TOPICAL FIRE REPORT SERIES Volume 14, Issue 12 / November 2013

Residential Building Garage Fires (2009–2011)

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

Findings

- An estimated 6,600 residential building garage fires were reported to United States fire departments each year and caused an estimated 30 deaths, 400 injuries and $457 million in property loss.
- Residential building garage fires are considered part of the residential fire problem and comprised about 2 percent of all residential building fires.
- Fires originating in residential building garages tend to be larger and spread farther than fires that start in other areas of a residence.
- Of residential building garage fires, 93 percent occurred in one- and two-family residential buildings.
- The leading causes of residential building garage fires were "electrical malfunction" (16 percent); "other unintentional, careless" action (15 percent); and "open flame" (11 percent).
- Residential building garage fires occurred most often in the colder months of January and December (at 10 percent each). Additionally, residential building garage fires also peaked in July at 10 percent.
- Electrical arcing was the most common heat source in residential building garage fires (17 percent).

From 2009 to 2011, an estimated 6,600 residential building fires originating in attached garages were reported by U.S. fire departments annually. These fires caused an estimated 30 deaths, 400 injuries and $457 million in property damage.[1, 2, 3] Residential building garage fires accounted for about 2 percent of all residential building fires reported to the National Fire Incident Reporting System (NFIRS) from 2009 to 2011.

In NFIRS, residential building garage fires are defined as those fires where the property use was reported to be residential, and the area of fire origin was noted to be a vehicle storage area (i.e., garage or carport). Therefore, this report focuses on garages that are physically attached to the residence.[4]

Attached garages are initially designed for the use of vehicle storage; however, many garages are used for storage or converted to living spaces, such as bedrooms and dens. When garages are converted for use as occupied spaces, they may often not have smoke alarms or heat sensors installed.

Few, if any, building codes require smoke alarms in residential garages, so very few garages have smoke alarms installed. Detection of a fire in a garage takes longer due to the absence of automatic detection; this delay in fire detection gives a fire time to grow larger in size, ultimately causing more damage.[5] When a fire occurs in a garage, enough smoke may eventually reach the smoke alarms installed in other areas of the home, causing them to activate.

The contents of garages may also result in fires that cause greater damage and present greater challenges to firefighters than encountered during other types of residential fires.[6] The garage usually contains an array of fuel sources such as flammable liquids, paint, various chemicals, ammunition, newspapers and stored items.

Other aspects of attached garages that may pose potential threats to firefighters include lightweight building assemblies often used to create a large, open space and garage doors, which should be safely secured in position so that they will not fall back down or close. This prevents firefighters from becoming trapped inside the building.[7]

This topical report addresses the characteristics of residential building garage fires as reported to NFIRS from 2009 to 2011. The NFIRS data are used for the analyses presented throughout the report. For the purpose of the report, the terms "residential fires" and "garage fires" are synonymous with "residential building fires" and "residential building garage fires," respectively. "Garage fires" is used throughout the body of this report; the findings, tables, charts, headings and endnotes reflect the full category, "residential building garage 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, fireplaces or certain other noncombustible containers not typically encountered in garages.[8] Confined fires rarely result in serious injury or large content loss and are expected to have no significant accompanying property loss due to flame damage.[9] Of the two classes of severity, nonconfined fires accounted for 97 percent of garage fires (Table 1). The smaller confined fires accounted for the remaining 3 percent. Because there are so few confined garage fires, the subsequent analyses in this report include all garage fires and do not distinguish between confined and nonconfined fires.

Table 1. Residential Building Garage Fires by Type of Incident (2009-2011)

Incident Type	Percent
Nonconfined fires	97.3
Confined fires	2.7
Trash or rubbish, contained	1.9
Cooking fire, confined to container	0.4
Fuel burner/boiler malfunction, fire confined	0.2
Chimney or flue fire, confined to chimney or flue	0.1
Total	100.0

Source: NFIRS 5.0.
Note: Confined fire incident type percentages do not add up to the total confined fires percentage due to rounding.

Loss Measures

Table 2 presents losses, averaged over this three-year period, of reported garage and nongarage residential fires.[10] Garage fires caused fewer fatalities per 1,000 fires than nongarage fires (Table 2). Garage fires, however, resulted in substantially more injuries per 1,000 fires and greater dollar loss per fire than nongarage fires. The increase in dollar loss per fire may ultimately be due to challenges in the detection and location of garage fires. The fires take longer to detect, become larger in size, and cause more widespread damage.

Table 2. Loss Measures for Residential Building Garage and Nongarage Fires (Three-year Average, 2009-2011)

Measure	Residential Building Garage Fires	Residential Building Nongarage Fires
Average Loss:		
Fatalities/1,000 fires	3.6	5.5
Injuries/1,000 fires	48.8	28.9
Dollar loss/fire	$54,800	$14,690

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 for 2009-2011, the 2009 and 2010 dollar-loss values were adjusted to their equivalent 2011 dollar-loss values to account for inflation.

Property Use

Residential buildings are divided into three major property types: one- and two-family residential buildings, multifamily residential buildings, and other residential buildings. One- and two-family residential buildings include detached single-family residences, manufactured homes, mobile homes not in transit, and duplexes. Multifamily residential buildings include apartments, condominiums and town houses. Other residential buildings include all other types of residences, such as hotels or motels, long-term care facilities, dormitories, and sorority or fraternity housing.

One- and two-family residential buildings accounted for 93 percent of residential garage fires reported to NFIRS (Table 3). By comparison, one- and two-family residential buildings accounted for 65 percent of fires originating in all other areas of residential buildings, more in line with the occurrence of one- and two-family residential building fires overall (66 percent).[11]

Table 3. Residential Building Garage and Nongarage Fires by Property Use (2009–2011)

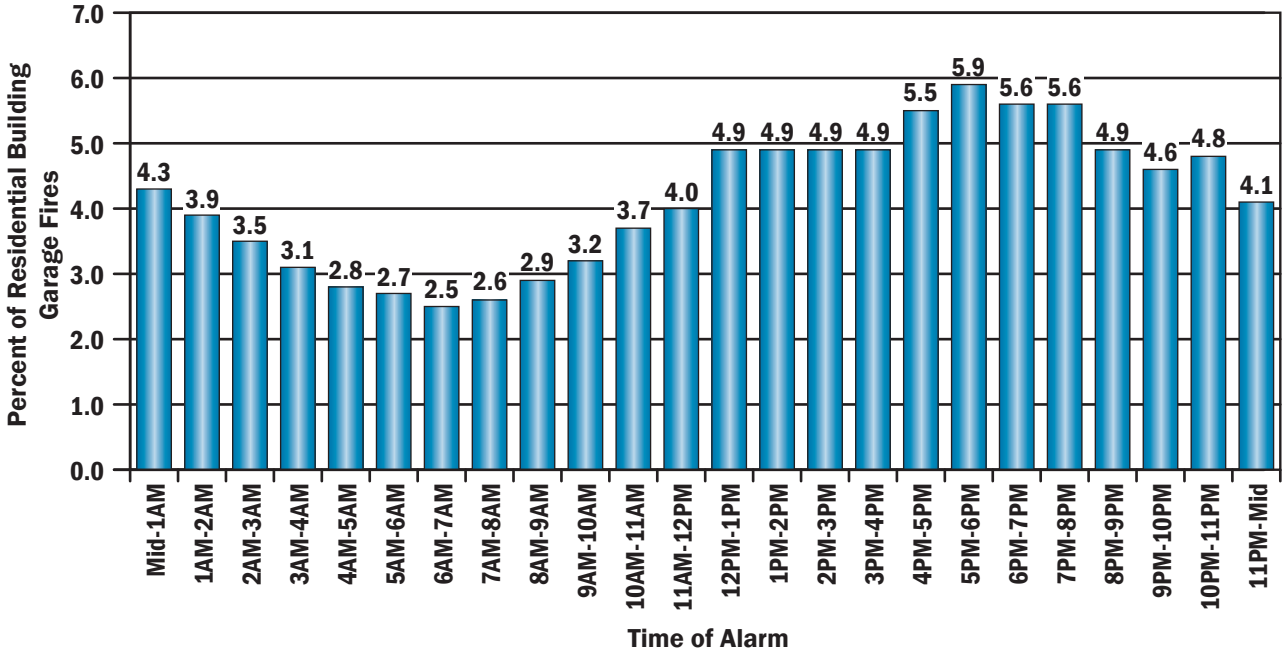
Property Type	Percent of Residential Building Garage Fires	Percent of Residential Building Nongarage Fires
One- and Two-family	93.3	64.9
Multifamily	3.6	28.7
Other	3.1	6.4
Total	100.0	100.0

Source: NFIRS 5.0.

When Residential Building Garage Fires Occur

As shown in Figure 1, garage fires occurred most frequently in the late afternoon to early evening hours, peaking from 4 to 8 p.m. and accounting for 23 percent of the fires.[12] They gradually declined throughout the late evening and early morning hours, reaching the lowest point from 6 to 7 a.m. Beginning at 7 a.m., fire incidence started to increase until the peak hours were reached.

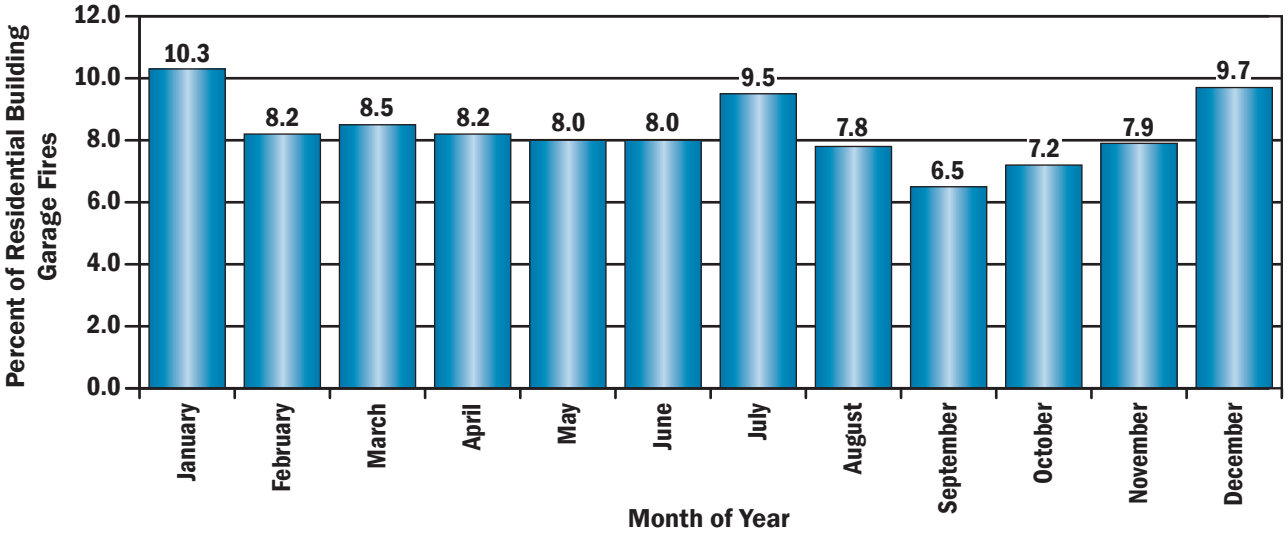
Figure 1. Residential Building Garage Fires by Time of Alarm (2009–2011)



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

Figure 2 illustrates that garage fires peaked twice during the year, once in the colder months and again in the summer. The cold weather peak, which was the highest peak, occurred during the months of December (10 percent) and January (10 percent). The increase in garage fires during these two months was partially a result of electrical malfunctions and other unintentional, careless actions. The second peak in garage fires was seen during the month of July (10 percent). This summer peak was also primarily a result of electrical malfunctions. The lowest incidence of garage fires occurred in September, which saw the least number of garage fires caused by electrical malfunctions.

Figure 2. Residential Building Garage Fires by Month (2009-2011)



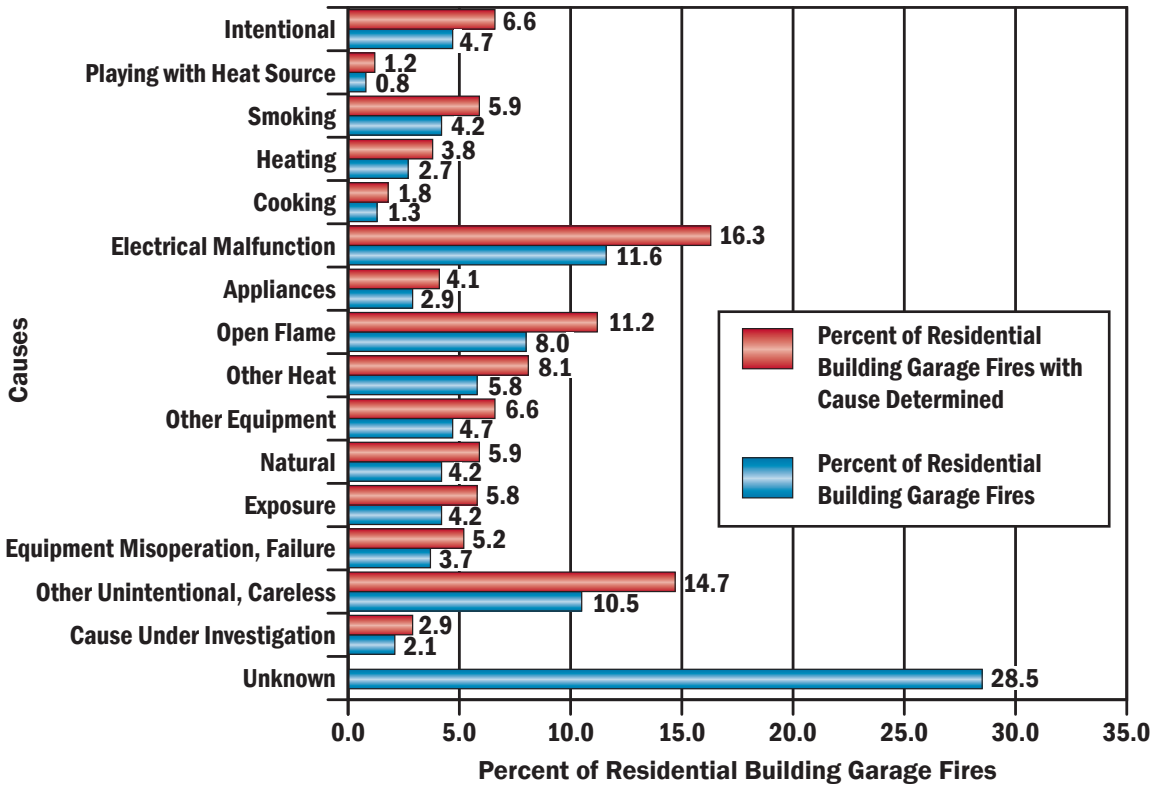
Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Causes of Residential Building Garage Fires

Electrical malfunctions caused 16 percent of all garage fires as shown in Figure 3. This finding suggests that homeowners and residents should make it a priority to have electrical equipment and electrical wiring in garages inspected and properly maintained.

The next two leading causes combined accounted for 26 percent of garage fires: other unintentional, careless actions (15 percent) and open flames (11 percent).[13]

Figure 3. Residential Building Garage Fires by Cause (2009-2011)

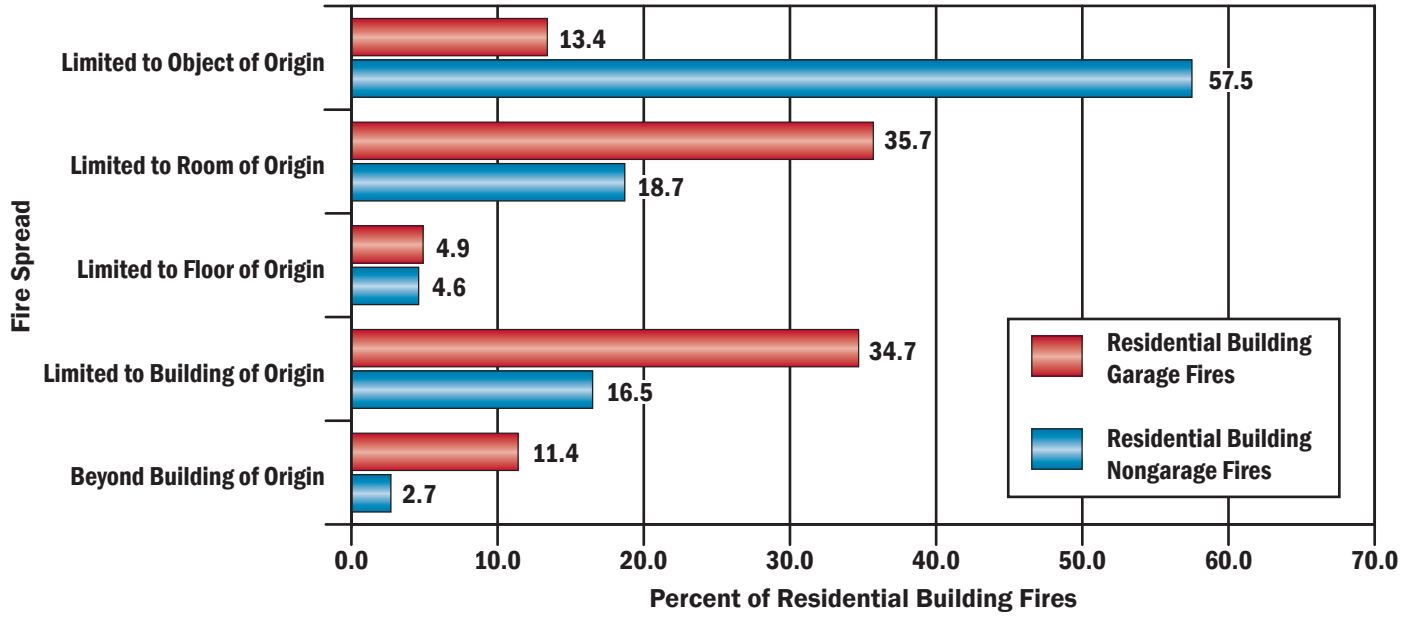


Source: NFIRS 5.0.
Notes: 1. Causes are listed in order of the U.S. Fire Administration (USFA) Structure Fire Cause Hierarchy for ease of comparison of fire causes across different aspects of the fire problem. Fires are assigned to one of 16 cause groupings using a hierarchy of definitions, approximately as shown in the chart above. A fire is included in the highest category into which it fits. If it does not fit the top category, then the second one is considered, and if not that one, the third and so on. For example, if the fire is judged to be intentionally set and a match was used to ignite it, it is classified as intentional and not open flame because intentional is higher in the hierarchy.
2. Totals do not add up to 100 percent due to rounding.

Fire Spread in Residential Building Garage Fires

The delay in the discovery of garage fires is evident in the extent of fire spread: 13 percent of garage fires were limited to the object of origin, 36 percent were limited to the room of origin, and 40 percent spread beyond the room of origin to the floor or building, while 11 percent of fires originating in garages spread beyond the building. Contrast this fire spread with the spread of fires originating elsewhere in residences: 58 percent of residential nongarage fires were limited to the object of origin, 19 percent were limited to the room of origin, and 21 percent spread beyond the room of origin to the floor or building, while 3 percent of fires originating in nongarage areas of residences spread beyond the building.[14]

Figure 4. Extent of Fire Spread in Residential Building Garage and Nongarage Fires (2009–2011)



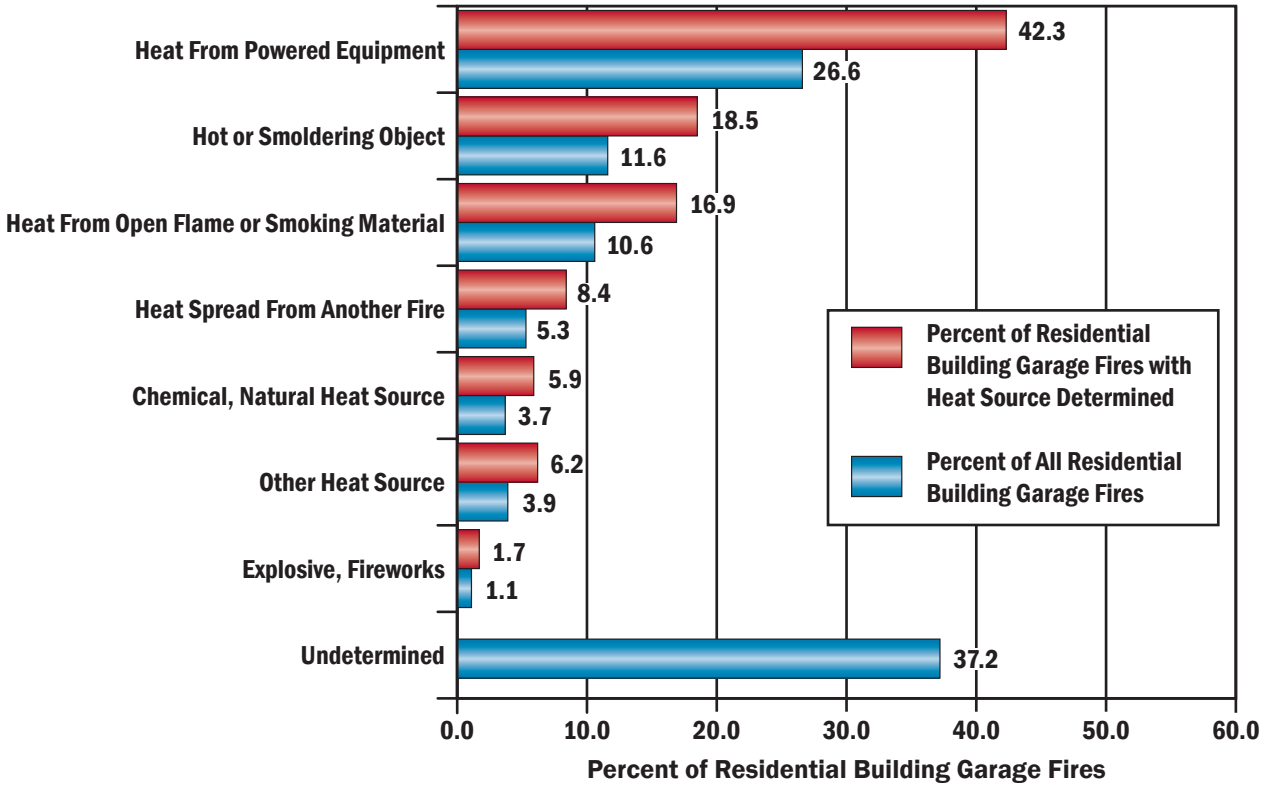
Source: NFIRS 5.0.
Note: Total for residential building garage fires does not add up to 100 percent due to rounding.

How Residential Building Garage Fires Start (Heat Source)

Figure 5 shows sources of heat categories in garage fires. The "heat from powered equipment" category, predominantly electrical distribution, lighting and power transfer equipment, accounted for 42 percent of all garage fires. Within this category, electrical arcing accounted for 17 percent; heat from other powered equipment accounted for 11 percent; radiated or conducted heat from operating equipment accounted for 8 percent; and sparks, embers or flames from operating equipment accounted for 7 percent of all garage fires.[15]

The "hot or smoldering object" category accounted for 19 percent of garage fires. This category includes fires started by hot embers or ashes (10 percent) and miscellaneous hot or smoldering objects (7 percent). The item that accounted for most garage fires in the third largest category, "heat from open flame or smoking material" (17 percent), was cigarettes (6 percent).

Figure 5. Sources of Heat in Residential Building Garage Fires by Major Category (2009–2011)



Source: NFIRS 5.0.
Note: Total for residential building garage fires with heat source determined does not add up to 100 percent due to rounding.

What Ignites First in Residential Building Garage Fires

Electrical wire, cable insulation (11 percent); rubbish, trash or waste (8 percent); and structural member or framing (8 percent) were the leading specific items most often first ignited in garage fires (Table 4). Of interest, boxes, cartons, bags, barrels or wastebaskets were the items first ignited in 6 percent of garage fires.

Table 4. Leading Items First Ignited in Residential Building Garage Fires (2009–2011)

Item First Ignited	Percent (Unknowns Apportioned)
Electrical wire, cable insulation	10.6
Rubbish, trash, waste	8.4
Structural member or framing	7.9
Item first ignited, other	6.4
Box, carton, bag, barrel, wastebasket	5.7
Multiple items first ignited	5.7
Exterior sidewall covering, surface	5.7

Source: NFIRS 5.0.

Factors Contributing to Ignition in Residential Building Garage Fires

Table 5 shows the categories of factors contributing to ignition in garage fires. By far, the leading category was "misuse of material or product" (47 percent). In this category, abandoned or discarded materials (16 percent) and heat source too close to combustibles (13 percent) were the specific factors that accounted for 29 percent of garage fires.

The "electrical failure, malfunction" category was a contributing factor in 23 percent of garage fires. The leading specific factor contributing to ignition in this category was other electrical failure, malfunction (11 percent), followed by unspecified short-circuit arc (6 percent). "Fire spread or control" was the third leading factor contributing to ignition category at 11 percent.

Table 5. Factors Contributing to Ignition for Residential Building Garage Fires by Major Category (Where Factors Contributing to Ignition are Specified, 2009–2011)

Factors Contributing to Ignition Category	Percent of Residential Building Garage Fires
Misuse of material or product	47.2
Electrical failure, malfunction	22.9
Fire spread or control	10.7
Mechanical failure, malfunction	8.3
Operational deficiency	7.4
Other factors contributing to ignition	5.2
Natural condition	3.0
Design, manufacture, installation deficiency	1.4

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

Alerting/Suppression Systems in Residential Building Garage Fires

Smoke Alarm Data

Smoke alarm data presented in Tables 6 and 7 are the raw counts from the NFIRS data set and are not scaled to national estimates of smoke alarms in residential buildings where garage fires occurred. 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.

Few, if any, smoke alarms are listed by Underwriters Laboratories for use in the temperature extremes that an attached garage can experience. In fact, the National Association of State Fire Marshals (NASFM) specifies that smoke alarms should **not** be installed in garages because, in general, garages are not temperature controlled; therefore, they are sometimes above or below the temperature range for which the smoke alarm was designed. Additionally, vehicle exhaust fumes will cause nuisance alarms and may lead to degradation in smoke alarm performance.[16] For these reasons, few, if any, codes require smoke alarms in garages in one- and two-family residential buildings, where 93 percent of garage fires occurred. As a result, very few garages have smoke alarms installed.

Smoke and heat rise; if the alarm is activated, it is often because of smoke seepage from any openings in the garage to other areas of the home. Hence, if smoke alarms operate, they are generally late in the detection and notification of garage fires.

Overall, smoke alarms were present in 40 percent of residences where garage fires occurred and were known to have operated in 24 percent of the fires. Because NFIRS does not collect information on the location of the smoke alarm with respect to the area of fire origin, it is assumed that many smoke alarms were located in the residence and not necessarily in the attached garage. By comparison, smoke alarms were present in 42 percent of nonconfined, nongarage fires and operated in 25 percent. In 32 percent of garage fires, no smoke alarms were present. In another 26 percent of these fires, firefighters were unable to determine if a smoke alarm was present (Table 6).

While 12 percent of all garage fires occurred in residential buildings that are **not** currently or routinely occupied, these buildings — which are 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 8 percent of all garage fires in unoccupied residential buildings were reported as having smoke alarms that operated. In addition, automatic suppression systems were reported as present in less than 1 percent of garage fires in residential buildings that were not routinely occupied. As a result, the detailed smoke alarm analyses in the next section focus on garage fires in occupied residential buildings only.

Table 6. NFIRS Smoke Alarm Presence in Residential Building Garage Fires (2009-2011)

Presence of Smoke Alarms	Count	Percent
Present	5,800	40.2
None present	4,678	32.4
Undetermined	3,726	25.8
Null/Blank	236	1.6
Total incidents	14,440	100.0

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

Smoke Alarms in Occupied Residential Building Garage Fires

One of the most important values of smoke alarms is detecting smoldering fires before they break into open flame or produce large volumes of smoke. Smoke alarms could be especially useful in early detection of garage fires, if the alarm is properly placed.

Smoke alarms were reported as present in 43 percent of garage fires in occupied residential buildings (Table 7). Smoke alarms were known to have operated in 26 percent of garage fires in occupied residential buildings and were known to be absent in 31 percent. Firefighters were unable to determine if a smoke alarm was present in another 26 percent of these fires.

When operational status is considered, the percentage of smoke alarms reported as present (43 percent) consisted of:

- Present and operated — 26 percent.
- Present, but did not operate — 9 percent (fire too small, 5 percent; alarm failed to operate, 4 percent).
- Present, but operational status unknown — 8 percent.

When the subset of incidents where smoke alarms were reported as present was analyzed separately, smoke alarms were reported to have operated in 60 percent of the incidents. The alarms failed to operate in 9 percent of the incidents. In 13 percent of the subset, the fire was too small to activate the alarm. The operational status of the alarm was undetermined in an additional 18 percent of the incidents.

Table 7. NFIRS Smoke Alarm Data for Occupied Residential Building Garage Fires (2009-2011)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		691	5.4
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	2,092	16.4
		Smoke alarm alerted occupants, occupants failed to respond	77	0.6
		No occupants	380	3.0
		Smoke alarm failed to alert occupants	208	1.6
		Undetermined	539	4.2
	Smoke alarm failed to operate		509	4.0
	Undetermined		1,010	7.9
None present			3,901	30.5
Undetermined			3,366	26.4
Total incidents			12,773	100.0

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

Automatic Extinguishing System Data

Overall, full or partial automatic extinguishing systems (AESs), mainly sprinklers, were present in just 2 percent of garage fires in occupied residential buildings (Table 8). Note that the data presented in Table 8 are the raw counts from the NFIRS data set and are not scaled to national estimates of AES in garage fires. The lack of suppression equipment (sprinklers) in homes experiencing garage fires is not unexpected, as sprinklers are largely absent nationwide in residential buildings.[17] In addition, none of the national model codes require sprinklers in garages in one- and two-family residences,[18] the location of 93 percent of garage fires reported to NFIRS.

USFA recommends that homeowners consider installing a single (sidewall) sprinkler head adjacent to the entry door of the garage to the home. Even in garages which may be subject to freezing temperatures, if properly installed, the single head on the interior wall should not freeze. Additionally, USFA encourages the use of a 30-minute fire-resistive wall separating the garage from the interior of the home and the installation of a rate of rise (heat) detector device to aid in the early detection of garage fires.[19]

Table 8. NFIRS Automatic Extinguishing System Data for Occupied Residential Building Garage Fires (2009–2011)

Presence of Automatic Extinguishing Systems	Count	Percent
AES present	236	1.8
Partial system present	11	0.1
AES not present	11,891	93.1
Unknown	635	5.0
Total incidents	12,773	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 occupied residential building garage fires. They are presented for informational purposes.

Examples

The following are some recent examples of garage fires reported by the media:

- July 2013: An early morning fire broke out in an attached garage of a two-story home in Vancouver, Washington. Smoldering fireworks disposed of in a garbage can caused the fire that damaged the garage and the vehicles parked inside it. The occupants had been setting off fireworks the previous evening and had gone to bed before the fire started. One resident refused to be transported to the hospital for the treatment of a smoke inhalation injury. No other injuries were reported as a result of the blaze.[20]
- May 2013: Firefighters were quickly able to extinguish a fire that started in an attached garage in Pittsfield Township, Michigan. The firefighters were dispatched to the home at 1:28 a.m. and were able to contain the fire to the garage area. According to fire department officials, the fire was believed to have resulted from careless smoking. Occupants of the home were able to evacuate safely and no injuries were reported.[21]
- April 2013: An attached garage fire resulted in an estimated $25,000 in damage to a home in Mentor, Ohio. Firefighters arrived on-scene around 1:20 p.m. and quickly worked to extinguish the fire that broke out on the exterior wall of the garage. Fire officials reported that the fire was caused by discarded hot embers that ignited the siding on the garage's exterior.[22]
- February 2013: At around 3 p.m., firefighters responded to a lawn mower fire in an attached garage in Hugo, Minnesota. Upon arrival, fire crews found the three-car garage to be fully involved. Firefighters were able to contain the fire before it spread through the single-story home. One firefighter suffered minor burn injuries and was transported to the hospital. No other injuries were reported.[23]

NFIRS Data Specifications for Residential Building Garage Fires

Data for this report were extracted from the NFIRS annual Public Data Release files for 2009, 2010 and 2011. Only version 5.0 data were extracted.

Garage fires were defined using the following criteria:

- Aid Types 3 (mutual aid given) and 4 (automatic aid given) were excluded to avoid double counting of incidents.
- Incident Types 111 to 123 (excluding Incident Type 112):

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

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

- Property Use series 400, which consists of the following:

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

- Structure Type:
  - For Incident Types 113 to 118:
    - 1—Enclosed building.
    - 2—Fixed portable or mobile structure, and
    - Structure Type not specified (null entry).
  - For Incident Types 111 and 120 to 123:
    - 1—Enclosed building.
    - 2—Fixed portable or mobile structure.
- Area of Fire Origin code 47 (vehicle storage area: garage, carport).

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

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

Notes:

[1] National estimates are based on 2009-2011 native version 5.0 data from NFIRS, residential structure fire-loss estimates from the National Fire Protection Association's (NFPA's) annual surveys of fire loss, and USFA's residential building fire-loss estimates: http://www.usfa.fema.gov/statistics/estimates/index.shtm. For information on NFPA's survey methodology, please see NFPA's report on fire loss in the U.S.: http://www.nfpa.org/~/media/Files/Research/NFPA%20reports/Overall%20Fire%20Statistics/osfireloss.pdf. In this topical report, estimates of fires are rounded to the nearest 100, deaths to the nearest five, injuries to the nearest 25, and losses to the nearest million dollars.

[2] In NFIRS version 5.0, a structure is a constructed item of which a building is one type. In previous versions of NFIRS, the term "residential structure" commonly referred to buildings where people live. To coincide with this concept, the definition of a residential structure fire for NFIRS 5.0 has, therefore, changed to include only those fires where the NFIRS 5.0 Structure Type is 1 or 2 (enclosed building and fixed portable or mobile structure) with a residential property use. Such structures are referred to as "residential buildings" to distinguish these buildings from other structures on residential properties that may include fences, sheds and other uninhabitable structures. In addition, confined fire incidents that have a residential property use but do not have a structure type specified are presumed to be 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] 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] In NFIRS, garages that are not physically attached to the residential building are considered to be nonresidential buildings and, therefore, are not part of the scope of this report.

[5] Greg Jakubowski, "Fighting Fire in Attached Garages," May 2012 issue of FireRescue, http://www.firefighternation.com/article/firefighting-operations/fighting-fire-attached-garages (accessed Aug. 8, 2013).

[6] Greg Jakubowski, "Fighting Fire in Attached Garages," May 2012 issue of FireRescue, http://www.firefighternation.com/article/firefighting-operations/fighting-fire-attached-garages (accessed Aug. 8, 2013).

[7] Mark van der Feyst, "The Hidden Dangers of Garage Fires," Fire Engineering, http://www.fireengineering.com/articles/2013/03/the-hidden-dangers-of-garage-fires._printArticle.html (accessed Aug. 8, 2013).

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

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

[10] The average fire death and fire injury loss rates computed from the national estimates do not agree with average fire death and fire injury loss rates computed from NFIRS data alone. The fire death rate computed from national estimates is (1,000*(30/6,600)) = 4.5 deaths per 1,000 residential building garage fires, and the fire injury rate is (1,000*(400/6,600) = 60.6 injuries per 1,000 residential building garage fires.

[11] "One- and Two-Family Residential Building Fires (2009-2011)," Topical Fire Report Series, U.S. Fire Administration, September 2013, Volume 14, Issue 10, http://www.usfa.fema.gov/downloads/pdf/statistics/v14i10.pdf.

[12] 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.

[13] The USFA Structure Fire Cause Methodology was used to determine the cause of residential building garage fires: www.usfa.fema.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm.

[14] Total percent of residential building nongarage fires does not add to 100 percent due to rounding.

[15] Total does not add up to 42 percent due to rounding.

[16] The National Association of State Fire Marshals, "Smoke Alarm Facts," http://firemarshals.org/rfsi/smokealarmfacts.html (accessed Aug. 13, 2013).

[17] "Residential Building Fires (2009-2011)," Topical Fire Report Series, U.S. Fire Administration, May 2013, Volume 14, Issue 4, http://www.usfa.fema.gov/downloads/pdf/statistics/v14i4.pdf.

[18] NFPA 13D (2013).

[19] U.S. Fire Administration, "Building Construction: Residential Garage Fires and Built-in Protection," Coffee Break Training — Fire Protection Series, No. FP-2013-47-1 November 19, 2013, http://www.usfa.fema.gov/nfa/coffee-break/index.shtm.

[20] Emily Gillespie, "Update: Smoldering fireworks cause garage fire in Village at Fishers Landing," columbian.com, July 5, 2013, http://www.columbian.com/news/2013/jul/05/smoldering-fireworks-damages-garage-village-fisher/ (accessed Aug. 6, 2013).

[21] Ben Baird, "Pittsfield Twp: Fire in attached garage believed started by careless smoking," heritage.com, May 1, 2013, http://www.heritage.com/articles/2013/05/01/ypsilanti_courier/news/doc517e7a4676aff351881900.txt (accessed Aug. 6, 2013).

[22] "Mentor garage fire causes $25,000 in damage," news-herald.com, April 15, 2013, http://news-herald.com/articles/2013/04/15/news/nh6798768.txt (accessed Aug. 6, 2013).

[23] "Crews stop attached garage fire in Hugo," twincitiesfirewire.com, Feb. 3, 2013, http://twincitiesfirewire.com/2013/02/03/crews-stop-attached-garage-fire-in-hugo/ (accessed Aug. 6, 2013).