Topical Fire Report Series

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Residential Building Electrical Fires (2014-2016)

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

- From 2014 to 2016, an estimated 24,000 residential building electrical fires were reported to United States fire departments each year. These fires caused an estimated 310 deaths, 850 injuries and $871 million in property loss.
- Residential building electrical fires resulted in over twice the dollar loss per fire than residential building nonelectrical fires did.
- Residential building electrical fires occurred most often in one- and two-family dwellings (83 percent).
- Residential building electrical fires occurred most often in the winter month of January (12 percent).
- In only 17 percent of residential building electrical fires, the fire spread was limited to the object where the fire started.
- Residential building electrical fires most often started in bedrooms (15 percent) and attics or vacant crawl spaces (13 percent).
- The leading specific items most often first ignited in residential building electrical fires were electrical wire, cable insulation (31 percent) and structural member or framing (18 percent).
- The leading specific factors contributing to the ignition of residential building electrical fires were other electrical failure, malfunction (43 percent), unspecified short-circuit arc (23 percent), and short-circuit arc from defective, worn insulation (11 percent).
- Smoke alarms were present in 51 percent and automatic extinguishing systems (AESs) were present in 3 percent of electrical fires that occurred in occupied residential buildings.

Electricity is a basic part of life in the U.S. It provides the energy for most powered items in a home, from lights to heating systems to televisions. Today it is hard to imagine a home without electricity. It is a part of our homes and our activities that most of us take for granted. Yet, using electricity can have dangerous consequences.

Electrical fires occur frequently throughout the U.S., causing injury, claiming lives, and resulting in large losses of property.[1] From 2014 to 2016, an estimated 24,000 residential building electrical fires were reported by U.S. fire departments annually.[2,3] These fires caused an estimated 310 deaths, 850 injuries and $871 million in property loss.[4,5] Residential building electrical fires continued to be a part of the residential fire problem and accounted for 6 percent of all residential building fires.[6] The term "electrical fires" is defined as those fires that include electrical distribution, wiring, transformers, meter boxes, power switching gear, outlets, cords, plugs, surge protectors, electric fences, lighting fixtures, and electrical arcing as the source of heat.[7]

This topical report addresses the characteristics of electrical fires in residential buildings as reported to the National Fire Incident Reporting System (NFIRS) from 2014 to 2016, the most recent data available at the time of the analysis.[8] The NFIRS data are used for the analyses presented throughout the report. For the purpose of the report, the terms "residential fires," "electrical fires," and "nonelectrical fires" are synonymous with "residential building fires,"

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“residential building electrical fires” and “residential building nonelectrical fires” respectively. “Electrical fires” is used throughout the body of this report; the findings, tables, charts, headings and endnotes reflect the full category, “residential building electrical fires.”

The residential building electrical fire problem

Although electrical fires declined by 22 percent from 2007 to 2016,[9] electrical malfunction was one of the top four leading causes of residential fires during each of these ten years. It has also been a leading cause of residential fire deaths, injuries and dollar loss during this time frame.[10] Electrical fires involve the flow of electric current or static electricity[11] and are caused by electrical system failures, appliance defects, incorrectly installed wiring, misuse and poor maintenance of electrical appliances, and overloaded circuits and extension cords.[12] These electrical fires can be unique. For example, electrical fires that start in walls can smolder for some time and cause smoke not to be seen immediately and detection to be delayed. By the time smoke is seen and fire is detected, the flames may have already spread behind and within walls.[13] As a result, electrical fires have the potential to spread farther and cause more damage and injuries. In addition, electrical fires can be particularly problematic to extinguish. Since they involve electricity, and water conducts electricity, using water to put out the fire can cause electrocution unless power is reliably disconnected.

Over the last 35 years, homes have been dramatically transformed by electrical devices. Today’s electrical demands can overburden the electrical system in a home,[14] putting it at a higher risk of an electrical fire. This may be particularly true for homes more than 40 years old that have older wiring, electrical systems, and devices. There is also the likelihood that older homes may not comply with more modern electric code requirements, which puts them at an elevated risk of hazardous conditions that could lead to an electrical fire.[15] Eventually, given enough time, any home can be at risk of an electrical fire as wire insulation ages, connections loosen, receptacles and switches come loose or wear out, and oil and dirt cause electrical components to overheat.[16]

Type of fire

Building fires are divided into two classes of severity in the NFIRS: “confined fires” and “nonconfined fires.” Confined building fires are small fire incidents that are limited in extent to specific types of equipment or objects, staying within pots, fireplaces or certain other noncombustible containers.[17] 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.[18] Nonconfined fires extend beyond certain types of equipment or objects. They are generally larger fires resulting in more serious injury and larger losses of property and content.

Of the two classes of severity, nonconfined fires accounted for almost all of the electrical fires (Table 1). Because there were so few confined electrical fires, the subsequent analyses in this report include all electrical fires and do not distinguish between confined and nonconfined fires.

Table 1. Residential building electrical fires by type of incident (2014-2016)

Incident type	Percent
Nonconfined fires	99.7
Confined fires	0.3
Trash or rubbish, contained	0.2
Incinerator overload or malfunction, fire confined	0.1
Total	100.0

Source: NFIRS 5.0.

Loss measures

Table 2 presents losses of reported electrical and nonelectrical fires, averaged over the three-year period of 2014 to 2016.[19] Electrical fires resulted in a higher number of injuries per thousand fires than nonelectrical fires (Table 2). In addition, electrical fires resulted in almost twice as many fatalities per thousand fires and over twice as much dollar loss per fire than nonelectrical fires. This may ultimately be due to challenges in the detection and location of some electrical fires that can be hidden inside walls.

Table 2. Loss measures for residential building electrical and nonelectrical fires (three-year average, 2014-2016)

Measure	Residential building electrical fires	Residential building nonelectrical fires
Average loss:		
Fatalities/1,000 fires	6.3	3.4
Injuries/1,000 fires	26.6	22.8
Dollar loss/fire	$27,500	$12,510

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. The 2014 and 2015 dollar-loss values were adjusted to 2016 dollars.
3. The "Residential building nonelectrical fires" category does not include fires of unknown cause.

Property use

Residential buildings are divided into three major property use categories: 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 dwellings accounted for 83 percent of residential building electrical fires reported to NFIRS (Table 3). By comparison, one- and two-family residential buildings accounted for 60 percent of nonelectrical fires, more in line with the occurrence of one- and two-family residential building fires overall (64 percent).[20] Multifamily residential buildings accounted for only 12 percent of electrical fires while they accounted for 33 percent of nonelectrical fires. Finally, all other residential buildings accounted for 6 percent of electrical fires while they accounted for 7 percent of nonelectrical fires.[21] One explanation for the lower percentage of electrical fires in multifamily and other dwellings may be that more stringent building and fire codes requiring regular fire and safety inspections (which include the inspection of wiring and electrical components) are often imposed on these types of residential buildings. In addition, multifamily dwellings and other residential buildings may more often be professionally maintained.

Table 3. Residential building electrical and nonelectrical fires by property use (2014-2016)

Property use	Percent of residential building electrical fires	Percent of residential building nonelectrical fires
One- and two-family	82.9	60.0
Multifamily	11.7	32.7
Other	5.5	7.4
Total	100.0	100.0

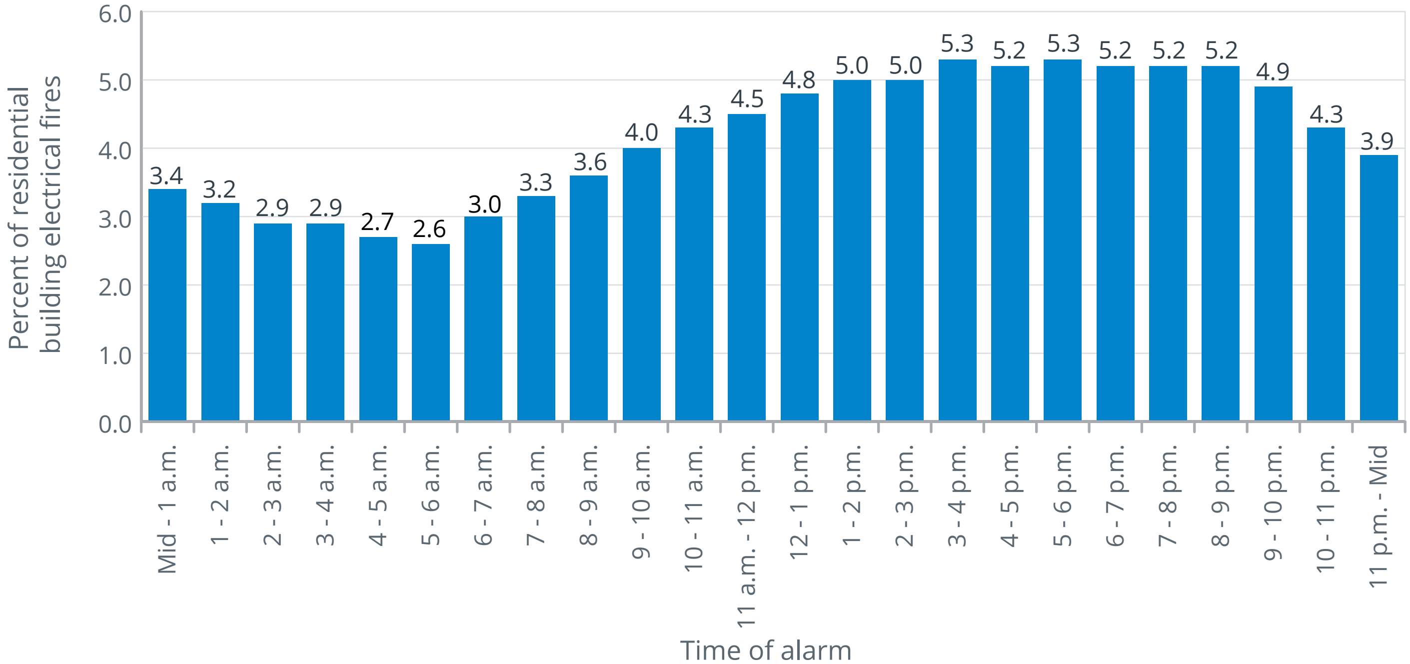
Source: NFIRS 5.0.

Notes: 1. Total percentages of residential building electrical fires and residential building nonelectrical fires do not add up to 100 percent due to rounding.
2. The "Percent of residential building nonelectrical fires" category does not include fires of unknown cause.

When residential building electrical fires occur

As shown in Figure 1, electrical fires occurred most frequently in the late afternoon to early evening hours.[22] They gradually declined throughout the late evening and early morning hours reaching the lowest point from 5 to 6 a.m. Beginning at 6 a.m., fire incidence started to increase until the peak hours were reached.

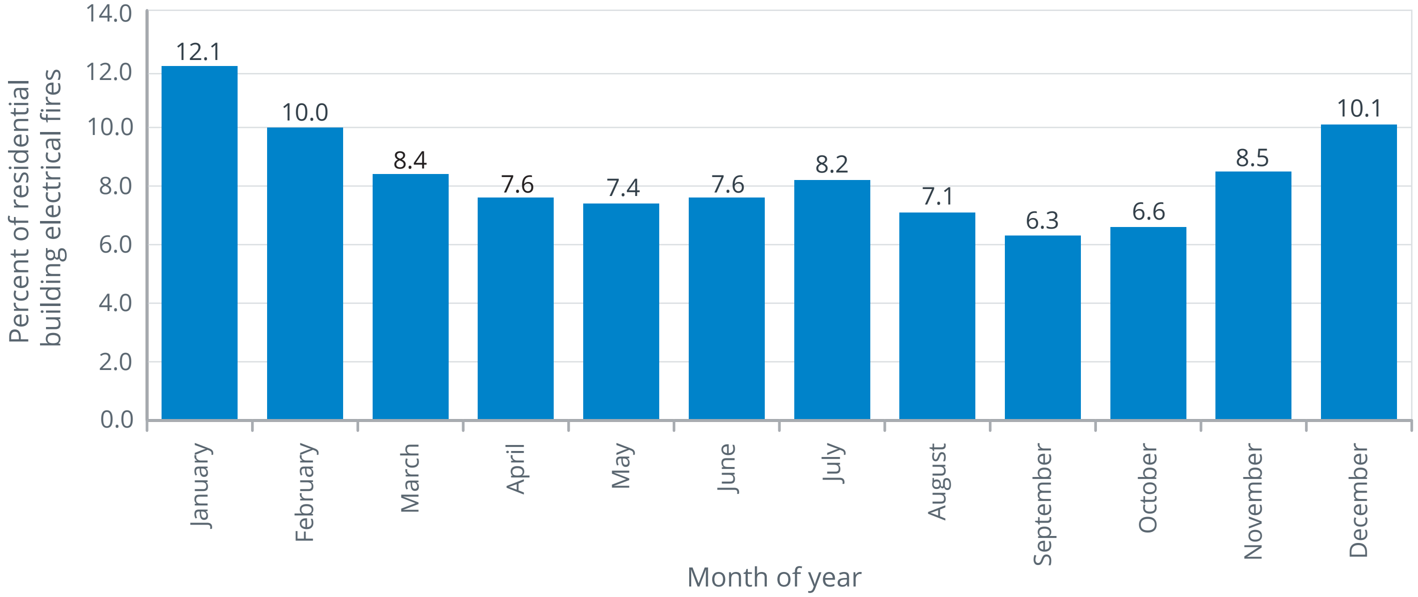
Figure 1. Residential building electrical fires by time of alarm (2014-2016)



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

Figure 2 illustrates that electrical fire incidence was highest during the winter month of January at 12 percent. This is not surprising, as cooler weather in this month and surrounding months typically results in more indoor activities that lead to an increase in lighting, heating and appliance use. In addition, during the winter months, cold temperatures and heaters may lead to dry air with low humidity,[23] which could result in wood studs and framing drying out and being somewhat more easily ignited by an arcing current or electrical overheating. The lowest incidence of electrical fires occurred in September at 6 percent.

Figure 2. Residential building electrical fires by month (2014-2016)

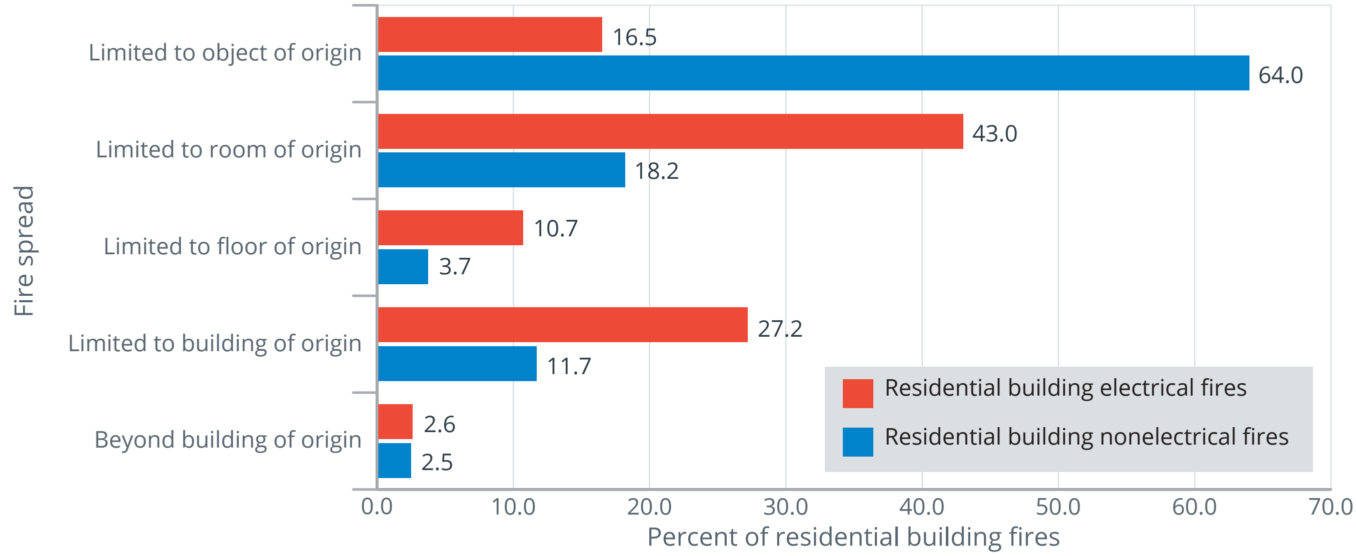


Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Fire spread in residential building electrical fires

While 64 percent of nonelectrical fires were limited to the object of origin, only 17 percent of electrical fires were limited to the object of origin (Figure 3). Of the remaining electrical fires that spread beyond the object of origin, 43 percent were limited to the room of origin, 11 percent were limited to the floor of origin, and 27 percent were limited to the building of origin. An additional 3 percent of electrical fires spread beyond the building of origin.[24] The larger fire spread may be partly due to challenges in the detection of some electrical fires (i.e., fires within walls) as previously discussed.

Figure 3. Extent of fire spread in residential building electrical and nonelectrical fires (2014-2016)



Source: NFIRS 5.0.
Notes: 1. Total percent of residential building nonelectrical fires does not add up to 100 percent due to rounding.
2. The "Residential building nonelectrical fires" category does not include fires of unknown cause.

Where residential building electrical fires start (area of fire origin)

Five areas in the home — bedrooms (15 percent); attics or vacant crawl spaces (13 percent); walls or concealed wall spaces (9 percent); cooking areas and kitchens (7 percent); and common rooms or lounge areas (7 percent) — accounted for 51 percent of electrical fires (Table 4).

Table 4. Leading areas of fire origin in residential building electrical fires (2014-2016)

Area of origin	Percent of residential building electrical fires (unknowns apportioned)
Bedrooms	15.4
Attic: vacant, crawl space above top story	13.0
Wall assembly, concealed wall space	8.7
Cooking area, kitchen	7.4
Common room, den, family room, living room, lounge	6.7

Source: NFIRS 5.0.

How residential building electrical fires start (heat source)

The "heat from powered equipment" category accounted for the majority (88 percent) of electrical fires (Table 5). Within this category, electrical arcing accounted for 74 percent; heat from other powered equipment accounted for 7 percent; radiated or conducted heat from operating equipment accounted for 5 percent; and sparks, embers or flames from operating equipment accounted for 2 percent of these electrical fires. The "hot or smoldering object" category accounted for an additional 6 percent of electrical fires, while the heat source for the remaining 6 percent of electrical fires fell into other categories.

Table 5. Sources of heat in residential building electrical fires by major category (2014-2016)

Heat source category	Percent of residential building electrical fires (unknowns apportioned)
Heat from powered equipment	87.8
Hot or smoldering object	6.3
All other heat source categories	5.8
Total	100.0

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

What ignites first in residential building electrical fires

Electrical wire, cable insulation (31 percent) and structural member or framing (18 percent) were the specific items most often first ignited in electrical fires (Table 6). Although less prominent, thermal, acoustical insulation (7 percent); exterior sidewall covering, surface, finish (6 percent); interior wall covering (6 percent); and other structural component or finish (5 percent) were also leading items first ignited.

Table 6. Leading specific items first ignited in residential building electrical fires (2014-2016)

Item first ignited	Percent of residential building electrical fires (unknowns apportioned)
Electrical wire, cable insulation	30.9
Structural member or framing	17.8
Thermal, acoustical insulation within wall, partition, or floor/ceiling	7.2
Exterior sidewall covering, surface, finish	6.2
Interior wall covering	5.5
Other structural component or finish	4.7

Source: NFIRS 5.0.

Factors contributing to ignition in residential building electrical fires

Table 7 shows the categories of factors contributing to ignition in electrical fires. As expected, the leading category by far was "electrical failure, malfunction" (88 percent). In this category, other electrical failure, malfunction (43 percent); unspecified short-circuit arc (23 percent); and short-circuit arc from defective, worn insulation (11 percent) were the specific factors that accounted for 77 percent of electrical fires. The "misuse of material or product" (6 percent) and "mechanical failure, malfunction" (5 percent) categories combined were a contributing factor in 11 percent of electrical fires.

Table 7. Factors contributing to ignition of residential building electrical fires by major category (where factors contributing to ignition were specified, 2014-2016)

Factors contributing to ignition category	Percent of residential building electrical fires
Electrical failure, malfunction	87.8
Misuse of material or product	5.5
Mechanical failure, malfunction	5.1
Operational deficiency	4.0
Design, manufacture, installation deficiency	1.2
Natural condition	1.1
Other factors contributing to ignition	1.0
Fire spread or control	0.2

Source: NFIRS 5.0.

Notes: 1. Only includes incidents where factors that contributed to the ignition of the fire were specified. At least one factor contributing to the ignition was specified in 80 percent of reported residential building electrical fires.

2. Multiple factors contributing to fire ignition may be noted for each incident; total will exceed 100 percent.

Equipment involved in ignition in residential building electrical fires

Three specific types of equipment played a leading role in the ignition of half of all residential electrical fires. These leading types of equipment involved in ignition, as shown in Table 8, were other electrical wiring (31 percent), outlets and receptacles (12 percent), and electrical branch circuits (8 percent).[25] Of interest, extension cords (5 percent), panel (fuse) boards (4 percent), and other lamps and lighting (4 percent) were also leading types of equipment involved in ignition.

Table 8. Leading specific type of equipment involved in ignition of residential building electrical fires (2014-2016)

Equipment involved in ignition	Percent of residential building electrical fires
Electrical wiring, other	30.5
Outlet, receptacle	12.0
Electrical branch circuit	7.6

Source: NFIRS 5.0.

Alerting/Suppression systems in residential building electrical fires

Fire fatalities and injuries have declined over the last 35 years, partly due to new technologies to detect and extinguish fires. Smoke alarms are present in most homes. In addition, the use of residential sprinklers is widely supported by the fire service and is gaining support within residential communities.

Smoke alarm data presented in Tables 9 and 10 are the raw counts from the NFIRS dataset and are not scaled to national estimates of smoke alarms in residential buildings where electrical fires occurred. In addition, the 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. The data presented in Table 11 are also the raw counts from the NFIRS dataset and are not scaled to national estimates of AESs in residential buildings where electrical fires occurred.

Smoke alarms in residential building electrical fires

Smoke alarms were reported as present in 50 percent of residences where electrical fires occurred. In 25 percent of electrical fires, no smoke alarms were present. In another 25 percent of these fires, firefighters were unable to determine if a smoke alarm was present (Table 9).

Table 9. NFIRS smoke alarm presence in residential building electrical fires (2014-2016)

Presence of smoke alarms	Count	Percent
Present	21,080	49.7
None present	10,782	25.4
Undetermined	10,505	24.7
Null/Blank	87	0.2
Total incidents	42,454	100.0

Source: NFIRS 5.0.

While 7 percent of electrical fires occurred in residential buildings that are **not** currently or routinely occupied, these buildings — which are under construction, undergoing major renovations, vacant and the like — are unlikely to have alerting and suppression systems that are in place and, if in place, that are operational. In fact, only 15 percent of all electrical fires in unoccupied residential buildings were reported as having smoke alarms that operated. In addition, AESs were reported as present in only 2 percent of electrical fires in residential buildings that were not routinely occupied. As a result, the detailed analyses in the following sections focus on electrical fires in occupied residential buildings only.[26]

Smoke alarms in occupied residential building electrical fires

Smoke alarms were reported as present in 51 percent of electrical fires in occupied residential buildings. In 24 percent of electrical fires in occupied residential buildings, there were no smoke alarms present. Lastly, in 25 percent of electrical fires in occupied residential buildings, firefighters were unable to determine if a smoke alarm was present (Table 10).

When smoke alarms were present (51 percent) and the alarm's operational status was considered, the percentage of smoke alarms reported as present consisted of:

- Present and operated — 26 percent.
- Present but did not operate — 17 percent (fire too small, 11 percent; alarm failed to operate, 7 percent).[27]
- Present but operational status unknown — 8 percent.

When the subset of incidents where smoke alarms were reported as present was analyzed separately as a whole, smoke alarms were reported to have operated in 51 percent of the incidents and failed to operate in 13 percent. In 21 percent of the subset, the fire was too small to activate the alarm. The operational status of the alarm was undetermined in an additional 16 percent of these incidents.[28]

Table 10. NFIRS smoke alarm data for occupied residential building electrical fires (2014-2016)

Presence of smoke alarms	Smoke alarm operational status	Smoke alarm effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		4,182	10.6
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	7,232	18.3
		Smoke alarm alerted occupants, occupants failed to respond	258	0.7
		No occupants	1,407	3.6
		Smoke alarm failed to alert occupants	319	0.8
		Undetermined	987	2.5
	Smoke alarm failed to operate		2,644	6.7
	Undetermined		3,161	8.0
None present			9,576	24.3
Undetermined			9,683	24.5
Total incidents			39,449	100.0

Source: NFIRS 5.0.
Note: The data presented in this table are raw data counts from the NFIRS dataset summed (not averaged) from 2014 to 2016. They do not represent national estimates of smoke alarms in electrical fires in occupied residential buildings. They are presented for informational purposes.

If a fire occurs, properly installed and maintained smoke alarms provide an early warning signal to everyone in a home. Smoke alarms help save lives and property. The U.S. Fire Administration (USFA) continues to partner with other government agencies and fire service organizations to improve and develop new smoke alarm technologies. More information on smoke alarm technologies, performance, disposal and storage, training bulletins, and public education and outreach materials can be found at https://www.usfa.fema.gov/prevention/technology/smoke_fire_alarms.html. Additionally, the USFA's position statement on smoke alarms is available at https://www.usfa.fema.gov/about/smoke_alarms_position.html.

Automatic extinguishing systems in residential building electrical fires

Overall, full or partial AESs — mainly sprinklers — were present in just 3 percent of occupied residential buildings where electrical fires occurred (Table 11). Residential sprinkler systems help to reduce the risk of deaths and injuries, homeowner insurance premiums, and uninsured property losses. Despite these advantages, many homes do not have AESs, although they are often found in hotels and businesses. Sprinklers are required by code in hotels and many multifamily residences. There are major movements in the U.S. fire service to require sprinklers in all new homes. At present, however, they are largely absent in residences nationwide.[29]

Table 11. NFIRS automatic extinguishing system data for occupied residential building electrical fires (2014-2016)

Presence of automatic extinguishing systems	Count	Percent
AES present	1,011	2.6
Partial system present	41	0.1
AES not present	36,357	92.2
Unknown	2,040	5.2
Total incidents	39,449	100.0

Source: NFIRS 5.0.
Notes: 1. The data presented in this table are raw data counts from the NFIRS dataset summed (not averaged) from 2014 to 2016. They do not represent national estimates of AESs in electrical fires in occupied residential buildings. They are presented for informational purposes.
2. Total does not add up to 100 percent due to rounding.

USFA and fire service officials across the nation are working to promote and advance residential fire sprinklers. More information on costs and benefits, performance, training bulletins, and public education and outreach materials regarding residential sprinklers is available at http://www.usfa.fema.gov/prevention/technology/home_fire_sprinklers.html. Additionally, the USFA's position statement on residential sprinklers is available at https://www.usfa.fema.gov/about/sprinklers_position.html.

Examples

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

- August 2018: An overheated electrical cord caused a fire in a bedroom of an apartment in Holyoke, Massachusetts. A neighbor in the apartment downstairs smelled smoke and called 911 around 6 p.m. Upon arrival, firefighters found heavy smoke and a small fire in the third-floor apartment bedroom, but were able to extinguish the fire quickly. No one was injured.[30]
- July 2018: Several residents of an apartment building in Austin, Minnesota, were displaced after an electrical fire damaged two units. Upon arrival to the early evening fire, firefighters extinguished the blaze, which appeared to have started as an electrical fire in the ceiling of the building's laundry room. Further investigation revealed that a resident felt warmth coming from the floor of her apartment and smelled burning over two hours prior to the emergency call. The resident then went to the laundry room beneath her apartment, but said the smell stopped. She later noticed the smell again and saw smoke, prompting her to make an emergency call. While no injuries were reported, the fire caused an estimated $10,000 in damage to the building and $2,500 in damage to contents.[31]
- April 2018: A fault in a duplex electrical receptacle caused a late-night fire at a group home in Severn, Maryland, which killed three people. Upon arrival, it took firefighters more than an hour to put out the blaze in the single-family dwelling. Two of the victims killed were male residents of the home, while the third victim was a female worker in the home. Investigators determined that the faulty receptacle was located in a rear bedroom of the home. All of the victims, however, were found at the front of the house. Investigators believe the worker was trying to save one of the residents as both were found dead inside the same room in the house. Paramedics tried to save the other resident when they found him inside the home, but were unsuccessful and declared him dead at the scene. The Office of the Chief Medical Examiner in Baltimore determined that the two victims who were found together both died of smoke inhalation and burns. The third victim died of smoke inhalation. The home was completely destroyed.[32]

Electrical fire safety

To help keep your home fire safe, make sure all electrical work in your home is done by a qualified electrician and follow these electrical safety tips:

- Appliances:
  - Always plug major appliances, such as refrigerators, stoves, washers and dryers, directly into a wall outlet.
  - Never use an extension cord with a major appliance — it can easily overheat and start a fire.
  - Always plug small appliances directly into a wall outlet.
  - Unplug small appliances when you are not using them.
  - Keep lamps, light fixtures and light bulbs away from anything that can burn.
  - Use light bulbs that match the recommended wattage on the lamp or fixture.
  - Check electrical cords on appliances often. Replace cracked, damaged and loose electrical cords. Do not try to repair them.
- Outlets:
  - Do not overload wall outlets.
  - Insert plugs fully into sockets.
  - Never force a three-prong cord into a two-slot outlet.
  - Install tamper-resistant electrical outlets if you have young children.

- Extension cords, power strips and surge protectors:
  - Replace worn, old or damaged extension cords right away.
  - Use extension cords for temporary purposes only.
  - Avoid putting cords where they can be damaged or pinched, like under a carpet or rug.
  - Do not overload power strips.
  - Use power strips that have internal overload protection.

For additional electrical home fire prevention tips and information, please visit the USFA's electrical fire safety outreach materials webpage at https://www.usfa.fema.gov/prevention/outreach/electrical.html.

You can also find information on home electrical safety and work place electrical safety, as well as resources to educate communities, at the Electrical Safety Foundation International, www.esfi.org.

NFIRS data specifications for residential building electrical fires

Data for this report were extracted from the NFIRS annual Public Data Release files for 2014, 2015 and 2016. Only version 5.0 data was extracted.

Residential building electrical fires were defined using the following criteria:

- Aid Types 3 (mutual aid given) and 4 (automatic aid given) were excluded to avoid counting a single incident more than once.

- Incident Types 111 to 123 (excludes 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, or
    - 2—Fixed portable or mobile structure, or
    - Structure Type not specified (null entry).
  - For Incident Types 111 and 120 to 123:
    - 1—Enclosed building, or
    - 2—Fixed portable or mobile structure.
- The USFA Structure Fire Cause Methodology was used to determine residential building electrical malfunction fire incidents (i.e., cause code = '06').[33]

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.

Information regarding the USFA's national estimates for residential building fires, as well as the data sources used to derive the estimates, can be found in the document "Data Sources and National Estimates Methodology Overview for the U.S. Fire Administration's Topical Fire Report Series (Volume 19)," https://www.usfa.fema.gov/downloads/pdf/statistics/data_sources_and_national_estimates_methodology_vol19.pdf. This document also addresses the specific NFIRS data elements analyzed in the topical reports, as well as "unknown" data entries and missing data.

To request additional information, visit https://www.usfa.fema.gov/contact.html. Provide feedback on this report.

Notes:

[1]"Residential Building Electrical Fires (2009-2011)," Topical Fire Report Series, USFA, March 2014, Volume 14, Issue 13, https://www.usfa.fema.gov/downloads/pdf/statistics/v14i13.pdf.

[2]The term "residential buildings" includes what are commonly referred to as "homes," whether they are one- or two-family dwellings or multifamily buildings. It also includes manufactured housing, hotels and motels, residential hotels, dormitories, assisted living facilities, and halfway houses — residences for formerly institutionalized individuals (patients with mental disabilities, drug addictions, or those formerly incarcerated) that are designed to facilitate their readjustment to private life. The term "residential buildings" does not include institutions such as prisons, nursing homes, juvenile care facilities, or hospitals, even though people may reside in these facilities for short or long periods of time.

[3]In NFIRS Version 5.0, a structure is a constructed item of which a building is one type. In previous versions of the 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 the NFIRS 5.0 includes 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 occur in 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.

[4]National estimates are based on 2014 to 2016 native Version 5.0 data from the NFIRS, residential structure fire loss estimates from the National Fire Protection Association's (NFPA) annual surveys of fire loss, and the USFA's residential building fire loss estimates: https://www.usfa.fema.gov/downloads/pdf/statistics/res_bldg_fire_estimates.pdf. Further information on the USFA's residential building fire loss estimates can be found in the "National Estimates Methodology for Building Fires and Losses," August 2012, https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf. For information on the NFPA's survey methodology, see the NFPA's report "Fire Loss in the United States During 2016," September 2017, https://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-in-the-us/overall-fire-problem/fire-loss-in-the-united-states. In this topical report, fires are rounded to the nearest 100, deaths to the nearest five, injuries to the nearest 25, and dollar loss to the nearest million. In this report, deaths and injuries refer to civilian casualties only and do not include firefighters who die or are injured as a result of a fire.

[5]The USFA Structure Fire Cause Methodology was used to identify fires for which the cause was electrical in nature. The cause methodology and definitions can be found in the document "National Fire Incident Reporting System Version 5.0 Fire Data Analysis Guidelines and Issues," July 2011, https://www.usfa.fema.gov/downloads/pdf/nfirs/nfirs_data_analysis_guidelines_issues.pdf.

[6]2014-2016 NFIRS data.
[7]The term "electrical fires" is an abbreviated form of the original term "electrical malfunction fires" as defined by USFA's Structure Fire Cause Methodology.
[8]Fire department participation in the NFIRS is voluntary; however, some states do require their departments to participate in the state system. Additionally, if a fire department is a recipient of a Fire Act Grant, participation is required. From 2014 to 2016, 68 percent of the NFPA's annual average estimated 1,328,500 fires to which fire departments responded were captured in the NFIRS. Thus, the NFIRS is not representative of all fire incidents in the U.S. and is not a "complete" census of fire incidents. Although the NFIRS does not represent 100 percent of the incidents reported to fire departments each year, the enormous dataset exhibits stability from one year to the next without radical changes. Results based on the full dataset are generally similar to those based on part of the data.
[9]"Residential Building Electrical Malfunction Fire Trends (2007-2016)," Fire Estimate Summary, USFA, May 2018, https://www.usfa.fema.gov/downloads/pdf/statistics/res_bldg_fire_estimates.pdf.
[10]"Residential Building Fire Causes (2007-2016)," "Residential Building Fire Death Causes (2007-2016)," "Residential Building Fire Injury Causes (2007-2016)," and "Residential Building Fire Dollar-Loss Causes (2007-2016)," Fire Estimate Summary, USFA, May 2018, https://www.usfa.fema.gov/downloads/pdf/statistics/res_bldg_fire_estimates.pdf.
[11]Vytenis Babrauskas. (2008). "Research on electrical fires: The state of the art." Fire Safety Science 9: 3-18. doi:10.3801/IAFSS.FSS.9-3, http://www.iafss.org/publications/fss/9/3# (accessed Sept. 12, 2018).
[12]"Common causes of home electrical fires," WireChief Electric LTD, Feb. 4, 2011, http://www.vancouverelectricianblog.com/common-home-electrical-fires/ (accessed Sept. 12, 2018).
[13]Mike Holmes, "Dangers of electrical fires: Ditch DIY when fixing faulty wiring," Postmedia News, Aug. 7, 2012, http://www.canada.com/news/Dangers+electrical+fires/7051750/story.html (accessed Sept. 12, 2018).
[14]"Know the dangers in your older home," Electrical Safety Foundation International, 2015, https://www.esfi.org/resource/know-the-dangers-in-your-older-home-217 (accessed Sept. 12, 2018).
[15]"Residential electrical system aging research project," The Code Authority, Underwriters Laboratories, Issue 2, 2008, https://www.ul.com/wp-content/uploads/2014/04/ul_ResidentialElectricalSystemResearch.pdf (accessed Sept. 12, 2018).
[16]Mike Holmes, "Dangers of electrical fires: Ditch DIY when fixing faulty wiring," Postmedia News, Aug. 7, 2012, http://www.canada.com/news/Dangers+electrical+fires/7051750/story.html (accessed Sept. 12, 2018).
[17]In the NFIRS, confined fires are defined by Incident Type Codes 113 to 118.
[18]The 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. However, there could be property damage as a result of smoke, water and overhaul.
[19]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 x (310/24,000)) = 12.9 deaths per 1,000 residential building electrical fires, and the fire injury rate is (1,000 x (850/24,000)) = 35.4 injuries per 1,000 residential building electrical fires.
[20]2014-2016 NFIRS data.
[21]Total percentage of residential building electrical fires does not add up to 100 percent due to rounding.
[22]For the purposes of this report, the time of the fire alarm is used as an approximation for the general time at which the fire started. However, in the NFIRS, it is the time at which the fire was reported to the fire department.
[23]"Effects of low humidity on health," Mercola, https://articles.mercola.com/sites/articles/archive/2014/01/13/low-humidity-health-effects.aspx (accessed Sept. 13, 2018).
[24]Total percentage of residential building electrical fires does not add up to 100 percent due to rounding.
[25]The three leading specific types of equipment involved in ignition do not add up to 50 percent due to rounding.
[26]The term "occupied" implies that the building is operational or in normal use. This includes residences that are unoccupied for a brief period of time such as when household members are away at work, school or on vacation.
[27]Total percentage of smoke alarms that were present but did not operate does not equal 17 percent due to rounding.
[28]Total does not add up to 100 percent due to rounding.
[29]U.S. Department of Housing and Urban Development and U.S. Census Bureau, American Housing Survey for the United States: 2011, September 2013, "Health and Safety Characteristics-All Occupied Units (National)," Table S-01-AO, https://www.census.gov/content/dam/Census/programs-surveys/ahs/data/2011/h150-11.pdf (accessed Sept. 17, 2018).
[30]Jeanette DeForge, "Holyoke Fire in Apartment Building Caused by Electrical Issue," www.masslive.com, Aug. 6, 2018, https://www.masslive.com/news/index.ssf/2018/08/holyoke_fire_in_apartment_buil.html (accessed Sept. 17, 2018).
[31]Mike Stoll, "Apartment Building Damaged in Electrical Fire; Resident Said Floor Felt Warm on Her Feet," www.austindailyherald.com, July 17, 2018, https://www.austindailyherald.com/2018/07/apartment-building-damaged-in-electrical-fire-resident-said-floor-felt-warm-on-her-feet/ (accessed Sept. 17, 2018).
[32]Phil Davis and Chase Cook, "Fault in Electrical Outlet Caused Fatal Fire at Arundel Lodge Home," www.capitalgazette.com, May 8, 2018, http://www.capitalgazette.com/news/for_the_record/ac-cn-arundel-lodge-update-20180508-story.html (accessed Sept. 17, 2018).
[33]See endnote 5.