TOPICAL FIRE REPORT SERIES Volume 13, Issue 4 / May 2012

One- and Two-Family Residential Building Fires (2008–2010)

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 240,500 one- and two-family residential building fires are reported to U.S. fire departments each year and cause an estimated 2,050 deaths, 8,350 injuries, and 5.8 billion dollars in property loss.
- One- and two-family residential building fires account for 66 percent of all residential building fires, representing the largest subgroup of residential building fires.
- Cooking is the leading cause of one- and two-family residential building fires reported to the fire service (32 percent). Nearly all one- and two-family residential building cooking fires are small, confined fires (91 percent).
- Fifty-one percent of nonconfined one- and two-family residential building fires extend beyond the room of origin. The leading causes of these larger fires are other unintentional or careless actions (17 percent), electrical malfunctions (16 percent), intentional (12 percent), and open flame (11 percent).
- One- and two-family residential building fire incidence is 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 2008 to 2010, fire departments responded to an estimated 240,500 fires in one- and two-family residences each year across the Nation.[1,2] These fires resulted in an annual average loss of 2,050 deaths, 8,350 injuries, and 5.8 billion dollars in property loss. One- and two-family residential building fires account for the majority of all residential building fires (66 percent) and dominate 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 occur in these one- and two-family dwellings. Because these fatalities occur all over the Nation and throughout the year, they do not often make national headlines. Nevertheless, fire deaths in one- and two-family dwellings account for far more deaths in most years than all natural disasters combined.[3]

Most one- and two-family residential building fires (60 percent) are larger, nonconfined fires, that is, fires that are not contained in pots, stoves, garbage containers, or other containers that confine them. Fires in all other types of residential buildings, by contrast, are mostly small "confined" or contained fires (68 percent).

One- and two-family residential building fires also differ from other residential building fires in their cause profiles. While cooking accounts for the cause of 32 percent of all one- and two-family residential building fires, cooking fires play a much larger role in all other types of residential buildings, accounting for 67 percent of fires. Heating and electrical malfunctions (short circuits, arcing, and the like), however, play a larger role in one- and two-family residential building fires than in other types of residential buildings.

This current topical report is an update to the *One- and Two-Family Residential Building Fires* (2007-2009) topical report (Volume 12, Issue 2) which was released in May 2011. 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 2008 to 2010, 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* (2008-2010) (Volume 13, Issue 5) topical report.

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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 footnotes 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 building fires are small fire incidents that are limited in extent, staying within pots or fireplaces or certain other noncombustible containers.[4] Confined fires rarely result in serious injury or large content losses, and are expected to have no significant accompanying property losses due to flame damage.[5] Of the two classes of severity, nonconfined fires account for 60 percent of one- and two-family fires. The smaller, confined fires account for the remaining 40 percent of one- and two-family fires. Cooking fires are 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 (2008–2010)

Incident Type	Percent
Nonconfined fires	60.4
Confined fires	39.6
Cooking fire, confined to container	23.5
Chimney or flue fire, confined to chimney or flue	9.1
Incinerator overload or malfunction, fire confined	0.2
Fuel burner/boiler malfunction, fire confined	3.2
Commercial compactor fire, confined to rubbish	0.0
Trash or rubbish fire, contained	3.6
Total	100.0

Source: NFIRS 5.0.

Loss Measures

Table 2 presents losses, averaged over the three-year period from 2008 to 2010, 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 is more than twice as high as the same loss measure for all other residential building fires. In addition, all of the average loss measures for nonconfined one- and two-family fires are notably higher than the same loss measures for confined one- and two-family fires.

Table 2. Loss Measures for One- and Two-Family Residential Building Fires (3-year average, 2008–2010)

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	3.2	6.7	0.0	11.0
Injuries/1,000 fires	30.1	28.2	8.0	41.4
Dollar loss/fire	$10,110	$18,900	$200	$31,170

Source: NFIRS 5.0.

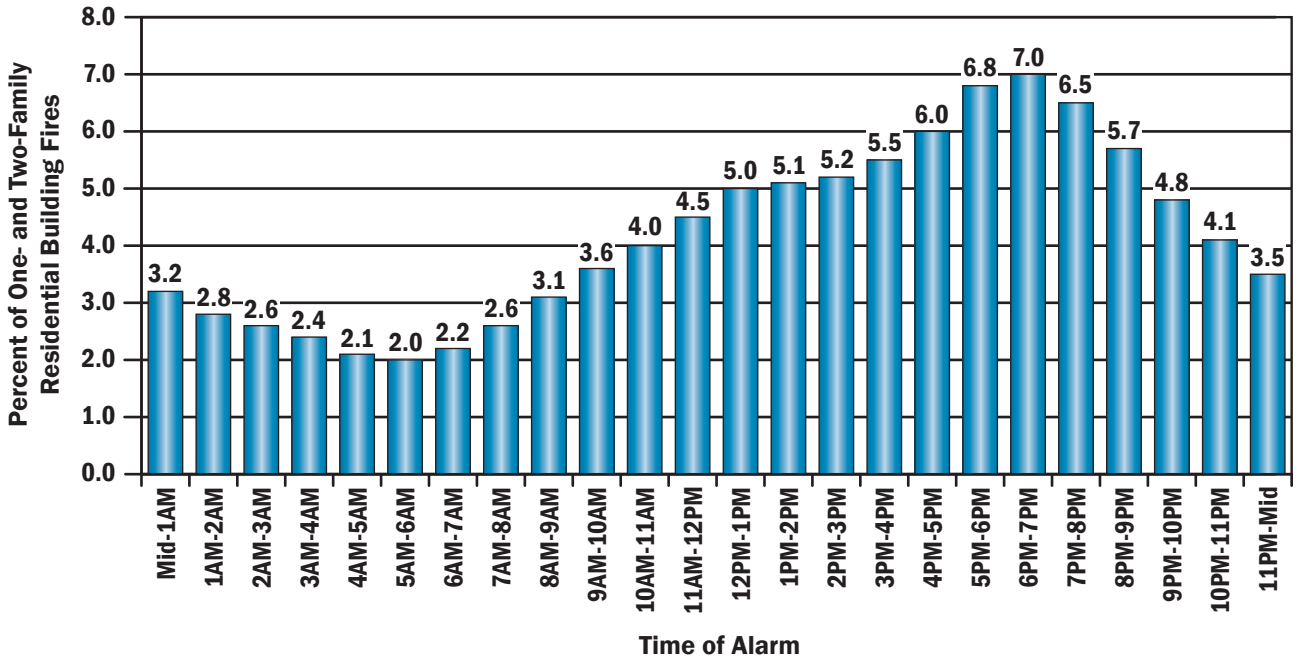
Notes: 1) Average loss for fatalities and injuries is computed per 1,000 fires; average dollar loss is computed ***per fire*** and is rounded to the nearest $10.

2) When calculating the average dollar loss per fire from 2008 to 2010, the 2008 and 2009 dollar loss values were adjusted to their equivalent 2010 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 occur most frequently in the early evening hours, peaking during the dinner hours from 5 to 8 p.m., when cooking fires are high.[7] Cooking fires, discussed later in the section "Causes of One- and Two-Family Residential Building Fires," account for 32 percent of one- and two-family fires. Fires then decline throughout the night, reaching the lowest point during the early morning hours (4 to 7 a.m.).

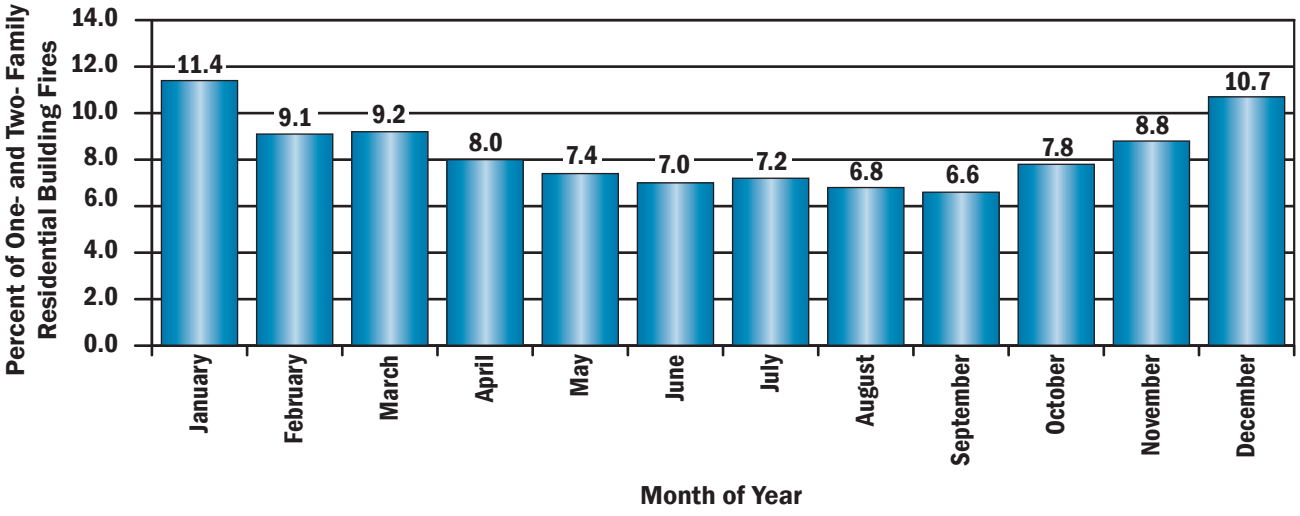
Figure 1. One- and Two-Family Residential Building Fires by Time of Alarm (2008–2010)



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

Figure 2 illustrates that one- and two-family fire incidence is 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 declines steadily, reaching a low in September.

Figure 2. One- and Two-Family Residential Building Fires by Month (2008–2010)



Source: NFIRS 5.0.

Causes of One- and Two-Family Residential Building Fires

Cooking is the leading cause of one- and two-family fires and accounts for 32 percent of all one- and two-family fires, as shown in Table 3. Nearly all of these cooking fires (91 percent) are small, confined fires with limited damage.

The next five causes combined account for 47 percent of one- and two-family fires: fires caused by heating (18 percent); electrical malfunctions, such as short circuits and wiring problems (10 percent); other unintentional or careless actions, a miscellaneous group, (8 percent); open flames that result from candles, matches, and the like (6 percent); and intentionally-set fires (6 percent).[8]

Table 3. Leading Causes of One- and Two-Family Residential Building Fires (2008–2010)

Cause	Percent (Unknowns Apportioned)
Cooking	32.3
Heating	17.7
Electrical malfunction	9.6
Other unintentional, careless	8.1
Open flame	5.9
Intentional	5.5

Source: NFIRS 5.0.

There is a striking difference between one- and two-family and the other residential occupancies in the prevalence of cooking as a fire cause. While cooking accounts for 32 percent of one- and two-family fires, it accounts for 69 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.

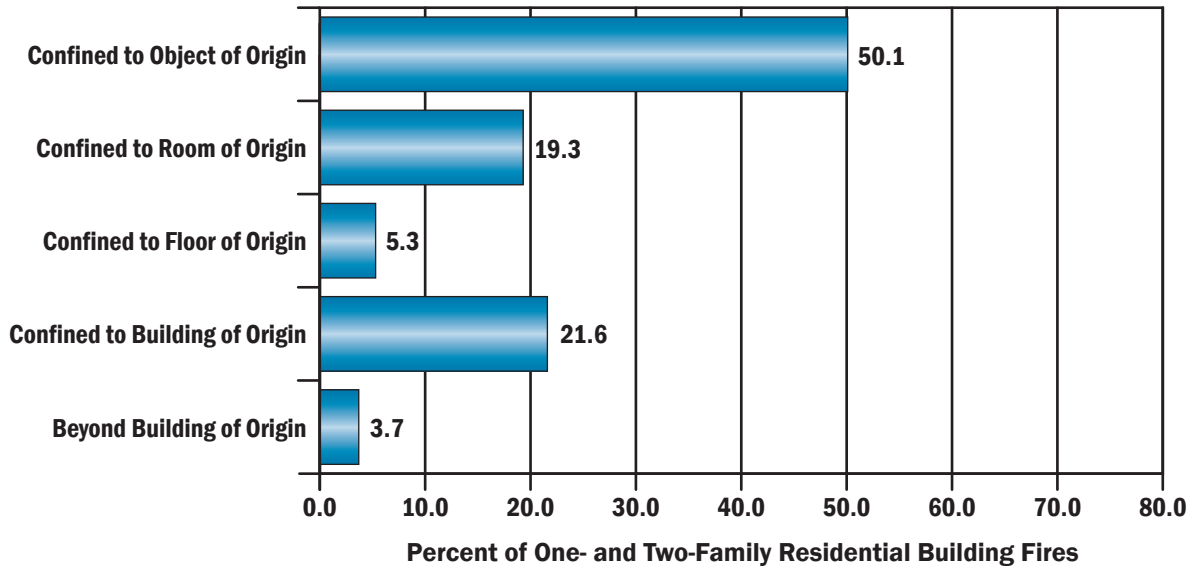
Heating and electrical malfunctions also play a larger role in one- and two-family fires than in multifamily fires. One reason for this may be that many one- and two-family residential buildings have fireplaces, chimneys, and fireplace-related equipment that most other types of residential properties do not.[9] This heating equipment difference may also be the explanation for the increase in confined chimney and flue fires (a component of heating fires) seen in one- and two-family fires (9 percent) (Table 1) as compared to multifamily fires (less than 1 percent).

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.[10, 11] As of 2009, 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 large player in residential fires.[12] As well, a 2008 study concludes 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.[13] Codes, including the National Electrical Code®, are comprehensive and standard in nearly every community. "Non-code" improvements or changes, however, are difficult to track and therefore, difficult to enforce.

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

Fifty percent of one- and two-family fires are confined to the object of origin (Figure 3). Included in these fires are those coded as "confined fires" in NFIRS. Approximately 31 percent of fires extend beyond the room of origin.

Figure 3. Extent of Fire Spread in One- and Two-Family Residential Building Fires (2008–2010)



Source: NFIRS 5.0.

Confined Fires

Confined fires are allowed abbreviated NFIRS reporting and many details of these fires that are not required are subsequently not reported. As previously discussed, however, it is known that confined fires account for 40 percent of all one- and two-family fires. Confined cooking fires—those cooking fires confined to a pot or the oven, for example—account for the majority of these confined fires (Table 1).

In addition, the numbers of confined one- and two-family fires are greatest from 5 to 8 p.m.; they account for 52 percent of the one- and two-family fires in this time period. Moreover, confined cooking fires account for 63 percent of the confined fires and 33 percent of all fires in one- and two-family buildings that occur from 5 to 8 p.m.

Confined one- and two-family fires peak in January, then decline through the spring and summer, reaching the lowest incidence during July and August.

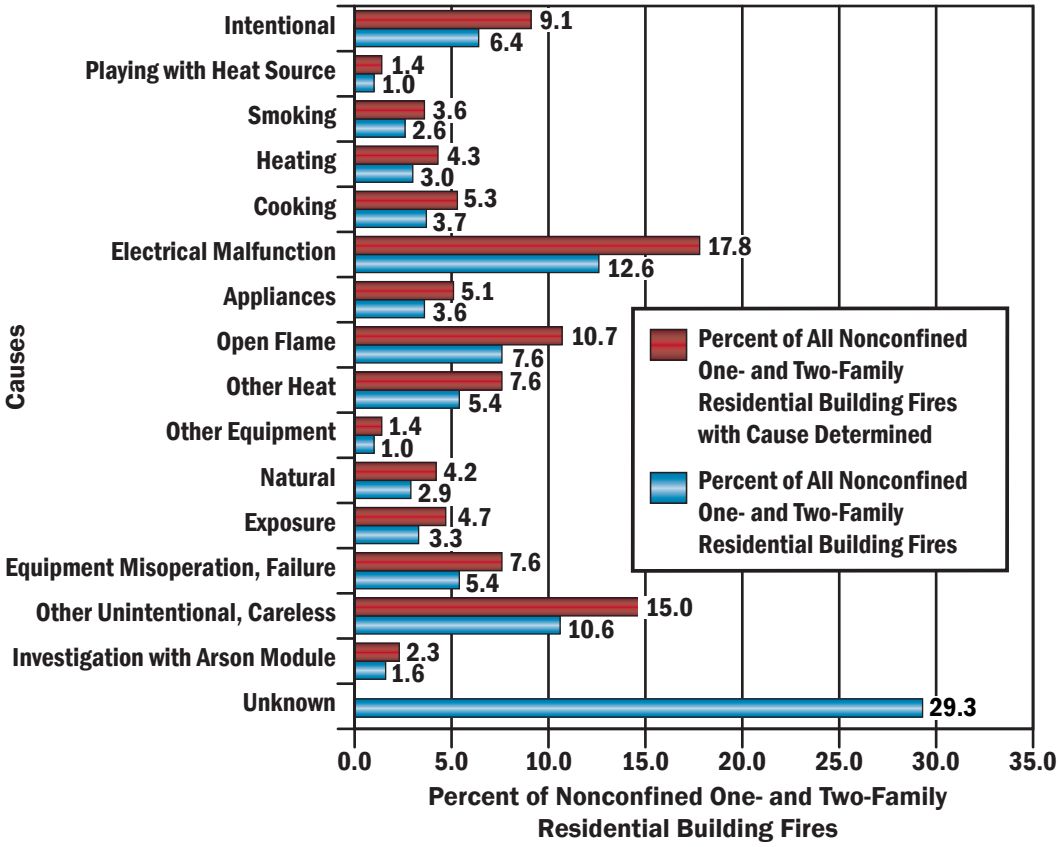
Nonconfined Fires

The next sections of this topical report address nonconfined one- and two-family fires—the larger and more serious fires—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 is the leading cause of one- and two-family fires overall, it only accounts for 5 percent of all nonconfined one- and two-family fires. At 18 percent, electrical malfunction is the leading cause of nonconfined one- and two- family fires. Other leading causes of nonconfined one- and two-family fires are carelessness or other unintentional actions (15 percent), open flames (11 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 (2008–2010)



Source: NFIRS 5.0.

Notes: 1) Causes are listed in order of the USFA Cause Hierarchy for ease of comparison of fire causes across different aspects of the fire problem. Fires are assigned to 1 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 may 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 start 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) are the next most common areas of fire origin in the home. Smaller, but not minor, percentages of fires start in vacant spaces and attics (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 is the leading cause of all one- and two-family fires at 32 percent, and it is not surprising that kitchens are the leading area of fire origin. The percentages are not identical between cooking and kitchen fires because some cooking fires start outside the kitchen, some areas of origin for cooking fires are not reported (as in most confined cooking fires), and some kitchen fires are not due to cooking. In fact, only 26 percent of nonconfined one- and two-family fires that start in the kitchen are cooking fires. Other, unspecified unintentional or careless actions account for 19 percent of kitchen fires, and non-heat producing equipment that malfunctions or fails also accounts for an additional 19 percent of kitchen fires.

Table 4. Leading Areas of Fire Origin in Nonconfined One- and Two-Family Residential Building Fires (2008–2010)

Areas of Fire Origin	Percent (Unknowns Apportioned)
Cooking area, kitchen	18.8
Bedrooms	13.3
Common room, den, family room, living room, lounge	6.6
Attic, vacant spaces	5.7
Wall surface: exterior	5.1
Laundry area	5.0
Vehicle storage area: garage, carport	4.8

Source: NFIRS 5.0.

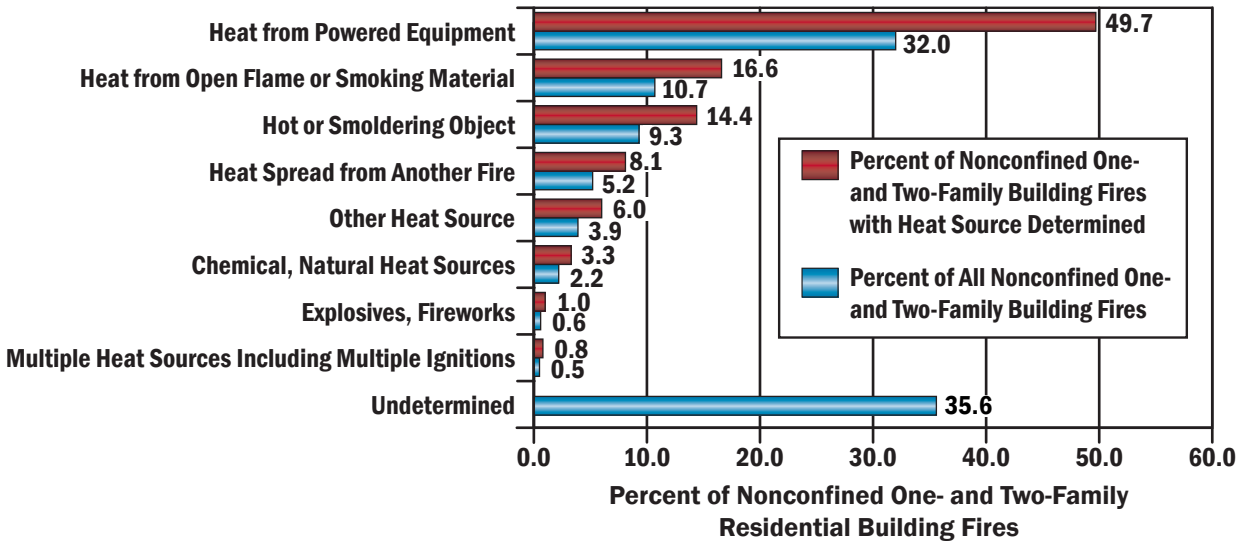
How Nonconfined One- and Two-Family Residential Building Fires Start (Heat Source)

Figure 5 shows sources of heat categories for nonconfined one- and two-family fires. Heat from powered equipment accounts 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 accounts for 17 percent of nonconfined one- and two-family fires. This category includes such items as candles (4 percent), cigarettes (4 percent), and lighters and matches (combined, 4 percent).

The third largest category pertains 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 (2008–2010)



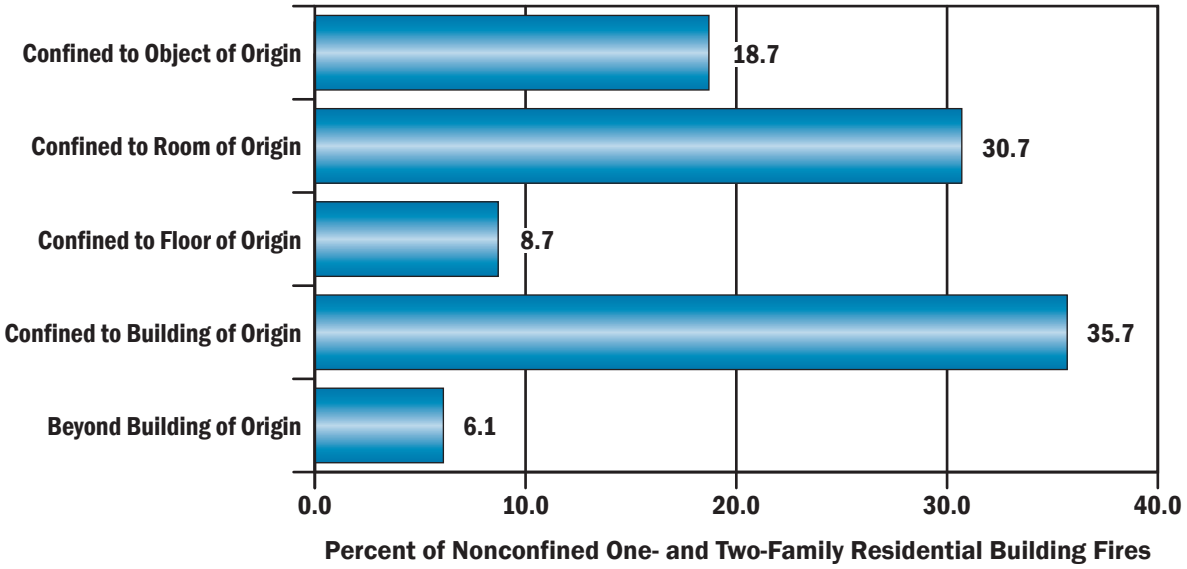
Source: NFIRS 5.0.
Note: Totals may not add up to 100 percent due to rounding.

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

Figure 6 shows the fire spread in nonconfined one- and two-family fires. Forty-nine percent of the nonconfined fires are limited to the object or room of fire origin—in 31 percent of nonconfined fires, the fire is confined to the room of origin; in another 19 percent of fires, the fire is confined to the object of origin. (Note that a fire confined to a sofa or bed is not defined as a "confined fire" 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.)

Fifty-one percent of nonconfined one- and two-family fires extend beyond the room of origin. The leading causes of these larger fires are unintentional or 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 (2008–2010)



Source: NFIRS 5.0.
Note: Total may 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 is the misuse of material or product (35 percent). In this category, the leading specific factors contributing to ignition are 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 contribute to 24 percent of nonconfined one- and two-family fires. Operational deficiency is the third leading category at 15 percent. Unattended equipment is the leading factor in the operational deficiency category and accounts 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, 2008–2010)

Factors Contributing to Ignition Category	Percent of Nonconfined One- and Two-Family Residential Building Fires (Unknowns Apportioned)
Misuse of material or product	35.1
Electrical failure, malfunction	24.4
Operational deficiency	14.7
Fire spread or control	10.9
Mechanical failure, malfunction	7.6
Other factors contributing to ignition	6.2
Natural condition	4.0
Design, manufacture, installation deficiency	2.6

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; 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 30 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 39 percent of nonconfined one- and two-family fires (Table 6). In 28 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 28 and 61 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 (2008–2010)

Presence of Smoke Alarms	Percent
Present	38.5
None present	28.2
Undetermined	33.3

Source: NFIRS 5.0.

While 19 percent of all nonconfined one- and two-family fires occur 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 operate. 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 (48 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 consists of:

- smoke alarms present and operated—25 percent;
- present but did not operate—11 percent (alarm did not operate, 6 percent; fire too small, 5 percent); and
- present but operational status unknown—8 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 operate in 14 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.

Nationally, only 3 percent of households lack smoke alarms.[14] 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 are also taken into account.[15] 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.[16]

Table 7. NFIRS Smoke Alarm Data for Nonconfined Fires in Occupied One- and Two-Family Residential Buildings (2008–2010)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		13,388	5.4
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	44,501	17.8
		Smoke alarm alerted occupants, occupants failed to respond	1,608	0.6
		No occupants	8,515	3.4
		Smoke alarm failed to alert occupants	1,912	0.8
		Undetermined	6,450	2.6
	Smoke alarm failed to operate		15,206	6.1
	Undetermined		18,671	7.5
None present			56,869	22.7
Undetermined			82,921	33.2
Total incidents			250,041	100.0

Source: NFIRS 5.0.
Notes: 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 may 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 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 21 percent of confined one- and two-family fires.[17] In 46 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 (2008–2010)

Smoke Alarm Effectiveness	Count	Percent
Smoke alarm alerted occupants	66,082	32.8
Smoke alarm did not alert occupants	42,800	21.2
Unknown	92,671	46.0
Total incidents	201,553	100.0

Source: NFIRS 5.0.
Notes: 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.[18] 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, AESs are reported as present in less than 1 percent of nonconfined one- and two-family fire incidents (Table 9). This is 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 (2008–2010)

AES Presence	Count	Percent
AES present	2,588	0.8
Partial system present	128	0.0
AES not present	276,066	89.9
Unknown	28,233	9.2
Total incidents	307,015	100.0

Source: NFIRS 5.0.

Notes: 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. Total may 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:

- March 2012: An early morning house fire in Linnton, OR, sent one man to the hospital. Firefighters found flames coming from three out of the four sides of the two-story home. The resident, a 67-year-old man, escaped from his house, but he suffered smoke inhalation and was taken to a hospital. Firefighters were only able to fight the blaze from the outside while protecting neighboring homes. Fire investigators determined that the fire started after embers from a fire in a fireplace ignited flammable materials nearby. The house, valued at $100,000 was a total loss, according to fire officials.[19]
- March 2012: The Verndale Fire Department was called to a house fire in Verndale, MN, in the late evening hours. The house was a rental home to a family of eight. At least one of the rooms was already engulfed in flames by the time firefighters arrived. The fire quickly spread into the walls and up into the attic. No one was at home when the fire started in the laundry room area. It is believed that the fire started from the clothes dryer. The house was a total loss.[20]
- March 2012: A house fire that killed a man and his dog in Chesapeake, VA, was ruled an accident. Crews were called to respond at 7:43 a.m. and found lots of smoke coming from a single-story home. Inside, firefighters found a 65-year-old man dead in the front room. The man was paralyzed and used an oxygen mask. Fire investigators determined that the cause of the fire was improper storage of combustible materials near an electric space heater.[21]
- March 2012: Firefighters in Cedar Rapids, IA, quickly contained an early evening house fire by isolating damage to one side exterior wall and a small area in the kitchen of the one and a half story structure. The homeowner spotted the fire when he returned home. He was able to get his two dogs out safely and call 911. When firefighters arrived on the scene, smoke and flames were coming from the east side of the house, near the back. Fire crews located flames in the kitchen area, above the microwave oven, where it is believed the fire started. The cause remains under investigation and there were no injuries.[22]

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

Data for this report were extracted from the NFIRS annual Public Data Release (PDR) files for 2008, 2009, and 2010. Only version 5.0 data were extracted.

One- and two-family fires are defined as:

- Aid Types 3 (mutual aid given) and 4 (automatic aid given) are 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

Notes: 1) Incident Types 113 to 118 do not specify if the structure is a building.
2) Incident Type 112 was included in data analyses prior to 2008 as previous analyses showed that Incident Types 111 and 112 were used interchangeably. As of 2008, Incident Type 112 is excluded.

- 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, and
    - 2—Fixed portable or mobile structure.

The analyses contained in this report reflect the current methodologies used by the U.S. Fire Administration (USFA). The USFA is committed to providing the best information on the United States 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.

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Notes:

[1] National estimates are based on 2008-2010 native version 5.0 data from the National Fire Incident Reporting System (NFIRS), residential structure fire loss estimates from the National Fire Protection Association's (NFPA's) annual surveys of fire loss, and the U.S. Fire Administration's (USFA's) residential building fire loss estimates. Fires are rounded to the nearest 100, deaths to the nearest 5, 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 fires 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 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] U.S. Census Bureau, *Statistical Abstract of the United States:* 2012, Section 6—Geography and Environment, Table 388, page 236, http://www.census.gov/prod/2011pubs/12statab/geo.pdf.

[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 will 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*(2,050/240,500)) = 8.5 deaths per 1,000 one- and two-family residential building fires and the fire injury rate is (1,000*(8,350/240,500)) = 34.7 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] 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.

[9] 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, "American Housing Survey for the United States: 2009," Table 2-25.

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

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

[12] 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, "American Housing Survey for the United States: 2009," Table 2-25.

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

[14] 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.

[15] Here, *at least* 23 percent of nonconfined one- and two-family residential building fires 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.

[16] 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."

[17] 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.

[18] 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 automatic extinguishing system (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.

[19] "Huge house fire destroys Linnton home," www.katu.com, March 18, 2012, http://www.katu.com/news/local/Huge-house-fire-destroys-Linnton-home-143107396.html (accessed March 20, 2012).

[20] "Family unharmed after house fire in Verndale Thursday," www.dl-online.com, March 20, 2012, http://www.dl-online.com/event/article/id/66561/ (accessed March 20, 2012).

[21] "Chesapeake fatal house fire ruled accidental," www.wvec.com, March 15, 2012, http://www.wvec.com/home/Man-dies-in-fire-at-Chesapeake-home--142449695.html (accessed March 20, 2012).

[22] Ron Steele, "Cedar Rapids firefighters quickly contain house fire Monday night," www.kwwl.com, March 19, 2012, http://www.kwwl.com/story/17195898/cedar-rapids-firefighters-quickly-contain-house-fire-monday-night (accessed March 20, 2012).