TOPICAL FIRE REPORT SERIES Volume 14, Issue 10 / September 2013

One- and Two-family Residential Building Fires (2009-2011)

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 236,200 one- and two-family residential building fires were reported to United States fire departments each year and caused an estimated 1,980 deaths, 8,525 injuries and 5.5 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 was the leading cause of one- and two-family residential building fires reported to the fire service (33 percent). Nearly all one- and two-family residential building cooking fires were small, confined fires (91 percent).
- In 52 percent of nonconfined one- and two-family fires, the fire extended beyond the room of origin. The leading causes of these larger fires were other unintentional, careless actions (17 percent); electrical malfunctions (16 percent); intentional (12 percent); and open flame (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 the larger, nonconfined fires in occupied one- and two-family residential buildings. This is a high percentage when compared to the 3 percent of households nationally lacking smoke alarms.

From 2009 to 2011, fire departments responded to an estimated 236,200 fires in one- and two-family residences each year across the nation.[1, 2] These fires resulted in an annual average loss of 1,980 deaths, 8,525 injuries and 5.5 billion dollars in property loss. One- and two-family residential building fires accounted for the majority of all residential building fires (65 percent) 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.

The vast majority of fire deaths in the nation occurred in one- and two-family dwellings. Because these fatalities occurred throughout the year all over the country, they did not often 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 (60 percent) were larger, nonconfined fires, that is, fires that 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 (69 percent).

One- and two-family residential building fires also differed from other residential building fires in their cause profiles. While cooking accounted for 33 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 68 percent of fires. Heating and electrical malfunctions, such as short circuits, arcing and the like, however, played a larger role in one- and two-family residential building fires than in other types of residential building fires.

This current topical report is an update to the "One- and Two-family Residential Building Fires (2008-2010)" topical report (Volume 13, Issue 4), which was released in May 2012. As part of a series of topical reports that addresses fires in the major residential building types, the remainder of this report addresses the characteristics of one- and two-family residential building fires reported to the National

Fire Incident Reporting System (NFIRS). The focus is on fires reported from 2009 to 2011, the most recent data available at the time of the analysis. It 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 (2009-2011)" (Volume 14, Issue 11) topical report.

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 not confined. Confined building fires are small fire incidents that are limited in extent, staying within pots, fireplaces or certain other noncombustible containers.[4] Confined fires rarely result in serious injury or large content losses, and they are expected to have no significant accompanying property losses due to flame damage.[5] Of the two classes of severity, nonconfined fires accounted for 60 percent of one- and two-family fires. The smaller, confined fires accounted for the remaining 40 percent of one- and two-family fires. Cooking fires were the predominant type of confined fires in one- and two-family dwellings, as they are in most residential occupancies (Table 1).

Table 1. One- and Two-family Residential Building Fires by Type of Incident (2009-2011)

Incident Type	Percent
Nonconfined fires	60.4
Confined fires	39.6
Cooking fire, confined to container	23.8
Chimney or flue fire, confined to chimney or flue	8.7
Incinerator overload or malfunction, fire confined	0.2
Fuel burner/boiler malfunction, fire confined	3.0
Commercial compactor fire, confined to rubbish	0.0
Trash or rubbish fire, contained	3.9
Total	100.0

Source: NFIRS 5.0.

Loss Measures

Table 2 presents losses, averaged over the three-year period from 2009 to 2011, of reported residential fires and one- and two-family fires.[6] The average number of fatalities per 1,000 fires for one- and two-family fires was twice as high as the same loss measure 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, as nonconfined fires generally are larger fires that often result in serious injuries and more content losses.

Table 2. Loss Measures for One- and Two-family Residential Building Fires (Three-year Average, 2009-2011)

Measure	Residential Building Fires (Excluding One- and Two-family)	One- and Two-family Residential Building Fires	**Confined One-** and Two-family Residential Building Fires	**Nonconfined One-** and Two-family Residential Building Fires
Average Loss:				
Fatalities/1,000 fires	3.3	6.6	0.0	10.9
Injuries/1,000 fires	30.3	28.8	7.6	42.6
Dollar loss/fire	$9,640	$18,480	$200	$30,470

Source: NFIRS 5.0.

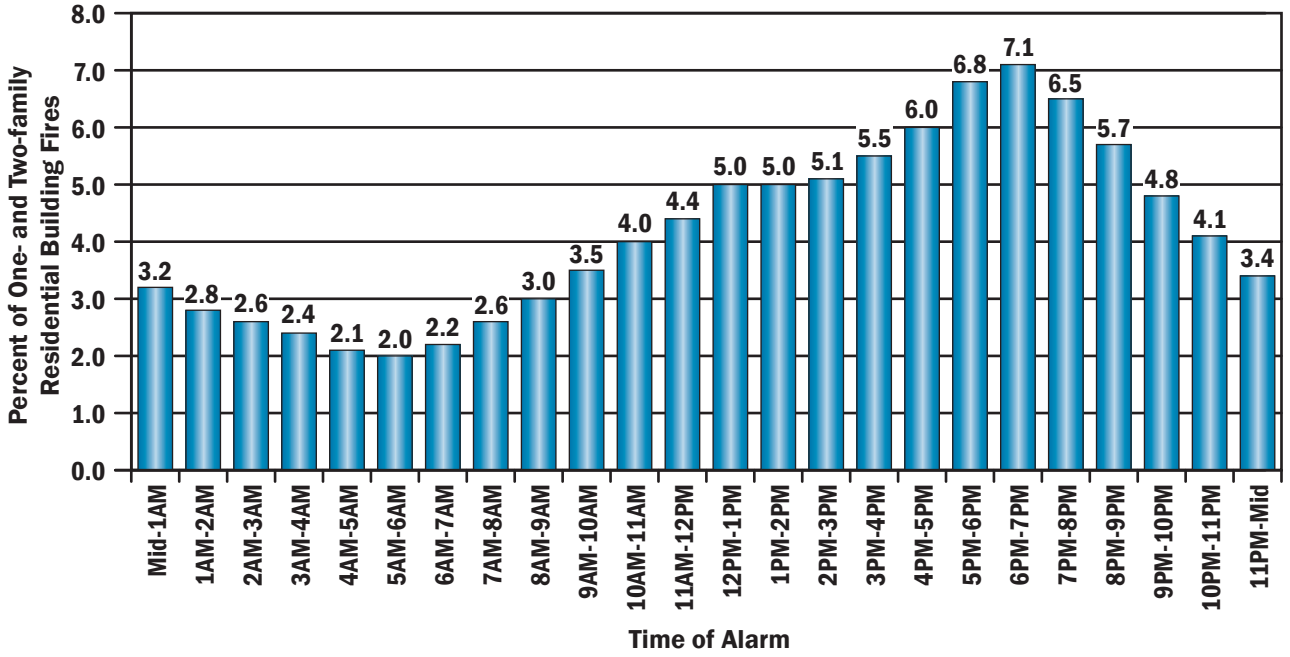
Notes: 1. Average loss for fatalities and injuries is computed per 1,000 fires; average dollar loss is computed **per fire** and is rounded to the nearest $10.

2. When calculating the average dollar loss per fire from 2009 to 2011, the 2009 and 2010 dollar-loss values were adjusted to their equivalent 2011 dollar-loss values to account for inflation.

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 fires were high.[7, 8] Cooking fires, discussed later in the section, "Causes of One- and Two-family Residential Building Fires," accounted for 33 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.

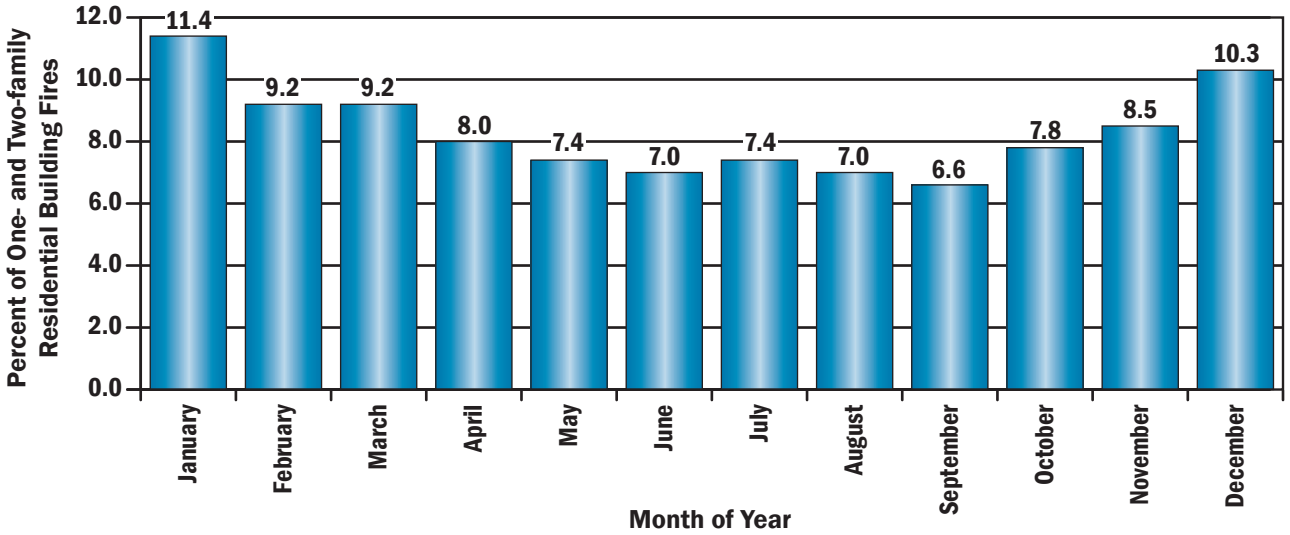
Figure 1. One- and Two-family Residential Building Fires by Time of Alarm (2009-2011)



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-related activities. During the spring and summer months, the fire incidence declined steadily, reaching a low in September.

Figure 2. One- and Two-family Residential Building Fires by Month (2009-2011)



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 cause of one- and two-family fires and accounted for 33 percent of all one- and two-family fires, as shown in Table 3.[9] Nearly all of these cooking fires (91 percent) were small, confined fires with limited damage.

The next five causes combined accounted for 46 percent of one- and two-family fires: fires caused by heating (17 percent); electrical malfunctions, such as short circuits and wiring problems (10 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).[10]

Table 3. Leading Causes of One- and Two-family Residential Building Fires (2009-2011)

Cause	Percent (Unknowns Apportioned)
Cooking	32.9
Heating	17.0
Electrical malfunction	9.6
Other unintentional, careless	8.3
Open flame	5.7
Intentional	5.6

Source: NFIRS 5.0.

There was a striking difference between one- and two-family and the other residential occupancies in the prevalence of cooking as a fire cause. While cooking accounted for 33 percent of one- and two-family fires, it accounted for 70 percent of multifamily residential building fires and 59 percent of all other types of residential occupancies. 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, contained and do not cause much damage. In addition, only the residents hear the smoke alarm if it is activated. 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 are connected to the building alarm system, and the fire department may automatically be called.

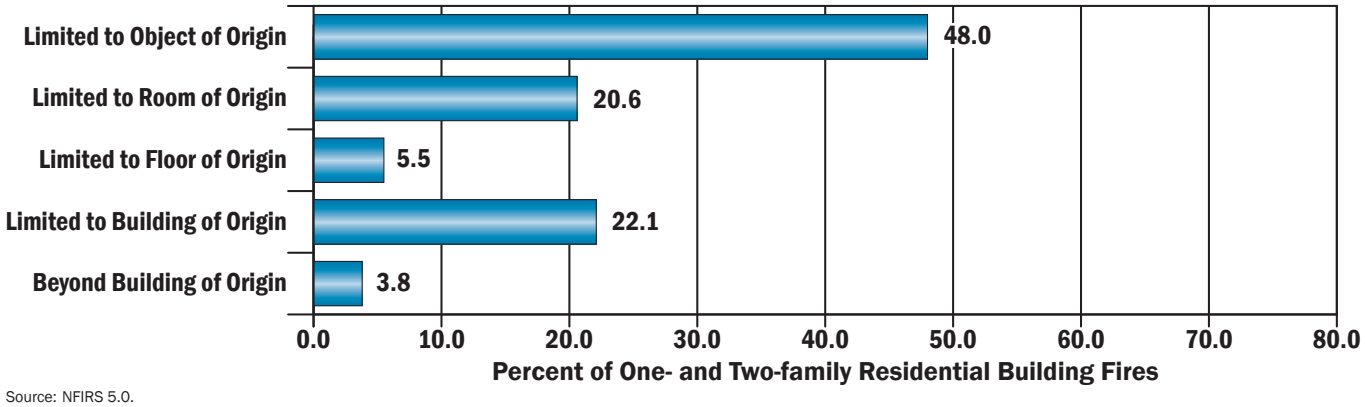
Heating and electrical malfunctions also played a larger role in one- and two-family fires than in multifamily fires. One reason for this may be that many one- and two-family residential buildings have fireplaces, chimneys and fireplace-related equipment that most other types of residential properties do not have.[11]

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.[12, 13] As of 2011, the median age of one- and two-family housing was over 35 years. With half of this housing stock older than 35 years, electrical issues become an increasingly larger player in residential fires.[14] 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.[15] 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 48 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, 31 percent of the fires extended beyond the room of origin.

Figure 3. Extent of Fire Spread in One- and Two-family Residential Building Fires (2009-2011)



Source: NFIRS 5.0.

Confined Fires

NFIRS allows abbreviated reporting for smaller, confined fires, and many reporting 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.[16] 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 40 percent of all one- and two-family fires. Cooking fires — those cooking fires confined to a pot or the oven, for example — accounted for the majority of these confined fires (Table 1).

In addition, the numbers of confined one- and two-family fires were greatest from 5 to 8 p.m.; they accounted for 52 percent of the one- and two-family fires in this time period. Moreover, confined cooking fires accounted for 64 percent of the confined fires and 33 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.

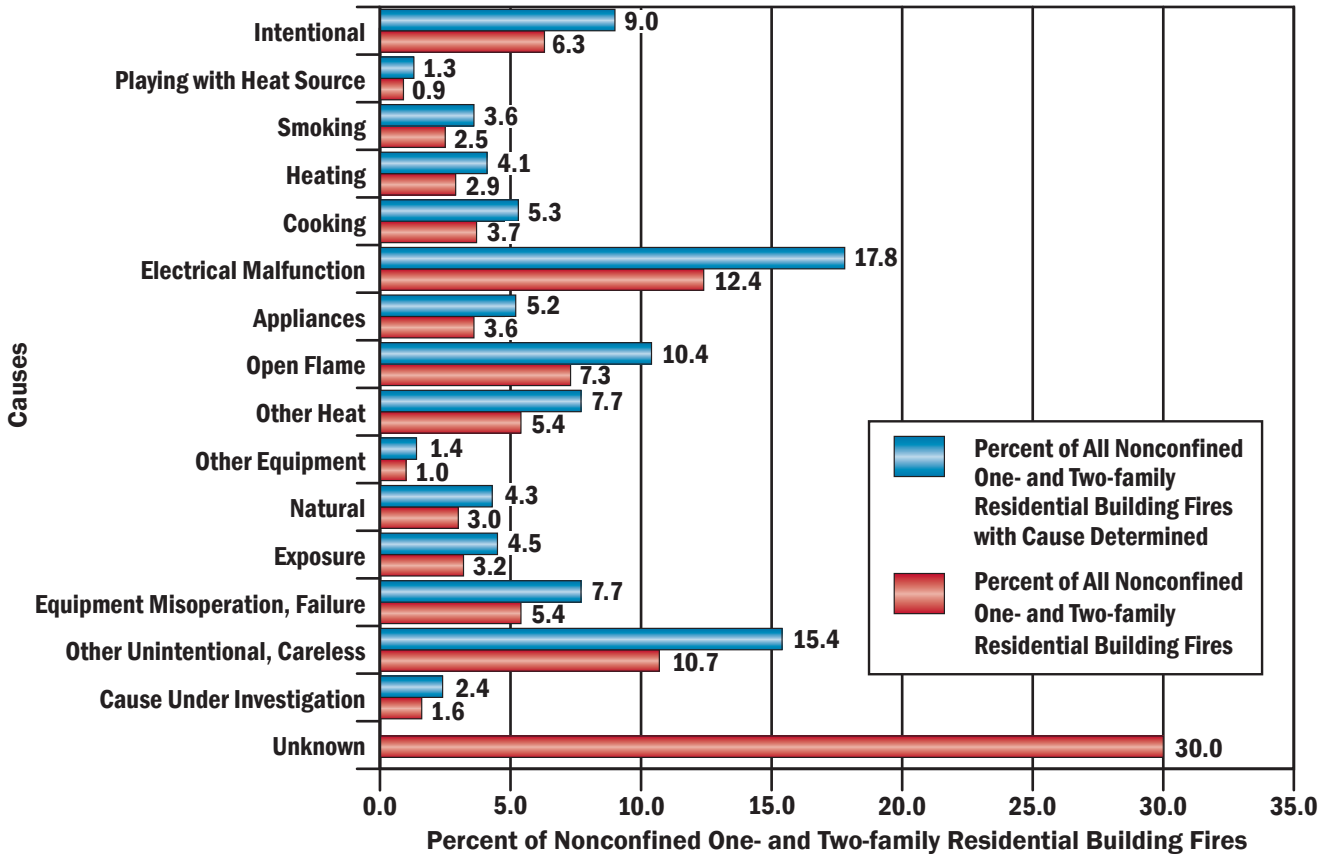
Nonconfined Fires

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 cause of one- and two-family fires overall, it only accounted for 5 percent of all nonconfined one- and two-family fires. At 18 percent, electrical malfunction was the leading cause of nonconfined one- and two-family fires. Other leading causes of nonconfined one- and two-family fires were other unintentional, careless actions (15 percent); open flames (10 percent); and intentional actions, a group that includes fires commonly called arson fires (9 percent) (Figure 4).

Figure 4. Causes of Nonconfined One- and Two-family Residential Building Fires (2009-2011)



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. Totals do 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 (19 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 (5 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 cause of all one- and two-family fires at 33 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 26 percent of nonconfined one- and two-family fires that started in the kitchen were cooking fires. Other unintentional, careless actions accounted for 19 percent of kitchen fires, and nonheat-producing equipment that malfunctions or fails also accounted for an additional 19 percent of kitchen fires.

Table 4. Leading Areas of Fire Origin in Nonconfined One- and Two-family Residential Building Fires (2009-2011)

Areas of Fire Origin	Percent (Unknowns Apportioned)
Cooking area, kitchen	19.0
Bedrooms	13.2
Common room, den, family room, living room, lounge	6.6
Attic, vacant spaces	5.8
Exterior wall surface	5.2
Laundry area	5.0
Vehicle storage area: garage, carport	4.8

Source: NFIRS 5.0.

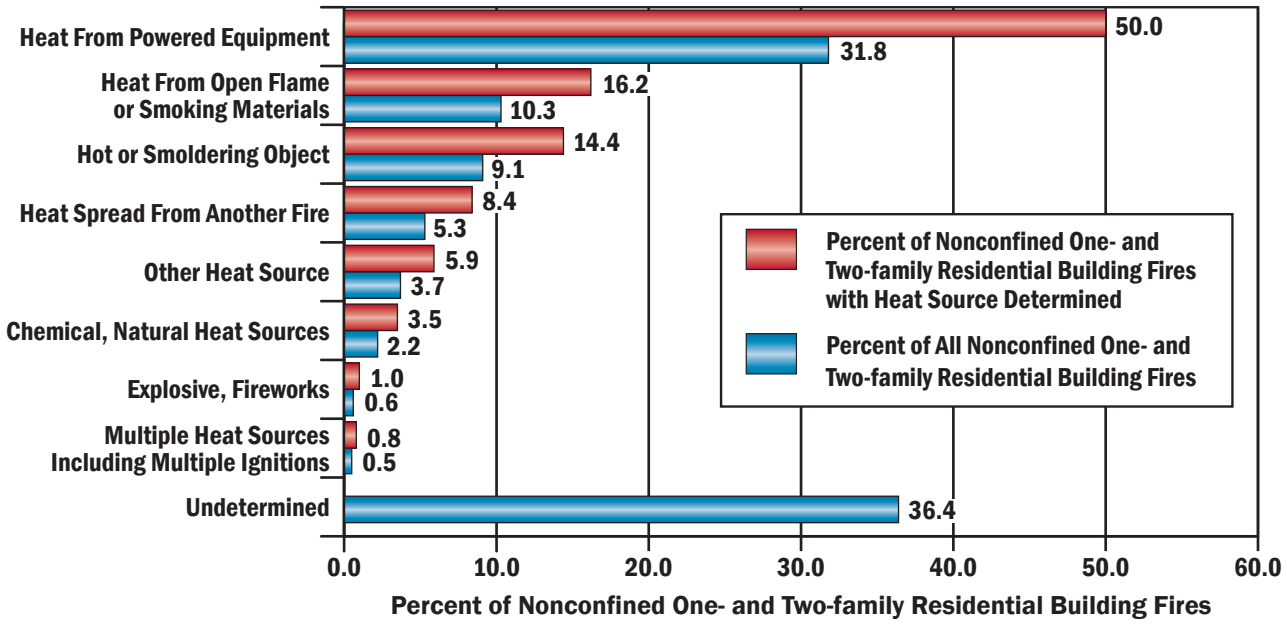
How Nonconfined One- and Two-family Residential Building Fires Start (Heat Source)

Figure 5 shows sources of heat categories for nonconfined one- and two-family fires. Heat from powered equipment accounted for 50 percent of nonconfined one- and two-family fires. This category includes electrical arcing (18 percent); radiated or conducted heat from operating equipment (14 percent); heat from other powered equipment (13 percent); and spark, ember or flame from operating equipment (5 percent).

Heat from open flame or smoking materials accounted for 16 percent of nonconfined one- and two-family fires. This category includes such items as cigarettes (4 percent), lighters and matches (combined, 4 percent), and candles (3 percent).

The third largest category pertained to hot or smoldering objects (14 percent). This category includes miscellaneous hot or smoldering objects (7 percent) and hot embers or ashes (6 percent).

Figure 5. Sources of Heat in Nonconfined One- and Two-family Residential Building Fires by Major Category (2009-2011)



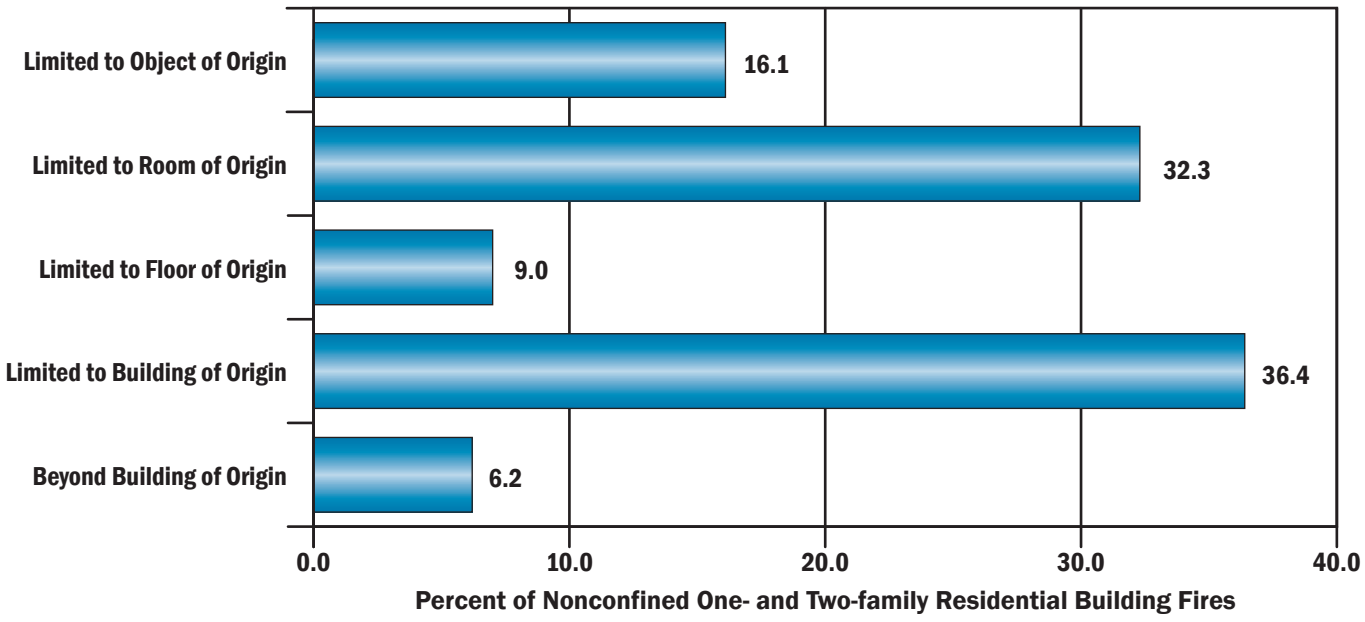
Source: NFIRS 5.0.
Note: Totals do not add up to 100 percent due to rounding.

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

Figure 6 shows the 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 32 percent of nonconfined fires, the fire was limited to the room of origin; in another 16 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 causes of these larger fires were other unintentional, careless actions (17 percent); electrical malfunctions (16 percent); intentional (12 percent); and open flame (11 percent).

Figure 6. Extent of Fire Spread in Nonconfined One- and Two-family Residential Building Fires (2009-2011)



Source: NFIRS 5.0.

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 (35 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 (9 percent of all nonconfined one- and two-family fires).

Electrical failures and malfunctions contributed to 25 percent of nonconfined one- and two-family fires. Operational deficiency was the third leading category at 15 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, 2009-2011)

Factors Contributing to Ignition Category	Percent of Nonconfined One- and Two-family Residential Building Fires (Unknowns Apportioned)
Misuse of material or product	35.0
Electrical failure, malfunction	24.5
Operational deficiency	14.9
Fire spread or control	10.8
Mechanical failure, malfunction	7.5
Other factors contributing to ignition	6.0
Natural condition	4.2
Design, manufacture, installation deficiency	2.5

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 a major contributor 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 are available for both confined and nonconfined fires, although for confined fires, the data are very limited in scope. As different levels of data are collected 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 data set 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 these 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 (2009-2011)

Presence of Smoke Alarms	Percent
Present	38.4
None present	28.9
Undetermined	32.7
Total	100.0

Source: NFIRS 5.0.

While 18 percent of all nonconfined one- and two-family fires occurred in residential buildings that were **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 of the fires where the presence of a smoke alarm was undetermined (49 percent), either the flames involved the building of origin or spread beyond it. The 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, 5 percent).
- Present but operational status unknown — 7 percent.

When the subset of incidents where smoke alarms were reported as present are analyzed separately, smoke alarms were reported to have operated in 57 percent and failed to have operated in 13 percent of the incidents. In 12 percent of this subset, the fire was too small to activate the alarm. The operational status of the alarm was undetermined in 17 percent of these incidents.[17]

Nationally, only 3 percent of households lack smoke alarms.[18] 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.[19] 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. The fires grow large, require fire department intervention, and thus are reported.[20]

Table 7. NFIRS Smoke Alarm Data for Nonconfined Fires in Occupied One- and Two-family Residential Buildings (2009-2011)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		13,891	5.4
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	45,627	17.8
		Smoke alarm alerted occupants, occupants failed to respond	1,635	0.6
		No occupants	8,694	3.4
		Smoke alarm failed to alert occupants	1,916	0.7
		Undetermined	6,736	2.6
	Smoke alarm failed to operate		15,125	5.9
	Undetermined		19,046	7.4
None present			59,540	23.3
Undetermined			83,473	32.6
Total incidents			255,683	100.0

Source: NFIRS 5.0.

Note: The data presented in this table are raw data counts from the NFIRS data set. They do not represent national estimates of smoke alarms in nonconfined one- and two-family residential building fires. They are presented for informational purposes. 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 33 percent of the reported confined one- and two-family fires (Table 8). In other words, in 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.[21] In 45 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 (2009-2011)

Smoke Alarm Effectiveness	Count	Percent
Smoke alarm alerted occupants	67,735	33.0
Smoke alarm did not alert occupants	45,066	22.0
Unknown	92,216	45.0
Total incidents	205,017	100.0

Source: NFIRS 5.0.
Note: The data presented in this table are raw data counts from the NFIRS data set. They do not represent national estimates of smoke alarms in confined one- and two-family residential building fires. They are presented for informational purposes.

Automatic Extinguishing Systems in Nonconfined One- and Two-family Residential Building Fires

Automatic extinguishing system (AES) data are available for both confined and nonconfined fires, although for confined fires, the data are also very limited in scope. In confined residential building fires, an AES was present in less than 1 percent of reported incidents.[22] In addition, the analyses presented here do not differentiate between occupied and unoccupied housing, as extremely few reported fires in unoccupied housing have AESs present.

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 less than 1 percent of nonconfined one- and two-family fire incidents (Table 9). This was the lowest reported presence of sprinklers in nonconfined fires in any residential occupancy. 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 nationwide.

Table 9. NFIRS Automatic Extinguishing System Data for Nonconfined One-and Two-family Residential Building Fires (2009-2011)

AES Presence	Count	Percent
AES present	2,835	0.9
Partial system present	121	0.0
AES not present	281,741	90.2
Unknown	27,825	8.9
Total incidents	312,522	100.0

Source: NFIRS 5.0.
Note: The data presented in this table are raw data counts from the NFIRS data set. They do not represent national estimates of AESs in nonconfined one- and two-family residential building fires. They are presented for informational purposes.

Examples

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

- February 2013: A toddler suffered second- and third-degree burns to more than 50 percent of his body in a fire that damaged a single-family home in Jurupa Valley, California. The blaze was reported at 3:30 p.m. When firefighters arrived at the scene, the attic of the home, along with a car parked in the yard and a detached garage, were in flames. The 1-year-old boy was rushed to a burn trauma facility in critical condition. No other injuries were reported. Four engine crews and a truck company contained the blaze by 4 p.m.[23]
- March 2013: A mother and her 4-year-old son escaped their burning home unharmed in Dayton, Ohio. The fire started when the boy was playing with a piece of paper and then put the paper up to a burning candle. When the fire started, he retreated to a bedroom until a smoke alarm sounded, which alerted the mother and child to escape. There was significant damage to the home, and officials stated that the child will be referred to the juvenile firesetter program for children who start fires.[24]
- March 2013: A midmorning fire in a single-family home killed a 20-year-old man in Clinton Township in Detroit, Michigan. The man was unable to escape from the house when it caught fire just before 11 a.m. A neighbor called 911 after she heard a nearby commotion. Two other young men who were staying at the home escaped and were trying to break a window to save the victim. By the time firefighters arrived on-scene, flames were coming out of several windows, and the fire had gutted four rooms. It is believed that the fire started in the room where the man was sleeping. He reportedly lived there with his mother, but she was at work at the time the fire started. Fire officials did not believe that the fire was suspicious.[25]
- April 2013: Fire officials in Tucson, Arizona, stated that the cause of an early morning duplex fire was a malfunctioning electrical connection in an extension cord. The fire started on the back porch and involved a refrigerator and an extension cord that was not functioning properly. Several people were treated for smoke inhalation, and another for burns to the head. Seven residents were displaced, as the fire consumed one building and damaged several others.[26]

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 2009, 2010 and 2011. 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.
    - 2—Fixed portable or mobile structure, and
    - Structure Type not specified (null entry).
  - For Incident Types 111 and 120 to 123:
    - 1—Enclosed building.
    - 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 current 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.

To request additional information or to comment on this report, visit http://apps.usfa.fema.gov/feedback/.

Notes:

[1] National estimates are based on 2009-2011 native version 5.0 data from NFIRS, residential structure fire loss estimates from the National Fire Protection Association's annual surveys of fire loss, and USFA's residential building fire loss estimates: http://www.usfa.fema.gov/statistics/estimates/index.shtm. Fires are rounded to the nearest 100, deaths to the nearest five, injuries to the nearest 25, and 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 be 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, National Hazard Statistics, U.S. Summaries for tornadoes, tropical storms and hurricanes, lightning, floods and flash floods (http://www.nws.noaa.gov/om/hazstats.shtml#).

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

[5] NFIRS distinguishes between "content" and "property" loss. Content loss includes loss 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. There could be, however, property damage as a result of smoke, water and overhaul.

[6] 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*(1,980/236,200)) = 8.4 deaths per 1,000 one- and two-family residential building fires, and the fire injury rate is (1,000*(8,525/236,200)) = 36.1 injuries per 1,000 one- and two-family residential building fires.

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

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

[9] The USFA Structure Fire Cause Methodology was used to determine the cause of one- and two-family residential building fire incidents. The cause definitions can be found at http://www.usfa.fema.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm.

[10] The total of the five cause categories does not add up to 46 percent due to rounding.

[11] 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, American Housing Survey Branch, "2011 American Housing Survey," Table C-12-AO.

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

[13] David A. Dini, "Residential Electrical System Aging Research Project," Fire Protection Research Foundation, Quincy, MA, July 1, 2008.

[14] 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, American Housing Survey Branch, "2011 American Housing Survey," Table C-12-AO.

[15] David A. Dini, "Residential Electrical System Aging Research Project," Fire Protection Research Foundation, Quincy, MA, July 1, 2008.

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

[17] Total does not add up to 100 percent due to rounding.

[18] 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.

[19] 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.

[20] 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."

[21] 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 was already aware of the fire, or there were no occupants present at the time of the fire.

[22] As confined fires 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.

[23] "Jurupa Valley: Child severely burned in residential fire," www.swrnn.com, February 28, 2013, http://www.swrnn.com/2013/02/28/jurupa-valley-child-severely-burned-in-residential-fire/ (accessed March 4, 2013).

[24] "4-year-old blamed for Dayton house fire," www.wdtn.com, March 4, 2013, http://www.wdtn.com/dpp/news/local/montgomery/4-year-old-blamed-for-dayton-house-fire (accessed March 4, 2013).

[25] Megha Satyanarayana, "Man, 20, dies in house fire in Clinton Township," www.freep.com, March 3, 2013, http://www.freep.com/article/20130303/NEWS04/130303034/20-year-old-man-killed-in-Clinton-Township-house-fire (accessed March 4, 2013).

[26] Lydia Camarillo, "TFD says extension cord malfunction is cause of duplex fire," www.tucsonnewsnow.com, April 30, 2013, http://www.tucsonnewsnow.com/story/22115944/duplex-on-fire-this-morning-near-12th-irvington (accessed May 2, 2013).