Code Council 2020-21 Workgroup Executive Summary
November 2021

At the Code Council Meeting on June 21, 2019, Chairperson Matthew Tebo, the Secretary of State's designee, created a Workgroup to evaluate specific existing and proposed new code provisions related to the Uniform Fire Prevention and Building Code (Uniform Code). The Workgroup included the following members of the State Fire Prevention and Building Code Council (Code Council): Benjamin Keller, Timothy DeRuyscher, Joseph Toomey, William Tuyn, Shawn Hamlin, and Robert Hughes.

Department of State staff to support the Workgroup included John Addario (Division Director), Panagiota Hyde (Office of General Counsel, Senior Attorney), and Kevin Duerr-Clark (Assistant Director for Code Development).

The purpose of the Workgroup was to evaluate the feasibility of specific code provisions and proposed modifications to the Uniform Code. The Workgroup was not intended to make any specific detailed recommendations, but rather, was tasked with evaluating the feasibility, identifying possible roadblocks and conflicts, and investigating potential alternatives. The Workgroup was then to present its findings to the remainder of the Code Council in a summary report so that the Code Council could determine any necessary actions. This document represents that summary report.

The provisions reviewed ranged from minor errata type modifications to the addition of new code sections and provisions. The majority of the topics discussed by the Workgroup resulted in finding that no immediate action was necessary by the Code Council because either the provisions currently included within the Uniform Code already addressed the topic, the natural course of periodic updates to the Uniform Code would address the item, or the item could be easily implemented in a future code update. Several topics identified the need for further detailed research and analysis to implement, should the Code Council deem it necessary.

Below is a list of the thirteen (13) topics assigned to the Workgroup. A summary of each topic is provided below as well as an appendix for certain topics providing a further detailed summary of the Workgroup's discussions.

Topic	Action	Appendix
Attached garages - heat/smoke detection vs 45-minute separation	No Action	A
Emergency responder radio coverage in existing buildings	No Action	None
International Code Council (ICC) language for exceptions for fire partitions	No Action	B
Fire command center sizing charts	No Action	C
Updating to the current NFPA sprinkler standards	No Action	None
Sprinkler provisions for new bed and breakfasts	No Action	D
The use of 10-year battery backups in smoke detectors	No Action	None
Interconnection of new smoke alarms using wireless technology	No Action	E
Updated versions of UL 217 (smoke alarms) and UL 268 (smoke detectors)	No Action	None
Mobile fueling operations	No Action	F
Automatic sprinkler system provisions (55 feet vs 30 feet building height)	Need Code Council Direction	G
Automatic sprinkler systems for Townhouses	Need Code Council Direction	H
Performance Code	DBSC to Review	I

The following abbreviations are used throughout this document and appendices:

2020 BCNYS – 2020 Building Code of New York State

2020 FCNYS – 2020 Fire Code of New York State

2020 RCNYS – 2020 Residential Code of New York State

DBSC – Division of Building Standards and Codes

Code Council – State Fire Prevention and Building Code Council

New York State – NYS

ICC – International Code Council

Uniform Code – Uniform Fire Prevention and Building Code

Attached garages – heat/smoke detection vs 45-minute separation

Previous editions of the Uniform Code required a 45-minute fire separation between the dwelling unit and the garage for buildings constructed to the RCNYS. Recent editions of the Uniform Code, in line with the ICC model codes, reduced that separation to a 20-minute separation. NYS also added requirements in the Uniform Code for heat detection in attached garages to reduce the amount of time a fire would go undetected in a garage attached to an occupied dwelling unit, which would also result in a shortened fire department response time.

Based on the number of denied Notices and Petitions that had been presented to the Code Council on the topic of increasing the fire separation between the dwelling unit and the garage in buildings constructed to the 2020 RCNYS from 20-minutes to 45-minutes, this topic was presented to discuss the potential of increasing the fire separation requirement.

The DBSC has performed significant review and analysis of this topic and presented the results to the Code Council on numerous occasions. Based on the previous documents produced by the DBSC, and the Workgroup discussion on the topic, it was concluded that when combined with the ICC model code requirement of a 20-minute fire separation, early detection is a cost-effective measure that provides for an increase in fire protection and helps mitigate the concerns over undetected fire spread. Smoke detectors in garages are responsible for nuisance alarms caused by vehicle exhaust. With the recent availability of heat detectors intended for use in residential garages, the NYS added requirement for heat detectors in garages provides for the early detection necessary. This is consistent with the recommendations of the Federal Emergency Management Agency (FEMA) and is a more cost-effective tool to mitigate the effects of fires originating in garages.

Based on the Uniform Code already providing for the necessary protections from undetected fire spread, as documented by the detailed review and analysis previously performed by the DBSC, no action by the Code Council is necessary. See Appendix A for additional information.

Emergency responder radio coverage in existing buildings (Fire Code Section 1103.2)

This topic discussed Section 1103.2 of the International Fire Code, which requires the retroactive installation of emergency responder radio coverage in certain existing buildings. This was originally proposed for removal during the 2016 update to the Uniform Code due to the retroactivity implication

for existing buildings. The 2017 Uniform Code Supplement, which modified the ICC model code books incorporated by reference into the Uniform Code, changed the scope of Section 1103 to "shall apply to existing buildings and structures undergoing construction and only to the extent as required by other sections of this code, the 2015 IEBC, or the 2015 IBC." This NYS-specific change to remove section 1103.2 was carried through to the 2020 Update.

Workgroup discussion indicated that radio coverage is still a relevant concern and that this requirement will not affect all buildings, but only those existing buildings that may have inadequate emergency responder radio coverage and those that meet the charging language requirements of Chapter 11.

Therefore, adding this back in during the next code update, not as a retroactive provision, but for certain buildings undergoing construction, would be consistent with how NYS typically addresses similar provisions in existing buildings and more closely align with the ICC model codes. There is no action needed on the part of the Code Council and the DBSC can consider presenting this change at the next code update.

International Code Council (ICC) language for exceptions for fire partitions

This topic discussed the incorporation of an ICC errata for exceptions for fire partitions. Upon thorough review, it was found that the 2020 BCNYS is consistent with the posted ICC Errata for Section 420.2 relating to fire partition exceptions. Therefore, no action is necessary. See Appendix B for additional information.

Fire command center sizing charts

This topic discussed the incorporation of an ICC errata for fire command center sizing. The noted errata was found to be included in the 2020 BCNYS. Therefore, no action is necessary. See Appendix C for additional information.

Updating to the current NFPA sprinkler standards

This topic discussed updating NFPA 13, 13R, 13D, 14, 20, 24, and 72 to the 2019 editions.

It is not uncommon for the ICC model codes (and consequently, the Uniform Code) to lag a cycle behind reference standards such as those published by the National Fire Protection Association (NFPA). This is due to the timing of the release of updated reference standards and the necessity to properly review, analyze, update, and adopt new model code books within the allotted ICC code development cycle.

While the Code Council does have the ability to update the reference standards to a more recent edition, doing so without the benefit of the ICC code development process poses some risks and complexities. For example, during the ICC code development process, updates to the model codes, including newer versions of reference standards, are heavily reviewed and scrutinized by industry experts worldwide in an effort to coordinate the entirety of the model codes and reference standards while ensuring public safety and keeping up with advances in construction technology. Without the benefit of the ICC code development process, the Code Council would be responsible for ensuring that the use of an updated standard did not negatively impact other code requirements or public safety.

The 2021 versions of the ICC model codes include the 2019 versions of the above noted NFPA standards. Therefore, it would make sense to revisit the updating of these standards once the Code Council determines an action plan and timetable for the review of the 2021 ICC model codes. The Workgroup

worked with DBSC to issue guidance outlining the process in which a municipality could accept the use of an updated standard, provided it can be shown by a permit applicant or their design professional that the updated standard is at least a stringent as the current Uniform Code provisions. The issued guidance can be found on the DBSC's website at:

https://dos.ny.gov/system/files/documents/2021/05/2020-12-02_-cop_alternative-materials-designs-and-methods-of-construction.pdf

Sprinkler provisions for new bed and breakfasts

This topic discussed adding a provision to the Uniform Code to require automatic sprinkler systems to be installed in all newly constructed bed and breakfasts. However, the definition of a *bed and breakfast* in the Uniform Code is specific to the conversion of a one-family dwelling. Technically, per the definitions provided in the Uniform Code, there are no "newly constructed" *bed and breakfasts* because a new building constructed as a one-family dwelling where one or more occupants are primarily permanent in nature, and rent is paid for guestrooms, would be defined as a *lodging house*. The Uniform Code currently considers a *lodging house* a Group R occupancy and is to be constructed to the 2020 BCNYS, which would require an automatic sprinkler system. A *lodging house* can be constructed to the 2020 RCNYS, provided it contains a residential fire sprinkler system complying with Section P2904 of the 2020 RCNYS, is owner-occupied, and has five or fewer guest rooms.

Under either scenario, newly constructed *lodging houses* would be required to install an automatic sprinkler system, so there is no action necessary on the part of the Code Council as the Uniform Code already provides for the requirement. See Appendix D for additional information.

The use of 10-year battery backups in smoke detectors

This topic discussed the potential of a new requirement for 10-year sealed batteries to be provided in smoke detectors.

Effective April 1, 2019, General Business Law §399-ccc provides, in relevant part, that: "All solely battery operated smoke detecting alarm devices that are distributed, sold, offered for sale, or imported, shall employ a non-removable, non-replaceable battery that powers the device for a minimum of ten years."

This will phase itself out naturally based on the fact that these will generally not be available for sale once stocks are depleted. There is a prior guidance document pertaining to the 2015 IRC and General Business Law §399-ccc which can be found on the DBSC's website at:
https://dos.ny.gov/system/files/documents/2019/05/2019-03%20Final.pdf

It is apparent that even online retailers have become aware of this and no longer ship non-qualifying devices to NYS. Between the likely adoption of NFPA 72 – 2019 in any future code update and the General Business Law, the use of anything but 10-year sealed battery backup for solely battery-operated smoke detectors will become the norm, and no immediate action is necessary on the part of the Code Council.

Interconnection of new smoke alarms using wireless technology

This topic contained two parts, one questioning whether the Uniform Code allows interconnection of new smoke alarms via wireless technology and whether the Uniform Code should be modified to require

interconnection of new smoke alarms via wireless technology during renovations in buildings regulated by the 2020 RCNYS.

Currently, the Uniform Code for dwelling units requires smoke alarms to be interconnected, which can be achieved either via hardwire or wireless interconnection. There are exceptions for requiring interconnection in existing buildings regulated by the 2020 RCNYS. As detailed in the appendix, requiring interconnection, even if by wireless technology, may have technical, financial, and/or availability complications in existing buildings rendering any such modification impracticable and, therefore, no action is necessary on the part of the Code Council. See Appendix E for additional information.

Updated versions of UL 217 (smoke alarms) and UL 268 (smoke detectors)

This topic considered updating reference standard NFPA 72 – 2019 to use the 8th edition of UL 217 regulating smoke alarms and the 7th edition of UL 268 regulating smoke detectors to address the new technology of devices in 2020 from UL and manufacturers.

UL has extended the effective date for UL 217 to June 30, 2022. (*See* https://www.ul.com/news/news-brief-ul-extends-effective-date-smoke-alarm-and-smoke-detector-manufacturers)

Based on the extended deadlines for compliance and the fact that this will likely be self-correcting in future updates to the code (including the potential incorporation of the NFPA 72 – 2019), and the need to give the industry an opportunity to catch up with the new technology, no immediate action is necessary by the Code Council.

Mobile Fueling Operations

This item discussed the removal of Section 5707 from the 2020 FCNYS relating to on-demand mobile fueling operations.

The Workgroup did not initially find any reason the Code Council should not consider including additional on-demand mobile fueling operations provisions in a future update to the Uniform Code. However, careful consideration should be taken as to how to implement these provisions at the local level. In communicating with other states and/or cities who have implemented similar provisions, it was determined that allowing the local jurisdiction to control where on-demand mobile fueling is permitted and approved is essential to ensuring that the operations are properly regulated, and that the local jurisdiction is equipped to handle the oversight of the operations. DBSC staff have begun working at the ICC code development level to make necessary changes to the ICC model codes to allow for a more seamless approach to on-demand mobile fueling. Barring a determination from the Code Council that they wish to not pursue this topic in a future code update, DBSC staff will be prepared to present code language to include some form of on-demand mobile fueling in the future Fire Code of New York State, including working with the industry and local government on how the operations can safely take place, for the Code Council's consideration.

See Appendix F for additional information.

Automatic sprinkler system provisions (55 feet Versus 30 feet building height)

This topic discussed the NYS specific change that was removed from the 2020 BCNYS for automatic sprinkler system thresholds to be consistent with the general policy to align the NYS Codes with the ICC

model codes. The ICC model code threshold has been 55-foot for some time. Historically, the Code Council had changed it to 30 feet to coincide with the 30-foot standpipe requirement.

The Workgroup anticipates that the change to re-instate the NYS specific requirement of 30 feet would primarily impact Group B occupancies. It was reported by a Workgroup member that there would be no initial cost that would result from making this change, but that assessment was based on 2002 costs and did not account for maintenance. The needs and benefits analysis from the regulatory impact statement of an earlier version of the Uniform Code is provided in Appendix G.

The Workgroup did not identify any immediate barriers to pursuing a change in the next code update. Should the Code Council determine that they wish to pursue this change, Workgroup members and DBSC staff can work together to identify any changes to the above noted needs and benefits analysis including but not limited to: any increases in costs or regulatory burden that may accompany the change; gathering and including any additional justification on the need for the change; and the manner in which the change would provide increased fire safety, as opposed to maintaining the current provision, leaving the option of installing an automatic sprinkler system in buildings 30 feet or more as a design choice for the design professional and developer.

Automatic sprinkler systems for Townhouses

This topic discussed a new requirement for townhouses that are served by a municipal/public water supply system governed by the New York State Department of Health (DOH), to have an automatic sprinkler system installed, regardless of the number of stories. Currently, the 2020 RCNYS only requires automatic sprinkler systems installed in townhouses having a height of three stories above grade plane. Those over three stories would be considered a Group R occupancy classification subject to the 2020 BCNYS, which would require an automatic sprinkler system under Section 903.2.8.

This topic involved multiple detailed discussions advocating for inclusion of the proposed provision, exclusion of the proposed provision, and requests for additional information to support either position. Several concepts discussed included the costs associated with the change, the overall safety of the current multiple design options, necessary education and outreach, and the impact to townhouses not supplied by a DOH regulated public/municipal system. However, not all points were agreed upon amongst all Workgroup members

Should the Code Council determine that they wish to consider making changes to the automatic sprinkler system requirements for townhouses, additional research will need to be performed in relation to the cost impacts, design choices and their ability to equally perform the design outcome, whether the change to new construction will have the proposed outcome of reducing large fire events in all townhouses, and whether or not these impact all townhouses or just the ones supplied by public/municipal water systems. The data currently researched by the Workgroup did not result in a conclusion that all Workgroup members could agree upon; therefore, the data does not provide clear support for or against the proposed change. Accordingly, a recommendation from the Code Council is needed to determine if further analysis on this topic is warranted.

See Appendix H for additional information.

Performance Code

This topic discussed the potential adoption of the ICC Performance Code (ICCPC) as part of the Uniform Code. Overall, the Workgroup did not identify any major concerns surrounding the use of the ICCPC in

NYS. However, the main concerns were administration and enforcement of the ICCPC at the local level and implementing how the review of a submittal would be conducted by the code enforcement official. As an interim measure to a full ICCPC adoption as part of the Uniform Code, DBSC could possibly implement the ICCPC through Part 1205 as a routine variance or board of review case that could be approved. This would allow DBSC staff or the board of review to accept the ICCPC design, including the peer review provided by the applicant, as part of a variance application rather than burdening the local officials. It would also allow DBSC the opportunity to become more familiar with the process and any challenges that may come with it, before potentially transferring the approval process to the local officials through the Uniform Code. However, this potential option would require an amendment to the existing Part 1205 regulation through the rule making process, which is currently being reviewed by the DBSC staff.

See Appendix I for additional information.

Code Council 2020-21 Workgroup Executive Summary - Appendix A

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Attached garages – heat/smoke detection vs 45-minute separation

The 45-minute fire separation between the dwelling and an attached garage was part of the legacy codes dating as far back as the 1970's. When the Code Council adopted the 2002 version of the Uniform Code, which was modeled after the 2000 ICC model code books, the NYS amendment was carried over without basis on Statute or other special condition. During the 2016 review and update to the Uniform Code, in an effort to be more consistent with the ICC Codes, the DBSC proposed not to carry over the outdated garage fire-separation provisions for these reasons:

1. A 45-minute fire separation is inconsistent with nationally accepted standards. The nationally accepted standard is a 20-minute fire separation.
2. The garage-dwelling separation requirements under the 2010 RCNYS are generally more expensive than those under the 2015 IRC.

The decision met the approval of the Code Council and was incorporated into the 2016 update to the Uniform Code (R302).

The question then became, based on the number of denied Notices and Petitions that had been presented to the Code Council and the concern of some Council Members, whether the 45-minute fire separation was necessary to reconsider. As a result of significant review and analysis by DBSC staff as presented to Council Members in past meetings, the main concern for building occupants would be for a fire in a garage to go undetected, therefore, the more appropriate mitigation to protect building occupants from garage fires was determined by the Code Council to be the use of early detection rather than increased fire separation. For the 2020 Update, it was proposed to the Council to mitigate the concerns of a fire in a garage by requiring interconnected heat detection in new attached garages (R314.2.3, R314.4.1). This was approved by the Council and incorporated into the 2020 update to the Uniform Code.

The following findings are addressed in greater detail in the document titled "The Separation Requirements Between a Garage and a One- Or Two-Family Dwelling," prepared by the DBSC and issued on March 2, 2018. The report was largely based on the NFPA's "Home Structure Fires Report (September 2017)[1]," which provides data on fires that occurred in one- and two-family homes in the

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1 The September 2017 NFPA report was recently replaced with an October 2021 report which provides data on fires between 2015 and 2019. The new 2021 report was not reviewed in detail by the Workgroup due to the timing of the report's release. However, DBSC staff did a cursory review of Table 10 A from the newly issued report and compared the information to Table 10 A from the September 2017 report, which was the focus of the data referenced in the DBSC document titled "The Separation Requirements Between a Garage and a One- Or Two-Family Dwelling." The total number of fires and civilian deaths, injuries, and direct property damage resulting from fires in one- or two-family homes originating in garages or vehicle storage areas marginally increased from the 2017 to the 2021 report,

United States between 2011 and 2015. The documents are provided as separate attachments to the end of this Appendix and the findings can be summarized as follows:

- The International Residential Code is part of a family of model codes (the "I-Codes") published by the International Code Council. The I-Codes are nationally recognized as the standard for building codes. The I-Codes, or codes based on the I-Codes, have been adopted in almost every state in the nation. The I-Codes are updated periodically. The prior version of the New York State Uniform Code was based on the 2015 edition of the I-Codes. Section R302 of the 2015 IRC was adopted as part of the Uniform Code. The provisions in section R302 of the 2015 IRC (and in the 2020 RCNYS which was based on the 2018 IRC) reflect the most up-to-date national consensus on fire-resistance rated assemblies.
- On average, the garage-dwelling separation requirements of the Uniform Code (2015 IRC Table R302.6) are equivalent to 65% of the nation, more restrictive than 1% of the nation, and less restrictive than about 6% of the nation. Approximately 28% of the nation does not have a statewide code to address this requirement.
- Approximately 1% of all one- or two-family home fires in New York State (excluding New York City) originate in a garage. This figure is three times lower than the national average. Despite the low incidence and the relatively low threat to life safety, fires originating in garages were the fourth leading cause of direct property damage.
- According to data obtained from RSMeans "Building Construction Cost Data," 2015, the vertical separation required between a garage and a dwelling is $1.46/SF more expensive under Section R309.2.1 of the 2010 RCNYS than under Table R302.6 of the 2015 IRC. If the exception to Section R309.2.1 of the 2010 RCNYS is applied, the additional cost increases to $1.62/SF. The cost of separation requirement for garages located less than 3 feet from a dwelling unit on the same lot cost is approximately $1.59/SF higher under the 2010 RCNYS as compared to the 2015 IRC. Additionally, the DBSC's research indicated that the cost of a 20-minute fire-rated door can be as low as $175, where the cost of a 45-minute fire-rated door may be as low as $400. Therefore, the cost increase for a 45-minute fire-rated door required under the 2010 RCNYS is more than double (about $225 higher) than what is required under the 2015 IRC.

Conclusion: Early detection is a cost-effective measure that when combined with the 20-minute fire separation, provides for sufficient fire protection; however, smoke detectors in garages are responsible for nuisance alarms caused by vehicle exhaust. With the recent availability of heat detectors intended for use in residential garages, NYS added a requirement for heat detectors in garages as part of the 2020 Codes. This is consistent with the recommendations of FEMA and a more effective tool to mitigate the effects of fires originating in garages.

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however, the percentage when compared to all other areas of origins either remained the same, or were within one percent of each other for garage and vehicle storage areas, making no notable changes to the findings noted in DBSC's report. https://www.nfpa.org/News-and-Research/Data-research-and-tools/Building-and-Life-Safety/Home-Structure-Fires

Appendix A – Additional Reports and Resources

Code Council 2020-21 Workgroup Executive Summary - Appendix B

November 2021

International Code Council (ICC) Language for Exceptions for Fire Partitions

2018 IBC

420.2 Separation walls. Walls separating dwelling units in the same building, walls separating sleeping units in the same building and walls separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as fire partitions in accordance with Section 708.

Exceptions:

1. Where sleeping units include private bathrooms, walls between bedrooms and the associated private bathrooms are not required to be constructed as fire partitions.

2. Where sleeping units are constructed as suites, walls between bedrooms within the sleeping unit and the walls between the bedrooms and associated living spaces are not required to be constructed as fire partitions.

3. In Group R-3 and R-4 facilities, walls within the dwelling units or sleeping units are not required to be constructed as fire partitions.

2018 IBC Errata[1] – posted 4/9/2018

420.2 Separation walls. Walls separating dwelling units in the same building, walls separating sleeping units in the same building and walls separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as fire partitions in accordance with Section 708.

~~Exceptions:~~

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2020 BCNYS

420.2 Separation walls. Walls separating dwelling units in the same building, walls separating sleeping units in the same building and walls separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as fire partitions in accordance with Section 708.

[1] https://cdn-web.iccsafe.org/wp-content/uploads/errata_central/2018-International-Building-Code-Errata-Complete.pdf

The 2020 BCNYS is in line with the posted ICC Errata for Section 420.2. As background, the removed exceptions do not appear to be pertinent, as those uses would not generally have required a fire partition as they are not separating dwelling and sleeping units from each other or other uses. The uses are part of the dwelling and sleeping unit. Two proposed code changes at the ICC hearings, G118-15 and G119-15, would have added these three exceptions to Section 420.2, and although they had been approved as modified by the Code Action Committee, they were met at the Public Comment Hearing with several request to disapprove and were both subsequently withdrawn by the proponent.

Code Council 2020-21 Workgroup Executive Summary - Appendix C

November 2021

Fire Command Center Sizing Charts

2018 IBC	**2018 IBC Errata**[1] – posted 4/9/2018	**2020 BCNYS**
[F] 911.1.3 Size. The room shall be not less than 200 square feet (19 m2) with a minimum dimension of 10 feet (3048 mm).	911.1.3 Size. The fire command center shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m2) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater. ~~The room shall be not less than 200 square feet (19 m2) with a minimum dimension of 10 feet (3048 mm).~~	911.1.3 Size. The fire command center shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m2) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater.

[1] https://cdn-web.iccsafe.org/wp-content/uploads/errata_central/2018-International-Building-Code-Errata-Complete.pdf

The 2020 BCNYS is in line with the posted ICC Errata for Section 911.1.3. As background, the struck-out text does not appear in change F44-16 as approved and appears to be a carryover from the original text.

Code Council 2020-21 Workgroup Executive Summary - Appendix D

November 2021

Sprinkler Provisions for New Bed and Breakfasts

The definition of a *bed and breakfast dwelling* is in part "An owner occupied residence resulting from a **conversion** of a one-family dwelling..." A "new" *bed and breakfast dwelling* would be considered a *lodging house* by definition and would already be required to have sprinklers under both the 2020 RCNYS and the 2020 BCNYS. Therefore, "new" *bed and breakfast dwellings* are currently required to have automatic sprinkler systems under the current version of the Uniform Code.

Nothing prevents the owner from constructing a one- or two-family dwelling and later converting it into a *bed and breakfast dwelling* to circumvent the automatic sprinkler requirements. However, there is no data to date showing that there is abuse of this potential loophole and that these conversions are problematic.

2020 RCNYS Relevant Sections

[NY] BED AND BREAKFAST DWELLING. An owner occupied residence resulting from a conversion of a one-family dwelling, used for providing overnight accommodations and a morning meal to not more than ten transient lodgers, and containing not more than five bedrooms for such lodgers.

[RB] LODGING HOUSE. A one-family dwelling where one or more occupants are primarily permanent in nature, and rent is paid for guestrooms.

R101.2 Scope. Owner-occupied lodging houses that (1) have five or fewer guestrooms and (2) are provided with a residential fire sprinkler system complying with Section P2904 of this code.

Therefore, a newly constructed building that functions similar to a *bed and breakfast dwelling* is actually a *lodging house*, which can be constructed under the 2020 RCNYS but requires a residential fire sprinkler system complying with P2904 of the 2020 RCNYS.

2020 BCNYS - Relevant Sections

If not designed and constructed to the 2020 RCNYS due to not meeting the scope of Section R101.2, a new building or structure that is designed and constructed to be used and occupied in a similar manner as a *bed and breakfast dwelling*, is still a *lodging house*, but its occupancy classification and use is R-3, as provided in Section 310.4 of the 2020 BCNYS:

310.4 Residential Group R-3. Residential Group R-3 occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-4 or I, including:

Buildings that do not contain more than two dwelling units
Care facilities that provide accommodations for five or fewer persons receiving care
Congregate living facilities (nontransient) with 16 or fewer occupants
Boarding houses (nontransient)

Convents
Dormitories
Fraternities and sororities
Monasteries
Congregate living facilities (transient) with 10 or fewer occupants
Boarding houses (transient)
<u>Lodging houses (transient) with five or fewer guest rooms and 10 or fewer occupants</u>
[*emphasis added*]

The 2020 BCNYS provides that *lodging houses*, as defined above, are required to have automatic sprinkler systems per Section 903.2 noted below:

> [F] 903.2 Where required. Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in Sections 903.2.1 through 903.2.12.
>
> > [F] 903.2.8 Group R. An automatic sprinkler system installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area.
> >
> > > [F] 903.2.8.1 Group R-3. An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-3 occupancies.

Code Council 2020-21 Workgroup Executive Summary - Appendix E

November 2021

Interconnection of New Smoke Alarms Using Wireless Technology

The 2020 Uniform Code does not require all new smoke alarm/detectors to be interconnected wired or wirelessly. There may be technical, financial, and/or availability complications with requiring all new smoke alarms to be interconnected wirelessly. However, the Uniform Code does not prohibit wireless technology from being used.

Uniform Code relevant Code Sections

2020 RCNYS provides the "where required" for smoke alarms:

> **[NY] R314.2 Where required.** Smoke alarms and heat detection shall be provided in accordance with this section.
>
> **[NY] R314.2.1 New construction.** Smoke alarms shall be provided in dwelling units. Heat detection shall be provided in new attached garages.
>
> **[NY] R314.2.2 Smoke alarms in existing buildings.** Existing dwellings undergoing repair, alteration, change of occupancy, addition or relocation shall be provided with smoke alarms as required by Appendix J.

When interconnection is required, a wireless connection can satisfy the requirement:

> **[NY] R314.4 Interconnection.** Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

Currently however, there are exceptions for interconnection. Typical Appendix J language directs you to R314.4 for interconnection, but allows, *"Smoke alarms shall not be required to be interconnected where battery operated alarms are permitted"* and *"In other than bed and breakfast dwellings, smoke alarms in existing areas shall not be required to be interconnected and hard wired where interior wall or ceiling finishes are not removed to expose the structure."*

Permission to use battery power exclusively, is restricted to installations in buildings without commercial power or an on-site electrical power system, or in buildings where existing interior wall or ceiling finishes are not removed to expose the structure.

Additionally, an exception to the above R314.4 provides for similar relief in that "*Smoke alarms and alarms installed to satisfy Section R314.4.1 shall not be required to be interconnected to existing smoke*

alarms where such existing smoke alarms are not interconnected or where such new smoke alarm or alarm is not capable of being interconnected to the existing smoke alarms."

Additionally, Section 704.6.2 of the 2020 PMCNYS does not require the interconnection of alarms *"in buildings that are not undergoing alterations repair or construction of any kind"* or *"where alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interconnection without the removal of interior finishes."*

Lastly, a similar allowance for wireless interconnection exists in the 2020 BCNYS Section 907.2.10.5.

There are possible complications with requiring all smoke alarms to be interconnected either by hardwire or wirelessly. They include, but are not limited to, the following:

1. Requiring hardwire in existing buildings has long since been considered overly onerous when existing wall or ceiling finishes are not removed to expose the structure;
2. Based on the research below, there are a limited number of manufacturers currently selling solely battery-operated units that have both wireless interconnectivity and 10-year batteries, however, not all of them are 10-year sealed batteries as required in NYS via General Business Law;
3. Coordination of allowable distances from manufacturers and required locations as provided in the Uniform Code; and
4. Interferences from other objects or reliability as noted by several manufacturers.

Cost and availability data:

		Retail Distributor→	Lowes			Home Depot	
		Manufacturer→	First Alert™			Kidde™	
Detector Type	**Interconnect Type**	**Primary Power Type**	**Model Name[1]**	**Notes**	**Price**	**Model Name[2]**	**Notes**
Smoke	Wireless interconnect	battery	1039826-SA511CN-6	2AA	$41.48	RF-SM-DC	3AA
		Battery -10 year	DNE			P4010DCS-W	3-volt
		hardwired	1039830-SA521CN-3ST	2AA battery backup	$41.48	RF-SM-ACDC	9-volt battery backup
	Wired interconnect	battery	DNE				
		hardwired	9120BP-12ST	9-volt battery backup	$14.97	i2060A	9-volt battery backup
		hardwired	1039938	Battery -10 year	$31.88	i12010S	3 volt 10 year-battery backup
	Stand-alone	battery	1039796	9-volt	$9.99	i9070	9-volt
		Battery – 10 year	0827	3-volt	$17.88	i9010	4.5-volt
		hardwired	DNE				
Combined CO & Smoke	Wireless interconnect	battery	1044807	2AA	$46.98	DNE	
		Battery – 10 year	1039287	10 year-battery (but not sealed), +Additional features	$124.00	P4010DCSCO-W	3-volt
		hardwired	1039289	10 year-battery backup, +Additional features	$124.00	P4010ACSCO-W	3-volt backup
	Wired interconnect	battery	DNE				
		hardwired	SC9120B-6	9 volt battery backup	$41.98	KN-COSM-IB	AA battery backup
		hardwired	1039806	3 volt 10 year-battery backup	$60.98		
	Stand-alone	battery	1039339	1AA	$39.98	KN-COSM-XTR-BA	1AA
		Battery – 10 year	1039869-PRC710-6	3-volt	$37.98	P3010K-CO	Sealed Lithium Battery
		hardwired	DNE				

If this was proposed as a requirement, rather than just optional as currently provided for in the current Uniform Code, language would need to include installation per the manufacturer's specifications and a note that if using wireless technology for interconnection, providing additional detectors above and beyond that required by R314.3 may be necessary to ensure the system functions properly.

Questions that would also still need to be answered if wireless battery operated was proposed as a requirement in existing buildings:

- Do these systems still need at least one hardwired?
- Can a heat detector be connected wirelessly to the system?
- Are these considered readily available? (Only one compliant option could be found initially.)

Code Council 2020-21 Workgroup Executive Summary - Appendix F

November 2021

Mobile Fueling Operations

Section 5707 of the 2018 International Fire Code (IFC) provides specific provisions for on-demand mobile fueling operations. As approved and voted on by the Code Council, Section 5707 was deleted from the final version of the 2020 FCNYS to allow the Code Council and DBSC Staff to more thoroughly review the content of Section 5707 without resulting in delay of the 2020 update to the Uniform Code. Mobile fueling operations are currently regulated in other parts of the 2020 FCNYS, and the incorporation of Section 5707 would have expanded on the existing regulations by allowing additional types of fuels not permitted under previous Uniform Code editions and providing a means for the Authority Having Jurisdiction to regulate dispensing of those fuels as a mobile operation. The topic was assigned to the Workgroup to evaluate the technical feasibility of adoption of Section 5707 in future code updates for NYS.

Gas It Up, a mobile fuel supplier interested in doing business in NYS, provided background information on how their mobile fueling operations are conducted in other states and identified some other areas across the United States that currently have regulations in place for such operations. This topic was discussed over multiple Workgroup meetings, in which the main objectives for this topic were identified as:

- Coordinate with the other provisions currently existing in the 2020 FCNYS pertaining to mobile fueling operations and evaluate the changes made during the 2021 ICC code update cycle and the associated NFPA 30A (Code for Motor Fuel Dispensing Facilities and Repair Garages) reference standard updates that could impact future provisions related to on-demand mobile fueling operations.
- Identify and research the other states and/or cities currently regulating on-demand mobile fueling operations and gain an understanding of how they implement the provisions, who regulates them, and whether they made changes to the 2018 provisions.
- Research the potential impact to, and synergies with, other State Agencies with regulatory authority (i.e. DEC, DOT, DMV).
- Research other companies performing this service.
- Review the fire reports, as obtained by the Office of Fire Prevention and Control (OFPC), for fire incidents citing improper fueling as a cause.

A detailed review of the objectives is provided below.

2021 IFC, 2018 NFPA 30, and Other 2020 FCNYS Provisions

Several other sections of the 2020 FCNYS and 2021 IFC address some form of mobile fueling operations. These include but are not limited to:

- Dispensing fuel from tank vehicles and tank cars in fuel tanks of motor vehicles (Section 5706.5.4)

- Tank vehicle and vehicle operations (Section 5706.6)
- Fueling of marine vehicles at other than approved marine motor fuel-dispensing facilities (Section 2310.4).

The above noted Sections and Section 5707 were reviewed by the Workgroup according to the DRAFT 2021 IFC and the 2020 FCNYS, in addition to the updated edition of NFPA 30A that would be included in the 2021 IFC. It is not apparent upon an initial cursory review, that there were any substantive changes to the provisions specific to mobile fueling operations. However, the 2021 IFC does not appear to coordinate among these various sections. As a result, any future provisions addressing mobile fueling operations would need to be coordinated with and take these additional sections, and any others, into consideration. DBSC staff presented several code change proposals to the ICC to address some of these coordination conflicts for consideration in the 2024 IFC.

Other Jurisdictions' Regulations

DBSC staff performed a review of other states and large cities that currently have provisions or regulations for conducting on-demand mobile fueling operations. The following states and large cities were identified as either having adopted the 2018 IFC unmodified (which would have included Section 5707), a modified version of Section 5707, or some other regulations pertaining to on-demand mobile fueling operations: California, Georgia, Minnesota, Montana, Nevada, Oregon, South Carolina, Utah, Washington, Wyoming, Dallas, Houston, New York City, and Seattle. This is not intended to be a comprehensive list and some states, such as New Jersey, are currently in the rule-making process for verbatim adoption.

Upon researching and contacting some of the states and cities listed, DBSC staff did not encounter any entities who had a negative response to on-demand mobile fueling being conducted within their jurisdiction. The main discussion point that surfaced was a need for control over the operations to remain at the local level. This allowed the local jurisdictions to determine when and where on-demand mobile fueling would be permitted in their jurisdiction and if they were not equipped to handle that type of process, or believed it was dangerous, they could opt to not allow it. Washington State has been working on new regulations to help guide the local jurisdictions on implementing these new provisions, the most recent of which went into effect in July of 2021. DBSC staff plans to follow Washington's progress in developing and implementing these new regulations to see if there is anything that would benefit NYS.

Impacts on Other State Agencies

The Workgroup considered the impact to other state agencies, including Department of Transportation (DOT), Department of Motor Vehicles (DMV), and the Department of Environmental Conservation (DEC), when considering regulations pertaining to on-demand mobile fueling operations. DBSC Staff performed preliminary reviews and outreach to these other agencies to evaluate the impact of placing new regulations in the Uniform Code regarding on-demand mobile fueling operations might have on the regulations of these other state agencies. DBSC staff has initially concluded there is no other state regulation that directly regulates mobile fueling beyond the regulations applicable to the vehicles (DMV), transportation of the materials (DOT), and spills (DEC). Careful coordination and consideration should be given to ensure there are no conflicts with related regulations. Any proposed language should

include this coordination and a more detailed review and outreach would need to be conducted as needed.

List of Companies Performing On-Demand Mobile Fueling

DBSC staff performed a search for companies other than Gas It Up who provide on-demand mobile fueling services. The list is provided below and includes those companies that appear to be currently operating. Research found a number of other possible companies that appear to have either ceased operations or merged with another operator and were, therefore, not provided below.

Company Name	States Served	Website
Booster	CA, MD, OR, TN, TX, WA	https://www.trybooster.com/
Shell Tap Up	TX, WA	https://www.tapup.shell/what-is-shell-tapup-.html
Yoshi	CA, GA, TN, TX	https://www.startyoshi.com/
Filld	CA, DC, OR, BC	https://filld.com/
GasNinja	CO, FL	https://gasninjas.com/
EZFill	FL	https://ezfillapp.com/
Fuel Panda	Unknown	https://www.fuelpanda.com/

Fire Reports

OFPC provided reports from 2001 to 2020 of fire incidents identified as passenger vehicle fires that cited improper fueling technique as the contributing factor. Unfortunately, the data provided on the reports lacked sufficient detail to distinguish the type of fueling technique or if on-demand mobile fueling was a contributing factor. Therefore, no conclusions could be drawn from the data provided in relation to on-demand mobile fueling.

Conclusion

The Workgroup did not initially find any reason the Code Council should not consider including additional on-demand mobile fueling operations provisions in a future update to the Uniform Code. However, careful consideration should be taken on how to implement these provisions at the local level. As discussed above, in communicating with other states and/or cities who have implemented similar provisions, it was determined that allowing the local jurisdiction to control where on-demand mobile fueling is permitted and approved is essential to ensuring that the operations are properly regulated, and that the local jurisdiction is equipped to handle the oversight of the operations.

Code Council 2020-21 Workgroup Executive Summary - Appendix G

November 2021

Automatic Sprinkler System Provisions (55 Feet Versus 30 Feet Building Height)

Below is an excerpt from the Revised Regulatory Impact Statement, which was part of the revised rule making for the 2003 update to the Uniform Code published in the January 9, 2002 State Register:

SPRINKLER/STANDPIPE TRADEOFF - SECTIONS 903.2.10.3 & 905.3.1
NEEDS AND BENEFITS

The purposes of these sections are to improve fire protection of mid-rise buildings, reduce installation costs, and coordinate requirements for automatic sprinkler systems and standpipe systems. The threshold for the installation of automatic sprinkler systems, installed in conformance with NFPA 13 or NFPA 13R, would be lowered from 55 feet to 30 feet. The threshold for automatic water supplies for standpipe systems would be raised from 30 feet to 75 feet. In both sections, height is specified as the distance from the highest occupied floor level to the lowest level of fire department vehicle access.

These sections are needed to improve fire protection and increase the cost efficiency of construction. They are also needed in light of the difficulties volunteer fire departments experience in recruiting and retaining members, and the increased costs to municipalities that maintain full-time fire departments. These requirements will benefit all parties involved by improving life safety for occupants and emergency responders, reducing construction costs and limiting municipal expenditures for fire protection services.

NFPA 13 is the referenced standard for the design and installation of automatic sprinkler systems. NFPA 13R is the referenced standard for the design and installation of automatic sprinkler systems in residential occupancies up to and including four stories in height. It differs from NFPA 13 primarily in the extent of coverage and the type of sprinkler heads required, as it is intended to provide a higher degree of life safety while considering the economic aspects of sprinkler protection in low-rise buildings. For light hazard occupancies, which include business occupancies, NFPA 13 requires a minimum residual pressure of 15 psi and a minimum flow rate of 500 to 750 gpm, by pipe schedule method; pressure and flow under hydraulic calculation method are to be sufficient for four sprinkler heads operating. Water supply for both systems is required to be sufficient to provide for system demand for 30 minutes.

The referenced standard for the design and installation of standpipe systems is NFPA 14. As expressed in NFPA 14, the purpose of standpipe systems is to provide a reasonable degree of protection from loss of life and property from fire. Standpipe systems accomplish this by making a fire-fighting water supply for fire hoses available at specified locations within a building, thus allowing manual fire suppression efforts to be commenced more rapidly.

NFPA 14 classifies standpipe systems by the type of water supply and the size of the hose connections provided. Water supplies may be manual or automatic. A manual water supply relies on fire department pumper trucks to pressurize water from hydrants or other approved sources to maintain adequate water in the system. Pumpers are used by all fire departments, whether rural or urban, to

provide water at adequate pressure and sufficient volume for fire fighting. An automatic water supply relies on the pressure in a water supply system, pressure tanks, gravity tanks or, most typically, on permanently installed equipment, referred to as a fire pump. The referenced standard for fire pumps, NFPA 20, prescribes their design and installation, including how they are powered. Electrically driven pumps are the type most frequently used, and require a reliable power source; this is most commonly achieved by a fuelfired generator. Standpipe systems may also be wet or dry, dry systems being used where pipes are subject to freezing.

There are three classes of standpipe systems, Class I, II and III. Class I systems provide a 2½ inch hose connection for use by fire departments and those trained in handling heavy hose streams. The minimum water flow rate for the hydraulically most remote locations is 500 gallons per minute (gpm) and 250 gpm for each additional standpipe (but not more than 1250 gpm total), with a minimum residual pressure of 100 psi. Class II systems normally provide a 1½ inch hose station to supply water for use primarily by building occupants or for initial fire department response. For Class II systems, the minimum flow rate at the hydraulically most remote location is 100 gpm, with a minimum residual pressure of 65 psi. With the approval of the code official, 1 inch hose is permitted for Class II systems. A Class III system is a combination of a Class I and a Class II system, providing both a 2½ inch connection and a 1½ inch hose station; flow and pressure meet the same standard as a Class I system.

The provisions of section 903.2.10.3 of the International Fire Code would generally be applicable to buildings six or more stories in height, based on a 12 foot floor-to-floor height. The proposed modifications would apply to buildings four or more stories in height. It would not be applicable where there are less than thirty occupants of the floor level. Based on the floor area allowances of Table 1003.2.2.2 of the Building Code, business occupancies having a floor area on a story of less than 3,000 square feet would not be required to have an automatic sprinkler system installed; for mercantile occupancies, floor levels having a floor area on a story of less than 1,800 square feet would similarly be exempted from the requirement. Section 903.2.10.3 also contains explicit exemptions for airport control towers, open parking structures and low hazard industrial occupancies.

The provisions of section 905.3.1 of the International Fire Code would generally be applicable to buildings four or more stories in height; a general exception to section 905.3 provides that standpipe systems are not required in Group R-3 occupancies. The proposed modifications would apply to buildings eight or more stories in height. The current exceptions in section 905.3.1, which provide for different classes of standpipe systems based on the installation of automatic sprinkler systems, use, freezing temperatures or location in building, would not be modified. Other provisions in section 905 require the installation of standpipe systems based on building area, certain assembly occupancies, with exceptions, and for covered mall buildings. Section 905.8 permits dry standpipe systems complying with NFPA 14 when, in the opinion of the code official, an approved water supply is not available or when the standpipe is subject to freezing. Section 905.11, which sets requirements for the installation of standpipe systems in existing buildings, is modified to make it applicable solely where required by Appendix K of the Building Code.

Under provisions of the Fire Code, a sprinkler system would not be required in a building of Group B occupancy and Type IIA construction, having a gross area of 112,500 square feet and a height of five stories, provided that the building does not exceed 65 feet in height. [see Building Code, Section 503 & Table 503]. Based on the floor area allowances of Table 1003.2.2.2, such a building could have an occupant load of over 1,100 persons. However, the provisions of section 905.3.1 would require a Class III standpipe system in such a building. The proposed rule making would require the installation of an

automatic sprinkler system, but would permit the standpipe system to be provided with a manual water supply, rather than an automatic water supply.

The coordinated proposals improve fire protection by requiring the installation of automatic sprinkler systems in buildings where the code does not currently require them. Where properly installed and maintained, such systems have been shown to consistently protect persons not intimate with fire development, and extend the period of time in which tenable conditions for egress are maintained. In that many fire departments hold the view that the use of 1½ inch hose by untrained occupants may endanger their safety by encouraging closer contact with fires and/or extending egress time, Class III standpipe systems can be viewed as not contributing to life safety. A manual Class I standpipe system would provide equivalent levels of property protection.

COSTS

There are no costs to the Department of State, the State of New York or local governments associated with the implementation or continuing compliance with these sections. There are no costs to regulated parties associated with the implementation and continued compliance with the proposed sections. The basis for concluding that regulated parties will be provided with the opportunity for cost savings is that the proposed sections reduce the quantity of water that must be provided automatically to the hydraulically most remote location in a covered building.

The proposed sections would result in cost savings, as well as improved fire protection. The cost impact of the coordinated proposals cannot be accurately predicted for all potential conditions. However, the cost of an automatic sprinkler system will always be lower than the cost of an automatic wet standpipe system. The cost differential is predicated on water pressure and flow requirements for the respective systems, and the resulting costs of additional required components. As noted above, a Class I or Class III standpipe system can require up to 1,250 gpm at a residual pressure of 100 psi, and an automatic sprinkler system may require up to 750 gpm at a residual pressure of 15 psi. A fire pump having a capacity of 1,250 gpm has a greater cost than one having a capacity of 750 gpm.

An automatic water supply for a standpipe system typically requires a fire pump and emergency generator, due to flow and pressure requirements. Typical installed costs exceed $100,000. At relatively low building heights, automatic sprinklers may not require a fire pump in municipalities with adequate water supply systems, due to lower pressure and flow requirements, compared to standpipes. Even in those circumstances where a fire pump may be required for the sprinkler system, it would be smaller. At an installed cost of $1.50 to $2.00 per square foot, the sprinkler system is likely to be less expensive for buildings up to 65,000 square feet in gross area (65,000 sf x $1.50/sf = $97,500), while providing faster response and reduced damage to the building and contents. In locations with water supply systems, automatic wet standpipes will typically require a fire pump; in most cases, a fire pump would not be required for a sprinkler system. Even where a fire pump is required for the sprinkler system, the required size and consequent cost would be substantially reduced.

It should be noted that flow and pressure in public water supply systems tends to be greater in more densely developed areas within cities or towns, in order to supply water for normal sanitary and convenience use. In localities having smaller populations, buildings having a height greater than four stories, with floor plates occupied by thirty or more persons, are less likely to be found. Thus, the proposed rule making will be unlikely to have substantial cost impacts in smaller localities.

For a typical four story 20,000 square foot office building, the additional costs for an automatic water supply for the standpipe system are:

fire pump $20,000
controller $20,000
electrical $50 - 60,000 (generator and appurtenances per NFPA 20 & 70)
TOTAL $90 - 100,000

The cost of a sprinkler system for a similar building would be approximately $30,000 (20,000 sf @ $1.50/sf).

While the cost advantages are most striking for small buildings, there are substantial savings available for larger structures as well. Using the example of the five story office building cited above, the cost of a sprinkler system would be approximately $175,000; the cost of an automatic water supply for the standpipe system would be approximately $125,000. However, section 504.2 of the Building Code would now permit the building to be of Type IIB construction, rather than IIA, although with a somewhat smaller building area. For the protection of corrugated decking alone, excluding beams, columns and accessories, 1 inch thick sprayed cementitious fireproofing costs approximately $1.60/sf, about the same cost as the sprinkler system.

Code Council 2020-21 Workgroup Executive Summary - Appendix H

November 2021

Automatic Sprinkler Systems for Townhouses

The Workgroup was tasked with reviewing the technical feasibility and barriers to adding a requirement under the existing Section R313.1 of the 2020 RCNYS, for townhouses served by a municipal/public water supply system governed by the New York State Department of Health (DOH), to have an automatic sprinkler system installed, regardless of the number of stories.

Section R313.1 of the 2020 RCNYS provides for the scenarios where a new townhouse built under the 2020 RCNYS would require an automatic fire sprinkler system (in accordance with Section P2904 or NFPA 13D). Currently, the 2020 RCNYS only requires automatic sprinkler systems installed in townhouses having a height of three stories above grade plane. Those over three stories would be considered a Group R occupancy classification subject to the 2020 Building Code of New York State, which would require an automatic sprinkler system under Section 903.2.8.

Townhouses are a unique structure regulated by the 2020 RCNYS in that, unlike many of the other buildings regulated under the 2020 RCNYS, by definition they are attached in groups of 3 or more single-family dwelling units. This gives the owner/occupant of a townhouse little to no control over the adjacent dwelling units' use and maintenance. To mitigate this concern from a fire safety perspective, the 2020 RCNYS requires additional protections including but not limited to the following:

- Townhouses are required to have proper fire separation and fire-resistant rated construction between the dwelling units.
- A separate means of egress for each dwelling unit is required.
- Townhouses must have open space on at least two sides.

Fire-resistant construction of townhouses is covered under Section R302.2 of the 2020 RCNYS, which requires the walls separating the individual dwelling units of townhouses to be either two 1-hour rated assemblies or a common wall. Where the townhouse is provided with a fire sprinkler system, the common wall must be not less than a 1-hour rated assembly, otherwise, without a sprinkler system the common wall must be not less than a 2-hour rated assembly.

The Workgroup identified multiple discussion points to consider when reviewing the possible requirement, which included the following and will be discussed in greater detail below:

1. the cost impacts;
2. necessary education and outreach;
3. the need or benefit of eliminating design choices; and
4. the impact on townhouses not supplied by a DOH regulated public/municipal water system.

Cost Impacts

In reviewing the cost impacts, various Workgroup members produced data supporting numbers ranging from $1.5 to over $8.0 per square foot to install an automatic sprinkler system in townhouses. Factors that impacted these numbers appeared to be the geographic region, scale, and size of installation (such as the number of townhouses being equipped), type of system, and features of the design and system that were included in the installation.

One of the justifications concerning the cost was that the cost savings realized by the addition of an automatic sprinkler system would balance out with the cost of its installation. For example, a contractor/homeowner could anticipate a reduced construction cost when installing an automatic sprinkler system by opting for the 1-hour common wall under Section R302.2.2 (1) versus the 2-hour common wall or double-wall option. Other potential reductions in costs include but are not limited to increase fire hydrant spacing under Section 507.5 of the 2020 Fire Code of New York State and different fire-resistance rated construction requirements for exterior walls per Section R302.1 of the 2020 RCNYS.

With the current range of numbers produced for the installation of an automatic sprinkler system, the Workgroup was unable to definitively confirm whether the cost of the installation will, in all or most cases, be balanced with the cost savings realized. It was suggested however, that the economy of scale could potentially play a role in decreasing the costs in the future based on other major jurisdictions that have implemented mandatory provisions seeing more competitive pricing. Should the Code Council wish to pursue this change, further detailed research would need to be performed.

Education and Outreach

Historically, the standard viewpoint of the installation of automatic sprinkler systems fed by public/municipal water systems is that they necessitate the need for specialty contractors and larger service pipes, they require costly improvements to the public/municipal system in order to supply the flows and demands needed for both the domestic and fire flow scenarios, or that they will result in denial of connection due to an inability to supply the demand, or an expensive surcharge to make the connection to offset the costs. Additionally, expensive backflow prevention devices and larger meters have generally been required by the public/municipal system provider for automatic sprinkler systems in both commercial and residential applications. Because the public/municipal system is outside the scope of the Uniform Code, changes to the Uniform Code would not remove these requirements that are provided at the local level.

The types of automatic sprinkler systems that would be required by the proposed change would typically require a flow not much greater than the normal domestic demand already required by the Uniform Code (a range of 20 to 26 gallons per minute was discussed by the Workgroup) and may only result in a slightly larger, but not uncommonly large service line, such as a one-inch service versus ¾-inch service. Additionally, the type of system is equated to the typical plumbing system already being installed within the townhouses and would therefore not necessarily require another contractor, but could be performed by the plumbing contractor already included with the construction.

The Workgroup established that education and outreach to the public/municipal water suppliers as well as the general public might help to offset these potentially unnecessary increased cost perceptions. However, this type of work is generally outside the scope of the Code Council to perform, and may best be suited for external stakeholders, organizations, manufacturers, and public interest groups.

Design Choices

Section R302.2 of the 2020 RCNYS currently provides for a design choice of either providing an automatic sprinkler system and a 1-hour wall, or not providing an automatic sprinkler system and providing a single 2-hour common wall or two 1-hour walls. Making the change noted to R313.1 would remove the design choice. Although it was noted during the discussions that adding a code compliant automatic sprinkler system to a building would generally increase the overall fire safety of the building, members of the Workgroup expressed concern over the proposal to remove a design choice without justification that the choice removed did not provide for an appropriate level of protection. It should be noted, the design choice is a New York specific item as the base model codes from the International Code Council (ICC) would require the automatic sprinkler system be installed.

The Workgroup members performed a series of different actions to better understand whether or not the existing design options provide for adequate protection from fire spread, or if the proposed change would reduce the fire spread from one townhouse unit to another.

The Workgroup did a review of fire reports from the New York State Fire Reporting System to see what types of fires occurred, whether they resulted in serious death or injury, whether they spread from the building of origin, whether the building contained an automatic extinguishing system, and the types of homes in which the fires occurred. The reports were run from 01/2008 to 12/2018 limiting the search to structure fires with a varying degree of severity and use types. The results of that review indicated it is impossible to determine the difference between a townhouse and other types of multifamily buildings (such as those regulated as a Group R under the 2020 BCNYS) and very difficult to understand if all of the single units of a townhouse would be considered part of one building or if each unit was considered a building. In addition, identifying the year of construction, whether the building was properly constructed with the required fire-separation, or whether fire-separation was even required at the time of original construction, are all difficult or impossible to determine. As a result, although the fire reports did indicate that when an automatic extinguishing system was provided in a structure, there was a reduced number of fire incidents, and a reduced number of incidents resulting in more severe injury or death or spread beyond the building of origin, it did not take into consideration the additional factors noted above and did not provide a percentage of the total each scenario represented.

Next, the Workgroup also discussed whether the fires that were occurring were part of the newer construction or older construction. A concern was raised (but no data was able to be produced to support or rebut the concern) that a large number of fires that occur are within older homes, not newer homes, and that providing for an automatic sprinkler system in newer construction may or may not result in a decrease in the number of large fire events.

Lastly, the discussion also included statements that the code effect of adding automatic sprinkler systems is a view toward both a short-term immediate increase in safety for new construction and that the installation of automatic sprinklers systems in new buildings today would inevitably make buildings safer in the future as the older building stock rotates out of service and the new buildings become the old buildings.

Other Townhouses

Another point discussed by the Workgroup was the focus of the change on only those townhouses served by a municipal/public water supply system. Some of the potential justifications that were discussed but need further verification or support were:

1. that the cost savings may be balanced with the added expenses for installing the automatic sprinkler systems,
2. that automatic sprinkler systems are safer than having no sprinkler systems, fires easily spread from one townhouse to another, and
3. that townhouses are a unique type of building regulated by the 2020 RCNYS in that they have three or more attached dwelling units, in which fire spreads from one unit to the next, resulting in more damage and chances of serious death or injury.

Based on the varying costs noted above, the argument of the automatic sprinkler system for townhouses served by a municipal/public water supply system balancing out with the savings may not be the case in all scenarios. Combined with the potential concern that based on the unique type of buildings and resulting fires that spread from one townhouse to another, the concern was raised that if all of these factors are true, then it is not necessarily justified for just townhouses served by a municipal/public water supply system, but that the Code Council may wish to consider it for all townhouses. This would also require additional research into the costs of installing an automatic sprinkler system in townhouses not supplied by a public/municipal water system, as these costs will most likely be higher. For example, additional equipment may include an onsite water storage tank and a pump.

Summary

Many of the justifications and arguments noted in this document were unable to be validated or rebutted with data to support the position, nor were all points agreed upon amongst all Workgroup members.

The Workgroup task was not to determine whether or not this should be implemented in NYS, but instead to review the need for the change and any potential barriers or concerns that might be faced moving forward. Should the Code Council determine they wish to consider making changes to the automatic sprinkler system requirements for townhouses, additional research will need to be performed in relation to the cost impacts, design choices and their ability to equally perform the design outcome, whether the change to new construction will have the proposed outcome of reducing large fire events in all townhouses, and whether or not these impact all townhouses or just the ones supplied by public/municipal water systems. The data currently researched by the Workgroup does not provide clear support for or against the proposed change.

Code Council 2020-21 Workgroup Executive Summary - Appendix I

November 2021

Performance Code

The Workgroup was tasked with understanding the technical feasibility of allowing the International Code Council Performance Code for Buildings and Facilities (ICCPC) to be used in NYS. The purpose of the ICCPC is to provide appropriate health, safety, welfare, and social and economic value, while promoting innovative, flexible, and responsive solutions that optimize the expenditure and consumption of resources. This is done by defining the objectives for achieving the intended levels of occupant safety, property protection, and community welfare and then providing the framework to achieve the defined objectives in terms of tolerable levels of damage and magnitude of potential hazard events (such as fire and natural hazards).

Although the ICCPC is not currently expressly mentioned in the Uniform Code or Energy Code (Title 19 NYCRR Parts 1219 through 1227 and Part 1240) or in the administration and enforcement thereof (Title 19 NYCRR Parts 1201 through 1210), various methods of performance-based design have been a long-standing compliance option in these regulations. Some examples are Chapter 16 of the 2020 BCNYS, which identifies the performance-based objectives of structural design and Section C407 of the Energy Conservation Construction Code of New York State which provides total building performance compliance criteria. Also, Boards of Review, in accordance with Title 19 NYCRR Part 1205 titled "Uniform Code: Variance Procedures" (Part 1205), have historically granted some variances based on performance design.

Daniel Nichols, a Fire Protection Engineer with the MTA Construction and Development Company, provided a presentation to the Workgroup with an overview of the benefits the use of the ICCPC could have in New York State and a discussion on how the regulations currently allow some forms of performance design. In summary, Mr. Nichols indicated the ICCPC could provide an alternative design approach that would result in buildings that are at least as safe as prescriptively designed buildings and open possibilities to design professionals to utilize the same design methods that other nations such as Canada, Japan, and England already implement. Appendix O of the 2021 International Building Code includes some administrative provisions for the use of the ICCPC, such as the need for peer review and required designer documentation such as construction documents, reports, and manuals.

Overall, the Workgroup did not identify any major concerns surrounding the use of the ICCPC. However, administration and enforcement of the ICCPC at the local level and implementing how the review of a submittal would be conducted by the code enforcement official were the main concerns. Appendix O of the 2021 ICCPC relies on the local officials to ultimately *"perform the knowledgeable review of the proposed design"* and verify compliance with the code (or the local officials may obtain competent third-party assistance), see Section 102.3.6.2 of the ICCPC. This would present a new requirement for local officials in which they are not currently experienced and will likely result in delays in the approval process and the need for the local governments to engage either third-party assistance or additional employees to accommodate the change.

In light of this concern, the Department of State noted that the use of the ICCPC could possibly be implemented, at least initially, through Part 1205 as a routine variance or board case that could be

approved. This would allow DBSC staff or the board to accept the ICCPC design, including the peer review provided by the applicant, as part of a variance application rather than burdening the local officials. DBSC can then either perform the knowledgeable review of the proposed design or engage the necessary third-party to assist in the review and then make a determination. This would relieve the local officials from having to undergo in-depth training on the topic of performance-based design review, to engage a third-party themselves, or to hire additional staff. Allowing it to be handled through the variance process would enable a more streamlined process than is currently available through the Board of Review process. It would also allow DBSC the opportunity to become more familiar with the process and any challenges that may come with it, before potentially transferring the approval process to the local officials through the Uniform Code. However, this potential option would require an amendment to the existing Part 1205 regulation through the rule making process.

Implementation through Part 1205 would still require a detailed review of the ICCPC, a creation of the administrative procedures that would implement it, and the necessary regulatory changes to Part 1205. However, it might prove less challenging for DBSC to implement it than it would be for the local officials. In any case, items to consider when implementing ICCPC provisions are topics such as the impact on future maintenance provisions that may conflict with other code requirements, qualifications of designers and peer reviewers, training for DBSC staff and/or local officials, the need for operational manuals/reports and recertification of them, among others.

RESEARCH

Home Structure Fires

September 2017

Marty Ahrens

Abstract
NFPA estimates that U.S. fire departments responded to an estimated average of 358,500 home structure fires per year during 2011-2015. These fires caused an average of 2,510 civilian deaths, 12,300 civilian injuries, and $6.7 billion in direct property damage per year. Seventy percent of reported home fires and 84% of the home fire deaths occurred in one- or two-family homes. The remainder occurred in apartments or other multi-family housing. Estimates were derived from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's fire department experience survey.

Over the five-years, cooking equipment was the leading cause of home structure fires and fire injuries and the second leading cause of fire deaths. Smoking materials were the leading cause of home fire deaths. Heating equipment was the second leading cause of home fires and home fire injuries, the third leading cause of home fire deaths, and the leading cause of fire deaths in one- or two-family homes. Leading causes vary in individual years.

One-quarter (24%) of home fire deaths were caused by fires that started in the living room, family room, or den; another quarter (23%) resulted from fires originating in the bedroom; and 17% were caused by fires starting in the kitchen. Almost three of every five (57%) home deaths resulted from fires with no smoke alarms or no working smoke alarms. Only 7% of home fires occurred in properties with fire sprinklers. Compared to other age groups, older adults were more likely to be killed by a home fire.

Keywords: fire statistics, home fires, residential fires, apartment fires, dwelling fires, multi-family housing

Acknowledgements
The National Fire Protection Association thanks all the fire departments and state fire authorities who participate in the National Fire Incident Reporting System (NFIRS) and the annual NFPA fire experience survey. These firefighters are the original sources of the detailed data that make this analysis possible. Their contributions allow us to estimate the size of the fire problem.

We are also grateful to the U.S. Fire Administration for its work in developing, coordinating, and maintaining NFIRS.

For more information about the National Fire Protection Association, visit www.nfpa.org or call 617-770-3000. To learn more about Research, Data & Analytics go to www.nfpa.org/research or call 617-984-7451.

Copies of this analysis are available from:

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NFPA No. USS12G

FACT SHEET » RESEARCH

U.S. Home Structure Fires

U.S. fire departments responded to an estimated average of 358,500 home structure[1] fires per year during 2011–2015. These fires caused an annual average of

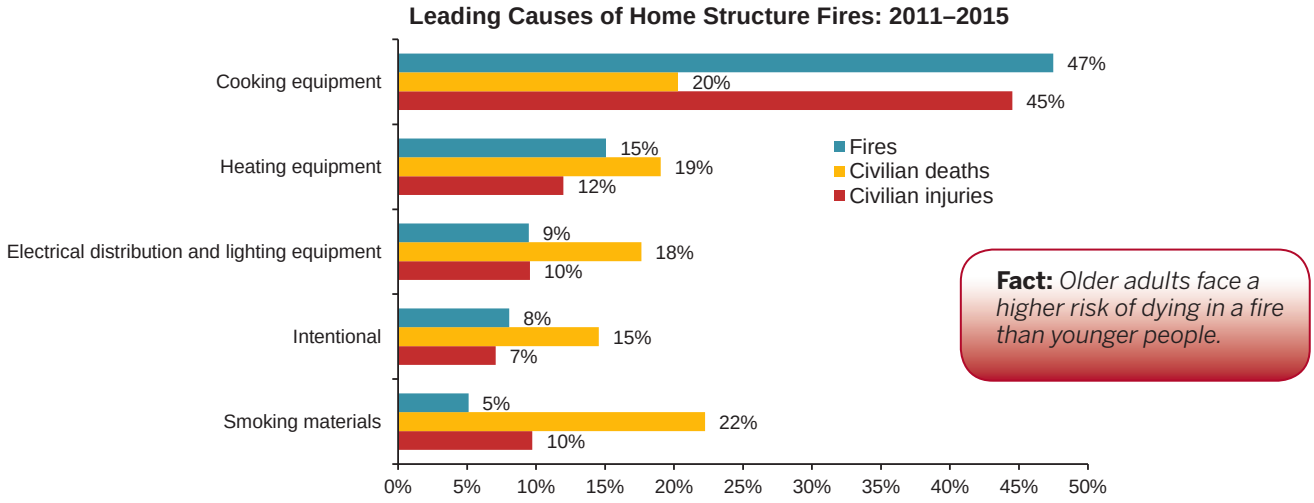
- 2,510 civilian fire deaths
- 12,300 civilian fire injuries
- $6.7 billion in direct damage

- Home fires caused 93% of all structure fire deaths and 80% of all fire deaths.
- On average, seven people died in U.S. home fires per day.

Causes and Circumstances of Home Fires in 2011–2015

Cooking equipment was the leading cause of home structure fires and home fire injuries and was the second leading cause of home fire deaths.

Smoking materials were the leading cause of civilian home fire deaths over this period. Heating equipment was the second most common cause of home fires and home fire injuries and was the third leading cause of home fire deaths.



Fact: *Older adults face a higher risk of dying in a fire than younger people.*

Almost all homes have at least one smoke alarm, but almost three out of five home fire deaths in 2011–2015 resulted from fires in homes where either no smoke alarm was present (39%), or at least one alarm was present but none operated (18%).

[1]Homes include one- or two-family homes, manufactured homes, as well as apartments or other multifamily housing. In general, any fire that occurs in or on a structure is considered a structure fire, even if the fire was limited to contents and the building itself was not damaged. Estimates were derived from USFA's National Fire Incident Reporting System and NFPA's annual fire department experience survey.

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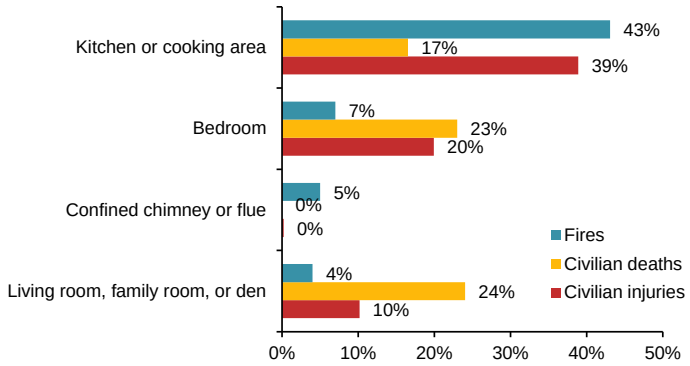
Where do home fires start?

- More than two of every five (43%) reported home structure fires started in the kitchen. Two out of five (39%) home fire injuries were caused by these incidents. In addition, 17% of home fire deaths resulted from kitchen fires.
- Just 4% of home fires started in the living room, family room, or den, but these incidents caused one-quarter (24%) of home fire deaths and 10% of home fire injuries.
- Only 7% of reported home fires started in the bedroom, but these fires caused almost one-quarter (23%) of home fire deaths and one in five (20%) of home fire injuries.
- Fires confined to chimneys or flues accounted for 5% of all reported home fires. These fires caused very few casualties.

Leading Areas of Origin in Home Structure Fires: 2011–2015

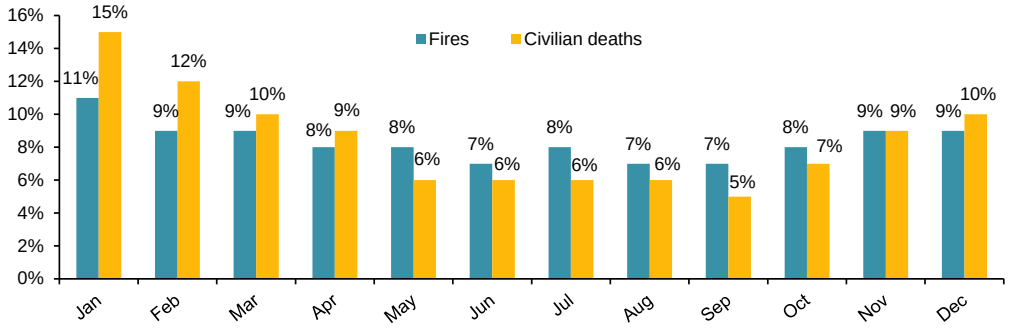


Fact: *18% of home fire deaths resulted from fires beginning with upholstered furniture.*

Home fires and home fire deaths peaked in the cooler months. Patterns for time of day were different for fires than for deaths.

- Home structure fires peaked around the dinner hours between 5:00 p.m. and 8:00 p.m.
- Only one in five (20%) of reported home structure fires occurred between 11:00 p.m. and 7:00 a.m. These fires caused half (52%) of all home fire deaths.

Home Structure Fires by Month: 2011–2015



Source: *Home Structure Fires*

Source: NFPA Research: www.nfpa.org/research
Contact information: 617-984-7451 or research@nfpa.org

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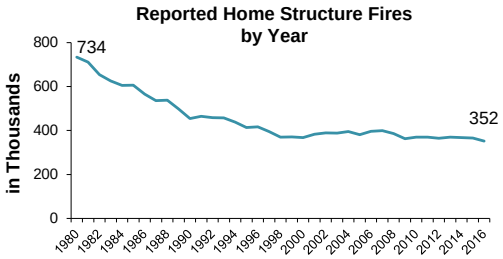
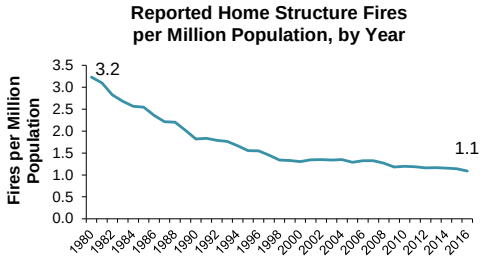
Trends in Home Structure Fires and Fire Deaths

The good news: Estimates from NFPA's Fire Department Experience Survey show that since 1980, the number of reported home* fires and fire deaths has been cut roughly in half. The rate of deaths per million fires has dropped even further. We have made great progress in preventing home fires.

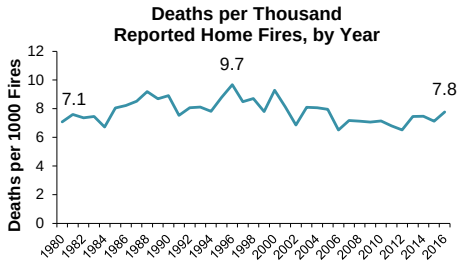
The bad news: Since 2006, the number of home fire deaths has largely plateaued, hovering between 2,380 and 2,865. The death rate per 1,000 fires was in fact higher in 2016 than in 1980.

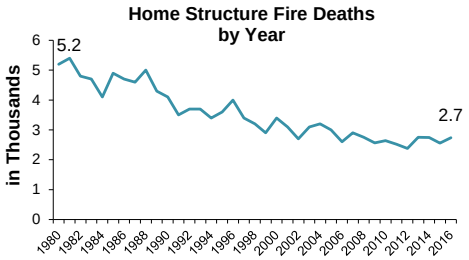


Reports of home fires fell 52% from 734,000 in 1980 to a new low of 352,000 in 2016. From 2015 to 2016, home fires fell 4%.

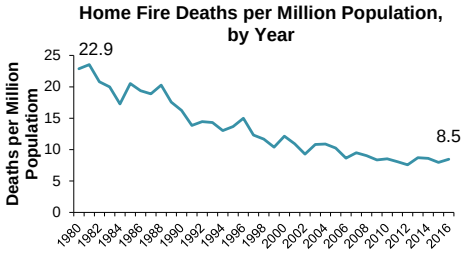


With the growth in U.S. population, the rate of fires per million population fell even more. The rate for fires fell 65% from 3.2 in 1980 to 1.1 in 2016.





Civilian deaths resulting from these fires fell 47% from 5,200 in 1980 to 2,735 in 2016. From 2015 to 2016, home fire deaths rose 7%.



The drop in the rate of home fire deaths per million population was also greater than the drop in actual fire deaths, falling 63% from 22.9 in 1980 to 8.5 in 2016.

In 2016, the death rate per 1,000 fires was 7.8, 10% higher than the 7.1 rate in 1980 and consistent with the average over the 37-year average. We have been more successful in preventing fires than in preventing death after a fire is reported.

Rates were generally higher from 1985–2005. The peak, in 1996, was 9.7 deaths per 1,000 fires. Overall, this line is much flatter than the other trend lines.

* Homes include one- or two-family homes, manufactured housing, apartments, and other multifamily housing.

Source: NFPA Research: www.nfpa.org/research
Contact information: 617-984-7451 or research@nfpa.org

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Executive Summary

An average of 358,500 reported home structure fires caused 2,510 civilian deaths per year. During the five-year period of 2011-2015, U.S. fire departments responded to an estimated average of 358,500 home structure fires per year. These fires caused an annual average of 2,510 civilian deaths, 12,300 civilian fire injuries, and $6.7 billion in direct property damage. Home fires accounted for three-quarters (73%) of all reported structure fires, 93% of civilian structure fire deaths, 87% of the civilian structure fire injuries, and two-thirds (68%) of direct structure fire property loss.

Overall, home structure fires accounted for 27% of all types of reported fires, including vehicle and outside fires, 80% of total civilian fire deaths, 78% of all civilian fire injuries, and 55% of estimated total property damage from fires.

During 2011-2015, roughly one of every 326 households per year had a reported home fire. On average, seven people died in U.S. home fires per day.

These statistics are estimates derived from data provided by the fire service. The statistics about fires and associated losses in this analysis are national estimates of fires reported to U.S. municipal fire departments. These estimates are projections based on the detailed information collected by the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS 5.0) and NFPA's annual Fire Experience Survey (FES). Fires reported only to federal or state agencies or industrial fire brigades are not captured here. The term "home" includes one- and two-family homes, manufactured homes, and apartments or other multi-family housing, regardless of ownership. In general, any fire in or on a structure is considered a structure fire, including incidents in which only contents were damaged.

FIRE VICTIMS

Older adults were more likely to die in home fires than people in other age groups. Understanding how home fires occur and the factors that contribute to injury or death is essential to finding better ways to prevent such incidents. Age is an important factor in the risk of fire death. In 2011-2015, people 65 and older were 2.3 times as likely to die from a home fire as the general population. Those 85 and older faced a risk 3.3 times as high as average. The risk was 1.6 times higher than average for people age 55-64. Children under five now have a fire death risk that is slightly lower than overall population.

Non-fatal injuries have a different age profile. The difference between age groups was smaller for non-fatal fire injuries. The highest risk (1.4 times the overall population) was seen among adults 85 or older. Adults age 25-54 were 1.2 times more likely than the overall population to be injured in a home fire.

For more information about home fire victims, see NFPA's report, *Characteristics of Home Fire Victims*.

WHEN ARE HOME FIRES MOST COMMON?

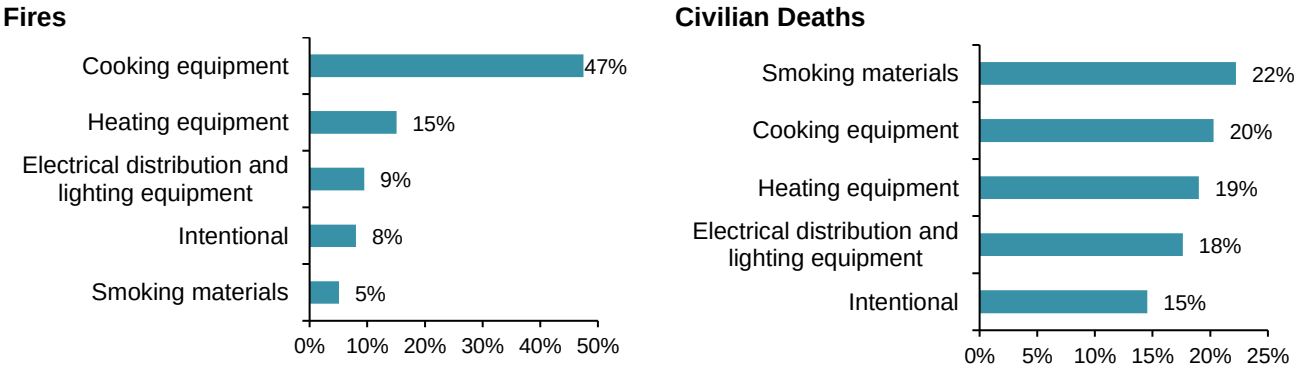
Home fire deaths occur more often in cooler months and between 11:00 p.m. and 7:00 a.m. In 2011-2015, 47% of home structure fires and 56% of home structure fire deaths occurred in the five months of November through March. Reported home fires peaked around the dinner hours of 5:00 to 8:00 p.m. While just one-fifth (20%) of reported home fires occurred between 11:00 p.m. and 7:00 a.m., half (52%) of the home fire deaths resulted from fires reported during these hours.

LEADING CAUSES OF HOME FIRES IN 2011-2015

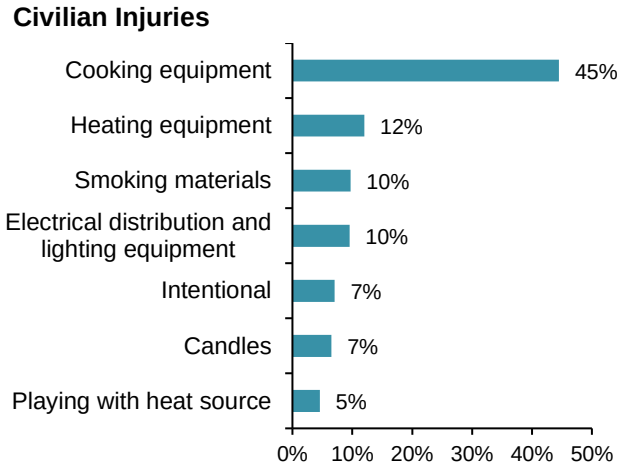
The ranking of fire causes can vary from year to year. The rankings here are based on the annual average percentage of fires and losses in 2011-2015. Rankings for individual years vary. The likely severity of a reported fire can be measured in deaths or injuries per 1,000 fires and average loss per fire. Note that causes were pulled from several data elements in NFIRS, so double counting is possible.

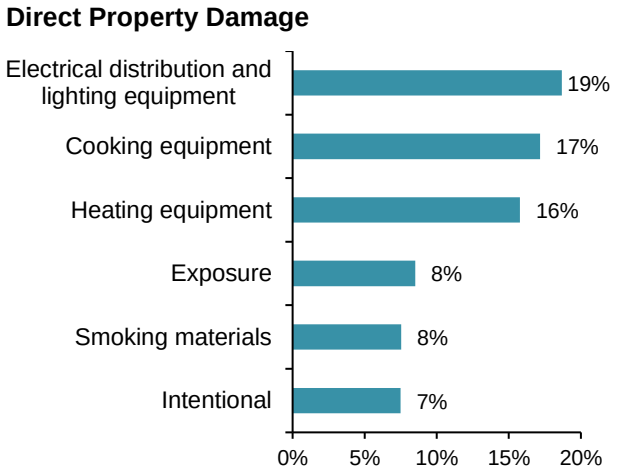
Cooking equipment continues to be the leading cause of reported home structure fires and civilian fire injuries. Cooking was the second leading cause of fire deaths for this total period, and in two years, ranked first. In 2011-2015, cooking equipment was involved in almost half (47%) of home structure fires, one of every five (20%) home fire deaths, 45% of home fire injuries, and 17% of the direct property damage. It is also the leading cause of unreported fires. In a survey of unreported residential fires in 2004-2005, the Consumer Product Safety Commission (CPSC) found that U.S. households had 50 cooking equipment fires they did not report for every such incident reported to the fire department. While cooking was the leading cause of fires and fire injuries, it ranked lower on the casualties per 1,000 fires and last among the major causes in average loss per fire.

Leading Causes of Home Structure Fires: 2011-2015



Leading Causes of Home Structure Fires: 2011-2015 (continued)





Smoking materials caused 22% of home fire deaths. Fires started by smoking materials have long been the leading cause of fire fatalities. This was still true for the overall 2011-2015 period. Only 5% of home fires were started by smoking materials, yet these fires caused more than one-fifth (22%) of the deaths, 10% of home fire injuries, and 8% of the direct property damage. The death rate of 30.5 deaths per 1,000 fires was 4.4 times the overall rate of 7.0 deaths per 1,000 reported home fires.

One out of five home fire deaths was caused by heating equipment. Heating equipment was the second leading cause of home fires (15%) and home fire injuries (12%), and the third leading cause of home fire deaths (19%) and of the direct property damage (16%) during this period. Chimney fires were the most common type of heating fire. Space heaters, including portable heaters and those that are permanently installed, were involved in five of every six home heating fire deaths and in 16% of home fire deaths from all causes. Loss rates per 1,000 fires started by heating equipment overall were lower than many other major causes because of lower losses associated with chimney and central heating fires.

Electrical distribution or lighting equipment was the leading cause of home fire property damage. These incidents caused 18% of the home fire deaths, 10% of the home fire injuries, and 19% of the direct property damage.

Intentional firesetting caused 8% of home structure fires. These fires caused 15% of home fire deaths, 7% of home fire injuries and 7% of direct property damage. Intentional fires heavily overlap with, but are not identical to, legally defined arson fires.

Playing with heat source and candles had the highest rates of injuries per 1,000 fires. Only 2% of home fires were started by someone, usually a child, playing with fire. These incidents caused 3% of home fire deaths, 5% of home fires injuries, 2% of direct property damage and had an injury rate of 92.8 per 1,000 reported home fires. This is roughly three times the overall rate of 34.3 injuries per 1,000 fires.

Candles also started 2% of home fires. These fires caused 3% of the deaths, 7% of the injuries and 4% of the direct property damage. Candle fires had an injury rate of 92.0 per 1,000 fires.

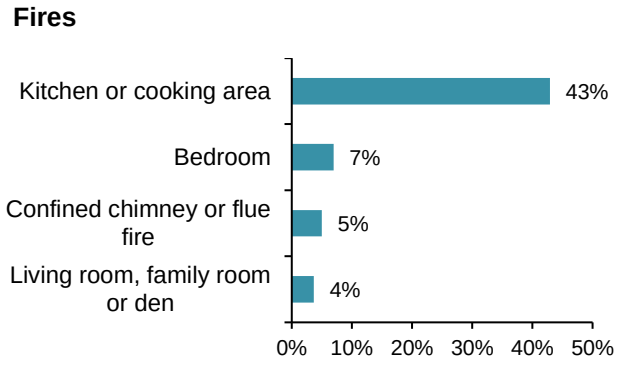
Fires started by exposures had the highest average property loss of the major causes. The 3% of home fires started by exposure to another fire caused 1% of the deaths, 1% of the injuries and 8% of the direct property damage. The average loss of $48,000 per fire was 2.6 times the average loss of $18,800 per fire.

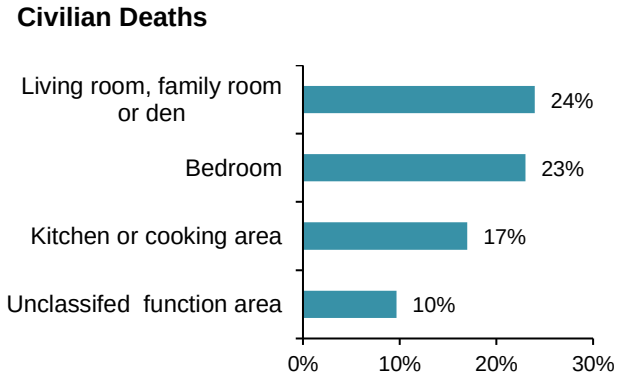
AREA OF ORIGIN AND FIRE SPREAD

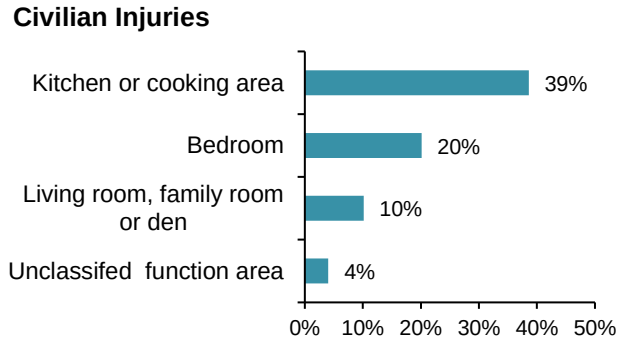
The kitchen was the leading area of origin for home fires and injuries. More than two of every five (43%) reported home fires in 2011-2015 started in the kitchen or cooking area. These fires caused 17% of the home fire deaths and two of every five (39%) home fire injuries. Apartment or multi-family housing fires were more likely to start in the kitchen (67%) than were fires in one- or two-family homes (33%).

Seven percent of home structure fires started in the bedroom. These incidents caused almost one-quarter (23%) of the home fire deaths and one-fifth (20%) of the civilian fire injuries.

Leading Areas of Origin in Home Structure Fires: 2011-2015







Five percent of home fires originated in and were confined to the chimney or flue. These fires resulted in less than 1% of civilian fire deaths, injuries or associated property damage.

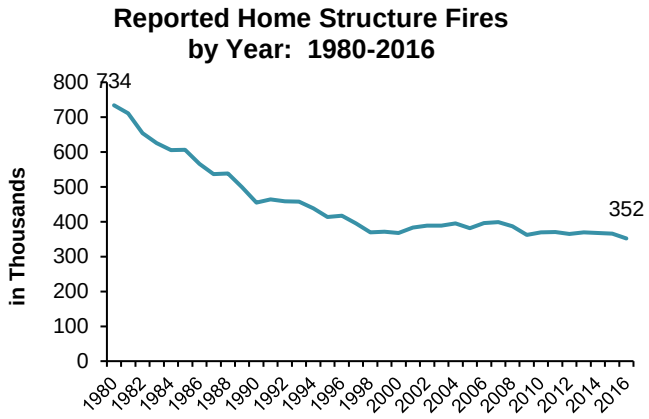
Only 4% of home structure fires originated in the living room, family room, or den, but these incidents caused one-quarter (24%) of the deaths and 10% of the injuries.

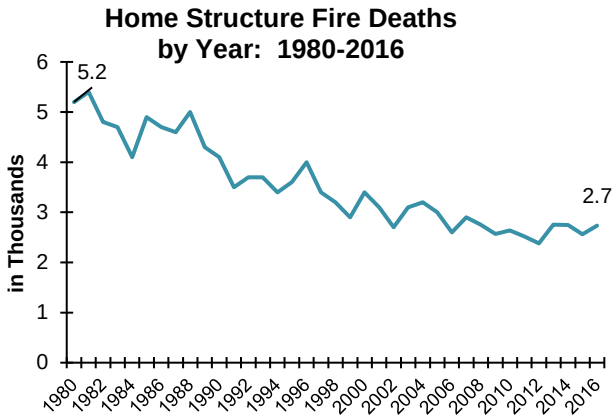
Most reported home fires were small. Fifty-six percent were confined to the object of origin. While the fire spread beyond the room of origin in only one-quarter (25%) of the reported fires, four out of five (81%) home fire deaths and almost half (46%) of the fire injuries were caused by these incidents.

TRENDS

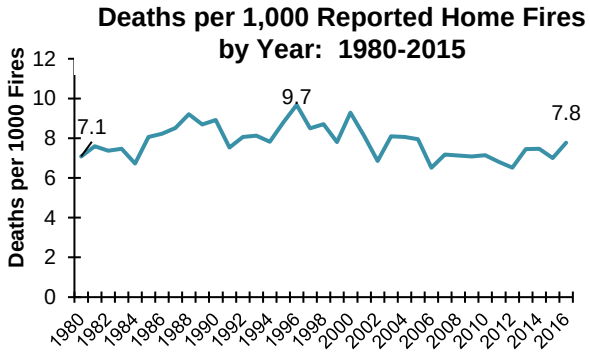
Estimates of reported home fires and home fire deaths in 2016 were roughly half as high as in 1980. Results from NFPA's annual survey of fire department experience are provided annually in NFPA's *Fire Loss in the United States* series of reports. Estimates of home fires and losses for 2016 show that substantial progress has been made since 1980, the first year in which national estimates of specific fire problems were available. Reported home fires fell 52% from 734,000 in 1980 to a new low of 352,000 in 2016. The decline was sharpest during the 1980s and continued more slowly in the 1990s. From 2015 to 2016, home fires fell 4%.

Deaths resulting from these fires fell 47% from 5,200 in 1980 to 2,735 in 2016.





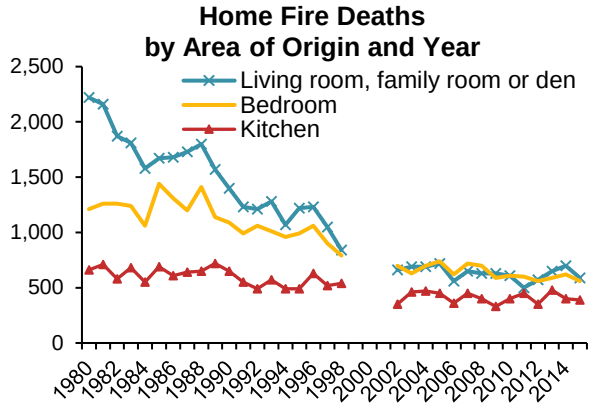
Home fire and fire death rates in 2016 were only one third as high as in 1980. The rate of reported home fires per million population fell 65% from 3.2 in 1980 to 1.1 in 2015, while the home fire death rate per million population fell 63% from 22.9 in 1980 to 8.0 in 2015.



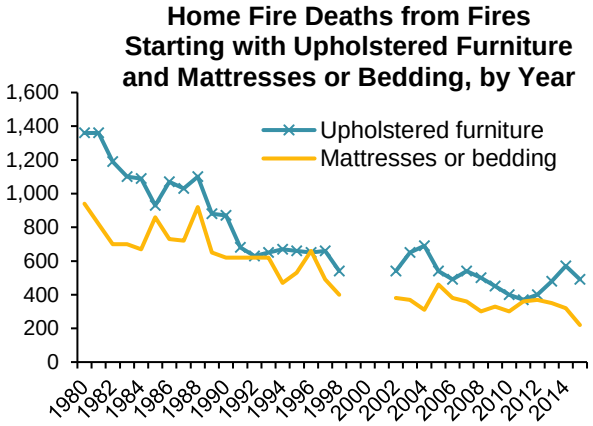
Deaths per 1,000 reported fires were higher in 2016 than in 1980. More progress has been made in reducing the number of fires and deaths than in preventing death in a reported fire. In 2016, the death rate per 1,000 fires was 7.8, 10% higher than the 7.1 rate in 1980. Rates were generally higher from 1985-2005. The peak, in 1996, was 9.7 deaths per 1,000 fires. Overall, this line is much flatter than the other trend lines.

REDUCTIONS IN HOME FIRE DEATHS BY MAJOR CAUSAL FACTORS

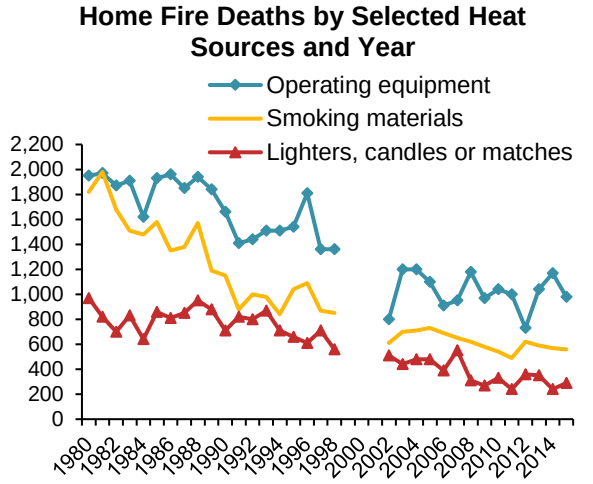
These estimates were derived from NFIRS and the FES. At present, the most recent NFIRS data we have is for 2015. Version 5.0 of NFIRS was introduced in 1999 and adopted gradually over the next several years. Due to the instability of estimates for 1999-2001, the transition years to NFIRS 5.0, estimates for these years are not shown in the graphs.



Deaths from fires originating in living rooms, family rooms, or dens fell more sharply than deaths from fires starting in bedrooms and kitchens. Historically, the largest number of fire deaths resulted from fires starting in living rooms, family rooms, or dens. The difference between the three leading areas of origin for home fire deaths has shrunk over time, with deaths from fires starting in bedrooms now sometimes exceeding the number resulting from fires starting in living rooms, family rooms or dens. Compared to home fire deaths in 1980-1984, the average number of deaths in 2011-2015 resulting from fires starting in the living room, family room, or den fell 69%; deaths from fires beginning in the bedroom fell 52%; and deaths from kitchen fires dropped 34%.

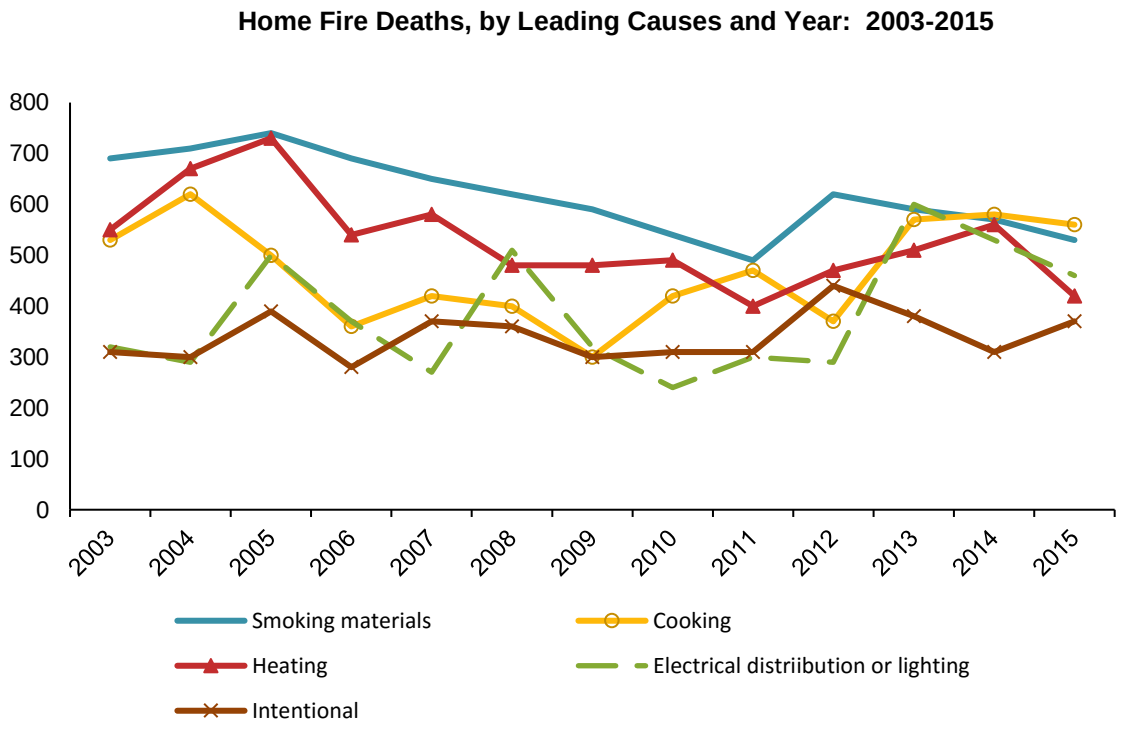


Fire deaths from upholstered furniture and mattress or bedding fires fell 62% and 57%, respectively, since the early 1980s. The two leading items in home fire deaths remain upholstered furniture, first ignited in 18% of home fire deaths in 2011-2015, and mattresses or bedding, first ignited in 13% of the deaths. The average number of deaths from home fires beginning with upholstered furniture was 62% lower than the 1980-1984 average. Deaths from fires starting with mattresses or bedding were down 57% from the earlier period.



Smoking material fire deaths have fallen more than deaths from fires started by small open flames or operating equipment. The annual average death toll from fires started by smoking materials was 67% lower in 2011-2015 than it was in 1980-1984, while deaths from fires started by small open flames (lighters, candles, or matches) were down 63% compared to the earlier period. The death toll from fires started by some type of operating equipment was 47% lower in the more recent period than in 1980-1984.

In recent years, the leading causes of home fire deaths have converged more than in the past. For most of the past few decades, smoking materials were clearly the leading cause. While smoking materials were the leading cause of home fire deaths over the five-year period of 2011-2015, cooking was the leading cause in 2014 and 2015. Electrical distribution and lighting equipment caused the largest number of home fire deaths in 2013.



PREVENTING FIRES AND FIRE LOSSES

Estimates in this report can be used to define scenarios or develop further research. Statistics by themselves do not solve problems. They need to be used. The engineering community can use these estimates to develop likely scenarios for product testing. Public educators may use it to set priorities. Often, the statistics indicate areas where further research is needed. More specifics may be needed about a general class of product involved in fires. How effective are changes that have already been made? What could be done to increase safety?

Safer products can prevent many fires from starting. Considerable progress has been made but more is left to be done. Equipment and other product redesign, such as the "fire-safe" cigarette which was designed to stop burning if not actively smoked, or automatic shut-offs on heating equipment, cooking equipment, or irons can mitigate human error and improve safety. Such changes may be the most effective and inexpensive approach to fire prevention. The CPSC issues product safety standards and recalls of unsafe consumer products and collects reports about such products from the public.

Almost three of every five home fire deaths resulted from fires with no working smoke alarms. A smoke alarm was present in almost three-quarters (73%) of reported home fires, substantially less than the 96% of homes with smoke alarms that were reported in telephone surveys done for NFPA in the past few years. However, 57% of home fire deaths resulted from fires in which either no smoke alarm was present (39%) or at least one alarm was present but did not operate (18%). Forty-two percent of home fire deaths resulted from fires with operating smoke alarms. Only a minority of homes have interconnected smoke alarms. When smoke alarms are interconnected, all alarms will sound when one is activated, enabling the warning to sound throughout the home.

People who are in the room of fire origin may be intimately involved with ignition. Their clothing or the furniture they are sitting in or lying on may catch fire. Traditional means of fire protection may not save them. Even if they are not intimately involved, being in the room where the fire starts dramatically reduces escape time. In some cases, victims were unable to take action to save themselves.

Home fire sprinklers can control a fire until help arrives even when the occupants are unable to act. Fire sprinklers were present in only 7% of reported home fires in 2010-2014. The death rate per 1,000 reported home fires was 81% lower when sprinkler systems were present compared to reported home fires without any automatic extinguishing systems.[1] For more information on how sprinklers can help, see firesprinklerinitiative.org.

Additional safety information on the topics discussed can be found at NFPA's website, nfpa.org.

[1] M. Ahrens, *U.S. Experience with Sprinklers*, (Quincy, MA: National Fire Protection Association, 2017), 9

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Note: Italicized items provide definitions, background, and general information about the estimates.

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Home Structure Fires: Overview

358,500 home structure fires were reported per year. During the five-year period of 2011-2015, U.S. fire departments responded to an estimated average of 358,500 home structure fires per year. These fires caused an annual average of 2,510 civilian (non-fire service) deaths, 12,300 civilian fire injuries, and $6.7 billion in direct property damage. On average, seven people died in U.S. home fires per day. Table A provides a more detailed breakdown of losses by occupancy. Seven of every ten (70%) reported home structure fires and five of every six (84%) of the home fire deaths occurred in one- or two-family homes, including manufactured homes.

Table A.
Reported Home Structure Fires by Property Use
2011-2015 Annual Averages

Property Use	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
One- or two-family home, including manufactured home	249,500	(70%)	2,100	(84%)	8,120	(66%)	$5,393	(80%)
Apartment or other multi-family housing	109,000	(30%)	400	(16%)	4,170	(34%)	$1,329	(20%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)

On average, one of every 326 households reported a fire per year. According to the U.S Census Bureau's American Community Survey, in 2011-2015, the U.S. had an average population of roughly 316.5 million residents living in 116.9 million households.[2] Dividing the total number of households by the number of home fires yields a rate of roughly one reported fire for every 326 households per year.[3]

93% of civilian structure fire deaths resulted from fires in the home. Based on annual averages for 2011-2015, the 358,500 reported home structure fires accounted for three-quarters (73%) of the 489,600 structure fires, 93% of the 2,700 civilian structure fire deaths, 87% of the 14,170 civilian structure fire injuries, and 68% of the $9.8 billion in direct property loss per year.

Overall, home structure fires accounted for 27% of all types of reported fires, including vehicle and outside fires, 80% of total civilian fire deaths, 78% of all civilian fire injuries, and 55% of estimated total property damage from fires.

The number of reported home structure fires has been cut in half since 1980 even as the population and number of homes grew. NFPA's annual Fire Experience Survey (FES) provides the earliest estimates of reported home fires and associated losses although it lacks the detail about causes and circumstances found in the National Fire Incident Reporting System (NFIRS).

[2] American Community Survey, U.S. Census Bureau, "ACS Demographic and Housing Estimates: 2011-2015 American Community Survey 5-Year Estimates," and "Households and Families, 2011-2015 American Community Survey 5-Year Estimates." Accessed on August 4, 2017.
[3] Estimates of fires are based on structures, not number of housing units or households. The calculation assumes one household per fire.

Data Sources, Definitions and Conventions Used in this Report

Unless otherwise specified, the statistics in this analysis are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to federal or state agencies or industrial fire brigades. The 2011-2015 estimates are projections based on the detailed information collected in Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS 5.0) and the National Fire Protection Association's (NFPA's) annual fire department experience survey. Except for property use and incident type, fires with unknown or unreported data were allocated proportionally in calculations of national estimates.

What is included in NFPA's definition of "home?"

- detached dwellings, duplexes, and manufactured housing, and
- apartments, tenements, and flats, townhouses, row houses, and other multi-family housing, regardless of ownership.

In general, any fire that occurs in or on a structure is considered a structure fire, even if the fire was limited to contents and the building itself was not damaged.

A few key tables (Tables A-C) have been incorporated into the text. The remainder of the tables are found after the text. Tables 1-12 describe reported fires, causes and circumstances in homes overall. Tables 1A-12A provide comparable estimates for fires and causes in one-or two-family homes. Estimates for apartment fires are found in Tables 1B-12B. Tables 13-15 show home fire death trends for specific causal factors.

What are "confined" and "non-confined" fires?

NFIRS 5.0 includes a category of structure fires collectively referred to as "confined fires," identified by incident type. These include confined cooking fires, confined chimney or flue fires, confined trash fires, confined fuel burner or boiler fires, confined commercial compactor fires, and confined incinerator fires (incident type 113-118). Table A.1 in Appendix A shows that confined fires accounted for a larger share of fires in apartments or other multi-family housing than in one- and two-family homes. Losses are generally minimal in these fires, which by definition, are assumed to have been limited to the object of origin. Although causal data is not required for these fires, it is sometimes present.

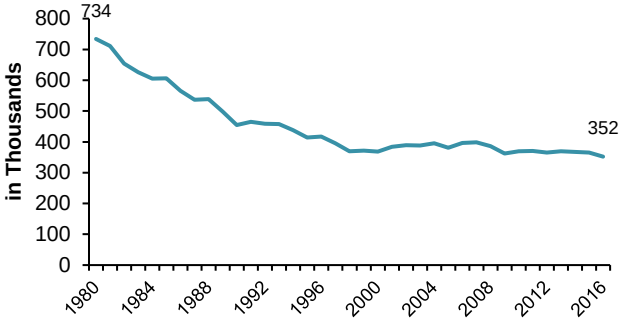
Confined and non-confined fires were analyzed separately and then summed for Cause of Ignition, Heat Source, Factor Contributing to Ignition, Area of Origin, and Item First Ignited. Non-confined fires and confined cooking fires were analyzed for Equipment Involved in Ignition. Other types of confined fires were not broken out further and were listed by incident type.

Additional information

Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Except for trend tables, property damage has not been adjusted for inflation. Fires are rounded to the nearest hundred, civilian deaths and injuries are generally rounded to the nearest ten (except for estimates based solely on the NFPA's fire experience survey where deaths are rounded to the nearest five and injuries to the nearest 25), and direct property damage is rounded to the nearest million dollars. Additional details on the methodology may be found in Appendix A and B.

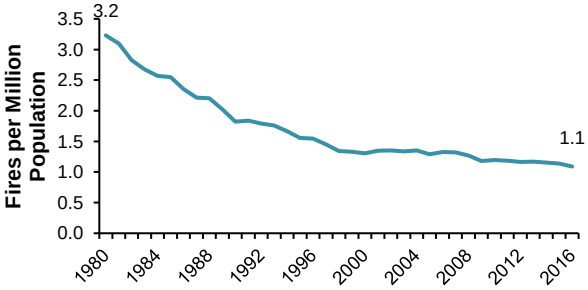
Tables 1, 1A and 1B show the number of reported fires in homes, one- or two-family homes, and apartments or other multi-family from housing, respectively, based on data collected by NFPA's FES and published in *Fire Loss in the United States* series of reports.[4] Losses associated with these fires are also shown. Figure 1A shows that the 352,000 home structure fires reported in 2016 was 52% less than the 734,000 fires reported in 1980 and the lowest recorded. The decline was sharpest during the 1980s and continued more slowly in the 1990s. Figure 1B shows that the drop in reported home structure fires was even greater when population growth was considered. The rate of reported home fires per million population fell 65% from 3.23 in 1980 to 1.09 in 2016.

Figure 1A.
Reported Home Structure Fires
by Year: 1980-2016



Source: NFPA's *Fire Loss in the United States*.

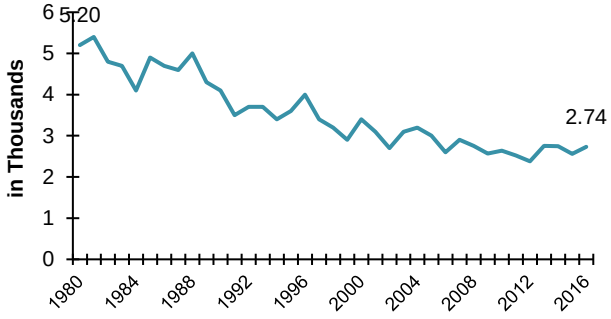
Figure 1B.
Reported Home Structure Fires
per Million Population, by Year: 1980-2016



Source: NFPA's *Fire Loss in the United States* and U.S. Census Bureau.

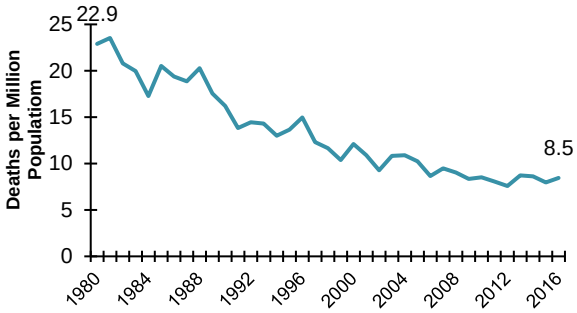
Home fire deaths have also been cut in half. Figure 2A shows that the estimated home fire death toll of 2,735 in 2016 was 47% lower than the 5,200 reported in 1980. From 2006 on, home fire deaths have consistently been below 3,000, a mark that was reached only twice between 1980 and 2005. Deaths increased 7% from 2015 to 2016. Figure 2B shows the rate of home fire deaths per million population was also greater than the drop in actual fire deaths, falling 63% from 22.9 in 1980 to 8.5 in 2016.

Figure 2A.
Reported Home Structure Fire Deaths
by Year: 1980-2016



Source: NFPA's *Fire Loss in the United States*.

Figure 2B.
Reported Home Structure Fire Deaths
per Million Population, by Year: 1980-2016



Source: NFPA's *Fire Loss in the United States* and U.S. Census Bureau.

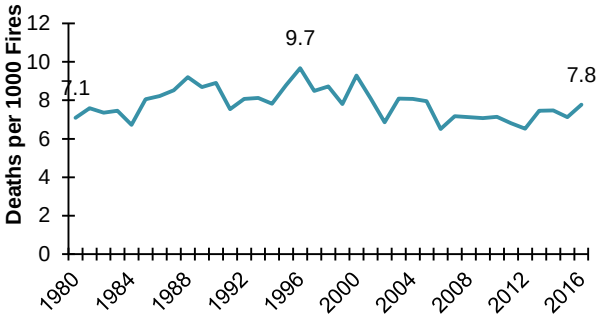
[4] The NFPA survey is separate from NFIRS. Although the definitions are the same, the survey does not include provisions for capturing unknown data. National estimates derived solely from NFPA's survey will differ somewhat from estimates derived when NFIRS and NFPA survey are combined.

Deaths per 1,000 reported fires were higher in 2016 than in 1980. More progress has been made in reducing the number of fires and deaths than in preventing death after a fire has been reported. In 2016, the death rate per 1,000 fires was 7.8, 10% higher than the 7.1 rate in 1980.

Rates were generally higher from 1985-2005. The peak, in 1996, was 9.7 deaths per 1,000 fires.

Overall, this line is much flatter than the other trend lines.

Figure 2C.
Deaths per Thousand
Reported Home Fires, by Year: 1980-2016

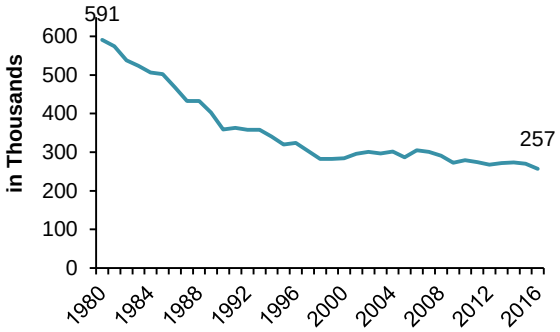


Source: NFPA's *Fire Loss in the United States*.

The home fire problem is dominated by and resembles the fire experience of one-and two-family homes. Figure 3 shows that the trend in reported one- and two-family home fires (including fires in manufactured housing) closely resembles that of fires in all homes.

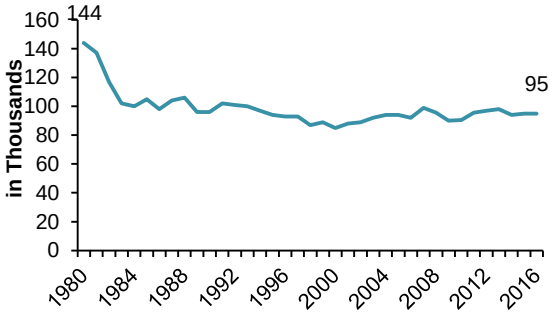
Figure 4 shows that the trend line is rather different in apartments or multi-family homes. These fires fell sharply in the early 1980s, declined more gradually in the 1990s, and have been relatively stable since then. The smallest number of apartment or multi-family housing fires was reported in 2000. The details from NFIRS show that two-thirds (69%) of the apartment fires reported during 2011-2015 had one of the confined structure fire incident types as compared to 39% of the fires in one-and two-family homes. It is possible that minor apartment or multi-family housing fires are more likely to be reported to fire departments than are minor fires in one- or two-family homes.

Figure 3. Reported Structure Fires
in One- or Two-Family Homes
by Year: 1980-2016



Source: NFPA's *Fire Loss in the United States.*

Figure 4. Reported Structure Fires
in Apartments or Multi-family Housing
by Year: 1980-2016



Unless otherwise specified, the estimates in the remainder of the report are derived from both NFIRS and NFPA's annual fire department experience survey.

When Do Home Fires Occur?

Home fire deaths peak in the cooler months. Figure 5 and Table 2 show that more than half (56%) of home structure fire deaths occurred in November, December January, February or March. Almost half (47%) of the fires were reported during these five months. This pattern reflects the influence of heating equipment fires and more time spent inside. If events were distributed evenly across the year, there would be 8.3% each month or 42% over the five-month period. Almost three-quarters of the home heating equipment fires (71%) and four of every five heating fire deaths (79%) in 2009-2013 were reported in these five months.[5]

Figure 5.
Home Structure Fires and Deaths by Month: 2011-2015

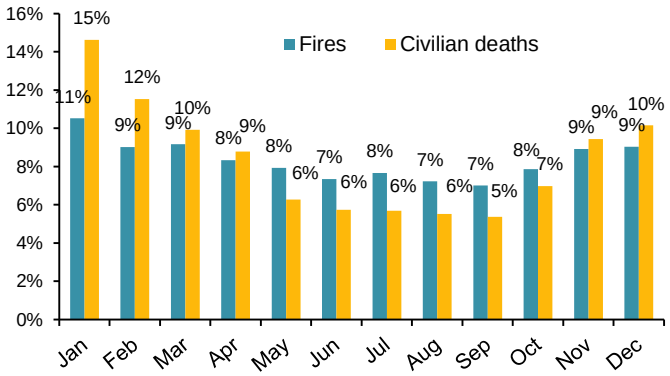
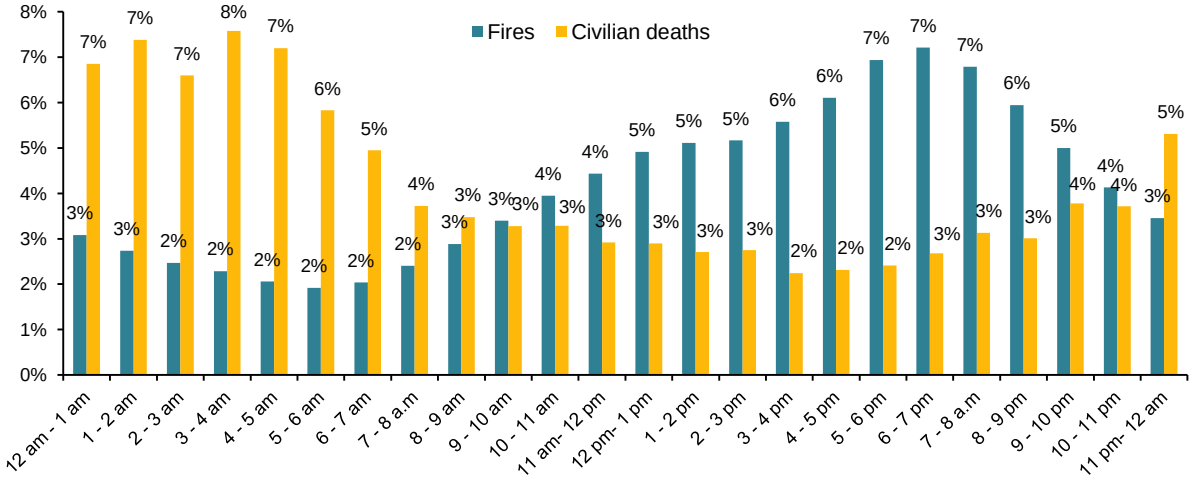


Table 3 shows that Sunday was the peak day for reported home fires; Saturday had the second largest number of fires. Home fire deaths peaked on Saturday, with Sunday having the second highest number of such deaths. Home fire injuries were also most common on Saturdays and Sundays.

Fires reported between 11 p.m. and 7 a.m. caused half of home fire deaths. Figure 6 and Table 4 show that reported home fires peaked around the dinner hours of 5:00 to 8:00 p.m. Only one in five (20%) of the reported home fires occurred between 11:00 p.m. and 7:00 a.m. but half (52%) of the home fire deaths resulted from incidents reported during these hours. The patterns are similar in one- or two-family homes and in apartments or other multi-family housing.

Figure 6. Home Structure Fires, by Alarm Time: 2011-2015



[5] R Campbell. *Home Fires Involving Heating Equipment*, (Quincy, MA: National Fire Protection Association, 2016) p. 22.

Ages of Victims

Older adults face a higher risk of dying in home fires than do young people.
To prevent fire deaths and injuries, it is necessary to know something about the victims and fire causes. Age data can be helpful when considering how to target intervention efforts. During this period, people 65 and over made up only 14% of the U.S. population, but they accounted for one-third (33%) of the home fire deaths. (See Figure 7 and Table B.) Children under 15 accounted for 19% of the population and 12% of the fire deaths.

Figure 7. Home Structure Fire Civilian Deaths and Injuries, by Age Group: 2011-2015

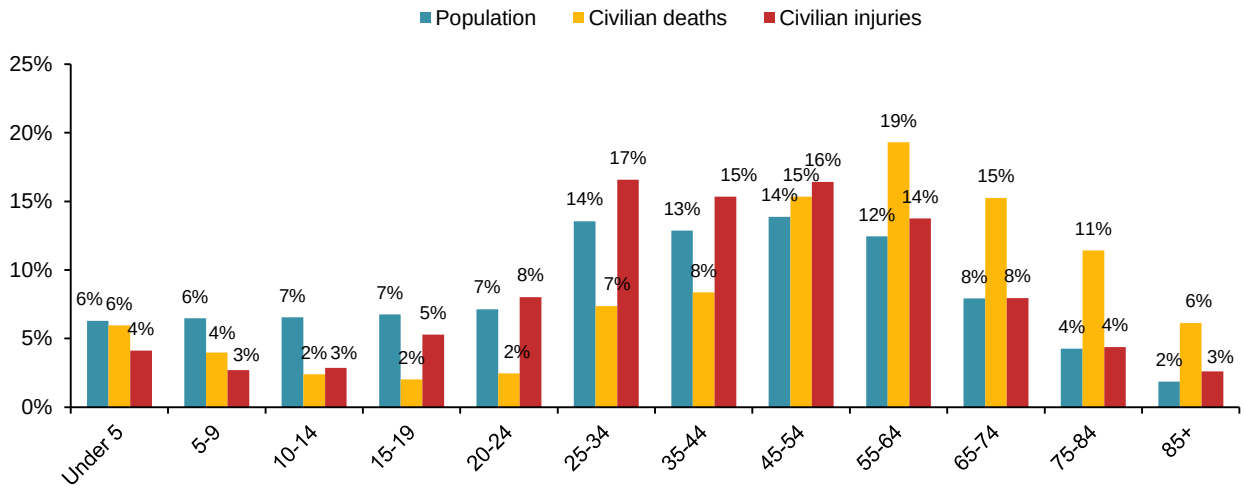


Figure 8 shows that people 85 and older were 3.3 times more likely than the overall population to be fatally injured in a home fire. For all people 65 or older, the relative risk was 2.3 times that of the overall population. While children under five have historically faced a higher risk of fire death than most other age groups, this has not been true in recent years. In 2011-2015, these young children had a home fire death risk slightly lower than that of the overall population.

Table B and Figure 8 show that the relative risk of home fire death was higher for people in the 45-54 age group or older than it was for young children.

The risk of home fire injury varies less by age than does the risk of home fire death. The highest risk (1.4 times that of the overall population) was seen among adults 85 or older. Adults age 25-54 were 1.2 times more likely than the overall population to be injured in a home fire.

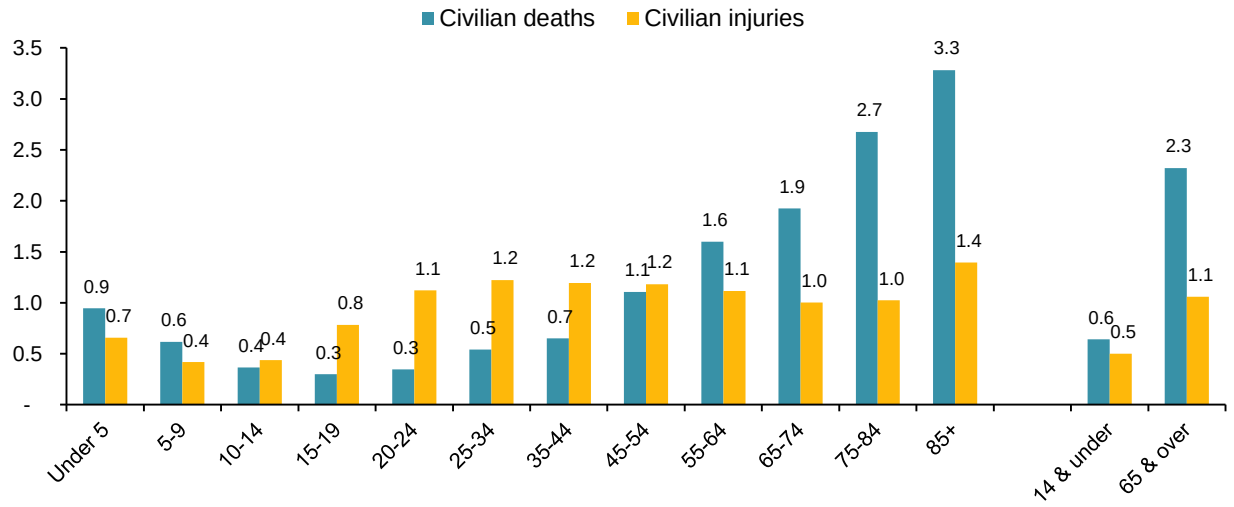
Relative Risk

Relative risk compares the risk of a specific group versus the population at large. The relative risk of fire death or injury for each age group was calculated by dividing the rate of death or injury per million population for each age group by the rate of the general population. A risk of 1.0 means the risk is the same as that of the overall population.

Table B. U.S. Civilian Fire Deaths and Injuries Reported in Home Structure Fires, by Age Group 2011-2015 Annual Averages

Age Group	Population in Millions		Civilian Deaths		Deaths per Million	Relative Risk of Death	Civilian Injuries		Injuries per Million	Relative Risk of Injury
Under 5	19.9	(6%)	150	(6%)	7.5	0.9	510	(4%)	25.5	0.7
5-9	20.5	(6%)	100	(4%)	4.9	0.6	330	(3%)	16.2	0.4
10-14	20.7	(7%)	60	(2%)	2.9	0.4	350	(3%)	17.0	0.4
15-19	21.4	(7%)	50	(2%)	2.4	0.3	650	(5%)	30.4	0.8
20-24	22.6	(7%)	60	(2%)	2.7	0.3	990	(8%)	43.6	1.1
25-34	42.9	(14%)	180	(7%)	4.3	0.5	2,040	(17%)	47.5	1.2
35-44	40.7	(13%)	210	(8%)	5.2	0.7	1,890	(15%)	46.4	1.2
45-54	43.9	(14%)	380	(15%)	8.8	1.1	2,020	(16%)	46.0	1.2
55-64	39.4	(12%)	480	(19%)	12.3	1.6	1,690	(14%)	42.9	1.1
65-74	25.1	(8%)	380	(15%)	15.2	1.9	980	(8%)	38.9	1.0
75-84	13.5	(4%)	290	(11%)	21.2	2.7	540	(4%)	39.8	1.0
85+	5.9	(2%)	150	(6%)	26.0	3.3	320	(3%)	54.2	1.4
Total	316.5	(100%)	2,510	(100%)	7.9	1.0	12,300	(100%)	38.8	1.0
Selected age groups										
14 and under	61.1	(19%)	310	(12%)	5.1	0.6	1,190	(10%)	19.5	0.5
65 and over	44.6	(14%)	820	(33%)	18.4	2.3	1,830	(15%)	41.1	1.1

Figure 8. Relative Risk of Civilian Death and Injury from Home Structure Fires, by Age Group 2011-2015



Note: See previous page for definition of relative risk. A relative risk of 1.0 is equal to that of the overall population.

Source: NFIRS, NFPA's fire experience survey and U.S. Census Bureau, 2011-2015 American Community Survey 5-year estimates.

Leading Causes of Reported Home Structure Fires

Table 5 and Figure 9 show the leading causes of home structure fires based on 2011-2015 annual averages with data summarized from several NFIRS data elements. Cooking equipment remained the leading cause of home structure fires and civilian fire injuries while smoking materials remained the leading cause of fire deaths overall during the five-year period. Note that the ranking of fire causes can vary from year to year.

Figure 9. Leading Causes of Reported Home Structure Fires: 2011-2015

Figure 9A. Fires

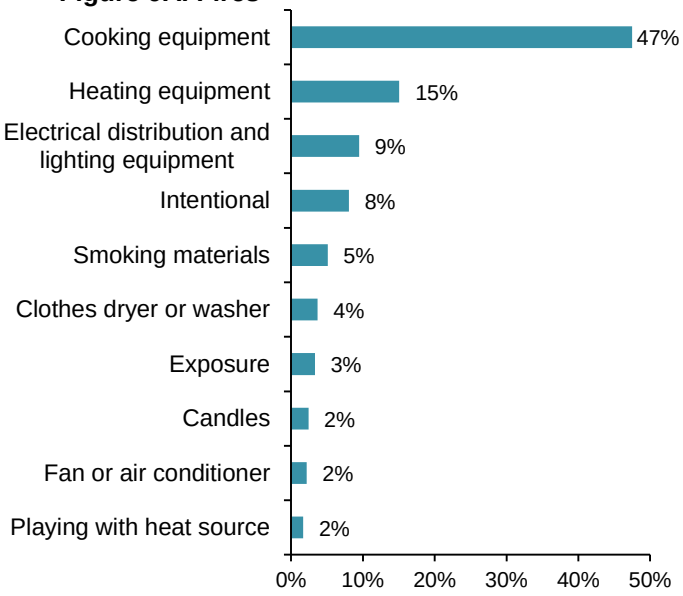


Figure 9B. Civilian Deaths

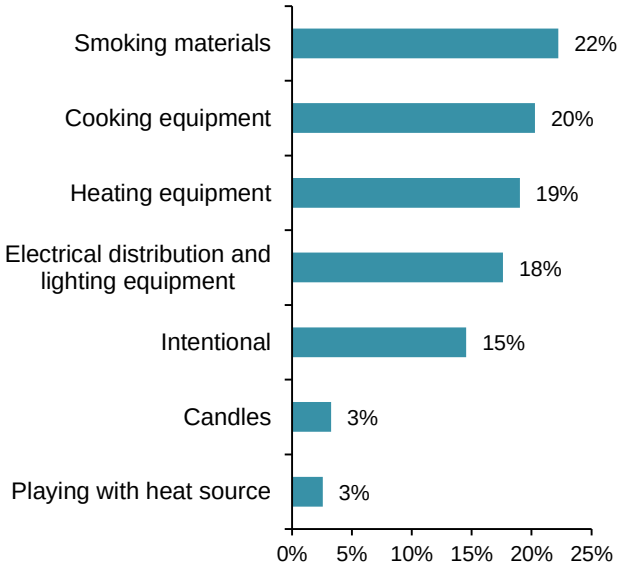


Figure 9C. Civilian Injuries

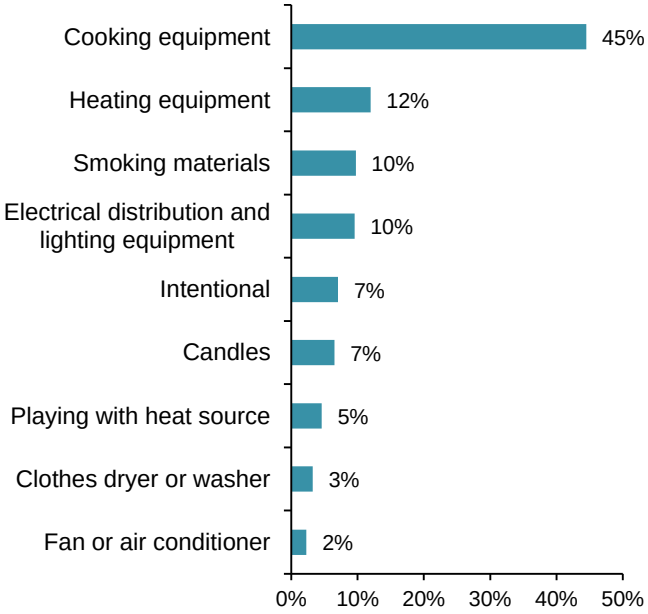
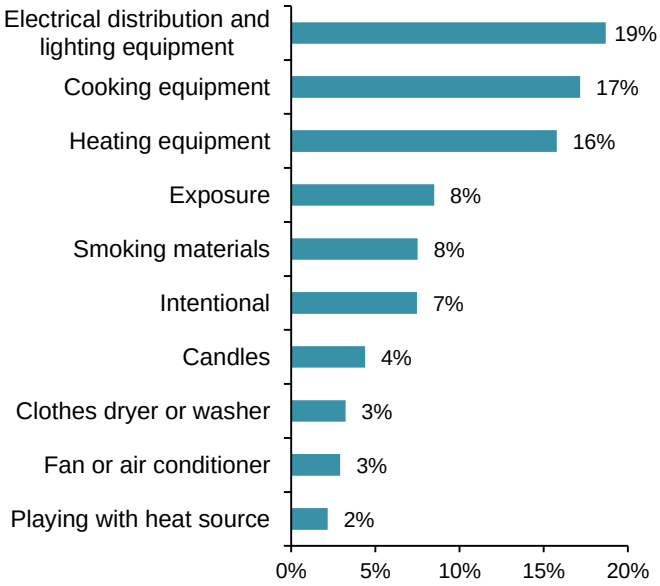


Figure 9D. Direct Property Damage



Each of the causes shown in Figure 9 will be discussed in more detail on the following pages. When some type of equipment is identified as a cause, it means the equipment was involved in the ignition and need not mean that the equipment was defective or malfunctioned. Improper use of equipment can also lead to fire.

The broad categories of cause of ignition, a field in NFIRS 5.0, are shown in Table 6. More detailed information on equipment involved in ignition may be found in Table 7. Table 8 shows more information on heat sources. Factors contributing to ignition are shown in Table 9.

How Leading Cause Categories Were Chosen and Calculated

In some cases, the equipment involved in ignition is most relevant; heat source, the field "cause," and factor contributing to ignition also provide relevant information. The causes shown here are not mutually exclusive when they have been pulled from different fields. Note also that multiple entries are allowed for factors contributing to ignition. Causal factors that lack detail (such as "unintentional" or "failure of equipment or heat source" in the cause field, or "heat from operating or powered equipment" or "arcing" in the heat source field) were not included in this listing. The causes shown are those that are well defined, account for at least 2% of the fires, and have clear prevention strategies or have historically been of interest. Detailed information about the methodology and what is included may be found in Appendix B.

Leading fire causes differ for one- or two-family homes vs. apartments or multi-family housing. Figure 10 and Tables 5A and 5B show that the cause profile for apartment or multi-family housing fires differs markedly from the profile for one- or two-family home fires, despite the fact their two leading causes are the same.

Cooking equipment was involved in more than one-third (37%) of the fires in one- or two-family homes and almost three-quarters (71%) of the fires in apartments or other multi-family housing. Heating equipment was involved in one of every five (19%) fires in one- or two-family homes but only 7% of the fires in apartments or other multi-family housing. Although heating equipment was the leading cause of fire deaths in one- or two-family homes (21%), heating ranked fifth among causes of fire death in apartments or other multi-family homes (9%). Smoking materials were the leading cause of fire death (33%) in apartment or multi-family homes and the second leading cause of fire deaths (20%) in one- or two-family homes.

The systems that tend to be centrally installed, maintained and supervised in apartment buildings, such as heating, cause a smaller share of the fires in apartments than in one- or two-family homes. Those causes that are more likely to reflect the actions of the occupants, such as cooking, rank high in both kinds of properties. This is not surprising given the role human error plays in many fires.

It is also possible that more minor fires are reported when they occur in apartments or multi-family housing than in one- or two-family homes, resulting in a different cause distribution.

Because reported fires in one- or two-family homes outnumber apartment or multi-family housing fires by more than two to one, the fires in one- or two-family homes dominate the cause profile for home fires overall.

Figure 10. Leading Causes of Reported Structure Fires and Fire Deaths in One- or Two-Family Homes vs. Apartments or Multi-Family Housing: 2011-2015

Figure 10A.
Fires in One- or Two-Family Homes

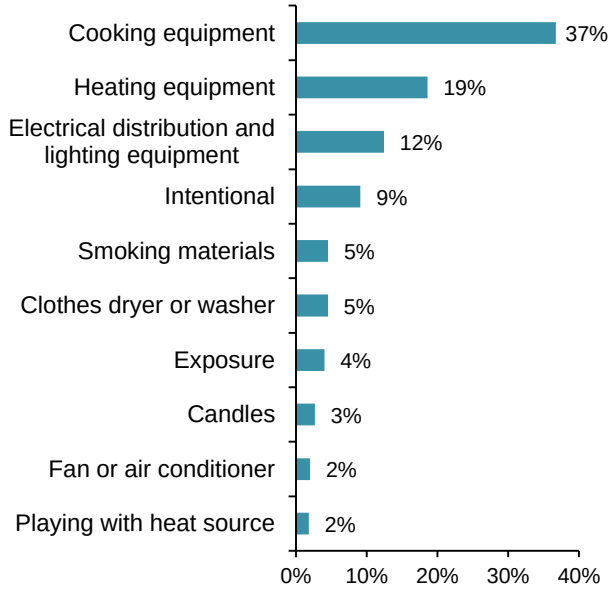


Figure 10B.
Fires in Apartments or Multi-Family Housing

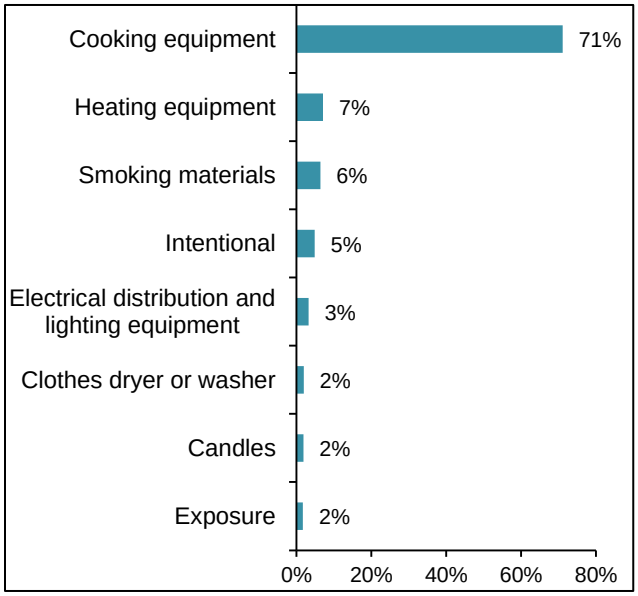


Figure 10C.
Fire Deaths in One- or Two-Family Homes

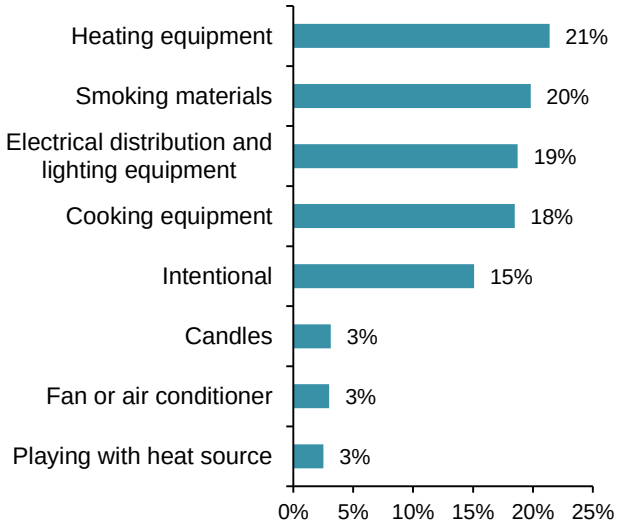
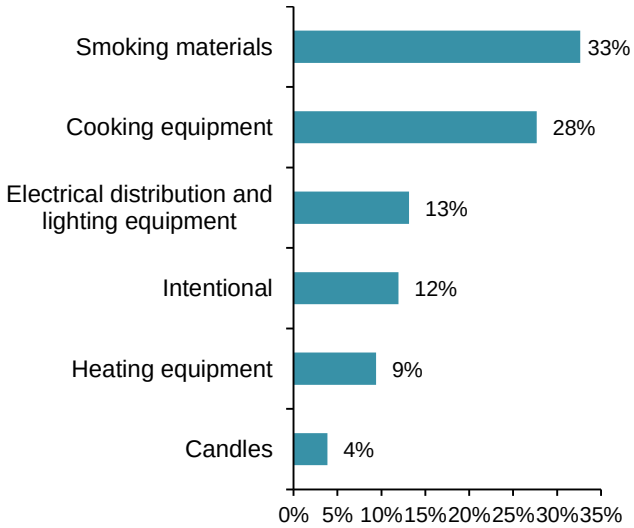


Figure 10D.
Fire Deaths in Apartments or Multi-Family Housing



Severity rates associated with different fire causes should also be considered.
The likely impact of reported fires of different causes can be estimated in deaths or injuries per 1,000 fires and average loss per fire. While cooking is the leading cause of fires and fire injuries,

Figure 11 shows that cooking ranked eighth among the major causes of death per 1,000 fires, sixth in injuries per 1,000 fires, and last among the major causes in average loss per fire.

Figure 11. Death and Injury Rates per 1,000 Reported Fires, by Cause of Fire: 2011-2015

Figure 11A. Deaths per 1,000 Fires

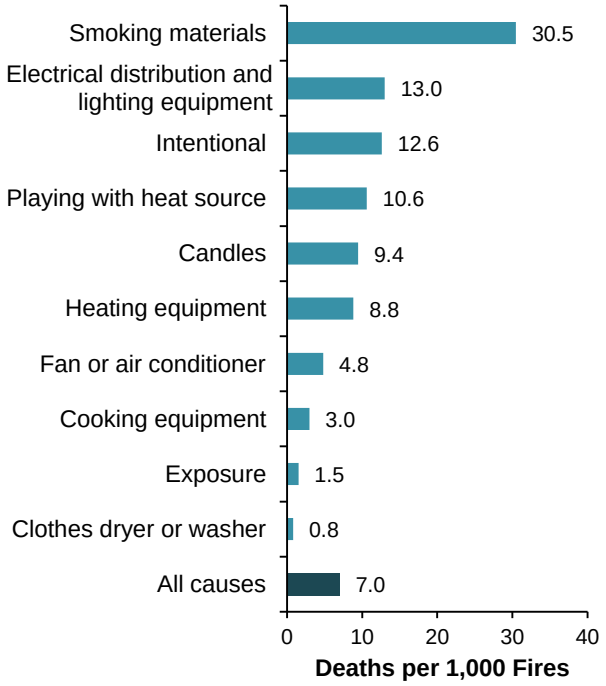


Figure 11B. Injuries per 1,000 Fires

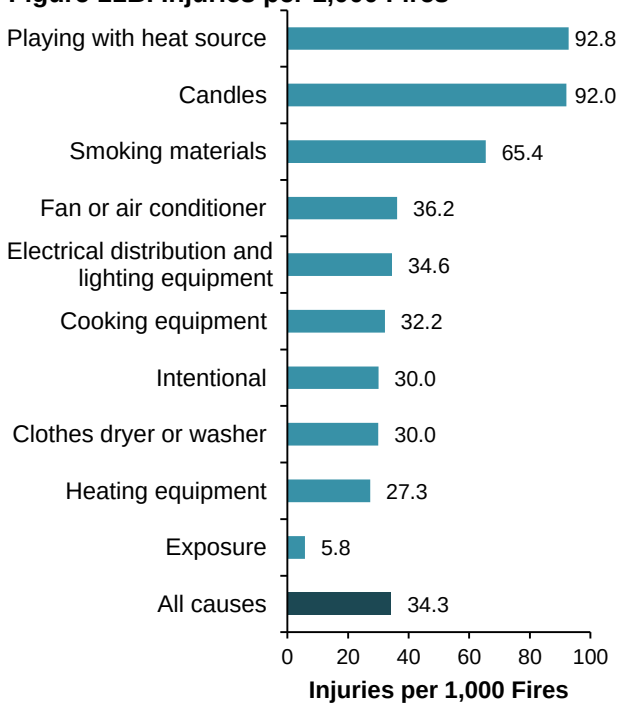


Figure 11C. Average Loss per Reported Home Fire by Cause of Fire: 2011-2015

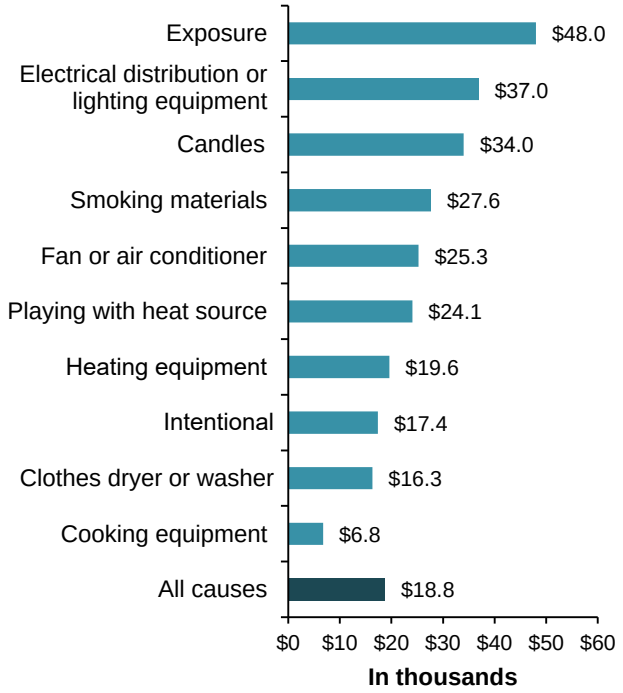


Figure 9C showed that playing with heat source ranked seventh in the number of injuries, but Figure 11B shows that the rate of 92.8 injuries per 1,000 fires was higher for playing than any of the other major causes.

Figure 9A and 9D show that exposure to other fire ranked seventh among the major causes in fire frequency and was fourth in direct property damage, yet Figure 11C shows that these fires had highest average property loss ($48,000) per fire.

While candles rank sixth through eighth on frequency of fires, casualties or property damage, fires started by candles had the second highest rate of injuries (92.0) per thousand fires and third highest average loss ($34,000) per fire.

Caution-

Estimates for 2012-2015 were influenced by a change in NFIRS rules.

In an effort to improve data quality while reducing inconsistent or missing data, the USFA introduced a new data entry rule for NFIRS in 2012. When the heat source or factor contributing to ignition is reported as being equipment-related, the specific type of equipment involved in ignition must be identified.

This had two effects on the reported data. First, the number of fires coded with undetermined causal factors other than equipment involved in ignition increased (i.e., some fires were no longer reported as being equipment-related). At the same time, more fires were reported as having some specific type of equipment involved in ignition, because now all the fires caused by heat from equipment have that added detail. This resulted in a marked increase in reported fires involving electrical distribution or lighting equipment. With the allocation of unknown data, the impact of these changes becomes even greater.

Due to these changes, caution should be used when interpreting recent trend data.

Almost half of all reported home structure fires were caused by cooking. During 2011-2015, cooking equipment was the leading cause of home fires and home fire injuries, and the second leading cause of fire deaths, direct property damage. According to the definitions used here, cooking equipment is equipment used to heat or warm food (unlike other kitchen equipment such as refrigerators, food processors, or can openers). Human error was a factor in many cooking fires. For example, unattended equipment was a contributing factor in one-third (30%) of the cooking fires reported in 2009-2013 and abandoned material was a factor in 11%.[6]

During 2011-2015, cooking equipment was involved in an estimated annual average of 170,200 reported home structure fires, 510 civilian fire deaths, 5,470 civilian injuries, and $1.2 billion in direct property damage. Three-quarters of these fires had incident types indicating a cooking fire confined to the vessel or object of origin. [7]

Cooking equipment was involved in almost half (47%) of the reported home structure fires, one of every five (20%) home fire deaths, 45% of home fire injuries, and 17% of the direct property damage. Cooking equipment was involved in 71% of the reported apartment or other multi-family housing fires, nearly twice the 37% share in one- or two-family homes. Despite the difference, cooking was the leading cause of fires in both property types. Ranges or cooktops were involved in three of every five (62%) home fires involving cooking equipment and almost one-third (30%) of all reported home fires.

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[6] M Ahrens. *Home Fires Involving Cooking Equipment,* (Quincy, MA: NFPA, 2015) 34.

[7] For purposes of this analysis, cooking equipment was assumed to be involved in all confined cooking fires (NFIRS incident type 113).

During this period, cooking equipment caused 3.0 deaths per thousand fires, 32.2 injuries per thousand fires, and an average loss of $6,800 per fire.

Figure 12 shows trend data for cooking fires and associated civilian deaths for recent years. The most recent data shows that during 2015, U.S. fire departments responded to an estimated 179,000 home structure fires involving cooking equipment. These fires caused 560 civilian deaths, 5,200 civilian injuries, and $1.2 billion in direct property damage. While the number of cooking fires was fairly consistent prior to 2012, fire death estimates were more volatile.

Figure 12. Home Cooking Fires and Deaths, by Year

Figure 12A. Fires

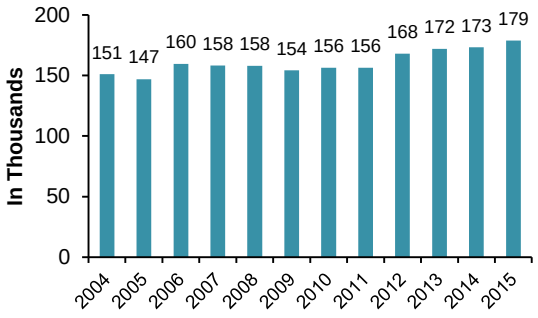
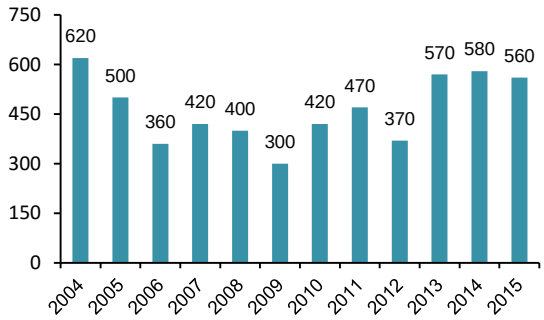


Figure 12B. Civilian Deaths



The 2004-2005 CPSC's Residential Fire Survey asked about all fires, including incidents that were not attended by the fire service.[8] The authors estimated that U.S. households experienced a total of 7.4 million fires per year, including 7.2 million that were not attended by the fire service. Cooking appliances were involved in 4.8 million home fires, including 4.7 million incidents that the fire department did not attend. One of every 22 occupied households had a cooking fire. The survey found that cooking equipment was involved in roughly two-thirds of home fire incidents, including 64% of the total and 65% of fires that the fire department did not attend. The overwhelming majority of cooking equipment fires (50 to one) did not have the fire department in attendance.

Additional information about reported home cooking fires may be found in NFPA's report, *Home Fires Involving Cooking Equipment*, by Marty Ahrens. In 2006, the U.S. Fire Administration and NFPA produced a study, *Behavioral Mitigation of Cooking Fires*. This study includes a more comprehensive literature review about cooking fires, cooking fire safety, and non-fire cooking burns. NFPA also has more resources on cooking safety, including tip sheets and several short videos.

Heating equipment was involved in 15% of home fires. Heating equipment is considered the cause of a fire when the equipment provided the heat to start the fire, even if the equipment itself was working properly. Home heating equipment includes central heating units, portable and stationary space heaters, fireplaces, chimneys, and heat transfer systems, as well as some devices not used to heat living spaces, most notably hot water heaters.

[8] Michael A. Greene and Craig Andres. *2004-2005 National Sample Survey of Unreported Residential Fires.* U.S. Consumer Product Safety Commission, July 2009, pp. 102, 127-133. Online at http://www.cpsc.gov/library/foia/foia09/os/UnreportedResidentialFires.pdf .

During 2011-2015, heating equipment was involved in the ignition of an estimated annual average of 54,000 reported home structure fires that resulted in an average of 480 civilian fire deaths, 1,470 civilian injuries, and $1.1 billion in direct property damage per year.

Heating equipment was involved in 15% of reported home structure fires, one of every five (19%) home fire deaths, 12% of the home fire injuries, and 16% of the direct property damage. Overall, heating equipment ranked second in home fires and home fire injuries, and third in home fire deaths and direct property damage. Space heaters, including portable heaters and those that are permanently installed, were involved in five of every six home heating fire deaths and in 16% of overall home fire deaths.

Heating equipment was involved in 19% of the fires in one- or two-family homes but only 7% of the apartment fires. One of every five (21%) fire deaths in one- or two-family homes resulted from fires involving heating equipment compared to only 9% of the apartment or multi-family home fire deaths. For purposes of this analysis, all confined chimney or flue fires and confined fuel burner or boiler fires are considered heating equipment fires.

During this period, heating equipment caused 8.8 deaths per thousand reported home fires, 27.3 injuries per thousand fires, and an average loss of $19,600 per fire.

Figure 13A shows that home heating fires hit a new low in 2015. More fluctuation is seen in the frequency of deaths, as shown in Figure 13B. Heating equipment was involved in an estimated 49,800 reported home fires in 2015, resulting in 420 civilian fire deaths, 1,330 civilian fire injuries, and $949 million in direct property damage.

Figure 13. Home Heating Fires and Deaths, by Year

Figure 13A. Fires

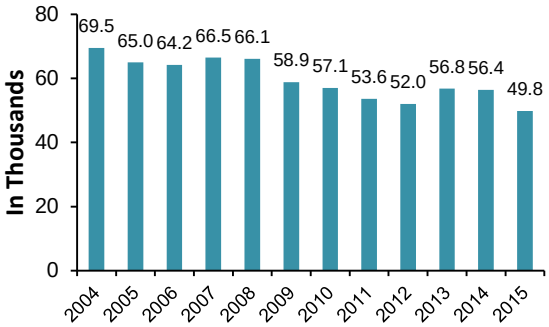
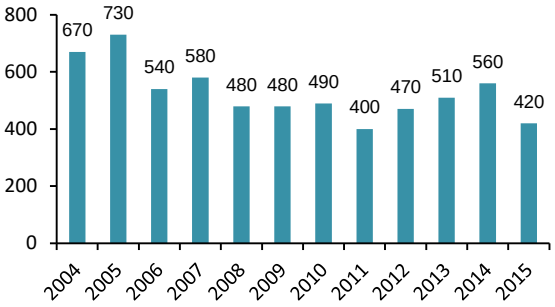


Figure 13B. Civilian Deaths



Additional information about specific types of home heating equipment may be found in NFPA's report, *Home Fires Involving Heating Equipment*, by Richard Campbell. His analysis also provides more details on the equipment involved in the confined heating equipment fires. Additional safety information may be found at nfpa.org/heating.

Smoking materials caused 22% of home fire deaths in 2011-2015. When looking at annual averages, smoking materials have been the leading cause of home fire deaths for decades. (In

some individual years, this varied.) During 2011-2015, smoking materials were the heat source in an estimated annual average of 18,300 reported home structure fires, 560 civilian fire deaths, 1,200 civilian fire injuries, and $506 million in direct property damage.[9] Only 5% of reported home structure fires were started by smoking materials, but these fires caused more than one-fifth (22%) of the home fire deaths. Smoking materials also caused 10% of all reported home fire injuries and 8% of the direct property damage. One-third (33%) of the apartment fire deaths resulted from fires started by smoking materials compared to 20% of the fire deaths in one- or two-family homes.

During the fire-year period of 2011-2015, smoking material incidents ranked fifth in number of home fires, first in home fire deaths, tied for third in home fire injuries and tied for fifth in direct property damage. Smoking materials caused 30.5 deaths per thousand fires, 65.4 injuries per thousand fires, and an average loss of $27,600 per fire.

Figure 14A shows that since 2009, smoking materials started 17,000 to 21,000 home structure fires. In 2015, smoking materials started an estimated 17,300 reported home structure fires, resulting in 530 civilian deaths, 1,050 civilian fire injuries, and $462 million in direct property damage. Figure 14B shows that deaths from these fires declined steadily from 2005 through 2011 before bouncing back from the record low seen in 2011 and starting a new decline.

Figure 14. Home Smoking Material Fires and Deaths, by Year

Figure 14A. Fires

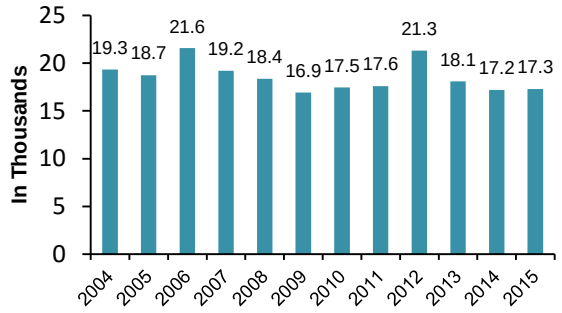
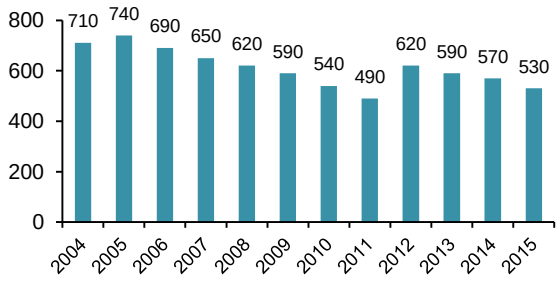


Figure 14B. Civilian Deaths



Additional information about fires started by smoking materials may be found in NFPA's report, *The Smoking Material Fire Problem*. Educational materials are also available.

On average, electrical distribution or lighting equipment was involved in an average of 34,000 home structure fires per year. Electrical distribution or lighting equipment includes:

- fixed wiring, meters or meter boxes, and switches, receptacles or outlets;
- transformers or associated overcurrent or disconnect equipment;
- power switch gear or overcurrent protection devices;
- cords and plugs, and
- lighting equipment.

During 2011-2015, electrical distribution or lighting equipment was involved in the ignition of 34,000 reported home structure fires, on average, per year. These fires caused an annual average

[9] A proportional share of fires with heat sources from unclassified open flame or smoking materials are included in the candle and smoking material estimates.

of 440 deaths, 1,170 injuries, and $1.3 billion in direct property damage. Electrical distribution or lighting equipment was involved in 9% of the home structure fires (12% in one- or two-family homes and 3% in apartments or other multi-family housing), 18% of the home fire deaths, 10% of the home fire injuries, and 19% of the direct property damage.

Overall, electrical distribution or lighting equipment ranked third among the major fire causes in number of home fires, fourth in home fire deaths, tied for third in home fire injuries, and first in direct property damage. During this period, electrical distribution or lighting equipment caused 13.0 deaths per thousand fires, 34.6 injuries per thousand fires, and an average loss of $37,000 per fire.

Figure 15A shows that 19,000-25,000 fires involving electrical distribution or lighting equipment were reported annually from 2004-2011 before spiking in 2012-2015. The 2012 change in NFIRS data entry rules requiring a valid entry in equipment involved in ignition when an equipment-related heat source or factor contributing to ignition was entered has had the largest impact on estimates of electrical distribution or lighting fires. In the past, many fires in which arcing was a heat source or an electrical failure or malfunction contributed to the ignition had "none" recorded as the equipment involved in ignition. It is possible that many people did not think of wiring as equipment.

Figure 15. Home Electrical Distribution or Lighting Fires and Deaths, by Year

Figure 15A. Fires

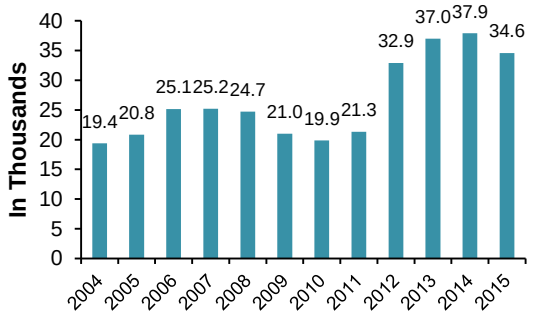


Figure 15B. Civilian Deaths

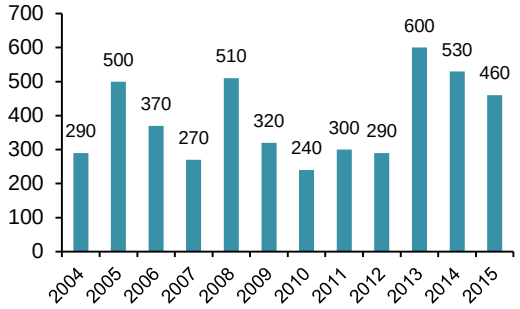


Figure 15B shows that annual death tolls from these incidents were quite volatile, ranging from 240 to 600. In 2015, electrical distribution or lighting equipment was involved in an estimated 34,600 home structure fires reported to U.S. fire departments. These fires caused 460 civilian deaths, 1,020 civilian injuries, and $1.1 billion in direct property damage.

Electrical failures or malfunctions can play a role in fires involving any type of equipment powered by electricity, such as cooking, heating, office and entertainment equipment, washers and dryers, etc. as well as electrical distribution or lighting equipment. Table 9 shows that electrical failures or malfunctions were factors in 13% of reported home fires and 17% of home

fire deaths.[10] Electrical failures or malfunctions were factors in 16% of the fires in one-or two family homes but only 6% of the reported fires in apartments or other multi-family housing.

For more information on both fires involving electrical distribution or lighting equipment and on fires in which electrical failures or malfunctions were contributing factors, see NFPA's report, *Home Electrical Fires*. Information on NFPA 70, National Electrical Code®, is available at nfpa.org/70. NFPA 70 provides detailed directions to ensure that electrical distribution equipment is installed safely. NFPA also has information for consumers about electrical safety and safety devices such as electrical circuit interrupters and tamper-resistant electrical receptacles.

Eight percent of home structure fires were intentionally set. During 2011-2015, intentional firesetting caused an average of 28,900 reported home structure fires, 360 civilian fire deaths, 870 civilian injuries, and $503 million in direct property damage. These fires caused 15% of the home fire deaths, 7% of the home fire injuries, and 7% of the direct property damage. Intentionally set fires ranked fourth in home fire frequency, fifth in home fire deaths and injuries (tied), and sixth in direct property damage. Intentional fires, defined in USFA's *NFIRS 5.0 Complete Reference Guide* as including fires started by a deliberate misuse of a heat source and fires of an incendiary nature, heavily overlap with, but are not identical to, legally defined arson fires.

During this period, intentional firesetting caused 12.6 deaths per thousand fires, 30.0 injuries per thousand fires, and an average loss of $17,400 per fire.

Figure 16A shows that 27,000-31,000 home structure fires were intentionally set annually in recent years. In 2015, U.S. fire departments responded to an estimated 28,000 home structure fires that were intentionally set. These fires caused 370 civilian deaths, 750 civilian injuries, and $435 million in direct property damage. Figure 16B shows that in most recent years, between 300 and 400 deaths resulted from intentional home fires.

Figure 16. Intentional Home Fires and Deaths, by Year

Figure 16A. Home Fires

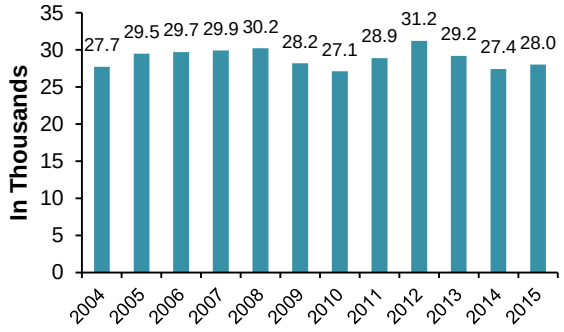
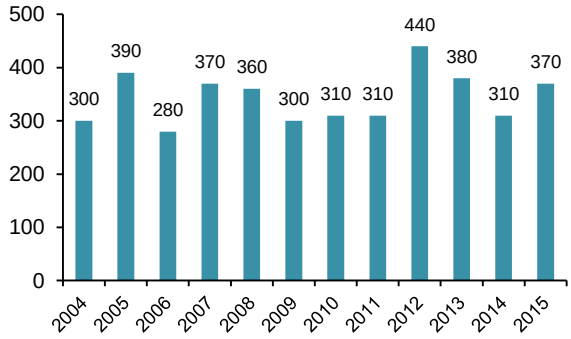


Figure 16B. Civilian Deaths



[10] Electrical failures or malfunctions are identified by NFIRS factors contributing to ignition codes 30-39. These estimates are sums of fires and losses with any type of electrical failure or malfunction. Because multiple entries are allowed, some double counting occurs.

Additional information may be found in NFPA's report, *Intentional Fires and Arson*, by Richard Campbell. Additional information and resources for prevention can be found at nfpa.org/arson.

Clothes dryers or washers were involved in 4% of home structure fires. During 2011-2015, clothes dryers or washers were involved in the ignition of an average of 13,300 non-confined home structure fires per year.[11] These fires caused an annual average of 10 deaths, 400 injuries, and $217 million in direct property damage. Overall, clothes dryers or washers were involved in 4% of the home structure fires, less than 1% of the home fire deaths, 3% of the home fire injuries, and 8% of the direct property damage.

During this period, clothes dryers or washers combined caused 0.8 deaths per thousand fires, 30.0 injuries per thousand fires, and an average loss of $16,300 per fire.

In 2015, clothes dryers or washers were involved in an estimated 13,200 home structure fires, resulting in 40 civilian deaths, 300 civilian injuries, and $190 million in direct property damage.

For more statistical information, see NFPA's report, *Home Fires Involving Clothes Dryers and Washing Machines*. Consumer safety information is also available.

Three percent of home fires were caused by exposure to other fires. The term "exposure" indicates that a fire was caused by another fire nearby. These fires may result from direct flame, radiant heat, or flying embers or brands. While exposures are technically fires that spread from outside to a building or vehicle, or from one building or vehicle to another building or vehicle, some fire departments use the term to indicate that the fire has spread from the property of one individual to a property belonging to, or occupied by, someone else.

During 2011-2015, exposures caused an average of 11,900 reported home structure fires, 20 civilian fire deaths, 70 civilian fire injuries, and $571 million in direct property damage per year. Exposures caused 3% of the home structure fires, 1% of the home fire deaths and injuries, and 8% of the direct property damage.

During this period, exposure to other fires caused 1.5 deaths per thousand fires, 5.8 injuries per thousand fires, and an average loss of $48,000 per fire. The average loss per fire was higher for exposures than any other major fire cause.

In 2015, 11,400 home structure fires were caused by exposure to another fire. These exposure fires resulted in an estimated 40 civilian deaths, 50 civilian injuries and $628 million in direct property damage.

[11] These estimates exclude any dryer or washer fires with confined fire incident types, such as confined cooking fires, confined chimney or flue fires, and contained or confined trash or rubbish fires. For estimates that include confined fires, see NFPA's full report, *Home Fires Involving Clothes Dryers and Washing Machines*.

Seven percent of home fire injuries resulted from fires started by candles. During 2011-2015, candles caused an estimated annual average of 8,700 reported home structure fires, 80 home fire deaths, 800 home fire injuries, and $295 million in direct property damage.[12]

Candles caused 2% of the home fires, 3% of home fire deaths, 7% of the home fire injuries, and 4% of the direct property damage.

During this period, candles caused 9.4 deaths per thousand fires, 92.0 injuries per thousand fires, and an average loss of $34,000 per fire. Candles had the second highest rate of injuries per 1,000 fires and average loss per fire among the major fire causes.

Home candle fires have been falling in recent years. In 2015, candles started an estimated 7,900 home fires. These fires caused 50 civilian deaths, 670 civilian injuries, and $278 million in direct property damage.

Additional statistical information on this subject may be found in NFPA's report, *Home Candle Fires* by Marty Ahrens. NFPA also offers information for consumers about candle fire safety.

Fans or air conditioners were involved in an average 7,800 home fires per year. During 2011-2015, fans or air conditioners were involved in an estimated annual average of 7,800 reported home structure fires, 40 home fire deaths, 280 home fire injuries, and $196 million in direct property damage.[13]

Fans and air conditioners caused 2% of the home fires, 1% of home fire deaths, 2% of the home fire injuries, and 3% of the direct property damage.

During this period, fans and air conditioners caused 4.8 deaths per thousand fires, 36.2 injuries per thousand fires, and an average loss of $25,300 per fire.

In 2015, fans or air conditioners were involved in an estimated 8,700 home fires. These fires caused 30 civilian deaths, 250 civilian injuries, and $186 million in direct property damage.

Additional statistical information on this subject may be found in NFPA's report, *Home Fires Involving Air Conditioning or Related Equipment*.

Playing with heat source had the highest rate of injuries per 1,000 fires. During 2011-2015, people, typically children, playing with fire or other heat sources started an estimated annual average of 6,100 home structure fires. These fires caused an average of 60 civilian fire deaths, 560 civilian fire injuries, and $146 million in direct property damage per year.

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[12] A proportional share of fires with heat sources from unclassified open flame or smoking materials are included in the candle and smoking material estimates.

[13] A proportional share of fires with heat sources from unclassified open flame or smoking materials are included in the candle and smoking material estimates.

Overall, the 2% of home structure fires started by someone playing with fire or some other heat source caused 3% of the home fire deaths, 5% of the home fire injuries, and 2% of the direct property damage.

During this period, fires started by play caused 10.6 deaths per thousand fires, 92.8 injuries per thousand fires, and an average loss of $24,100 per fire.

In 2015, an estimated 5,400 reported home structure fires started by fire play caused 60 civilian deaths, 380 civilian injuries, and $117 million in direct property damage.

Additional information on this topic may be found in NFPA's report, *Playing with Fire,* by Richard Campbell. NFPA 1035, *Standard for Professional Qualifications for Fire and Life Safety Educator, Public Information Officer, and Juvenile Firesetter Intervention Specialist* identifies the job performance requirements for individuals to effectively intervene in this situation. NFPA also provides consumer information on young fire setters and safety tips about children and fire.

More Detailed Information about Fire Circumstances

The previous section focused on major cause scenarios. This analysis also includes more detailed information based on several NFIRS data elements including equipment involved in ignition, heat source, factor contributing to ignition, area of fire origin, item first ignited, extent of fire spread, smoke alarms and automatic suppression systems. The more detailed information in this section may be used in a variety of fire prevention strategies.

Oxygen administration equipment was involved in 3% of home fire deaths. While this equipment was involved in less than 1% of reported home fires, it was involved in an estimated average of 70, or 3%, of the home fire deaths per year. Although the equipment involved in ignition field in NFIRS is intended to document the equipment that provided the heat of ignition, fire departments sometimes use the field to document fires in which medical oxygen was a factor. Most fires and burns involving home medical oxygen are not reported to the fire department. In 2003-2006, U.S. emergency rooms saw an average of 1,190 people who had been burned in incidents involving home medical oxygen.[14] The majority of these fires, fire deaths, and burn injuries involved smoking.

It appears that these fires or burns are becoming more common. In their review of burn patients included in the American Burn Association's National Burn Repository (NBR) who had been using home oxygen therapy (HOT), Assimacopoulos, et al., found that the number of patients treated at burn centers for injuries incurred while on HOT climbed from less than 50 in 2002 to more than 200 in 2011.[15] The percentage of such patients in the NBR increased from 0.41% in

[14] Marty Ahrens. *Fires and Burns Involving Home Medical Oxygen,* Quincy, MA: NFPA, 2008.
[15] Evangelia M. Assimacopoulos, et al., "The National Incidence and Resource Utilization of Burn Injuries Sustained While Smoking on Home Oxygen Therapy," *Journal of Burn Care & Research*, 2016, 37(1) pp.25-31,

2002 to 0.94% in 2010. Smoking was a factor in 83% of these burns. Note that the NBR contains only cases treated at burn centers. Patients treated in emergency rooms or general hospitals only are not included.

Home fires started by some type of operating equipment caused 39% of home fire deaths. A variety of flammability standards focus on preventing ignition by smoking materials or small open flames. Less attention has been paid to scenarios involving equipment. Table 8 shows that some type of operating equipment was the heat source in an average of 980, or 39%, of the home structure fire deaths per year. Heat from operating equipment started an average of 183,800, or half (51%), of all reported home fires annually. Operating equipment heat sources include:

- Radiated or conducted heat from operating equipment (68,300 fires and 360 deaths per year),
- Arcing (31,600 fires and 300 deaths per year);
- Sparks, embers or flames from operating equipment (24,800 fires and 100 deaths annually); and
- Unclassified heat from powered equipment (59,100 fires and 220 deaths per year).

Table 8 also shows that small open flames from candles, lighters or matches were the heat sources in an average of 27,100, or 8%, of the fires and 290, or 12%, of the deaths per year.

In one of every five fire deaths, the fire started when something that could catch fire was too close to a heat source. Factors contributing to ignition provide information on how the heat source and/or equipment involved actually started the fire. Multiple entries are allowed. Percentages were calculated based on the number of fires, not the entries, so sums will exceed 100%.

Table 9 shows that 530, or 21%, of the home fire deaths resulted from fires in which a heat source was too close to a combustible. Heat sources in this scenario include cooking and heating equipment, candles, lamps and bulbs, and a variety of other products that produce heat. An open flame is not necessary to start a fire. Combustible materials include food and cooking materials, trash, mattresses and bedding, upholstered furniture, or anything that can catch fire.

As noted earlier, some type of electrical failure or malfunction was a factor in incidents resulting in 13% of home fires and 17% of the home structure fire deaths. Electrical failures may occur in any type of electric-powered equipment, including heating, cooling, and cooking equipment, as well as in electrical distribution or lighting equipment.

Abandoned or discarded material was a factor in 12% of the home fires and 14% of the associated deaths, while unattended equipment contributed to 14% of the fires and 6% of the deaths.

Kitchens were the leading area of origin for home structure fires. Figure 17 and Table 10 show that more than two of every five (43%) home structure fires started in the kitchen or cooking area. Seventeen percent of the civilian deaths, 39% of the civilian injuries, and 15% of the direct property damage resulted from these fires. Two-thirds (67%) of the reported apartment

or multi-family housing fires and one-third (33%) of the fires in one- or two-family homes originated in the kitchen.

Figure 17. Leading Areas of Origin in Home Structure Fires: 2011-2015

Figure 17A. Fires

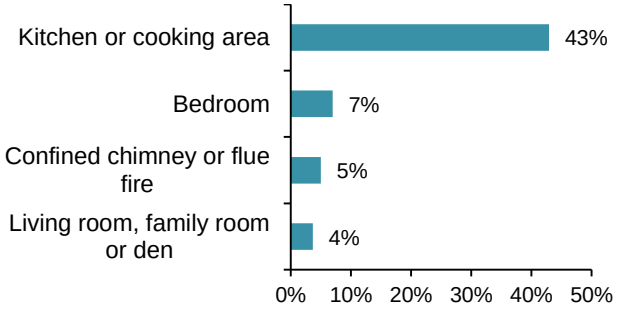


Figure 17B. Civilian Deaths

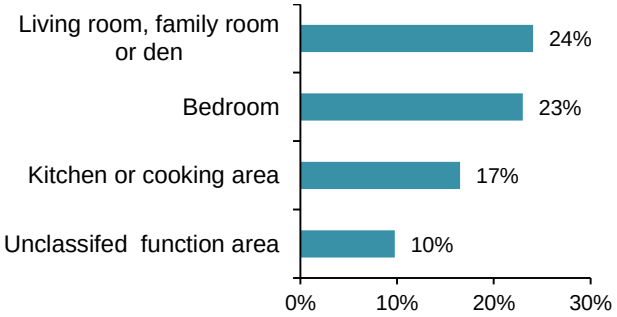


Figure 17C. Civilian Injuries

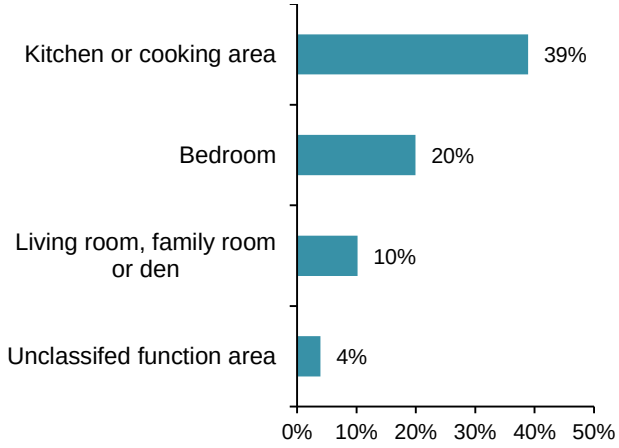
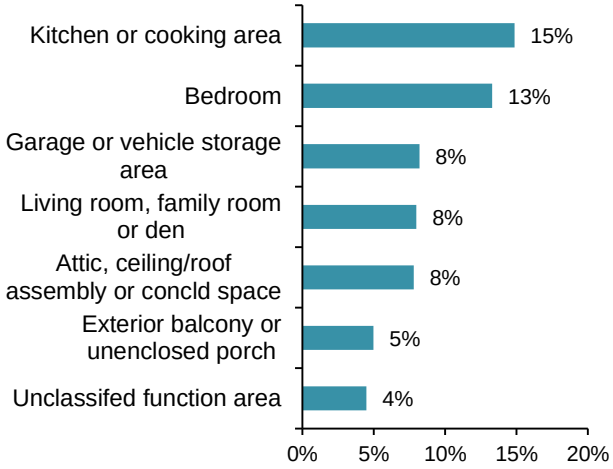


Figure 17D. Direct Property Damage



The 7% of home structure fires originating in the bedroom caused one-quarter (23%) of the civilian deaths, one of every five (20%) civilian injuries, and 13% of the direct property damage. The 4% of home structure fires originating in the living room, family room, or den caused one-quarter (24%) of the civilian fire deaths, 10% of the civilian injuries, and 8% of the direct property damage

Five percent of home fires (7% in one- or two-family homes and less than 1% in apartments) were reported as confined chimney or flue fires. These fires caused less than 1% of home fire deaths, injuries, and property damage.

Only 2% of the home structure fires began with upholstered furniture but these fires caused 18% of home fire deaths. Figure 18A and Table 11 show that cooking materials, including food, were the items first ignited in almost one-third (30%) of the reported home structure fires. Seven percent of the reported home fires began with an unclassified item, 5% started with the ignition of structural members or framing, and 5% started when electrical wire or cable insulation ignited.

Although mattresses or bedding were first ignited in only 3% of the fires, 13% of the home fire deaths and 10% of the home fire injuries resulted from these incidents. Only 2% of the home structure fires began with upholstered furniture. Figure 18B shows that these fires accounted for 18% of the home fire deaths. NFPA has detailed reports on fires that began specifically with upholstered furniture and with mattresses and bedding.

Figure 18. Leading Items First Ignited in Home Structure Fires: 2011-2015

Figure 18A. Fires

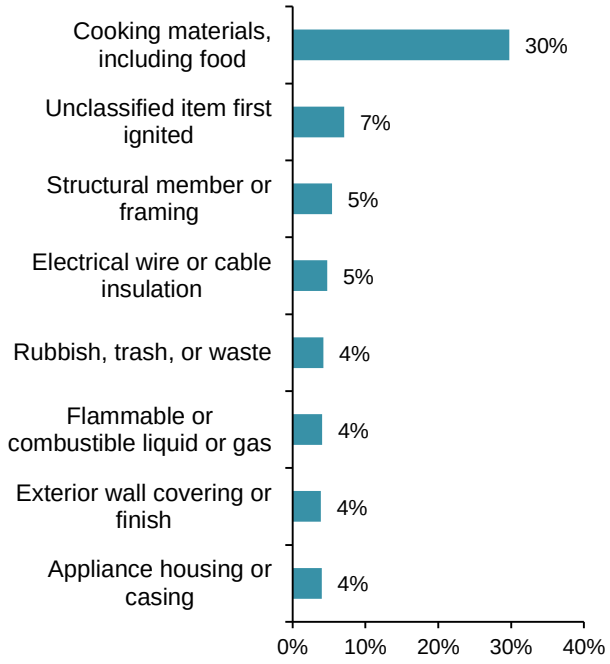


Figure 18B. Civilian Deaths

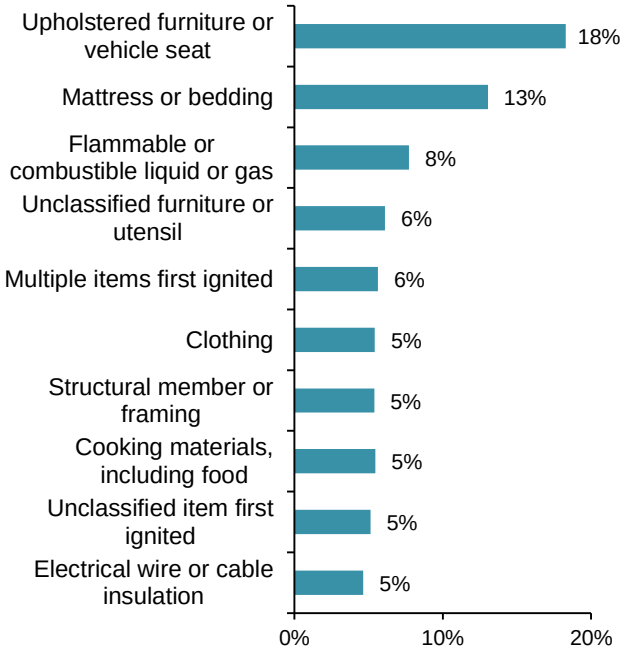


Figure 18C shows that more than one-quarter (27%) of home structure fire injuries were caused by fires that started with cooking materials; 10% resulted from fires that began with mattresses or bedding; 8% were caused by fires that began when flammable or combustible liquids, gases or associated piping of filters ignited; and 6% resulted from fires that began with upholstered furniture.

Figure 18D shows that structural members or framing were first ignited in fires that caused 16% of the direct property damage, even though only 5% of the fires started with these items. Eight percent of the property damage resulted from fires that began when cooking materials or food ignited. An additional 8% was caused by fires that started with exterior wall covering or finish. Six percent resulted from fires that began with electrical wire or cable insulation.

Figure 18. Leading Items First Ignited in Home Structure Fires: 2011-2015 (continued)

Figure 18C. Civilian Injuries

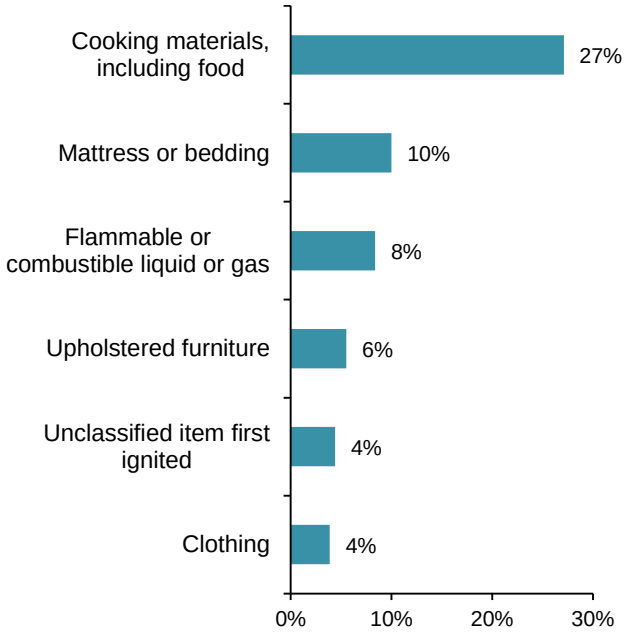
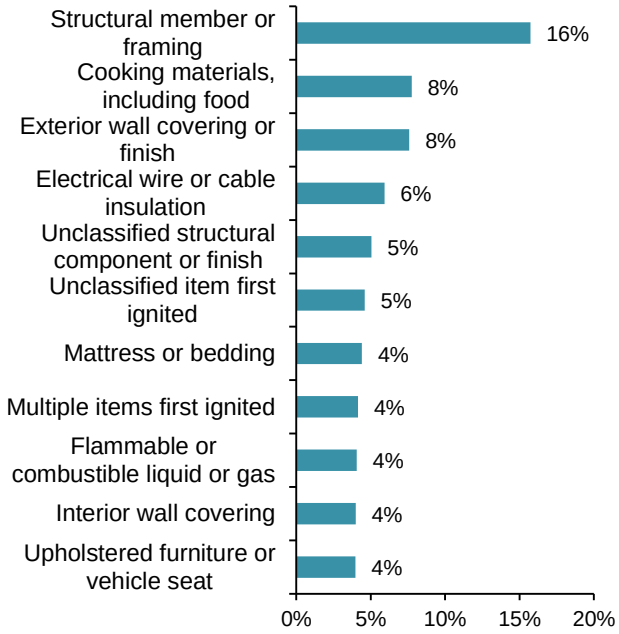


Figure 18D. Direct Property Damage



Fire spread beyond the room of origin in only one-quarter of the fires. Almost half (48%) of the reported home fires (two of every five [39%] in one- or two-family homes and two-thirds [69%] in apartments) were confined or contained fires identified by NFIRS incident type. As discussed earlier, Version 5.0 of NFIRS requires less detail about fires confined to a cooking vessel, chimney or flues, incinerators or compactors, or fuel burners or boilers; and contained or confined trash or rubbish fires in or on structures with no flame damage to the structure or other contents.

In addition to the 48% of home fires with incident types indicating contained or confined fires, Table 12 shows that the fire did not spread beyond the object of origin in another 8% of reported home structure fires. Only one-quarter (25%) spread beyond the room of origin; these fires caused four out of five (81%) home fire deaths. This scenario was more common in one- and two-family homes, where 85% of the fire deaths resulted from fires extending beyond the room of origin compared to 60% of the fire deaths in apartments.

Fire Protection

The vast majority of all households have smoke alarms, but households with fires tend to have less smoke alarm protection. Results from a 2010 telephone survey indicate that 96% of all homes have at least one smoke alarm.[16] In the 2004-2005 CPSC survey, Green and Andres compared smoke alarm coverage and performance in households that did not have fires with

[16] Harris Poll® National Quorum National Fire Protection Association – Smoke Alarms, 2010.

households that had fires that were handled without summoning the fire department (unreported fires). In 93% of the unreported fires, at least one smoke alarm was present, slightly less than the 97% of households without fires that had smoke alarms. Compared to households that did not have fires, households with fires were less likely to have smoke alarms in every bedroom (31% vs. 22%) or to have interconnected smoke alarms (19% vs. 13%). Interconnected smoke alarms were more likely to alert occupants to a fire than were alarms that were not interconnected.[17]

Almost three of every five home fire deaths resulted from fires in properties without working smoke alarms. Smoke alarms were present in three-quarters (73%) of reported home fires, a substantial but considerably smaller majority than that found in CPSC's study of unreported fires. Figure 19A shows that smoke alarms operated in slightly more than half (53%) of the reported home fires. The fire was too small to operate the smoke alarm in 13% of the fires. When smoke alarms were present in fires considered large enough to activate them, they operated 88% of the time.

Figure 19B shows that almost three of every five (57%) home fire deaths resulted from fires with no working smoke alarms, including almost two out of five (39%) deaths that resulted from fires with no smoke alarms at all and 18% from fires in which smoke alarms were present but failed to operate. For more information, see NFPA's report, *Smoke Alarms in U.S. Home Fires*. NFPA 72®, *National Fire Alarm and Signaling Code*, contains detailed information about smoke alarm and smoke detector installation, testing and maintenance. NFPA also provides information about smoke alarms for consumers.

Figure 19. Reported Home Structure Fires and Fire Deaths by Smoke Alarm Performance 2011-2015

Figure 19A. Fires

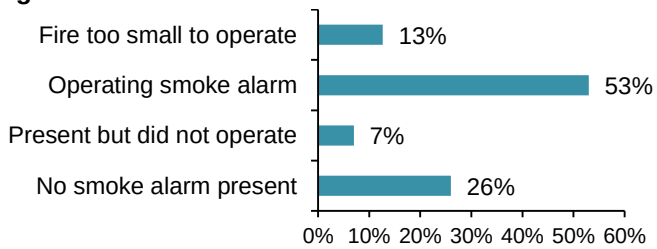
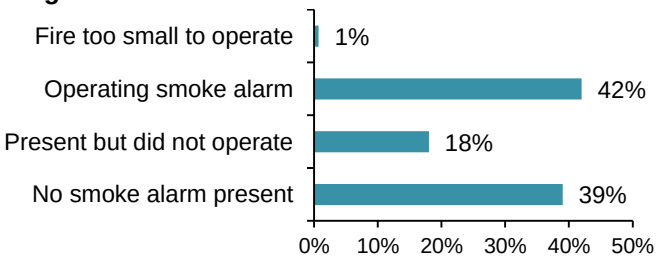


Figure 19B. Civilian Deaths



The fire death rate per 1,000 reported home fires was 7.5 when no automatic extinguishing equipment was present, five times the rate of 1.4 in home fires with sprinklers. Table C shows that in 2010-2014, sprinklers were present in 7% of the reported home fires, excluding fires in properties under construction and fires with automatic extinguishing equipment that was not present in the fire area.

When the fire was large enough to activate sprinklers in fires with sprinklers present, sprinklers operated 94% of the time. When sprinklers operated, they were effective in controlling the fire in

[17] MA Greene and C Andres. *2004-2005 National Sample Survey of Unreported Residential Fires*. (U.S. Consumer Product Safety Commission: 2009) 73-91, 150-180.

96% of these incidents. In reported fires with sprinklers that were large enough to activate them, sprinklers operated and were effective 91% of the time.[18]

Table C.
Sprinkler Systems in Reported Home Structure Fires
Excluding Fires in Properties in Construction and
Fires in Which Automatic Extinguishing Equipment Was Present, but Not in Fire Area
2010-2014 Annual Averages

Share of reported home fires with sprinklers present	7%
When present, operating in fires large enough to activate*	94%
When operating, effective in controlling fire*	96%
When present and fire large enough, operated *and* effective*	91%
Civilian deaths per 1,000 reported fires	
Without automatic extinguishing equipment	7.5
When sprinklers were present regardless of operation	1.4
Percent reduction	81%
Civilian injuries per 1,000 reported fires	
Without automatic extinguishing equipment	25
When sprinklers were present regardless of operation	34
Percent reduction	31%
Firefighter injuries per 1,000 reported fires	
Without automatic extinguishing equipment	13
When sprinklers were present regardless of operation	62
Percent reduction	79%
Average loss per fire	
Without automatic extinguishing equipment	$19,300
When sprinklers were present regardless of operation	$8,100
Percent reduction	58%

*Fires with NFIRS confined fire incident types 113-118 were excluded from these calculations because of the small number with usable data.

Eighty-nine percent of the sprinklers found in reported home fires were wet-pipe sprinklers.

In 98% of the home fires in which sprinklers operated, five or fewer sprinklers operated. Only one sprinkler operated in 88% of these incidents. Regardless of operation, the death rate of 1.4 per 1,000 reported home fires in properties with any type of sprinklers was 81% lower than the 7.5 deaths per 1,000 reported fires with no automatic extinguishing equipment. The average loss per fire was 58% lower in reported fires in which sprinklers were present, compared to fires in properties without automatic extinguishing equipment.

[18]] M. Ahrens, *U.S. Experience with Sprinklers* (USS14) (Quincy, MA: National Fire Protection Association, 2017), 10-12. http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fires-by-property-type/high-risebuilding-fires.

Fire Sprinkler Initiative is working to get sprinklers in more homes
Fire sprinklers are found in a small minority of homes despite their demonstrated ability to save lives. One- and two-family homes are much less likely to have this protection than apartments. NFPA's Fire Sprinkler Initiative is working to bring sprinklers into all new homes, including one- or two-family homes and apartments or multi-family homes. See www.firesprinklerinitiative.org.

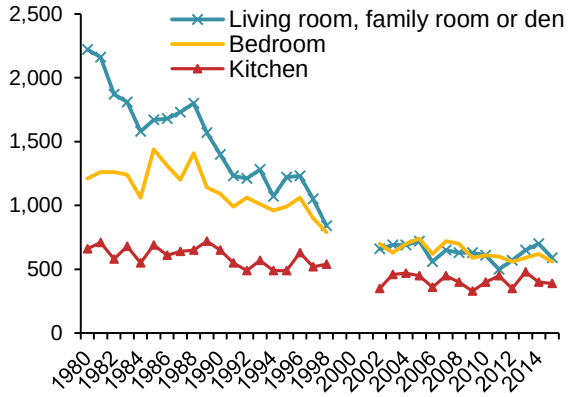
NFPA 13, *Standard for the Installation of Sprinkler Systems*, NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, and* NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, provide detailed information about these systems.

Changes in Fire Death Patterns over Time

Over the years, a variety of strategies have been employed to reduce the number of fire deaths. Flammability standards for upholstered furniture, mattresses and bedding, and other products reduce the likelihood that these items will be ignited or sustain burning. Automatic shut-offs in portable heaters activate if the device is tipped over. Other types of equipment, such as irons and coffee makers, will automatically shut off after a period of time. Arc fault circuit interrupters can prevent an electrical fault from causing a fire. Smoke alarms provide early warning of fire, allowing more time for escape. Automatic sprinklers can control a fire and limit its spread before the fire department arrives.

This section compares trends in a few major fire death scenarios. Averages are shown for two five-year periods: 1980-1984, the earliest years of national data available, and 2011-2015, the latest data available. Due to the instability of estimates for 1999-2001, the transition years to NFIRS 5.0, estimates for these years are not shown in the graphs but are included in the tables.[19]

Figure 20. Home Fire Deaths By Area of Origin and Year

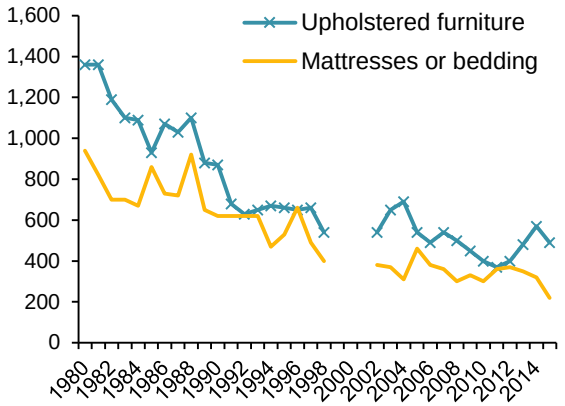


Deaths from fires originating in living rooms, family rooms, or dens fell more sharply than deaths from fires starting in bedrooms and kitchens. Table 13 and Figure 20 show that the differences between the three leading areas of origin for home fire deaths have shrunk over time. Deaths from fires starting in bedrooms now sometimes exceed the number resulting from fires starting in living rooms, families or dens.

[19] The total death estimates shown in Tables 15-18 were derived from the NFIRS and the NFPA survey together and consequently differ slightly from the estimates shown in Table 1 that are derived solely from the NFPA survey.

Deaths from fires in living rooms, family rooms, or dens (combined) fell 69% from the 1980-1984 average of 1,930 per year to the 2011-2015 average of 600 per year. Over the same periods, deaths from bedroom fires fell 52% from 1,210 per year to 580 per year. While kitchens ranked third in fire deaths, the decline in kitchen deaths was the smallest seen in the three areas, falling 34% from an average of 640 per year in 1980-1984 to 420 per year in 2011-2015.

Figure 21. Home Fire Deaths from Fires Starting with Upholstered Furniture and Mattresses or Bedding, by Year

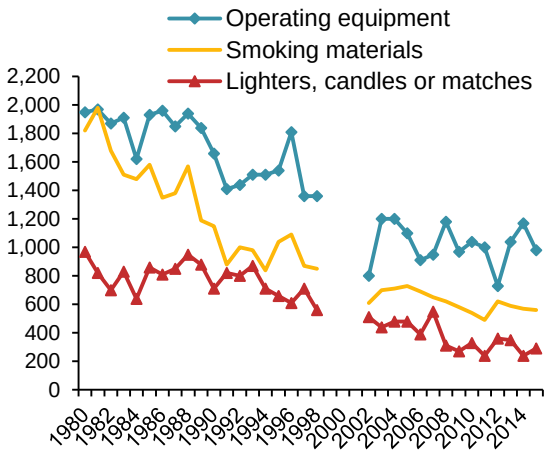


Fire deaths from upholstered furniture and mattress and bedding fires fell 62% and 57%, respectively, since the early 1980s. Figure 21 and Table 14 show trends for the two leading items first ignited in home fire deaths: 1) upholstered furniture, and 2) mattresses and bedding. Deaths from home fires that began with upholstered furniture fell 62% from an average of 1,220 per year in 1980-1984 to 460 per year in 2011-2015. Deaths from fires beginning with mattresses and bedding fell 57% from an average of 770 per year in 1980-1984 to 330 per year in 2011-2015.

Smoking material fire deaths have fallen more than deaths from fires started by small open flames or operating equipment. Some flammability standards are intended to prevent ignition by cigarettes. Others address small open flames. Operating equipment is a diverse category involving a wide variety of equipment types and scenarios, including cooking, heating, and electrical. Few flammability standards address these fires. In 1980 and 1981, the number of deaths resulting from fires started by smoking materials was similar to the number from fires started by operating equipment.[20]

Table 15 and Figure 22 show that the average number of deaths from home fires started by operating equipment fell 47% from 1,860 per year in 1980-1984 to 980 per year in 2011-2015. This is consistent with the overall drop in fire deaths over the two periods. It is important to remember that many, if not most, fires started by operating equipment involve some type of human error, such as unattended cooking, or leaving something that can catch fire too close to a heat source.

Figure 22. Home Fire Deaths, by Selected Heat Sources and Year



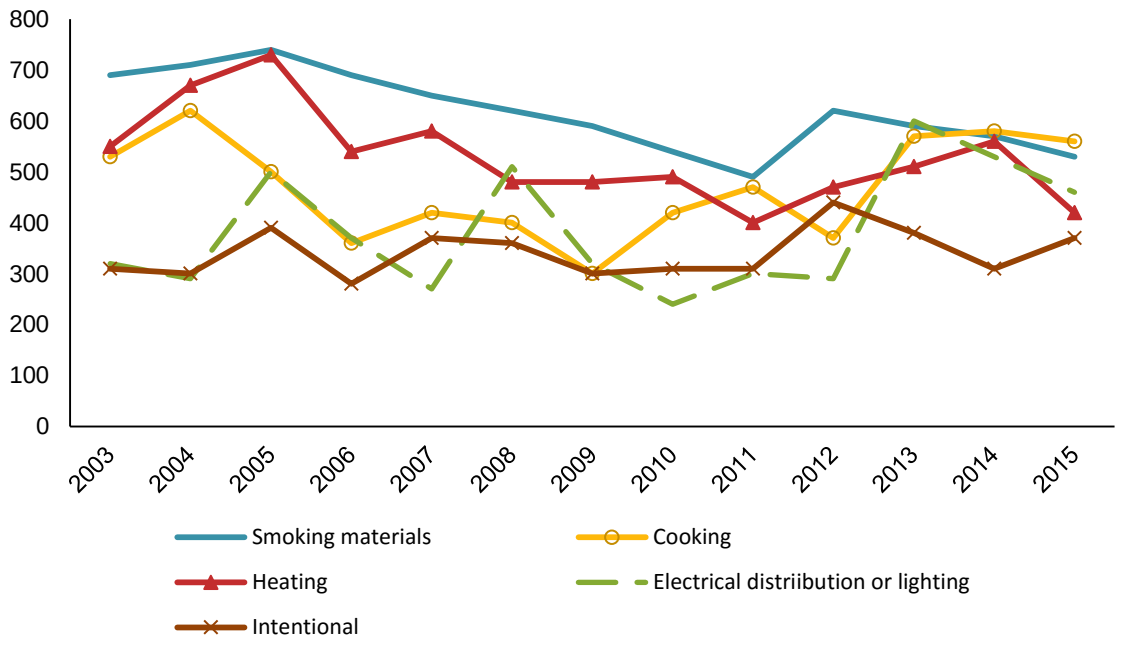
Fires started by small open flames (lighters, candles and matches) fell 63%, dropping from an

[20] In 1980-1998, operating equipment identified by form of heat of ignition codes for heat from fuel-fires, fuel-powered objects, heat from electrical equipment arcing or overloaded, electric lamps, and properly and improperly operating equipment (form of heat of ignition codes 10-29, 54, 56, and 57). From 1999 on, operating equipment was identified by heat source codes for operating equipment (heat source 10-13).

average of 790 such deaths per year in 1980-1984 to 290 deaths per year in 2011-2015. The decline in deaths from smoking materials was steeper, dropping 67% from an average of 1,690 per year in 1980-1984 to 560 per year in 2011-2015.

In recent years, the leading causes of home fire deaths have converged more than in the past. For most of the past few decades, smoking materials were clearly the leading cause. While smoking materials were the leading cause of home fire deaths over the five-year period of 2011-2015, cooking was the leading cause in 2014 and 2015. Electrical distribution and lighting equipment caused the largest number of home fire deaths in 2013. The USFA added a quality control check requiring a valid equipment involved in ignition entry (other than no equipment involved) when an equipment-related heat source or factor contributing to ignition was present.

Figure 23. Home Fire Deaths, by Leading Causes and Year: 2003-2015



Unreported Home Fires

U.S. households handle more than 7 million fires a year without calling the fire department. Most of this analysis has focused on fires that were reported to the fire department. However, the vast majority of fires are handled without fire department assistance. In a telephone survey done for the CPSC in 2004-2005, respondents were asked about "any incident, large or small, that resulted in unwanted flames or smoke, and could have caused damage to life or property if left unchecked.[21]

[21] Michael A. Greene and Craig Andres. *2004-2005 National Sample Survey of Unreported Residential Fires*, U.S. Consumer Product Safety Commission, July 2009.

Their findings revealed that in 2004-2005:

* U.S. households experienced an average of 7.4 million fires per year.
* In 7.2 million household fires per year, the fire department did not attend. These fires caused an estimated 130,000 injuries or illnesses. Serious injuries at unattended fires were very rare. Three-quarters of those injured received no medical attention and one-quarter received first aid at the scene. Three-quarters of the injuries or illnesses from unattended fires involved burns.
* 18% of the fires self-extinguished; 78% of fires were put out by a household member using a variety of methods, tools or materials, including: water, shutting off power, smothering, removing the fuel from the heat source, and fire extinguishers.
* The combined estimates of unreported and reported fires, one of every 15 households experienced a fire. This translates to 6.6 fires per 100 households. The rate for unattended fires only was 6.3 per 100 households.
* Cooking equipment was involved in almost two-thirds (64%) of all fires with 50 unattended fires for every incident attended by the fire service.
* Households that experienced any fire, including those without fire department attendance, were more likely to rent than own their home, to have more people in the household, to have occupants who smoke, and to have someone living in the household under 18 but no one over 65.
* Three-quarters (76%) of all households had fire extinguishers. Extinguishers were used in 5% of the fires. When an extinguisher was used, it put out the fire completely in half of the cases and minimized the fire but did not completely put it out in almost one-quarter of the fires. In roughly one-fifth of the fires, an extinguisher was used to little or no effect.

Additional Information Sources

NFPA offers more information. Three chapters found in the 20th edition of the NFPA *Fire Protection Handbook,* "One- or Two-Family Dwellings" by James K. Lathrop, "Manufactured Housing" by Kirsten M. Paoletti, and "Apartment Buildings" by Kenneth Bush, describe some of the special fire safety concerns for these properties.

NFPA offers a wide variety of statistical information at http://www.nfpa.org/news-and-research. Members may download a number of related reports. *Manufactured Home Fires* focuses specifically on these homes and examines the impact of the 1976 federal standards and fire risks relative to other types of dwellings. *Characteristics of Home Fire Victims* examines factors such as relative risk, leading causes, and victim activities, conditions and characteristics by age and gender among civilians who were injured or killed in home fires. The report also shows a breakdown of victim ages for the major fire causes. NFPA also offers reports on a wide variety of equipment involved in home fires.

The Public Education tab on NFPA's home page leads to information for consumers, children and life safety educators. NFPA's codes and standards may be viewed without charge at nfpa.org/freeaccess.

Report an unsafe product or find out about CPSC's product recalls. The Consumer Product Safety Commission (CPSC) is the federal body with primary regulatory authority for the safety of most household products. In some cases, the Commission issues mandatory standards products must meet. They can also order the recall of products that have been determined to be unsafe. The CPSC has established a publicly available database about consumer product safety information at http://www.saferproducts.gov/. This database includes recalls and reports that have been submitted about unsafe products.

Public safety officials, other government agencies, child service providers, and members of the public may report incidents involving unsafe products. Details are requested about the product involved, date of incident, the manufacturer or private labeler, any illness, injury or death and treatment received, any threat of injury or death, photographs and other detailed documentation. People who report are asked if they are willing to allow the report to be published in the database and whether they are willing to provide their name and contact information to the manufacturer or private labeler. Contact information must be provided with the initial report for a report to be included in the public database. Businesses are given an opportunity to review the report and submit a comment to the database about the incident. Recall information may also be accessed at this site.

CPSC staff review all reports although they cannot investigate every report received. Other organizations can also review information about products to assess needs for new standards or safety information.

Supporting Tables

The next section contains detailed tables that support the text. There are three sets of tables. The first set, Tables 1-15, are based on fires (or deaths) in all home properties. Tables 1-12 show estimates of reported fires, causes and circumstances in homes overall. Tables 13-15 show home fire death trends for selected areas of origin, item first ignited, and selected heat sources.

Because fires in one- or two-family homes differ from fires in apartments or other multi-family housing, separate sets of tables are provided for these two occupancy groups, Tables 1-12 are repeated for these two property groups. Tables 1A-12A shows estimates of fires in one- or two-family homes. Tables 1B-12B shows comparable data for apartments or other multi-family housing.

Table 1. Reported Home Structure Fires by Year: 1980-2016

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions) As Reported	Direct Property Damage (in Millions) In 2016 Dollars
1980	734,000	5,200	19,700	$2,848	$8,298
1981	711,000	5,400	19,125	$3,128	$8,236
1982	654,500	4,820	20,450	$3,147	$7,811
1983	625,500	4,670	20,750	$3,205	$7,709
1984	605,500	4,075	18,750	$3,362	$7,748
1985	606,000	4,885	19,175	$3,693	$8,218
1986	565,500	4,655	18,575	$3,464	$7,584
1987	536,500	4,570	19,965	$3,599	$7,595
1988	538,500	4,955	22,075	$3,897	$7,906
1989	498,500	4,335	20,275	$3,876	$7,501
1990	454,500	4,050	20,225	$4,157	$7,636
1991	464,500	3,500	21,275	$5,463[1]	$9,616
1992	459,000	3,705	21,100	$3,775	$6,455
1993	458,000	3,720	22,000	$4,764[2]	$7,906
1994	438,000	3,425	19,475	$4,215	$6,823
1995	414,000	3,640	18,650	$4,264	$6,708
1996	417,000	4,035	18,875	$4,869	$7,449
1997	395,500	3,360	17,300	$4,453	$6,653
1998	369,500	3,220	16,800	$4,273	$6,292
1999	371,000	2,895	16,050	$4,965	$7,144
2000	368,000	3,420	16,975	$5,525	$7,698
2001	383,500	3,110	15,200	$5,516	$7,474
2002	389,000	2,670	13,650	$5,931	$7,908
2003	388,500	3,145	13,650	$5,949[3]	$7,761
2004	395,500	3,190	13,700	$5,833	$7,414
2005	381,000	3,030	13,300	$6,729	$8,262
2006	396,000	2,580	12,500	$6,832	$8,126
2007	399,000	2,865	13,600	$7,389[4]	$8,541
2008	386,500	2,755	13,560	$8,243[5]	$9,192
2009	362,500	2,565	12,650	$7,616	$8,511
2010	369,500	2,640	13,350	$6,928	$7,626
2011	370,000	2,520	13,910	$6,914	$7,378
2012	365,000	2,380	12,875	$7,010	$7,329
2013	369,500	2,755	12,200	$6,792	$6,987

Table 1. Reported Home Structure Fires by Year: 1980-2016 (Continued)

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions) As Reported	In 2016 Dollars
2014	367,500	2,745	11,825	$6,826	$6,908
2015	365,500	2,560	11,075	$6,960[6]	$7,043
2016	352,000	2,735	10,750	5,654	$5,654

[1] Includes $1.5 billion in damage caused by the Oakland Fire Storm, most of which entailed damage to homes but for which no detailed breakdown by property type was available.

[2] Includes $809 million in damage caused by Southern California wildfires

[3] This does not include the Southern California wildfires that caused an estimated property damage of $2 billion.

[4] This does not include the California Fire Storm 2007 that caused an estimated property damage of $1.8 billion.

[5] Does not include the California wildfires 2008 with an estimated property damage of $1.4 billion

[6] Does not include two California wildfires: the Valley fire with a loss of $1.5 billion and the Butte fire with a loss of $450 million

Source: NFPA series of annual reports Fire Loss in the United Sates by Michael J. Karter, Jr. and Hylton Haynes. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 2.
Reported Home Structure Fires, by Month
2011-2015 Annual Averages

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	37,700	(11%)	370	(15%)	1,380	(11%)	$720	(11%)
February	32,400	(9%)	290	(12%)	1,190	(10%)	$626	(9%)
March	32,800	(9%)	250	(10%)	1,210	(10%)	$621	(9%)
April	29,900	(8%)	220	(9%)	1,020	(8%)	$552	(8%)
May	28,400	(8%)	160	(6%)	940	(8%)	$551	(8%)
June	26,300	(7%)	140	(6%)	890	(7%)	$514	(8%)
July	27,500	(8%)	140	(6%)	910	(7%)	$582	(9%)
August	25,900	(7%)	140	(6%)	870	(7%)	$488	(7%)
September	25,100	(7%)	130	(5%)	800	(7%)	$446	(7%)
October	28,200	(8%)	180	(7%)	970	(8%)	$480	(7%)
November	32,000	(9%)	240	(9%)	1,030	(8%)	$591	(9%)
December	32,400	(9%)	250	(10%)	1,080	(9%)	$552	(8%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Monthly average	29,900	(8%)	210	(8%)	1,020	(8%)	$560	(8%)

Table 3.
Reported Home Structure Fires, by Day of Week
2011-2015 Annual Averages

Day of Week	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	55,500	(15%)	370	(15%)	1,880	(15%)	$992	(15%)
Monday	50,600	(14%)	340	(14%)	1,690	(14%)	$959	(14%)
Tuesday	49,500	(14%)	340	(13%)	1,730	(14%)	$916	(14%)
Wednesday	49,500	(14%)	350	(14%)	1,700	(14%)	$903	(13%)
Thursday	50,300	(14%)	350	(14%)	1,690	(14%)	$967	(14%)
Friday	49,200	(14%)	360	(14%)	1,750	(14%)	$952	(14%)
Saturday	53,900	(15%)	400	(16%)	1,860	(15%)	$1,033	(15%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Daily average	51,200	(14%)	360	(14%)	1,760	(14%)	$960	(14%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 4.
Reported Home Structure Fires, by Alarm Time
2011-2015 Annual Averages

Alarm Time	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Midnight-12:59 a.m.	11,100	(3%)	170	(7%)	520	(4%)	$302	(4%)
1:00-1:59 a.m.	9,800	(3%)	190	(7%)	540	(4%)	$316	(5%)
2:00-2:59 a.m.	8,900	(2%)	170	(7%)	480	(4%)	$303	(5%)
3:00-3:59 a.m.	8,200	(2%)	190	(8%)	490	(4%)	$305	(5%)
4:00-4:59 a.m.	7,400	(2%)	180	(7%)	440	(4%)	$278	(4%)
5:00-5:59 a.m.	6,900	(2%)	150	(6%)	400	(3%)	$226	(3%)
6:00-6:59 a.m.	7,300	(2%)	120	(5%)	370	(3%)	$186	(3%)
7:00-7:59 a.m.	8,600	(2%)	90	(4%)	330	(3%)	$175	(3%)
8:00-8:59 a.m.	10,400	(3%)	90	(3%)	390	(3%)	$191	(3%)
9:00-9:59 a.m.	12,200	(3%)	80	(3%)	450	(4%)	$205	(3%)
10:00-10:59 a.m.	14,200	(4%)	80	(3%)	470	(4%)	$230	(3%)
11:00-11:59 a.m.	15,900	(4%)	70	(3%)	500	(4%)	$282	(4%)
Noon-12:59 p.m.	17,600	(5%)	70	(3%)	530	(4%)	$318	(5%)
1:00-1:59 p.m.	18,300	(5%)	70	(3%)	540	(4%)	$329	(5%)
2:00-2:59 p.m.	18,500	(5%)	70	(3%)	530	(4%)	$300	(4%)
3:00-3:59 p.m.	20,000	(6%)	60	(2%)	580	(5%)	$327	(5%)
4:00-4:59 p.m.	21,900	(6%)	60	(2%)	620	(5%)	$345	(5%)
5:00-5:59 p.m.	24,900	(7%)	60	(2%)	650	(5%)	$320	(5%)
6:00-6:59 p.m.	25,900	(7%)	70	(3%)	670	(5%)	$364	(5%)
7:00-7:59 p.m.	24,300	(7%)	80	(3%)	650	(5%)	$310	(5%)
8:00-8:59 p.m.	21,300	(6%)	80	(3%)	610	(5%)	$276	(4%)
9:00-9:59 p.m.	17,900	(5%)	90	(4%)	540	(4%)	$272	(4%)
10:00-10:59 p.m.	14,800	(4%)	90	(4%)	500	(4%)	$269	(4%)
11:00-11:59 p.m.	12,400	(3%)	130	(5%)	520	(4%)	$293	(4%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Average by hour	14,900	(4%)	100	(4%)	510	(4%)	$280	(4%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 5.
Leading Causes of Reported Home Structure Fires
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	170,200	(47%)	510	(20%)	5,470	(45%)	$1,155	(17%)
Heating equipment	54,000	(15%)	480	(19%)	1,470	(12%)	$1,060	(16%)
Electrical distribution or lighting equipment	34,000	(9%)	440	(18%)	1,170	(10%)	$1,256	(19%)
Intentional	28,900	(8%)	360	(15%)	870	(7%)	$503	(7%)
Smoking materials	18,300	(5%)	560	(22%)	1,200	(10%)	$506	(8%)
Clothes dryer or washer	13,300	(4%)	10	(0%)	400	(3%)	$217	(3%)
Exposure	11,900	(3%)	20	(1%)	70	(1%)	$571	(8%)
Candles	8,700	(2%)	80	(3%)	800	(7%)	$295	(4%)
Fan or air conditioner	7,800	(2%)	40	(1%)	280	(2%)	$196	(3%)
Playing with heat source	6,100	(2%)	60	(3%)	560	(5%)	$146	(2%)

∗ These estimates exclude any dryer or washer fires with confined fire incident types, such as confined cooking fires, confined chimney or flue fires, and contained or confined trash or rubbish fires. For estimates that include confined fires, see NFPA's full report, *Home Fires Involving Clothes Dryers and Washing Machines*.

Note: This table summarizes findings from multiple fields, meaning that the same fire may be listed under multiple causes. The methodology used is described in Appendix B.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 6.
Reported Home Structure Fires, by Cause of Ignition (from NFIRS Cause Field)
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Cause of Ignition	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	261,800	(73%)	1,850	(74%)	10,160	(83%)	$4,534	(67%)
Non-Confined	124,300	(35%)	1,850	(74%)	8,710	(71%)	$4,502	(67%)
Confined	137,500	(38%)	0	(0%)	1,450	(12%)	$32	(0%)
Failure of equipment or heat source	46,300	(13%)	250	(10%)	1,080	(9%)	$876	(13%)
Non-Confined	30,700	(9%)	250	(10%)	1,030	(8%)	$871	(13%)
Confined	15,700	(4%)	0	(0%)	50	(0%)	$5	(0%)
Intentional	28,900	(8%)	360	(15%)	870	(7%)	$503	(7%)
Non-Confined	17,000	(5%)	360	(15%)	830	(7%)	$502	(7%)
Confined	11,900	(3%)	0	(0%)	40	(0%)	$1	(0%)
Unclassified cause	15,900	(4%)	30	(1%)	140	(1%)	$458	(7%)
Non-Confined	9,700	(3%)	30	(1%)	110	(1%)	$458	(7%)
Confined	6,200	(2%)	0	(0%)	30	(0%)	$0	(0%)
Act of nature	5,600	(2%)	10	(0%)	50	(0%)	$352	(5%)
Non-Confined	5,000	(1%)	10	(0%)	50	(0%)	$352	(5%)
Confined	500	(0%)	0	(0%)	0	(0%)	$0	(0%)
Other Known Cause	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Non-Confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Non-Confined	186,700	(52%)	2,510	(100%)	10,730	(87%)	$6,684	(99%)
Confined	171,900	(48%)	0	(0%)	1,560	(13%)	$38	(1%)

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 7.
Reported Home Structure Fires, by Equipment Involved in Ignition
2011-2015 Annual Averages
(Unknowns in non-confined fires and confined cooking fires were allocated proportionally)

Equipment Involved	Fires		Civilian Deaths		Civilian Injurie		Direct Property Damage (in Millions)	
Cooking equipment	170,200	(47%)	510	(20%)	5,470	(45%)	$1,155	(17%)
Range or cooktop	106,200	(30%)	440	(18%)	4,360	(35%)	$843	(13%)
Non-confined fire	34,200	(10%)	440	(18%)	3,440	(28%)	$825	(12%)
Confined fire	72,000	(20%)	0	(0%)	920	(7%)	$18	(0%)
Oven or rotisserie	21,800	(6%)	20	(1%)	270	(2%)	$43	(1%)
Non-confined fire	2,900	(1%)	20	(1%)	160	(1%)	$40	(1%)
Confined fire	18,800	(5%)	0	(0%)	110	(1%)	$3	(0%)
Portable cooking or warming device	7,900	(2%)	30	(1%)	240	(2%)	$78	(1%)
Non-confined fire	2,100	(1%)	30	(1%)	190	(2%)	$77	(1%)
Confined fire	5,800	(2%)	0	(0%)	60	(0%)	$1	(0%)
Microwave oven	6,700	(2%)	10	(0%)	120	(1%)	$33	(0%)
Non-confined fire	1,600	(0%)	10	(0%)	90	(1%)	$32	(0%)
Confined fire	5,200	(1%)	0	(0%)	30	(0%)	$1	(0%)
Grill, barbecue or hibachi	4,100	(1%)	10	(0%)	110	(1%)	$127	(2%)
Non-confined fire	1,700	(0%)	10	(0%)	90	(1%)	$127	(2%)
Confined fire	2,300	(1%)	0	(0%)	20	(0%)	$0	(0%)
Other known cooking equipment or confined cooking fire	23,500	(7%)	0	(0%)	370	(3%)	$30	(0%)
Other known cooking equipment in non-confined fire	900	(0%)	0	(0%)	60	(0%)	$26	(0%)
Confined cooking fire with other or unknown equipment	22,600	(6%)	0	(0%)	310	(3%)	$5	(0%)
Heating equipment	54,000	(15%)	480	(19%)	1,470	(12%)	$1,060	(16%)
Fireplace or chimney fire*	22,600	(6%)	30	(1%)	90	(1%)	$264	(4%)
Fireplace or chimney with non-confined incident type	3,600	(1%)	30	(1%)	70	(1%)	$258	(4%)
*Confined chimney or flue fire**	19,000	(5%)	0	(0%)	20	(0%)	$6	(0%)
Fixed or portable space heater	15,300	(4%)	410	(16%)	1,130	(9%)	$563	(8%)
Furnace, central heat, or boiler*	10,900	(3%)	20	(1%)	90	(1%)	$76	(1%)
Furnace or boiler with non-confined incident type	8,900	(2%)	0	(0%)	30	(0%)	$2	(0%)
*Confined fuel burner or boiler fire**	2,000	(1%)	20	(1%)	60	(0%)	$74	(1%)
Water heater	4,100	(1%)	10	(0%)	130	(1%)	$104	(2%)

* The estimates of fires involving fireplaces or chimneys include all fires with the confined chimney or flue incident type regardless of what may have been coded as equipment involved. Likewise, the estimates of fires involving furnaces, central heat or boilers include all fires with confined fuel burner or boiler incident type. The estimates shown should be considered upper bounds. Except for confined cooking fires, the estimates for equipment involved in ignition did not break out the confined fires further. NFPA's report, *Home Fires Involving Heating Equipment,* shows a detailed breakdown of the equipment involved in the confined heating fires.

Table 7. (Continued)
Reported Home Structure Fires, by Equipment Involved in Ignition
2011-2015 Annual Averages
(Unknowns in non-confined fires and confined cooking fires were allocated proportionally)

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
No equipment involved in ignition	45,500	(13%)	790	(31%)	2,530	(21%)	$2,157	(32%)
Electrical distribution and lighting equipment	34,000	(9%)	440	(18%)	1,170	(10%)	$1,256	(19%)
Wiring and related equipment	23,800	(7%)	250	(10%)	630	(5%)	$842	(13%)
Lamp, bulb or lighting	5,000	(1%)	50	(2%)	210	(2%)	$166	(2%)
Cord or plug	3,300	(1%)	130	(5%)	230	(2%)	$143	(2%)
Transformers and power supplies	1,900	(1%)	20	(1%)	110	(1%)	$105	(2%)
Contained trash or rubbish fire	15,700	(4%)	0	(0%)	60	(0%)	$2	(0%)
Clothes dryer	13,300	(4%)	10	(0%)	400	(3%)	$215	(3%)
Fan	4,900	(1%)	10	(1%)	140	(1%)	$119	(2%)
Air conditioner	2,800	(1%)	20	(1%)	140	(1%)	$78	(1%)
Unclassified equipment involved in ignition	2,800	(1%)	40	(2%)	130	(1%)	$137	(2%)
Other known equipment involved in ignition	15,300	(4%)	200	(8%)	780	(6%)	$544	(8%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
The following types of equipment were involved in fewer than 1% of the fires but at least 2% of the fire deaths								
Oxygen administration equipment			70	(3%)				
Portable appliance designed to produce heat			30	(1%)				

∗ These estimates exclude any dryer or washer fires with confined fire incident types, such as confined cooking fires, confined chimney or flue fires, and contained or confined trash or rubbish fires. For estimates that include confined fires, see NFPA's full report, *Home Fires Involving Clothes Dryers and Washing Machines*.

Note: Non-confined fires in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among fires with known equipment involved. The same approach was used with confined cooking fires. Fires in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Non-confined fires in which the equipment was partially unclassified (i.e., unclassified kitchen or cooking equipment, unclassified heating, cooling or air condition equipment, etc.) were allocated proportionally among fires in that grouping (kitchen or cooking equipment; heating, cooling or air conditioning equipment, etc.). The same approach was used with confined cooking fires. The estimates of fires involving fireplace or chimney include all fires with the confined chimney or flue incident type regardless of what may have been coded as equipment involved. Likewise, the estimates of fires involving furnaces, central heat or boilers include all fires with confined fuel burner or boiler incident type. The estimates shown should be considered upper bounds. Non-cooking confined fires were not analyzed separately. Estimates of other types of equipment exclude confined fires. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 8.
Reported Home Structure Fires, by Heat Source
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Radiated or conducted heat from operating equipment	68,300	(19%)	360	(14%)	2,660	(22%)	$769	(11%)
Non-confined	26,200	(7%)	360	(14%)	2,120	(17%)	$760	(11%)
Confined	42,100	(12%)	0	(0%)	540	(4%)	$9	(0%)
Unclassified heat from powered equipment	59,100	(16%)	220	(9%)	2,000	(16%)	$696	(10%)
Non-confined	24,700	(7%)	220	(9%)	1,610	(13%)	$687	(10%)
Confined	34,400	(10%)	0	(0%)	390	(3%)	$9	(0%)
Arcing	31,600	(9%)	300	(12%)	990	(8%)	$920	(14%)
Non-confined	28,200	(8%)	300	(12%)	980	(8%)	$919	(14%)
Confined	3,400	(1%)	0	(0%)	10	(0%)	$1	(0%)
Unclassified heat source	31,000	(9%)	180	(7%)	740	(6%)	$476	(7%)
Non-confined	11,700	(3%)	180	(7%)	570	(5%)	$473	(7%)
Confined	19,200	(5%)	0	(0%)	170	(1%)	$3	(0%)
Unclassified hot or smoldering object	25,400	(7%)	130	(5%)	640	(5%)	$528	(8%)
Non-confined	13,600	(4%)	130	(5%)	530	(4%)	$525	(8%)
Confined	11,700	(3%)	0	(0%)	110	(1%)	$3	(0%)
Spark, ember or flame from operating equipment	24,800	(7%)	100	(4%)	690	(6%)	$315	(5%)
Non-confined	8,700	(2%)	100	(4%)	580	(5%)	$313	(5%)
Confined	16,100	(4%)	0	(0%)	110	(1%)	$2	(0%)
Hot ember or ash	24,700	(7%)	110	(4%)	430	(4%)	$460	(7%)
Non-confined	12,400	(3%)	110	(4%)	410	(3%)	$458	(7%)
Confined	12,300	(3%)	0	(0%)	20	(0%)	$3	(0%)
Smoking materials	18,300	(5%)	560	(22%)	1,200	(10%)	$506	(8%)
Non-confined	13,800	(4%)	560	(22%)	1,170	(10%)	$504	(8%)
Confined	4,500	(1%)	0	(0%)	30	(0%)	$2	(0%)
Heat from direct flame or convection currents	15,800	(4%)	50	(2%)	420	(3%)	$274	(4%)
Non-confined	6,400	(2%)	50	(2%)	330	(3%)	$272	(4%)
Confined	9,500	(3%)	0	(0%)	90	(1%)	$2	(0%)
Lighter	10,200	(3%)	160	(6%)	790	(6%)	$266	(4%)
Non-confined	6,700	(2%)	160	(6%)	770	(6%)	$266	(4%)
Confined	3,500	(1%)	0	(0%)	20	(0%)	$0	(0%)
Candle	8,700	(2%)	80	(3%)	800	(7%)	$295	(4%)
Non-confined	8,000	(2%)	80	(3%)	790	(6%)	$295	(4%)
Confined	700	(0%)	0	(0%)	10	(0%)	$0	(0%)

Table 8. (Continued)
Reported Home Structure Fires, by Heat Source
2011-2015 Annual Averages

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Match	8,200	(2%)	50	(2%)	170	(1%)	$81	(1%)
Non-confined	2,500	(1%)	50	(2%)	160	(1%)	$81	(1%)
Confined	5,600	(2%)	0	(0%)	10	(0%)	$0	(0%)
Other known heat source	32,500	(9%)	200	(8%)	770	(6%)	$1,135	(17%)
Non-confined	23,800	(7%)	200	(8%)	700	(6%)	$1,132	(17%)
Confined	8,700	(2%)	0	(0%)	70	(1%)	$3	(0%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Non-confined	186,700	(52%)	2,510	(100%)	10,730	(87%)	$6,684	(99%)
Confined	171,900	(48%)	0	(0%)	1,560	(13%)	$38	(1%)
The following heat sources started fewer than 2% of the fires but caused at least 2% of the fire deaths.								
Multiple heat sources, including multiple ignitions.			50	(2%)				

Note: Sums may not equal totals due to rounding errors. The statistics on matches, lighters, smoking materials and candles include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 9.
Reported Home Structure Fires, by Factors Contributing to Ignition
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Equipment unattended	51,200	(14%)	150	(6%)	2,110	(17%)	$389	(6%)
Non-Confined	14,000	(4%)	150	(6%)	1,570	(13%)	$380	(6%)
Confined	37,100	(10%)	0	(0%)	530	(4%)	$9	(0%)
Electrical failure or malfunction	46,400	(13%)	440	(17%)	1,360	(11%)	$1,411	(21%)
Non-Confined	40,400	(11%)	440	(17%)	1,350	(11%)	$1,409	(21%)
Confined	6,000	(2%)	0	(0%)	10	(0%)	$2	(0%)
Abandoned or discarded material or product	42,400	(12%)	360	(14%)	1,520	(12%)	$719	(11%)
Non-Confined	21,400	(6%)	360	(14%)	1,330	(11%)	$715	(11%)
Confined	20,900	(6%)	0	(0%)	190	(2%)	$4	(0%)
Heat source too close to combustibles	38,600	(11%)	530	(21%)	2,170	(18%)	$930	(14%)
Non-Confined	24,900	(7%)	530	(21%)	2,050	(17%)	$927	(14%)
Confined	13,700	(4%)	0	(0%)	120	(1%)	$3	(0%)
Failure to clean	28,700	(8%)	10	(1%)	190	(2%)	$79	(1%)
Non-Confined	4,300	(1%)	10	(1%)	130	(1%)	$76	(1%)
Confined	24,400	(7%)	0	(0%)	60	(1%)	$3	(0%)
Unclassified misuse of material or product	27,100	(8%)	330	(13%)	1,420	(12%)	$366	(5%)
Non-Confined	12,300	(3%)	330	(13%)	1,240	(10%)	$363	(5%)
Confined	14,800	(4%)	0	(0%)	170	(1%)	$3	(0%)
Mechanical failure or malfunction	24,700	(7%)	90	(4%)	520	(4%)	$454	(7%)
Non-Confined	13,100	(4%)	90	(4%)	480	(4%)	$451	(7%)
Confined	11,700	(3%)	0	(0%)	40	(0%)	$3	(0%)
Unclassified factor contributed to ignition	23,900	(7%)	290	(11%)	970	(8%)	$456	(7%)
Non-Confined	11,600	(3%)	290	(11%)	800	(7%)	$453	(7%)
Confined	12,300	(3%)	0	(0%)	160	(1%)	$3	(0%)
Accidentally turned on, not turned off	12,100	(3%)	30	(1%)	410	(3%)	$121	(2%)
Non-Confined	3,900	(1%)	30	(1%)	310	(3%)	$118	(2%)
Confined	8,200	(2%)	0	(0%)	90	(1%)	$2	(0%)

* Electrical failures or malfunctions and mechanical failures or malfunctions were summed from NFIRS factors contributing to ignition codes 30-37 and 20-27, respectively.

Table 9. (Continued)
Reported Home Structure Fires, by Factors Contributing to Ignition
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Exposure fire	11,900	(3%)	20	(1%)	70	(1%)	$571	(8%)
Non-Confined	11,800	(3%)	20	(1%)	70	(1%)	$571	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Playing with heat source	6,100	(2%)	60	(3%)	560	(5%)	$146	(2%)
Non-Confined	4,900	(1%)	60	(3%)	560	(5%)	$146	(2%)
Confined	1,100	(0%)	0	(0%)	10	(0%)	$0	(0%)
Improper container or storage	5,900	(2%)	20	(1%)	150	(1%)	$103	(2%)
Non-Confined	2,400	(1%)	20	(1%)	140	(1%)	$102	(2%)
Confined	3,500	(1%)	0	(0%)	10	(0%)	$1	(0%)
Unclassified operational deficiency	5,700	(2%)	20	(1%)	190	(2%)	$59	(1%)
Non-Confined	1,800	(0%)	20	(1%)	150	(1%)	$58	(1%)
Confined	3,900	(1%)	0	(0%)	40	(0%)	$1	(0%)
Other known factor contributing to ignition	47,600	(13%)	360	(14%)	1,430	(12%)	$1,384	(21%)
Non-Confined	29,100	(8%)	360	(14%)	1,290	(10%)	$1,380	(21%)
Confined	18,500	(5%)	0	(0%)	150	(1%)	$4	(0%)
Exposure fire	11,900	(3%)	20	(1%)	70	(1%)	$571	(8%)
Non-Confined	11,800	(3%)	20	(1%)	70	(1%)	$571	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Total Fires	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Non-Confined	186,700	(52%)	2,510	(100%)	10,730	(87%)	$6,684	(99%)
Confined	171,900	(48%)	0	(0%)	1,560	(13%)	$38	(1%)
Total Factors	372,300	(104%)	2,710	(108%)	13,070	(106%)	$7,189	(107%)
Non-Confined	195,900	(55%)	2,710	(108%)	11,460	(93%)	$7,149	(106%)
Confined	176,400	(49%)	0	(0%)	1,610	(13%)	$39	(1%)
The following factors were involved in less than 2% of the fires but were factors in at least 2% of the deaths.								
Flammable liquid or gas spilled			70	(3%)				
Flammable liquid used to kindle fire			70	(3%)				
Unclassified fire spread or control			40	(2%)				

Note: Multiple entries are allowed which can result in sums higher than totals. Fires in which the factor contributing to ignition was coded as "none," unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 10.
Reported Home Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	155,400	(43%)	420	(17%)	4,810	(39%)	$1,025	(15%)
Non-Confined	38,900	(11%)	420	(17%)	3,400	(28%)	$999	(15%)
Confined	116,500	(32%)	0	(0%)	1,410	(11%)	$26	(0%)
Bedroom	23,900	(7%)	580	(23%)	2,430	(20%)	$865	(13%)
Non-Confined	22,900	(6%)	580	(23%)	2,420	(20%)	$865	(13%)
Confined	1,000	(0%)	0	(0%)	10	(0%)	$0	(0%)
Confined chimney or flue fire	19,000	(5%)	0	(0%)	20	(0%)	$6	(0%)
Non-Confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Confined	19,000	(5%)	0	(0%)	20	(0%)	$6	(0%)
Living room, family room or den	12,900	(4%)	600	(24%)	1,260	(10%)	$538	(8%)
Non-Confined	12,000	(3%)	600	(24%)	1,250	(10%)	$538	(8%)
Confined	1,000	(0%)	0	(0%)	10	(0%)	$0	(0%)
Unclassified outside area	11,000	(3%)	10	(0%)	70	(1%)	$118	(2%)
Non-Confined	3,900	(1%)	10	(0%)	60	(0%)	$118	(2%)
Confined	7,000	(2%)	0	(0%)	10	(0%)	$0	(0%)
Laundry room or area	10,500	(3%)	30	(1%)	310	(3%)	$197	(3%)
Non-Confined	9,300	(3%)	30	(1%)	300	(2%)	$197	(3%)
Confined	1,200	(0%)	0	(0%)	10	(0%)	$0	(0%)
Attic or ceiling/roof assembly or concealed space	9,300	(3%)	20	(1%)	130	(1%)	$519	(8%)
Non-Confined	9,200	(3%)	20	(1%)	130	(1%)	$519	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Exterior wall surface	9,200	(3%)	10	(0%)	120	(1%)	$221	(3%)
Non-Confined	9,000	(3%)	10	(0%)	120	(1%)	$221	(3%)
Confined	200	(0%)	0	(0%)	0	(0%)	$0	(0%)
Garage or vehicle storage area*	9,000	(3%)	50	(2%)	400	(3%)	$557	(8%)
Non-Confined	8,000	(2%)	50	(2%)	400	(3%)	$557	(8%)
Confined	1,000	(0%)	0	(0%)	0	(0%)	$0	(0%)
Exterior balcony or unenclosed porch	8,300	(2%)	50	(2%)	230	(2%)	$347	(5%)
Non-Confined	7,100	(2%)	50	(2%)	230	(2%)	$347	(5%)
Confined	1,200	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified function area	7,700	(2%)	250	(10%)	470	(4%)	$295	(4%)
Non-Confined	6,600	(2%)	250	(10%)	460	(4%)	$295	(4%)
Confined	1,100	(0%)	0	(0%)	0	(0%)	$0	(0%)

* NFIRS 5.0 does not have a separate area of origin code for fires starting in chimneys. Any home fire with NFIRS incident type 114 - "Chimney of fire originating in and confined to a chimney or flue" is captured here.
** Does not include fires with property use coded as residential garage.

Table 10. (Continued)
Reported Home Structure Fires, by Area of Origin
2010-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified area of origin	7,400	(2%)	40	(2%)	130	(1%)	$106	(2%)
Non-Confined	3,700	(1%)	40	(2%)	120	(1%)	$105	(2%)
Confined	3,700	(1%)	0	(0%)	10	(0%)	$1	(0%)
Lavatory or bathroom	6,900	(2%)	40	(1%)	260	(2%)	$118	(2%)
Non-Confined	5,900	(2%)	40	(1%)	250	(2%)	$118	(2%)
Confined	900	(0%)	0	(0%)	10	(0%)	$0	(0%)
Wall assembly or concealed space	6,100	(2%)	20	(1%)	90	(1%)	$206	(3%)
Non-Confined	6,100	(2%)	20	(1%)	90	(1%)	$206	(3%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Heating equipment room	5,500	(2%)	10	(1%)	110	(1%)	$87	(1%)
Non-Confined	2,600	(1%)	10	(1%)	90	(1%)	$86	(1%)
Confined	2,800	(1%)	0	(0%)	10	(0%)	$1	(0%)
Other known area of origin	56,400	(16%)	380	(15%)	1,450	(12%)	$1,517	(23%)
Non-Confined	41,400	(12%)	380	(15%)	1,410	(11%)	$1,514	(23%)
Confined	15,000	(4%)	0	(0%)	50	(0%)	$3	(0%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Non-Confined	186,700	(52%)	2,510	(100%)	10,730	(87%)	$6,684	(99%)
Confined	171,900	(48%)	0	(0%)	1,560	(13%)	$38	(1%)
Although fewer than 2% of the fires began in the following areas of origin, these fires caused at least 2% of the deaths.								
Unclassified structural area			70	(3%)				
Dining room			50	(2%)				
Multiple areas of origin			40	(2%)				

Note: Sums may not equal totals due to rounding errors. Confined structure fires other than chimney or flue fires (NFIRS incident type 113, and 115-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 11.
Reported Home Structure Fires, by Item First Ignited
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking materials, including food	107,000	(30%)	140	(5%)	3,340	(27%)	$521	(8%)
Non-Confined	20,700	(6%)	140	(5%)	2,310	(19%)	$504	(7%)
Confined	86,300	(24%)	0	(0%)	1,030	(8%)	$17	(0%)
Unclassified item first ignited	24,400	(7%)	130	(5%)	540	(4%)	$310	(5%)
Non-Confined	9,200	(3%)	130	(5%)	440	(4%)	$306	(5%)
Confined	15,200	(4%)	0	(0%)	100	(1%)	$4	(0%)
Structural member or framing	19,100	(5%)	140	(5%)	380	(3%)	$1,058	(16%)
Non-Confined	18,800	(5%)	140	(5%)	380	(3%)	$1,057	(16%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Electrical wire or cable insulation	17,200	(5%)	120	(5%)	430	(3%)	$398	(6%)
Non-Confined	15,000	(4%)	120	(5%)	430	(3%)	$397	(6%)
Confined	2,200	(1%)	0	(0%)	0	(0%)	$1	(0%)
Rubbish, trash, or waste	15,200	(4%)	30	(1%)	240	(2%)	$161	(2%)
Non-Confined	5,300	(1%)	30	(1%)	210	(2%)	$159	(2%)
Confined	9,900	(3%)	0	(0%)	30	(0%)	$1	(0%)
Flammable or combustible liquids or gases, piping or filter	14,700	(4%)	190	(8%)	1,020	(8%)	$273	(4%)
Non-Confined	6,900	(2%)	190	(8%)	910	(7%)	$271	(4%)
Confined	7,800	(2%)	0	(0%)	110	(1%)	$2	(0%)
Exterior wall covering or finish	14,100	(4%)	30	(1%)	220	(2%)	$511	(8%)
Non-Confined	13,900	(4%)	30	(1%)	220	(2%)	$510	(8%)
Confined	200	(0%)	0	(0%)	0	(0%)	$0	(0%)
Appliance housing or casing	13,600	(4%)	20	(1%)	300	(2%)	$128	(2%)
Non-Confined	6,000	(2%)	20	(1%)	260	(2%)	$125	(2%)
Confined	7,700	(2%)	0	(0%)	40	(0%)	$3	(0%)
Household utensils	9,700	(3%)	10	(1%)	240	(2%)	$37	(1%)
Non-Confined	2,000	(1%)	10	(1%)	150	(1%)	$35	(1%)
Confined	7,800	(2%)	0	(0%)	90	(1%)	$2	(0%)
Unclassified organic materials	9,700	(3%)	10	(0%)	60	(1%)	$65	(1%)
Non-Confined	2,000	(1%)	10	(0%)	50	(0%)	$64	(1%)
Confined	7,700	(2%)	0	(0%)	10	(0%)	$1	(0%)
Mattress or bedding	9,100	(3%)	330	(13%)	1,200	(10%)	$297	(4%)
Non-Confined	8,500	(2%)	330	(13%)	1,200	(10%)	$297	(4%)
Confined	600	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified structural component or finish	7,300	(2%)	60	(2%)	200	(2%)	$340	(5%)
Non-Confined	7,000	(2%)	60	(2%)	200	(2%)	$340	(5%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)

Table 11. (Continued)
Reported Home Structure Fires, by Item First Ignited
2010-2015 Annual Averages
(Unknowns were allocated proportionally)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Clothing	7,300	(2%)	140	(5%)	470	(4%)	$182	(3%)
Non-Confined	6,200	(2%)	140	(5%)	450	(4%)	$182	(3%)
Confined	1,100	(0%)	0	(0%)	20	(0%)	$0	(0%)
Multiple items first ignited	7,000	(2%)	140	(6%)	400	(3%)	$278	(4%)
Non-Confined	4,900	(1%)	140	(6%)	390	(3%)	$278	(4%)
Confined	2,100	(1%)	0	(0%)	20	(0%)	$0	(0%)
Interior wall covering, excluding drapes	6,400	(2%)	90	(3%)	240	(2%)	$268	(4%)
Non-Confined	6,200	(2%)	90	(3%)	240	(2%)	$268	(4%)
Confined	200	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified furniture or utensils	5,700	(2%)	150	(6%)	350	(3%)	$170	(3%)
Non-Confined	4,200	(1%)	150	(6%)	340	(3%)	$170	(3%)
Confined	1,500	(0%)	0	(0%)	10	(0%)	$0	(0%)
Cabinetry	5,500	(2%)	40	(1%)	310	(3%)	$165	(2%)
Non-Confined	4,400	(1%)	40	(1%)	290	(2%)	$164	(2%)
Confined	1,100	(0%)	0	(0%)	20	(0%)	$1	(0%)
Upholstered furniture	5,500	(2%)	460	(18%)	720	(6%)	$268	(4%)
Non-Confined	5,200	(1%)	460	(18%)	710	(6%)	$267	(4%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Magazine, newspaper, or writing paper	5,500	(2%)	50	(2%)	170	(1%)	$70	(1%)
Non-Confined	2,500	(1%)	50	(2%)	170	(1%)	$69	(1%)
Confined	2,900	(1%)	0	(0%)	10	(0%)	$0	(0%)
Insulation within structural area	5,500	(2%)	0	(0%)	70	(1%)	$154	(2%)
Non-Confined	5,300	(1%)	0	(0%)	70	(1%)	$153	(2%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Other known item first ignited	48,900	(14%)	250	(10%)	1,390	(11%)	$1,071	(16%)
Non-Confined	32,400	(9%)	250	(10%)	1,320	(11%)	$1,067	(16%)
Confined	16,500	(5%)	0	(0%)	70	(1%)	$3	(0%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Non-Confined	186,700	(52%)	2,510	(100%)	10,730	(87%)	$6,684	(99%)
Confined	171,900	(48%)	0	(0%)	1,560	(13%)	$38	(1%)

The following items were first ignited in fewer than 2% of the fires but at least 2% of the deaths.		
Floor covering, rug, carpet or mat	70	(3%)
Unclassified soft goods or wearing apparel	40	(2%)

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.
Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 12.
Reported Home Structure Fires, by Extent of Fire Spread
2011-2015 Annual Averages
(Unknowns Non-confined Fires Were Allocated Proportionally)

Extent of Fire Spread	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	171,900	(48%)	0	(0%)	1,560	(13%)	$38	(1%)
Confined to object of origin	28,200	(8%)	80	(3%)	750	(6%)	$236	(4%)
Confined to room of origin	67,500	(19%)	390	(15%)	4,320	(35%)	$852	(13%)
Confined to floor of origin	17,700	(5%)	280	(11%)	1,440	(12%)	$644	(10%)
Confined to building of origin	62,400	(17%)	1,420	(56%)	3,500	(28%)	$4,034	(60%)
Extended beyond building of origin	10,900	(3%)	340	(14%)	720	(6%)	$919	(14%)
Total	358,500	(100%)	2,510	(100%)	12,300	(100%)	$6,723	(100%)
Fire extended beyond room of origin	91,000	(25%)	2,040	(81%)	5,660	(46%)	$5,597	(83%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 13.
Reported Home Fire Deaths in Selected Areas of Origin
by Year 1980-2015
(Unknowns were allocated proportionally)

Year	Living Room, Family Room or Den		Bedroom		Kitchen		Other Area of Origin		Total Deaths	
1980	2,220	(42%)	1,210	(23%)	660	(13%)	1,160	(22%)	5,240	(100%)
1981	2,160	(41%)	1,260	(24%)	710	(13%)	1,180	(22%)	5,320	(100%)
1982	1,870	(39%)	1,260	(26%)	580	(12%)	1,130	(23%)	4,840	(100%)
1983	1,810	(39%)	1,240	(27%)	680	(15%)	950	(20%)	4,680	(100%)
1984	1,580	(39%)	1,060	(26%)	550	(13%)	910	(22%)	4,100	(100%)
1985	1,670	(34%)	1,440	(30%)	690	(14%)	1,060	(22%)	4,860	(100%)
1986	1,680	(36%)	1,310	(28%)	610	(13%)	1,040	(22%)	4,640	(100%)
1987	1,730	(38%)	1,200	(27%)	640	(14%)	950	(21%)	4,520	(100%)
1988	1,800	(36%)	1,410	(28%)	650	(13%)	1,130	(23%)	4,990	(100%)
1989	1,570	(36%)	1,140	(26%)	720	(17%)	910	(21%)	4,350	(100%)
1990	1,400	(35%)	1,090	(27%)	650	(16%)	860	(22%)	4,010	(100%)
1991	1,230	(35%)	990	(28%)	550	(15%)	760	(22%)	3,520	(100%)
1992	1,210	(33%)	1,060	(29%)	490	(13%)	910	(25%)	3,670	(100%)
1993	1,280	(34%)	1,010	(27%)	570	(15%)	880	(23%)	3,730	(100%)
1994	1,070	(31%)	960	(28%)	490	(14%)	880	(26%)	3,410	(100%)
1995	1,220	(34%)	990	(27%)	490	(14%)	910	(25%)	3,600	(100%)
1996	1,230	(31%)	1,060	(27%)	630	(16%)	1,060	(27%)	3,980	(100%)
1997	1,050	(32%)	900	(27%)	520	(16%)	850	(26%)	3,330	(100%)
1998	840	(27%)	790	(25%)	540	(17%)	1,000	(31%)	3,170	(100%)
1999	660	(23%)	630	(22%)	540	(19%)	1,030	(36%)	2,870	(100%)
2000	860	(27%)	790	(24%)	530	(16%)	1,060	(33%)	3,250	(100%)
2001	790	(26%)	700	(23%)	460	(15%)	1,070	(36%)	3,010	(100%)
2002	660	(26%)	700	(28%)	350	(14%)	810	(32%)	2,520	(100%)
2003	690	(23%)	630	(21%)	460	(15%)	1,220	(41%)	3,010	(100%)
2004	690	(23%)	700	(23%)	470	(15%)	1,200	(39%)	3,070	(100%)
2005	720	(25%)	740	(26%)	450	(16%)	960	(33%)	2,870	(100%)
2006	560	(23%)	620	(25%)	360	(14%)	950	(38%)	2,480	(100%)
2007	650	(23%)	720	(26%)	450	(16%)	990	(35%)	2,800	(100%)
2008	630	(24%)	700	(26%)	400	(15%)	950	(35%)	2,670	(100%)
2009	630	(26%)	590	(24%)	330	(14%)	880	(36%)	2,440	(100%)
2010	610	(24%)	610	(24%)	400	(16%)	930	(36%)	2,545	(100%)
2011	500	(21%)	600	(25%)	450	(18%)	880	(36%)	2,430	(100%)
2012	570	(25%)	560	(24%)	350	(15%)	830	(36%)	2,300	(100%)
2013	650	(25%)	590	(22%)	480	(18%)	940	(35%)	2,660	(100%)
2014	700	(26%)	620	(23%)	400	(15%)	940	(35%)	2,660	(100%)
2015	590	(24%)	560	(22%)	390	(16%)	950	(38%)	2,500	(100%)
1980-1984 annual average	1,930	(40%)	1,210	(25%)	640	(13%)	1,070	(22%)	4,830	(100%)
2011-2015 annual average	600	(24%)	580	(23%)	420	(17%)	910	(36%)	2,510	(100%)
Change from 1980-1984 to 2011-2015	-1,330	(-69%)	-630	(-52%)	-220	(-34%)	-160	(-15%)	-2,320	-(48%)

Table 13.
Reported Home Fire Deaths in Selected Areas of Origin
by Year 1980-2015
(Unknowns were allocated proportionally) (Continued)

Note: Estimates from 1999 on are based on NFIRS 5.0 data and include deaths from confined fires. Because of low participation in NFIRS 5.0 during 1999-2001, estimates for these years are highly uncertain and must be used with caution. Estimates of total deaths vary slightly from those in Table 1. Estimates in Table 1 were based solely on NFPA's fire experience survey data.

Source: NFIRS and NFPA's fire experience survey.

Table 14
Reported Home Fire Deaths from Fires
Starting with Upholstered Furniture or Mattresses and Bedding
by Year: 1980-2015
(Unknowns were allocated proportionally)

Year	Upholstered Furniture		Mattress or Bedding		Other Item		Total Deaths	
1980	1,360	(26%)	940	(18%)	2,940	(56%)	5,240	(100%)
1981	1,360	(26%)	820	(15%)	3,140	(59%)	5,320	(100%)
1982	1,190	(25%)	700	(14%)	2,950	(61%)	4,840	(100%)
1983	1,100	(24%)	700	(15%)	2,880	(62%)	4,680	(100%)
1984	1,090	(27%)	670	(16%)	2,340	(57%)	4,100	(100%)
1985	930	(19%)	860	(18%)	3,070	(63%)	4,860	(100%)
1986	1,070	(23%)	730	(16%)	2,840	(61%)	4,640	(100%)
1987	1,030	(23%)	720	(16%)	2,770	(61%)	4,520	(100%)
1988	1,100	(22%)	920	(18%)	2,970	(60%)	4,990	(100%)
1989	880	(20%)	650	(15%)	2,820	(65%)	4,350	(100%)
1990	870	(22%)	620	(15%)	2,520	(63%)	4,010	(100%)
1991	680	(19%)	620	(18%)	2,220	(63%)	3,520	(100%)
1992	630	(17%)	620	(17%)	2,420	(66%)	3,670	(100%)
1993	650	(17%)	620	(17%)	2,460	(66%)	3,730	(100%)
1994	670	(20%)	470	(14%)	2,270	(67%)	3,410	(100%)
1995	660	(18%)	530	(15%)	2,410	(67%)	3,600	(100%)
1996	650	(16%)	660	(17%)	2,670	(67%)	3,980	(100%)
1997	660	(20%)	490	(15%)	2,180	(65%)	3,330	(100%)
1998	540	(17%)	400	(13%)	2,230	(70%)	3,170	(100%)
1999	480	(17%)	210	(7%)	2,180	(76%)	2,870	(100%)
2000	580	(18%)	460	(14%)	2,210	(68%)	3,250	(100%)
2001	620	(21%)	460	(15%)	1,930	(64%)	3,010	(100%)
2002	540	(21%)	380	(15%)	1,610	(64%)	2,520	(100%)
2003	650	(22%)	370	(12%)	1,980	(66%)	3,010	(100%)
2004	690	(23%)	310	(10%)	2,070	(68%)	3,070	(100%)
2005	540	(19%)	460	(16%)	1,870	(65%)	2,870	(100%)
2006	490	(20%)	380	(15%)	1,610	(65%)	2,480	(100%)
2007	540	(19%)	360	(13%)	1,890	(68%)	2,800	(100%)
2008	500	(19%)	300	(11%)	1,870	(70%)	2,670	(100%)
2009	450	(19%)	330	(14%)	1,650	(68%)	2,440	(100%)
2010	400	(16%)	300	(12%)	1,840	(72%)	2,545	(100%)
2011	370	(15%)	360	(15%)	1,700	(70%)	2,430	(100%)
2012	400	(18%)	370	(16%)	1,530	(66%)	2,300	(100%)
2013	480	(18%)	350	(13%)	1,820	(69%)	2,660	(100%)
2014	570	(21%)	320	(12%)	1,770	(67%)	2,660	(100%)
2015	490	(20%)	220	(9%)	1,780	(71%)	2,500	(100%)
1980-1984 annual average	1,220	(25%)	770	(16%)	2,850	(59%)	4,830	(100%)
2011-2015 annual average	460	(18%)	330	(13%)	1,720	(69%)	2,510	(100%)
Change from 1980-1984 to 2010-2015	-760	(-62%)	-440	(-57%)	-1,130	(-40%)	-2,320	(-48%)

Note: Estimates from 1999 on are based on NFIRS 5.0 data and exclude deaths from confined fires. Because of low participation in NFIRS 5.0 during 1999-2001, estimates for these years are highly uncertain and must be used with caution. Estimates of total deaths vary slightly from those in Table 1. Estimates in Table 1 were based solely on NFPA's fire experience survey data.
Source: NFIRS and NFPA's fire experience survey.

Table 15.
Reported Home Fire Deaths, by Selected Types of Heat Sources and Year
1980-2015
(Unknowns were allocated proportionally)

Year	Operating Equipment		Smoking Materials		Lighters, Candles and Matches		Other Heat Source		Total Deaths	
1980	1,950	(37%)	1,820	(35%)	970	(19%)	490	(9%)	5,240	(100%)
1981	1,970	(37%)	1,980	(37%)	820	(15%)	550	(10%)	5,320	(100%)
1982	1,870	(39%)	1,680	(35%)	700	(14%)	580	(12%)	4,840	(100%)
1983	1,910	(41%)	1,510	(32%)	830	(18%)	440	(9%)	4,680	(100%)
1984	1,620	(39%)	1,480	(36%)	640	(16%)	360	(9%)	4,100	(100%)
1985	1,930	(40%)	1,580	(33%)	860	(18%)	490	(10%)	4,860	(100%)
1986	1,960	(42%)	1,350	(29%)	810	(18%)	510	(11%)	4,640	(100%)
1987	1,850	(41%)	1,380	(31%)	850	(19%)	450	(10%)	4,520	(100%)
1988	1,940	(39%)	1,570	(31%)	950	(19%)	530	(11%)	4,990	(100%)
1989	1,840	(42%)	1,190	(27%)	880	(20%)	430	(10%)	4,350	(100%)
1990	1,660	(41%)	1,150	(29%)	710	(18%)	490	(12%)	4,010	(100%)
1991	1,410	(40%)	880	(25%)	820	(23%)	410	(12%)	3,520	(100%)
1992	1,440	(39%)	1,000	(27%)	800	(22%)	420	(11%)	3,670	(100%)
1993	1,510	(41%)	980	(26%)	870	(23%)	370	(10%)	3,730	(100%)
1994	1,510	(44%)	840	(25%)	710	(21%)	350	(10%)	3,410	(100%)
1995	1,540	(43%)	1,040	(29%)	660	(18%)	360	(10%)	3,600	(100%)
1996	1,810	(45%)	1,090	(27%)	610	(15%)	470	(12%)	3,980	(100%)
1997	1,360	(41%)	870	(26%)	710	(21%)	390	(12%)	3,330	(100%)
1998	1,360	(43%)	850	(27%)	560	(18%)	400	(13%)	3,170	(100%)
1999	940	(33%)	830	(29%)	370	(13%)	720	(25%)	2,870	(100%)
2000	1,140	(35%)	860	(26%)	650	(20%)	560	(17%)	3,250	(100%)
2001	1,110	(37%)	760	(25%)	560	(19%)	580	(19%)	3,010	(100%)
2002	800	(32%)	610	(24%)	510	(20%)	610	(24%)	2,520	(100%)
2003	1,200	(40%)	700	(23%)	440	(15%)	660	(22%)	3,000	(100%)
2004	1,200	(39%)	710	(23%)	480	(16%)	690	(22%)	3,070	(100%)
2005	1,100	(38%)	730	(26%)	480	(17%)	570	(20%)	2,870	(100%)
2006	910	(36%)	690	(28%)	390	(16%)	490	(20%)	2,480	(100%)
2007	950	(34%)	650	(23%)	550	(20%)	490	(20%)	2,800	(100%)
2008	1,180	(44%)	620	(23%)	310	(12%)	560	(21%)	2,670	(100%)
2009	970	(40%)	580	(24%)	270	(11%)	610	(25%)	2,440	(100%)
2010	1,040	(41%)	540	(21%)	330	(13%)	630	(25%)	2,545	(100%)
2011	1,000	(41%)	490	(20%)	240	(10%)	690	(28%)	2,430	(100%)
2012	730	(32%)	620	(27%)	360	(16%)	600	(26%)	2,300	(100%)
2013	1,040	(39%)	590	(22%)	350	(13%)	680	(26%)	2,660	(100%)
2014	1,170	(44%)	570	(21%)	240	(9%)	670	(25%)	2,660	(100%)
2015	970	(39%)	530	(21%)	280	(11%)	720	(29%)	2,500	(100%)
1980-1984 annual average	1,860	(39%)	1,690	(35%)	790	(16%)	490	(10%)	4,830	(100%)
2011-2015 annual average	980	(39%)	560	(22%)	290	(12%)	670	(27%)	2,510	(100%)
Change from 1980-1984 to 2011-2015	-880	(-47%)	-1,130	(-67%)	-500	(-63%)	180	(37%)	-2,320	(-48%)

Table 15. (Continued)
Reported Home Fire Deaths, by Selected Types of Heat Sources and Year
1980-2015

Note: Estimates from 1999 on are based on NFIRS 5.0 data and exclude deaths from confined fires. Because of low participation in NFIRS 5.0 during 1999-2001, estimates for these years must be used with caution. In 1980-1998, operating equipment identified by form of heat of ignition codes for heat from fuel-fires, fuel-powered objects, heat from electrical equipment arcing or overloaded, electric lamps, and properly and improperly operating equipment (form of heat of ignition codes 10-29, 54, 56, and 57). Beginning in 1999, operating equipment was identified by heat source codes for operating equipment (heat source 10-13). The 1980-1998 estimates of lighter, candles, and matches include proportional shares of deaths from fires in which the form of heat of ignition was an unknown-type of open flame. Estimates for open flame and smoking material beginning in 1999 include a proportional share of deaths in which the heat source was an unclassified open flame or smoking material. Estimates of total deaths vary slightly from those in Table 1. Estimates in Table 1 were based solely on NFPA's fire experience survey data.

Source: NFIRS and NFPA's fire experience survey.

Table 1A.
Reported One- or Two-Family Home Structure Fires
by Year: 1980-2016

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions) As Reported	Direct Property Damage (in Millions) In 2016 Dollars
1980	590,500	4,175	16,100	$2,447	$7,130
1981	574,000	4,430	14,875	$2,713	$7,144
1982	538,000	3,960	15,750	$2,794	$6,935
1983	523,500	3,825	16,450	$2,792	$6,716
1984	506,000	3,290	15,100	$2,945	$6,787
1985	501,500	4,020	15,250	$3,217	$7,159
1986	468,000	4,005	14,650	$2,992	$6,551
1987	433,000	3,780	15,200	$3,078	$6,496
1988	432,500	4,125	17,125	$3,349	$6,794
1989	402,500	3,545	15,225	$3,335	$6,454
1990	359,000	3,370	15,250	$3,534	$6,492
1991	363,000	2,905	15,600	$3,354	$5,904
1992	358,000	3,160	15,275	$3,178	$5,434
1993	358,000	3,035	15,700	$4,111	$6,822
1994	341,000	2,785	14,000	$3,537	$5,725
1995	320,000	3,035	13,450	$3,615	$5,687
1996	324,000	3,470	13,700	$4,121	$6,305
1997	302,500	2,700	12,300	$3,735	$5,580
1998	283,000	2,775	11,800	$3,642	$5,363
1999	282,500	2,375	11,550	$4,123	$5,932
2000	283,500	2,920	12,575	$4,639	$6,463
2001	295,500	2,650	11,400	$4,652	$6,303
2002	300,500	2,280	9,950	$5,005	$6,673
2003	297,000	2,735	10,000	$5,052	$6,591
2004	301,500	2,680	10,500	$4,948	$6,289
2005	287,000	2,570	10,300	$5,781	$7,098
2006	304,500	2,155	8,800	$5,936	$7,061
2007	300,500	2,350	9,650	$6,225	$7,195
2008	291,000	2,365	9,185	$6,892	$7,685
2009	272,500	2,100	9,300	$6,391	$7,142
2010	279,000	2,200	9,400	$5,895	$6,489
2011	274,500	2,105	9,485	$5,746	$6,132
2012	268,000	2,000	8,825	$5,818	$6,083
2013	271,500	2,430	8,300	$5,626	$5,788
2014	273,500	2,345	8,025	$5,844	$5,914
2015	270,500	2,155	8,050	$5,799	$5,869
2016	257,000	2,410	7,375	$4943	$4,943

Note: See Table 1, Reported Home Structure Fires by Year, for notes about inclusion or exclusion of unusually large loss fires.

Source: *Fire Loss in the United Sates* series of NFPA annual reports by Michael J. Karter, Jr. and Hylton Haynes. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 2A.
Reported One- or Two-Family Home Structure Fires, by Month
2011-2015 Annual Averages

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	27,400	(11%)	310	(15%)	950	(12%)	$597	(11%)
February	23,100	(9%)	240	(11%)	790	(10%)	$510	(9%)
March	22,900	(9%)	210	(10%)	800	(10%)	$487	(9%)
April	20,600	(8%)	180	(9%)	660	(8%)	$443	(8%)
May	19,300	(8%)	130	(6%)	610	(8%)	$437	(8%)
June	18,200	(7%)	120	(6%)	560	(7%)	$400	(7%)
July	19,300	(8%)	120	(6%)	620	(8%)	$455	(8%)
August	17,700	(7%)	120	(6%)	540	(7%)	$388	(7%)
September	16,800	(7%)	110	(5%)	530	(6%)	$364	(7%)
October	19,100	(8%)	150	(7%)	640	(8%)	$386	(7%)
November	22,400	(9%)	210	(10%)	700	(9%)	$465	(9%)
December	22,700	(9%)	210	(10%)	720	(9%)	$461	(9%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Average by month	20,800	(8%)	180	(8%)	680	(8%)	$449	(8%)

Table 3A.
Reported One- or Two-Family Home Structure Fires, by Day of Week
2011-2015 Annual Averages

Day of Week	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	37,900	(15%)	310	(15%)	1,230	(15%)	$802	(15%)
Monday	35,600	(14%)	290	(14%)	1,100	(14%)	$777	(14%)
Tuesday	34,700	(14%)	280	(13%)	1,160	(14%)	$736	(14%)
Wednesday	34,600	(14%)	290	(14%)	1,120	(14%)	$739	(14%)
Thursday	35,200	(14%)	300	(14%)	1,120	(14%)	$764	(14%)
Friday	34,400	(14%)	300	(14%)	1,140	(14%)	$768	(14%)
Saturday	37,000	(15%)	340	(16%)	1,250	(15%)	$806	(15%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Average by day	35,600	(14%)	300	(14%)	1,160	(14%)	$770	(14%)

Note: Sums may not equal totals due to rounding errors.
Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 4A.
Reported One- or Two-Family Home Structure Fires, by Alarm Time
2011-2015 Annual Averages

Alarm Time	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Midnight- 12:59 a.m.	7,700	(3%)	150	(7%)	340	(4%)	$247	(5%)
1:00-1:59 a.m.	7,000	(3%)	160	(8%)	370	(5%)	$263	(5%)
2:00-2:59 a.m.	6,500	(3%)	140	(7%)	340	(4%)	$251	(5%)
3:00-3:59 a.m.	6,000	(2%)	160	(7%)	320	(4%)	$241	(4%)
4:00-4:59 a.m.	5,500	(2%)	150	(7%)	290	(4%)	$220	(4%)
5:00-5:59 a.m.	5,200	(2%)	130	(6%)	270	(3%)	$186	(3%)
6:00-6:59 a.m.	5,500	(2%)	100	(5%)	250	(3%)	$153	(3%)
7:00-7:59 a.m.	6,400	(3%)	80	(4%)	240	(3%)	$148	(3%)
8:00-8:59 a.m.	7,500	(3%)	70	(4%)	270	(3%)	$153	(3%)
9:00-9:59 a.m.	8,700	(3%)	70	(3%)	310	(4%)	$165	(3%)
10:00-10:59 a.m.	10,000	(4%)	70	(3%)	320	(4%)	$186	(3%)
11:00-11:59 a.m.	11,100	(4%)	60	(3%)	340	(4%)	$228	(4%)
12:00-12:59 p.m.	12,200	(5%)	60	(3%)	360	(4%)	$244	(5%)
1:00-1:59 p.m.	12,700	(5%)	50	(3%)	350	(4%)	$265	(5%)
2:00-2:59 p.m.	12,800	(5%)	60	(3%)	340	(4%)	$242	(4%)
3:00-3:59 p.m.	13,900	(6%)	50	(2%)	400	(5%)	$259	(5%)
4:00-4:59 p.m.	15,200	(6%)	50	(2%)	410	(5%)	$279	(5%)
5:00-5:59 p.m.	17,100	(7%)	50	(2%)	410	(5%)	$248	(5%)
6:00-6:59 p.m.	17,600	(7%)	50	(3%)	430	(5%)	$266	(5%)
7:00-7:59 p.m.	16,200	(7%)	70	(3%)	410	(5%)	$241	(4%)
8:00-8:59 p.m.	14,200	(6%)	60	(3%)	400	(5%)	$226	(4%)
9:00-9:59 p.m.	11,900	(5%)	80	(4%)	350	(4%)	$223	(4%)
10:00-10:59 p.m.	10,000	(4%)	80	(4%)	310	(4%)	$226	(4%)
11:00-11:59 p.m.	8,400	(3%)	110	(5%)	320	(4%)	$233	(4%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Average by alarm hour	10,400	(4%)	90	(4%)	340	(4%)	$225	(4%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 5A.
Leading Causes of Reported One- or Two-Family Home Structure Fires
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	91,600	(37%)	390	(18%)	3,200	(39%)	$822	(15%)
Heating equipment	46,400	(19%)	450	(21%)	1,100	(14%)	$931	(17%)
Electrical distribution or lighting equipment	31,100	(12%)	390	(19%)	910	(11%)	$1,106	(21%)
Intentional	22,700	(9%)	320	(15%)	560	(7%)	$391	(7%)
Smoking materials	11,300	(5%)	420	(20%)	74	(9%)	$307	(6%)
Clothes dryer or washer	11,300	(5%)	10	(1%)	300	(4%)	$189	(4%)
Exposure	10,000	(4%)	20	(1%)	50	(1%)	$366	(7%)
Candles	6,600	(3%)	70	(3%)	550	(7%)	$236	(4%)
Fan or air conditioner	6,100	(2%)	50	(3%)	200	(2%)	$198	(4%)
Playing with heat source	4,600	(2%)	50	(3%)	420	(5%)	$110	(2%)

Note: This table summarizes findings from multiple fields, meaning that the same fire may be listed under multiple causes. Estimates of fires involving electrical distribution or lighting equipment or clothes dryers or washers exclude confined fires. The methodology used is described in Appendix B.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 6A.
Reported One- or Two-Family Home Structure Fires
by Cause of Ignition (from NFIRS Cause Field)
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	173,100	(69%)	1,530	(72%)	6,590	(81%)	$3,616	(67%)
Non-Confined	100,100	(40%)	1,530	(72%)	5,890	(72%)	$3,596	(67%)
Confined	73,100	(29%)	0	(0%)	700	(9%)	$20	(0%)
Failure of equipment or heat source	37,500	(15%)	220	(11%)	840	(10%)	$774	(14%)
Non-Confined	26,500	(11%)	220	(11%)	810	(10%)	$770	(14%)
Confined	11,000	(4%)	0	(0%)	30	(0%)	$4	(0%)
Intentional	22,700	(9%)	320	(15%)	560	(7%)	$391	(7%)
Non-Confined	14,100	(6%)	320	(15%)	540	(7%)	$391	(7%)
Confined	8,700	(3%)	0	(0%)	20	(0%)	$0	(0%)
Unclassified cause	11,000	(4%)	30	(1%)	90	(1%)	$297	(6%)
Non-Confined	8,000	(3%)	30	(1%)	80	(1%)	$297	(5%)
Confined	3,000	(1%)	0	(0%)	10	(0%)	$0	(0%)
Act of nature	5,100	(2%)	10	(1%)	40	(1%)	$316	(6%)
Non-Confined	4,800	(2%)	10	(1%)	40	(1%)	$316	(6%)
Confined	400	(0%)	0	(0%)	0	(0%)	$0	(0%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Non-Confined	153,400	(61%)	2,100	(100%)	7,350	(91%)	$5,369	(100%)
Confined	96,100	(39%)	0	(0%)	770	(9%)	$24	(0%)

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 7A.
Reported One- or Two-Family Home Structure Fires
by Equipment Involved in Ignition
2011-2015 Annual Averages
(Unknowns in non-confined fires and confined cooking fires were allocated proportionally)

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	91,600	(37%)	390	(18%)	3,200	(39%)	$822	(15%)
Range or cooktop	56,600	(23%)	340	(16%)	2,550	(31%)	$571	(11%)
Non-confined fire	23,600	(9%)	340	(16%)	2,110	(26%)	$562	(10%)
Confined fire	33,000	(13%)	0	(0%)	440	(5%)	$9	(0%)
Oven or rotisserie	13,000	(5%)	10	(0%)	160	(2%)	$33	(1%)
Non-confined fire	2,100	(1%)	10	(0%)	90	(1%)	$31	(1%)
Confined fire	10,800	(4%)	0	(0%)	70	(1%)	$2	(0%)
Portable cooking or warming device	4,200	(2%)	30	(1%)	160	(2%)	$62	(1%)
Non-confined fire	1,600	(1%)	30	(1%)	130	(2%)	$62	(1%)
Confined fire	2,600	(1%)	0	(0%)	30	(0%)	$0	(0%)
Microwave oven	3,900	(2%)	0	(0%)	60	(1%)	$26	(0%)
Non-confined fire	1,200	(0%)	0	(0%)	50	(1%)	$25	(0%)
Confined fire	2,700	(1%)	0	(0%)	10	(0%)	$1	(0%)
Grill, barbecue or hibachi	3,200	(1%)	10	(0%)	90	(1%)	$104	(2%)
Non-confined fire	1,600	(1%)	10	(0%)	80	(1%)	$104	(2%)
Confined fire	1,700	(1%)	0	(0%)	10	(0%)	$0	(0%)
Other known cooking equipment or confined cooking fire	10,700	(4%)	0	(0%)	180	(2%)	$25	(0%)
Other known cooking equipment in non-confined fire	700	(0%)	0	(0%)	50	(1%)	$23	(0%)
Confined cooking fire with other or unknown equipment	10,100	(4%)	0	(0%)	130	(2%)	$3	(0%)
Heating equipment	46,400	(19%)	450	(21%)	1,100	(14%)	$931	(17%)
Fireplace or chimney fire*	22,100	(9%)	40	(2%)	90	(1%)	$89	(5%)
Fireplace or chimney with non-confined incident type	3,600	(1%)	40	(2%)	70	(1%)	$68	(5%)
*Confined chimney or flue fire**	18,500	(7%)	0	(0%)	20	(0%)	$21	(0%)
Fixed or portable space heater	12,400	(5%)	380	(18%)	800	(10%)	$804	(9%)
Furnace, central heat, or boiler*	7,600	(3%)	20	(1%)	80	(1%)	$76	(1%)
Furnace or boiler with non-confined incident type	1,700	(1%)	20	(1%)	50	(1%)	$51	(1%)
*Confined fuel burner or boiler fire**	5,800	(2%)	0	(0%)	30	(0%)	$25	(0%)
Water heater	3,300	(1%)	10	(0%)	110	(1%)	$107	(2%)
Other known heating equipment in non-confined fire	1,000	(0%)	10	(1%)	30	(0%)	$28	(1%)
No equipment involved in ignition	37,800	(15%)	610	(29%)	1,720	(21%)	$1,626	(30%)

* The estimates of fires involving fireplaces or chimneys include all fires with the confined chimney or flue incident type regardless of what may have been coded as equipment involved. Likewise, the estimates of fires involving furnaces, central heat or boilers include all fires with confined fuel burner or boiler incident type. The estimates shown should be considered upper bounds. Except for confined cooking fires, the estimates for equipment involved in ignition did not break out the confined fires further. John Hall's report, *Home Fires Involving Heating Equipment,* shows a detailed breakdown of the equipment involved in the confined heating fires.

Table 7A. (Continued)
Reported One- or Two-Family Home Structure Fires
by Equipment Involved in Ignition
2011-2015 Annual Averages
(Unknowns in non-confined fires and confined cooking fires were allocated proportionally)

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical distribution and lighting equipment	31,100	(12%)	390	(19%)	910	(11%)	$1,106	(21%)
Wiring and related equipment	22,000	(9%)	220	(10%)	480	(6%)	$739	(14%)
Lamp, bulb or lighting	4,200	(2%)	40	(2%)	150	(2%)	$146	(3%)
Cord or plug	3,000	(1%)	120	(6%)	190	(2%)	$125	(2%)
Transformers and power supplies	1,800	(1%)	20	(1%)	90	(1%)	$96	(2%)
Other known electrical distribution or lighting equipment	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Clothes dryer	11,200	(4%)	10	(1%)	300	(4%)	$188	(3%)
Contained trash or rubbish fire	10,500	(4%)	0	(0%)	30	(0%)	$1	(0%)
Fan	3,700	(1%)	10	(0%)	90	(1%)	$88	(2%)
Air conditioner	2,400	(1%)	20	(1%)	100	(1%)	$66	(1%)
Unclassified equipment involved in ignition	2,400	(1%)	40	(2%)	110	(1%)	$110	(2%)
Torch, burner or soldering iron	1,300	(1%)	10	(0%)	50	(1%)	$46	(1%)
Other known equipment involved in ignition	11,000	(4%)	170	(8%)	530	(6%)	$410	(8%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
The following types of equipment were involved in less than 1% of the fires, but in at least 2% of the deaths.								
Oxygen administration equipment			60	(3%)				
Portable appliance designed to produce heat			30	(1%)				

Note: Non-confined fires in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among fires with known equipment involved. The same approach was used with confined cooking fires. Fires in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Non-confined fires in which the equipment was partially unclassified (i.e., unclassified kitchen or cooking equipment, unclassified heating, cooling or air condition equipment, etc.) were allocated proportionally among fires in that grouping (kitchen or cooking equipment; heating, cooling or air conditioning equipment, etc.). The same approach was used with confined cooking fires. The estimates of fires involving fireplace or chimney include all fires with the confined chimney or flue incident type regardless of what may have been coded as equipment involved. Similarly, the estimates of fires involving furnaces, central heat or boilers include all fires with confined fuel burner or boiler incident type. The estimates shown should be considered upper bounds. Non-cooking confined fires were not analyzed separately. Estimates of other types of equipment exclude confined fires. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 8A.
Reported One- or Two-Family Home Structure Fires by Heat Source
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Radiated or conducted heat from operating equipment	40,400	(16%)	320	(15%)	1,660	(20%)	$615	(11%)
Non-confined	19,900	(8%)	320	(15%)	1,410	(17%)	$610	(11%)
Confined	20,500	(8%)	0	(0%)	250	(3%)	$5	(0%)
Unclassified heat from powered equipment	35,700	(14%)	190	(9%)	1,260	(16%)	$558	(10%)
Non-confined	19,100	(8%)	190	(9%)	1,050	(13%)	$554	(10%)
Confined	16,600	(7%)	0	(0%)	210	(3%)	$5	(0%)
Arcing	27,500	(11%)	270	(13%)	760	(9%)	$808	(15%)
Non-confined	25,100	(10%)	270	(13%)	750	(9%)	$807	(15%)
Confined	2,400	(1%)	0	(0%)	10	(0%)	$1	(0%)
Hot ember or ash	20,800	(8%)	90	(4%)	330	(4%)	$398	(7%)
Non-confined	10,800	(4%)	90	(4%)	310	(4%)	$396	(7%)
Confined	10,000	(4%)	0	(0%)	10	(0%)	$2	(0%)
Unclassified heat source	20,200	(8%)	160	(8%)	460	(6%)	$390	(7%)
Non-confined	9,800	(4%)	160	(8%)	380	(5%)	$388	(7%)
Confined	10,400	(4%)	0	(0%)	70	(1%)	$2	(0%)
Unclassified hot or smoldering object	17,600	(7%)	110	(5%)	390	(5%)	$376	(7%)
Non-confined	11,200	(4%)	110	(5%)	340	(4%)	$374	(7%)
Confined	6,400	(3%)	0	(0%)	50	(1%)	$2	(0%)
Spark, ember or flame from operating equipment	16,300	(7%)	90	(4%)	500	(6%)	$258	(5%)
Non-confined	7,100	(3%)	90	(4%)	430	(5%)	$256	(5%)
Confined	9,200	(4%)	0	(0%)	70	(1%)	$2	(0%)
Smoking materials	11,300	(5%)	420	(20%)	740	(9%)	$307	(6%)
Non-confined	9,500	(4%)	420	(20%)	730	(9%)	$307	(6%)
Confined	1,800	(1%)	0	(0%)	10	(0%)	$1	(0%)
Heat from direct flame or convection currents	10,700	(4%)	40	(2%)	250	(3%)	$227	(4%)
Non-confined	5,300	(2%)	40	(2%)	220	(3%)	$225	(4%)
Confined	5,400	(2%)	0	(0%)	30	(0%)	$1	(0%)
Lighter	7,800	(3%)	120	(6%)	550	(7%)	$159	(3%)
Non-confined	5,300	(2%)	120	(6%)	540	(7%)	$158	(3%)
Confined	2,500	(1%)	0	(0%)	10	(0%)	$0	(0%)
Candle	6,600	(3%)	70	(3%)	550	(7%)	$236	(4%)
Non-confined	6,300	(3%)	70	(3%)	550	(7%)	$235	(4%)
Confined	400	(0%)	0	(0%)	0	(0%)	$0	(0%)

Table 8A. (Continued)
Reported One- or Two-Family Home Structure Fires by Heat Source
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Match	6,500	(3%)	40	(2%)	130	(2%)	$66	(1%)
Non-confined	2,200	(1%)	40	(2%)	120	(1%)	$66	(1%)
Confined	4,300	(2%)	0	(0%)	10	(0%)	$0	(0%)
Radiated heat from another fire	4,900	(2%)	10	(0%)	50	(1%)	$100	(2%)
Non-confined	4,200	(2%)	10	(0%)	40	(1%)	$100	(2%)
Confined	700	(0%)	0	(0%)	0	(0%)	$0	(0%)
Lightning	4,200	(2%)	10	(1%)	30	(0%)	$331	(6%)
Non-confined	4,100	(2%)	10	(1%)	30	(0%)	$331	(6%)
Confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Other known heat source	18,800	(8%)	170	(8%)	470	(6%)	$565	(10%)
Non-confined	13,500	(5%)	170	(8%)	440	(5%)	$563	(10%)
Confined	5,400	(2%)	0	(0%)	30	(0%)	$2	(0%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Non-confined	153,400	(61%)	2,100	(100%)	7,350	(91%)	$5,369	(100%)
Confined	96,100	(39%)	0	(0%)	770	(9%)	$24	(0%)
The following heat sources started fewer than 2% of the fire fires but were the heat source in at least 2% of the fire deaths								
Multiple heat sources, including multiple ignitions.			50	(2%)				
Heat from direct flame or convection currents			40	(2%)				
Flame or torch used for lighting			40	(2%)				

Note: Sums may not equal totals due to rounding errors. The statistics on matches, lighters, smoking materials and candles include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 9A.
Reported One- or Two-Family Home Structure Fires
by Factor Contributing to Ignition
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical failure or malfunction	40,200	(16%)	400	(19%)	1,040	(13%)	$1,246	(23%)
Non-Confined	36,000	(14%)	400	(19%)	1,030	(13%)	$1,245	(23%)
Confined	4,200	(2%)	0	(0%)	10	(0%)	$2	(0%)
Heat source too close to combustible	27,100	(11%)	440	(21%)	1,460	(18%)	$735	(14%)
Non-Confined	20,100	(8%)	440	(21%)	1,390	(17%)	$733	(14%)
Confined	7,000	(3%)	0	(0%)	70	(1%)	$2	(0%)
Equipment unattended	25,000	(10%)	120	(6%)	1,190	(15%)	$282	(5%)
Non-Confined	9,700	(4%)	120	(6%)	960	(12%)	$277	(5%)
Confined	15,300	(6%)	0	(0%)	230	(3%)	$5	(0%)
Abandoned or discarded material or product	24,300	(10%)	290	(14%)	930	(11%)	$490	(9%)
Non-Confined	15,300	(6%)	290	(14%)	850	(10%)	$488	(9%)
Confined	9,000	(4%)	0	(0%)	80	(1%)	$2	(0%)
Failure to clean	22,200	(9%)	10	(1%)	140	(2%)	$70	(1%)
Non-Confined	3,600	(1%)	10	(1%)	90	(1%)	$67	(1%)
Confined	18,600	(7%)	0	(0%)	50	(1%)	$3	(0%)
Mechanical failure or malfunction	19,800	(8%)	80	(4%)	430	(5%)	$412	(8%)
Non-Confined	11,200	(5%)	80	(4%)	400	(5%)	$409	(8%)
Confined	8,500	(3%)	0	(0%)	40	(0%)	$3	(0%)
Unclassified misuse of material or product	16,600	(7%)	260	(12%)	850	(10%)	$254	(5%)
Non-Confined	9,000	(4%)	260	(12%)	760	(9%)	$252	(5%)
Confined	7,600	(3%)	0	(0%)	90	(1%)	$2	(0%)
Unclassified factor contributed to ignition	16,200	(7%)	230	(11%)	590	(7%)	$353	(7%)
Non-Confined	9,400	(4%)	230	(11%)	520	(6%)	$351	(7%)
Confined	6,800	(3%)	0	(0%)	80	(1%)	$2	(0%)
Exposure fire	10,000	(4%)	20	(1%)	50	(1%)	$366	(7%)
Non-Confined	10,000	(4%)	20	(1%)	50	(1%)	$366	(7%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Accidentally turned on, not turned off	6,500	(3%)	20	(1%)	240	(3%)	$94	(2%)
Non-Confined	2,800	(1%)	20	(1%)	190	(2%)	$93	(2%)
Confined	3,800	(2%)	0	(0%)	50	(1%)	$1	(0%)

Table 9A. (Continued)
Reported One- or Two-Family Home Structure Fires
by Factor Contributing to Ignition
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Rekindle	5,100	(2%)	0	(0%)	0	(0%)	$94	(2%)
Non-Confined	4,800	(2%)	0	(0%)	0	(0%)	$94	(2%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Playing with heat source	4,600	(2%)	50	(3%)	420	(5%)	$110	(2%)
Non-Confined	4,000	(2%)	50	(3%)	410	(5%)	$110	(2%)
Confined	600	(0%)	0	(0%)	10	(0%)	$0	(0%)
Outside or open fire for debris or waste disposal	4,300	(2%)	0	(0%)	20	(0%)	$31	(1%)
Non-Confined	1,200	(0%)	0	(0%)	20	(0%)	$31	(1%)
Confined	3,100	(1%)	0	(0%)	0	(0%)	$0	(0%)
Storm	4,200	(2%)	20	(1%)	30	(0%)	$323	(6%)
Non-Confined	4,100	(2%)	20	(1%)	30	(0%)	$323	(6%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Improper container or storage	3,900	(2%)	10	(1%)	120	(1%)	$82	(2%)
Non-Confined	2,000	(1%)	10	(1%)	110	(1%)	$82	(2%)
Confined	1,900	(1%)	0	(0%)	10	(0%)	$0	(0%)
Other known factor contributing to ignition	29,700	(12%)	310	(15%)	1,150	(14%)	$809	(15%)
Non-Confined	17,900	(7%)	310	(15%)	1,040	(13%)	$806	(15%)
Confined	11,800	(5%)	0	(0%)	110	(1%)	$3	(0%)
Total Fires	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Non-Confined	153,400	(61%)	2,100	(100%)	7,350	(91%)	$5,369	(100%)
Confined	96,100	(39%)	0	(0%)	770	(9%)	$24	(0%)
Total Factors	259,600	(104%)	2,280	(108%)	8,660	(107%)	$5,752	(107%)
Non-Confined	160,900	(64%)	2,280	(108%)	7,860	(97%)	$5,727	(106%)
Confined	98,700	(40%)	0	(0%)	810	(10%)	$25	(0%)
The following factors were involved in less than 2% of the fires, but in at least 2% of the deaths.								
Flammable liquid or gas spilled			60	(3%)				
Flammable liquid used to kindle fire			60	(3%)				
Unclassified fire spread or control			40	(2%)				

* Multiple entries are allowed which can result in sums higher than totals.
Note: Sums may not equal totals due to rounding errors. Fires in which the factor contributing to ignition was coded as "none," unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.
Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 10A.
Reported One- or Two-Family Home Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	83,100	(33%)	340	(16%)	2,740	(34%)	$726	(13%)
Non-Confined	27,700	(11%)	340	(16%)	2,070	(25%)	$712	(13%)
Confined	55,400	(22%)	0	(0%)	670	(8%)	$14	(0%)
Bedroom	19,300	(8%)	470	(23%)	1,620	(20%)	$662	(12%)
Non-Confined	18,700	(7%)	470	(23%)	1,610	(20%)	$662	(12%)
Confined	600	(0%)	0	(0%)	10	(0%)	$0	(0%)
Confined chimney or flue fire	18,500	(7%)	0	(0%)	20	(0%)	$6	(0%)
Non-Confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Confined	18,500	(7%)	0	(0%)	20	(0%)	$6	(0%)
Living room, family room, or den	10,500	(4%)	490	(23%)	850	(10%)	$439	(8%)
Non-Confined	9,900	(4%)	490	(23%)	850	(10%)	$439	(8%)
Confined	500	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified outside area	9,000	(4%)	10	(0%)	50	(1%)	$95	(2%)
Non-Confined	3,500	(1%)	10	(0%)	50	(1%)	$95	(2%)
Confined	5,500	(2%)	0	(0%)	10	(0%)	$0	(0%)
Attic or ceiling/roof assembly or concealed space	8,700	(3%)	20	(1%)	110	(1%)	$440	(8%)
Non-Confined	8,600	(3%)	20	(1%)	110	(1%)	$440	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Garage or vehicle storage area	8,600	(3%)	50	(2%)	390	(5%)	$539	(10%)
Non-Confined	7,800	(3%)	50	(2%)	390	(5%)	$539	(10%)
Confined	800	(0%)	0	(0%)	0	(0%)	$0	(0%)
Laundry room or area	8,500	(3%)	30	(1%)	240	(3%)	$177	(3%)
Non-Confined	7,800	(3%)	30	(1%)	240	(3%)	$177	(3%)
Confined	700	(0%)	0	(0%)	10	(0%)	$0	(0%)
Exterior wall surface	8,500	(3%)	10	(0%)	110	(1%)	$190	(4%)
Non-Confined	8,300	(3%)	10	(0%)	110	(1%)	$190	(4%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified function area	6,400	(3%)	210	(10%)	350	(4%)	$238	(4%)
Non-Confined	5,700	(2%)	210	(10%)	350	(4%)	$238	(4%)
Confined	800	(0%)	0	(0%)	0	(0%)	$0	(0%)

* NFIRS 5.0 does not have a separate area of origin code for fires starting in chimneys. Any home fire with NFIRS incident type 114 - "Chimney of fire originating in and confined to a chimney or flue" is captured here.
** Does not include fires with property use coded as residential garage.

Table 10A. (Continued)
Reported One- or Two-Family Home Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Exterior balcony or unenclosed porch	5,700	(2%)	40	(2%)	160	(2%)	$207	(4%)
Non-Confined	5,000	(2%)	40	(2%)	160	(2%)	$207	(4%)
Confined	600	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified area of origin	5,500	(2%)	40	(2%)	80	(1%)	$92	(2%)
Non-Confined	3,200	(1%)	40	(2%)	80	(1%)	$92	(2%)
Confined	2,300	(1%)	0	(0%)	0	(0%)	$0	(0%)
Wall assembly or concealed space	5,400	(2%)	20	(1%)	70	(1%)	$171	(3%)
Non-Confined	5,400	(2%)	20	(1%)	70	(1%)	$171	(3%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Lavatory, bathroom, locker room or check room	4,900	(2%)	30	(1%)	170	(2%)	$89	(2%)
Non-Confined	4,400	(2%)	30	(1%)	170	(2%)	$88	(2%)
Confined	500	(0%)	0	(0%)	10	(0%)	$0	(0%)
Crawl space or substructure space	4,300	(2%)	40	(2%)	130	(2%)	$143	(3%)
Non-Confined	4,000	(2%)	40	(2%)	130	(2%)	$142	(3%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Heating equipment room	4,200	(2%)	10	(1%)	90	(1%)	$72	(1%)
Non-Confined	2,200	(1%)	10	(1%)	80	(1%)	$71	(1%)
Confined	2,000	(1%)	0	(0%)	10	(0%)	$1	(0%)
Unclassified structural area	4,200	(2%)	70	(3%)	100	(1%)	$173	(3%)
Non-Confined	3,900	(2%)	70	(3%)	100	(1%)	$173	(3%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Courtyard, terrace, or patio	3,800	(2%)	20	(1%)	90	(1%)	$99	(2%)
Non-Confined	2,400	(1%)	20	(1%)	90	(1%)	$99	(2%)
Confined	1,400	(1%)	0	(0%)	0	(0%)	$0	(0%)
Other known area of origin	30,400	(12%)	220	(10%)	730	(9%)	$837	(16%)
Non-Confined	24,800	(10%)	220	(10%)	710	(9%)	$836	(15%)
Confined	5,600	(2%)	0	(0%)	20	(0%)	$1	(0%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Non-Confined	153,400	(61%)	2,100	(100%)	7,350	(91%)	$5,369	(100%)
Confined	96,100	(39%)	0	(0%)	770	(9%)	$24	(0%)

Table 10A. (Continued)
Reported One- or Two-Family Home Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Fewer than 2% of the fires began in the following areas of origin, these fires caused at least 2% of the deaths.				
Dining room	40	(2%)		
Multiple areas or origin	40	(2%)		

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 11A.
Reported One- or Two-Family Home Structure Fires, by Item First Ignited
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking materials, including food	54,300	(22%)	100	(5%)	1,890	(23%)	$307	(6%)
Non-Confined	13,800	(6%)	100	(5%)	1,410	(17%)	$298	(6%)
Confined	40,500	(16%)	0	(0%)	480	(6%)	$9	(0%)
Unclassified item first ignited	17,700	(7%)	110	(5%)	350	(4%)	$241	(4%)
Non-Confined	7,500	(3%)	110	(5%)	300	(4%)	$238	(4%)
Confined	10,200	(4%)	0	(0%)	50	(1%)	$3	(0%)
Structural member or framing	17,100	(7%)	120	(6%)	300	(4%)	$899	(17%)
Non-Confined	16,800	(7%)	120	(6%)	300	(4%)	$898	(17%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Electrical wire or cable insulation	14,800	(6%)	110	(5%)	340	(4%)	$355	(7%)
Non-Confined	13,200	(5%)	110	(5%)	340	(4%)	$355	(7%)
Confined	1,700	(1%)	0	(0%)	0	(0%)	$1	(0%)
Exterior wall covering or finish	12,800	(5%)	30	(1%)	190	(2%)	$428	(8%)
Non-Confined	12,700	(5%)	30	(1%)	190	(2%)	$428	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Flammable or combustible liquids or gases, piping or filter	11,400	(5%)	180	(8%)	790	(10%)	$222	(4%)
Non-Confined	5,800	(2%)	180	(8%)	720	(9%)	$221	(4%)
Confined	5,600	(2%)	0	(0%)	70	(1%)	$2	(0%)
Appliance housing or casing	9,900	(4%)	20	(1%)	200	(2%)	$107	(2%)
Non-Confined	4,800	(2%)	20	(1%)	180	(2%)	$105	(2%)
Confined	5,100	(2%)	0	(0%)	20	(0%)	$2	(0%)
Rubbish, trash, or waste	9,000	(4%)	20	(1%)	160	(2%)	$124	(2%)
Non-Confined	4,100	(2%)	20	(1%)	150	(2%)	$123	(2%)
Confined	4,900	(2%)	0	(0%)	10	(0%)	$1	(0%)
Unclassified organic materials	7,900	(3%)	10	(0%)	50	(1%)	$46	(1%)
Non-Confined	1,700	(1%)	10	(0%)	40	(0%)	$46	(1%)
Confined	6,200	(2%)	0	(0%)	10	(0%)	$1	(0%)
Mattress or bedding	6,900	(3%)	240	(12%)	780	(10%)	$221	(4%)
Non-Confined	6,600	(3%)	240	(12%)	780	(10%)	$221	(4%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified structural component or finish	6,200	(2%)	50	(2%)	130	(2%)	$288	(5%)
Non-Confined	6,000	(2%)	50	(2%)	130	(2%)	$288	(5%)
Confined	200	(0%)	0	(0%)	0	(0%)	$0	(0%)

Table 11A. (Continued)
Reported One- or Two-Family Home Structure Fires, by Item First Ignited
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Interior wall covering, excluding drapes	5,900	(2%)	80	(4%)	190	(2%)	$238	(4%)
Non-Confined	5,700	(2%)	80	(4%)	190	(2%)	$237	(4%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Clothing	5,500	(2%)	100	(5%)	330	(4%)	$119	(2%)
Non-Confined	4,900	(2%)	100	(5%)	320	(4%)	$119	(2%)
Confined	600	(0%)	0	(0%)	10	(0%)	$0	(0%)
Multiple items first ignited	5,400	(2%)	130	(6%)	260	(3%)	$231	(4%)
Non-Confined	4,200	(2%)	130	(6%)	250	(3%)	$231	(4%)
Confined	1,200	(0%)	0	(0%)	10	(0%)	$0	(0%)
Household utensils	5,200	(2%)	10	(0%)	120	(1%)	$27	(1%)
Non-Confined	1,300	(1%)	10	(0%)	80	(1%)	$26	(0%)
Confined	3,900	(2%)	0	(0%)	40	(0%)	$1	(0%)
Insulation within structural area	5,000	(2%)	0	(0%)	50	(1%)	$129	(2%)
Non-Confined	4,900	(2%)	0	(0%)	50	(1%)	$129	(2%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Upholstered furniture	4,300	(2%)	360	(17%)	480	(6%)	$200	(4%)
Non-Confined	4,100	(2%)	360	(17%)	480	(6%)	$200	(4%)
Confined	200	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified furniture or utensils	4,100	(2%)	130	(6%)	220	(3%)	$131	(2%)
Non-Confined	3,300	(1%)	130	(6%)	220	(3%)	$131	(2%)
Confined	800	(0%)	0	(0%)	10	(0%)	$0	(0%)
Cabinetry	4,100	(2%)	30	(2%)	200	(2%)	$134	(2%)
Non-Confined	3,400	(1%)	30	(2%)	180	(2%)	$133	(2%)
Confined	700	(0%)	0	(0%)	10	(0%)	$1	(0%)
Light vegetation, including grass	3,800	(2%)	0	(0%)	30	(0%)	$60	(1%)
Non-Confined	2,300	(1%)	0	(0%)	30	(0%)	$60	(1%)
Confined	1,500	(1%)	0	(0%)	0	(0%)	$0	(0%)

Table 11A. (Continued)
Reported One- or Two-Family Home Structure Fires, by Item First Ignited
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Other known item first ignited	38,000	(15%)	260	(12%)	1,080	(13%)	$885	(16%)
Non-Confined	26,200	(11%)	260	(12%)	1,030	(13%)	$882	(16%)
Confined	11,800	(5%)	0	(0%)	40	(1%)	$3	(0%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Non-Confined	153,400	(61%)	2,100	(100%)	7,350	(91%)	$5,369	(100%)
Confined	96,100	(39%)	0	(0%)	770	(9%)	$24	(0%)
The following items were first ignited in less than 2% of the fires but at least 2% of the deaths.								
Floor covering, rug, carpet or mat			60	(3%)				
Magazine, newspaper or writing paper			50	(2%)				
Unclassified soft goods or wearing apparel			30	(2%)				

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 12A.
Reported One- or Two-Family Home Structure Fires
by Extent of Fire Spread
2011-2015 Annual Averages
(Unknowns Non-confined Fires Were Allocated Proportionally)

Extent of Fire Spread	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	96,100	(39%)	0	(0%)	770	(9%)	$24	96,100
Confined to object of origin	21,800	(9%)	70	(3%)	480	(6%)	$192	21,800
Confined to room of origin	51,000	(20%)	240	(11%)	2,720	(34%)	$635	51,000
Confined to floor of origin	14,200	(6%)	210	(10%)	890	(11%)	$498	14,200
Confined to building of origin	56,200	(23%)	1,270	(61%)	2,660	(33%)	$3,298	56,200
Extended beyond building of origin	10,100	(4%)	310	(15%)	600	(7%)	$746	10,100
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	249,500
Fire spread extended beyond room of origin	80,500	(32%)	1,800	(85%)	4,200	(51%)	$4,542	80,500

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 1B.
Reported Apartment or Multi-Family Housing Structure Fires
by Year: 1980-2016

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions) As Reported	In 2016 Dollars
1980	143,500	1,025	3,600	$401	$3,365
1981	137,000	970	4,250	$415	$2,844
1982	116,500	860	4,700	$353	$2,149
1983	102,000	845	4,300	$413	$2,362
1984	99,500	785	3,650	$417	$2,189
1985	104,500	865	3,925	$476	$2,330
1986	97,500	650	3,925	$472	$2,235
1987	103,500	790	4,765	$521	$2,292
1988	106,000	830	4,950	$548	$2,230
1989	96,000	790	5,050	$541	$2,003
1990	95,500	680	4,975	$623	$2,078
1991	101,500	595	5,675	$609	$1,864
1992	101,000	545	5,825	$597	$1,725
1993	100,000	685	6,300	$653	$1,777
1994	97,000	640	5,475	$678	$1,755
1995	94,000	605	5,200	$649	$1,587
1996	93,000	565	5,175	$748	$1,730
1997	93,000	660	5,000	$718	$1,584
1998	86,500	445	5,000	$631	$1,352
1999	88,500	520	4,500	$842	$1,722
2000	84,500	500	4,400	$886	$1,700
2001	88,000	460	3,800	$864	$1,568
2002	88,500	390	3,700	$926	$1,627
2003	91,500	410	3,650	$897	$1,508
2004	94,000	510	3,200	$885	$1,412
2005	94,000	460	3,000	$948	$1,412
2006	91,500	425	3,700	$896	$1,252
2007	98,500	515	3,950	$1,164	$1,536
2008	95,500	390	3,975	$1,351	$1,660
2009	90,000	465	3,350	$1,225	$1,512
2010	90,500	440	3,950	$1,033	$1,237
2011	95,500	415	4,425	$1,168	$1,315
2012	97,000	380	4,050	$1,192	$1,288
2013	98,000	325	3,900	$1,166	$1,219
2014	94,000	400	3,800	$982	$994

Table 1B. (Continued)
Reported Apartment or Multi-Family Housing Structure Fires
by Year: 1980-2016

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions) As Reported	In 2016 Dollars
2015	95,000	405	3,025	$1,161	$1,175
2016	95,000	325	3,375	$711	$711

Note: See Table 1, Reported Home Structure Fires by Year, for notes about inclusion or exclusion of unusually large loss fires.

Source: *Fire Loss in the United Sates* series of NFPA annual reports by Michael J. Karter, Jr. and Hylton Haynes. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.

Table 2B.
Reported Apartment or Multi-Family Housing Structure Fires, by Month
2011-2015 Annual Averages

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	10,400	(9%)	60	(14%)	420	(10%)	$122	(9%)
February	9,200	(8%)	50	(12%)	400	(10%)	$117	(9%)
March	10,000	(9%)	40	(10%)	420	(10%)	$134	(10%)
April	9,300	(9%)	40	(10%)	360	(9%)	$109	(8%)
May	9,100	(8%)	20	(6%)	330	(8%)	$114	(9%)
June	8,100	(7%)	20	(5%)	330	(8%)	$114	(9%)
July	8,200	(7%)	20	(5%)	290	(7%)	$128	(10%)
August	8,200	(8%)	20	(6%)	330	(8%)	$99	(7%)
September	8,300	(8%)	20	(6%)	280	(7%)	$82	(6%)
October	9,100	(8%)	30	(7%)	320	(8%)	$94	(7%)
November	9,500	(9%)	30	(8%)	340	(8%)	$126	(9%)
December	9,600	(9%)	40	(11%)	360	(9%)	$92	(7%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Average by month	9,100	(8%)	30	(8%)	350	(8%)	$111	(8%)

Table 3B.
Reported Apartment or Multi-Family Housing Structure Fires, by Day of Week
2011-2015 Annual Averages

Day of Week	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	17,600	(16%)	60	(14%)	660	(16%)	$189	(14%)
Monday	15,000	(14%)	50	(13%)	590	(14%)	$182	(14%)
Tuesday	14,700	(14%)	60	(15%)	570	(14%)	$180	(14%)
Wednesday	14,900	(14%)	60	(14%)	580	(14%)	$164	(12%)
Thursday	15,100	(14%)	60	(14%)	570	(14%)	$203	(15%)
Friday	14,800	(14%)	60	(15%)	610	(15%)	$184	(14%)
Saturday	16,900	(15%)	60	(15%)	600	(14%)	$227	(17%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Average by day	15,600	(14%)	60	(14%)	600	(14%)	$190	(14%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 4B.
Reported Apartment or Multi-Family Housing Structure Fires, by Alarm Time
2011-2015 Annual Averages

Alarm Time	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Midnight- 12:59 a.m.	3,300	(3%)	30	(7%)	170	(4%)	$55	(4%)
1:00-1:59 a.m.	2,800	(3%)	20	(6%)	170	(4%)	$53	(4%)
2:00-2:59 a.m.	2,400	(2%)	20	(6%)	150	(4%)	$52	(4%)
3:00-3:59 a.m.	2,200	(2%)	30	(9%)	170	(4%)	$64	(5%)
4:00-4:59 a.m.	1,900	(2%)	30	(7%)	160	(4%)	$58	(4%)
5:00-5:59 a.m.	1,700	(2%)	20	(5%)	130	(3%)	$40	(3%)
6:00-6:59 a.m.	1,800	(2%)	20	(5%)	120	(3%)	$33	(2%)
7:00-7:59 a.m.	2,200	(2%)	10	(3%)	90	(2%)	$27	(2%)
8:00-8:59 a.m.	2,900	(3%)	10	(3%)	120	(3%)	$38	(3%)
9:00-9:59 a.m.	3,500	(3%)	20	(4%)	140	(3%)	$40	(3%)
10:00-10:59 a.m.	4,100	(4%)	10	(3%)	160	(4%)	$44	(3%)
11:00-11:59 a.m.	4,800	(4%)	10	(3%)	160	(4%)	$54	(4%)
12:00-12:59 p.m.	5,400	(5%)	10	(3%)	170	(4%)	$74	(6%)
1:00-1:59 p.m.	5,600	(5%)	10	(3%)	200	(5%)	$64	(5%)
2:00-2:59 p.m.	5,700	(5%)	10	(3%)	190	(5%)	$59	(4%)
3:00-3:59 p.m.	6,100	(6%)	10	(3%)	190	(4%)	$68	(5%)
4:00-4:59 p.m.	6,700	(6%)	10	(2%)	210	(5%)	$66	(5%)
5:00-5:59 p.m.	7,700	(7%)	10	(3%)	230	(6%)	$72	(5%)
6:00-6:59 p.m.	8,200	(8%)	10	(3%)	240	(6%)	$98	(7%)
7:00-7:59 p.m.	8,100	(7%)	10	(3%)	240	(6%)	$69	(5%)
8:00-8:59 p.m.	7,100	(7%)	10	(3%)	210	(5%)	$50	(4%)
9:00-9:59 p.m.	6,000	(5%)	10	(3%)	200	(5%)	$49	(4%)
10:00-10:59 p.m.	4,800	(4%)	20	(4%)	180	(4%)	$43	(3%)
11:00-11:59 p.m.	4,000	(4%)	20	(5%)	200	(5%)	$60	(5%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Average by alarm hour	4,500	(4%)	20	(4%)	170	(4%)	$55	(4%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 5B.
Leading Causes of Reported Apartment or Multi-Family Housing Structure Fires
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	77,500	(71%)	110	(28%)	2,260	(54%)	$324	(24%)
Heating equipment	7,800	(7%)	40	(9%)	370	(9%)	$135	(10%)
Smoking materials	7,000	(6%)	130	(33%)	460	(11%)	$187	(14%)
Intentional	5,400	(5%)	50	(12%)	310	(7%)	$111	(8%)
Electrical distribution or lighting equipment	3,600	(3%)	50	(13%)	270	(6%)	$158	(12%)
Clothes dryer or washer	2,100	(2%)	0	(0%)	100	(3%)	$29	(2%)
Candles	2,000	(2%)	20	(4%)	250	(6%)	$62	(5%)
Exposure	1,900	(2%)	0	(1%)	20	(0%)	$193	(15%)

Note: This table summarizes findings from multiple fields, meaning that the same fire may be listed under multiple causes. Estimates of fires involving electrical distribution or lighting equipment or clothes dryers or washers exclude confined fires. The methodology used is described in Appendix B.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 6B.
Cause of Ignition in Reported Apartment or Multi-Family Housing Structure Fires
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Cause of Ignition	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	90,100	(83%)	320	(80%)	3,580	(86%)	$918	(69%)
Non-Confined	24,100	(22%)	320	(79%)	2,830	(68%)	$905	(68%)
Confined	66,000	(61%)	0	(0%)	750	(18%)	$13	(1%)
Failure of equipment or heat source	8,100	(7%)	30	(7%)	230	(6%)	$105	(8%)
Non-Confined	4,300	(4%)	30	(7%)	220	(5%)	$104	(8%)
Confined	3,700	(3%)	0	(0%)	20	(0%)	$1	(0%)
Intentional	5,400	(5%)	50	(12%)	310	(7%)	$111	(8%)
Non-Confined	2,900	(3%)	50	(12%)	290	(7%)	$111	(8%)
Confined	2,400	(2%)	0	(0%)	20	(0%)	$0	(0%)
Unclassified cause	5,000	(5%)	10	(2%)	50	(1%)	$158	(12%)
Non-Confined	1,700	(2%)	10	(2%)	40	(1%)	$158	(12%)
Confined	3,400	(3%)	0	(0%)	10	(0%)	$0	(0%)
Act of nature	500	(0%)	0	(0%)	10	(0%)	$37	(3%)
Non-Confined	300	(0%)	0	(0%)	10	(0%)	$37	(3%)
Confined	200	(0%)	0	(0%)	0	(0%)	$0	(0%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Non-Confined	33,300	(31%)	400	(100%)	3,380	(81%)	$1,315	(99%)
Confined	75,700	(69%)	0	(0%)	790	(19%)	$14	(1%)

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 7B.
Reported Apartment or Multi-Family Housing Structure Fires
by Equipment Involved in Ignition
2011-2015 Annual Averages
(Unknowns Non-confined Fires and Confined Cooking Fires Were Allocated Proportionally)

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	77,500	(71%)	110	(28%)	2,260	(54%)	$324	(24%)
Range or cooktop	49,400	(45%)	100	(24%)	1,810	(43%)	$1,805	(20%)
Non-confined fire	9,700	(9%)	100	(24%)	1,320	(32%)	$1,320	(19%)
Confined fire	39,700	(36%)	0	(0%)	480	(12%)	$485	(1%)
Oven or rotisserie	8,000	(7%)	10	(2%)	110	(3%)	$109	(1%)
Non-confined fire	700	(1%)	10	(2%)	70	(2%)	$69	(1%)
Confined fire	7,200	(7%)	0	(0%)	40	(1%)	$40	(0%)
Portable cooking or warming device	3,700	(3%)	10	(1%)	80	(2%)	$84	(1%)
Non-confined fire	500	(0%)	10	(1%)	60	(1%)	$58	(1%)
Confined fire	3,200	(3%)	0	(0%)	30	(1%)	$27	(0%)
Microwave oven	2,700	(2%)	0	(0%)	50	(1%)	$53	(1%)
Non-confined fire	300	(0%)	0	(0%)	40	(1%)	$38	(0%)
Confined fire	2,400	(2%)	0	(0%)	10	(0%)	$15	(0%)
Grill, barbecue or hibachi	600	(1%)	0	(0%)	10	(0%)	$14	(2%)
Non-confined fire	200	(0%)	0	(0%)	10	(0%)	$11	(2%)
Confined fire	500	(0%)	0	(0%)	0	(0%)	$3	(0%)
Other known cooking equipment or confined cooking fire	13,200	(12%)	0	(0%)	190	(5%)	$193	(0%)
Other known cooking equipment in non-confined fire	200	(0%)	0	(0%)	10	(0%)	$11	(0%)
Confined cooking fire with other or unknown equipment	13,000	(12%)	0	(0%)	180	(4%)	$183	(0%)
Heating equipment	7,800	(7%)	40	(9%)	370	(9%)	$135	(10%)
Furnace, central heat, or boiler*	3,400	(3%)	0	(0%)	20	(0%)	$16	(1%)
Furnace or boiler with non-confined incident type	300	(0%)	0	(0%)	10	(0%)	$9	(1%)
*Confined fuel burner or boiler fire**	3,100	(3%)	0	(0%)	10	(0%)	$7	(0%)
Fixed or portable space heater	2,900	(3%)	40	(9%)	330	(8%)	$326	(7%)
Water heater	700	(1%)	0	(0%)	20	(1%)	$24	(1%)
Fireplace or chimney fire*	600	(1%)	0	(0%)	10	(0%)	$6	(1%)
Fireplace or chimney with non-confined incident type	100	(0%)	0	(0%)	0	(0%)	$3	(1%)
*Confined chimney or flue fire**	500	(0%)	0	(0%)	0	(0%)	$2	(0%)
Other known heating equipment in non-confined fire	100	(0%)	0	(0%)	0	(0%)	$4	(0%)
No equipment involved in ignition	7,700	(7%)	160	(40%)	820	(20%)	$521	(39%)
Contained trash or rubbish fire	5,100	(5%)	0	(0%)	30	(1%)	$1	(0%)

Table 7B.
Reported Apartment or Multi-Family Housing Structure Fires
by Equipment Involved in Ignition
2011-2015 Annual Averages
(Unknowns in Non-confined Fires and Confined Cooking Fires Were Allocated Proportionally)
(Continued)

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical distribution and lighting equipment	3,600	(3%)	50	(13%)	270	(6%)	$158	(12%)
Wiring and related equipment	2,300	(2%)	30	(8%)	150	(4%)	$108	(8%)
Lamp, bulb or lighting	800	(1%)	10	(2%)	50	(1%)	$21	(2%)
Other known electrical distribution or lighting equipment	500	(0%)	10	(3%)	60	(2%)	$29	(2%)
Clothes dryer	2,100	(2%)	0	(0%)	100	(3%)	$29	(2%)
Air conditioner or fan	1,600	(1%)	0	(1%)	90	(2%)	$43	(2%)
Confined commercial compactor fire	800	(1%)	0	(0%)	0	(0%)	$0	(0%)
Other known equipment involved in ignition	2,700	(2%)	32	(8%)	223	(5%)	$117	(9%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
The following equipment was involved in less than 1% of the fires, but in at least 2% of the deaths.								
Oxygen administration equipment			10	(3%)				
Cord or plug			10	(3%)				

Note: Non-confined fires in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among fires with known equipment involved. The same approach was used with confined cooking fires. Fires in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Non-confined fires in which the equipment was partially unclassified (i.e., unclassified kitchen or cooking equipment, unclassified heating, cooling or air condition equipment, etc.) were allocated proportionally among fires in that grouping (kitchen or cooking equipment; heating, cooling or air conditioning equipment, etc.). The estimates of fires involving fireplace or chimney include all fires with the confined chimney or flue incident type regardless of what may have been coded as equipment involved. Similarly, the estimates of fires involving furnaces, central heat or boilers include all fires with confined fuel burner or boiler incident type. The estimates shown should be considered upper bounds. Non-cooking confined fires were not analyzed separately. Estimates of other types of equipment exclude confined fires. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 8B.
Reported Apartment or Multi-Family Housing Structure Fires, by Heat Source
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Radiated or conducted heat from operating equipment	28,700	(26%)	50	(12%)	1,000	(24%)	$154	(12%)
Non-confined	6,000	(6%)	50	(12%)	710	(17%)	$150	(11%)
Confined	22,700	(21%)	0	(0%)	290	(7%)	$4	(0%)
Unclassified heat from powered equipment	24,100	(22%)	30	(8%)	740	(18%)	$138	(10%)
Non-confined	5,400	(5%)	30	(8%)	560	(13%)	$134	(10%)
Confined	18,700	(17%)	0	(0%)	180	(4%)	$4	(0%)
Unclassified heat source	10,900	(10%)	20	(4%)	290	(7%)	$87	(7%)
Non-confined	1,900	(2%)	20	(4%)	190	(5%)	$85	(6%)
Confined	9,000	(8%)	0	(0%)	100	(2%)	$1	(0%)
Spark, ember or flame from operating equipment	8,400	(8%)	10	(2%)	190	(5%)	$58	(4%)
Non-confined	1,500	(1%)	10	(2%)	150	(4%)	$58	(4%)
Confined	6,900	(6%)	0	(0%)	40	(1%)	$1	(0%)
Unclassified hot or smoldering object	7,800	(7%)	20	(5%)	260	(6%)	$148	(11%)
Non-confined	2,400	(2%)	20	(5%)	190	(5%)	$147	(11%)
Confined	5,400	(5%)	0	(0%)	60	(1%)	$1	(0%)
Smoking materials	7,000	(6%)	130	(33%)	460	(11%)	$187	(14%)
Non-confined	4,000	(4%)	130	(33%)	440	(11%)	$186	(14%)
Confined	3,000	(3%)	0	(0%)	20	(0%)	$1	(0%)
Heat from direct flame or convection currents	5,100	(5%)	10	(2%)	160	(4%)	$48	(4%)
Non-confined	1,100	(1%)	10	(2%)	110	(3%)	$48	(4%)
Confined	4,000	(4%)	0	(0%)	60	(1%)	$1	(0%)
Arcing	4,200	(4%)	40	(9%)	230	(5%)	$118	(9%)
Non-confined	3,400	(3%)	40	(9%)	230	(5%)	$118	(9%)
Confined	900	(1%)	0	(0%)	0	(0%)	$0	(0%)
Hot ember or ash	2,900	(3%)	20	(6%)	110	(3%)	$65	(5%)
Non-confined	1,600	(1%)	20	(6%)	100	(2%)	$64	(5%)
Confined	1,300	(1%)	0	(0%)	10	(0%)	$0	(0%)
Lighter	2,300	(2%)	30	(9%)	240	(6%)	$101	(8%)
Non-confined	1,400	(1%)	30	(9%)	240	(6%)	$101	(8%)
Confined	800	(1%)	0	(0%)	10	(0%)	$0	(0%)

Table 8B. (Continued)
Reported Apartment or Multi-Family Housing Structure Fires, by Heat Source
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Candle	2,000	(2%)	20	(4%)	250	(6%)	$62	(5%)
Non-confined	1,700	(2%)	20	(4%)	240	(6%)	$62	(5%)
Confined	300	(0%)	0	(0%)	10	(0%)	$0	(0%)
Other known heat source	5,700	(5%)	30	(7%)	260	(6%)	$164	(12%)
Non-confined	2,800	(3%)	30	(7%)	230	(5%)	$163	(12%)
Confined	2,900	(3%)	0	(0%)	30	(1%)	$1	(0%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Non-confined	33,300	(31%)	400	(100%)	3,380	(81%)	$1,315	(99%)
Confined	75,700	(69%)	0	(0%)	790	(19%)	$14	(1%)
The following heat sources were involved in less than 2% of the fires, but in at least 2% of the deaths								
Flame or torch used for lighting			10	(2%)				
Match			10	(3%)				

Note: Sums may not equal totals due to rounding errors. The statistics on matches, lighters, smoking materials and candles include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 9B.
Reported Apartment or Multi-Family Housing Structure Fires, by Factor Contributing to Ignition
2011-2015 Annual Averages
(Unknowns Fires Were Allocated Proportionally)

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Equipment unattended	27,600	(25%)	30	(6%)	920	(22%)	$103	(8%)
Non-Confined	4,100	(4%)	30	(6%)	620	(15%)	$100	(7%)
Confined	23,600	(22%)	0	(0%)	300	(7%)	$4	(0%)
Abandoned or discarded material or product	18,600	(17%)	80	(19%)	600	(14%)	$218	(16%)
Non-Confined	5,800	(5%)	80	(19%)	490	(12%)	$215	(16%)
Confined	12,800	(12%)	0	(0%)	110	(3%)	$2	(0%)
Heat source too close to combustibles	11,700	(11%)	90	(23%)	710	(17%)	$194	(15%)
Non-Confined	4,800	(4%)	90	(23%)	650	(16%)	$192	(14%)
Confined	7,000	(6%)	0	(0%)	60	(1%)	$1	(0%)
Unclassified misuse of material or product	10,500	(10%)	70	(17%)	570	(14%)	$107	(8%)
Non-Confined	3,100	(3%)	70	(17%)	480	(12%)	$106	(8%)
Confined	7,400	(7%)	0	(0%)	90	(2%)	$2	(0%)
Unclassified factor contributed to ignition	7,600	(7%)	50	(13%)	380	(9%)	$101	(8%)
Non-Confined	2,100	(2%)	50	(13%)	290	(7%)	$100	(8%)
Confined	5,500	(5%)	0	(0%)	90	(2%)	$1	(0%)
Electrical failure or malfunction	6,300	(6%)	40	(10%)	320	(8%)	$180	(14%)
Non-Confined	4,800	(4%)	40	(10%)	310	(7%)	$179	(13%)
Confined	1,500	(1%)	0	(0%)	0	(0%)	$0	(0%)
Accidentally turned on, not turned off	5,700	(5%)	10	(2%)	170	(4%)	$26	(2%)
Non-Confined	1,100	(1%)	10	(2%)	120	(3%)	$25	(2%)
Confined	4,600	(4%)	0	(0%)	50	(1%)	$1	(0%)
Failure to clean	5,000	(5%)	0	(0%)	60	(1%)	$10	(1%)
Non-Confined	700	(1%)	0	(0%)	40	(1%)	$10	(1%)
Confined	4,300	(4%)	0	(0%)	20	(0%)	$0	(0%)
Mechanical failure or malfunction	4,400	(4%)	10	(2%)	90	(2%)	$48	(4%)
Non-Confined	1,900	(2%)	10	(2%)	80	(2%)	$48	(4%)
Confined	2,500	(2%)	0	(0%)	10	(0%)	$1	(0%)
Equipment not being operated properly	2,100	(2%)	0	(1%)	60	(2%)	$9	(1%)
Non-Confined	300	(0%)	0	(1%)	50	(1%)	$8	(1%)
Confined	1,800	(2%)	0	(0%)	20	(0%)	$0	(0%)
Improper container or storage	2,100	(2%)	0	(0%)	30	(1%)	$20	(2%)
Non-Confined	500	(0%)	0	(0%)	30	(1%)	$20	(2%)
Confined	1,600	(1%)	0	(0%)	0	(0%)	$0	(0%)

Table 9B. (Continued)
Reported Apartment or Multi-Family Housing Structure Fires, by Factor Contributing to Ignition
2011-2015 Annual Averages
(Unknowns Fires Were Allocated Proportionally)

Factor Contributing	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified operational deficiency	2,000	(2%)	10	(2%)	70	(2%)	$11	(1%)
Non-Confined	300	(0%)	10	(2%)	50	(1%)	$11	(1%)
Confined	1,600	(1%)	0	(0%)	20	(1%)	$0	(0%)
Exposure fire	1,900	(2%)	0	(1%)	20	(0%)	$193	(15%)
Non-Confined	1,800	(2%)	0	(1%)	20	(0%)	$193	(15%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Other known factor contributing to ignition	7,100	(7%)	40	(11%)	420	(10%)	$213	(16%)
Non-Confined	3,700	(3%)	40	(11%)	380	(9%)	$212	(16%)
Confined	3,400	(3%)	0	(0%)	40	(1%)	$1	(0%)
Total Fires	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Non-Confined	33,300	(31%)	400	(100%)	3,380	(81%)	$1,315	(99%)
Confined	75,700	(69%)	0	(0%)	790	(19%)	$14	(1%)
Total Factors	112,600	(103%)	430	(107%)	4,410	(106%)	$1,435	(108%)
Non-Confined	35,000	(32%)	430	(107%)	3,600	(86%)	$1,420	(107%)
Confined	77,600	(71%)	0	(0%)	810	(19%)	$15	(1%)
The following factors were involved in less than 2% of the fires, but in at least 2% of the deaths.								
Flammable liquid used to kindle fire			10	(3%)				
Flammable liquid or gas spilled			10	(2%)				
Unclassified fire spread or control			10	(2%)				

* Multiple entries are allowed which can result in sums higher than totals.

Note: Sums may not equal totals due to rounding errors. Non-confined structure fires in which the factor contributing to ignition was coded as "none," unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 10B.
Reported Apartment or Multi-Family Housing Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns Fires Were Allocated Proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	73,000	(67%)	80	(19%)	2,070	(50%)	$293	(22%)
Non-Confined	10,800	(10%)	80	(19%)	1,330	(32%)	$281	(21%)
Confined	62,200	(57%)	0	(0%)	750	(18%)	$12	(1%)
Bedroom	4,600	(4%)	110	(27%)	810	(19%)	$201	(15%)
Non-Confined	4,300	(4%)	110	(27%)	810	(19%)	$201	(15%)
Confined	400	(0%)	0	(0%)	0	(0%)	$0	(0%)
Exterior balcony or unenclosed porch	2,500	(2%)	10	(1%)	70	(2%)	$136	(10%)
Non-Confined	2,000	(2%)	10	(1%)	70	(2%)	$136	(10%)
Confined	500	(0%)	0	(0%)	0	(0%)	$0	(0%)
Living room, family room, lounge or den	2,500	(2%)	110	(27%)	400	(10%)	$99	(7%)
Non-Confined	2,000	(2%)	110	(27%)	400	(10%)	$99	(7%)
Confined	400	(0%)	0	(0%)	0	(0%)	$0	(0%)
Trash or rubbish chute, area or container	2,400	(2%)	0	(0%)	10	(0%)	$2	(0%)
Non-Confined	100	(0%)	0	(0%)	0	(0%)	$2	(0%)
Confined	2,300	(2%)	0	(0%)	0	(0%)	$0	(0%)
Laundry room or area	2,100	(2%)	0	(0%)	70	(2%)	$21	(2%)
Non-Confined	1,500	(1%)	0	(0%)	70	(2%)	$21	(2%)
Confined	500	(0%)	0	(0%)	0	(0%)	$0	(0%)
Lavatory or bathroom	1,900	(2%)	10	(1%)	90	(2%)	$29	(2%)
Non-Confined	1,500	(1%)	10	(1%)	80	(2%)	$29	(2%)
Confined	500	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified area of origin	1,700	(2%)	0	(1%)	50	(1%)	$14	(1%)
Non-Confined	500	(0%)	0	(1%)	40	(1%)	$14	(1%)
Confined	1,200	(1%)	0	(0%)	10	(0%)	$0	(0%)
Other known area of origin	18,300	(17%)	90	(23%)	600	(14%)	$532	(40%)
Non-Confined	10,600	(10%)	90	(23%)	580	(14%)	$531	(40%)
Confined	7,600	(7%)	0	(0%)	20	(1%)	$1	(0%)

Table 10B. (Continued)
Reported Apartment or Multi-Family Housing Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns Fires Were Allocated Proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Non-Confined	33,300	(31%)	400	(100%)	3,380	(81%)	$1,315	(99%)
Confined	75,700	(69%)	0	(0%)	790	(19%)	$14	(1%)
Although fewer than 2% of the fires began in the following areas of origin, these fires caused at least 2% of the deaths.								
Unclassified function area			40	(11%)				

Note: Sums may not equal totals due to rounding errors. Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 11B.
Reported Apartment or Multi-Family Housing Structure Fires, by Item First Ignited
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking materials, including food	53,700	(49%)	30	(8%)	1,440	(34%)	$201	(15%)
Non-Confined	6,200	(6%)	30	(8%)	890	(21%)	$192	(14%)
Confined	47,400	(44%)	0	(0%)	550	(13%)	$8	(1%)
Unclassified item first ignited	6,300	(6%)	20	(5%)	190	(5%)	$67	(5%)
Non-Confined	1,700	(2%)	20	(5%)	140	(3%)	$67	(5%)
Confined	4,600	(4%)	0	(0%)	50	(1%)	$1	(0%)
Rubbish, trash, or waste	6,300	(6%)	10	(2%)	80	(2%)	$36	(3%)
Non-Confined	1,100	(1%)	10	(2%)	60	(1%)	$35	(3%)
Confined	5,100	(5%)	0	(0%)	20	(0%)	$1	(0%)
Household utensils	4,600	(4%)	10	(1%)	120	(3%)	$10	(1%)
Non-Confined	600	(1%)	10	(1%)	70	(2%)	$9	(1%)
Confined	4,000	(4%)	0	(0%)	50	(1%)	$1	(0%)
Appliance housing or casing	3,500	(3%)	0	(1%)	100	(2%)	$22	(2%)
Non-Confined	1,200	(1%)	0	(1%)	80	(2%)	$21	(2%)
Confined	2,400	(2%)	0	(0%)	20	(0%)	$1	(0%)
Flammable or combustible liquids or gases, piping or filter	3,000	(3%)	20	(5%)	240	(6%)	$51	(4%)
Non-Confined	1,100	(1%)	20	(5%)	200	(5%)	$51	(4%)
Confined	1,900	(2%)	0	(0%)	40	(1%)	$1	(0%)
Electrical wire or cable insulation	2,500	(2%)	10	(3%)	90	(2%)	$47	(4%)
Non-Confined	2,000	(2%)	10	(3%)	90	(2%)	$47	(4%)
Confined	500	(0%)	0	(0%)	0	(0%)	$0	(0%)
Structural member or framing	2,300	(2%)	20	(4%)	90	(2%)	$165	(12%)
Non-Confined	2,300	(2%)	20	(4%)	90	(2%)	$165	(12%)
Confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Mattress or bedding	2,100	(2%)	80	(19%)	420	(10%)	$74	(6%)
Non-Confined	1,900	(2%)	80	(19%)	420	(10%)	$74	(6%)
Confined	200	(0%)	0	(0%)	0	(0%)	$0	(0%)
Magazine, newspaper, or writing paper	1,900	(2%)	0	(0%)	50	(1%)	$15	(1%)
Non-Confined	600	(1%)	0	(0%)	40	(1%)	$15	(1%)
Confined	1,300	(1%)	0	(0%)	0	(0%)	$0	(0%)
Clothing	1,800	(2%)	30	(7%)	140	(3%)	$60	(4%)
Non-Confined	1,300	(1%)	30	(7%)	130	(3%)	$60	(4%)
Confined	500	(0%)	0	(0%)	10	(0%)	$0	(0%)

Table 11B. (Continued)
Reported Apartment or Multi-Family Housing Structure Fires, by Item First Ignited
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Box, carton, bag, basket, or barrel	1,700	(2%)	0	(1%)	50	(1%)	$24	(2%)
Non-Confined	600	(1%)	0	(1%)	40	(1%)	$24	(2%)
Confined	1,100	(1%)	0	(0%)	10	(0%)	$0	(0%)
Multiple items first ignited	1,700	(2%)	20	(4%)	140	(3%)	$48	(4%)
Non-Confined	800	(1%)	20	(4%)	130	(3%)	$48	(4%)
Confined	900	(1%)	0	(0%)	10	(0%)	$0	(0%)
Other known item first ignited	17,700	(16%)	160	(40%)	1,030	(25%)	$509	(38%)
Non-Confined	12,000	(11%)	160	(40%)	1,000	(24%)	$508	(38%)
Confined	5,700	(5%)	0	(0%)	30	(1%)	$1	(0%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Non-Confined	33,300	(31%)	400	(100%)	3,380	(81%)	$1,315	(99%)
Confined	75,700	(69%)	0	(0%)	790	(19%)	$14	(1%)
The following items were first ignited in less than 2% of the fires, but in at least 2% of the fires.								
Upholstered furniture			90	(22%)				
Unclassified furniture or utensil			20	(6%)				
Unclassified structural component or finish			10	(2%)				
Unclassified soft goods or wearing apparel			10	(2%)				

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Table 12B.
Reported Apartment or Multi-Family Housing Structure Fires, by Extent of Fire Spread
2011-2015 Annual Averages
(Unknowns Non-confined Fires Were Allocated Proportionally)

Extent of Fire Spread	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	75,700	(69%)	0	(0%)	790	(19%)	$14	(1%)
Confined to object of origin	6,300	(6%)	20	(4%)	270	(7%)	$44	(3%)
Confined to room of origin	16,400	(15%)	150	(36%)	1,590	(38%)	$216	(16%)
Confined to floor of origin	3,500	(3%)	70	(16%)	550	(13%)	$145	(11%)
Confined to building of origin	6,200	(6%)	140	(35%)	850	(20%)	$737	(55%)
Extended beyond building of origin	800	(1%)	30	(8%)	120	(3%)	$173	(13%)
Total	109,000	(100%)	400	(100%)	4,170	(100%)	$1,329	(100%)
Fire extended beyond room of origin	10,500	(10%)	240	(60%)	1,510	(36%)	$1,055	(79%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA's fire experience survey.

Appendix A.
How National Estimates Statistics Are Calculated

The statistics in this analysis are estimates derived from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual survey of U.S. fire departments. NFIRS is a voluntary system through which participating fire departments report detailed factors about the fires to which they respond. Roughly two-thirds of U.S. fire departments participate, although not all of these departments provide data every year. Fires reported to federal or state fire departments or industrial fire brigades are not included in these estimates.

NFIRS provides the most detailed incident information of any national database not limited to large fires. NFIRS is the only database capable of addressing national patterns for fires of all sizes by specific property use and specific fire cause. NFIRS also captures information on the extent of flame spread, and automatic detection and suppression equipment. For more information about NFIRS visit www.nfirs.fema.gov/. Copies of the paper forms may be downloaded from www.nfirs.fema.gov/documentation/design/NFIRS_Paper_Forms_2012.pdf.

NFIRS has a wide variety of data elements and codes. Many code choices describe several conditions. These cannot be broken down further. For example, area of origin code 83 captures fires starting in vehicle engine areas, running gear areas or wheel areas. It is not possible to tell the portion of each from the coded data.

Methodology may change slightly from year to year. NFPA is continually examining its methodology to provide the best possible answers to specific questions. From time to time, changes are made to methodologies or groupings. *Earlier editions of the same report may have used different methodologies to produce the same analysis, meaning that the estimates are not directly comparable from year to year.* Readers should use the latest report available and contact us if clarification is needed.

NFPA's fire department experience survey provides estimates of the big picture. Each year, NFPA conducts an annual survey of fire departments which enables us to capture a summary of fire department experience on a larger scale. Surveys are sent to all municipal departments protecting populations of 5,000 or more and a random sample, stratified by community size, of the smaller departments. Typically, a total of roughly 3,000 surveys are returned, representing about one of every ten U.S. municipal fire departments serving about one third of the U.S. population.

The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities have fewer people protected per department and are less likely to respond to the survey. A larger number must be surveyed to obtain an adequate sample of those departments. (NFPA also makes follow-up calls to a sample of the smaller fire departments that do not respond, to confirm that those that did respond are truly representative of fire departments their size.) On the other hand, large city departments are so few in number and protect such a large proportion of the total U.S. population that it makes sense to survey all of them. Most respond, resulting in excellent precision for their part of the final estimate.

The survey includes the following information: (1) the total number of fire incidents, civilian deaths, and civilian injuries, and the total estimated property damage (in dollars), for each of the major property use classes defined in NFIRS; (2) the number of on-duty firefighter injuries, by type of duty and nature of

illness; 3) the number and nature of non-fire incidents; and (4) information on the type of community protected (e.g., county versus township versus city) and the size of the population protected, which is used in the statistical formula for projecting national totals from sample results. The results of the survey are published in the annual report *Fire Loss in the United States*. To download a free copy of the report, visit http://www.nfpa.org/assets/files/PDF/OS.fireloss.pdf.

PROJECTING NFIRS TO NATIONAL ESTIMATES

As noted, NFIRS is a voluntary reporting system. Different states and jurisdictions have different reporting requirements and practices. Participation rates in NFIRS are not necessarily uniform across regions and community sizes, both factors correlated with frequency and severity of fires. This means NFIRS may be susceptible to systematic biases. No one at present can quantify the size of these deviations from the ideal, representative sample. But there is enough reason for concern so that a second database -- the NFPA's fire experience survey -- is needed to project NFIRS to national estimates and to project different parts of NFIRS separately. This multiple calibration approach makes use of the annual NFPA's fire experience survey where its statistical design advantages are strongest.

Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific fire problems and circumstances are obtained by multiplying the NFIRS data by the scaling ratios. Reports for incidents in which mutual aid was given are excluded from NFPA's analyses.

Analysts at the NFPA, the USFA and the Consumer Product Safety Commission developed the analytical rules used in analyzing data from the two data sets. "The National Estimates Approach to U.S. Fire Statistics," by John R. Hall, Jr. and Beatrice Harwood, provides a more detailed explanation of national estimates.

Version 5.0 of NFIRS, first introduced in 1999, used a different coding structure for many data elements, added some property use codes, and dropped others. The essentials of the approach described by Hall and Harwood are still used, but some modifications have been necessary to accommodate the changes in NFIRS 5.0.

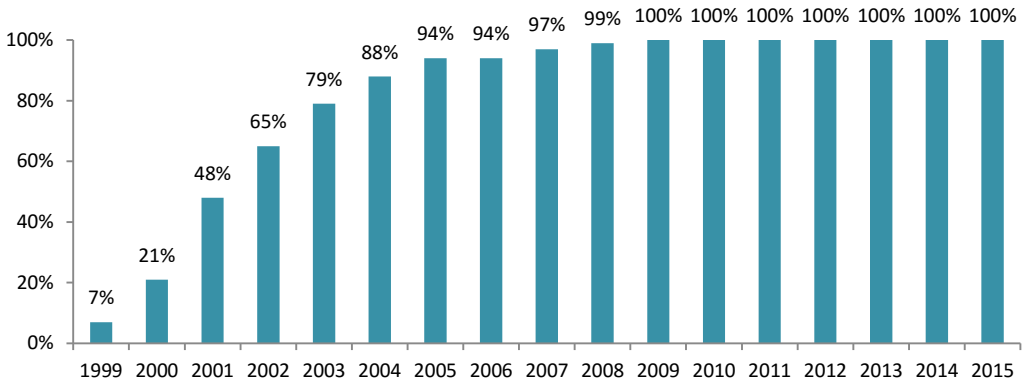
Figure A.1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

For 2002 data on, analyses are based on scaling ratios using only data originally collected in NFIRS 5.0:

$$\frac{\text{NFPA's fire experience survey projections}}{\text{NFIRS totals (Version 5.0)}}$$

For 1999 to 2001, the same rules may be applied, but estimates for these years in this form will be less reliable due to the smaller amount of data originally collected in NFIRS 5.0; they should be viewed with extreme caution.

Figure A.1. Fires Originally Collected in NFIRS 5.0 by Year



NFIRS 5.0 introduced six categories of confined structure fires, including:

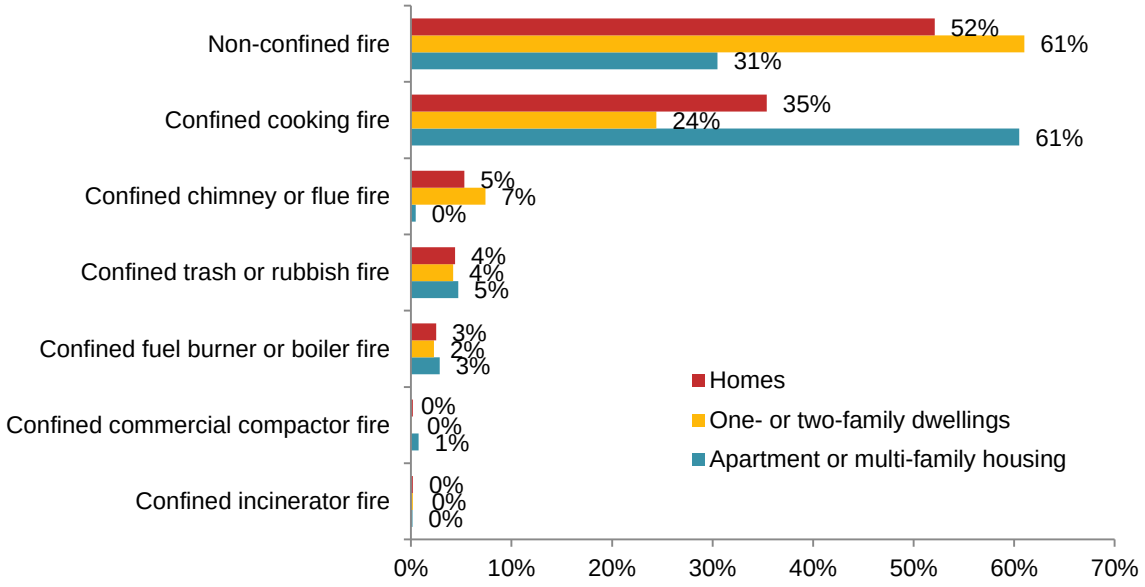
- cooking fires confined to the cooking vessel,
- confined chimney or flue fires,
- confined incinerator fire,
- confined fuel burner or boiler fire or delayed ignition,
- confined commercial compactor fire, and
- trash or rubbish fires in a structure with no flame damage to the structure or its contents.

Although causal and other detailed information is typically not required for these incidents, it is provided in some cases. Some analyses, particularly those that examine cooking equipment, heating equipment, fires caused by smoking materials, and fires started by playing with fire, may examine the confined fires in greater detail. Because the confined fire incident types describe certain scenarios, the distribution of unknown data differs from that of all fires. Consequently, allocation of unknowns must be done separately. Table A1 shows the breakdown of these fires. Figure A.1 shows the percentage of the different confined fires and of non-confined fires for all homes, one-and two-family homes (including manufactured homes), and apartments in 2011-2015.

Table A.1. Confined and Non-Confined Reported Home Structure Fires
2011-2015 Annual Averages

Type of Fire	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire	**171,900**	**(48%)**	**0**	**(0%)**	**1,560**	**(13%)**	**$38**	**(1%)**
Confined cooking fire	*126,800*	*(35%)*	*0*	*(0%)*	*1,440*	*(12%)*	*$28*	*(0%)*
Confined chimney or flue fire	*19,000*	*(5%)*	*0*	*(0%)*	*20*	*(0%)*	*$6*	*(0%)*
Confined or contained trash or rubbish fire	*15,700*	*(4%)*	*0*	*(0%)*	*60*	*(0%)*	*$2*	*(0%)*
Confined fuel burner or boiler fire	*8,900*	*(3%)*	*0*	*(0%)*	*30*	*(0%)*	*$2*	*(0%)*
Confined commercial compactor fire	*900*	*(0%)*	*0*	*(0%)*	*0*	*(0%)*	*$0*	*(0%)*
Confined incinerator fire	*500*	*(0%)*	*0*	*(0%)*	*0*	*(0%)*	*$0*	*(0%)*
Non-confined fire	**186,700**	**(52%)**	**2,510**	**(100%)**	**10,730**	**(87%)**	**$6,684**	**(99%)**
Total	**358,500**	**(100%)**	**2,510**	**(100%)**	**12,300**	**(100%)**	**$6,723**	**(100%)**

Figure A.2. Home Structure Fires by Incident Type and Occupancy 2011-2015



Some analyses of structure fires show only non-confined fires. In these tables, percentages shown are of non-confined structure fires rather than all structure fires. This approach has the advantage of showing the frequency of specific factors in fire causes, but the disadvantage of possibly overstating the percentage of factors that are seldom seen in the confined fire incident types and of understating the factors specifically associated with the confined fire incident types. Other analyses include entries for confined fire incident types in the causal tables and show percentages based on total structure fires. In these cases, the confined fire incident type is treated as a general causal factor.

For most fields other than Property Use and Incident Type, NFPA allocates unknown data proportionally among known data. This approach assumes that if the missing data were known, it would be distributed in the same manner as the known data. NFPA makes additional adjustments to several fields. *Casualty and loss projections can be heavily influenced by the inclusion or exclusion of unusually serious fire.*

A fire incident report is not the same as an investigation report. Percentages of known or unknown data are provided in the descriptions of data elements that follow. Causal factors associated with fire deaths were more likely to be unknown. In some fire departments, causal factors will be left undetermined when a fire is referred for further investigation. Unfortunately, the incident reports are often not updated after the investigation is completed. For more information on unknowns in NFIRS, see NASFM Fire Research Education Foundation's 2014 report, *Conquering the "Unknowns:" Research and Recommendations on the Chronic Problem of Undetermined and Missing Data in the Causal Factors Sections of the National Fire Incident Reporting System*.

Although the percentage of unknown data is high, the sheer size of the database allows for greater confidence. The database of total reported fires (excluding mutual aid given) for 2011-2015, includes 650,110 non-confined fires, 6,987 associated civilian deaths, 30,587 associated civilian injuries, and $20.3 billion in direct property damage. It also included 597,954 fires with confined structure fire incident types (NFIRS incident type codes 113-118), 4,442 associated civilian injuries, and $116 million

in direct property damage. Roughly 70% of fires reported, 56-57% of the civilian deaths and injuries and 61% of the property damage from fires reported to local fire departments are captured in the NFIRS database. Mutual aid given fires were excluded from this analysis.

In the formulas that follow, the term "all fires" refers to all fires in NFIRS on the dimension studied. The percentages of fires with known or unknown data are provided for non-confined fires and associated losses, and for confined fires only.

Cause of Ignition: This field is used chiefly to identify intentional fires. "Unintentional" in this field is a specific entry and does not include other fires that were not intentionally set: failure of equipment or heat source, act of nature, or "other" (unclassified)." The last should be used for exposures but has been used for other situations as well. Fires that were coded as under investigation and those that were coded as undetermined after investigation were treated as unknown. For non-confined home structure fires, the cause was known in 67% of the fires, 39% of the civilian deaths, 63% of the civilian injuries, and 54% of the direct property damage. For confined fires, the cause was known in 17% of the fires.

Factor Contributing to Ignition: In this field, the code "none" is treated as an unknown and allocated proportionally. For Human Factor Contributing to Ignition, NFPA enters a code for "not reported" when no factors are recorded. "Not reported" is treated as an unknown, but the code "none" is treated as a known code and not allocated. Multiple entries are allowed in both of these fields. Percentages are calculated on the total number of fires, not entries, resulting in sums greater than 100%. Although Factor Contributing to Ignition is only required when the cause of ignition was coded as: 2) unintentional, 3) failure of equipment or heat source; or 4) act of nature, data is often present when not required. Consequently, any fire in which no factor contributing to ignition was entered was treated as unknown.

In some analyses, all entries in the category of mechanical failure, malfunction (factor contributing to ignition 20-29) are combined and shown as one entry, "mechanical failure or malfunction." This category includes:

21. Automatic control failure;
22. Manual control failure;
23. Leak or break. Includes leaks or breaks from containers or pipes. Excludes operational deficiencies and spill mishaps;
25. Worn out;
26. Backfire. Excludes fires originating as a result of hot catalytic converters;
27. Improper fuel used; Includes the use of gasoline in a kerosene heater and the like; and
20. Mechanical failure or malfunction, other.

Entries in "electrical failure, malfunction" (factor contributing to ignition 30-39) may also be combined into one entry, "electrical failure or malfunction." This category includes:

31. Water-caused short circuit arc;
32. Short-circuit arc from mechanical damage;
33. Short-circuit arc from defective or worn insulation;
34. Unspecified short circuit arc;
35. Arc from faulty contact or broken connector, including broken power lines and loose connections;
36. Arc or spark from operating equipment, switch, or electric fence;
37. Fluorescent light ballast; and
30. Electrical failure or malfunction, other.

The factor contributing to ignition was coded as none, undetermined or left blank in 50% of the non-

confined home structure fires, 69% of the associated deaths, 49% of the associated injuries, 60% of the associated direct property damage and 89% of the confined fires.

Heat Source. In NFIRS 5.0, one grouping of codes encompasses various types of open flames and smoking materials. In the past, these had been two separate groupings. A new code was added to NFIRS 5.0, which is code 60: "Heat from open flame or smoking material, other." NFPA treats this code as a partial unknown and allocates it proportionally across the codes in the 61-69 range, shown below.

61. Cigarette;
62. Pipe or cigar;
63. Heat from undetermined smoking material;
64. Match;
65. Lighter: cigarette lighter, cigar lighter;
66. Candle;
67 Warning or road flare, fuse;
68. Backfire from internal combustion engine. Excludes flames and sparks from an exhaust system, (11); and
69. Flame/torch used for lighting. Includes gas light and gas-/liquid-fueled lantern.

In addition to the conventional allocation of missing and undetermined fires, NFPA multiplies fires with codes in the 61-69 range by

$$\frac{\text{All fires in range 60-69}}{\text{All fires in range 61-69}}$$

The downside of this approach is that heat sources that are truly a different type of open flame or smoking material are erroneously assigned to other categories. The grouping "smoking materials" includes codes 61-63 (cigarettes, pipes or cigars, and heat from undetermined smoking material, with a proportional share of the code 60s and true unknown data.

In non-confined home structure fires, code 60: "heat from open flame or smoking material, other" was entered for 3% of the fires, as well as civilian deaths and injuries and 2% of the direct property damage. The heat source was undetermined in 37% of the non-confined home structure fires, 62% of the civilian deaths, 35% of the civilian injuries, and 51% of the direct property damage. The heat source was known in 17% of the confined fires, including 1% with heat source code 60.

Equipment Involved in Ignition (EII). NFIRS 5.0 originally defined EII as the piece of equipment that provided the principal heat source to cause ignition if the equipment malfunctioned or was used improperly. In 2006, the definition was modified to "the piece of equipment that provided the principal heat source to cause ignition." However, much of the data predates the change. Individuals who have already been trained with the older definition may not change their practices. To compensate, NFPA treats fires in which EII = NNN and heat source is not in the range of 40-99 as an additional unknown.

To allocate unknown data for EII, the known data is multiplied by

$$\frac{\text{All fires}}{\text{(All fires – blank – undetermined – [fires in which EII =NNN and heat source <>40-99])}}$$

In addition, the partially unclassified codes for broad equipment groupings (i.e., code 100 - heating, ventilation, and air conditioning, other; code 200 - electrical distribution, lighting and power transfer, other; etc.) were allocated proportionally across the individual code choices in their respective broad groupings (heating, ventilation, and air conditioning; electrical distribution, lighting and power transfer, other; etc.). Equipment that is totally unclassified is not allocated further. This approach has the same

downside as the allocation of heat source 60 described above. Equipment that is truly different is erroneously assigned to other categories.

In some analyses, various types of equipment are grouped together.

Code Grouping	EII Code	NFIRS definitions
Central heat	132	Furnace or central heating unit
	133	Boiler (power, process or heating)
Fixed or portable space heater	131	Furnace, local heating unit, built-in
	123	Fireplace with insert or stove
	124	Heating stove
	141	Heater, excluding catalytic and oil-filled
	142	Catalytic heater
	143	Oil-filled heater
Fireplace or chimney	120	Fireplace or chimney
	121	Fireplace, masonry
	122	Fireplace, factory-built
	125	Chimney connector or vent connector
	126	Chimney – brick, stone or masonry
	127	Chimney-metal, including stovepipe or flue
Fixed wiring and related equipment	210	Unclassified electrical wiring
	211	Electrical power or utility line
	212	Electrical service supply wires from utility
	213	Electric meter or meter box
	214	Wiring from meter box to circuit breaker
	215	Panel board, switch board or circuit breaker board
	216	Electrical branch circuit
	217	Outlet or receptacle
	218	Wall switch
	219	Ground fault interrupter
Transformers and power supplies	221	Distribution-type transformer
	222	Overcurrent, disconnect equipment
	223	Low-voltage transformer
	224	Generator
	225	Inverter
	226	Uninterrupted power supply (UPS)
	227	Surge protector
	228	Battery charger or rectifier
	229	Battery (all types)

Code Grouping	EII Code	NFIRS definitions
Lamp, bulb or lighting	230	Unclassified lamp or lighting
	231	Lamp-tabletop, floor or desk
	232	Lantern or flashlight
	233	Incandescent lighting fixture
	234	Fluorescent light fixture or ballast
	235	Halogen light fixture or lamp
	236	Sodium or mercury vapor light fixture or lamp
	237	Work or trouble light
	238	Light bulb
	241	Nightlight
	242	Decorative lights – line voltage
	243	Decorative or landscape lighting – low voltage
	244	Sign
Cord or plug	260	Unclassified cord or plug
	261	Power cord or plug, detachable from appliance
	262	Power cord or plug- permanently attached
	263	Extension cord
Torch, burner or soldering iron	331	Welding torch
	332	Cutting torch
	333	Burner, including Bunsen burners
	334	Soldering equipment
Portable cooking or warming equipment	631	Coffee maker or teapot
	632	Food warmer or hot plate
	633	Kettle
	634	Popcorn popper
	635	Pressure cooker or canner
	636	Slow cooker
	637	Toaster, toaster oven, counter-top broiler
	638	Waffle iron, griddle
	639	Wok, frying pan, skillet
	641	Breadmaking machine

The equipment involved in ignition was undetermined, not reported, or coded as no equipment with a heat source code outside the range of 40-99 (non-equipment related heat sources) in 64% of the non-confined fires, 79% of the associated deaths, 58% of the injuries, 73% of the direct property damage, and in 89% of confined cooking equipment fires.

Area of Origin. Two areas of origin: bedroom for more than five people (code 21) and bedroom for less than five people (code 22) are combined and shown as simply "bedroom." Chimney is no longer a valid area of origin code for non-confined fires. The area of origin was unknown or not reported in 13% of non-confined home structure fires, 22% of associated deaths, 7% of associated injuries, and 19% of the direct property damage. It was also unknown in 82% of confined fires excluding those confined to the chimney or flue which were all assumed to have begun in the chimney or flue.

Item First Ignited. In most analyses, mattress and pillows (item first ignited 31) and bedding, blankets, sheets, and comforters (item first ignited 32) are combined and shown as "mattresses and bedding." In many analyses, wearing apparel not on a person (code 34) and wearing apparel on a person (code 35) are combined and shown as "clothing." In some analyses, flammable and combustible liquids and gases, piping and filters (item first ignited 60-69) are combined and shown together. The item first ignited was undetermined or unreported in 37% of the non-confined structure fires, 62% of the associated deaths, 34% of the associated injuries, 52% of the direct property damage, and in 84% of the confined home fires.

Extent of Fire Spread. All structure fires with incident types indicating a confined fire were shown separately and are assumed to be confined to the object of origin. Fires that spread beyond the room of origin were calculated by summing fires with damage:

a) confined to the floor of origin (code 3),
b) confined to the building of origin (code 4), and
c) extending beyond building of origin (code 5).

The extent of fire spread was unknown or not reported in 2% of non-confined home structure fires, 1% of associated deaths, 1% of associated injuries, and 1% of the direct property damage.

Rounding and percentages. The data shown are estimates and generally rounded. An entry of zero may be a true zero or it may mean that the value rounds to zero. Percentages are calculated from unrounded values. It is quite possible to have a percentage entry of up to 100% even if the rounded number entry is zero. The same rounded value may account for a slightly different percentage share. Because percentages are expressed in integers and not carried out to several decimal places, percentages that appear identical may be associated with slightly different values.

In this analysis, when estimates were derived solely from the NFPA's fire experience survey , fires were rounded to the nearest 500, civilian deaths were rounded to the nearest five, civilian injuries were rounded to the nearest 25, and direct property damage was rounded to the nearest million dollars. For estimates derived from NFIRS and the NFPA's fire experience survey , fires were rounded to the nearest hundred, civilian deaths and injuries were rounded to the nearest ten, and direct property damage was rounded to the nearest million dollars.

Inflation. Property damage estimates are not adjusted for inflation unless so indicated. In this analysis, inflation adjusted damage estimates are provided in Table 1, 1A and 1B.

Appendix B.
Methodology and Definitions Used in "Leading Cause" Tables

The cause table reflects relevant causal factors that accounted for at least 2% of the fires in a given occupancy. Only those causes that seemed to describe a scenario are included. Because the causal factors are taken from different fields, some double counting is possible. Percentages are calculated against the total number of structure fires, including both confined and non-confined fires. Bear in mind that every fire has at least three "causes" in the sense that it could have been prevented by changing behavior, heat source, or ignitability of first fuel, the last an aspect not reflected in any of the major cause categories. For example, several of the cause categories in this system refer to types of equipment (cooking, heating, electrical distribution and lighting, clothes dryers and washers, torches). However, the problem may be not with the equipment but with the way it is used. The details in national estimates are derived from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS). This methodology is based on the coding system used in Version 5.0 of NFIRS. The *NFIRS 5.0 Reference Guide*, containing all of the codes, can be downloaded from http://www.nfirs.fema.gov/documentation/reference/.

Cooking equipment and heating equipment are calculated by summing fires identified by equipment involved in ignition and relevant confined fires. Confined fires will be shown if they account for at least 2% of the incidents. **Confined cooking fires** (cooking fires involving the contents of a cooking vessel without fire extension beyond the vessel) are identified by NFIRS incident type 113.

Confined heating equipment fires include **confined chimney or flue fires (**incident type 114) and **confined fuel burner or boiler** fires (incident type 116). The latter includes delayed ignitions and incidents where flames caused no damage outside the fire box. The two types of confined heating fires may be combined or listed separately, depending on the numbers involved.

Intentional fires are identified by fires with a "1" (intentional) in the field "cause." The estimate includes a proportional share of fires in which the cause was undetermined after investigation, under investigation, or not reported. All fires with intentional causes are included in this category regardless of the age of the person involved. Earlier versions of NFIRS included ignition factor codes for incendiary and suspicious. Intentional fires were deliberately set; they may or may not be incendiary in a legal sense. No age restriction is applied.

Fires caused by **playing with heat source** (typically matches or lighters) are identified by code 19 in the field "factor contributing to ignition." Fires in which the factor contribution to ignition was undetermined (UU), entered as none (NN) or left blank are considered unknown and allocated proportionally. Because factor contributing to ignition is not required for intentional fires, the unknown share, by these definitions, is somewhat larger than it should be.

The heat source field is used to identify fires started by: **smoking materials** (cigarette, code 61; pipe or cigar, code 62; and heat from undetermined smoking material, code 63); **candles** (code 66), **lightning** (code 73); and **spontaneous combustion or chemical reaction** (code 72). Fires started by heat from unclassified open flame or smoking materials (code 60) are allocated proportionally among the "other open flame or smoking material" codes (codes 61-69) in an allocation of partial unknown data. This includes smoking materials and candles. This approach results in any true unclassified smoking or open flame heat sources such as incense being inappropriately allocated. However, in many fires, this code was used as an unknown.

The equipment involved in ignition field is used to find several cause categories. This category includes equipment that functioned properly and equipment that malfunctioned.

Cooking equipment Non-confined fire refers to equipment used to cook, heat or warm food (codes 620-649 and 654). Fire in which ranges, ovens or microwave ovens, food warming appliances, fixed or portable cooking appliances, deep fat fryers, open fired charcoal or gas grills, grease hoods or ducts, or other cooking appliances) were involved in the ignition are said to be caused by cooking equipment. Food preparation devices that do not involve heating, such as can openers or food processors, are not included here. As noted in Appendix A, a proportional share of unclassified kitchen and cooking equipment (code 600) is included here.

Heating equipment Non-confined fire (codes 120-199) includes central heat, portable and fixed heaters (including wood stoves), fireplaces, chimneys, hot water heaters, and heat transfer equipment such as hot air ducts or hot water pipes. Heat pumps are not included. As noted in Appendix A, a proportional share of unclassified heating, ventilation and air condition equipment (code 100) is included here.

Electrical distribution or lighting equipment (codes 200-299) include: fixed wiring; transformers; associated overcurrent or disconnect equipment such as fuses or circuit breakers; meters; meter boxes; power switch gear; switches, receptacles and outlets; light fixtures, lamps, bulbs or lighting; signs; cords and plugs; generators, transformers, inverters, batteries and battery charges.

Torch, burner or soldering iron (codes 331-334) includes welding torches, cutting torches, Bunsen burners, plumber furnaces, blowtorches, and soldering equipment. As noted in Appendix A, a proportional share of shop tools and industrial equipment (code 300) is included here.

Clothes dryer or washer (codes 811, 813 and 814) includes clothes dryers alone, washer and dryer combinations within one frame, and washing machines for clothes. As noted in Appendix A, a proportional share of unclassified personal and household equipment (code 800) is included here.

Electronic, office or entertainment equipment (codes 700-799) includes: computers and related equipment; calculators and adding machines; telephones or answering machines; copiers; fax machines; paper shredders; typewriters; postage meters; other office equipment; musical instruments; stereo systems and/or components; televisions and cable TV converter boxes,, cameras, excluding professional television studio cameras, video equipment and other electronic equipment. Older versions of NFIRS had a code for electronic equipment that included radar, X-rays, computers, telephones, and transmitter equipment.

Shop tools and industrial equipment excluding torches, burners or soldering irons (codes 300-330, 335-399) includes power tools; painting equipment; compressors; atomizing equipment; pumps; wet/dry vacuums; hoists, lifts or cranes; powered jacking equipment; water or gas drilling equipment; unclassified hydraulic equipment; heat-treating equipment; incinerators, industrial furnaces, ovens or kilns; pumps; compressors; internal combustion engines; conveyors; printing presses; casting, molding; or forging equipment; heat treating equipment; tar kettles; working or shaping machines; coating machines; chemical process equipment; waste recovery equipment; power transfer equipment; power takeoff; powered valves; bearings or brakes; picking, carding or weaving machines; testing equipment; gas regulators; separate motors; non-vehicular internal combustion engines; and unclassified shop tools and industrial equipment. As noted in Appendix A, a proportional share of shop tools and industrial equipment (code 300) is included here.

Medical equipment (codes 410-419) includes: dental, medical or other powered bed, chair or wheelchair; dental equipment; dialysis equipment; medical monitoring and imaging equipment; oxygen administration equipment; radiological equipment; medical sterilizers, therapeutic equipment and unclassified medical equipment. As noted in Appendix A, a proportional share of commercial and medical equipment (code 400) is included here.

Mobile property (vehicle) describes fires in which some type of mobile property was involved in ignition, regardless of whether the mobile property itself burned (mobile property involved codes 2 and 3).

Exposures are fires that are caused by the spread of or from another fire. These were identified by factor contributing to ignition code 71. This code is automatically applied when the exposure number is greater than zero.

REPORT ON
THE SEPARATION REQUIREMENTS BETWEEN A GARAGE AND A ONE- OR TWO-FAMILY DWELLING

March 2, 2018

New York State Department of State
Division of Building Standards and Codes
Code Development Unit

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Part I: Introduction

U.S. fire departments responded to an average of 358,500 home structure fires per year during 2011-2015. On average, these fires caused 2,510 civilian deaths, 12,300 civilian injuries, and $6.7 billion in direct property damage annually. Approximately 70% of these fires occurred in in one- or two-family homes, which resulted in 84% of the home fire deaths. The remainder occurred in apartments or other multi-family housing[1]. This report is intended to provide an overview of the fire hazard associated with garages accessory to one- or two-family dwellings and the associated cost of providing additional fire resistance for mitigating this hazard.

Part II: Summary of Findings

- **Fires that originate in a garage occur relatively infrequently and appear to pose a low threat to occupant safety as compared to fires that originate in other areas of a home. Despite the low frequency of occurrences, garage fires contribute to a somewhat significant portion of direct property damage as compared to fires of other origin.**
- **Approximately 1% of all one- or two-family home fires in New York State, excluding New York City, originate in a garage. This figure is three times less than the national average.**
- **On average, the Uniform Code's requirement for the protection of openings (2015 IRC Section R302.5.1) is equivalent to 26% of the nation, more restrictive than 42% of the nation, and less restrictive than 4% of the nation. Approximately 28% of the nation does not have a statewide code to address this requirement.**
- **On average, the Uniform Code's garage-dwelling separation requirements (2015 IRC Table R302.6) are equivalent to 65% of the nation, more restrictive than 1% of the nation, and less restrictive than about 6% of the nation. Approximately 28% of the nation does not have a statewide code to address this requirement.**
- **According to the U.S. Fire Administration's report titled Structure Fire Response Times (January 2006, Revised August 2006), 90% of all fires within the nation are responded to within 11-minutes. This generally falls within the range recommended by NFPA 1720 (9 to 14-minutes).**
- **The garage-dwelling separation requirements under the 2010 Residential Code of New York State (2010 RCNYS) are generally more expensive than those under the 2015 International Residential Code (2015 IRC).**

Part III: Home Structure Fires Statistics: Death, Injuries, and Property Damage

The National Fire Protection Association (NFPA) is a nonprofit organization dedicated to "*eliminating death, injury, property and economic loss due to fire, electrical and related hazards*".[2] The Fire Protection Research Foundation is a nonprofit research affiliate of the NFPA that plans, manages, and communicates research in support of the NFPA. This research is used to develop NFPA's codes and standards. The Foundation publishes research reports in many areas of fire and life safety. One such research report, titled Home Structure Fires (September 2017), provides data on fires that occurred in one- and two-family homes in the United States between 2011 and 2015. This data was obtained from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS)[3] and the NFPA's fire department experience survey. The table and figures in Part

[1] NFPA Research Report titled Home Structure Fires, September 2017

[2] https://www.nfpa.org/About-NFPA

[3] NFIRS is a reporting standard created by the National Fire Data Center in the United States Fire Administration (USFA), a division of the Federal Emergency Management Agency (FEMA). NFIRS was established after the passage of the Federal Fire Prevention and Control Act of 1974 (P.L. 93-498). This Act authorized the USFA to gather and analyze information on the magnitude of the Nation's fire problem, in addition to detailed characteristics and trends. It also empowers the USFA to develop uniform data reporting methods, and to encourage and assist state agencies in developing and reporting data. One of the objectives of NFIRS is to obtain data that can be used to more accurately assess and

III[4] of this report provide a summary of the data presented Table 10A of the NFPA's Home Structure Fires report.

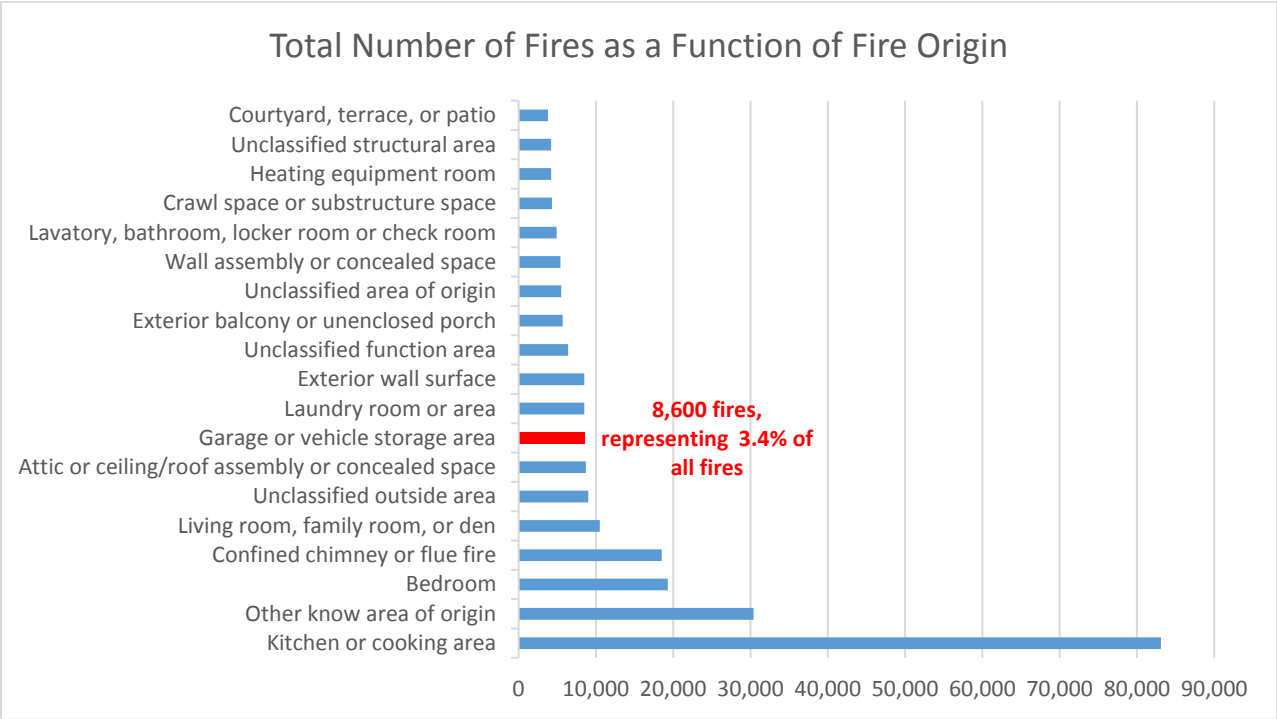
NFPA Home Structure Fires Report, Table 10A Summary: One- and Two-Family Home Structure Fires[5]				
Area of Fire Origin	**Total # of Fires**	**# of Civilian Deaths**	**# of Civilian Injuries**	**Direct Property Damage (Millions)**
Kitchen or cooking area	83,100	340	2,740	$726
Other know area of origin	30,400	220	730	$837
Bedroom	19,300	470	1,620	$662
Confined chimney or flue fire	18,500	0	20	$6
Living room, family room, or den	10,500	490	850	$439
Unclassified outside area	9,000	10	50	$95
Attic or ceiling/roof assembly or concealed space	8,700	20	110	$440
Garage or vehicle storage area	**8,600**	**50**	**390**	**$539**
Laundry room or area	8,500	30	240	$177
Exterior wall surface	8,500	10	110	$190
Unclassified function area	6,400	210	350	$238
Exterior balcony or unenclosed porch	5,700	40	160	$207
Unclassified area of origin	5,500	40	80	$92
Wall assembly or concealed space	5,400	20	70	$171
Lavatory, bathroom, locker room or check room	4,900	30	170	$89
Crawl space or substructure space	4,300	40	130	$143
Heating equipment room	4,200	10	90	$72
Unclassified structural area	4,200	70	100	$173
Courtyard, terrace, or patio	3,800	20	90	$99
Total	**249,500**	**2,120**	**8,100**	**$5,395**

According to the above table and illustrated in the figure below, fires that originated in a garage occurred about as frequently as those that originated in attics, laundry rooms, and along exterior wall surfaces (approximately 3% of all fires). These occurrences are marginal when compared to fires that originated in other areas of a home.

subsequently combat the fire problem at a national level. (U. S. Fire Administration, The National Fire Incident Reporting System (NFIRS), FA-290/January 2007).

[4] Excluding Table 1.

[5] Data extracted from NFPA Home Structure Fires Report (September 2017) Table 10A, and ranked by total number of fires. The original Table 10A is presented in Appendix A of this report.



The NYS Division of Homeland Security & Emergency Services Office of Fire Prevention and Control provided the Division of Building Standards and Codes (DBSC) with data[6] on fires that occurred in one- or two-family homes and garages associated with those homes. This data, which is presented in Table 1 below, was used to determine the percentage of fires that originate in garages accessory to one- or two-family homes. **According to the data, approximately 1% of all one- or two-family home fires in New York State[7] originate in a garage. This figure is three times less than the national average[8], as depicted on the previous chart.**

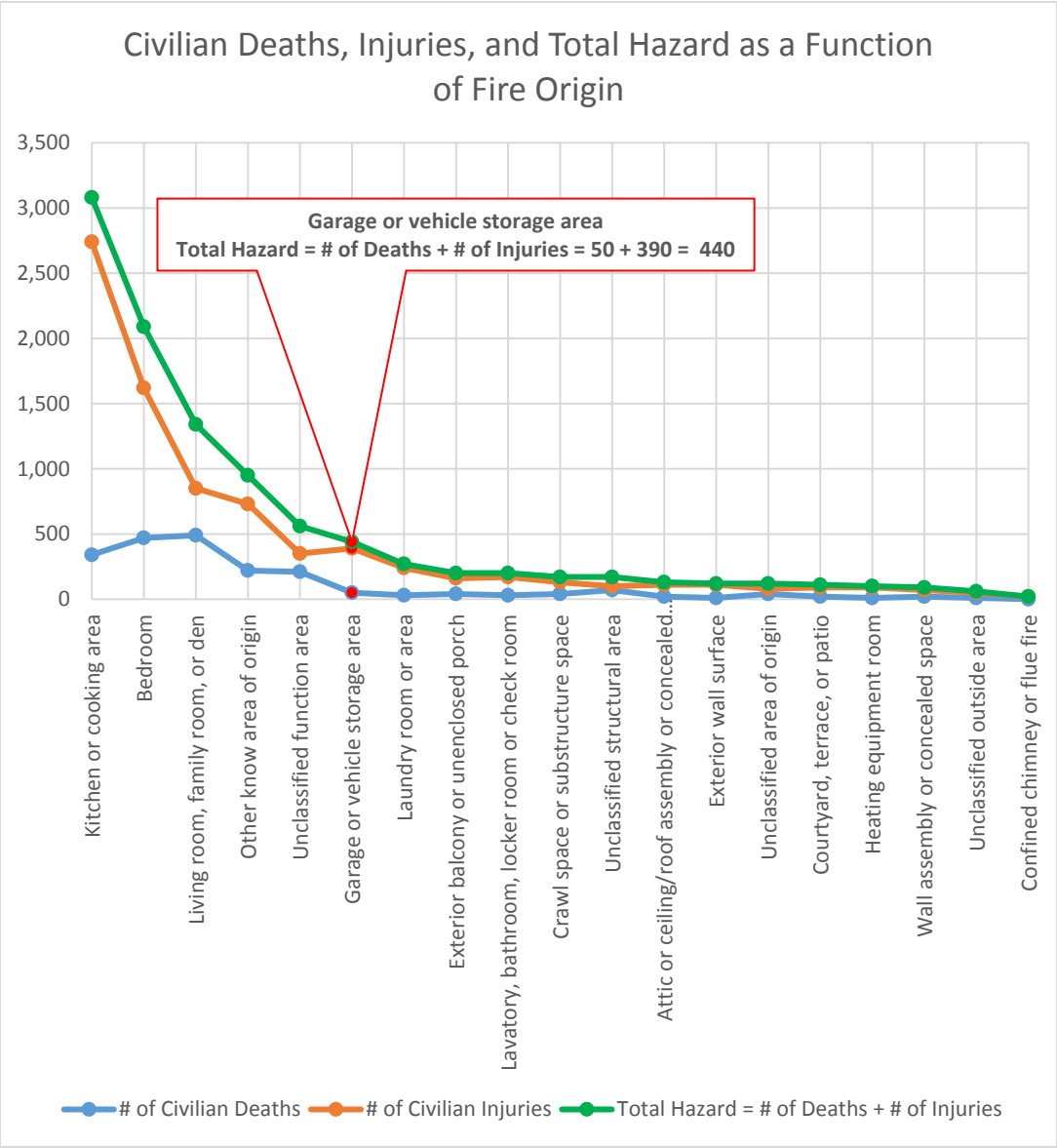
Table 1
New York State Garage Fires as a Percentage of Total Fires for 2011-2015

Year	Number of Fires Originating in One- or Two-family Homes			Number of Fires Originating in Garages for One- or Two-family Homes		
	Statewide	NYC	Under the Uniform Code [1]	Statewide	NYC	Under the Uniform Code [1]
2011	16,425	4,992	11,433	154	17	137
2012	17,428	5,705	11,723	155	15	140
2013	17,580	6,034	11,546	144	9	135
2014	18,511	6,465	12,046	126	6	120
2015	19,111	6,789	12,322	148	9	139
		Total =	**59,070**		**Total =**	**671**
Garage Fires as a Percentage of Total Fires = (671 ÷ 59,070) x 100% = 1.1%						

1. Statewide fires less NYC fires.

[6] Data obtained through the New York State Fire Reporting System.
[7] Excluding New York City.
[8] For the years 2011-2015.

In addition to being infrequent, garage fires resulted in a small percentage of all fire related deaths (2.4%[9]). These occurrences are similar to fires that originated in laundry rooms, exterior balconies/unenclosed porches, bathrooms, and crawl spaces. The following chart depicts the overall hazard that a garage poses to occupant safety as compared to the hazard associated with other areas of a home. This is accomplished by creating a new data set, titled Total Hazard, which is the summation of the total number of civilian deaths and total number of civilian injuries for each area of fire origin. This new data set is depicted as the green line on the following chart.

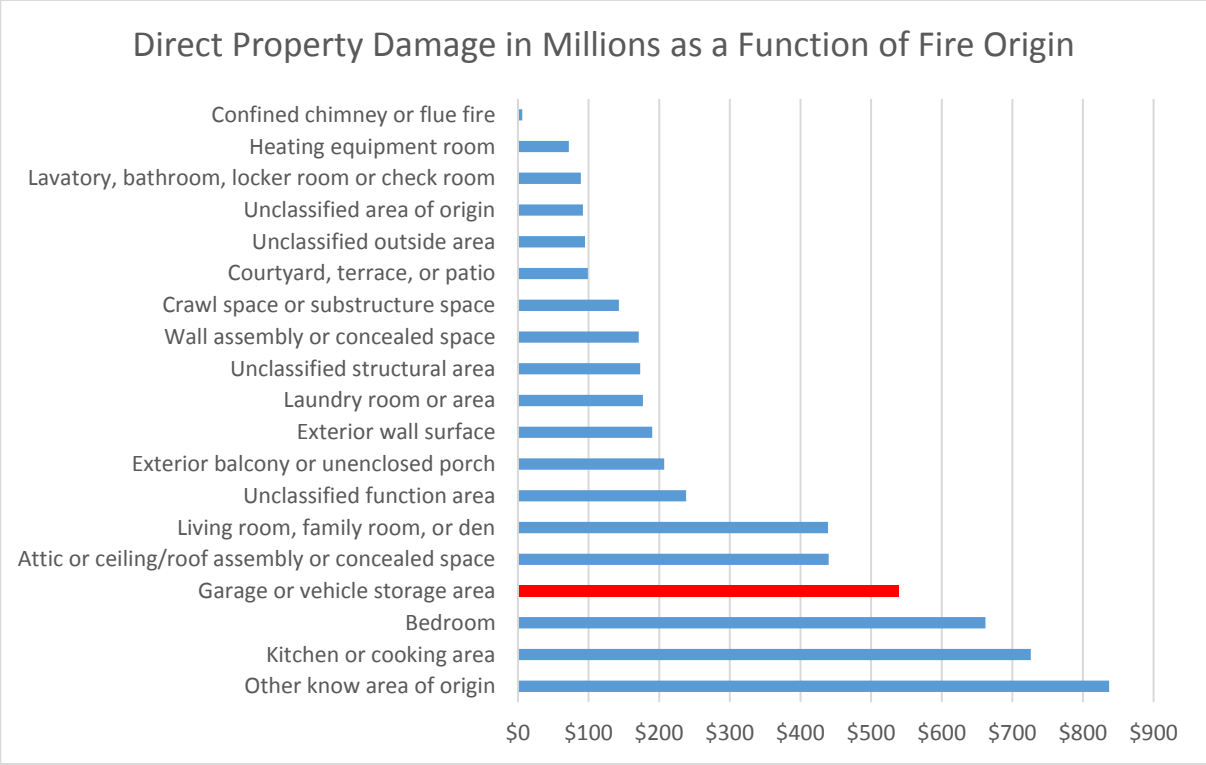


As evident on the above chart, the Total Hazard that garage fires pose is relatively small, representing only 4.3%[10] of all hazards. Kitchens, bedrooms, and living room all present a significantly greater threat to safety.

[9] Garage fire related deaths as a percentage = (50 deaths ÷ 2,120 total residential fire deaths) × 100% = 2.4%. See Table 10A Summary for additional data on deaths and injuries.

[10] Total Hazard for a garage as a percentage = [(50 deaths + 390 injuries) ÷ (2,120 total residential fire deaths + 8,100 total residential fire injuries)] × 100% = 4.3%. Refer to Table 10A Summary for additional data on deaths and injuries.

Despite the infrequent occurrence and relatively low threat to life safety, garage fires resulted in the fourth leading cause of direct property damage (approximately 10%[11] of all fires). See chart below. Fires that originated in other areas of the home and contributed to a greater amount of direct property damage include kitchens and bedrooms.



- **Fires that originate in a garage occur relatively infrequently and appear to pose a low threat to occupant safety as compared to fires that originate in other areas of a home. Despite the low frequency of occurrences, garage fires contribute to a somewhat significant portion of direct property damage as compared to fires of other origin.**
- **Approximately 1% of all one- or two-family home fires in New York State, excluding New York City, originate in a garage. This figure is three times less than the national average.**

<u>Part IV: National Information on Code Requirements for Garage-Dwelling Separation</u>

The DBSC reviewed the codes adopted by other states to assess how other states perceive the risk that a garage poses to a dwelling. This review focused on the following two provisions of the Uniform Code: Sections R302.5.1 and R302.6 of the 2015 International Residential Code (2015 IRC).[12] The assessment is provided in Table 2 below; Table 3 provides a summary of the assessment.

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[11] ($539,000,000 ÷ $5,395,000,000) ×100% = 10%. Refer to Table 10A in the Appendix A of this report for details.

[12] **R302.5.1 Opening Protection**. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1 3/8 inches (35 mm) in thickness, solid or honeycomb-core steel doors not less than 1 3/8 inches (35 mm) thick, or 20-minute fire-rated doors, equipped with a self-closing device.

R302.6 Dwelling-garage fire separation. The garage shall be separated as required by Table R302.6. Openings in garage walls shall comply with Section R302.5. Attachment of gypsum board shall comply with Table R702.3.5. The wall separation provisions of Table R302.6 shall not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.

Table 2
Comparison of Other State's Garage/Dwelling Separation Requirements to the Uniform Code
E = Equivalent to the Uniform Code, M = More Restrictive than the Uniform Code, L = Less Restrictive than the Uniform Code

State	Separation Requirement					Statewide Sprinkler Requirement [14]
	2015 IRC R302.5.1 Opening Protection	Table R302.6 of the 2015 IRC				
		Residence & Attics	Habitable Rooms Above a Garage	Structure(s) Supporting Floor/ Ceiling Assemblies	Garages Located < 3' from a Dwelling Unit on the Same Lot	
Alabama	L [8]	E	E	E	E	None
Alaska	Not adopted Statewide [10]					None
Arizona	Not adopted Statewide [10]					None
Arkansas	E	E	E	E	E	None
California	M [1, 2]	E	M [3]	E	E	Required
Colorado	Not adopted Statewide [10]					None
Connecticut	E	M [9]	E	M [9]	M [9]	None
Delaware	Not adopted Statewide [10]					None
Florida	L [8]	E	E	E	E	None
Georgia	E	E	E	E	E	None
Hawaii	Not adopted Statewide [14]					None
Idaho	E	E	E	E	E	None
Illinois	Not adopted Statewide [10]					None
Indiana	L [8]	E	E	E	E	None
Iowa	Not adopted Statewide [10]					None
Kansas	Not adopted Statewide [10]					None
Kentucky	L [8]	E	E	E	E	None
Louisiana	L [8]	E	E	E	E	None
Maine	L [8]	E	E	E	E	None
Maryland	E	E	E	E	E	Required
Massachusetts	E	M [11]	E	M [11]	M [11]	Required [15]
Michigan	L [8]	E	E	E	E	None
Minnesota	L [8]	E	E	E	E	None
Mississippi	No specific statewide code adopted					None
Missouri	Not adopted Statewide [10, 12]					None
Montana	E	E	E	E	E	None
Nebraska	E	E	E	E	E	None
Nevada	Not adopted Statewide [10]					None
New Hampshire	L [8]	E	E	E	E	None
New Jersey	L [8]	E	M [13]	M [13]	E	None
New Mexico	L [7]	E	E	E	E	None
North Carolina	L [8]	E	E	E	E	None
North Dakota	L [8]	E	E	E	E	None
Ohio	L [8]	E	E	E	E	None
Oklahoma	E	E	E	E	E	None
Oregon	L [8]	E	E	E	E	None
Pennsylvania	L [9]	E	E	E	E	None
Rhode Island	L [8]	E	E	E	E	None
South Carolina	L [9]	E	E	E	E	None
South Dakota	Not adopted Statewide [10]					None
Tennessee	L [8]	E	E	E	E	None
Texas	L [8]	E	L	E	L	None
Utah	M [1]	E	E	E	E	None
Vermont	Not adopted Statewide [10]					None
Virginia	L [8]	E	E	E	E	None
Washington	E	E	E	E	E	None
West Virginia	E	E	E	E	E	None
Wisconsin	E	M [4]	E	M [5]	M [6]	None
Wyoming	E	E	E	E	E	None

Table 2 Footnotes:

1. Requires self-latching hardware.
2. Provides an exception for the type of door required when sprinklers are installed.
3. Includes provisions for carports.
4. 3/4 hour rated, one layer of 5/8" Type X gypsum on the garage side, one layer of 1/2" gypsum on each side, or two layers of 1/2" gypsum on the garage side.
5. One layer of 5/8" Type X gypsum on the garage side, two layers of 1/2" gypsum on the garage side, or other 3/4-hour fire-resistive protection.
6. 3/4-hour wall and 1/3-hour doors and windows.
7. Solid doors and honeycomb core steel doors are not required to be self-closing.
8. Does not require self-closing device.
9. 5/8" Type X gypsum.
10. International Codes-Adoption by State (October 2017), https://cdn-web.iccsafe.org/wp-content/uploads/Master-I-Code-Adoption-Chart-OCT.pdf
11. 5/8" Type X gypsum.
12. https://up.codes/codes/missouri
13. Constructed with not less than a one-hour fire resistance rating; NJAC 5-23.
14. https://www.nfpa.org/Public-Education/Campaigns/Fire-Sprinkler-Initiative/Legislation-and-adoptions/Sprinkler-requirements
15. Fire sprinklers for new townhouses shall be designed and installed in accordance with NFPA 13, 13R, or 13D, as applicable. Only one- and two-family dwellings having an aggregate area greater than 14,400 square feet shall have fire sprinklers installed in accordance with NFPA 13D. Aggregate areas shall include basements but not garages and unfinished attics. Additions to such sprinklered dwellings shall have automatic sprinklers installed in accordance with NFPA 13D.

Table 3 Summary of Table 2					
State	Separation Requirement				
	2015 IRC R302.5.1 Opening Protection	Table R302.6 of the 2015 IRC			
		Residence & Attics	Habitable Rooms Above a Garage	Structure(s) Supporting Floor/ Ceiling Assemblies	Garages Located < 3' from a Dwelling Unit on the Same Lot
# of States that have Equivalent Requirements to the Uniform Code	13	33	33	32	32
	Approximately 26% of the Nation	Approximately 65% of the Nation			
# of States that are Less Restrictive than the Uniform Code	21	0	1	0	1
	Approximately 42% of the Nation	Approximately 1% of the Nation			
# of States that are More Restrictive than the Uniform Code	2	3	2	4	3
	Approximately 4% of the Nation	Approximately 6% of the Nation			
# of States with no Statewide Adoption	13	13	13	13	13
	Approximately 26% of the Nation	Approximately 26% of the Nation			

- **On average, the Uniform Code's requirement for the protection of openings (2015 IRC Section R302.5.1) is equivalent to 26% of the nation, more restrictive than 42% of the nation, and less restrictive than 4% of the nation. Approximately 28% of the nation does not have a statewide code to address this requirement.**
- **On average, the Uniform Code's garage-dwelling separation requirements (2015 IRC Table R302.6) are equivalent to 65% of the nation, more restrictive than 1% of the nation, and less restrictive than about 6% of the nation. Approximately 28% of the nation does not have a statewide code to address this requirement.**

Part V: National Response Time Data

The United States Fire Administration (USFA) /National Fire Data Center prepared a report[13] of the national fire department response times using the NFIRS database. The report's findings are as follows.

- Response times are commonly less than 5 minutes for half of all fire department responses regardless of the season, time of day, or region of the country.
- 90% of all fires are responded to in less than 11 minutes.
- The response times in the northeastern portion of the country are the lowest, while response times in the west are the highest.
- Average response times exhibit a relationship between flame spread and longer response times after the fire has spread beyond the area of origin.

Response times in the report are measured from alarm time to arrival at the fire. This excludes the time during which the fire is ignited to the time that it is detected, and the time for the fire department to set up, combat, and extinguish the fire.

The NFPA, upon request of the Department of Homeland Security, Office of State and Local Government Coordination and Preparedness[14], has made a portion of NFPA 1720[15] available to assist fire departments with grant application processes. The NFPA standard establishes the minimum requirements pertaining to "the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by volunteer and combination fire departments". The following table is a reproduction of Table 4.3.2 of NFPA 1720, which is intended to be used by local governments to determine staffing and response time objectives for combating low-hazard occupancy fires, such as 2,000 ft^2, two-story, single-family homes without basement.

NFPA 1720 Table 4.3.2				
Demand Zone[a]	**Demographics**	**Minimum Staff to Respond[b]**	**Response Time (minutes)[c]**	**Meets Objective (%)**
Urban area	>1,000 people/mi^2	15	9	90
Suburban area	500–1,000 people/mi^2	10	10	80
Rural area	<500 people/mi2	6	14	80
Remote area	Travel distance ≥ 8 mi	4	Directly dependent on travel distance	90
Special risks	Determined by AHJ	Determined by AHJ based on risk	Determined by AHJ	90

a. A jurisdiction can have more than one demand zone.
b. Minimum staffing includes members responding from the AHJs department and automatic aid.
c. Response time begins upon completion of the dispatch notification and ends at the time interval shown in the table.

[13] USFA/NFDA Structure Fire Response Times (January 2006, Revised August 2006). See Appendix B of this report.
[14] https://www.nfpa.org/Codes-and-Standards/ARCHIVED/Safer-Act-Grant/NFPA-1720?_sm_au_=iVVSkk4SZ0rHV8fs
[15] Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments, 2014 Edition.

- **According to the U.S. Fire Administration's report titled Structure Fire Response Times (January 2006, Revised August 2006), 90% of all fires within the nation are responded to within 11-minutes. This generally falls within the range recommended by NFPA 1720 (9 to 14-minutes).**

Part VI: Cost Analysis

The DBSC performed a cost analysis of the garage-dwelling separation requirements for both the 2010 RCNYS and the 2015 IRC. The 2015 RSMeans Building Construction Cost Data was used in the analysis, providing material and installation costs based on national averages. These national averages can be adjusted to approximate a more accurate cost for a specific geographic area using a Location Factor. The Location Factors presented in the 2015 RSMeans for different regions of New York were averaged to estimate an average statewide Location Factor[16]; see Table 4 below. This factor was applied to the square foot costs in the 2015 RSMeans to arrive at an average statewide square foot cost, as presented in Table 5.

Table 4
Average Location Factor for New York State

Location	Location Factor
Mount Vernon	116.6
White Plains	116.7
Yonkers	120.2
New Rochelle	116.8
Suffern	111.3
Hicksville	123.7
Riverhead	121.9
Albany	102.1
Schenectady	101.7
Kingston	109.6
Poughkeepsie	117.0
Monticello	107.2
Glens Falls	96.0
Plattsburgh	98.0
Syracuse	98.5
Utica	97.1
Watertown	97.5
Binghamton	99.8
Buffalo	102.9
Niagara Falls	101.5
Rochester	100.2
Jamestown	94.9
Elmira	97.0
Average Location Factor for NYS	**106.4**

[16] Excluding New York City.

Table 5

Cost[1] Analysis of Garage/Dwelling Separation Requirements: 2010 Residential Code of New York State (2010 RCNYS) vs. 2015 International Residential Code (2015 IRC)

Separation	Requirement		Cost[2] $/sft	Cost[3] Difference, $/sft	RSMeans Line # and/or UL Listings
Vertical separation from the garage and a residence or attic.	2010 RCNYS R309.2.1	3/4-hour fire-resistance rating (1/2-inch gypsum board applied to either side of a 2x4 stud.	2.92	1.46	UL U317[4] 09 29 10.30 0300
	2015 IRC Table R302.6	Not less than 1/2-inch gypsum board or equivalent applied to the garage side.	1.46		09 29 10.30 0300
	2010 RCNYS R309.2.1 **Exception**	One layer of 5/8-inch thick, type-X, gypsum board may be installed on the garage side and one layer of 1/2-inch, type X, gypsum board may be installed on the opposite side.	3.08	1.62	09 29 10.30 2100 09 29 10.30 0400
	2015 IRC Table R302.6	Not less than 1/2-inch gypsum board or equivalent applied to the garage side.	1.46		09 29 10.30 0300
Horizontal separation from habitable rooms above the garage.	2010 RCNYS	One layer of 5/8-inch thick, type X, gypsum board.	1.62	0.00	09 29 10.30 3100
	2015 IRC Table R302.6	Not less than 5/8-inch Type X gypsum board or equivalent.	1.62		09 29 10.30 3100
Structure(s) supporting floor/ceiling assemblies used for separation.	2010 RCNYS	5/8-inch (15.87 mm) type X gypsum board or equivalent installed on walls.	1.53	0.06	09 29 10.30 2100
	2015 IRC Table R302.6	Not less than 1/2-inch gypsum board or equivalent installed on walls.	1.46		09 29 10.30 0300
	2010 RCNYS	5/8-inch (15.87 mm) type X gypsum board or equivalent installed on beams or columns.	3.44	0.08	09 29 10.30 3600
	2015 IRC Table R302.6	Not less than 1/2-inch gypsum board or equivalent installed on beams or columns.	3.36		09 29 10.30 1500
Garages located less than 3 feet from a dwelling unit on the same lot.	2010 RCNYS Table R302.1	1 hour with exposure from both sides	3.05	1.59	UL U309[5] 09 29 10.30 2100
	2015 IRC Table R302.6	Not less than 1/2-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area.	1.46		09 29 10.30 0300

Table 5 Footnotes

1. Cost data obtained from RSMeans Building Construction Cost Data, 2015.
2. Cost/sft = [RSMeans Average Cost x (New York State Location Factor ÷ 100)] x 1.51. New York State Location Factor = 106.4; see Table 3 for details. 1.51 = 51% markup for overhead, sales tax, and profit.
3. 2010 RCNYS Cost less 2015 IRC Cost.
4. The fire resistance rating of 1/2-inch thick gypsum board applied to either side of a 2x4 wood stud wall is 0.75-hours (UL U317 Interior Partitions - Wood Stud).
5. The fire resistance rating of 5/8-inch thick Type X gypsum board applied to either side of a 2x4 wood stud wall is 1-hour (UL U309). See Also Gypsum Association Fire Resistance Design Manual 19th Edition GA-600-2009, GA File No. WP 8105 for additional documentation.

According to the above cost analysis, the vertical separation required between a garage and a dwelling is $1.46/sft more expensive under Section R309.2.1 of the 2010 RCNYS than under Table R302.6 of the 2015 IRC. If the exception to Section R309.2.1 of the 2010 RCNYS is applied, the cost difference escalates to $1.62/sft. The separation requirement for garages located less than 3 feet from a dwelling unit on the same lot cost approximately $1.59/sft more under the 2010 RCNYS as compared to the 2015 IRC. All other cost differences appear nominal.

RSMeans[17] does not provide cost data for 20- and 45-minute fire rated doors. Division conducted a thorough internet search to acquire this information and determined that the cost of a 20-minute fire rated door can cost as little as $175[18], whereas the cost of a 45-minute fire rated door may be as little as $400[19]. According to these estimates, the cost difference for a fire rated door is a about $225 more expensive under the 2010 RCNYS than under the 2015 IRC.

- **The garage-dwelling separation requirements under the 2010 RCNYS are generally more expensive than those under the 2015 IRC.**

[17] The 2015 editions of RSMeans, including Square Foot Costs, Residential Cost Data, Light Commercial Cost Data, Building Construction Cost Data, and Assemblies Cost Data.
[18] Jeld-Wen Colonist 6 panel smooth fire rated door, MLDCOLFR20. https://www.etodoors.com/jeld-wen-colonial-6-panel-textured.html/
[19] Email correspondence with https://www.greenarrowdoors.com/.

APPENDIX A

NFPA HOME STRUCTURE FIRES REPORT (SEPTEMBER 2017)

TABLE 10A

Table 10A.
Reported One- or Two-Family Home Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	83,100	(33%)	340	(16%)	2,740	(34%)	$726	(13%)
Non-Confined	27,700	(11%)	340	(16%)	2,070	(25%)	$712	(13%)
Confined	55,400	(22%)	0	(0%)	670	(8%)	$14	(0%)
Bedroom	19,300	(8%)	470	(23%)	1,620	(20%)	$662	(12%)
Non-Confined	18,700	(7%)	470	(23%)	1,610	(20%)	$662	(12%)
Confined	600	(0%)	0	(0%)	10	(0%)	$0	(0%)
Confined chimney or flue fire	18,500	(7%)	0	(0%)	20	(0%)	$6	(0%)
Non-Confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Confined	18,500	(7%)	0	(0%)	20	(0%)	$6	(0%)
Living room, family room, or den	10,500	(4%)	490	(23%)	850	(10%)	$439	(8%)
Non-Confined	9,900	(4%)	490	(23%)	850	(10%)	$439	(8%)
Confined	500	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified outside area	9,000	(4%)	10	(0%)	50	(1%)	$95	(2%)
Non-Confined	3,500	(1%)	10	(0%)	50	(1%)	$95	(2%)
Confined	5,500	(2%)	0	(0%)	10	(0%)	$0	(0%)
Attic or ceiling/roof assembly or concealed space	8,700	(3%)	20	(1%)	110	(1%)	$440	(8%)
Non-Confined	8,600	(3%)	20	(1%)	110	(1%)	$440	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Garage or vehicle storage area	8,600	(3%)	50	(2%)	390	(5%)	$539	(10%)
Non-Confined	7,800	(3%)	50	(2%)	390	(5%)	$539	(10%)
Confined	800	(0%)	0	(0%)	0	(0%)	$0	(0%)
Laundry room or area	8,500	(3%)	30	(1%)	240	(3%)	$177	(3%)
Non-Confined	7,800	(3%)	30	(1%)	240	(3%)	$177	(3%)
Confined	700	(0%)	0	(0%)	10	(0%)	$0	(0%)
Exterior wall surface	8,500	(3%)	10	(0%)	110	(1%)	$190	(4%)
Non-Confined	8,300	(3%)	10	(0%)	110	(1%)	$190	(4%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified function area	6,400	(3%)	210	(10%)	350	(4%)	$238	(4%)
Non-Confined	5,700	(2%)	210	(10%)	350	(4%)	$238	(4%)
Confined	800	(0%)	0	(0%)	0	(0%)	$0	(0%)

* NFIRS 5.0 does not have a separate area of origin code for fires starting in chimneys. Any home fire with NFIRS incident type 114 - "Chimney of fire originating in and confined to a chimney or flue" is captured here.
** Does not include fires with property use coded as residential garage.

Table 10A. (Continued)
Reported One- or Two-Family Home Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Exterior balcony or unenclosed porch	5,700	(2%)	40	(2%)	160	(2%)	$207	(4%)
Non-Confined	5,000	(2%)	40	(2%)	160	(2%)	$207	(4%)
Confined	600	(0%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified area of origin	5,500	(2%)	40	(2%)	80	(1%)	$92	(2%)
Non-Confined	3,200	(1%)	40	(2%)	80	(1%)	$92	(2%)
Confined	2,300	(1%)	0	(0%)	0	(0%)	$0	(0%)
Wall assembly or concealed space	5,400	(2%)	20	(1%)	70	(1%)	$171	(3%)
Non-Confined	5,400	(2%)	20	(1%)	70	(1%)	$171	(3%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Lavatory, bathroom, locker room or check room	4,900	(2%)	30	(1%)	170	(2%)	$89	(2%)
Non-Confined	4,400	(2%)	30	(1%)	170	(2%)	$88	(2%)
Confined	500	(0%)	0	(0%)	10	(0%)	$0	(0%)
Crawl space or substructure space	4,300	(2%)	40	(2%)	130	(2%)	$143	(3%)
Non-Confined	4,000	(2%)	40	(2%)	130	(2%)	$142	(3%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Heating equipment room	4,200	(2%)	10	(1%)	90	(1%)	$72	(1%)
Non-Confined	2,200	(1%)	10	(1%)	80	(1%)	$71	(1%)
Confined	2,000	(1%)	0	(0%)	10	(0%)	$1	(0%)
Unclassified structural area	4,200	(2%)	70	(3%)	100	(1%)	$173	(3%)
Non-Confined	3,900	(2%)	70	(3%)	100	(1%)	$173	(3%)
Confined	300	(0%)	0	(0%)	0	(0%)	$0	(0%)
Courtyard, terrace, or patio	3,800	(2%)	20	(1%)	90	(1%)	$99	(2%)
Non-Confined	2,400	(1%)	20	(1%)	90	(1%)	$99	(2%)
Confined	1,400	(1%)	0	(0%)	0	(0%)	$0	(0%)
Other known area of origin	30,400	(12%)	220	(10%)	730	(9%)	$837	(16%)
Non-Confined	24,800	(10%)	220	(10%)	710	(9%)	$836	(15%)
Confined	5,600	(2%)	0	(0%)	20	(0%)	$1	(0%)
Total	249,500	(100%)	2,100	(100%)	8,120	(100%)	$5,393	(100%)
Non-Confined	153,400	(61%)	2,100	(100%)	7,350	(91%)	$5,369	(100%)
Confined	96,100	(39%)	0	(0%)	770	(9%)	$24	(0%)

Table 10A. (Continued)
Reported One- or Two-Family Home Structure Fires, by Area of Origin
2011-2015 Annual Averages
(Unknowns were allocated proportionally)

Area of Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Fewer than 2% of the fires began in the following areas of origin, these fires caused at least 2% of the deaths.				
Dining room	40	(2%)		
Multiple areas or origin	40	(2%)		

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA's fire experience survey.

APPENDIX B

USFA/NFDA STRUCTURE FIRE RESPONSE TIMES

(JANUARY 2006, REVISED AUGUST 2006)

U.S. Fire Administration/National Fire Data Center

Structure Fire Response Times

Topical Fire Research Series, Volume 5 – Issue 7

January 2006 / Revised August 2006

Homeland Security

TOPICAL FIRE RESEARCH SERIES

Structure Fire Response Times

January 2006 / Revised August 2006 Volume 5, Issue 7

Findings

- Regardless of region, season, or time of day, structure fire response times are generally less than 5 minutes half the time.
- The nationwide 90th percentile response time to structure fires is less than 11 minutes.
- Structure fires in the Northeast have the lowest response times while those in the West have the highest.
- Average structure fire response times show a relationship between flame spread and longer response times, but only after flames have spread beyond the room of origin.

Definition of Response Time

The definition of "response time" depends on the perspective from which one approaches the data. In the fire service, "total" response time is usually measured from the time a call is received by the emergency communications center to the arrival of the first apparatus at the scene. For the public, the clock for response time begins when the public becomes aware there is an emergency incident occurring and the fire department is notified. In reality, however, the response time clock for fire suppression begins at the moment of fire ignition and continues until the fire is extinguished.

Response Time Components

Response time components include ignition, combustion, discovery, 911 activation,[1] call processing and dispatch, turnout time, drive time, setup time, "vertical" response, combat, and extinguishment (Figure 1).

Fire *ignition* occurs when oxygen, fuel, and heat combine to produce flame. *Combustion* is a self-sustaining chemical reaction yielding energy or products that cause further reactions of the same kind.[2] Depending on the available fuel load and other conditions, a fire may grow undetected for some time prior to being detected. *Discovery* or detection occurs when someone becomes aware of the fire and takes steps to mitigate the situation (e.g., calls the fire department, uses a fire extinguisher). Depending on whether or not one tries to extinguish the fire, *911 activation* may occur several minutes after the fire is detected. In the case of an incendiary or suspicious fire (or other criminal firesetting act), this activation might be postponed deliberately.

Once 911 has been activated, *call processing and dispatch* is the time it takes for the 911 operator to ascertain the location and type of incident and alert the appropriate emergency service providers to the emergency.

Turnout time is measured from the time the alarm is received by firefighting personnel to the time the appropriate apparatus begins its actual driving response to the scene. Turnout time comprises getting to the station (in most volunteer organizations), donning protective gear, and other preparatory activities.

Drive time is the time it takes to drive from the fire station (or location that received the alarm) to curbside of the address of the incident.

U.S. Department of Homeland Security
United States Fire Administration • National Fire Data Center
Emmitsburg, Maryland 21727
http://www.usfa.fema.gov/inside-usfa/nfdc/pubs/tfrs.shtm

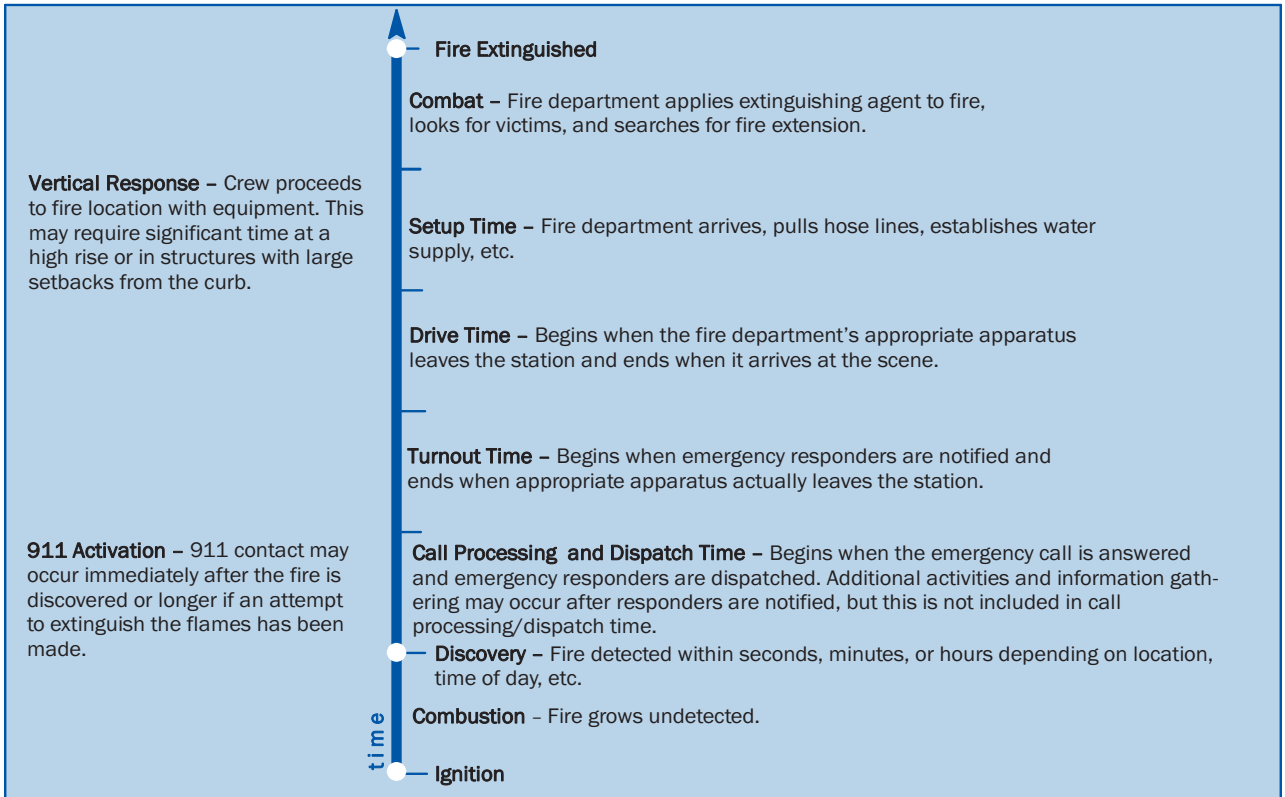


FIGURE 1. COMPONENTS OF TOTAL RESPONSE TIME

Setup time begins once a fire engine or other apparatus arrives on the scene and ends after personnel established a water supply, set up necessary equipment, etc. Additional time may be required if the structure is set far back from the curb or in a high-rise where a *vertical response* is required.

Once equipment and personnel are on the scene and setup is completed, *combat time* is the period of time required to completely *extinguish* the fire.

Methodology

National Fire Incident Reporting System (NFIRS) 5.0 data for 2001 and 2002 were used. If no arrival time was included or if response time appeared to exceed 24 hours, the incident was excluded. Only 0.14% of incidents recorded a response time of more than 24 hours; as such, these were considered as outliers and omitted from the analysis. Incidents classified as automatic or mutual aid were also excluded to avoid double counting. With the exception of flame spread, trends included all structure fires (incident type codes 110 through 123). Only fires with flame spread (incident type codes 110 through 112 and 120 through 123) were included in the analysis of response times related to flame spread.

Data for this study were queried in whole minutes. This means that response times of exactly 4 minutes and those up to 4 minutes and 59 seconds are all included in the 4-minute category. As such, slight differences between 3 minutes, 4 minutes, or 5 minutes are not as substantial as when data are examined more closely (i.e., including the seconds). References to the x-minute range mean everything from x minutes to x minutes and 59 seconds while "less than x minutes" means everything from zero to 1 second below x minutes.

Because the vast majority of response times are 20 minutes or less (98.7%), the charts and graphs in this paper do not reflect response times more than 20 minutes.

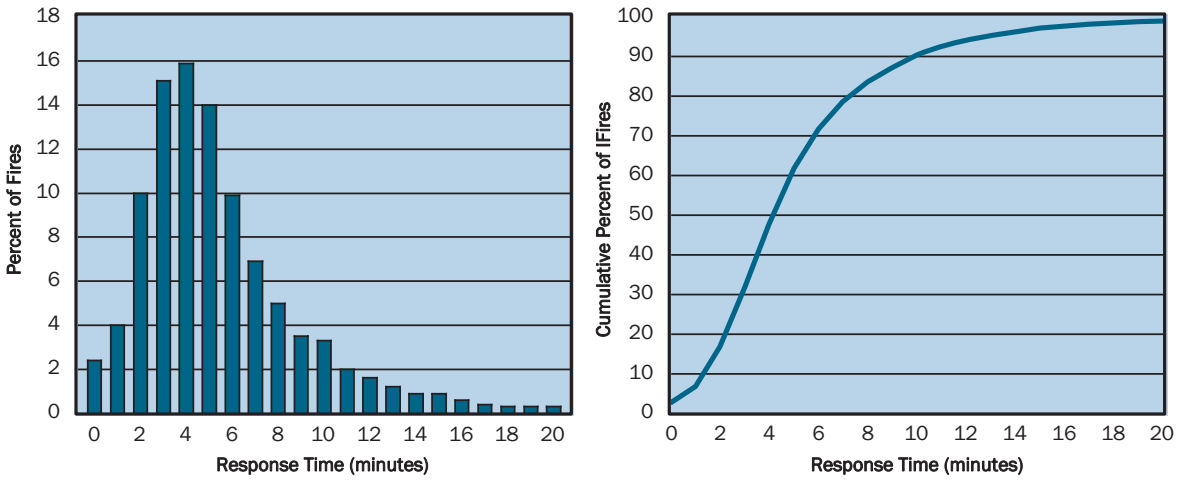
Several caveats need to be kept in mind with respect to response times. First, they are subject to a variety of measurement errors when units report their arrival on scene prematurely or belatedly. Second, response times are frequently not comparable across fire-rescue systems because of the differing manners in which they are calculated. Also, it is difficult, if not impossible, to measure some components of response time.

Response times here are measured from alarm time to arrival on scene, but there is uncertainty in the data. NFIRS 5.0 defines alarm time as "when the alarm was received by the fire department." This definition is vague and subjective. Some departments may read this definition to mean when the notification comes into the 911 communications center (911 activation) while others may read it as when the notification comes into the station (dispatch time). Thus, depending on the interpretation by the department, response times reported to NFIRS may or may not include call processing and dispatch time, which could typically take between 30 and 120 seconds.

General Trends

As shown in Figure 2, the highest percentage (16%) of structure fires had a response time in the 4-minute range. The percent of structure fires with response times of 3 and 5 minutes were not far behind at 15% and 14%, respectively. Overall, 61% of structure fires in 2001 and 2002 had a response time of less than 6 minutes.

FIGURE 2. STRUCTURE FIRE RESPONSE TIMES

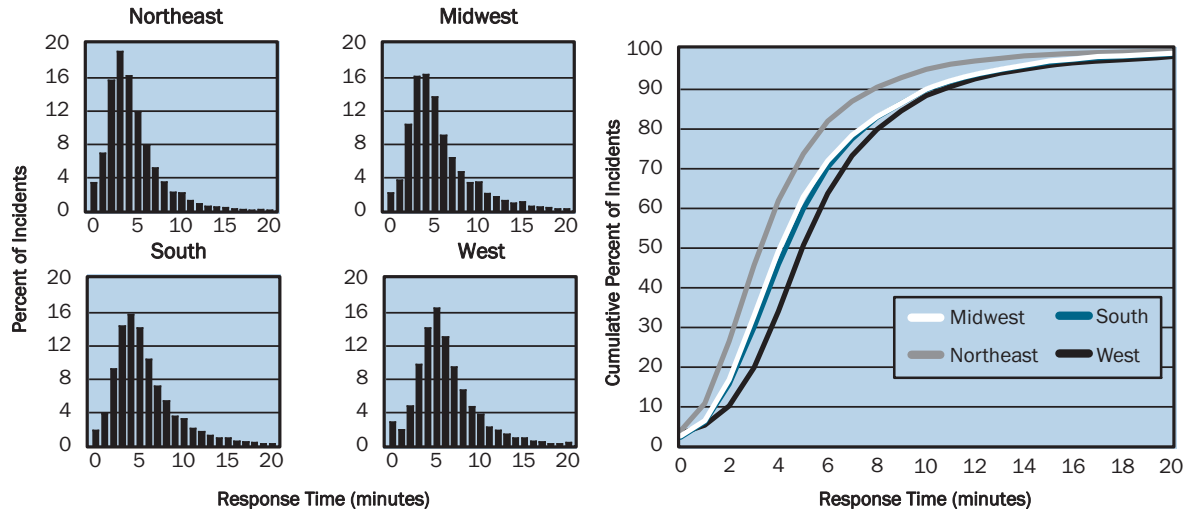


Regional Trends

Regional variation in response time was observed (Figure 3). As the regions move from the Northeast to the West, the percent of structure fires with a response time of less than 5 minutes decreases. The regional differences may be due to population densities. Usually as population densities increase, fire stations are situated so that they cover less and less geographic area, which may contribute to reduced response times. However, more investigation is needed as there is also variability within the regions.[3]

The peak in response time (minute range with the highest percentage) also moves from lower (3-minute range) to higher (5-minute range) as we move from the Northeast to the West.

FIGURE 3. REGIONAL RESPONSE TIME TRENDS



Seasonal Trends[4]

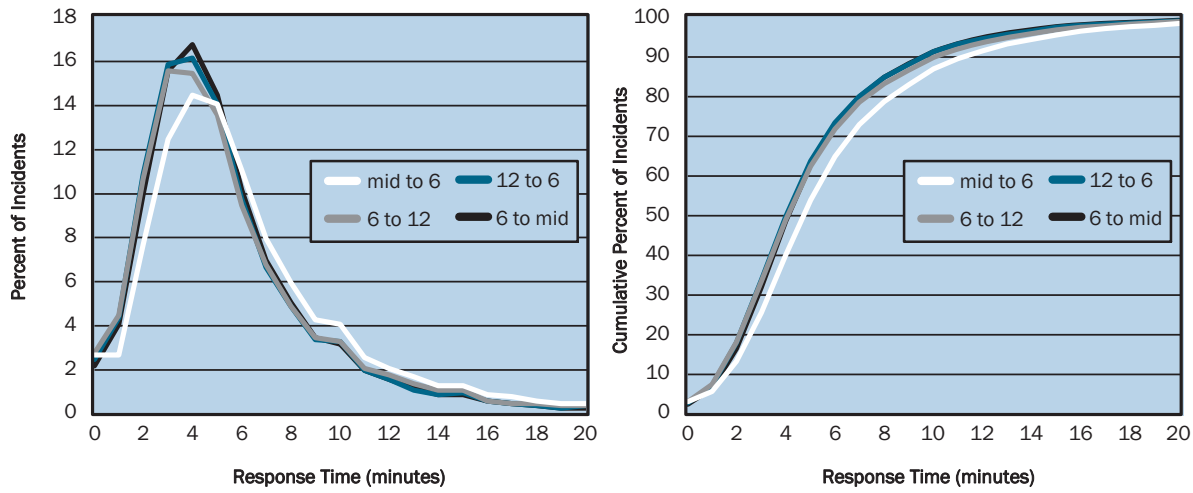
Although the number of fires fluctuates depending on the season, response times to structure fires in 2001 and 2002 were similar throughout the year and are virtually indistinguishable from the national trends shown in Figure 2. Each season, response times peak with 15% to 16% having a response time in the 4-minute range. Throughout the year, about half of fires have response times of less than 5 minutes. Winter has the lowest percentage of calls with a response time of less than 5 minutes (46%). Spring and summer have the highest percentage of calls with a response time of less than 5 minutes (48% each).

Time of Day Trends

Regardless of time of day, response times to structure fires peaked at the 4-minute range (Figure 4); however, more fires have a 4-minute range response time between 6 p.m. and midnight (17%) than any other time of day. Between midnight and 6 a.m., only 14% of fires had a response time in the 4-minute range. These results were expected because firefighters—both career and volunteer—tend to be asleep between midnight and 6 a.m. In addition, it is more difficult to see at night and just after awakening, which results in driving more slowly.

Fires have a better chance of having a response time of less than 5 minutes between noon and 6 p.m. (49%). Only 40% had a response time of less than 5 minutes between midnight and 6 a.m.

FIGURE 4. TIME OF DAY RESPONSE TIME TRENDS

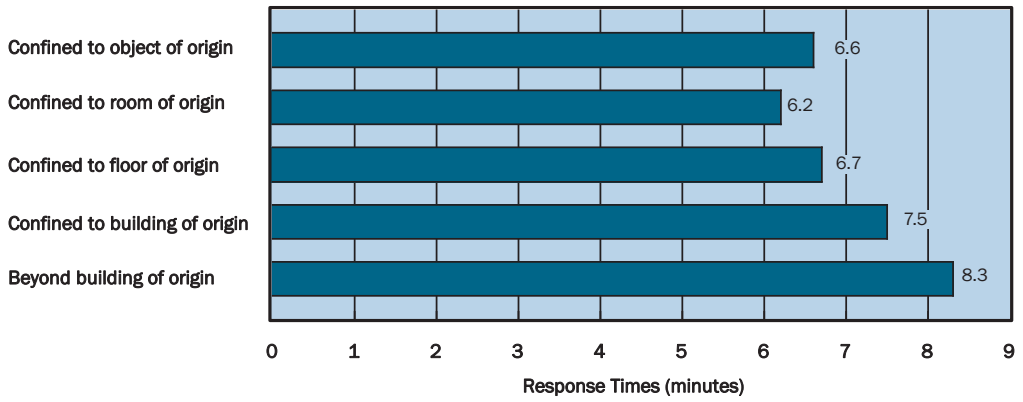


Flame Spread and Response Time

The fire service is primarily concerned with how response time impacts flame spread. About half of structure fires confined to the room of origin (51%) and confined to the floor of origin (51%) had a response time of less than 5 minutes. More than half of fires confined to the building of origin (54%) and nearly half of fires beyond the building of origin (49%) had a response time of less than 6 minutes.

Figure 5 shows that the mean response time was lowest for fires confined to the room of origin (less than 7 minutes) while fires that spread beyond the building of origin have the highest mean response time (less than 9 minutes).

FIGURE 5. MEAN RESPONSE TIMES VS. FLAME SPREAD



Conclusion

Despite the differences in time of day, season, or location in the country, there is not a great difference in response times to structure fires as analyzed here. A more detailed analysis may uncover larger differences.

In most of the analyses done here, response times were less than 5 minutes nearly 50% of the time and less than 8 minutes about 75% of the time. Nationally, average response times were generally less than 8 minutes. The overall 90th percentile, a level often cited in the industry, was less than 11 minutes. How much current response times have been impacted by industry standards and fire department goals is not clear.

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

Notes:

1. Approximately 96% of the geographic United States is covered by some type of 911. *National Emergency Number Association*.
2. *Essentials of Fire Fighting*, Fourth Edition, 2001.
3. The regions of the United States are defined by the U.S. Census Bureau as the *Northeast* (Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); *South* (Alabama, Arkansas, District of Columbia, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); *Midwest* (Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, North Dakota, Nebraska, Ohio, South Dakota, Wisconsin); *West* (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, Wyoming).
4. For purposes of this analysis, the seasons are defined as winter: January–March; spring: April–June; summer: July–September; fall: October–December.