TOPICAL FIRE REPORT SERIES Volume 14, Issue 5 / June 2013

Nonresidential Building Fires (2009–2011)

These topical reports are designed to explore facets of the U.S. fire problem as depicted through data collected in the U.S. Fire Administration's National Fire Incident Reporting System. 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 86,500 nonresidential building fires were reported to United States fire departments each year and caused an estimated 85 deaths, 1,325 injuries, and $2.6 billion in property losses per year.
- Cooking was the leading cause of all nonresidential building fires (29 percent). Nearly all nonresidential building cooking fires were small, confined fires (97 percent).
- Outside and special properties accounted for the most nonresidential building fires (21 percent), while storage buildings accounted for the most nonresidential building fire deaths (29 percent).
- Nonresidential building fires occurred most frequently from 3 to 6 p.m.
- Nonconfined nonresidential building fires most often started in vehicle storage areas (9 percent).
- Fifty-six percent of nonconfined nonresidential building fires extended beyond the room of origin. The leading causes of these larger fires were unintentional or careless actions (19 percent), intentional actions (13 percent), and electrical malfunctions (12 percent).
- Misuse of material or product (32 percent) was the leading factors contributing to ignition category in nonconfined nonresidential building fires.
- Smoke alarms were not present in 52 percent of the larger, nonconfined fires in occupied nonresidential buildings.

From 2009 to 2011, fire departments responded to an estimated 86,500 fires in nonresidential buildings each year across the nation.[1, 2] These fires resulted in an annual average of 85 deaths, 1,325 injuries, and $2.6 billion in property losses. Although national estimates for 2009 to 2011 show that nonresidential building fires represented only 6 percent of all reported fires, 3 percent of fire deaths and 8 percent of fire injuries, they accounted for 22 percent of the total dollar loss from all fires.[3] Nonresidential building fires can also have a significant economic impact on a community as they may lead to lost jobs and closed businesses. In addition, because many nonresidential buildings are places where a large number of people gather, they hold the greatest potential for a mass casualty incident to occur.

"Nonresidential buildings," a subset of nonresidential structures, includes enclosed structures and fixed portable or mobile structures. The majority of nonresidential fires, deaths and injuries occur in buildings, and that is where prevention efforts are most often targeted. Specifically, nonresidential buildings include assembly places; eating and drinking establishments; educational and institutional facilities; stores and offices; detached garages; basic industry facilities; manufacturing facilities; storage facilities; as well as outside and other miscellaneous nonresidential buildings. They also include institutions such as prisons, nursing homes, juvenile care facilities and hospitals, though many people may temporarily reside there for short (or long) periods of time.

As part of a series of topical reports that addresses fires in types of residential and nonresidential buildings, this report addresses the characteristics of all nonresidential building fires reported to the National Fire Incident Reporting System. The focus is on fires reported from 2009 to 2011, the most recent data available at the time of the analysis.

For the purpose of this report, the term "nonresidential fires" is synonymous with "nonresidential building fires." "Nonresidential fires" is used throughout the body of this report; the findings, tables, charts, headings and endnotes reflect the full category, "nonresidential building fires."

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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 and stay within pots, fireplaces or certain other noncombustible containers.[4]

Confined fires rarely result in serious injuries 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 accounted for 51 percent of nonresidential fires. The smaller confined fires accounted for the remaining 49 percent of nonresidential fires. Trash or rubbish fire was the predominant type of confined fires in nonresidential buildings (Table 1).

Table 1. Nonresidential Building Fires by Type of Incident (2009–2011)

Incident Type	Percent
Nonconfined fires	51.4
Confined fires	48.6
Cooking fire, confined to container	17.5
Chimney or flue fire, confined to chimney or flue	1.5
Incinerator overload or malfunction, fire confined	0.5
Fuel burner/boiler malfunction, fire confined	2.4
Commercial compactor fire, confined to rubbish	0.7
Trash or rubbish fire, contained	26.0
Total	100.0

Source: NFIRS 5.0.

Loss Measures

Table 2 presents losses, averaged over the three-year period from 2009 to 2011, of reported nonresidential and residential building fires.[6] The average number of fatalities and injuries per 1,000 nonresidential fires was notably lower than the same loss measures for residential building fires. Fire evacuation procedures may be more likely to be in place in nonresidential buildings than in homes, which may be one reason for the lower rates of death and injury. Additionally, fire codes often require inspections of nonresidential buildings. These inspections are not as prevalent for residential buildings (especially one- and two-family dwellings). This may be another reason for the lower rates of fire incidence, death and injury in nonresidential buildings. Finally, occupants of nonresidential buildings are more likely to be awake and alert during all hours of the day as they typically relocate to residential buildings to sleep. As a result, occupants of nonresidential buildings may be better able to identify incidents and quickly take action or take preventative measures before an incident occurs.

Nonresidential fires, however, tended to be the most costly fires. This was especially true for nonconfined nonresidential fires. The higher property-loss values may be due to nonresidential buildings often being larger and therefore more expensive than residential buildings. In addition, the contents of nonresidential buildings are more likely to have a higher value than the contents of residential buildings.

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

Measure	Nonresidential Building Fires	**Confined** Nonresidential Building Fires	**Nonconfined** Nonresidential Building Fires	Residential Building Fires
Average Loss:				
Fatalities/1,000 fires	1.0	0.0	1.9	5.5
Injuries/1,000 fires	10.0	2.7	16.8	29.3
Dollar loss/fire	$26,740	$400	$51,600	$15,430

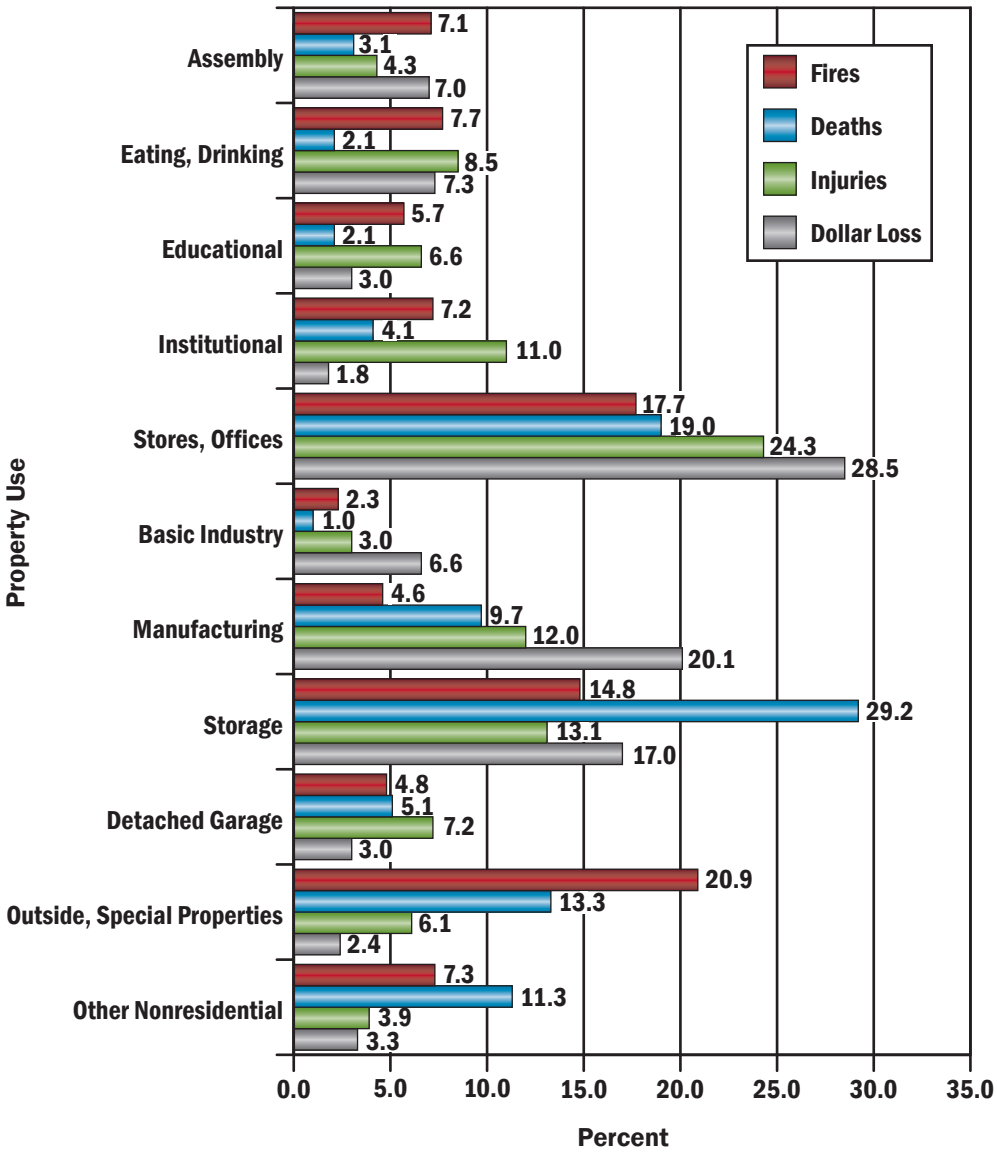
Source: NFIRS 5.0.

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

Property Use

Figure 1 presents the percentage distribution of fires and fire losses by major nonresidential property use category (i.e., assembly places, eating and drinking establishments, educational facilities, etc.).[7] Buildings on outside and special properties accounted for 21 percent of nonresidential fires. The second and third leading property use categories, stores and offices (18 percent) and storage facilities (15 percent) respectively, accounted for an additional 33 percent of nonresidential fires. Storage buildings accounted for 29 percent of the fire deaths. In addition, 24 percent of injuries and 29 percent of dollar losses associated with nonresidential fires occurred in stores and offices.

Figure 1. Nonresidential Building Fires and Fire Losses by Property Use (2009–2011)

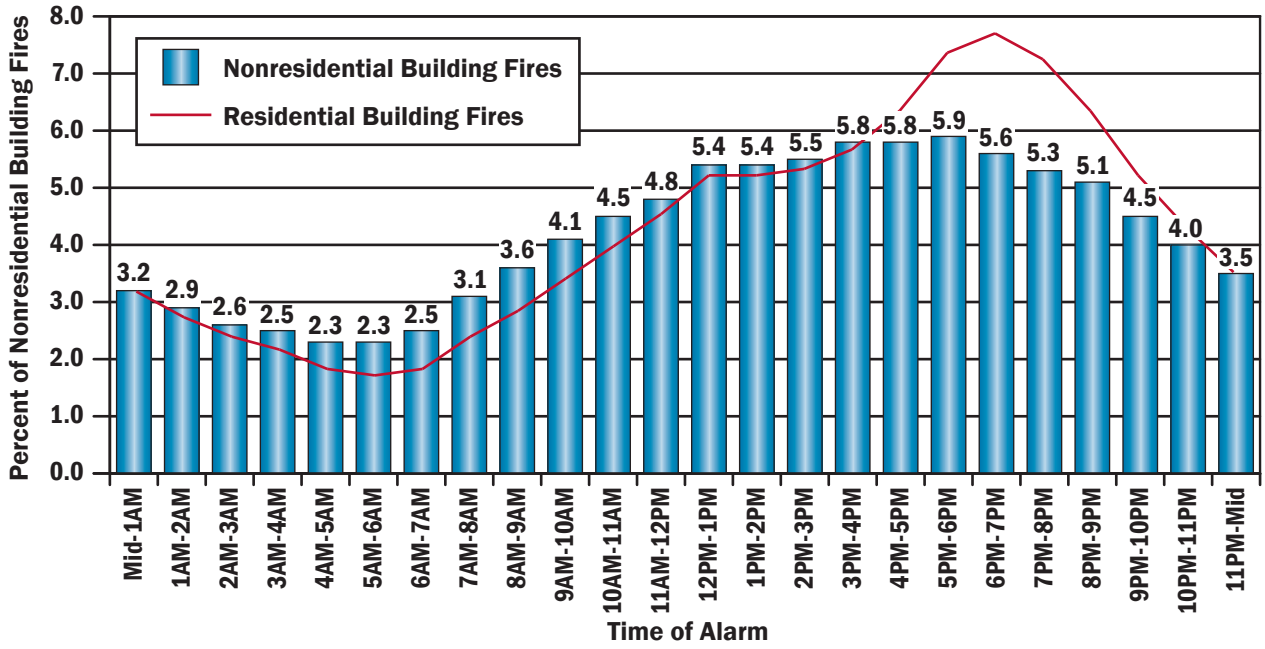


Source: NFIRS 5.0.
Notes: 1. Total of fires does not add up to 100 percent due to rounding.
2. When calculating the dollar losses by property use for 2009 to 2011, the 2009 and 2010 dollar-loss values were adjusted to their equivalent 2011 dollar-loss values to account for inflation.

When Nonresidential Building Fires Occur

As shown in Figure 2, nonresidential fires occurred most frequently from 3 to 6 p.m.[8] Fires then declined throughout the night, reaching the lowest point during the early to midmorning hours (4 to 6 a.m.). Nonresidential fire incidence was similar to that of residential building fires with the exception of residential building fire incidence peaking in the early evening hours.

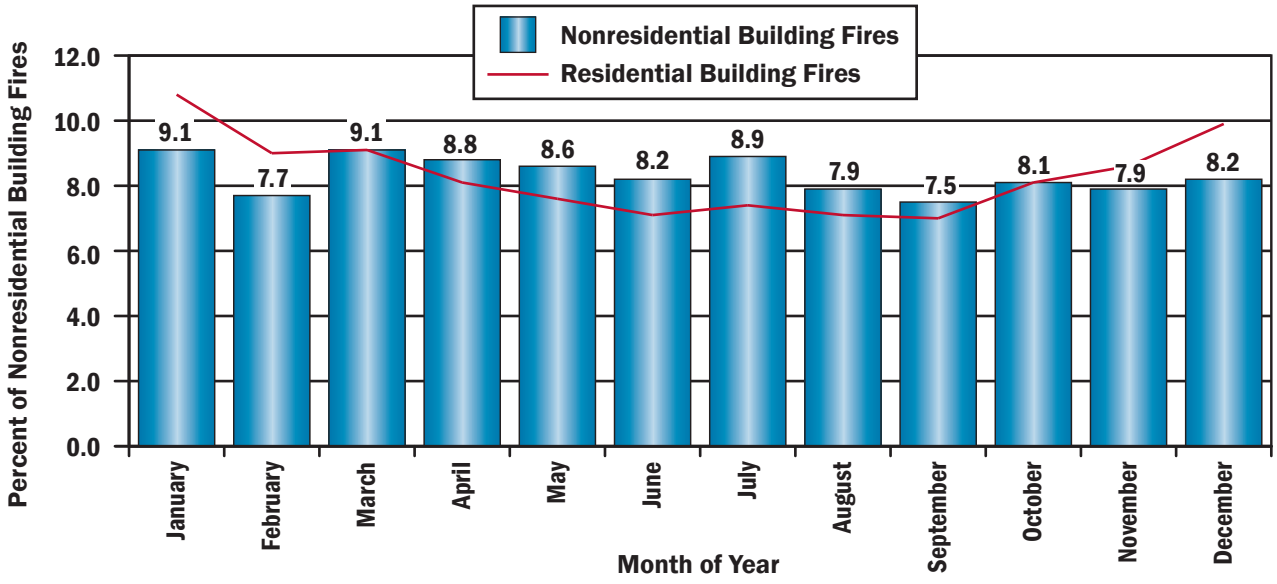
Figure 2. Nonresidential Building Fires by Time of Alarm (2009–2011)



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

Figure 3 illustrates that unlike residential building fires, which followed a seasonal trend and were markedly higher in the cooler months, nonresidential fires occurred without much variation throughout the year. Nonresidential fire incidence was only slightly higher in the months of January and March and slightly lower in the months of February and September.

Figure 3. Nonresidential Building Fires by Month (2009–2011)



Source: NFIRS 5.0.

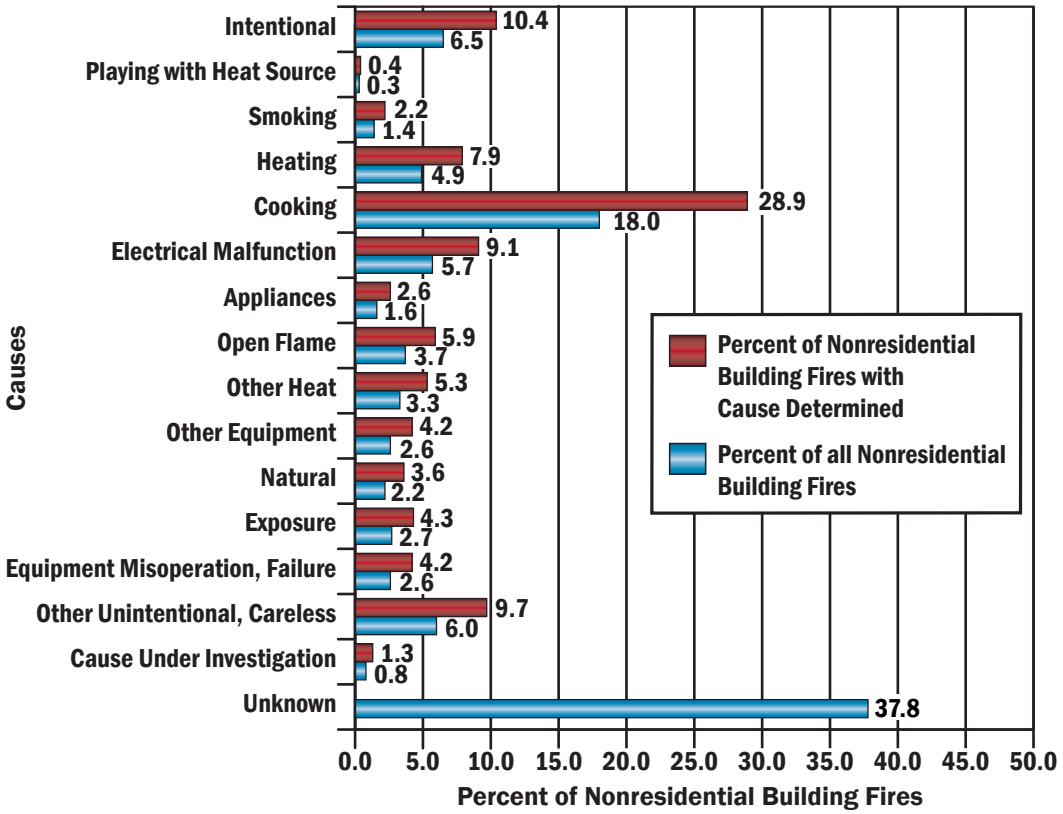
Causes of Nonresidential Building Fires

Cooking was the leading cause and accounted for 29 percent of all nonresidential fires, as shown in Figure 4. Nearly all of these cooking fires (97 percent) were small, confined fires with limited damage.

The next four causes combined accounted for 37 percent of nonresidential fires: intentional action (10 percent); other unintentional, careless action, a miscellaneous group, (10 percent); electrical malfunction such as short circuits or wiring problems (9 percent); and heating (8 percent).[9]

Comparatively, cooking (46 percent) and heating (13 percent) were also the leading causes of residential building fires.[10] However, a higher percentage of residential building fires were the results of these two causes.

Figure 4. Causes of Nonresidential Building Fires (2009–2011)



Source: NFIRS 5.0.

Notes: 1. Causes are listed in order of the U.S. Fire Administration 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. Total of all nonresidential building fires does not add up to 100 percent due to rounding.

When looking at the different categories of property use (i.e., assembly, eating and drinking, education, etc.), however, there were some differences in leading fire causes as shown in Table 3. As for all nonresidential fires, cooking was by far the leading cause for assembly (38 percent), eating and drinking (57 percent), educational (45 percent), institutional (69 percent), stores and offices (28 percent), and other nonresidential (29 percent) building fires. The leading causes for basic industry, manufacturing, storage, detached garage, and outside or special property fires, however, were different than cooking. The leading causes for industrial fires were electrical malfunction (14 percent) and other unintentional, careless action (also at 14 percent). For manufacturing fires, the leading causes were heating (16 percent) and other equipment (15 percent). Other unintentional, careless action (22 percent) was the leading cause of storage fires, while exposure (16 percent), intentional action (16 percent), and other unintentional, careless action (15 percent) were the leading causes of detached garage fires. Finally, intentional action (26 percent) was the leading cause of outside or special property fires.

Table 3. Leading Causes of Nonresidential Building Fires by Property Use (2009–2011)

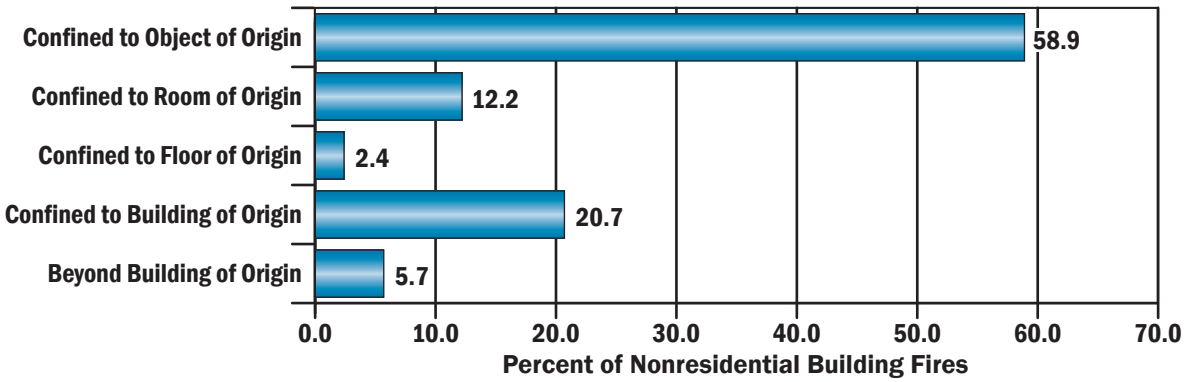
Property Use Category	Leading Fire Causes	Percent (Unknowns Apportioned)
Assembly	Cooking	38.2
	Intentional	11.6
	Heating	11.1
Eating, Drinking	Cooking	56.9
	Electrical Malfunction	8.3
	Heating	7.5
Educational	Cooking	45.2
	Intentional	20.1
	Heating	9.6
Institutional	Cooking	68.7
	Heating	5.1
	Electrical Malfunction	4.7
Stores, Offices	Cooking	28.0
	Electrical Malfunction	14.2
	Heating	10.5
Basic Industry	Electrical Malfunction	13.8
	Other Unintentional, Careless	13.5
	Heating	11.3
Manufacturing	Heating	16.0
	Other Equipment	14.6
	Equipment Misoperation, Failure	13.4
Storage	Other Unintentional, Careless	21.6
	Open Flame	11.7
	Intentional	10.6
Detached Garage	Exposure	16.0
	Intentional	15.6
	Other Unintentional, Careless	15.3
Outside, Special Properties	Intentional	25.7
	Cooking	15.4
	Other Unintentional, Careless	10.0
Other Nonresidential	Cooking	28.9
	Other Unintentional, Careless	15.0
	Intentional	11.0

Source: NFIRS 5.0.

Fire Spread in Nonresidential Building Fires

In 59 percent of nonresidential fires, the fire was confined to the object of origin (Figure 5). Included in these fires are those coded as "confined fires" in NFIRS. Additionally, 29 percent of fires extended beyond the room of origin.

Figure 5. Extent of Fire Spread in Nonresidential Building Fires (2009–2011)



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

Confined Fires

NFIRS allows abbreviated reporting for smaller, confined fires, and many reporting details of these fires are not required to be reported. It is important to note that not all fires where the extent of fire spread is confined to the object of origin are counted as NFIRS confined fires.[11] For example, a fire confined to a chair or clothes dryer is not defined as a "confined fire" in NFIRS because of the greater potential for spread. Unlike fires in pots or chimneys, there is no container to stop the fire even though the fire did not spread beyond the object of origin.

As previously discussed, however, it is known that confined fires accounted for 49 percent of all nonresidential fires (Table 1). Trash or rubbish fires accounted for 54 percent of these confined fires, while cooking fires — those cooking fires confined to a pot or the oven, for example — accounted for an additional 36 percent.

Confined nonresidential fires occurred most frequently in the late afternoon and evening hours from 4 to 7 p.m. In addition, like all nonresidential fires, confined nonresidential fires occurred without much variation throughout the year with a slight peak occurring in July.

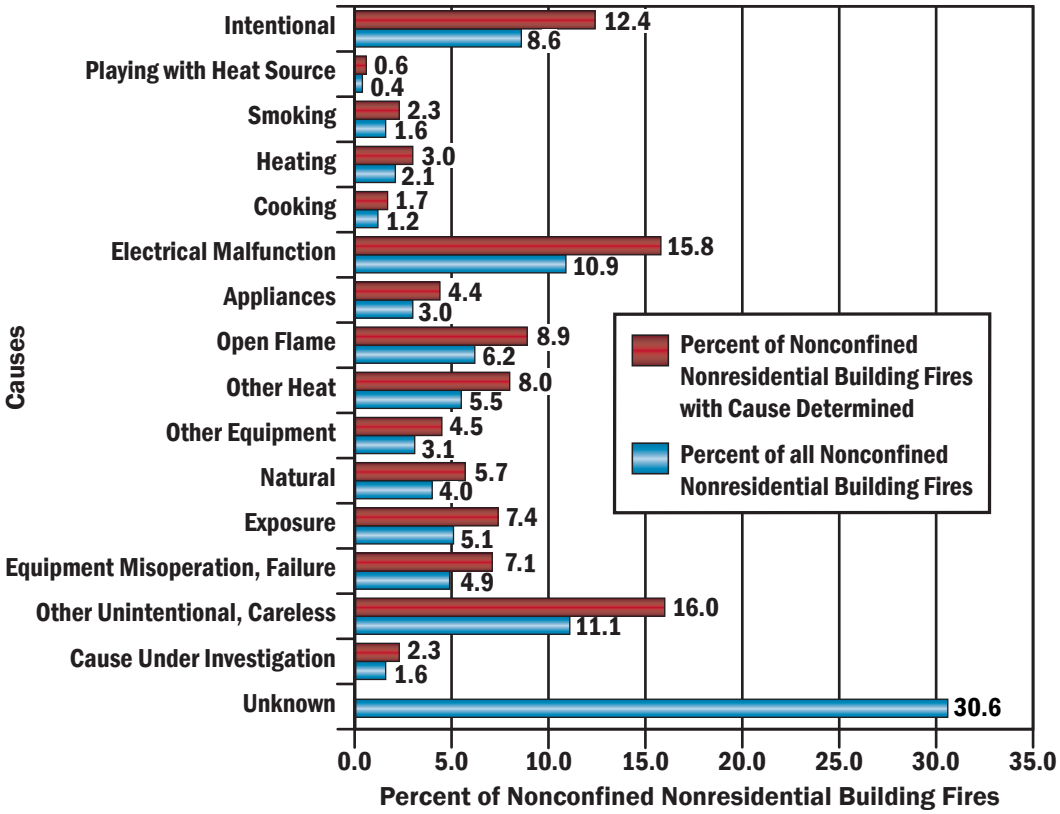
Nonconfined Fires

The next sections of this topical report address nonconfined nonresidential 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 Nonresidential Building Fires

While cooking was the leading cause of nonresidential fires overall, it only accounted for 2 percent of all nonconfined nonresidential fires. Other unintentional, careless action and electrical malfunction were the leading causes of nonconfined nonresidential fires each at 16 percent. Other leading causes of nonconfined nonresidential fires were intentional action, a group that includes fires commonly called arson fires (12 percent); open flame, a group that includes candles, matches and lighters (9 percent); and other heat, a group that includes fireworks and explosives (8 percent) (Figure 6).

Figure 6. Causes of Nonconfined Nonresidential Building Fires (2009–2011)



Source: NFIRS 5.0.

Notes: 1. Causes are listed in order of the 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.

There were also differences in leading fire causes for nonconfined nonresidential fires than for all nonresidential fires when looking at the different categories of property use (Table 4). For example, while the three leading causes of all nonresidential fires in assembly places were cooking (38 percent), intentional action (12 percent) and heating (11 percent), the three leading causes of nonconfined nonresidential fires in assembly places were electrical malfunction (20 percent); intentional action (19 percent); and other unintentional, careless action (10 percent). In addition, while the three leading causes of all nonresidential fires in institutional facilities were cooking (69 percent), heating (5 percent) and electrical malfunction (5 percent), the leading causes of nonconfined nonresidential fires in institutional facilities were electrical malfunction (19 percent), appliances (14 percent) and intentional action (13 percent).

Table 4. Leading Causes of Nonconfined Nonresidential Building Fires by Property Use (2009–2011)

Property Use Category	Leading Fire Causes	Percent (Unknowns Apportioned)
Assembly	Electrical Malfunction	20.1
	Intentional	19.1
	Other Unintentional, Careless	9.9
Eating, Drinking	Electrical Malfunction	21.0
	Other Unintentional, Careless	11.6
	Cooking	11.1
Educational	Intentional	36.1
	Electrical Malfunction	15.8
	Other Unintentional, Careless	7.7
Institutional	Electrical Malfunction	18.5
	Appliances	14.3
	Intentional	12.7
Stores, Offices	Electrical Malfunction	23.5
	Other Unintentional, Careless	11.5
	Intentional	10.8
Basic Industry	Electrical Malfunction	18.6
	Other Unintentional, Careless	17.4
	Equipment Misoperation, Failure	12.4
Manufacturing	Equipment Misoperation, Failure	18.3
	Other Heat	12.7
	Other Unintentional, Careless	12.3
Storage	Other Unintentional, Careless	22.8
	Open Flame	12.1
	Electrical Malfunction	11.2
Detached Garage	Exposure	16.4
	Other Unintentional, Careless	15.6
	Intentional	15.6
Outside, Special Properties	Other Unintentional, Careless	17.2
	Intentional	15.7
	Exposure	14.4
Other Nonresidential	Other Unintentional, Careless	26.8
	Intentional	15.0
	Electrical Malfunction	14.2

Source: NFIRS 5.0.

Where Nonconfined Nonresidential Building Fires Start (Area of Fire Origin)

Vehicle storage area (9 percent) was the leading area of fire origin in nonconfined nonresidential fires as shown in Table 5. Other storage areas (7 percent), exterior wall surfaces (6 percent), and cooking areas and kitchens (6 percent) were the next most common areas of fire origin in nonresidential buildings.

Table 5. Leading Areas of Fire Origin in Nonconfined Nonresidential Building Fires (2009–2011)

Areas of Fire Origin	Percent (Unknowns Apportioned)
Vehicle storage area: garage, carport	8.8
Storage area, other	7.0
Exterior wall surface	6.3
Cooking area, kitchen	6.1

Source: NFIRS 5.0.

The leading areas of fire origin, however, varied among the different categories of nonresidential property use (Table 6). For example, the leading areas of fire origin for eating and drinking establishments, as expected, were cooking areas and kitchens (36 percent). Also as expected, the leading area of fire origin for detached garages was vehicle storage area (56 percent). For both assembly places and educational facilities, however, the leading area of fire origin was bathrooms, checkrooms, lavatories and locker rooms (9 percent and 22 percent, respectively). In addition, laundry areas (16 percent) and bedrooms (15 percent) were the two leading areas of fire origin for institutional facilities, while processing and manufacturing areas (26 percent), machinery rooms (9 percent), and other service or equipment areas (9 percent) were the leading areas of fire origin for manufacturing buildings.

Table 6. Leading Areas of Fire Origin in Nonconfined Nonresidential Building Fires by Property Use (2009–2011)

Property Use Category	Leading Area of Fire Origin — Percent (Unknowns Apportioned)	Second Leading Area of Fire Origin — Percent (Unknowns Apportioned)	Third Leading Area of Fire Origin — Percent (Unknowns Apportioned)
Assembly	Bathroom, checkroom, lavatory, locker room 9.0	Cooking area, kitchen 7.4	Attic, vacant crawl space 4.9
Eating, Drinking	Cooking area, kitchen 35.5	Exterior wall surface 6.5	Exterior roof surface 5.2
Educational	Bathroom, checkroom, lavatory, locker room 21.5	Assembly area without fixed seats 6.6	Cooking area, kitchen 5.6
Institutional	Laundry area 15.5	Bedrooms 15.2	Cooking area, kitchen 9.8
Stores, Offices	Office 6.1	Cooking area, kitchen 5.7	Laundry area 5.4
Basic Industry	Storage area, other 9.0	Service or equipment area, other 8.2	Structural area, other 7.5
Manufacturing	Processing/Manufacturing area 25.8	Machinery room or area 9.0	Service or equipment area, other 8.8
Storage	Storage area, other 17.9	Supplies or tools storage area 12.3	Vehicle storage area: garage, carport 10.3
Detached Garage	Vehicle storage area: garage, carport 55.8	Exterior wall surface 12.2	Outside area, other 3.6
Outside, Special Properties	Exterior wall surface 8.0	Outside area, other 7.2	Storage area, other 6.4
Other Nonresidential	Function area, other 14.3	Area of fire origin, other 9.4	Cooking area, kitchen 9.1

Source: NFIRS 5.0.

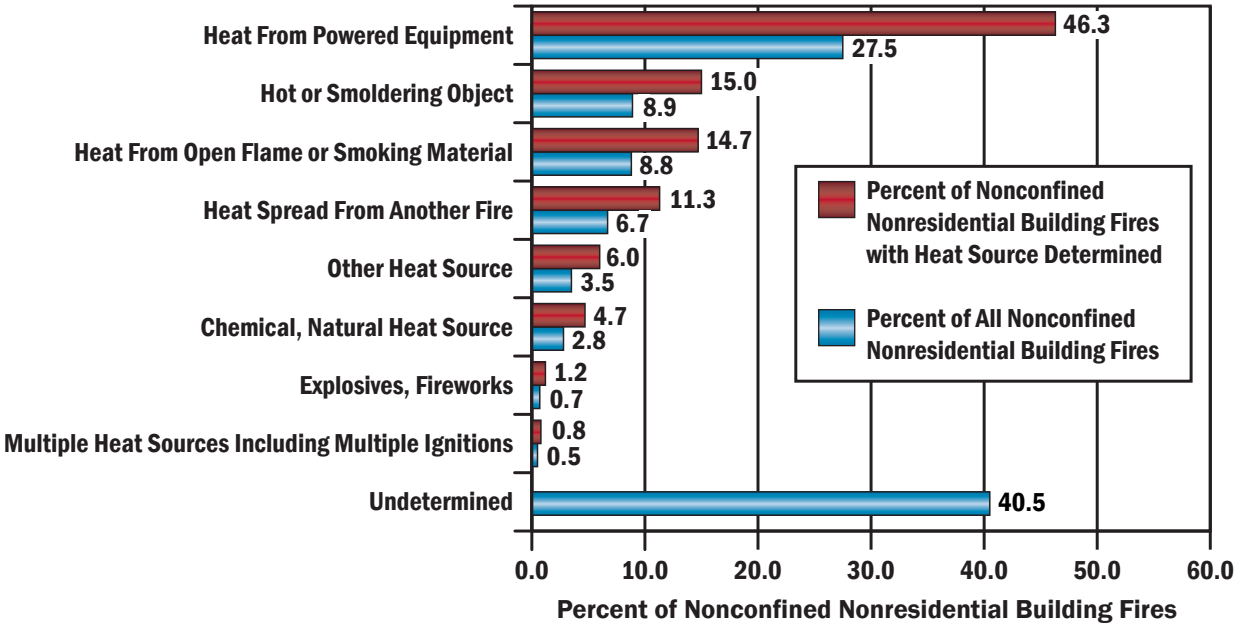
How Nonconfined Nonresidential Building Fires Start (Heat Source)

Figure 7 shows sources of heat categories for nonconfined nonresidential fires. Heat from powered equipment accounted for 46 percent of nonconfined nonresidential fires. This category includes electrical arcing (16 percent); heat from other powered equipment (13 percent); radiated or conducted heat from operating equipment (10 percent); and spark, ember or flame from operating equipment (7 percent).

Hot or smoldering objects accounted for 15 percent of nonconfined nonresidential fires. This category includes miscellaneous hot or smoldering objects (6 percent) and hot embers or ashes (6 percent).

Additionally, heat from open flames or smoking materials also accounted for 15 percent of nonresidential fires. This category includes such items as other miscellaneous open flames or smoking materials (5 percent), lighters and matches (combined, 4 percent), and cigarettes (2 percent).

Figure 7. Sources of Heat in Nonconfined Nonresidential Building Fires by Major Category (2009–2011)



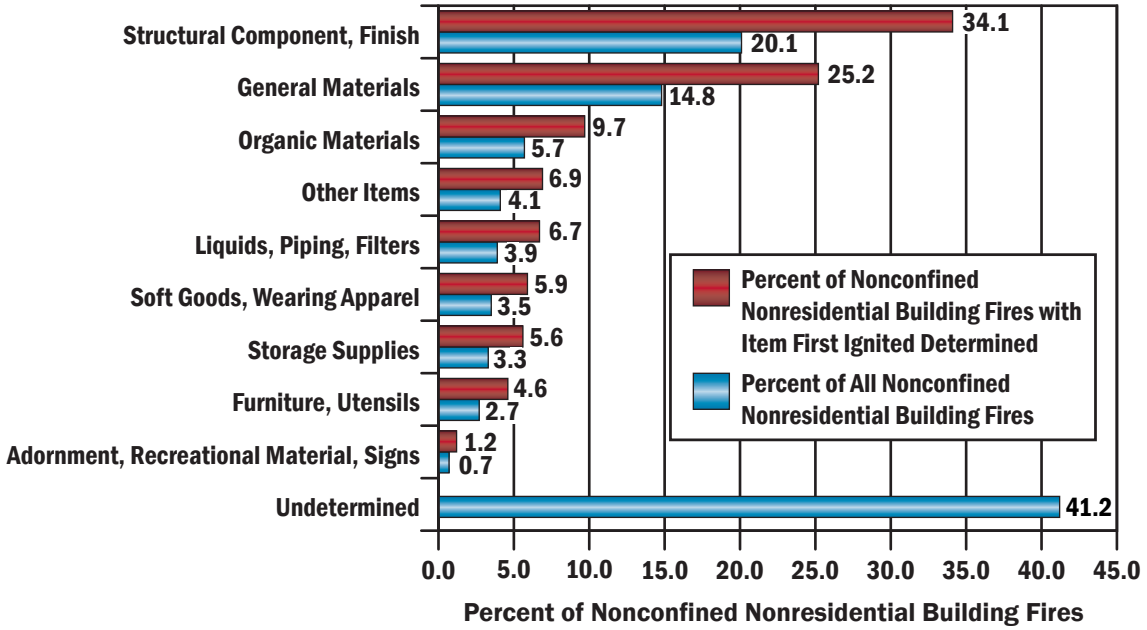
Source: NFIRS 5.0.
Note: Total of all nonconfined nonresidential building fires does not add up to 100 percent due to rounding.

What Ignites First in Nonconfined Nonresidential Building Fires

Of the items first ignited in nonconfined nonresidential fires where the item first ignited was determined, 34 percent fell under the "structural component, finish" category (Figure 8). This category includes structural member or framing and exterior sidewall covering. The second leading category of items first ignited in nonconfined nonresidential fires was "general materials" which accounted for 25 percent of these fires. "General materials" include items such as electrical wire, cable insulation, and trash or rubbish. The next leading category of nonconfined nonresidential fires was "organic materials" at 10 percent. This category includes items such as cooking materials and light vegetation including grass and leaves.

Electrical wire, cable insulation (10 percent), exterior sidewall covering (9 percent), and structural member or framing (9 percent) were the specific items most often first ignited in nonconfined nonresidential fires.

Figure 8. Item First Ignited in Nonconfined Nonresidential Building Fires by Major Category (2009–2011)



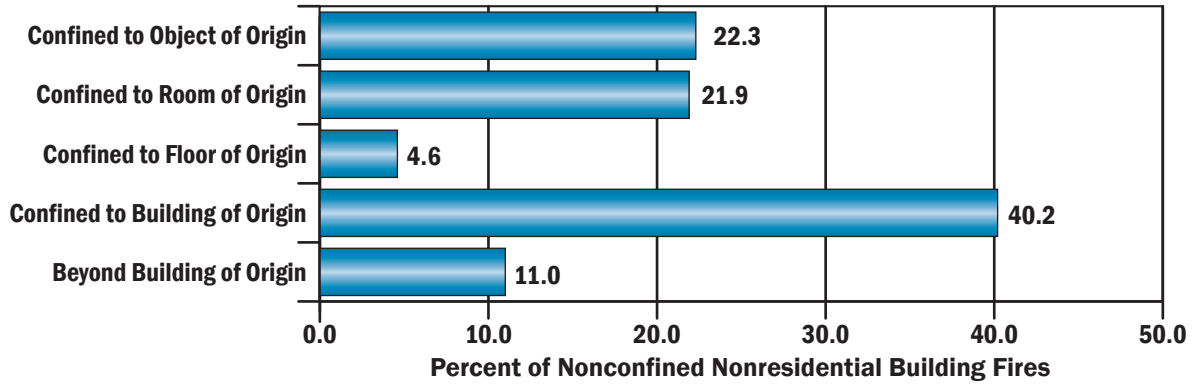
Source: NFIRS 5.0.
Note: Total of nonconfined nonresidential building fires with item first ignited determined does not add up to 100 percent due to rounding.

Fire Spread in Nonconfined Nonresidential Building Fires

Figure 9 shows the extent of fire spread in nonconfined nonresidential fires. Of these nonconfined fires, 44 percent were limited to the object or room of fire origin — in 22 percent of these fires, the fire was confined to the room of origin; in another 22 percent, the fire was confined to the object of origin. (Note that a fire confined to a sofa or clothes dryer 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.)

Additionally, 56 percent of nonconfined nonresidential fires extended beyond the room of origin. The leading causes of these larger fires were unintentional, careless actions (19 percent), intentional actions (13 percent), and electrical malfunctions (12 percent).

Figure 9. Extent of Fire Spread in Nonconfined Nonresidential Building Fires (2009–2011)



Source: NFIRS 5.0.

Factors Contributing to Ignition in Nonconfined Nonresidential Building Fires

Table 7 shows the categories of factors contributing to ignition in nonconfined nonresidential fires. The leading category was the misuse of material or product (32 percent). In this category, the leading specific factors contributing to ignition were a heat source too close to combustible materials (11 percent) and abandoned or discarded materials such as matches or cigarettes (7 percent).

Electrical failures and malfunctions contributed to 23 percent of nonconfined nonresidential fires. Fire spread or control was the third leading category at 17 percent. Exposure was the leading specific factor in the fire spread or control category and accounted for 10 percent of all nonconfined nonresidential fires.

Table 7. Factors Contributing to Ignition for Nonconfined Nonresidential Building Fires by Major Category (Where Factors Contributing to Ignition are Specified, 2009–2011)

Factors Contributing to Ignition Category	Percent of Nonconfined Nonresidential Building Fires (Unknowns Apportioned)
Misuse of material or product	32.1
Electrical failure, malfunction	22.7
Fire spread or control	17.4
Mechanical failure, malfunction	10.6
Operational deficiency	9.1
Other factors contributing to ignition	6.4
Natural condition	5.2
Design, manufacture, installation deficiency	2.0

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 Nonresidential 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. In addition, the installation of smoke alarms and fire sprinklers is generally required in nonresidential buildings where an increased risk to life is present, such as hospitals, prisons, or educational facilities, or that present an increased fire hazard to occupants and firefighters, such as high-rise buildings and industrial facilities.

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 8 to 10 are the raw counts from the NFIRS data set and are not scaled to national estimates of smoke alarms in nonresidential fires. In addition, NFIRS does not allow for the determination of the type of smoke alarm (i.e., 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 only 23 percent of nonconfined nonresidential fires (Table 8). By comparison, because building codes generally require smoke alarms to be installed in locations where people sleep, smoke alarms were reported as present in 42 percent of nonconfined residential fires.[12] In 57 percent of nonconfined nonresidential fires, there were no smoke alarms present. In another 20 percent of these fires, firefighters were unable to determine if a smoke alarm was present. Thus, smoke alarms were potentially missing in between 57 and 77 percent of these fires with the ability to spread and possibly result in fatalities.

Table 8. Presence of Smoke Alarms in Nonconfined Nonresidential Building Fires (2009–2011)

Presence of Smoke Alarms	Percent
Present	23.1
None present	57.0
Undetermined	19.9

Source: NFIRS 5.0.

While 24 percent of all nonconfined nonresidential fires occur in buildings that are **not** currently or routinely occupied, these occupancies— buildings under construction, undergoing major renovation, vacant and the like — are less likely to have alerting and suppression systems that are in place and, if in place, that operate. In fact, only 3 percent of all nonconfined fires in unoccupied nonresidential buildings were reported as having smoke alarms that were present and that operated. As a result, the detailed smoke alarm analyses in the next section focus on nonconfined fires in occupied nonresidential buildings only.[13]

Smoke Alarms in Nonconfined Fires in Occupied Nonresidential Buildings

Smoke alarms were reported as present in 28 percent of nonconfined fires in occupied nonresidential buildings (Table 9). In 52 percent of nonconfined fires in occupied nonresidential buildings, there were no smoke alarms present. In another 20 percent of these fires, firefighters were unable to determine if a smoke alarm was present; unfortunately, in 50 percent of the fires where the presence of a smoke alarm was undetermined, 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 (28 percent) and the alarm operational status is considered, the percentage of smoke alarms reported as present consisted of:

—Present and operated — 16 percent.

—Present but did not operate — 8 percent (fire too small, 6 percent; alarm failed to operate, 2 percent).

—Present but operational status unknown — 4 percent.

When the subset of incidents where smoke alarms were reported as present are analyzed separately and as a whole, smoke alarms were reported to have operated in 58 percent of the incidents and failed to operate in 7 percent. In 21 percent of this subset, the fire was too small to activate the alarm. The operational status of the alarm was undetermined in 15 percent of these incidents.[14]

Again, in at least 52 percent of nonconfined fires in occupied nonresidential buildings there were no smoke alarms present — and perhaps more if fires without information on smoke alarms could be factored in.[15] A portion 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.

Table 9. NFIRS Smoke Alarm Data for Nonconfined Fires in Occupied Nonresidential Buildings (2009–2011)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		4,449	5.8
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	8,653	11.2
		Smoke alarm alerted occupants, occupants failed to respond	359	0.5
		No occupants	2,516	3.3
		Smoke alarm failed to alert occupants	130	0.2
		Undetermined	879	1.1
	Smoke alarm failed to operate		1,419	1.8
	Undetermined		3,261	4.2
None present			40,044	51.9
Undetermined			15,482	20.1
Total incidents			77,192	100.0

Source: NFIRS 5.0.

Notes: 1. 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 fires in occupied nonresidential buildings. They are presented for informational purposes.
2. Total does not add up to 100 percent due to rounding.

Smoke Alarms in Confined Fires

Less information about smoke alarm status is collected for confined fires, but the data still give important insights about the effectiveness of alerting occupants in these types of fires. The analyses presented here do not differentiate between occupied and unoccupied nonresidential 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 buildings as these types of fires are unlikely to be reported in buildings that are not occupied.

Smoke alarms alerted occupants in 28 percent of the reported confined nonresidential fires (Table 10). Occupants were not alerted by smoke alarms in 26 percent of confined nonresidential fires.[16] In 46 percent of these confined fires, the smoke alarm effectiveness was unknown.

Table 10. NFIRS Smoke Alarm Data for Confined Nonresidential Building Fires (2009–2011)

Smoke Alarm Effectiveness	Count	Percent
Smoke alarm alerted occupants	26,368	27.6
Smoke alarm did not alert occupants	24,903	26.1
Unknown	44,278	46.3
Null/Blank	1	0.0
Total incidents	95,550	100.0

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

Automatic Extinguishment Systems in Nonconfined Fires in Occupied Nonresidential Buildings

Automatic extinguishing system data are available for both confined and nonconfined fires, although for confined fires, the data are also very limited in scope. In confined nonresidential building fires, an AES was present in only 2 percent of reported incidents.[17] As a result, the analyses here focus on nonconfined fires. In addition, the analyses presented here focus on occupied buildings since unoccupied buildings, such as those that are under construction, are less likely to have AESs present.

Although sprinklers are required by code in many nonresidential buildings that present an increased fire hazard or risk to life, full or partial AESs were reported as present in 20 percent of nonconfined fires in occupied nonresidential buildings (Table 11). AESs were not present in 71 percent of these fires.

Table 11. NFIRS Automatic Extinguishing System Data for Nonconfined Fires in Occupied Nonresidential Buildings (2009–2011)

AES Presence	Count	Percent
AES present	14,345	18.6
Partial system present	686	0.9
AES not present	54,833	71.0
Unknown	7,328	9.5
Total incidents	77,192	100.0

Source: NFIRS 5.0.
Note: The data presented in this table are raw data counts from the NFIRS data set. They do not represent national estimates of AESs in nonconfined fires in occupied nonresidential buildings. They are presented for informational purposes.

Examples

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

—February 2013: Fire crews responded to a two-alarm blaze at a Portsmouth, Va., church at approximately 5:08 a.m. When crews arrived, there was heavy smoke which made it difficult to determine the area from where the smoke was coming. After investigating, crews discovered that the fire started in the basement of the parsonage and then made its way into the walls and up to a first-floor kitchen area. Firefighters were able to contain the fire to the basement and the kitchen area, and there was no damage to the main church building. The fire was reportedly started by a homeless person who gained entry into the building through an unlocked basement door. In an attempt to stay warm, the person started a fire in a container that was found in the basement.[18]

—February 2013: Fire investigators in Honolulu, Hawaii, reported that the cause of an early morning fire in one of Waikiki's busiest restaurants was an accidental gas leak to a deep fat fryer. The pilot light in the fryer was the source of ignition for the leaking gas. The cause of the leak, however, was undetermined. An employee of the restaurant tried to extinguish the fire with a fire extinguisher, but the flames quickly spread through the ventilation system. Total damages were estimated at $2,500,000, which included damage to the restaurant's kitchen and exhaust duct as well as smoke damage to adjacent businesses.[19]

—January 2013: A malfunctioning heating unit ignited a fire that caused about $40,000 in damages to an eye doctor's office in Totowa, N.J. The fire department responded to the morning fire and took about 30 minutes to extinguish it. The fire reportedly caused extensive damage to the heating unit and the duct work surrounding it. The business also had to replace some ceiling tiles and electrical work.[20]

—December 2012: An early morning fire at a Cincinnati, Ohio, hazardous waste treatment facility started when workers were shredding an industrial filter containing sodium chlorate and caused a flash fire. Two people were burned, one seriously, and were transported to a hospital for treatment.[21]

NFIRS Data Specifications for Nonresidential Building Fires

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

Nonresidential building 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 100-399, 500-999, 000-009, NNN, and UUU:

Property Use	Description
100-159, 163-199	Assembly
160-162	Eating and drinking establishments
200-299	Educational
300-399	Health care, detention, and correction
500-599	Stores and offices
600-699	Industrial, utility, defense, agriculture, mining
700	Manufacturing, processing
800-880, 882-899	Storage
881	Detached garage
900-999	Outside or special property
000-009, NNN, UUU	Property use, other

Note: For a complete listing of the NFIRS Property Use codes, view the NFIRS 5.0 Complete Reference Guide: http://www.nfirs.fema.gov/documentation/reference/ (January 2013).

—Structure Type:

  —For Incident Types 113 to 118:
    —1—Enclosed building.
    —2—Fixed portable or mobile structure, and
    —Structure Type not specified (null entry).

  —For Incident Types 111 and 120 to 123:
    —1—Enclosed building.
    —2—Fixed portable or mobile structure.

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

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

Notes:

[1] National estimates are based on 2009 to 2011 native version 5.0 data from NFIRS, nonresidential structure fire-loss estimates from the National Fire Protection Association's annual surveys of fire loss, and the USFA's nonresidential building fire-loss estimates: http://www.usfa.fema.gov/statistics/estimates/index.shtm. Fires are rounded to the nearest 100, deaths to the nearest 5, injuries to the nearest 25, and losses 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 "nonresidential structure" commonly referred to buildings where people work, gather, learn, dine, shop, etc. To coincide with this concept, the definition of a nonresidential 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 nonresidential property use. Such structures are referred to as "nonresidential buildings" to distinguish these buildings from other structures on nonresidential properties that may include fences, bridges and other various open structures. Confined fire incidents without a structure type specified are presumed to occur in buildings. Nonconfined fire incidents without a structure type specified are considered to be invalid incidents (structure type is a required field) and are not included.

[3] The percentages shown here are derived from the national estimates of nonresidential building fires as explained in endnote one and the summary data resulting from NFPA's annual fire-loss surveys (Karter, Jr., Michael, J., *Fire Loss in the United States During 2011*, NFPA, September 2012; *Fire Loss in the United States During 2010*, NFPA, September 2011; *Fire Loss in the United States During 2009*, NFPA, August 2010).

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

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

[6] The average fire death and fire injury loss rates computed from the national estimates do not agree with average fire death and fire injury loss rates computed from NFIRS data alone. The fire death rate computed from national estimates is (1,000*(85/86,500)) = 1.0 death per 1,000 nonresidential building fires and the fire injury rate is (1,000*(1,325/86,500)) = 15.3 injuries per 1,000 nonresidential building fires.

[7] There are 11 major nonresidential building property use categories. "Assembly" buildings are places where people gather, such as fixed-use recreational facilities, places of worship, public or government buildings, and ballrooms and gymnasiums, but do not include eating and drinking establishments. "Eating and drinking" establishments include places specializing in on-premise consumption of food, including carryout and drive-thru restaurants as well as bars and nightclubs. "Educational" buildings include schools for children and adults such as daycare; preschool; elementary, middle, and high school; college; and adult education centers. "Institutional" buildings include health care, detention and correctional facilities. "Stores and offices" include stores, specialty shops, personal services and offices. "Basic industry" buildings include industrial, utility, defense, agriculture and mining facilities. "Manufacturing" buildings include processing facilities and factories. "Storage" buildings include outside material storage areas, livestock, poultry storage, warehouses, fire stations, and commercial parking structures for vehicles such as buses and trucks. "Detached garages" include parking garages, detached residential garages and detached parking structures associated with multifamily housing. "Outside and special properties" include facilities such as guard posts, outside kiosks and the like. "Other nonresidential" buildings include nonresidential buildings not classified with any other property use category.

[8] 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.

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

[10] USFA, "Residential Building Fires (2009–2011)," Volume 14, Issue 4, May 2013: http://www.usfa.fema.gov/downloads/pdf/statistics/v14i4.pdf.

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

[12] USFA, "Residential Building Fires (2009–2011)," Volume 14, Issue 4, May 2013: http://www.usfa.fema.gov/downloads/pdf/statistics/v14i4.pdf.

[13] "Occupied" implies that the building is operational or in normal use. This includes properties that are closed or unoccupied for a brief period of time, such as businesses that are closed for the weekend.

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

[15] Here, **at least** 52 percent of nonconfined fires in occupied nonresidential buildings had no smoke alarms present — the 52 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] 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.

[17] As confined fires codes are designed to capture fires contained to noncombustible containers, it is not recommended to code a fire incident as a small, low- or no-loss confined fire incident if the AES operated and contained the fire as a result. The preferred method is to code the fire as a standard fire incident with fire spread confined to the object of origin and provide the relevant information on AES presence and operation.

[18] "Crews Battle 2-Alarm Church Fire," www.wavy.com, Feb. 18, 2013, http://www.wavy.com/dpp/news/local_news/portsmouth/crews-battle-2-alarm-church-fire (accessed March 4, 2013).

[19] Jill Kuramoto, "Damage From Cheesecake Factory Fire Estimated at 2.5 Million," www.kitv.com, Feb. 1, 2013, http://www.kitv.com/news/hawaii/Damage-from-Cheesecake-Factory-fire-estimated-at-2-5-million/-/8905354/18378540/-/qmjv7x/-/index.html (accessed March 4, 2013).

[20] Matthew Kadosh, "Heater Ignites Fire At Totowa Eye Doctor Office," www.northjersey.com, Jan. 31, 2013, http://www.northjersey.com/news/188102611_Heater_ignites_fire_at_Totowa_eye_doctor_office.html (accessed March 4, 2013).

[21] "2 Injured in Chemical Explosion at Cincinnati Industrial Waste Facility," www.newsnet5.com, December 28, 2012, http://www.newsnet5.com/dpp/news/state/2-injured-in-chemical-explosion-at-cincinnati-industrial-waste-facility (accessed May 16, 2013).