Winter Residential Building Fires

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

- Winter residential building fires result in an estimated average of approximately 945 deaths, 3,825 injuries, and $1,708,000,000 in property loss each year.
- Approximately half of winter residential building fires are small, confined fires.
- Winter residential building fires occur mainly in the early evening hours, peaking from 5 to 8 p.m.
- Cooking is the leading cause of all winter residential building fires (36 percent) as well as confined winter residential building fires (61 percent). Electrical malfunction is the leading cause of nonconfined winter residential building fires (16 percent).
- Twenty-two percent of all winter residential building fires and 43 percent of nonconfined winter residential building fires extend beyond the room of origin.
- The kitchen or other cooking area is the most prevalent area of fire origin for nonconfined winter residential building fires (20 percent).
- "Heat from powered equipment" is the leading heat source category for nonconfined winter residential building fires (51 percent).
- Thirty-three percent of items first ignited in nonconfined winter residential building fires fall under the "structural component, finish" category.

From 2005 to 2007, an estimated 108,400 winter residential building fires occurred annually in the United States.[1, 2, 3] These fires result in an estimated average of approximately 945 deaths, 3,825 injuries, and $1,708,000,000 in property loss each year. This report addresses the characteristics of winter residential building fires reported to the National Fire Incident Reporting System (NFIRS) between 2005 and 2007. Winter residential building fires are defined as those residential building fires that occur in the months of January, February, and March.

Type of Fire

Building fires consist of two major categories of incidents: fires that are confined to specific types of equipment or objects (confined fires) and those that are not (nonconfined fires). Confined building fires are small fire incidents that are limited in scope, confined to 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.[4] As shown in Table 1, half (50 percent) of winter residential building fires are nonconfined and the other half (50 percent) are confined.

Table 1. Winter Residential Building Fires by Type of Incident (2005–2007)

Incident Type	Percent
Nonconfined fires	50.3
Confined fires	49.7
Cooking fire, confined to container	28.2
Chimney or flue fire, confined to chimney or flue	11.7
Incinerator overload or malfunction, fire confined	0.2
Fuel burner/boiler malfunction, fire confined	5.2
Commercial compactor fire, confined to rubbish	0.4
Trash or rubbish fire, contained	4.0
Total	100.0

Source: NFIRS 5.0.

Loss Measures

Table 2 presents losses, averaged over this 3-year period, of reported residential building fires and winter residential building fires.[5]

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Table 2. Loss Measures for Winter Residential Building Fires (3-year average, 2005–2007)

Measure	Residential Building Fires	Winter Residential Building Fires	Confined Winter Residential Building Fires	Nonconfined Winter Residential Building Fires
Average Loss:				
Fatalities/1,000 Fires	5.4	6.6	0.0	13.2
Injuries/1,000 Fires	28.1	29.1	6.7	51.2
Dollar Loss/Fire	$14,560	$13,100	$170	$25,860

Source: NFIRS 5.0.
Notes: 1) One death in a confined fire was reported to NFIRS during 2005 to 2007; the resulting loss of 0.0 fatalities per 1,000 fires reflects only data reported to NFIRS.
2) 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.

Property Use

Table 3 presents the percentage distribution of property use for all winter residential building fires, confined winter residential building fires, and nonconfined winter residential building fires. Fires in one- and two-family dwellings account for 67 percent of all winter residential building fires. Fires in these types of dwellings also account for 58 percent of confined winter residential building fires and 77 percent of nonconfined winter residential building fires. Multifamily dwellings (apartments, rowhouses, town houses, condominiums, and tenements) account for 26 percent of all winter residential building fires, 35 percent of confined winter residential fires, and 18 percent of nonconfined winter residential building fires.

Table 3. Percentage Distribution of Property Use for Winter Residential Building Fires (3-year average, 2005–2007)

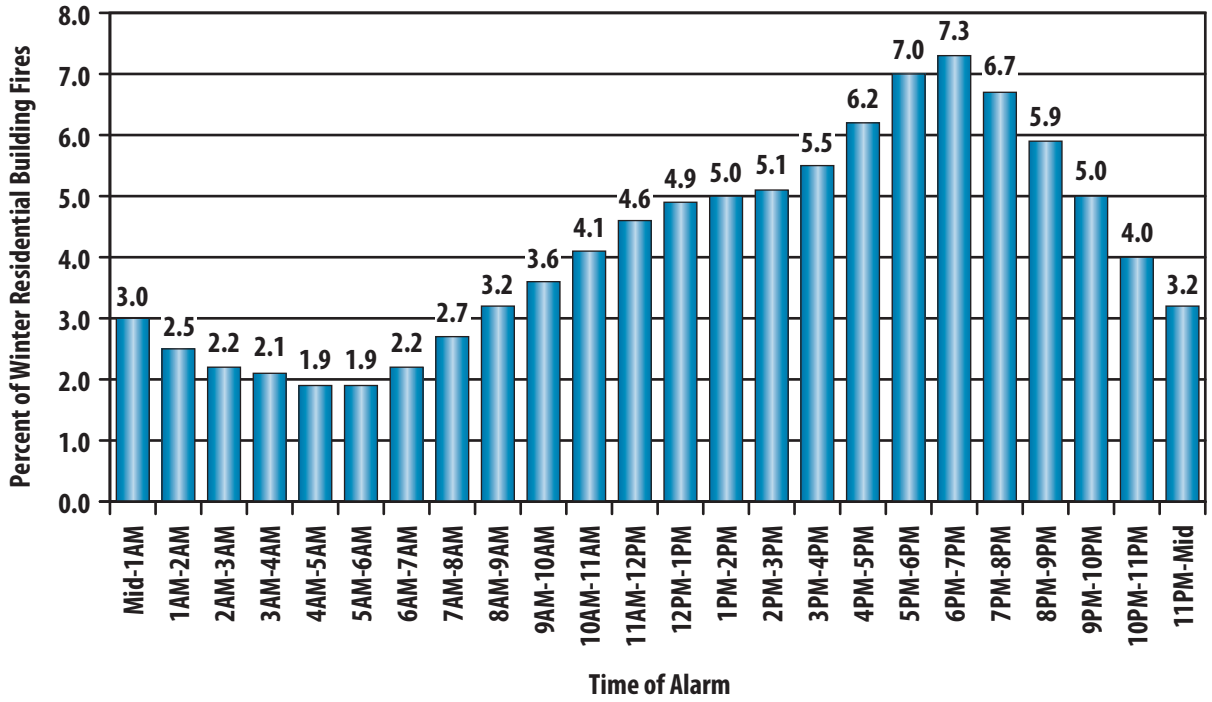
Property Use	All Winter Residential Building Fires	Confined Winter Residential Building Fires	Nonconfined Winter Residential Building Fires
One- or two-family dwelling	67.4%	57.6%	77.0%
Multifamily dwelling	26.3%	35.1%	17.6%
Other residential buildings	6.3%	7.3%	5.4%
Total	100.0%	100.0%	100.0%

Source: NFIRS 5.0.

When Winter Residential Building Fires Occur

As shown in Figure 1, winter residential building fires occur mainly in the early evening hours, peaking from 5 to 8 p.m., and then decline throughout the night, reaching the lowest point during the early morning hours (4 to 6 a.m.). Fire incidence steadily rises again throughout the day until reaching its peak in the early evening hours. This 3-hour early evening period accounts for 21 percent of winter residential building fires.[6]

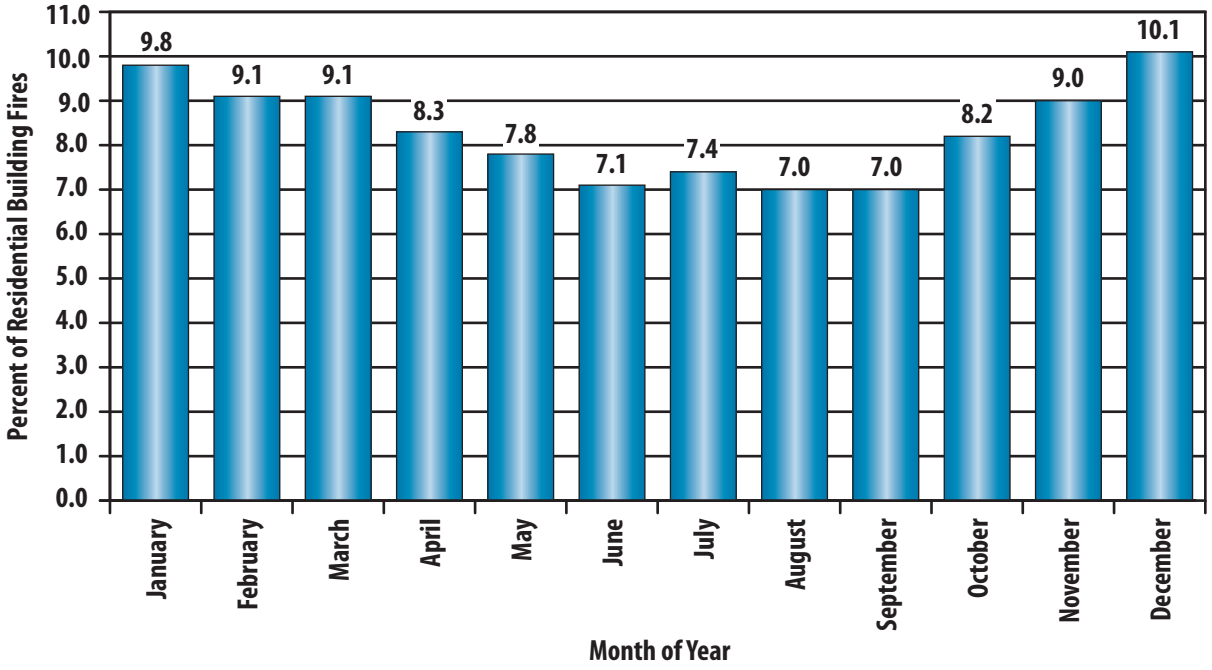
Figure 1. Winter Residential Building Fires by Time of Alarm (2005–2007)



Source: NFIRS 5.0.

Figure 2 illustrates that, although it is at its highest in December at 10 percent, residential building fire incidence is collectively highest in the 3 winter months of January, February, and March. Fire incidence then declines reaching the lowest point in the summer months.

Figure 2. Residential Building Fires by Month (2005–2007)

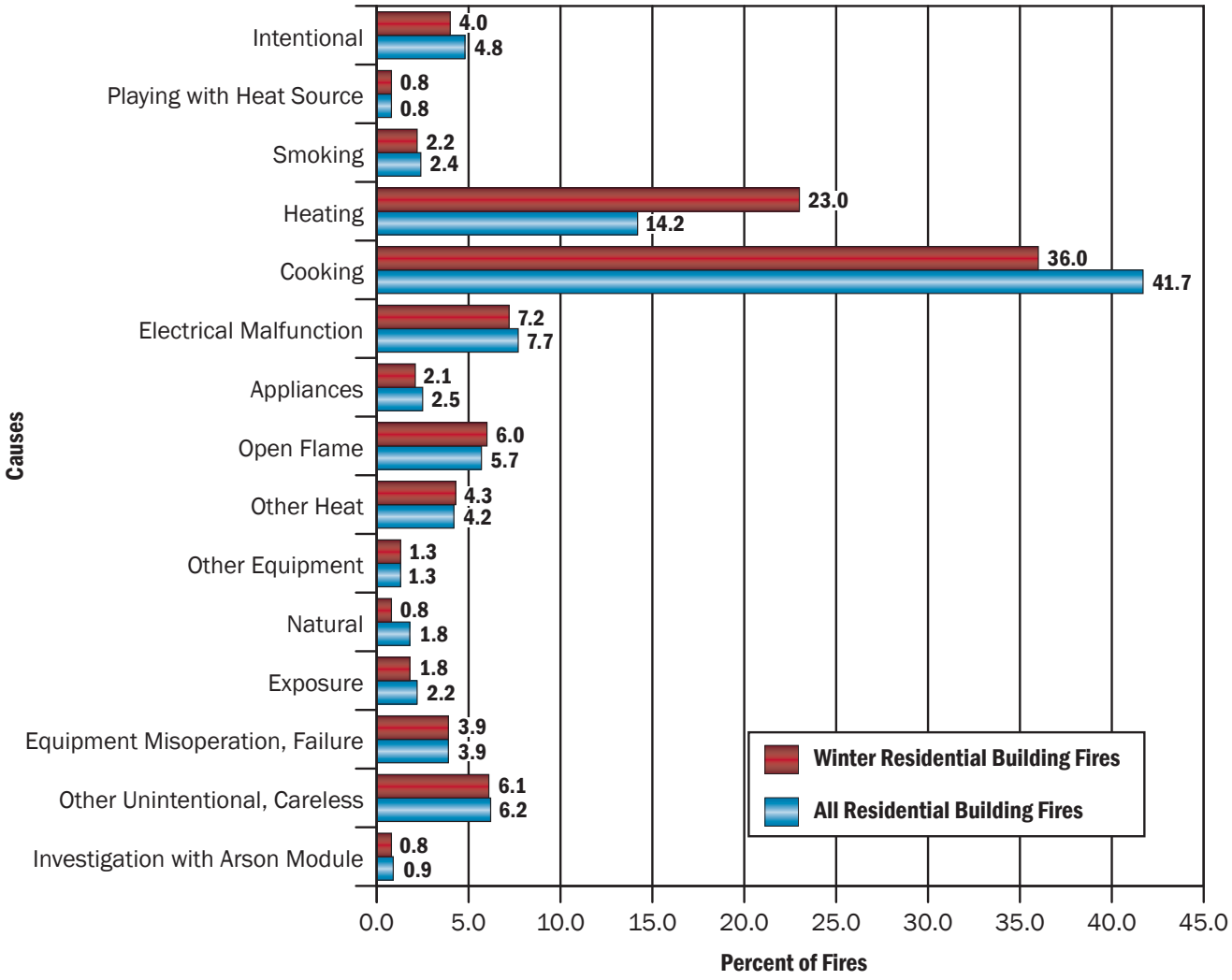


Source: NFIRS 5.0.

Causes of Winter Residential Building Fires

As shown in Figure 3, when compared to all residential building fires, the leading causes of winter residential building fires are the same. While cooking is the leading cause of all residential building fires at 42 percent, cooking is also the leading cause of winter residential building fires at 36 percent. Nearly all of the winter residential building cooking fires (94 percent) are small, confined fires with limited damage. The next four causes combined account for 42 percent of winter residential building fires: heating fires (23 percent), fires caused by electrical malfunction (7 percent), unintentional or careless fires (6 percent), and open flame fires (6 percent).[7]

Figure 3. Causes of Residential Building Fires versus Winter Residential Building Fires (2005–2007, Unknowns Apportioned)

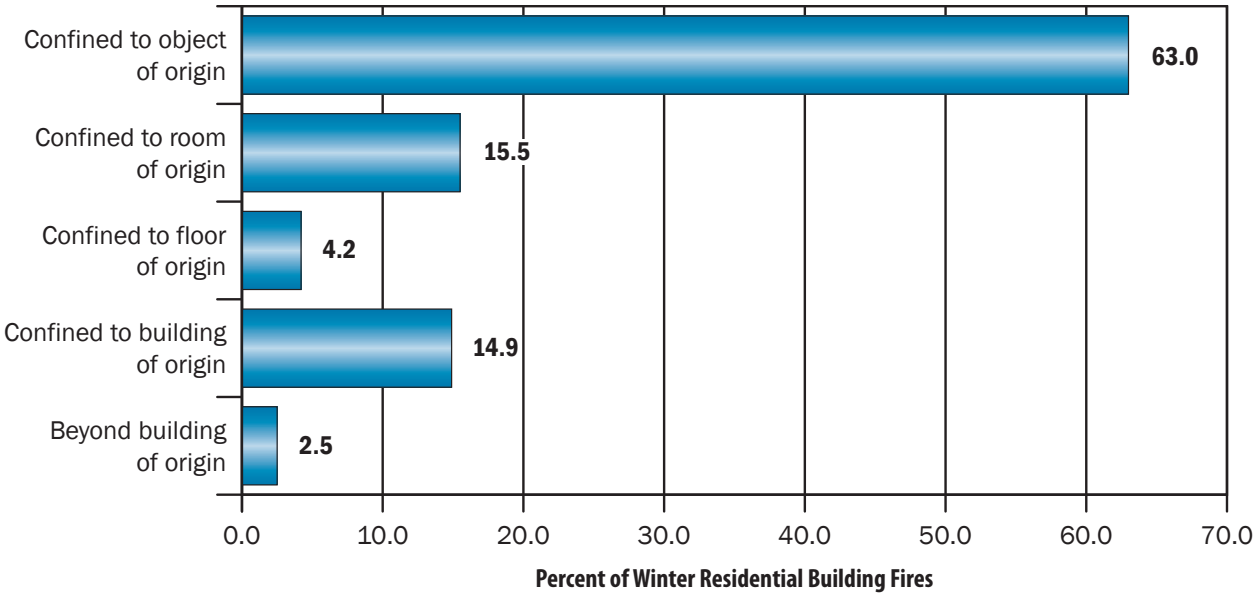


Source: NFIRS 5.0.
Note: Totals may not add to 100 percent due to rounding.

Fire Spread in Winter Residential Buildings

Figure 4 shows the fire spread in winter residential building fires. The majority of winter residential building fires, 63 percent, are limited to the object of fire origin. Sixteen percent of the winter residential building fires are confined to the room of origin, and an additional 15 percent are confined to the building of origin. Twenty-two percent of winter residential building fires extend beyond the room of origin. The leading causes of these larger fires are electrical malfunction, other unintentional (carelessness), and open flame.

Figure 4. Extent of Fire Spread in Winter Residential Building Fires (2005–2007)



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

Causes of Confined Winter Residential Building Fires

Confined fires are allowed abbreviated NFIRS reporting and many reporting details of the fire are not required and not reported. However, it is known that cooking (61 percent) and heating (36 percent) are the top two causes of confined winter residential building fires accounting for a total of 97 percent of all these types of fires.

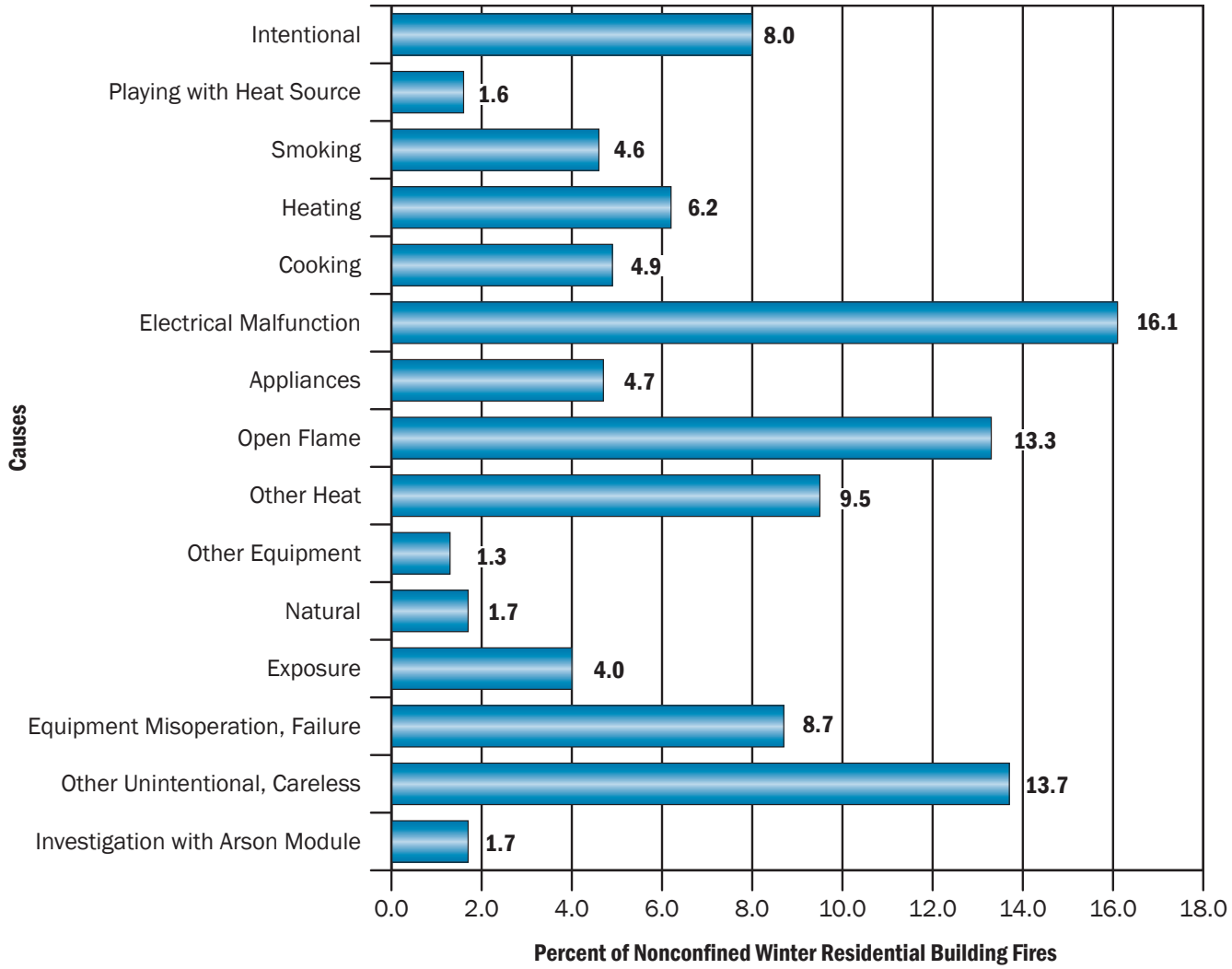
Nonconfined Fires

The next sections of this report address nonconfined winter residential building fires, where detailed fire data are available.

Causes of Nonconfined Winter Residential Building Fires

The top causes for nonconfined winter residential building fires are different than those of all winter residential building fires and confined winter residential building fires. Sixteen percent of nonconfined winter residential building fires are caused by electrical malfunction. The next two leading causes of these types of fires are other unintentional, careless at 14 percent and open flame at 13 percent (Figure 5).

Figure 5. Causes of Nonconfined Winter Residential Building Fires (2005–2007, Unknowns Apportioned)



Source: NFIRS 5.0.

Where Nonconfined Winter Residential Building Fires Start (Area of Fire Origin)

Twenty percent of nonconfined winter residential building fires start in the kitchens or cooking areas (Table 4). Fires in bedrooms (15 percent) and common rooms (7 percent) are the next leading areas of fire origin. Less common are fires that start in laundry areas (5 percent) and function areas (5 percent).

Note that these areas of fire origin do not include areas associated with confined fires. As confined cooking fires are a substantial percentage of winter residential building fires, it is likely that the kitchen is, by far, the leading area of fire origin for all winter residential building fires.

Table 4. Leading Areas of Fire Origin in Nonconfined Winter Residential Building Fires (2005–2007)

Areas of Fire Origin	Percent (Unknowns Apportioned)
Cooking area, kitchen	20.4
Bedroom	14.8
Common room, den, family room, living room, lounge	7.2
Laundry area	5.0
Function areas, other	4.8

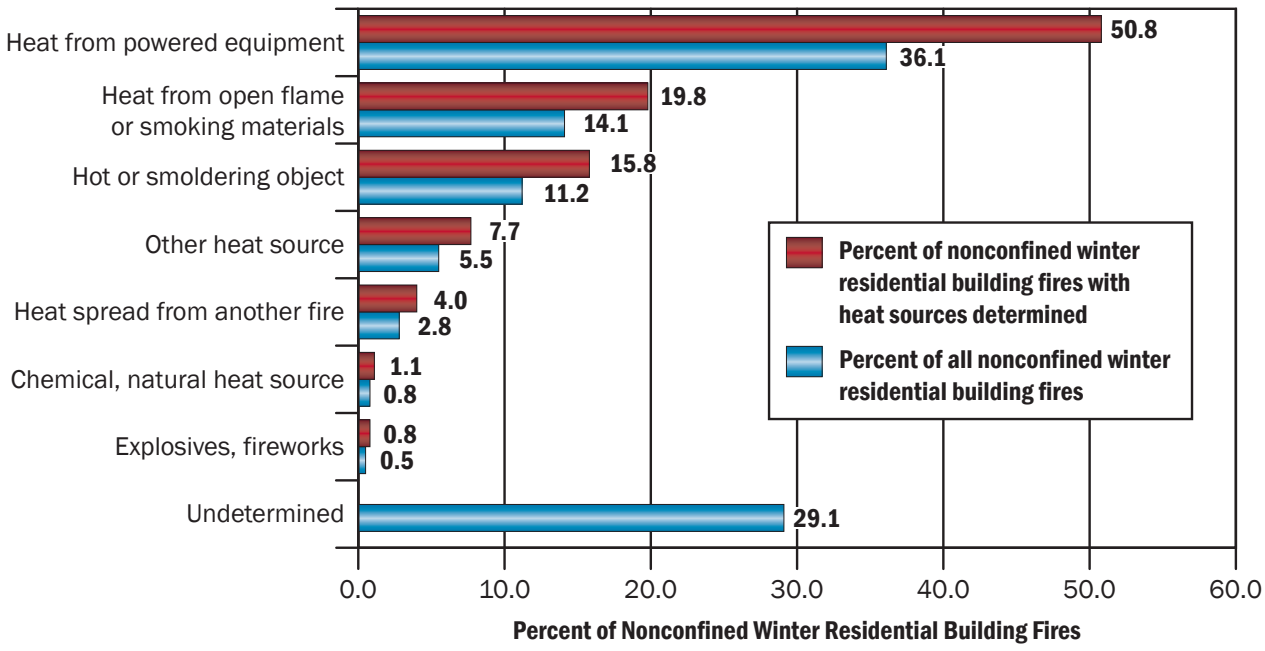
Source: NFIRS 5.0.

How Nonconfined Winter Residential Building Fires Start (Heat Source)

Figure 6 shows sources of heat categories in nonconfined winter residential building fires. The "heat from powered equipment" category accounts for 51 percent of nonconfined winter residential building fires where the heat source was determined. Within that category, radiated or conducted heat from operating equipment accounts for 17 percent of all fires, electrical arcing accounts for 14 percent of all fires, and heat from other powered equipment accounts for 14 percent of all nonconfined winter residential building fires.

The "heat from open flame or smoking materials" category accounts for 20 percent of nonconfined winter residential building fires where the heat source was determined. This category includes candles, cigarettes, lighters, and matches. The third largest category pertains to "hot or smoldering objects" (16 percent). This category includes hot embers or ashes, molten, hot material, and heat sparked from friction.

Figure 6. Sources of Heat in Nonconfined Winter Residential Building Fires by Major Category (2005–2007)



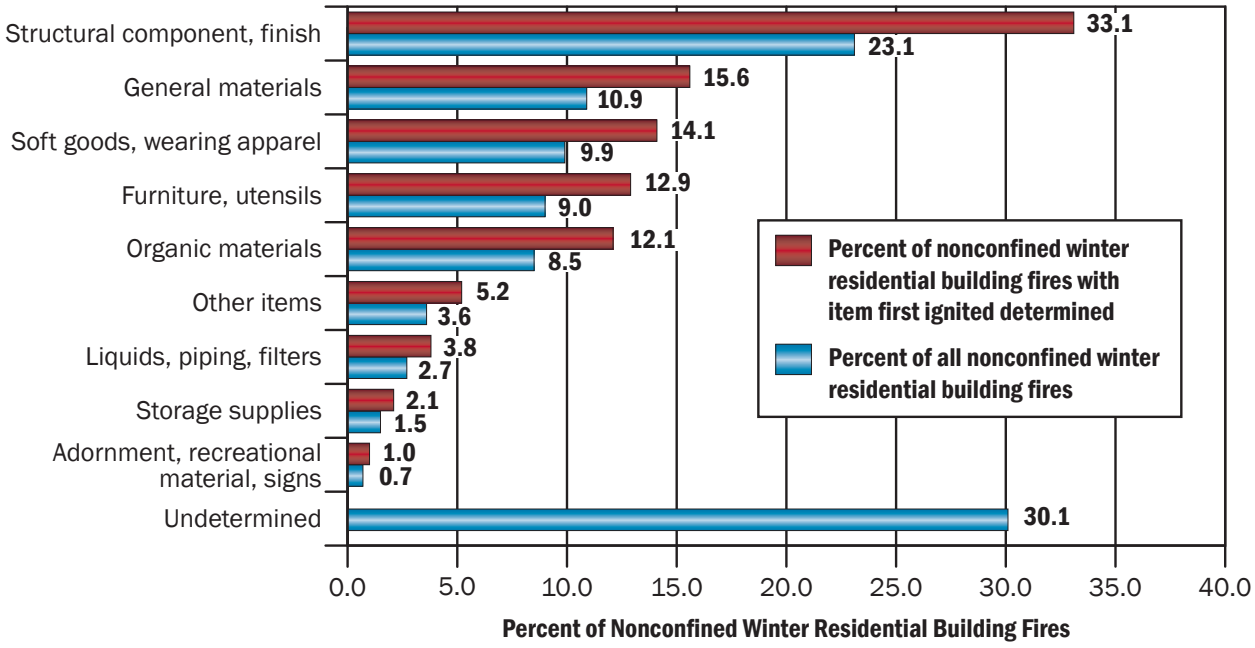
Source: NFIRS 5.0.

What Ignites First in Nonconfined Winter Residential Building Fires

Thirty-three percent of the nonconfined winter residential building fires with the item first ignited determined fall under the "structural component, finish" category (Figure 7). This category includes exterior roof covering and trim, floor covering (rug, carpet, or mat), and interior wall and ceiling covering. The second leading category, "general materials," accounts for 16 percent of nonconfined winter residential building fires, and third is "soft goods, wearing apparel" (14 percent).

Structural member or framing (11 percent), cooking materials (10 percent), and electrical wire, cable insulation (7 percent) are the specific items most often first ignited in nonconfined winter residential building fires.

Figure 7. Item First Ignited in Nonconfined Winter Residential Building Fires by Major Category (2005–2007)

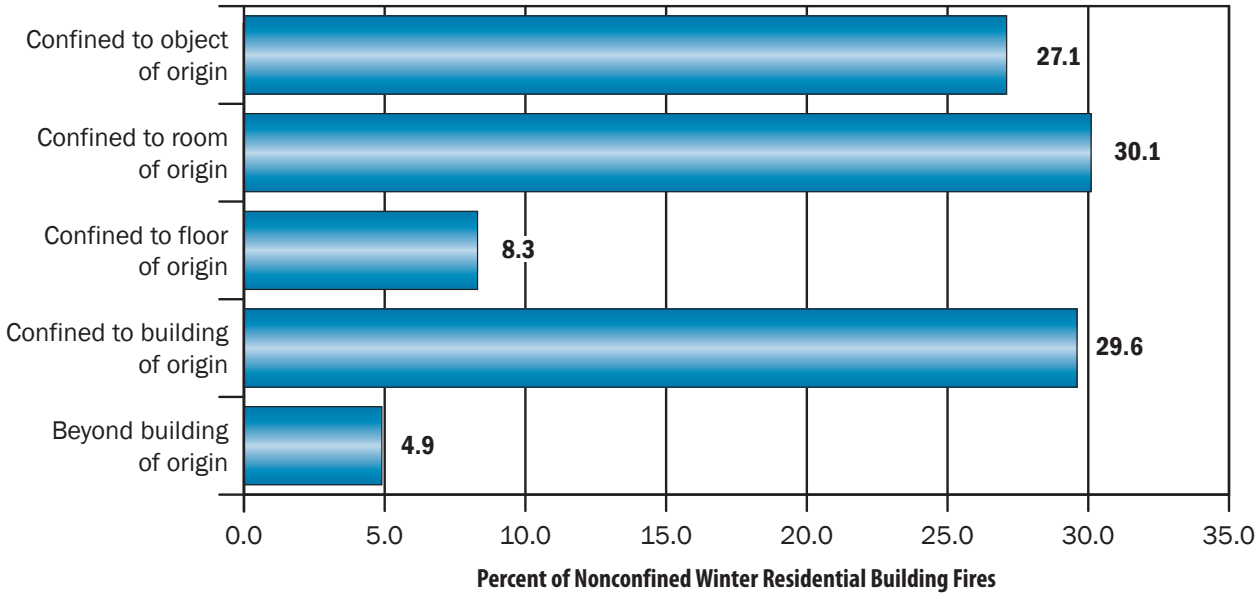


Source: NFIRS 5.0.

Fire Spread in Nonconfined Winter Residential Building Fires

Figure 8 shows the fire spread in nonconfined winter residential building fires. Thirty percent of nonconfined winter residential building fires are confined to the room of origin and another 30 percent are confined to the building of origin. In 27 percent of nonconfined winter residential building fires, the fire is confined to the object of origin. Forty-three percent of nonconfined winter residential building fires extend beyond the room of origin. The leading causes of these larger fires are electrical malfunction, other unintentional (carelessness), and open flame.

Figure 8. Extent of Fire Spread in Nonconfined Winter Residential Building Fires (2005–2007)



Source: NFIRS 5.0.

Factors Contributing to Ignition in Nonconfined Winter Residential Building Fires

Table 5 shows the factors contributing to ignition categories of nonconfined winter residential building fires. The leading category of factors contributing to ignition is the "misuse of material or product" (39 percent). Within this category, heat source too close to combustible materials and abandoned or discarded materials account for 16 percent and 10 percent of all nonconfined winter residential building fires, respectively.

The "electrical failure or malfunction" category is a contributing factor in 22 percent of nonconfined winter residential building fires. The "operational deficiency" and "fire spread or control" categories are the third and fourth leading factors at 16 and 9 percent, respectively.

Table 5. Factors Contributing to Ignition for Nonconfined Winter Residential Building Fires by Major Category (Where Factors Contributing to Ignition are Specified, 2005–2007)

Factors Contributing to Ignition Categories	Percent of Nonconfined Winter Residential Building Fires
Misuse of material or product	38.8
Electrical failure, malfunction	22.0
Operational deficiency	16.3
Fire spread or control	8.6
Mechanical failure, malfunction	8.5
Other factors contributing to ignition	6.5
Design, manufacture, installation deficiency	3.3
Natural condition	1.8

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.

Suppression/Alerting Systems in Winter Residential Building Fires

Smoke alarm data are available for both confined and nonconfined fires although for confined fires, the data are very limited in scope. Automatic Extinguishing System (AES) data are only available for nonconfined fires.

Smoke alarms were present in 45 percent of nonconfined winter residential building fires and were known to have operated in 25 percent of nonconfined winter residential building fires (Table 6). In 26 percent of nonconfined winter residential building fires, there were no smoke alarms present. In another 29 percent of these fires, firefighters were unable to determine if a smoke alarm was present. In 6 percent of nonconfined winter residential building fires, the alarm failed to operate.

Smoke alarms operated and alerted occupants in 37 percent of confined winter residential building fires (Table 7). In 19 percent of these confined fires, the occupants were not alerted by the smoke alarm.[8] In 44 percent of confined winter residential building fires, the smoke alarm effectiveness was unknown. Note that the data presented in Tables 6 and 7 are the raw counts from the NFIRS data set and not scaled to national estimates of smoke alarms in winter residential building fires.

Table 6. NFIRS Smoke Alarm Data for Nonconfined Winter Residential Building Fires (NFIRS, 2005–2007)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		5,037	5.0
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	18,217	18.3
		Smoke alarm alerted occupants, occupants failed to respond	783	0.8
		No occupants	3,074	3.1
		Smoke alarm failed to alert occupants	636	0.6
		Undetermined	2,164	2.2
	Smoke alarm failed to operate		6,437	6.4
	Undetermined		8,042	8.1
None present			26,130	26.2
Undetermined			29,281	29.3
Null/Blank			19	0.0
Total Incidents			99,820	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 winter residential building fires. They are presented for informational purposes.

Table 7. NFIRS Smoke Alarm Data for Confined Winter Residential Building Fires (NFIRS, 2005–2007)

Smoke Alarm Effectiveness	Count	Percent
Smoke alarm alerted occupants	36,655	37.2
Smoke alarm did not alert occupants	18,459	18.7
Unknown	43,435	44.1
Null/Blank	1	0.0
Total Incidents	98,550	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 winter residential building fires. They are presented for informational purposes.

Overall, full or partial AESs were present in 3 percent of nonconfined winter residential building fires (Table 8). The lack of AESs is not unexpected as only 3 percent of all nonconfined residential building fires have an AES present.

Table 8. NFIRS Automatic Extinguishing System (AES) Data for Nonconfined Winter Residential Building Fires (2005–2007)

AES Presence	Count	Percent
AES present	3,175	3.2
Partial system present	29	0.0
AES not present	89,528	89.7
Unknown	7,069	7.1
Null/Blank	19	0.0
Total Incidents	99,820	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 winter residential building fires. They are presented for informational purposes.

Examples

The following are some recent examples of winter residential building fires reported by the media in January 2010:

- Firefighters responded to a residential building fire in Manville, NJ, where they found a victim in the living room on the second floor. The victim was later pronounced dead and the accidental fire appears to have started in the kitchen with a deep fryer that was being used on top of a gas-burning stove.[9]
- Upon arrival at a mobile home fire in Shreveport, LA, firefighters found the home fully involved in flames. The home had no utilities connected and the resident, who perished in the fire, was using a propane cooking burner for heat that ignited nearby combustible materials.[10]
- A man from Columbus County, NC, lost his life after an unattended cooking fire spread at his home. A deputy fire marshal said it looked like a pot left on the stove was the cause of the fire. No other injuries resulted from the blaze.[11]
- A man died in a fire that fully engulfed his Rock Hill, SC, home. The man became trapped inside during the fire and died of smoke inhalation. Investigators say an oil space heater in the living room started the flames. Damage was estimated at $50,000 in property loss and another $10,000 for contents. In addition, about 75 percent of the home was destroyed by flames, smoke, and water damage.[12]
- An elderly man was killed as a result of burns he sustained during a fire in a high-rise apartment building in Dayton, OH. According to fire officials, the man was cooking when his clothes caught on fire. Other residents were evacuated from the apartment building, and no one else was injured during the fire.[13]

Conclusion

Approximately half of winter residential building fires are small incidents that are confined to noncombustible containers. These confined fires are small fire incidents that are limited in scope, confined to 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. However, the other half of winter residential building fires are not confined and, on average, result in approximately twice the number of fatalities and injuries than all residential building fires. As a result, like at all other times of the year, it is important each household diligently practice fire safety throughout the winter season. Practicing fire safety can lessen or eliminate fires and their resultant injuries, deaths, and property loss. For winter fire prevention and home fire safety, please visit http://www.usfa.dhs.gov/downloads/pdf/publications/fa-249-508.pdf. In addition, for cooking fire safety tips which should be practiced all year round, please visit http://www.usfa.dhs.gov/citizens/all_citizens/home_fire_prev/cooking.shtm.

NFIRS Data Specifications for Winter Residential Building Fires

Data for this report were extracted from the NFIRS annual Public Data Release (PDR) files for 2005, 2006, and 2007. Only version 5.0 data were extracted.

Winter residential building fires were defined as:

- Incident types 111 to 123:

Incident Type	Description
111	Building fire
112	Fires in structure other than in a building
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: Incident types 113 to 118 do not specify if the structure is a building. Incident type 112 is included as previous analyses have shown that incident types 111 and 112 are used interchangeably.

- Residential building fires that occur in the 3 months of January, February, and March.
- Aid types 3 (mutual aid given) and 4 (automatic aid given) were excluded to avoid double counting of incidents.
- Structure type:
  - 1 - Enclosed building,
  - 2 - Fixed portable or mobile structure, and
  - Structure type not specified (null entry).

To request additional information or to comment on this report, visit http://www.usfa.dhs.gov/applications/feedback/index.jsp

Notes:

[1] National estimates are based on 2005-2007 native version 5.0 data from the National Fire Incident Reporting System (NFIRS) and residential structure fire loss estimates from the National Fire Protection Association's (NFPA's) annual surveys of fire loss. Fires are rounded to the nearest 100, deaths to the nearest 5, injuries to the nearest 25, and loss to the nearest $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, incidents that have a residential property use, but do not have a structure type specified are presumed to be buildings.

[3] Residential buildings include, but are not limited to, one- or two-family dwellings, multifamily dwellings, boarding houses or residential hotels, commercial hotels, college dormitories, and sorority/fraternity houses.

[4] 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 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.

[5] 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 would be (1000*(945/108,400)) = 8.7 deaths per 1,000 winter residential building fires and the fire injury rate would be (1000*(3,825/108,400)) = 35.3 injuries per 1,000 winter residential building fires.

[6] 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.

[7] The USFA structure fire cause hierarchy was used to determine the cause of winter residential building fire incidents: http://www.usfa.dhs.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm.

[8] 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, or the smoke alarm was present and operated but the occupant was already aware of the fire.

[9] Jennifer Golson and Tom Haydon, "Fire victim's death tears heart of Manville," www.nj.com, January 3, 2010. http://www.nj.com/news/ledger/jersey/index.ssf?/base/news-15/1262481905152500.xml&coll=1 (accessed January 26, 2010).

[10] H. Butch Browing, "Louisiana – three fires in the state kill three people," blog.drivinglaws.com, January 9, 2010. http://blog.drivinglaws.org/2010/01/09/louisiana-three-fires-in-the-state-kill-three-people/ (accessed January 26, 2010).

[11] Scott Saxton, "Stove fire kills man from Columbus County," www.wect.com, January 15, 2010. http://www.wect.com/Global/story.asp?S=11831742 (accessed January 26, 2010).

[12] Shannon Greene and Christy Mullins, "Former pastor dies in Rock Hill house fire," www.heraldonline.com, January 15, 2010. http://www.heraldonline.com/120/story/1870279.html (accessed January 26, 2010).

[13] "Victim identified in fatal fire," www.whiotv.com, January 21, 2010. http://www.whiotv.com/news/22305129/detail.html (accessed January 26, 2010).