroom in which there were more than 50 empty beer cans. It appeared she had not tried to escape.

The adjacent unit was damaged by pressurized smoke coming from the common attic space above, but there was no fire damage. The building, valued at $750,000, and its contents, valued at $100,000, sustained damage estimated at $300,000 and $50,000, respectively.

Kenneth J. Tremblay, 2011, "Firewatch," *NFPA Journal*, November/December, 15-16.

No Batteries Found in Smoke Alarms in Fatal Fire, Florida
A man in his 60s died of smoke inhalation when a fire that started in the living room filled his single-family house with smoke as he slept. His body was discovered by a deputy sheriff who responded to a 911 call from a Meals-on-Wheels driver who'd become worried because the man had not answered his door in two days.

The one-story, single-family house was constructed of wood and concrete and had a wood-framed roof covered by asphalt shingles. There were no sprinklers, and the three smoke alarms installed in the kitchen, the hallway, and the master bedroom had no batteries.

Fire department investigators discovered a distinctive V-pattern burn that clearly showed that the fire started in an upholstered couch and burned until it burned itself out. They also noted that high heat left the walls very dark from about the 5-foot (2-meter) level to the ceiling and stained the floor throughout the house. When they found an ashtray with cigarette butts and open beer cans around the couch, they determined that the victim had dropped a lit cigarette on the couch before going to bed.

The house, which was valued at $100,000, and its contents, valued at $20,000, sustained an estimated $5,000 in damage

Kenneth J. Tremblay, 2011, "Firewatch," *NFPA Journal*, May/June, 33-34.

Smoking Material Fire Kills Two, Utah

Two women, one 90 years old and the other 55, died when a fire started by smoking materials that had been improperly disposed of ignited a recliner, filling their single-family home with smoke.

The single-story, wood-frame house, which was 40 feet (12 meters) long and 30 feet (9 meters) wide, had concrete block walls and a pitched wooden roof covered with asphalt shingles. A battery-operated smoke alarm had been installed in the first-floor hallway, but firefighters said they did not hear it operating during their initial search and rescue operations. There were no sprinklers.

The former husband of one of the women, who visited frequently and acted as their caretaker, arrived around10:15 a.m. When he opened the door, he found smoke filling the house. He called 911 and told the arriving crews that the two women, who were both physically disabled, were probably inside.

Firefighters found the first victim in the bathroom off the master bedroom on the first floor and quickly took her outside for emergency medical treatment. A second crew found the other woman in a basement bedroom on the floor next to the bed. She was pronounced dead at the scene.

Investigators determined that the fire started in the basement family room in an upholstered recliner, on the arm of which they found a full ashtray that was leaning in a bit toward the seat. After the fire consumed the available oxygen, it almost self-extinguished. Firefighters put out the smoldering remains.

The women died of smoke inhalation. The house, valued at $100,000, and its contents, valued at $30,000, sustained undetermined damages.

Kenneth J. Tremblay, 2011, "Firewatch," *NFPA Journal*, March/April, 23-24.

Heating Equipment

One dead in apartment fire, Connecticut
A 61-year-old man died of burns in an apartment building fire when he became confused while trying to escape from the building.

The three-story, wood-frame apartment building was 20 feet (6 meters) long and 35 feet (11 meters) wide. The building's fire alarm system, which was designed and installed according to NFPA 72©, National Fire Alarm and Signaling Code, included smoke detectors in common areas, manual pull stations, and heat detectors. Local smoke alarms were located in each apartment. There were no sprinklers.

The fire started on the first floor when a faulty electric space heater cord ignited an upholstered couch. The tenant had bought the second-hand heater with the damaged cord, which a friend had repaired with electrical tape. At some point, the cord, which had been run under the couch, overheated and ignited the couch.

The first-floor tenant detected the fire in his apartment and tried unsuccessfully to control it before opening the door to the stairway and corridor, which filled with smoke that set off the fire alarm system. The fire department also received 911 calls at 11:43 a.m.

At some point, the victim, who lived on the second floor, responded to the fire alarm by opening the door to the second floor and the stairwell to try to leave the building. Firefighters found him sitting on a step in the hot, smoky stairwell, where he apparently collapsed after becoming confused by exposure to the smoke.

The building, which was valued at $234,000, sustained $200,000 in damage. Damage to its contents, which were valued at $50,000, was estimated at $35,000.

FYI Close the door on fire and keep it closed. This advice applies to fires in ovens and clothes dryers, as well as fires in rooms, apartments, and buildings. An open door provides a clear path for fire and smoke to spread. Remember, fire needs oxygen to burn, and a closed door limits the amount of oxygen available to the fire.

Kenneth J. Tremblay, 2012, "Firewatch," *NFPA Journal*, March/April, 17-18.

Electrical Distribution or Lighting Equipment

Overheated extension cord blamed for deadly fire, Texas

A 73-year-old woman died and her husband and son were injured in their two-family duplex when an overheated electrical extension cord powering a space heater ignited and the resulting fire spread to nearby combustibles.

The exterior walls of the wood-frame, single-story house were made of brick, and the roof was covered with asphalt shingles. The structure consisted of two separate homes with a common gable roof. Each unit had an attached garage. Neither unit had smoke alarms or sprinklers.

Firefighters responded to a 911 call reporting the fire and a possible trapped occupant at 7:57 a.m. When they arrived several minutes later, they saw the fire through the front windows and used hose lines to knock it down so they could search the interior for the victim.

They found her body in the living room, where she had succumbed to smoke inhalation and burns.

Investigators determined that the fire started in the living room between the fireplace and the front door when the small-gauge electrical cord of a space heater, which had been spliced, overheated and ignited the carpet and upholstered furniture. The victim's husband told them that he and his wife had several portable electric heaters scattered throughout the house for heat and that he would "always shut them off and she would always turn them back on."

He said that he was unaware of the fire until his wife woke him and he escaped through a bedroom window while his wife returned to the interior of the house. After the couple's adult son, who lived in the house next store, was alerted to the fire, he kicked open the front door, but was knocked back by heavy fire. Another person broke a window, further ventilating the fire, which then spread into the kitchen and dining areas, as well as the hallway and bedrooms.

The victim's husband and son suffered from smoke inhalation and were treated by firefighters at the scene.

The damage estimates for the unit of origin and the common attic space were estimated at $40,000. The damage to the home's contents was estimated at $20,000.

Kenneth J. Tremblay, "Firewatch," *NFPA Journal*, November/December 2015

Extension cord starts fatal fire, Michigan

A 62-year-old man died in a fire that began when the cord of an electric heater ignited combustibles n his single-family home. The one-story, wood-frame house had a single battery-operated smoke alarm.

One of the occupants awoke to the fire and called 911 at 3:46 a.m. Responding firefighters extinguished the blaze and found the victim in a bathroom off his bedroom, overcome by smoke.

Investigators determined that the space heater had been plugged into an electrical extension cord that had too small a gauge. The cord overloaded, then overheated, igniting the upholstered chair under which it was run and the items on the chair, including diapers, a plastic baby seat, and other child-care items. The flames then spread to the wall paneling and into the hall towards the victim's bedroom.

The fire damaged approximately 50 percent of the house, but the estimated loss was not reported.

Kenneth J. Tremblay, 2015,"Firewatch", *NFPA Journal*, January/February 35.

Boy, mother die in fire, South Carolina
A 35-year-old woman and her 7-year-old son died of smoke inhalation when they were overcome by smoke as they tried to leave their burning home.

The two-story, wood-frame structure had an asphalt-shingled roof and was equipped with smoke alarms, although the type and location were not reported. There were no sprinklers.

A neighbor called 911 to report the fire at 2 a.m. When arriving firefighters entered the home, they found the two victims lying just inside the door. They removed them from the home, performed CPR, and transported them to the hospital, where they died of their injuries.

Investigators determined that the operating smoke alarm woke the boy and his mother, and that they tried to escape but were overcome by smoke. The investigators also determined that the fire was started by an overloaded extension cord that ignited upholstered furniture in the living room.

The house, which was valued at $70,000, sustained $35,000 in damage. Its contents, which were valued at $40,000, sustained an estimated loss of $10,000.

Kenneth J. Tremblay, 2012, "Firewatch", *NFPA Journal*, May/June, 34.

Man dies when he delays exit from burning home, Virginia
A 71-year-old man with a history of medical problems died when he delayed his escape from an early morning fire in his home to retrieve a pair of shorts. The woman who owned the house made it safely outside by herself.

The three-bedroom, single-family, wood-frame ranch house, which was 60 feet (18 meters) long and 24 feet (7 meters) wide, had an attached carport and a finished basement containing a television room and a kitchenette. Its exterior walls were covered with brick and vinyl siding, and the roof was topped with asphalt shingles. Battery-operated smoke alarms were located outside and inside the bedrooms. There were no sprinklers.

The woman awoke to the sound of an operating smoke alarm and found smoke coming from the basement. She called for the victim, who had lung ailments that required that he use home oxygen. While the man called 911 to report the fire at 1:20 a.m., the woman looked downstairs and saw an upholstered couch on fire in the television room.

As they were leaving the house, the man decided that he needed to get a pair of shorts, as he was wearing only his undergarments. As he made his way down the hallway, the woman left and propped open the front door. She told investigators that she could not see him after he went down the hallway because it was "all black." She also told them that she thought she heard him fall.

Firefighters, who arrived to find heavy smoke coming from the house, found the victim sitting on the kitchen floor near an exit and removed him from the house. Ambulance crews tried to revive him on the way to the hospital, where he later succumbed to smoke inhalation.

Investigators determined that the fire started in the basement television room. A sectional couch had been pushed up against an extension cord that showed signs of electrical failure near its blades. Heat from the extension cord failure ignited the upholstery, and the fire burned undetected until the smoke alarm sounded.

Direct flame damage was limited to the basement, although there was heavy smoke damage throughout the home. An oxygen generator and portable oxygen bottles were not affected by the fire.

The house and its contents, together valued at approximately $247,000, sustained $100,000 worth of damage.

Kenneth J. Tremblay, 2012, "Firewatch", *NFPA Journal*, May/June, 31-32.

Extension Cord Involved in Sofa Ignition Catastrophic Fire, North Carolina

In March 2006, a North Carolina fire department was notified at 4:00 a.m. of a fire in a 1½-story, single-family home of unprotected ordinary construction. Five people died in this fire, including one child under age six.

The fire originated in the living room. A couch was positioned against an extension cord plug. Pressure from the arm support flattened the plug causing a short circuit in the wiring. The short circuit ignited the couch. Fire burned into the fabric and foam cushion, producing heavy black smoke. Four of the victims were located in a first-story bedroom with doors closed. The fifth victim was found near the doorway. He had attempted to extinguish the fire with water from a sink.

There was a delay in reporting the fire, and one occupant attempted to extinguish the fire rather than evacuate. The remains of a smoke alarm was found, with battery installed, but it is undetermined if it activated.

Excerpted and adapted from Stephen G. Badger, 2007, “U.S. Multiple-Death Fires for 2006,” *NFPA Journal*, September/October, 58.