Topical Fire Report Series Volume 16, Issue 4 / June 2015

One- and Two-Family Residential Building Fires (2011-2013)

These topical reports are designed to explore facets of the U.S. fire problem as depicted through data collected in the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS). Each topical report briefly addresses the nature of the specific fire or fire-related topic, highlights important findings from the data, and may suggest other resources to consider for further information. Also included are recent examples of fire incidents that demonstrate some of the issues addressed in the report or that put the report topic in context.

Findings

- **An estimated 241,700 one- and two-family residential building fires were reported to fire departments within the United States each year and caused an estimated 2,025 deaths, 8,400 injuries, and 5.4 billion dollars in property loss.**
- **One- and two-family residential building fires accounted for 65 percent of all residential building fires, representing the largest subgroup of residential building fires.**
- **Cooking, at 35 percent, was the leading reported cause of one- and two-family residential building fires reported to the fire service. Of these cooking fires, 87 percent were small, confined fires with limited damage.**
- **In 52 percent of nonconfined one- and two-family residential building fires, the fire extended beyond the room of fire origin. The leading reported causes of these larger fires were other unintentional, careless actions (16 percent); electrical malfunctions (14 percent); intentional actions (12 percent); and open flames (11 percent).**
- **One- and two-family residential building fire incidence was higher in the cooler months, peaking in January at 11 percent.**
- **Smoke alarms were not present in 23 percent of nonconfined fires in occupied one- and two-family residential buildings. This is a high percentage when compared to the 3 percent of households lacking smoke alarms nationally.**
- **Automatic extinguishing systems (AESs) were present in only 1 percent of nonconfined fires in occupied one- and two-family residential buildings.**

From 2011 to 2013, fire departments responded to an estimated 241,700 fires in one- and two-family residences each year across the nation.[1, 2] These fires resulted in an annual average of 2,025 deaths, 8,400 injuries, and 5.4 billion dollars in property loss. One- and two-family residential building fires accounted for 65 percent of all residential building fires and dominated the overall residential building fire profile. One- and two-family residential buildings include detached dwellings, manufactured homes, mobile homes not in transit, and duplexes.

From 2011 to 2013, 67 percent of all fire deaths in the nation occurred in one- and two-family dwellings. Because these fatalities occurred throughout the year and all over the country, they often did not make national headlines. Nevertheless, fire deaths in one- and two-family dwellings accounted for far more deaths in most years than all natural disasters combined.[3]

Most one- and two-family residential building fires (61 percent) were larger, nonconfined fires; they were not contained in pots, stoves, garbage containers or other types of noncombustible containers that confine them. Fires in all other types of residential buildings, by contrast, were mostly small and "confined" to noncombustible containers (68 percent).

One- and two-family residential building fires also differed from all other residential building fires in their cause profiles. While cooking accounted for 35 percent of all one- and two-family residential building fires, cooking played a much larger role in all other types of residential building fires, accounting for 69 percent of fires. However, heating and electrical malfunctions, such as short circuits, arcing and the like, played a larger role in one- and two-family residential building fires than in all other types of residential building fires.

This current topical report is an update to the "One- and Two-Family Residential Building Fires (2010-2012)" (Volume 15, Issue 3) topical report, which was released in September 2014. As part of a series of topical reports that address fires in the major residential building types, the remainder of

this report addresses the characteristics of one- and two-family residential building fires as reported to the National Fire Incident Reporting System (NFIRS). The focus is on fires reported from 2011 to 2013, the data most currently available at the time of the analysis.[4] This data is useful by itself and as a point of comparison with other residential building categories. Comparisons to multifamily residential building fires noted throughout the report are based on analyses from the "Multifamily Residential Building Fires (2011-2013)" (Volume 16, Issue 5) topical report.[5]

For the purpose of this report, the terms "residential fires" and "one- and two-family fires" are synonymous with "residential building fires" and "one- and two-family residential building fires," respectively. "One- and two-family fires" is used throughout the body of this report; the findings, tables, charts, headings and endnotes reflect the full category, "one- and two-family residential building fires."

Type of Fire

Building fires are divided into two classes of severity in NFIRS: "confined fires," which are fires confined to certain types of equipment or objects, and "nonconfined fires," which are fires that are not confined to certain types of equipment or objects. Confined building fires are small fire incidents that are limited in extent, staying within pots, fireplaces or certain other noncombustible containers.[6] Confined fires rarely result in serious injury or large content loss, and they are expected to have no significant accompanying property loss due to flame damage.[7] Of the two classes of severity, nonconfined fires accounted for 61 percent of one- and two-family fires. The smaller, confined fires accounted for the remaining 39 percent of one- and two-family fires. Cooking fires were the predominant type of confined fires in one- and two-family dwellings, as they were in most residential occupancies (Table 1).

Table 1. One- and Two-Family Residential Building Fires by Type of Incident (2011-2013)

Incident Type	Percent
Nonconfined fires	60.9
Confined fires	39.1
Cooking fire, confined to container	24.3
Chimney or flue fire, confined to chimney or flue	7.8
Incinerator overload or malfunction, fire confined	0.2
Fuel burner/boiler malfunction, fire confined	2.5
Commercial compactor fire, confined to rubbish	0.0
Trash or rubbish fire, contained	4.3
Total	100.0

Source: NFIRS 5.0.

Loss Measures

Table 2 presents losses, averaged over the three-year period from 2011 to 2013, of reported one- and two-family fires and all other residential fires.[8] The average number of fatalities per 1,000 fires and average dollar loss per fire for one- and two-family fires were about two times as high as the same loss measures for all other residential building fires. In addition, all of the average loss measures associated with nonconfined one- and two-family fires were notably higher than the same loss measures for confined one- and two-family fires. This can be expected, however, as nonconfined fires are generally larger fires that often result in serious injuries and more content loss.

Table 2. Loss Measures for One- and Two-Family Residential Building Fires (Three-Year Average, 2011-2013)

Measure	One- and Two-Family Residential Building Fires	**Confined One- and** Two-Family Residential Building Fires	**Nonconfined One- and** Two-Family Residential Building Fires	Residential Building Fires (Excluding One- and Two-Family)
Average Loss				
Fatalities/1,000 fires	6.7	0.0	11.0	3.1
Injuries/1,000 fires	27.9	7.1	41.3	29.0
Dollar loss/fire	$18,680	$210	$30,550	$10,390

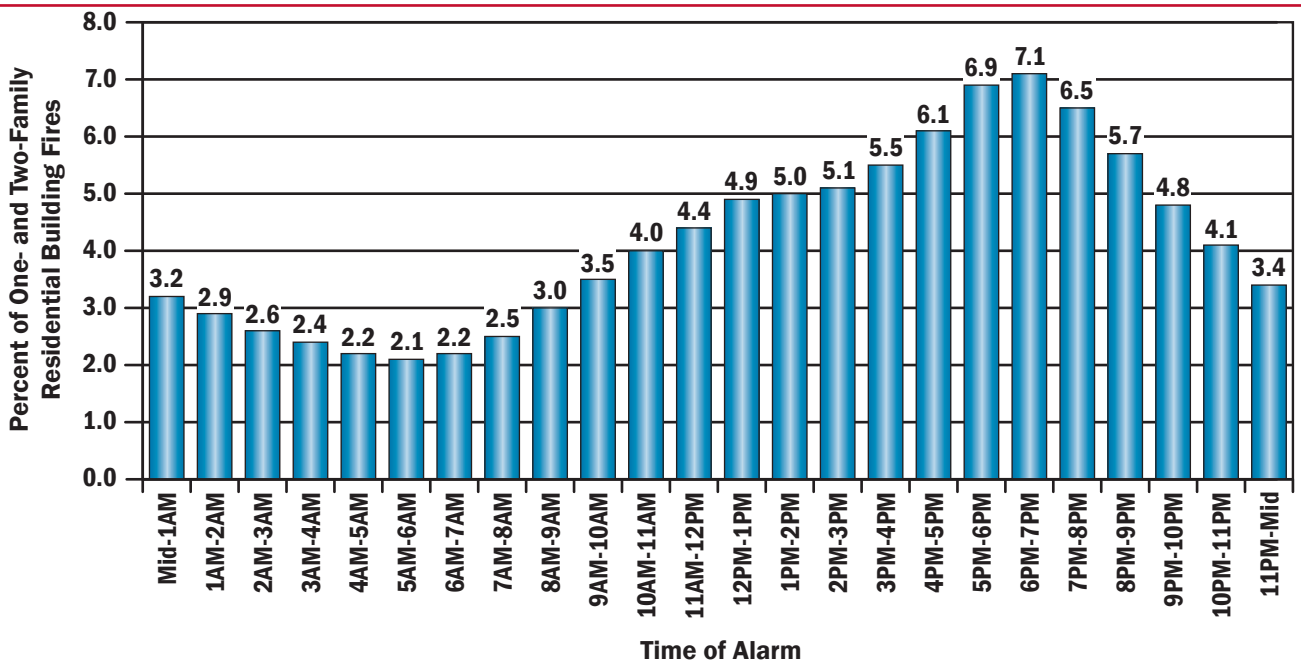
Source: NFIRS 5.0.

Notes: 1. Average loss for fatalities and injuries is computed per 1,000 fires; average dollar loss is computed **per fire** and rounded to the nearest $10.
2. The 2011 and 2012 dollar-loss values were adjusted to 2013 dollars.

When One- and Two-Family Residential Building Fires Occur

As shown in Figure 1, one- and two-family fires occurred most frequently in the early evening hours, peaking during the dinner hours from 5 to 8 p.m., when cooking fire incidence was high.[9, 10] Cooking fires, discussed later in the Causes of One- and Two-Family Residential Building Fires section, accounted for 35 percent of one- and two-family fires. Fires then declined throughout the night, reaching the lowest point during the early morning hours from 4 to 7 a.m.

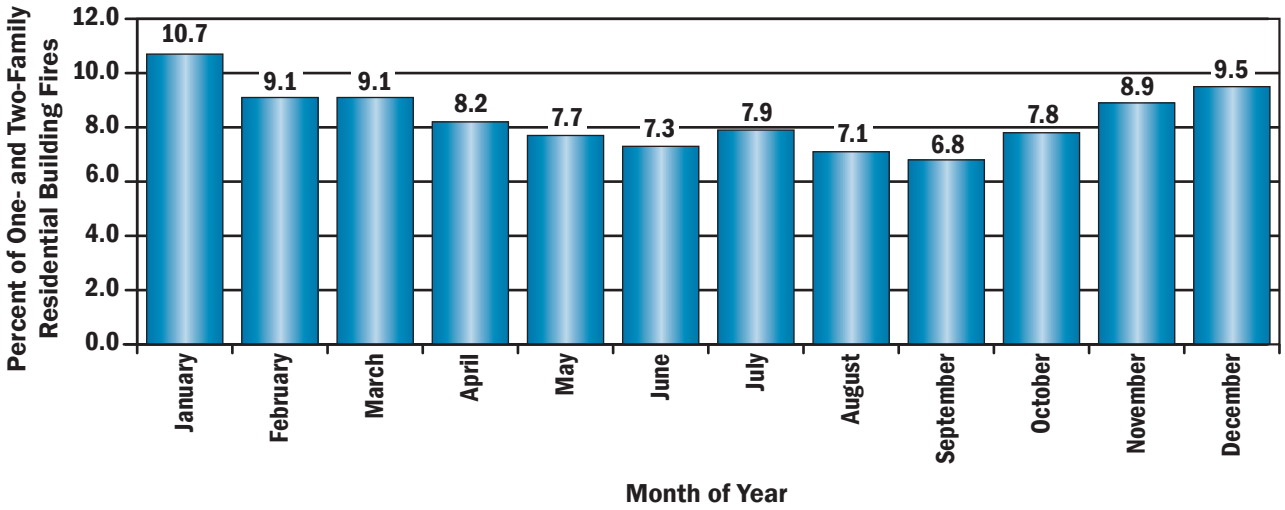
Figure 1. One- and Two-Family Residential Building Fires by Time of Alarm (2011-2013)



Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Figure 2 illustrates that one- and two-family fire incidence was higher in the cooler months, peaking in January at 11 percent. Winter peaks are often explained by the increase in heating fires. The increase in fires in the cooler months may also be the result of more indoor activities in general, as well as more indoor seasonal and holiday activities. During the spring and summer months, the fire incidence generally declined, reaching a low in September.

Figure 2. One- and Two-Family Residential Building Fires by Month (2011-2013)



Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Causes of One- and Two-Family Residential Building Fires

Cooking was the leading reported cause of one- and two-family fires and accounted for 35 percent of all one- and two-family fires, as shown in Table 3.[11] Of these cooking fires, 87 percent were small, confined fires with limited damage.

Heating, at 16 percent, was the second leading reported cause of one- and two-family fires. The next four causes combined accounted for 28 percent of one- and two-family fires: fires caused by electrical malfunctions, such as short circuits and wiring problems (8 percent); other unintentional, careless actions, a miscellaneous group (8 percent); open flames that resulted from candles, matches and the like (6 percent); and intentional actions (6 percent).[12]

Table 3. Leading Causes of One- and Two-Family Residential Building Fires (2011-2013)

Cause	Percent (Unknowns Apportioned)
Cooking	35.0
Heating	16.2
Electrical malfunction	8.4
Other unintentional, careless	7.6
Open flame	5.8
Intentional	5.8

Source: NFIRS 5.0.

There was a striking difference between one- and two-family and all other residential occupancies in the prevalence of cooking as a fire cause. While cooking accounted for 35 percent of one- and two-family fires, it accounted for 72 percent of multifamily residential building fires and 59 percent of other residential building fires. The most persuasive explanation for this difference may be that the smaller, confined fires in one- and two-family dwellings are not reported as often to fire departments. They are small and contained, and they often do not cause much damage. In addition, if it is activated, only the residents hear the smoke alarm. However, these same confined fires in multifamily residences may be reported if someone else in the complex hears the alarm or smells the smoke. Alternatively, if it is a newer complex, the alarms will be connected to the building alarm system, and the fire department may automatically be called.

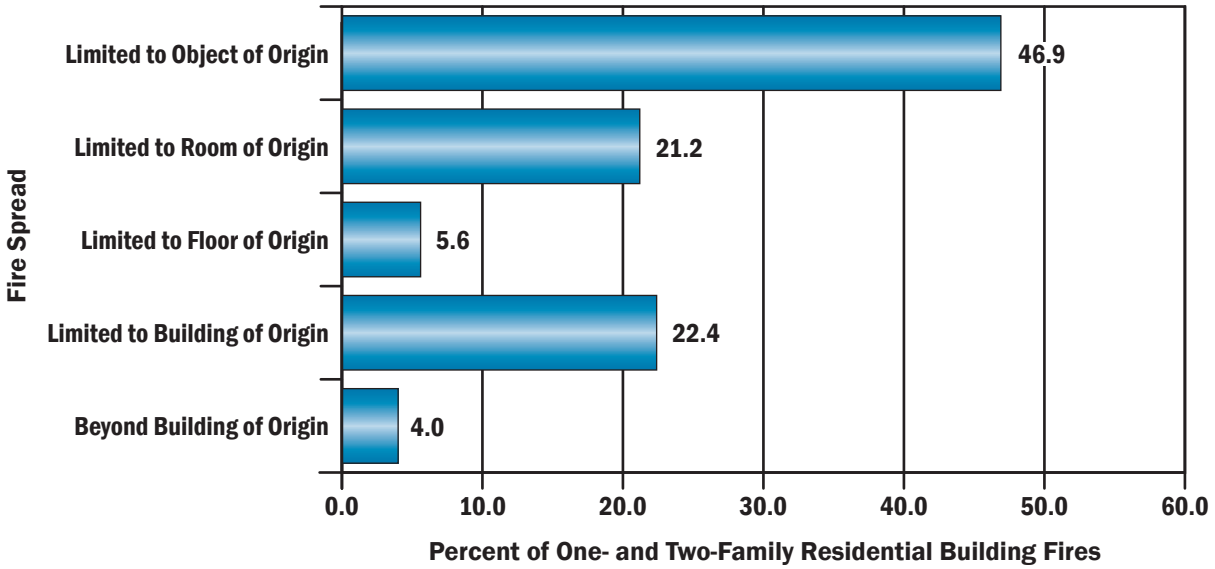
Heating and electrical malfunctions played a larger role in one- and two-family fires than in multifamily fires. One reason for this may be that many one- and two-family residential buildings have fireplaces, chimneys and fireplace-related equipment that most other types of residential properties do not have.[13]

A strong relationship between housing age and the rate of electrical fires has been observed, with housing over 40 years old having the strongest association with electrical distribution fires.[14, 15] As of 2013, the median age of one- and two-family housing was over 35 years. With more than half of the housing stock older than 35 years, electrical issues become an increasingly larger player in residential fires.[16] In addition, a 2008 study concluded that there are three major areas in older properties that contribute to compromised electrical systems: the effects of aging on the wiring itself, misuse and abuse of the electrical components, and noncode-compliant installations.[17] Codes, including the National Electrical Code®, are comprehensive and standard in nearly every community. "Noncode" improvements or changes, however, are difficult to track and, therefore, difficult to enforce.

Fire Spread in One- and Two-Family Residential Building Fires

In 47 percent of one- and two-family fires, the fire was limited to the object of origin (Figure 3). Included in these fires are those coded as "confined fires" in NFIRS. Additionally, 32 percent of the fires extended beyond the room of origin.

Figure 3. Extent of Fire Spread in One- and Two-Family Residential Building Fires (2011-2013)



Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Confined Fires

NFIRS allows abbreviated reporting for smaller, confined fires, and many details of these fires are not required to be reported. It is important to note that not all fires where the extent of fire spread is limited to the object of origin are counted as NFIRS confined fires.[18] For example, a fire in which the fire spread is limited to a mattress or clothes dryer is not defined as a "confined fire" in NFIRS because of the greater potential for spread. Unlike fires in pots or chimneys, there is no container to stop the fire, even though the fire did not spread beyond the object of origin.

As previously discussed, however, it is known that confined fires accounted for 39 percent of all one- and two-family fires. Cooking fires — those cooking fires confined to a pot or the oven, for example — accounted for 62 percent of these confined fires (Table 1).

In addition, the number of confined one- and two-family fires was greatest from 5 to 8 p.m.; these fires accounted for 52 percent of the one- and two-family fires in this time period. Moreover, confined cooking fires accounted for 66 percent of the confined fires and 34 percent of all fires in one- and two-family buildings that occurred from 5 to 8 p.m.

Confined one- and two-family fires peaked in January, then declined through the spring and summer, reaching the lowest incidence in August.

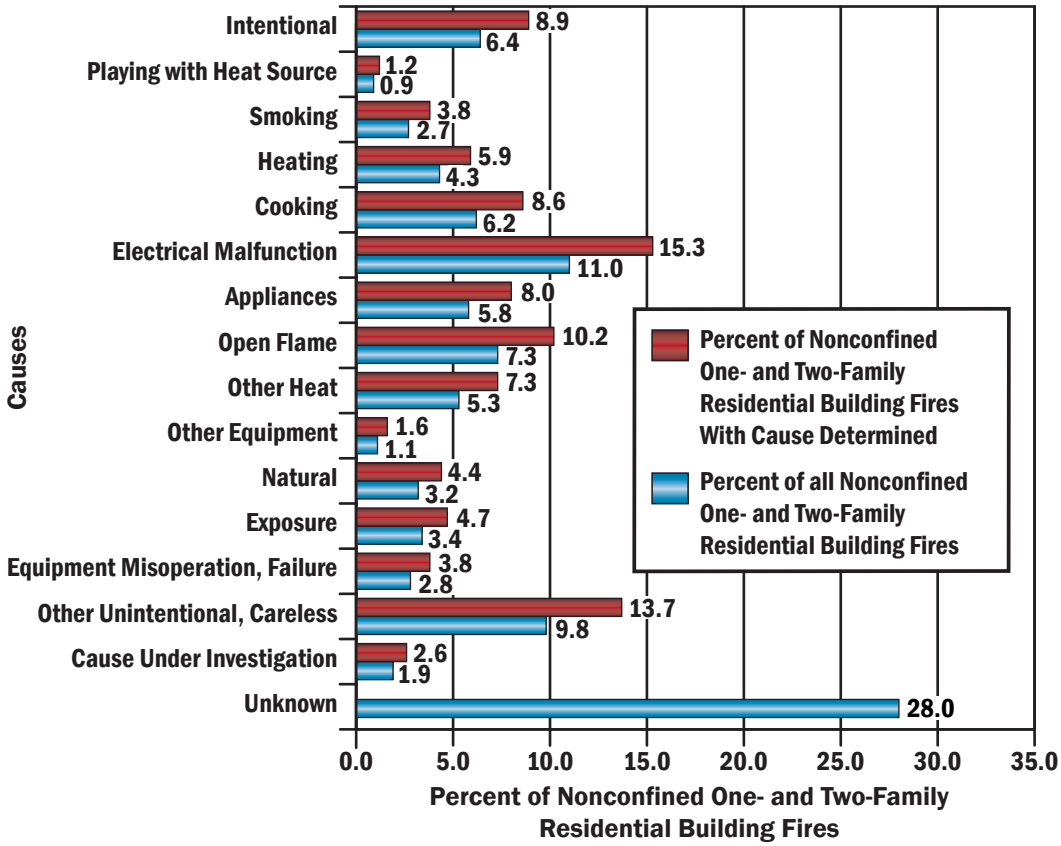
Nonconfined Fires

This section addresses nonconfined one- and two-family fires — the larger and more serious fires that are not confined to noncombustible containers — where more detailed fire data are available, as they are required to be reported in NFIRS.

Causes of Nonconfined One- and Two-Family Residential Building Fires

While cooking was the leading reported cause of one- and two-family fires overall, it only accounted for 9 percent of all nonconfined one- and two-family fires (Figure 4). At 15 percent, electrical malfunction was the leading reported cause of nonconfined one- and two-family fires. The second and third leading reported causes of nonconfined one- and two-family fires were other unintentional, careless actions (14 percent) and open flames (10 percent).

Figure 4. Causes of Nonconfined One- and Two-Family Residential Building Fires (2011-2013)



Source: NFIRS 5.0.

Notes: 1. Causes are listed in order of the U.S. Fire Administration (USFA) Structure Fire Cause Hierarchy for ease of comparison of fire causes across different aspects of the fire problem. Fires are assigned to one of 16 cause groupings using a hierarchy of definitions, approximately as shown in the chart above. A fire is included in the highest category into which it fits. If it does not fit the top category, then the second one is considered, and if not that one, the third and so on. For example, if the fire is judged to be intentionally set and a match was used to ignite it, it is classified as intentional and not open flame because intentional is higher in the hierarchy.

2. Total percent of all nonconfined one- and two-family residential building fires does not add up to 100 percent due to rounding.

Where Nonconfined One- and Two-Family Residential Building Fires Start (Area of Fire Origin)

Nonconfined one- and two-family fires most often started in cooking areas and kitchens (18 percent), as shown in Table 4. Bedrooms (13 percent) and common rooms, living rooms or lounge areas (7 percent) were the next most common areas of fire origin in the home. Smaller but not minor percentages of fires started in attics and vacant spaces (6 percent); exterior wall surfaces (6 percent); laundry areas (5 percent); and vehicle storage areas, such as garages and carports (5 percent).

Note that these areas of origin do not include areas associated with confined fires. Cooking was the leading reported cause of all one- and two-family fires at 35 percent, and it is not surprising that kitchens were the leading area of fire origin. The percentages were not identical between cooking and kitchen fires because some cooking fires started outside the kitchen, some areas of origin for cooking fires were not reported (as in most confined cooking fires), and some kitchen fires were not due to cooking. In fact, only 42 percent of nonconfined one- and two-family fires that started in the kitchen were cooking fires. Other unintentional, careless actions accounted for 14 percent, and appliances, such as freezers and refrigerators, accounted for an additional 9 percent of nonconfined one- and two-family fires that started in the kitchen.

Table 4. Leading Areas of Fire Origin in Nonconfined One- and Two-Family Residential Building Fires (2011-2013)

Areas of Fire Origin	Percent (Unknowns Apportioned)
Cooking area, kitchen	18.3
Bedrooms	12.7
Common room, den, family room, living room, lounge	6.7
Attic, vacant spaces	5.7
Exterior wall surfaces	5.5
Laundry area	5.1
Vehicle storage area: garage, carport	5.0

Source: NFIRS 5.0.

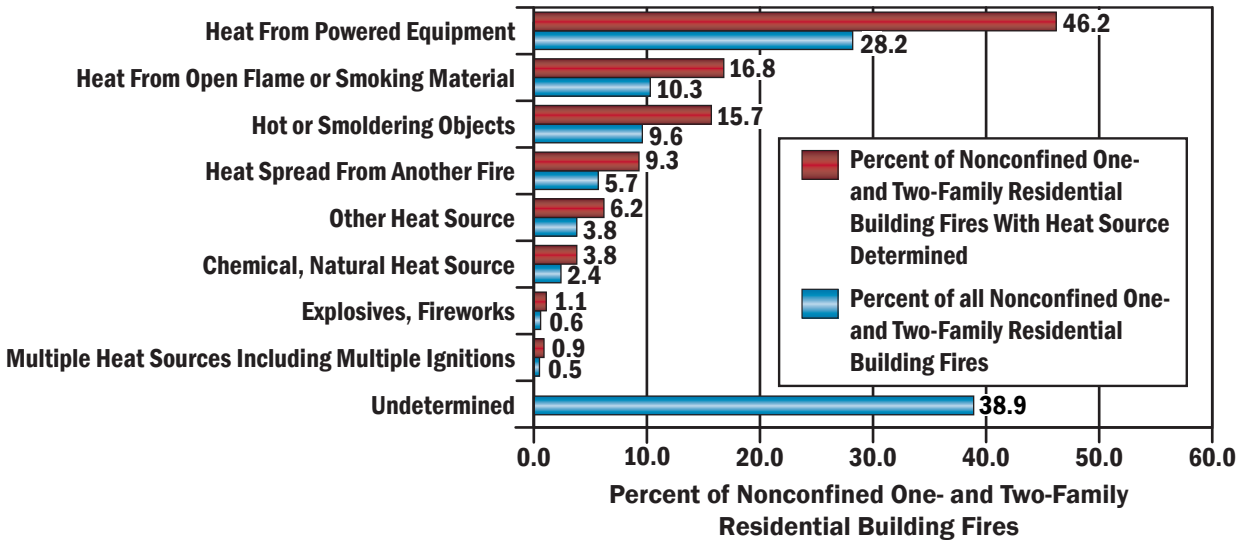
How Nonconfined One- and Two-Family Residential Building Fires Start (Heat Source)

Figure 5 shows sources of heat categories for nonconfined one- and two-family fires. Heat from powered equipment accounted for 46 percent of nonconfined one- and two-family fires. This category includes electrical arcing (16 percent); radiated or conducted heat from operating equipment (13 percent); heat from other powered equipment (12 percent); and spark, ember or flame from operating equipment (5 percent).

Heat from open flame or smoking materials accounted for 17 percent of nonconfined one- and two-family fires. This category includes such items as miscellaneous open flame or smoking materials (4 percent), cigarettes (4 percent), lighters and matches (combined, 4 percent), and candles (3 percent).

The third largest category pertained to hot or smoldering objects (16 percent). This category includes miscellaneous hot or smoldering objects (7 percent) and hot embers or ashes (7 percent).

Figure 5. Sources of Heat in Nonconfined One- and Two-Family Residential Building Fires by Major Category (2011-2013)



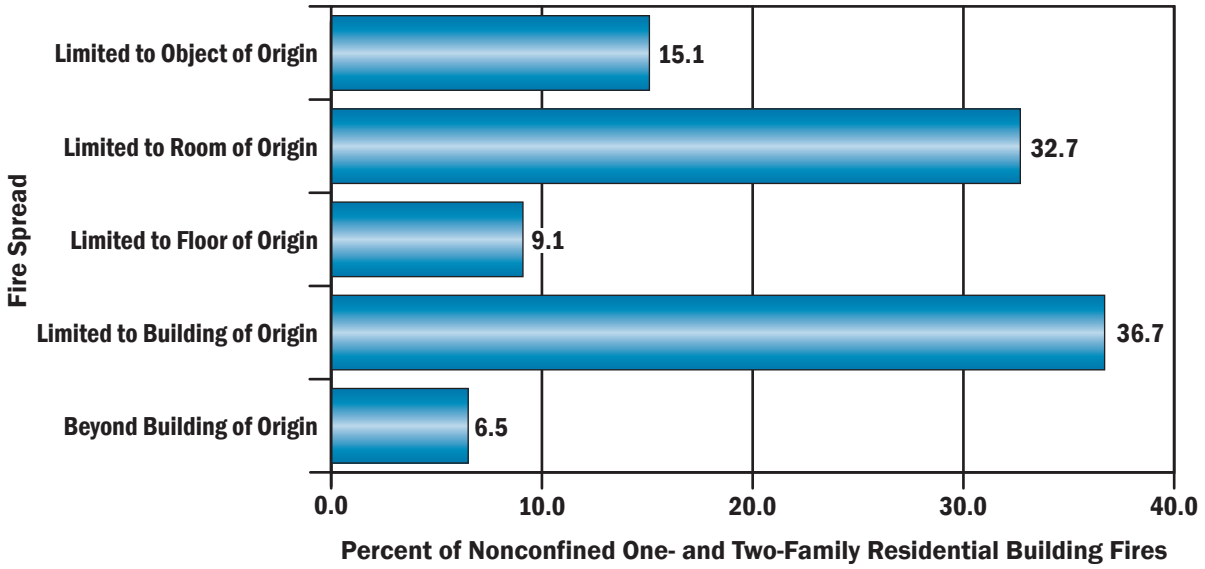
Source: NFIRS 5.0.

Fire Spread in Nonconfined One- and Two-Family Residential Building Fires

Figure 6 shows the extent of fire spread in nonconfined one- and two-family fires. In 48 percent of the nonconfined fires, the fire was limited to the object or room of fire origin — in 33 percent of nonconfined fires, the fire was limited to the room of origin; in another 15 percent of fires, the fire was limited to the object of origin.

In 52 percent of nonconfined one- and two-family fires, the fire extended beyond the room of origin. The leading reported causes of these larger fires were other unintentional, careless actions (16 percent); electrical malfunctions (14 percent); intentional actions (12 percent); and open flames (11 percent).

Figure 6. Extent of Fire Spread in Nonconfined One- and Two-Family Residential Building Fires (2011-2013)



Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Factors Contributing to Ignition in Nonconfined One- and Two-Family Residential Building Fires

Table 5 shows the categories of factors contributing to ignition in nonconfined one- and two-family fires. The leading category was the misuse of material or product (36 percent). In this category, the leading specific factors contributing to ignition were a heat source too close to combustible materials (13 percent of all nonconfined one- and two-family fires) and abandoned or discarded materials, such as matches or cigarettes (10 percent of all nonconfined one- and two-family fires).

Electrical failures and malfunctions contributed to 23 percent of nonconfined one- and two-family fires. Operational deficiency was the third leading category at 14 percent. Unattended equipment was the leading factor in the operational deficiency category and accounted for 7 percent of all nonconfined one- and two-family fires.

Table 5. Factors Contributing to Ignition for Nonconfined One- and Two-Family Residential Building Fires by Major Category (Where Factors Contributing to Ignition Are Specified, 2011-2013)

Factors Contributing to Ignition Category	Percent of Nonconfined One- and Two-Family Residential Building Fires (Unknowns Apportioned)
Misuse of material or product	35.6
Electrical failure, malfunction	22.9
Operational deficiency	14.0
Fire spread or control	11.9
Mechanical failure, malfunction	7.1
Other factors contributing to ignition	6.3
Natural condition	4.7
Design, manufacture, installation deficiency	2.4

Source: NFIRS 5.0.
Notes: 1. Includes only incidents where factors that contributed to the ignition of the fire were specified.
2. Multiple factors contributing to fire ignition may be noted for each incident; the total will exceed 100 percent.

Alerting/Suppression Systems in One- and Two-Family Residential Building Fires

Technologies to detect and extinguish fires have been major contributors to the drop in fire fatalities and injuries over the past 35 years. Smoke alarms are now present in the majority of residential buildings. In addition, the use of residential sprinklers is widely supported by the fire service and is gaining support within residential communities.

Smoke alarm data is available for both confined and nonconfined fires, although for confined fires, the data is very limited in scope. As different levels of data are reported on smoke alarms in confined and nonconfined fires, the analyses are performed separately. Note that the data presented in Tables 6 to 8 are the raw counts from the NFIRS dataset and are not scaled to national estimates of smoke alarms in one- and two-family fires. In addition, NFIRS does not allow for the determination of the type of smoke alarm — that is, if the smoke alarm was photoelectric or ionization — or the location of the smoke alarm with respect to the area of fire origin.

Smoke Alarms in Nonconfined Fires

Overall, smoke alarms were reported as present in 38 percent of nonconfined one- and two-family fires (Table 6). In 29 percent of nonconfined one- and two-family fires, there were no smoke alarms present. In another 33 percent of these fires, firefighters were unable to determine if a smoke alarm was present. Thus, smoke alarms were potentially missing in between 29 and 62 percent of fires with the ability to spread and possibly result in fatalities.

Table 6. Presence of Smoke Alarms in Nonconfined One- and Two-Family Residential Building Fires (2011-2013)

Presence of Smoke Alarms	Percent
Present	38.1
None present	29.2
Undetermined	32.7
Total	100.0

Source: NFIRS 5.0.

While 19 percent of all nonconfined one- and two-family fires occurred in residential buildings that are **not** currently or routinely occupied, these occupancies — buildings under construction, undergoing major renovation, vacant and the like — are unlikely to have alerting and suppression systems that are in place and, if in place, that are operational. In fact, only 6 percent of nonconfined fires in unoccupied one- and two-family residential buildings were reported as having smoke alarms that operated. As a result, the detailed smoke alarm analyses in the next section focus on nonconfined fires in occupied one- and two-family residential buildings only.

Smoke Alarms in Nonconfined Fires in Occupied One- and Two-Family Residential Buildings

Smoke alarms were reported as present in 44 percent of nonconfined fires in occupied one- and two-family residential buildings (Table 7). In 23 percent of nonconfined fires in occupied one- and two-family residential buildings, there were no smoke alarms present. In another 33 percent of these fires, firefighters were unable to determine if a smoke alarm was present. Unfortunately, in almost half (49 percent) of the fires where the presence of a smoke alarm was undetermined, either the flames involved the building of origin or spread beyond it. These fires were so large and destructive that it is unlikely the presence of a smoke alarm could be determined.

When smoke alarms were present (44 percent) and the alarm operational status is considered, the percentage of smoke alarms reported as present consisted of:

- Present and operated — 25 percent.
- Present but did not operate — 11 percent (alarm failed to operate, 6 percent; fire too small, 6 percent).[19]
- Present but operational status unknown — 7 percent.[20]

When the subset of incidents where smoke alarms were reported as present was analyzed separately as a whole, smoke alarms were reported to have operated in 57 percent of these incidents. The alarms failed to operate in 13 percent of these incidents, and the fire was too small to activate the alarm in another 13 percent. The operational status of the alarm was undetermined in an additional 17 percent of these incidents.

Nationally, only 3 percent of households lack smoke alarms.[21] Here, at least 23 percent of nonconfined fires in occupied one- and two-family residential buildings had no smoke alarms present — and perhaps more if fires without information on smoke alarms were also taken into account.[22] A large proportion of reported fires without smoke alarms may reflect the effectiveness of the alarms themselves: Smoke alarms do not prevent fires, but they may prevent a fire from being reported if it is detected at an early stage and extinguished before the fire department becomes involved. Alternatively, fires in homes without smoke alarms may **not** be detected at an early stage, causing them to grow large, require fire department intervention, and thus be reported.[23]

Properly installed and maintained smoke alarms provide an early warning signal to household members in the event that a fire occurs. Smoke alarms help save lives and property. USFA continues to partner with other government agencies and fire service entities to improve and develop new smoke alarm technologies. More information on smoke alarm technologies, performance, disposal and storage, training bulletins, and public education and outreach materials can be found at http://www.usfa.fema.gov/prevention/technology/smoke_fire_alarms.html.

Table 7. NFIRS Smoke Alarm Data for Nonconfined Fires in Occupied One- and Two-Family Residential Buildings (2011-2013)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		14,572	5.8
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	44,558	17.8
		Smoke alarm alerted occupants, occupants failed to respond	1,609	0.6
		No occupants	8,566	3.4
		Smoke alarm failed to alert occupants	1,752	0.7
		Undetermined	6,707	2.7
	Smoke alarm failed to operate		14,167	5.7
	Undetermined		18,558	7.4
None present			57,946	23.1
Undetermined			81,874	32.7
Total incidents			250,309	100.0

Source: NFIRS 5.0.

Notes: 1. The data presented in this table are raw data counts from the NFIRS dataset summed (not averaged) from 2011-2013. They do not represent national estimates of smoke alarms in nonconfined fires in occupied one- and two-family residential buildings. They are presented for informational purposes.
2. Total does not add up to 100 percent due to rounding.

Smoke Alarms in Confined Fires

Less information about smoke alarm status is collected for confined fires, but the data still give important insights about the effectiveness of alerting occupants in these types of fires. The analyses presented here do not differentiate between occupied and unoccupied residential buildings, as this data detail is not required when reporting confined fires in NFIRS. However, an assumption may be made that confined fires are fires in occupied housing, as these types of fires are unlikely to be reported in residential buildings that are not occupied.

Smoke alarms alerted occupants in 34 percent of the reported confined one- and two-family fires (Table 8). In other words, in about one-third of fires in these types of homes, residents received a warning from a smoke alarm. The data suggest that smoke alarms may alert residents to confined fires, as the early alerting allowed the occupants to extinguish the fires, or the fires self-extinguished. If this is the case, it is an example of the contribution to life safety and the ability to rapidly respond to fires in early stages that smoke alarms afford. Details on smoke alarm effectiveness for confined fires are needed to pursue this analysis further.

Occupants were not alerted by smoke alarms in 22 percent of confined one- and two-family fires.[24] In 44 percent of these confined fires, the smoke alarm effectiveness was unknown.

Table 8. NFIRS Smoke Alarm Data for Confined One-and Two-Family Residential Building Fires (2011-2013)

Smoke Alarm Effectiveness	Count	Percent
Smoke alarm alerted occupants	66,141	33.5
Smoke alarm did not alert occupants	43,415	22.0
Unknown	87,632	44.4
Null/Blank	1	0.0
Total incidents	197,189	100.0

Source: NFIRS 5.0.

Notes: 1. The data presented in this table are raw data counts from the NFIRS dataset summed (not averaged) from 2011-2013. They do not represent national estimates of smoke alarms in confined one- and two-family residential building fires. They are presented for informational purposes.
2. Total does not add up to 100 percent due to rounding.

Automatic Extinguishing Systems in Nonconfined Fires in Occupied One- and Two-Family Residential Buildings

AES data is available for both confined and nonconfined fires, although for confined fires, the data is also very limited in scope. In confined residential building fires, an AES was present in only 1 percent of reported incidents.[25] In addition, the following AES analyses focus on nonconfined fires in occupied one- and two-family buildings only, as even fewer AESs are present in unoccupied housing.

Residential sprinklers are the primary AES in one- and two-family residences and are not yet widely installed. In fact, full or partial AESs were reported as present in only 1 percent of nonconfined fires in occupied one- and two-family buildings (Table 9). This was the lowest reported presence of sprinklers in nonconfined fires in any occupied residential occupancy.

Residential sprinkler systems help to reduce the risk of civilian and firefighter casualties, homeowner insurance premiums, and uninsured property losses. Yet many residences are unequipped with AESs that are often installed in hotels and businesses. Sprinklers are required by code in hotels and many multifamily residences. There are major movements in the U.S. fire service to require or facilitate use of sprinklers in all new homes, which could improve the use of residential sprinklers in the future. At present, however, they are largely absent in residences nationwide.[26]

USFA and fire service officials across the nation are working to promote and advance residential fire sprinklers. More information on costs and benefits, performance, training bulletins, and public education and outreach materials regarding residential sprinklers can be found at http://www.usfa.fema.gov/prevention/technology/home_fire_sprinklers.html. Additionally, USFA's position statement on residential sprinklers is available at http://www.usfa.fema.gov/about/sprinklers_position.html.

Table 9. NFIRS Automatic Extinguishing System Data for Nonconfined Fires in Occupied One- and Two-Family Residential Buildings (2011-2013)

Automatic Extinguishing System Presence	Count	Percent
Automatic extinguishing system present	2,855	1.1
Partial system present	103	0.0
Automatic extinguishing system not present	225,984	90.3
Unknown	21,367	8.5
Total incidents	250,309	100.0

Source: NFIRS 5.0.
Notes: 1. The data presented in this table are raw data counts from the NFIRS dataset summed (not averaged) from 2011-2013. They do not represent national estimates of AESs in nonconfined fires in occupied one- and two-family residential buildings. They are presented for informational purposes.
2. Total does not add up to 100 percent due to rounding.

Examples

The following are some recent examples of one- and two-family fires reported by the media:

- April 2015: A lightning strike caused a late night house fire in San Antonio, Texas. Upon arrival, the San Antonio Fire Department encountered flames coming out of the second-story roof but were able to eventually control the fire. The family of three who lived in the home escaped without injury. The entire second-story roof of the home, however, was destroyed, with damages estimated at $110,000.[27]

- April 2015: A faulty portable space heater caused a two-story house fire in Cecil County, Maryland, that injured one resident and one firefighter. The young resident, who reported the afternoon fire, suffered minor burns. The firefighter, who was first to arrive at the scene, was seriously burned while entering the home after initial reports falsely indicated that someone was still trapped inside. For treatment of their injuries, the resident was transported to a local hospital and the firefighter was transported to a burn center. The fire started in a second-floor bedroom. Damage to the home was estimated at $95,000, and although smoke alarms were present inside of the home, they did not activate.[28]

- April 2015: A man and his grandmother were killed in a Revloc, Pennsylvania, duplex fire. Upon arrival, fire crews found much of the building engulfed in flames. Witnesses reported that the 24-year-old man re-entered the house in an attempt to save the 65-year-old woman. While others in the duplex were able to safely escape, the man and his grandmother became trapped and died from smoke and gas inhalation. Their bodies were later recovered. It was reported that a wood burner may have started the fire.[29]

NFIRS Data Specifications for One- and Two-Family Residential Building Fires

Data for this report were extracted from the NFIRS annual Public Data Release files for 2011, 2012 and 2013. Only Version 5.0 data were extracted.

One- and two-family fires were defined using the following criteria:

- Aid Types 3 (mutual aid given) and 4 (automatic aid given) were excluded to avoid double counting of incidents.

- Incident Types 111 to 123 (excluding Incident Type 112):

Incident Type	Description
111	Building fire
113	Cooking fire, confined to container
114	Chimney or flue fire, confined to chimney or flue
115	Incinerator overload or malfunction, fire confined
116	Fuel burner/boiler malfunction, fire confined
117	Commercial compactor fire, confined to rubbish
118	Trash or rubbish fire, contained
120	Fire in mobile property used as a fixed structure, other
121	Fire in mobile home used as fixed residence
122	Fire in motor home, camper, recreational vehicle
123	Fire in portable building, fixed location

Note: Incident Types 113 to 118 do not specify if the structure is a building.

- Property Use 419:

Property Use	Description
419	One- or two-family dwelling, detached, manufactured home, mobile home not in transit, duplex

- Structure Type:
  - For Incident Types 113 to 118:
    - 1—Enclosed building, or
    - 2—Fixed portable or mobile structure, or
    - Structure Type not specified (null entry).
  - For Incident Types 111 and 120 to 123:
    - 1—Enclosed building, or
    - 2—Fixed portable or mobile structure.

The analyses contained in this report reflect the current methodologies used by USFA. USFA is committed to providing the best and most currently available information on the U.S. fire problem and continually examines its data and methodology to fulfill this goal. Because of this commitment, data collection strategies and methodological changes are possible and do occur. As a result, analyses and estimates of the fire problem may change slightly over time. Previous analyses and estimates on specific issues (or similar issues) may have used different methodologies or data definitions and may not be directly comparable to the current ones.

Information regarding USFA's national estimates for residential building fires as well as the data sources used to derive the estimates can be found in the document, "Data Sources and National Estimates Methodology Overview for the U.S. Fire Administration's Topical Fire Report Series (Volume 16)," http://www.usfa.fema.gov/downloads/pdf/statistics/data_sources_and_national_estimates_methodology_vol16.pdf. This document also addresses the specific NFIRS data elements analyzed in the topical reports, as well as "unknown" data entries and missing data.

To request additional information or to comment on this report, visit http://www.usfa.fema.gov/contact.html.

Notes:

[1]National estimates are based on 2011-2013 native Version 5.0 data from NFIRS, residential structure fire loss estimates from the National Fire Protection Association's (NFPA's) annual surveys of fire loss, and USFA's residential building fire loss estimates: http://www.usfa.fema.gov/data/statistics/order_download_data.html. Further information on USFA's residential building fire loss estimates can be found in the "National Estimates Methodology for Building Fires and Losses," August 2012, http://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf. For information on NFPA's survey methodology, see NFPA's report on fire loss in the U.S.: http://www.nfpa.org/~/media/Files/Research/NFPA%20reports/Overall%20Fire%20Statistics/osfireloss.pdf. In this topical report, fires are rounded to the nearest 100, deaths to the nearest five, injuries to the nearest 25, and dollar loss to the nearest $100 million.

[2]In NFIRS Version 5.0, a structure is a constructed item of which a building is one type. In previous versions of NFIRS, the term "residential structure" commonly referred to buildings where people live. To coincide with this concept, the definition of a residential structure fire for NFIRS 5.0 has, therefore, changed to include only those fires where the NFIRS 5.0 Structure Type is 1 or 2 (enclosed building and fixed portable or mobile structure) with a residential property use. Such structures are referred to as "residential buildings" to distinguish these buildings from other structures on residential properties that may include fences, sheds and other uninhabitable structures. In addition, confined fire incidents that have a residential property use but do not have a Structure Type specified are presumed to occur in buildings. Nonconfined fire incidents that have a residential property use without a Structure Type specified are considered to be invalid incidents (Structure Type is a required field) and are not included.

[3]National Oceanic and Atmospheric Administration's National Weather Service, Summary of Natural Hazard Statistics for 2013 in the U.S. (http://www.nws.noaa.gov/om/hazstats/sum13.pdf).

[4]Fire department participation in NFIRS is voluntary; however, some states do require their departments to participate in the state system. Additionally, if a fire department is a recipient of a Fire Act Grant, participation is required. From 2011 to 2013, 68 percent of NFPA's annual average estimated 1,334,800 fires to which fire departments responded were captured in NFIRS. Thus, NFIRS is not representative of all fire incidents in the U.S. and is not a "complete" census of fire incidents. Although NFIRS does not represent 100 percent of the incidents reported to fire departments each year, the enormous dataset exhibits stability from one year to the next, without radical changes. Results based on the full dataset are generally similar to those based on part of the data.

[5]Multifamily residential buildings include structures such as apartments, town houses, row houses, condominiums, and other tenement properties.

[6]In NFIRS, confined fires are defined by Incident Type codes 113-118.

[7]NFIRS distinguishes between "content" and "property" loss. Content loss includes losses to the contents of a structure due to damage by fire, smoke, water and overhaul. Property loss includes losses to the structure itself or to the property itself. Total loss is the sum of the content loss and the property loss. For confined fires, the expectation is that the fire did not spread beyond the container (or rubbish for Incident Type code 118), and hence, there was no property damage (damage to the structure itself) from the flames. However, there could be property damage as a result of smoke, water and overhaul.

[8]The average fire death and fire injury loss rates computed from the national estimates do not agree with average fire death and fire injury loss rates computed from NFIRS data alone. The fire death rate computed from national estimates is (1,000*(2,025/241,700)) = 8.4 deaths per 1,000 one- and two-family residential building fires, and the fire injury rate is (1,000*(8,400/241,700)) = 34.8 injuries per 1,000 one- and two-family residential building fires.

[9]For the purposes of this report, the time of the fire alarm is used as an approximation for the general time at which the fire started. However, in NFIRS, it is the time at which the fire was reported to the fire department.

[10]USFA, "Cooking Fires in Residential Buildings (2008-2010)," Volume 13, Issue 12, January 2013, http://www.usfa.fema.gov/downloads/pdf/statistics/v13i12.pdf.

[11]The USFA Structure Fire Cause Methodology was used to determine the cause of one- and two-family residential building fires. The cause methodology and definitions can be found in the document "National Fire Incident Reporting System Version 5.0 Fire Data Analysis Guidelines and Issues," July 2011, http://www.usfa.fema.gov/downloads/pdf/nfirs/nfirs_data_analysis_guidelines_issues.pdf.

[12]Fires caused by intentional actions include, but are not limited to, fires that are deemed to be arson. Intentional fires are those fires that are deliberately set and include fires that result from the deliberate misuse of a heat source and fires of an incendiary nature (arson) that require fire service intervention. For information and statistics on arson fires only, refer to the Uniform Crime Reporting Program arson statistics from the U.S. Department of Justice, FBI, Criminal Justice Information Services Division, http://www.fbi.gov/about-us/cjis/ucr/ucr.

[13]The American Housing Survey does not indicate the number of fireplaces, chimneys and fireplace-related equipment per se. It does collect data on fireplaces, etc., as the primary heating unit, which applies to this analysis. U.S. Department of Housing and Urban Development (HUD) and U.S. Census Bureau, 2013 American Housing Survey, "General Characteristics by Units in Structure-All Occupied Units (National)," Table C-12-AO, http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=AHS_2013_C12AO&prodType=table (accessed April 14, 2015).

[14]Smith, Linda E. and Dennis McCoskrie, "What Causes Wiring Fires in Residences?" Fire Journal, January/February 1990.

[15]Dini, David A., "Residential Electrical System Aging Research Project," Fire Protection Research Foundation, Quincy, Massachusetts, July 1, 2008, http://www.nfpa.org/research/fire-protection-research-foundation/reports-and-proceedings/electrical-safety/aging-electrical-system-performance (accessed May 5, 2015).

[16] The American Housing Survey does not have a category for one- and two-family residences that conforms to the definition used by NFIRS. Housing age given here is an estimate based on the information presented for single-family attached and detached housing. HUD and U.S. Census Bureau, 2013 American Housing Survey, "General Characteristics by Units in Structure-All Occupied Units (National)," Table C-12-AO, http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=AHS_2013_C12AO&prodType=table (accessed April 14, 2015).

[17]Dini, David A., "Residential Electrical System Aging Research Project," Fire Protection Research Foundation, Quincy, Massachusetts, July 1, 2008, http://www.nfpa.org/research/fire-protection-research-foundation/reports-and-proceedings/electrical-safety/aging-electrical-system-performance (accessed May 5, 2015).

[18]As noted previously, in NFIRS, confined building fires are small fire incidents that are limited in scope, are confined to specific noncombustible containers, rarely result in serious injury or large content loss, and are expected to have no significant accompanying property loss due to flame damage. In NFIRS, confined fires are defined by Incident Type codes 113-118.

[19] Total does not add up to 11 percent due to rounding.

[20] Total does not add up to 44 percent due to rounding.

[21] Greene, Michael and Craig Andres, "2004-2005 National Sample Survey of Unreported Residential Fires," Division of Hazard Analysis, Directorate for Epidemiology, U.S. Consumer Product Safety Commission, July 2009.

[22] Here, **at least** 23 percent of nonconfined fires in occupied one- and two-family residential buildings had no smoke alarms present — the 23 percent that were known to not have smoke alarms and some portion (or as many as all) of the fires where the smoke alarm presence was undetermined.

[23] The "2004-2005 National Sample Survey of Unreported Residential Fires," however, suggests that this may not be the case. It is observed that "if this conjecture is true, it would suggest that the percentage decrease in fire department-attended fires would have been greater than unattended fires in the 20 year period between the surveys."

[24] In confined fires, the entry "smoke alarm did not alert occupants" can mean no smoke alarm was present; the smoke alarm was present but did not operate; the smoke alarm was present and operated, but the occupant/s was already aware of the fire; or there were no occupants present at the time of the fire.

[25] As confined fire codes are designed to capture fires contained to noncombustible containers, it is not recommended to code a fire incident as a small-, low- or no-loss confined fire incident if the AES operated and contained the fire as a result. The preferred method is to code the fire as a standard fire incident with fire spread confined to the object of origin and provide the relevant information on AES presence and operation.

[26] HUD and U.S. Census Bureau, 2011 American Housing Survey, "Health and Safety Characteristics-All Occupied Units (National)," Table S-01-AO, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=AHS_2011_S01AO&prodType=table (accessed May 5, 2015).

[27] "Lightning Sparks House Fire," www.kens5.com, April 13, 2015, http://www.kens5.com/story/news/local/2015/04/13/lightning-sparks-house-fire/25700497/ (accessed April 13, 2015).

[28] Brown, Robin, "2 Injured in House Fire," www.delawareonline.com, April 12, 2105, http://www.delawareonline.com/story/news/local/2015/04/12/injured-house-fire/25691967/ (accessed April 13, 2015).

[29] "Man, Grandmother Die in House Fire as He Tries to Save Her," www.nytimes.com, April 4, 2015, http://www.nytimes.com/aponline/2015/04/04/us/ap-us-fatal-duplex-fire.html?_r=0 (accessed May 5, 2015).