

Portable Heater Fires in Residential Buildings

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 3,800 portable heater fires occur annually in the United States.
- Only 2 percent of residential building heating fires involve portable heaters, but these fires account for 25 percent of fatal residential building heating fires.
- Residential building portable heater fires peak in February (21 percent).
- Thirty-four percent of residential building portable heater fires occur in bedrooms. Of these fires, 23 percent are started by bedding such as blankets, sheets, and comforters.
- Fifty percent of the residential building portable heater fires occur because the heat source is too close to combustibles.

From 2005 to 2007, portable heater fires in residential buildings—a subset of residential building heating fires—accounted for an estimated average of 3,800 fires in the United States each year. These fires resulted in an average of approximately 115 deaths, 250 injuries, and \$98 million in property loss.^{1,2,3} The term *portable heater fires* applies to those fires that are caused by catalytic heaters, oil-filled heaters, or other heaters that are designed to be carried or moved for use in a variety of locations.⁴ Portable heaters are a subset of *space heaters*—small heaters designed to heat specific areas or rooms of a building.⁵

This topical report addresses the characteristics of residential building portable heater fires reported to the National Fire Incident Reporting System (NFIRS) between 2005 and 2007. For a broader overview of heating fires, see the companion topical report, *Heating Fires in Residential Buildings* (Volume 10, Issue 2).

While residential building portable heater fires are small in number, representing only 2 percent of all residential building heating fires, their consequences are substantial: they account for a quarter (25 percent) of fatal residential building heating fires. Moreover, many of these fires are preventable as human error—placing the heater too close to combustible items or leaving the heater unattended—was a contributing factor to the fire.

For the purpose of this report, the term “residential portable heater fires” is synonymous with “residential building

portable heater fires” as residential heating fires commonly mean those fires caused by heating that occur in buildings. “Residential portable heater fires” is used throughout the body of this report; the findings, tables, charts, headings, and footnotes reflect the full category, “residential building portable heater fires.”

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.^{6,7} Very few residential portable heater fires are confined fires—less than 1 percent.

The few fire incident records coded as “confined” residential portable heater fires in NFIRS had sufficient data to be included in the overall analyses. As a result, the remainder of this report will address all combined residential portable heater fires and will not distinguish between confined and nonconfined fires.

Table 1 presents losses, averaged over this 3-year period, for residential fires and portable heater fires reported to NFIRS.⁸

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Table 1. Loss Measures for Residential Building Portable Heater Fires (3-year average, 2005–2007)

Measure	Residential Building Fires	Residential Building Heating Fires	Nonconfined Residential Building Heating Fires	Residential Building Portable Heater Fires
Average Loss:				
Fatalities/1,000 Fires	5.4	1.9	14.4	28.4
Injuries/1,000 Fires	28.1	9.3	53.8	95.8
Dollar Loss/Fire	\$14,560	\$3,540	\$25,490	\$34,810

Source: NFIRS 5.0.

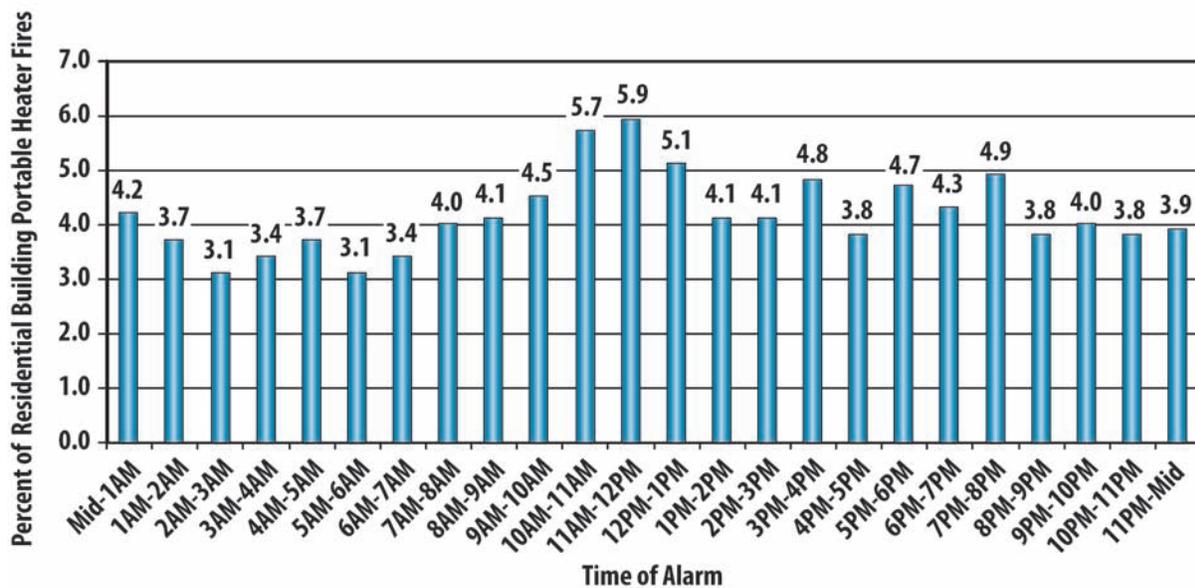
Notes: Average loss for fatalities and injuries is computed per 1,000 fires; average dollar loss is computed *per fire* and is rounded to the nearest \$10.

When Residential Building Portable Heater Fires Occur

As shown in Figure 1, residential portable heater fires are relatively constant throughout the day with some variations. They are generally at their lowest in the early mornings,

roughly between 2 a.m. and 7 a.m., and peak from 10 a.m. to 12 p.m. This latter 2-hour period accounts for 12 percent of residential portable heater fires.⁹

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

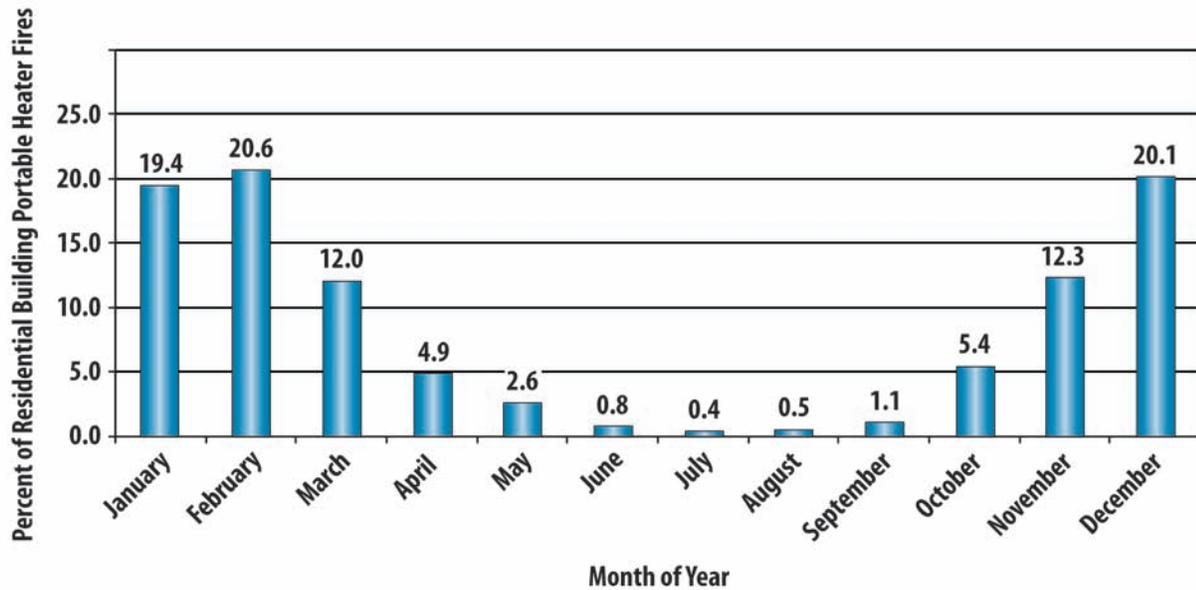


Source: NFIRS 5.0.

Figure 2 shows the pattern of residential portable heater fires reported to NFIRS throughout the year. As would be expected, the number of portable heater fires increases during the late fall and winter months (November through March), peaking in February. They are most prevalent

during the winter months of December through February when the use of portable heaters is most common. From March to August, fires decline from 12 percent to less than 1 percent. Residential portable heater fires are uncommon in the summer months.

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



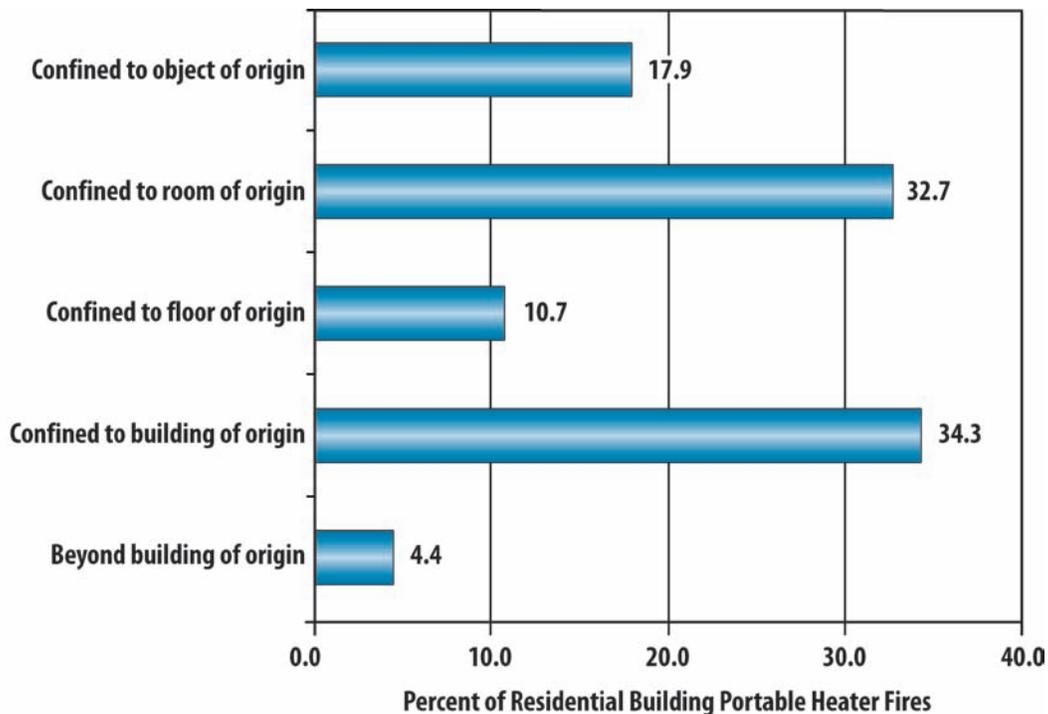
Source: NFIRS 5.0.

Fire Spread in Residential Building Portable Heater Fires

Just over half of residential portable heater fires (51 percent) remained confined to the object or room of origin (Figure 3). When compared to other residential heating-related fires, residential portable heater fires tend to spread further through the home. Forty-nine percent of residential portable heater fires spread beyond the object or room of

fire origin; by contrast, only 34 percent of nonconfined residential heating fires (excluding portable heaters) spread beyond the room of origin. This increased fire spread may be, in part, why residential portable heater fires tend to be more serious as evidenced in the loss measures of Table 1.

Figure 3. Extent of Fire Spread of Residential Building Portable Heater Fires (2005–2007)



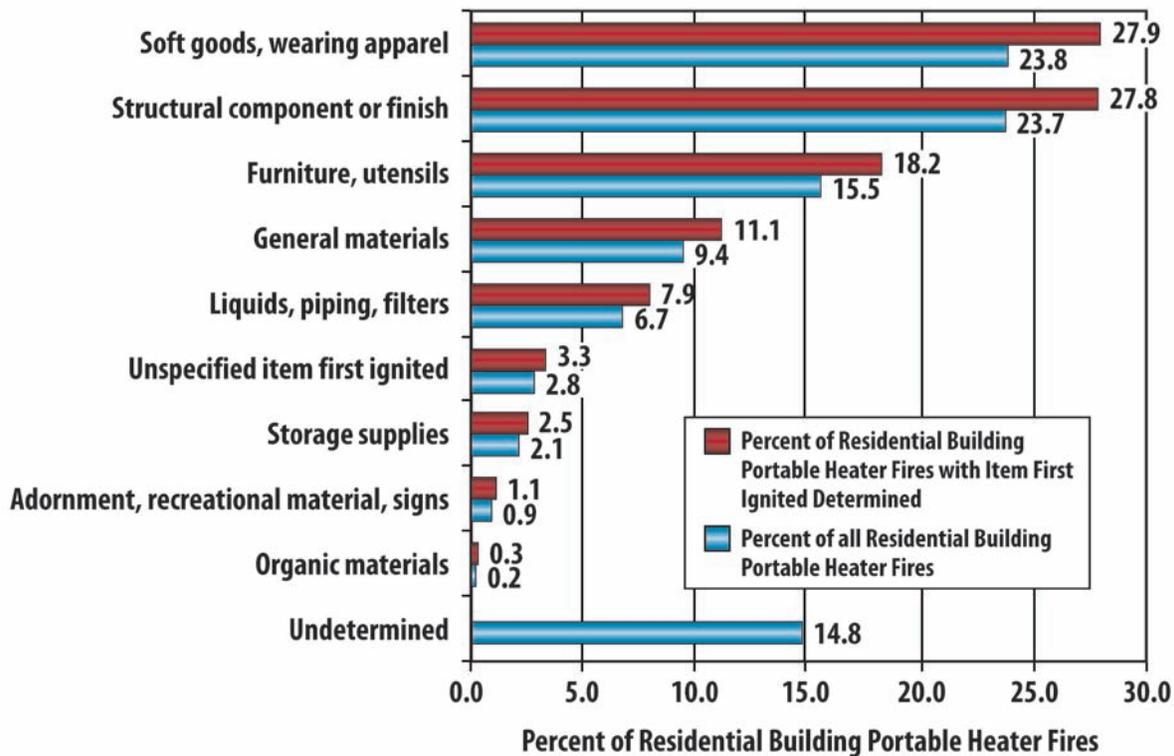
Source: NFIRS 5.0.

Items First Ignited in Residential Building Portable Heater Fires

Twenty-eight percent of items first ignited in residential portable heater fires fall under the “soft goods, wearing apparel” category (Figure 4). This category includes bedding, curtains, and clothing. “Structural component

or finish” accounts for another 28 percent of residential portable heater fires. “Furniture and utensils” is the third leading category at 18 percent.

Figure 4. Items First Ignited in Residential Building Portable Heater Fires (2005–2007)



Source: NFIRS 5.0.

Of the fires that occur in bedrooms, bedding, such as blankets, sheets, and comforters, is the leading item first ignited by portable heaters. These bedding items account for 23 percent of the residential portable heater fires that originate in the bedroom. Clothing not on a person accounts for another 15 percent.

For residential portable heater fires that occur in common rooms, 19 percent are started by upholstered sofas and chairs too close to the portable heater. Floor coverings such as rugs, carpets, or mats account for an additional 17 percent.

Factors Contributing to Ignition

Table 2 shows the leading factors contributing to ignition of residential portable heater fires. Placing a heat source too close to combustible objects was the leading contributing factor (50 percent). Unattended equipment was a contributing factor in 12 percent of residential portable heater fires and electrical failure or malfunction was a contributing factor in 9 percent of the fires. These 3 contributing factors played a role in 71 percent of residential portable heater fires.

Table 2. Leading Factors Contributing to Ignition for Residential Building Portable Heater Fires (Where Factor Contributing Specified, 2005–2007)

Factor Contributing to Ignition	Percent of Residential Building Portable Heater Fires (Unknowns Apportioned)
Heat source too close to combustibles	50.2
Equipment unattended	11.6
Unspecified electrical failure, malfunction	9.0
Unspecified mechanical failure, malfunction	6.5
Unspecified short-circuit arc	5.2

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.

Where Residential Building Portable Heater Fires Start

One- and two-family residences are disproportionately represented in residential portable heater fires. One- and two-family residences account for 88 percent of residential portable heater fires—yet they represent only 66 percent of residential fires. Multifamily dwellings account for an additional 9 percent of portable heater fires. Multifamily dwellings, especially older apartments, condominiums, and the like often have building-wide heating systems and the need

for portable heaters may be less, perhaps accounting for the differences in portable heater fire incidence.

Most residential portable heater fires start in bedrooms (34 percent) or common rooms including dens, family rooms, living rooms, and lounges (20 percent). Fires that start in other function or activity areas account for 8 percent of fires (Table 3).

Table 3. Leading Areas of Fire Origin in Residential Building Portable Heater Fires (2005–2007)

Area of Origin	Percent of Residential Building Portable Heater Fires (Unknowns Apportioned)
Bedrooms	34.4
Common room, den, family room, living room, lounge	20.1
Other function areas	8.1
Bathroom, checkroom, lavatory, locker room	7.2
Substructure area or space, crawl space	5.1

Source: NFIRS 5.0.

Suppression/Alerting Systems in Residential Building Portable Heater Fires

Smoke alarms were present in 41 percent of residential portable heater fires. Smoke alarms are known to have operated in 24 percent of portable heater fires. Smoke alarms were not present in 32 percent of residential portable heater fires (Table 4). In another 27 percent of these fires, firefighters were unable to determine if a smoke alarm was present.

Of the residential portable heater fires where a smoke alarm was present, the alarms failed to operate in 21 percent of the incidents.

Note that the data presented in Table 4 are the raw counts from the NFIRS data set and not scaled to national estimates of smoke alarms in residential portable heater fires.

Table 4. NFIRS Smoke Alarm Data for Residential Building Portable Heater 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		27	2.1
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	222	17.0
		Smoke alarm alerted occupants, occupants failed to respond	10	0.8
		No occupants	43	3.3
		Smoke alarm failed to alert occupants	10	0.8
		Undetermined	22	1.7
	Smoke alarm failed to operate		111	8.5
Undetermined		83	6.4	
None present			414	31.7
Undetermined			354	27.1
Null/Blank			9	0.7
Total Incidents			1,305	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 residential building portable heater fires. They are presented for informational purposes. Total may not add to 100 percent due to rounding.

Full or partial Automatic Extinguishing Systems (AESs) were present in less than 1 percent of residential portable heater fires. This finding is not surprising since only 3 percent of nonconfined residential building fires, where the data are available to analyze, have an AES present.

Note that, as in the smoke alarm data, the data presented in Table 5 are the raw counts from the NFIRS data set and not scaled to national estimates of AESs in residential portable heater fires.

Table 5. NFIRS Automatic Extinguishing System (AES) Data for Residential Building Portable Heater Fires (2005–2007)

AES Presence	Count	Percent
AES present	9	0.7
Partial system present	1	0.1
AES not present	1,243	95.2
Undetermined	43	3.3
Unknown (blank or null entry)	9	0.7
Total Incidents	1,305	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 residential building portable heater fires. They are presented for informational purposes. Total may not add to 100 percent due to rounding.

Examples

These recent examples of residential portable heater fires illustrate issues and concerns associated with these fires—unattended equipment left too close to combustibles—and

the damage they cause. These incidents were captured from local media reports.

- December 2007: A kerosene space heater caused a fire that displaced four people from a townhouse in Suffolk, VA. The portable heater was left unattended and it ignited nearby objects in the living room. No one was hurt in the fire, but it did cause major property damage estimated at \$48,000. The fire prompted city fire officials to issue safety guidelines for the use of portable heaters.¹⁰
- January 2008: Firefighters were called to a fire that killed one man in Lexington, NC. Fire officials reported that the fire was caused by a portable heating device that was left too close to a couch.¹¹
- November 2008: Firefighters were called to a fire in a mobile home in South Haven, MI. The fire began after a portable heating device ignited nearby combustible materials. Firefighters reported that there were no working smoke alarms in the mobile home. The fire claimed the life of a 19-year-old woman.¹²
- December 2008: A three-alarm fire broke out at a neighborhood church in Lawrence, MA on Christmas day. The fire was most likely started by an electric space heater [portable heater] left plugged in. The fire caused \$200,000 in damage. No one was hurt in the fire and firefighters had control of the fire within 20 minutes.¹³

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Conclusion

Residential building portable heater fires are a small but damaging subset of residential heating fires. The number of residential heating fires has decreased over the past few decades due to safer heating equipment and better public education about the dangers and prevention of heating fires. Despite the decrease in overall heating fires, portable heater fires still remain a serious problem. An estimated 3,800 residential portable heater fires occur each year in the United States. Many of these fires and resulting damage can be prevented by moving portable heaters away from nearby combustible materials and turning the heater off when not in the room or area.

Many homes have installed central heating systems but portable heaters are still used to augment heating systems in cooler areas of the home or for early or unexpected cold weather. The challenge for communities and the fire service is to emphasize heating fire prevention and safe use and maintenance of portable heating equipment.

NFIRS Data Specifications for Residential Building Portable Heater Fires

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

Residential building portable heater fires were defined as:

- Incident Types 111, 112, 114, 116, 120-123:¹⁴

Incident Type	Description
111	Building fire
112	Fires in structure other than in a building
114	Chimney or flue fire, confined to chimney or flue
116	Fuel burner/boiler malfunction, fire confined
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 that Incident Types 114 and 116 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.

- Structure type:
 - 1 - Enclosed building
 - 2 - Fixed portable or mobile structure
 - Structure type not specified (null entry)
- Aid types 3 (mutual aid given) and 4 (automatic aid given) were excluded to avoid double counting of incidents.
- Property use 400 to 464:

Property Use	Description
400	Residential, other
419	One- or Two-family dwelling
429	Multifamily dwelling
439	Boarding/Rooming house, residential hotels
449	Hotel/Motel, commercial
459	Residential board and care
460	Dormitory-type residence, other
462	Sorority house, fraternity house
464	Barracks, dormitory

- The USFA cause hierarchy was used to determine residential building heating fire incidents.¹⁵
- Equipment involved in ignition codes 141 to 143:

Equipment Involved in Ignition	Description
141	Heater; includes floor furnaces, wall heaters, and baseboard heaters; excludes hot water heaters
142	Heater, catalytic
143	Heater, oil-filled

- Equipment portability code 1 was used to identify portability.

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 to 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) 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 For purposes of this analysis, residential building portable heater fires are defined as those residential buildings (defined above) for which the cause of the fire was determined to be portable heaters.

⁵ Space heaters may be fixed (stationary) or portable. Space heaters typically include heating and wood stoves; heaters (including portable kerosene heaters, portable electric heaters, oil-filled heater, and catalytic heaters); local furnaces; and fireplace inserts.

⁶ 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.

⁷ In NFIRS, confined fires are defined by Incident Type codes 113 to 118.

⁸ The average fire death and fire injury loss rates computed from the national estimates above 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 $(1,000 * (115 / 3,800)) = 30.3$ deaths per 1,000 residential building portable heater fires and the fire injury rate would be $(1,000 * (250 / 3,800)) = 65.8$ injuries per 1,000 residential building portable heater fires.

⁹ 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.

¹⁰ "Heater blamed in Suffolk fire that displaced four," www.hamptonroads.com, December 4, 2007. <http://hamptonroads.com/2007/12/heater-blamed-suffolk-fire-displaced-four> (accessed April 30, 2009).

¹¹ "Portable Heating Device Cause in Fatal Fire," [WXII12.com](http://www.wxii12.com), January 8, 2008. <http://www.wxii12.com/print/15004655/detail.html> (accessed April 30, 2009).

¹² "Home apparently lacked working smoke detectors," www.mlive.com, November 24, 2008. <http://www.mlive.com/news/kzgazette/index.ssf?/base/news-31/1227541844323110.xml&coll=7> (accessed April 30, 2009).

¹³ Peter Schworm "Space heater eyed as cause in Lawrence fire," www.boston.com, December 26, 2008. http://www.boston.com/news/local/breaking_news/2008/12/space_heater_ey.html (accessed April 30, 2009).

¹⁴ Heating is defined by the equipment used to heat a residential building. Incident Types 113, 115, 117, and 118 were excluded because by definition these Incident Types were not heating fires.

¹⁵ The USFA cause hierarchy is designed for structure fires. Buildings are a subset of structures. The cause hierarchy can be found at: http://www.usfa.dhs.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm.