

Meeting Minutes: NEC 2023 Adoption Review Committee (Board of Electricity)

Date: Dec. 6, 2022

Time: 9:00 a.m.

Location: Minnesota Room, DLI, 443 Lafayette Road No., St. Paul, MN 55155

Committee Members Present

1. Steve Haiby – via phone
2. Mike Hanson
3. Jeff Heimerl
4. Dean Hunter – Cmt. Chair / CO’s Designee
5. Desiree Weigel – Secretary

Committee Members Absent

Alfreda Daniels

DLI Staff & Visitors

Jeff Lebowski (Board Counsel, DLI)
Brittany Wysokinski (Bd. Counsel, DLI) – via phone
Lyndy Logan (DLI)
Marty Kumm (DLI)
Amanda Spuckler (DLI)
Nick Erickson (Housing First)
Sarah Gudmunson (Board member)
Duane Hendricks (Chair, BOE)
Chad Kurdi (BKV Group)
Tim McClintock (NEMA)
Andy Snope (IBEW 292)
Gary Thaden (NECA)

1. **Call to Order – Committee Chair Hunter**

- A. **Roll call:** Committee Chair Hunter called the meeting to order at 9:02 a.m. Roll call was taken by Secretary Weigel and a quorum was declared with 5 of 6 voting committee members present in person or by phone.
- B. **Announcements/Introductions – Committee Chair Hunter**
 - Committee members:
 1. Alfreda Daniels – Public member
 2. Steve Haiby – Representative of Electrical Suppliers in rural areas
 3. Michael Hanson – Master Electrician – Contractor
 4. Jeff Heimerl – Journeyworker Electrician
 5. Dean Hunter (Chair) – Commissioner’s Designee
 6. Desiree Weigel – Electrical Inspector
 - All handouts discussed and meeting information are posted on the Committee’s website.
 - Everyone present in person and via phone can hear all discussions.
 - Public participation is welcome and encouraged.
 - All votes will be taken by roll call if any Committee member is attending via phone.

2. **Approval of Meeting Agenda**

A motion was made by Heimerl, seconded by Weigel, to approve the agenda as presented. The vote was unanimous with 5 votes in favor of the motion; the motion carried.

3. **Approval of Previous Meeting Minutes**

A motion was made by Heimerl, seconded by Weigel, to approve the Nov. 17, 2022, minutes as presented. The vote was unanimous with 5 votes in favor of the motion; the motion carried.

4. Regular Business

- A. Expense Approval – No expenses

5. Special Business

A. Committee review of the 2023 NEC (continued) – Dean Hunter

- *Analysis of Changes 2023 NEC* can be viewed here: <https://www.iaei.org/store/>
- Free access to the 2023 NEC: <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70>
- Hunter said all Committee presentations are meant as informational only to cover significant 2023 changes.
- Public participation/comments welcome – please submit to dli.electricity@state.mn.us
- Rulemaking docket for MN Rules 1315 can be found here: <https://www.dli.mn.gov/about-department/rulemaking/rulemaking-docket-minnesota-rules-1315>
- Hunter provided and summarized the following documents:
 - Housing First’s comments dated Dec. 1, 2022 – see **Attachment A**
 - IBEW Local 110’s comments dated Nov. 22, 2022 – see **Attachment B**
 - NEMA comments dated Dec. 6, 2022 – see **Attachment C**
 - AFCI Issue Brief – see **Attachment D**
 - Electrical Fires and Arc Fault Circuit Interrupter Protection – see **Attachment E**
 - Residential Building Fire Trends – see **Attachment F**
- Hunter asked if anyone wanted to discuss previously submitted documents and/or comments – there was no discussion.
- Hunter asked the Committee for a motion to bring their recommendation to the full board.
- Hanson said they previously discussed a code change in a laundry area and issuing an FAQ instead of an amendment. Hunter said that will be an enforcement FAQ and this will be reviewed at a future meeting to be sure that nothing is omitted.
- **A motion was made by Hanson, seconded by Heimerl, to bring the recommendation forward to the full board to adopt the NEC 2023 without amendments. The vote was unanimous with 5 votes in favor of the motion; the motion carried.**

5. Announcements

The recommendation to adopt the NEC 2023 without amendments will be brought forward to the Board of Electricity meeting in January.

6. Adjournment

A motion was made by Heimerl, seconded by Weigel, to adjourn the meeting at 9:16 a.m. The roll call vote was unanimous with 5 votes in favor of the motion; the motion carried.

Respectfully Submitted,

Desiree Weigel

Desiree Weigel
Secretary



December 1, 2022

Board of Electricity 2023 NEC Adoption Committee
443 Lafayette Road
St. Paul, MN 55155

Re: 2023 National Electric Code Comments

Via Electronic Delivery

Members of the 2023 NEC Adoption Committee,

On behalf of our members, Housing First Minnesota thanks the Board of Electricity for conducting a more transparent and rigorous technical review of the 2023 National Electrical code. Earlier, we asked the this body perform ta technical review which mirrors that of the Plumbing Board and Construction Codes Advisory Council. Increasing the number of meetings and holding discussion on each and every major change is a welcome and commendable.

There are, however, areas in which the Board and its process can improve:

- Some members of the committee appeared to approach the housing industry's opposition to some code changes as something to be defended or debated, not investigated. As illustrated by the TIA issued for 210.8(f) in the 2020 NEC, the publishers of the code books make errors, and bodies that oversee local code adoption must perform standard oversight and review.
- As noted by a member of this committee, there are more factors at play in performing a cost analysis than provided by the committee. Limiting a cost analysis to research on component prices as listed on a home improvement store website is simply not sufficient, nor reflective of actual costs relating to regulatory mandates in the context of building projects.
- While sometimes received with substantial skepticism by members of the committee, Minnesota's housing affordability and access challenges are immense and certainly deserving of serious review from appointed policy makers in the housing space.

As stated throughout this process by Housing First Minnesota, as well as to other key housing regulators, this is the time to lower housing costs, not raise them.

Please contact me with any questions at nick@housingfirstmn.org or (651) 697-7586.

Sincerely,

A handwritten signature in blue ink, appearing to read "Nick Erickson".

Nicholas Erickson
Senior Director of Housing Policy
Housing First Minnesota

IBEW
LOCAL 110
Affiliated with the AFL-CIO



Jamie M. McNamara

BUSINESS MANAGER
FINANCIAL SECRETARY

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November 22, 2022

Amanda Spuckler
dli.rules@state.mn.us
Minnesota Department of Labor and Industry
443 Lafayette Road
St. Paul, MN 55155

Re: Proposed Amendment to Rules Governing the Adoption of the 2023 National Electrical Code, Minnesota rules chapter 1315.

IBEW Local 110 urges the earliest possible adoption and without amendment of the 2023 National Electrical Code/NFPA 70.

IBEW Local 110 represents nearly 2,500 members in the electrical industry. These members rely on and use the NEC on a daily basis to complete their projects to a standard that is second to none.

Any modifications or amendments to the NEC will only cause confusion, increase costs, and potentially increase safety risks to the citizens of Minnesota.

The National Electrical Code adoption process, at the National level, was conducted through an open, transparent process incorporating many opportunities from multiple industry stakeholders to provide comment on proposed changes. In Minnesota the NEC 2023 adoption review committee conducted a transparent open forum of analysis consisting of several public meetings providing extensive input from stakeholders from Minnesota representing multiple interests from all areas of the Electrical and Construction Industry.

For these reasons, IBEW Local 110 urges the earliest possible effective date for adoption of the 2023 NEC without amendment in order to protect the public health and safety of the residents of Minnesota and to provide an efficient and cost-effective transition from the previous code.

Sincerely,

Jamie McNamara
Business Manager/Financial Secretary
International Brotherhood of Electrical Workers Local 110



National Electrical Manufacturers Association

December 6, 2022

Minnesota Board of Electricity
NEC 2023 Adoption Review Committee
Minnesota Department of Labor and Industry
443 Lafayette Road
St Paul, MN 55155

Re: **NEMA Supports Adoption of 2023 Edition of the National Electrical Code®**

Dear Members of the Committee:

The National Electrical Manufacturers Association (NEMA) is the leading trade association of the electroindustry industry, including electrical equipment and medical imaging manufacturers. The approximately 325 member companies manufacture products used in the generation, transmission and distribution, control, and end-use of electricity. NEMA member companies have a significant presence in the state of Minnesota, [employing over 36,000](#) manufacturing and engineering jobs and contributing [over \\$4 billion dollars](#) to the state's economy.

On behalf of the National Electrical Manufacturers Association (NEMA), I am writing to express support of the recommendation by the NEC 2023 Adoption Review Committee to update Minnesota's electrical code from the 2020 edition of the National Electrical Code® (NEC) to the 2023 edition of the NEC without amendment. The committee is to be applauded for their thorough review and vetting of key changes that will advance electrical safety for all Minnesotans.

As part of the review process, the committee sought input from stakeholders. Published in the committee's 11/17/2022 minutes is a letter from Housing First (HF) that outlines four proposed amendments that were considered by the committee. In response, I would offer the following comments:

Proposed Amendment 1: TIA for 210.8(F). HF proposes that section 210. 8(f) be deleted because a message to NFPA that a more rigorous technical review of the provisions it adopts is long overdue. The NEC is created through an exhaustive stakeholder consensus process that considers input from a balance of interests and reflects the collective knowledge of qualified electricians, electrical inspectors, manufacturers, testing lab personnel, and other professionals, including representation from the National Association of Home Builders (NAHB). That stakeholder consensus process requires supermajority support for any new modifications to the Code. This process provides multiple opportunities for the public to engage, and a Tentative Interim Amendment (TIA) is further opportunity to address technical requirements impacting a code or standard.

In fact, the recommendation is for 210.8(F) be delayed until 2026. The TIA and subsequent recommendation to delay demonstrates that the NEC includes a comprehensive and thorough technical review that is continuously working to identify issues and propose appropriate corrective action. The appropriate response is for the BOE to adopt the proposed NEC recommendation and for HF to engage in the 2026 NEC development process.

Proposed Amendment 2: 225.41/230.85 Emergency Disconnects. HF requests removing a requirement that has been in place for three years, which provides a safe way for first responders to remove power from subject structure they are trying to protect. Introduced in the 2020 edition of the NEC, this requirement received widespread support from multiple organizations including the National Association of Home Builders. Without providing any documented fire statistics, HF simply alleges the number of fires extremely low. The purpose of the provision is to advance safety for first responders which is and should be of paramount importance.

Proposed Amendment 3: 210.12(A) AFCI in Dwelling Units. HF requests removing the requirement for AFCIs, a fire prevention technology that has been in the NEC since the 1999 edition. The original call for better circuit protection came from the US Consumer Product Safety Commission in response to their concern over home electrical fires and the resulting deaths, injuries, and property loss. HF claims there is no data to support AFCI expansion. **While neither the 2020 NEC nor 2023 NEC expand AFCI protection in dwelling units**, according to the U.S. Fire Administration March 2020 report¹, overall trends from the report period 2009-2018 shows a reduction in fires, deaths, injuries, and dollar losses related to electrical malfunctioning.

HF claims the NFPA has not been able to demonstrate the effectiveness of AFCIs. This is a gross mischaracterization of the NFPA research, The research HF cites merely concluded that better data and analysis is needed, it did not make a conclusion on the actual effectiveness of AFCIs.

HF also cites nuisance tripping as a reason to roll back this important fire safety prevention technology. NEMA has published an Issue Brief² that highlights that appliances that meet product safety standards work extremely well with AFCIs. The Insurance Institute for Business and Home Safety also published a white paper³ that highlights the importance of AFCIs, and the rigorous testing required by product safety standards to recognize various arcing conditions generated by electronic devices.

Finally, I would like to address a misrepresentation of “states are removing AFCI requirements because of nuisance tripping.” HF stated in their written comments, that nuisance tripping is so widespread that 21 out of 45 states have removed or reduced AFCI requirements. Currently, there are 28 states in the USA that have adopted AFCIs as prescribed by the model code with no amendments. States which have previously amended AFCI requirements are now reversing themselves. For example, the state of Arkansas removed their AFCI existing amendment this year and Ohio is on track to remove their current amendment. Indiana is a state that had an amendment that removed AFCIs in their entirety but updated their residential code in 2019 to full AFCI adoption. In addition, the state of Massachusetts, amended their NEC adoption to go beyond the minimum model code, requiring AFCI protection for all 15- and 20-ampere branch circuits. HF’s proposal to delete AFCI’s in its entirety for dwelling units is inconsistent with the current and evolving status of the NEC and must be rejected because it would be a “rollback” in safety.

Proposed Amendment 4: 210.8(A)(6) Kitchens. HF has proposed limiting GFCI protection only to receptacles installed within 6 feet of a sink, with no substantiation supporting this rollback in safety requirements. Since the introduction of the GFCI in the 1971 NEC, published data⁴ from the U.S. Consumer Product Safety Commission (CPSC) show a decreasing trend in the number of electrocutions in the United States. Expanding GFCI protection is intended to support continuation of this trend.

Once again, NEMA urges the Minnesota Board of Electricity to maintain this tradition of excellence by adopting the 2023 edition of the NEC without amendment. If you have any questions or need further documentation, please contact Tim McClintock at Tim.McClintock@nema.org or (303) 749-9782.

Sincerely,

A handwritten signature in black ink that reads "Tim McClintock". The signature is written in a cursive, slightly slanted style.

Tim McClintock
Senior Technical Field Representative
Midwest Region

REFERENCES

¹U.S. Fire Administration – (March 2020) *Residential Building Fire Trends*

²NEMA – *AFCI Issue Brief*

³Insurance Institute for Business and Home Safety – *Electrical Fires and Arc-Fault Circuit Interrupter Protection*

⁴Consumer Product Safety Commission - *U.S. Consumer Pr*

Circuit Breaker Arc-Fault Circuit Interrupters (AFCI)

Smoke alarms, fire extinguishers and escape ladders are all examples of emergency equipment used in homes to take action when a fire occurs. A circuit breaker arc-fault circuit interrupter (AFCI) is a product designed to detect a wide range of arcing electrical faults to help reduce the electrical system from being an ignition source of a fire. Unlike a standard circuit breaker detecting overloads and short circuits, an AFCI utilizes advanced electronic technology to “sense” the different arcing conditions that may occur on a circuit. While there are different techniques employed to detect arcs by the various AFCI circuit breaker manufacturers, the end result is the same: detection of arcing conditions on the branch-circuit wiring, plugged-in electrical cords, and within appliances and other utilization equipment.

Importance

AFCI circuit breakers were created as a direct response to a U.S. Consumer Product Safety Commission report conducted by Underwriters Laboratories (UL) that identified an electrical problem in residential wiring systems causing numerous residential fires. In 1999, AFCI protection became a requirement in the National Electrical Code®. According to a 2017 National Fire Protection Association report, between 2010 and 2014, U.S. municipal fire departments responded to an estimated annual average of 45,210 home structure fires involving electrical failure or malfunction. These fires caused annual averages of 420 civilian deaths, 1,370 civilian injuries, and \$1.4 billion in direct property damage.

Affordability

The average cost for an AFCI circuit breaker is \$38, according to a NEMA blind survey for 2017 HUD Manufactured Housing Construction Safety Standards, or \$300 to protect a new 2,000-square-foot, four-bedroom home from electrical fires caused by electrical arcing. That equates to 83 cents per month to protect a family from electrical fires over a 30-year mortgage. When installed correctly, AFCI circuit breakers are expected to last the life of a standard circuit breaker under normal operating conditions. AFCI circuit breakers can be purchased at electrical supply houses, home improvement stores, and online. Several companies manufacture AFCI circuit breakers for consumers to choose from.

Compatibility

AFCI circuit breakers work extremely well with appliances and devices that meet U.S. product safety standards. AFCI circuit breakers also compliment ground-fault circuit interrupters (GFCIs) and function well together to provide electrical safety and fire protection throughout a home. Both devices are required by the National Electrical Code® because they provide different but critically important protection. AFCIs detect dangerous arcing in a home’s wiring and stop electrical fires before they can start whereas GFCIs help to prevent possible shock and electrocution where these hazards to a person are present.

NEMA Position

The National Electrical Manufacturers Association actively supports and promotes the installation and use of AFCI technology in residential and commercial buildings as an important electrical safety device to protect persons and property.

The National Electrical Manufacturers Association (NEMA) represents nearly 350 electrical equipment and medical imaging manufacturers that make safe, reliable, and efficient products and systems. Our combined industries account for 360,000 American jobs in more than 7,000 facilities covering every state. Our industry produces \$106 billion shipments of electrical equipment and medical imaging technologies per year with \$36 billion exports.



Insurance Institute for Business & Home Safety®

Electrical Fires and Arc-Fault Circuit Interrupter Protection

Electrical Fires and Arc-Fault Circuit Interrupter Protection

Protective devices such as circuit breakers (and fuses before them) have long been used in nearly all homes to reduce the risk of electric fires. These devices protect against excessive current, which can cause overheating and damage to the electrical circuit itself, potentially resulting in fire or explosion. Circuit breakers and fuses are designed to interrupt the current flow when it exceeds the limit the circuit was designed for. However, they do not address another common cause of electric circuit fires—those caused by arcing or leakage of electrical currents (i.e., exposure of electrical currents to air) in a circuit that is energized.¹ It is estimated that at least 65% of the almost 50,000 annual home fires result from these arc faults (Hall, 2013) that can reach temperatures of several thousand degrees Celsius and present a serious fire hazard.

What are Arc Faults?

Common causes of arc faults include:

- Loose connections in outlets, switches and wires in fixtures such as ceiling fans and lights
- Frayed or damaged electrical cords due to impacts, pressure from residing under furniture, or age and normal wear and tear
- Damage to wiring insulation—e.g., damage by nails or screws driven through walls
- Spillage of liquids

Protective Benefits of Arc-Fault Circuit Interrupters

Arc-fault circuit interrupters (AFCIs) are electronic devices designed to detect dangerous arc faults that occur at currents below levels that would trip an ordinary circuit breaker. The precise methods for detecting arc faults differ across manufacturers and devices, but generally speaking, AFCIs continually monitor the current and voltage wave forms in an electrical circuit and interrupt (cut off power to the circuit) if these wave forms have characteristics indicative of dangerous arcing. In addition to detecting problems in electrical wiring and connections, AFCIs can also detect and protect against arcing in connected cords and appliances.

¹Arcing conditions sometimes result in excessive current through the circuit, the type of condition standard circuit breakers are designed to respond to and protect against. However, in many situations, the high temperatures produced by arc faults can occur without drawing excessive current. In the absence of excess current, standard circuit breakers cannot protect against such arc faults, which they were not designed to detect.

Arc-Fault Circuit Interrupters and the National Electrical Code[®] (NEC)

The fire risk associated with arc faults has long been recognized. Research in the development of AFCIs took on greater urgency in the 1980s and 1990s in response to growing concern about electrical fires by the Consumer Product Safety Commission (CPSC). The goal was to develop a device that went beyond standard circuit breakers to detect and respond quickly to arc faults before they ignited, while at the same time minimizing nuisance tripping. In 1997, the first AFCIs that could detect and respond to different types of arcing conditions became commercially available. AFCIs were first included in the 1999 NEC² with a delayed adoption until 2002 in order to permit a transition period to accommodate the new requirement (Domitrovich & Lippert, 2013). In 1999, Underwriters Laboratories (UL) finalized UL 1699 Standard for Arc-Fault Circuit Interrupters which provides a standard for testing and listing approved AFCIs (Siemens Industry Inc., 2012).

The NEC requirements have evolved and expanded over time. Initially the NEC required protection of 120 volt, 15- and 20-ampere branch circuits that supplied outlets in bedrooms in new construction. Subsequent editions of the NEC have extended these requirements to include AFCI protection for branch circuits in kitchens, family rooms, dining rooms, living rooms, bedrooms, parlors, libraries, dens, sunrooms, recreation rooms, closets, hallways and laundry areas. (Outlets in bathrooms, garages, unfinished basements and outdoors are not required to be AFCI-protected.) Recognizing that electrical fires could also occur in existing dwellings, the NEC also requires AFCI protection where branch circuit wiring in an existing home is modified, replaced or extended (National Fire Protection Agency, 2014).

The NEC provides for multiple methods of protecting branch circuits for arc-fault conditions, but the simplest method of protection (particularly in new construction) can be achieved by installing listed combination-type AFCI devices at the panel box at the origin of the branch circuits. This method of protection may also be preferred when a branch circuit in an existing home is modified. However, an alternative method of providing protection in modifications to existing circuits is to install a listed branch circuit-type AFCI in the first outlet of the circuit, which will provide protection for the outlet and the remaining downstream branch circuit wiring and power supply cords.

Addressing Concerns about AFCIs

Most jurisdictions adopting the NEC do so without modifying the provisions related to arc-fault protection. However, some states have faced occasional efforts to remove or modify the arc-fault protection requirements during their code adoption process. Two of

²The NEC (also known as NFPA 70) published by the National Fire Protection Association (NFPA) is the most widely adopted standard for the safe installation of electrical wiring and equipment in the United States.

the most commonly cited arguments against mandating AFCIs are the issues of nuisance tripping and the increased cost of AFCIs over standard circuit breakers.

On occasion, normal operating conditions can mimic arcing conditions that cause AFCIs to interrupt the current (trip) when dangerous conditions do not actually exist. This is referred to as nuisance tripping. Since they became commercially available in 1997, AFCI technology has evolved and improved, resulting in fewer incidences of nuisance tripping while expanding the dangerous conditions they protect against. And it is important to remember that what may be perceived as nuisance tripping may actually be a properly functioning AFCI accurately detecting and responding to dangerous arcing conditions that are not readily apparent.

One source of nuisance tripping may be in the way circuits have been wired by electricians. For example, the practice of having more than one electrical circuit share a neutral line or having crossed neutral lines will cause the ground fault detection function in an AFCI to interrupt the circuit. In such cases, the AFCIs are performing as intended. But the practice of having multiple circuits share a neutral line has recently been prohibited in the 2011 edition of the NEC. Consequently, this should not be a source of nuisance tripping in new homes with AFCIs going forward.

The incompatibility of certain electrical devices has also been cited as a cause of nuisance tripping. A typical home will have multiple electronic devices with different loads on a common circuit and the combination of devices in use can result in a variety of current wave forms flowing through the circuit under normal operating conditions. Additionally, some electronic devices will have operational or “safe arcing” as part of their normal operating conditions. Treadmills, televisions and fluorescent lights have been known to create wave forms that mimic those of dangerous arcing. AFCIs are designed to analyze a range of current wave forms flowing through a circuit and distinguish between those that represent dangerous arcing versus those that are present under normal operating conditions and do not pose a risk. The technology for doing so is not perfect. However, before AFCIs are listed by UL (under standard UL 1699) and make it to market, they are tested not only to ensure they respond quickly to dangerous arcing conditions, but also to make sure they do not respond to a variety of safe conditions that resemble dangerous arcing conditions (Underwriters Laboratories, 2006).

The other cited issue is cost. Standard circuit breakers sold in big-box hardware retailers cost between \$3.72 and \$4.56, while circuit breakers with arc-fault protection cost between \$37.97 and \$42.97. In a typical 2,500-square-foot home requiring 12 breakers, the difference in the cost of the two types of breakers could be between \$400 and \$470. According to the U.S. census, the median price of a new home in 2015 was \$271,300, so the cost of upgrading all of the circuit breakers to AFCIs represents a tiny fraction (about 0.15%) of the price of a typical new home. Safety advocates agree this is a small price to pay for the potential reduction in human and property losses that could be realized with the widespread use of AFCI protection.

Public and Private Organizations Endorse AFCI Technology

Laboratory-tested AFCI devices have proven to be effective in detecting and isolating wiring problems that could lead to electrical fires and fatalities (Domitrovich & Lippert, 2013). The same NFPA study that estimated an average of nearly 50,000 electrical fires between 2007 and 2011 also estimated that these fires resulted in an annual average of 455 civilian deaths, 1,518 civilian injuries, and \$1.48 billion in direct property losses (Hall, 2013). The CPSC estimates 50% or more of these electrical fires could be prevented by the use of AFCI protection (Karels, 2003). Over their nearly 2 decades of commercial availability, AFCIs have gained the endorsement of many organizations.

- **Consumer Product Safety Commission (CPSC).** A letter to jurisdictions considering adopting the 2008 NEC stated, “The CPSC staff is a strong proponent of the implementation of AFCIs as a powerful tool in mitigating fires that originate in the electrical distribution system” (Trotta, 2008).
- **U.S. Fire Administration (USFA).** USFA literature highlights the value of AFCIs. “Arc fault circuit interrupters (AFCIs) shut off electricity when a dangerous situation occurs. Have a licensed electrician install them in your home” (U.S. Fire Administration, 2012).
- **National Association of State Fire Marshals (NASFM).** “The National Association State Fire Marshals (NASFM) strongly supports the broad adoption of AFCI technology through national, state, and local building codes. AFCIs are the most welcome addition to fire prevention in decades. AFCIs promise to save hundreds of lives every year,” says NASFM President John C. Dean (Siemens Industry Inc., 2012).
- **National Association of Home Inspectors (NAHI).** “NAHI strongly encourages its members to educate all of their clients about the life- and property-saving benefits of AFCI technology, especially those clients considering the purchase of a home more than 20 years old,” says Executive Director Mallory Anderson (Siemens Industry Inc., 2012).
- **Electrical Safety Foundation International (ESFI).** “ESFI urges that AFCI technology be installed in all new and existing housing to protect homes and families from fires caused by electrical arcing,” observes ESFI President Brett Brenner (Siemens Industry Inc., 2012).
- **The Federal Emergency Management Agency (FEMA).** FEMA recommends installation of AFCIs as a mean of preventing electrical fires (National Fire Data Center, 2014).

References

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Residential Building Fire Trends (2009-2018)

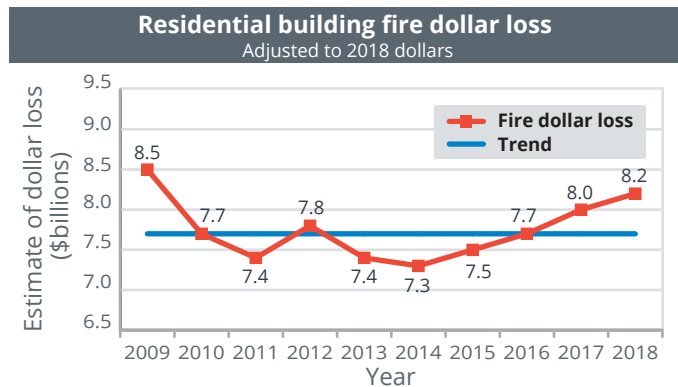
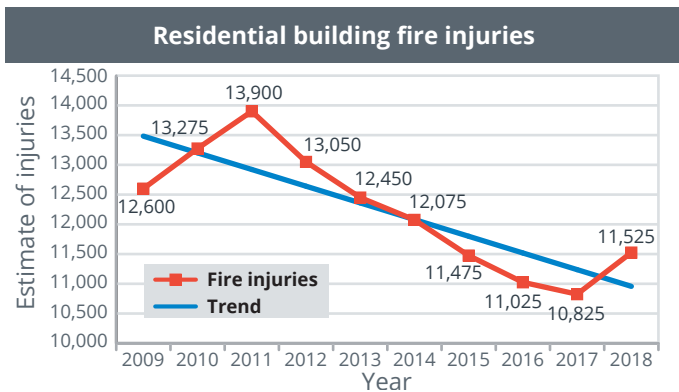
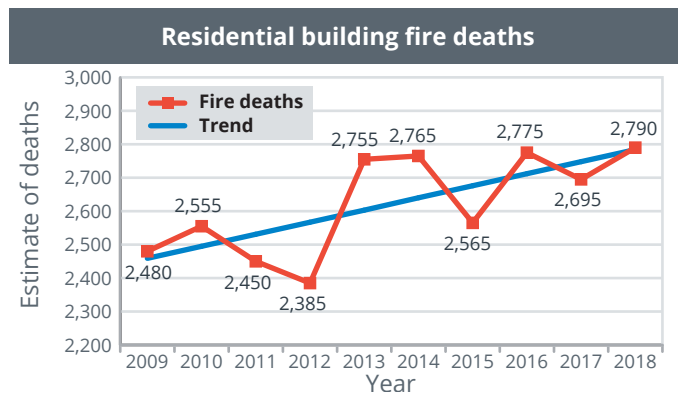
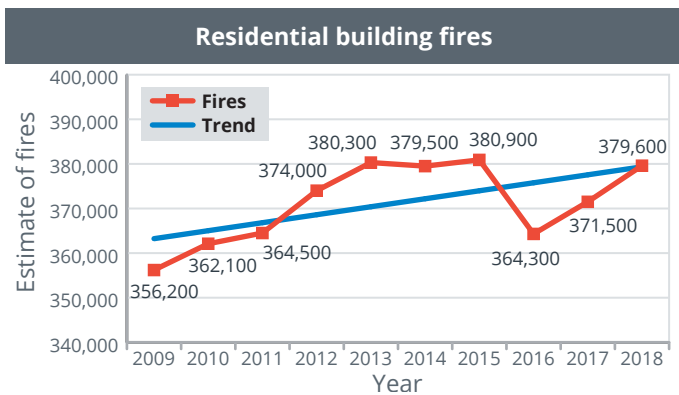
Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for residential building fires and losses in 2018, the most recent year for which data are available, are as follows:

- 🔍 Fires: 379,600.
- 🔍 Deaths: 2,790.
- 🔍 Injuries: 11,525.
- 🔍 Dollar loss: \$8,194,500,000.

Overall trends for residential building fires and losses for the 10-year period of 2009 to 2018 show the following:

- 🔍 A 4% increase in fires.
- 🔍 A 13% increase in deaths.
- 🔍 A 19% decrease in injuries.
- 🔍 A 0.04% decrease in dollar loss. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)



Residential Building Fire Causes (2009-2018)

Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS). Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

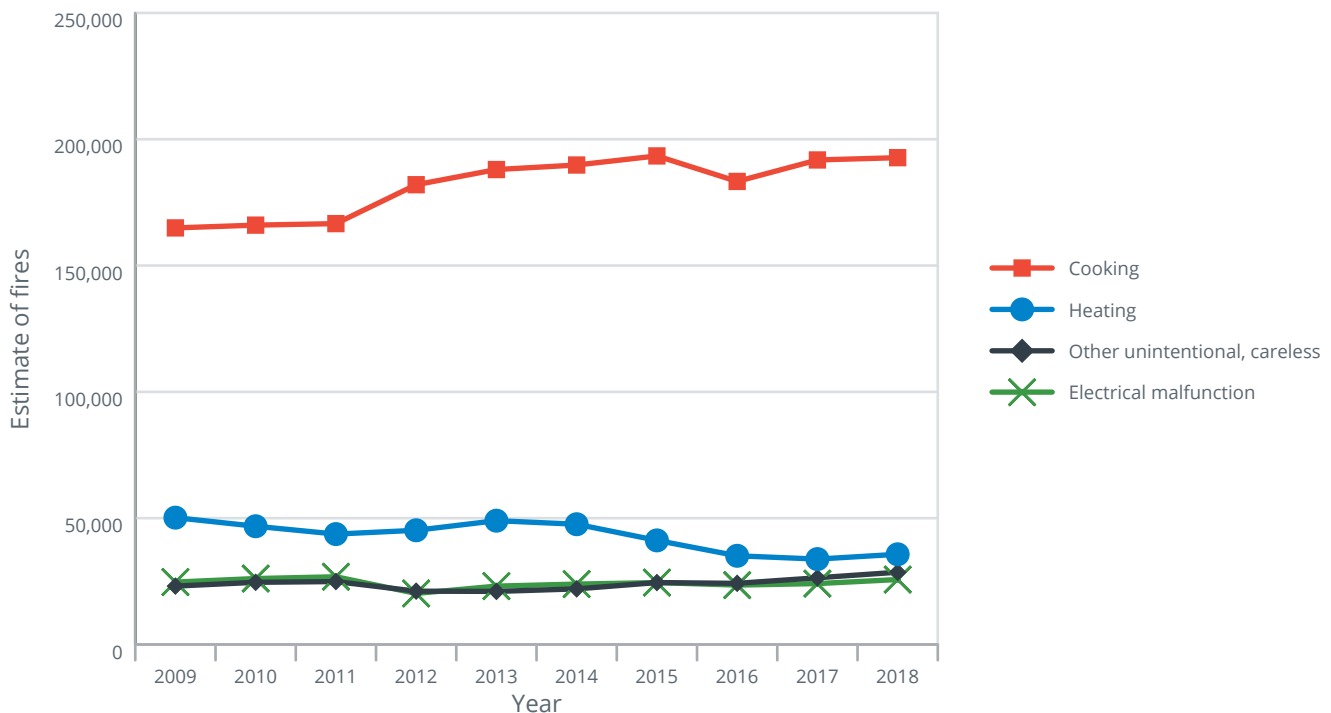
National estimates for the leading causes of fires in residential buildings for 2018, the most recent year for which data are available, are as follows:

1. Cooking: 192,700 fires.
2. Heating: 35,700 fires.
3. Other unintentional, careless: 28,600 fires.
4. Electrical malfunction: 25,700 fires.

Overall trends in the leading fire causes for the 10-year period of 2009 to 2018 show the following:

- Cooking as the leading cause of residential building fires for the 10-year period.
- An 18% increase in residential cooking fires. (This is likely due to an NFIRS coding edit implemented in 2012.)
- A 30% decrease in residential heating fires.
- A 17% increase in residential other unintentionally or carelessly set fires.
- A 2% decrease in residential electrical malfunction fires.

Leading causes of residential building fires (2009-2018)



Residential Building Fire Death Causes (2009-2018)

Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration’s (USFA’s) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA’s “National Estimates Methodology for Building Fires and Losses” (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

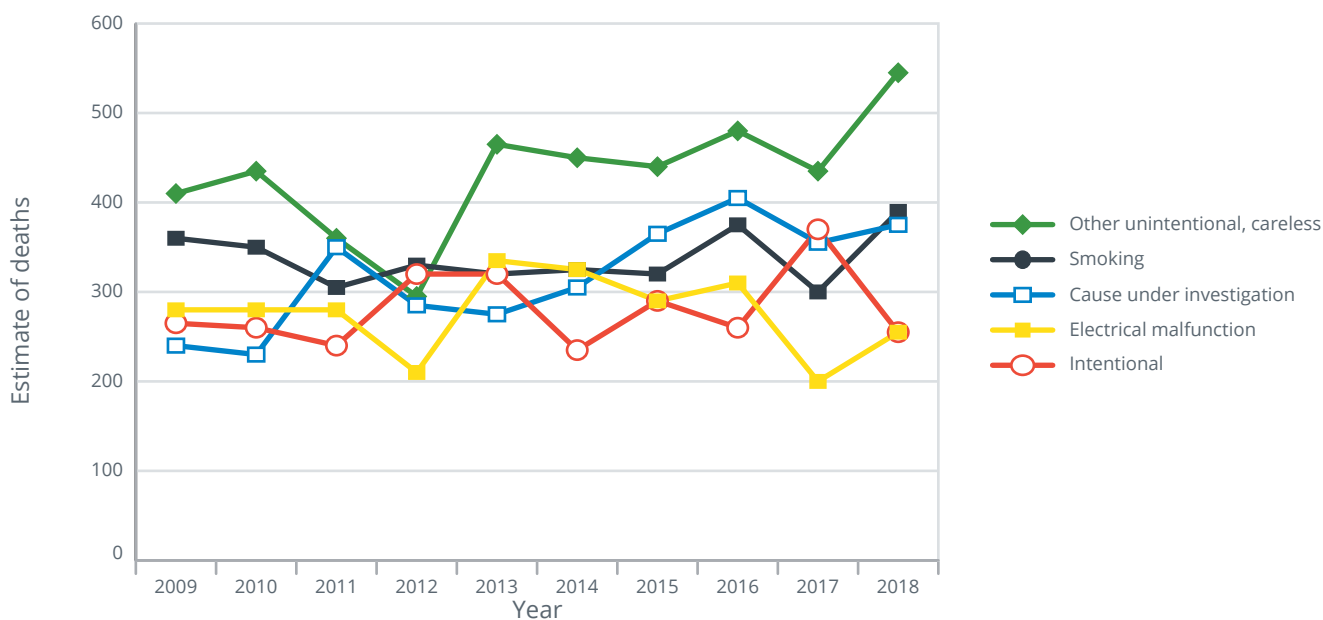
National estimates for the leading causes of residential building fire deaths for 2018, the most recent year for which data are available, are as follows:

1. Other unintentional, careless: 545 deaths.
2. Smoking: 390 deaths.
3. Cause under investigation: 375 deaths.

Overall trends in the leading fire death causes for the 10-year period of 2009 to 2018 show the following:

- Other unintentional, careless was the leading cause of residential fire deaths in nine years out of the 10-year period, and there was a 33% increase in residential other unintentionally or carelessly set fire deaths. In 2018, 16 reported multifatality fire incidents (resulting in two, four or five deaths each) may have contributed to the increase in the estimate of fire deaths.
- Smoking was the second leading cause of residential fire deaths in 2018, and there was a 4% increase in residential smoking fire deaths. In 2018, seven reported multifatality fire incidents (including one resulting in six deaths) may have contributed to the increase in the estimate of fire deaths.
- A 58% increase in residential cause-under-investigation fire deaths.

Leading causes of residential building fire deaths (2009-2018)



Residential Building Fire Injury Causes (2009-2018)

Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration’s (USFA’s) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA’s “National Estimates Methodology for Building Fires and Losses” (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

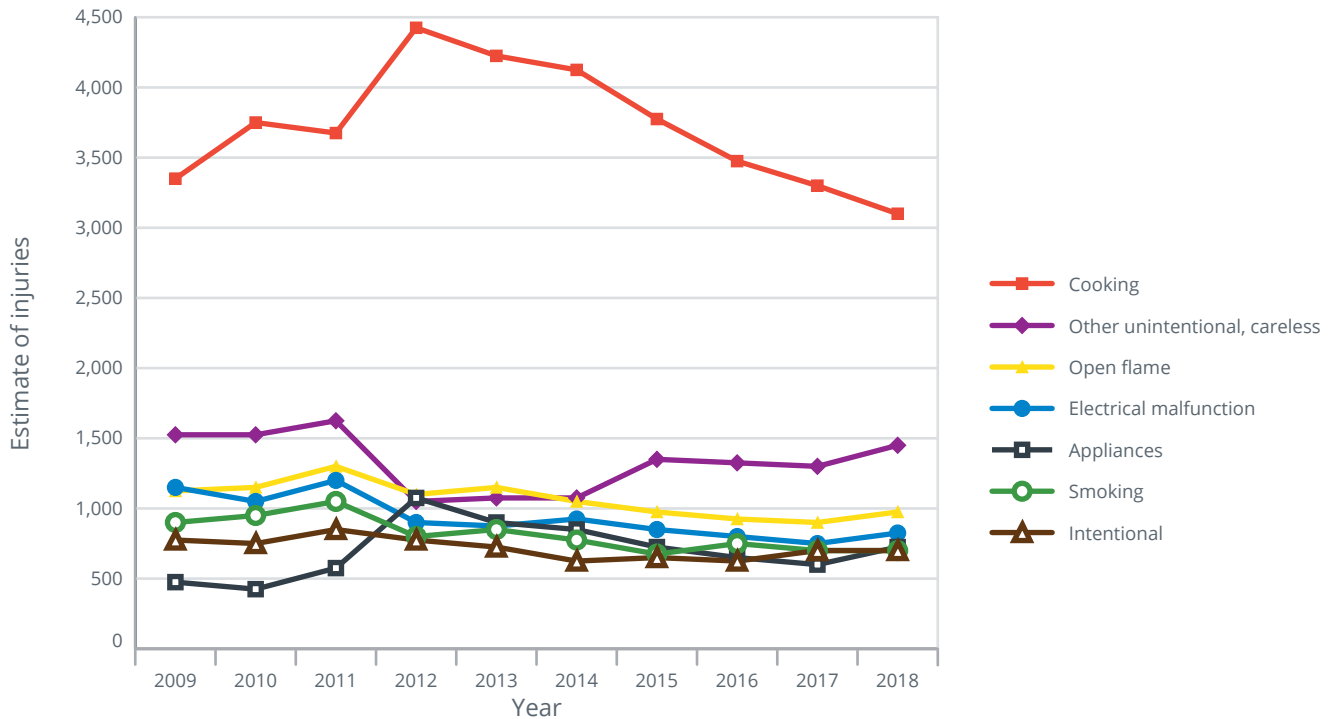
National estimates for the leading causes of residential building fire injuries for 2018, the most recent year for which data are available, are as follows:

1. Cooking: 3,100 injuries.
2. Other unintentional, careless: 1,450 injuries.
3. Open flame: 975 injuries.
4. Electrical malfunction: 825 injuries.

Overall trends in the leading fire injury causes for the 10-year period of 2009 to 2018 show the following:

- Cooking was the leading cause of residential building fire injuries for the 10-year period.
- A 12% decrease in residential cooking fire injuries.
- An 11% decrease in residential other unintentionally or carelessly set fire injuries.
- A 24% decrease in residential open-flame fire injuries.
- A 34% decrease in residential electrical malfunction fire injuries.

Leading causes of residential building fire injuries (2009-2018)



Residential Building Fire Dollar-Loss Causes (2009-2018)

Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration’s (USFA’s) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA’s “National Estimates Methodology for Building Fires and Losses” (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for the leading causes of residential building fire dollar loss for 2018, the most recent year for which data are available, are as follows:

1. Other unintentional, careless: \$1,580,500,000.
2. Electrical malfunction: \$1,227,400,000.
3. Open flame: \$723,400,000.

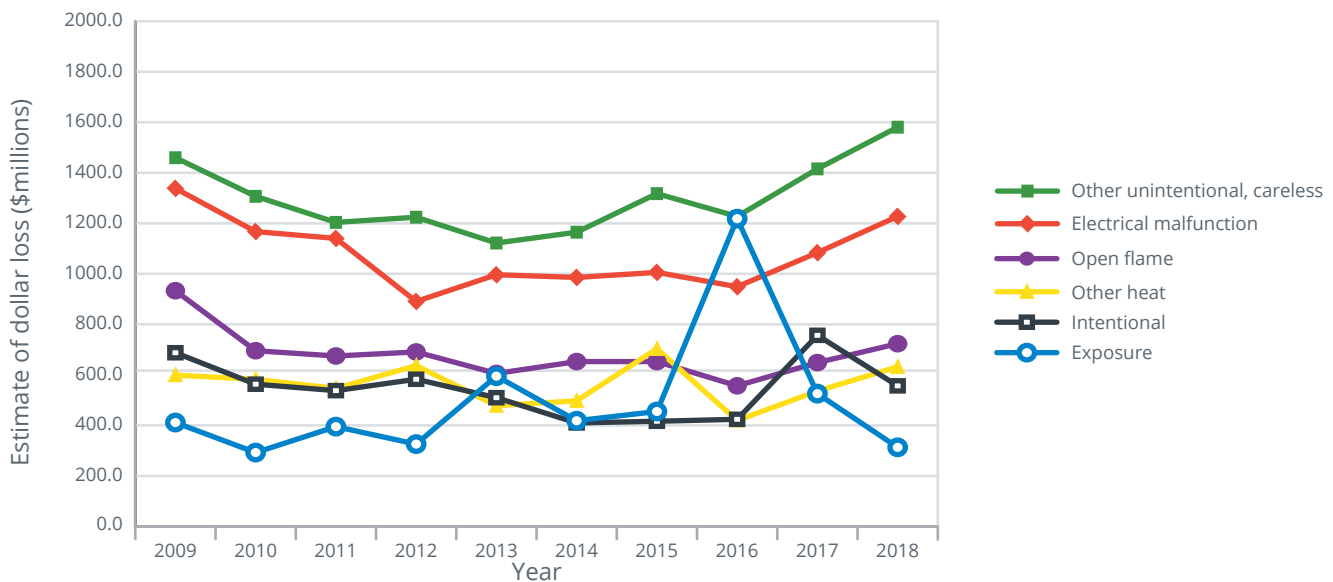
Overall trends in the leading causes of fire dollar loss for the 10-year period of 2009 to 2018 show the following:

- Other unintentional, careless was the leading cause of residential fire dollar loss for the 10-year period, and there was a 10% increase in residential other unintentionally or carelessly set fire dollar loss. There were 33 incidents with a reported dollar loss of \$1,000,000 or more which may have contributed to the continued increase in the estimate of fire dollar loss in 2018.
- An 11% decrease in residential electrical malfunction fire dollar loss. There were 32 incidents with a reported dollar loss of \$1,000,000 or more which may have contributed to the continued increase in the estimate of fire dollar loss in 2018.
- A 21% decrease in residential open flame fire dollar loss.
- The spike in the 2016 residential exposure fire dollar loss is attributed in part to the Gatlinburg, Tennessee, wildfires.

Note: The overall constant dollar-loss trends take inflation into account by adjusting each year’s dollar loss to its equivalent 2018 value.

Leading causes of residential building fire dollar loss (2009-2018)

Adjusted to 2018 dollars



Residential Building Other Unintentional, Careless Fire Trends (2009-2018)

Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

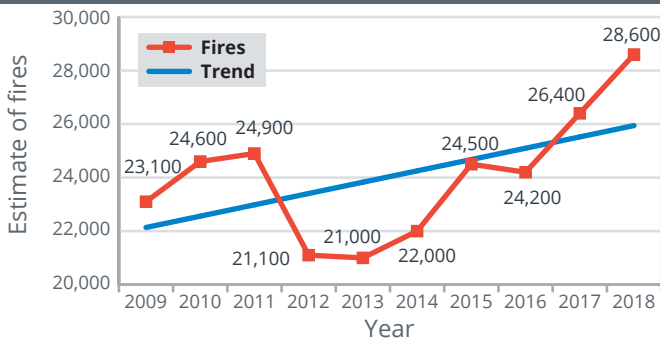
National estimates for residential building other unintentional, careless fires and losses for 2018, the most recent year for which data are available, are as follows:

- ◆ Fires: 28,600.
- ◆ Deaths: 545.
- ◆ Injuries: 1,450.
- ◆ Dollar loss: \$1,580,500,000.

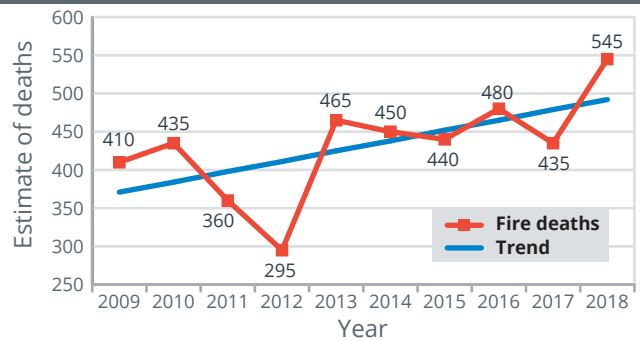
Overall trends for residential building other unintentional, careless fires and losses for the 10-year period of 2009 to 2018 show the following:

- ◆ A 17% increase in fires.
- ◆ A 33% increase in deaths. In 2018, 16 reported multifatality fire incidents (resulting in two, four or five deaths each) may have contributed to the increase in the estimate of fire deaths.
- ◆ An 11% decrease in injuries.
- ◆ A 10% increase in dollar loss. There were 33 incidents with a reported dollar loss of \$1,000,000 or more which may have contributed to the continued increase in the estimate of fire dollar loss in 2018. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)

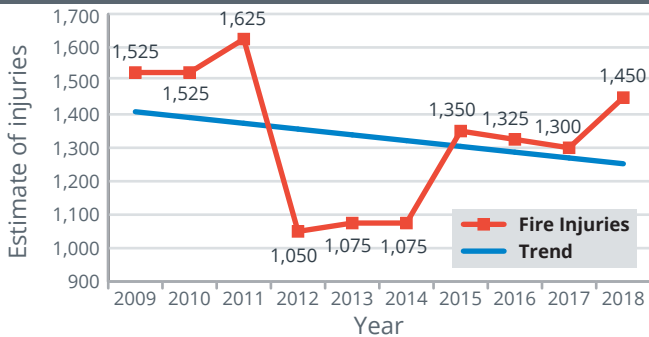
Residential building other unintentional, careless fires



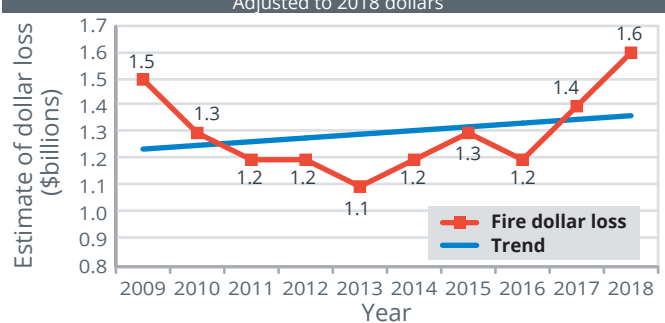
Residential building other unintentional, careless fire deaths



Residential building other unintentional, careless fire injuries



Residential building other unintentional, careless fire dollar loss



Residential Building Cooking Fire Trends (2009-2018)

Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS). Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

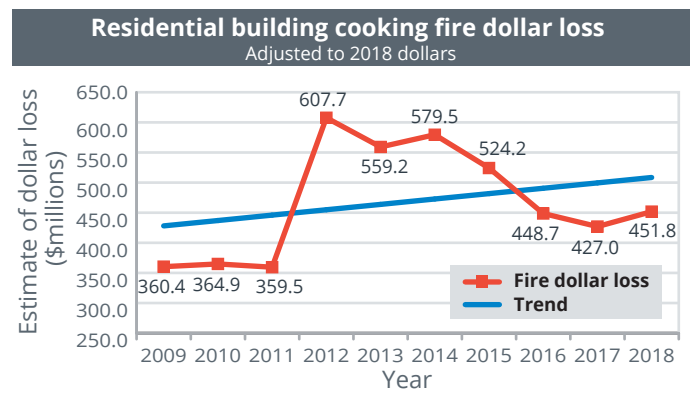
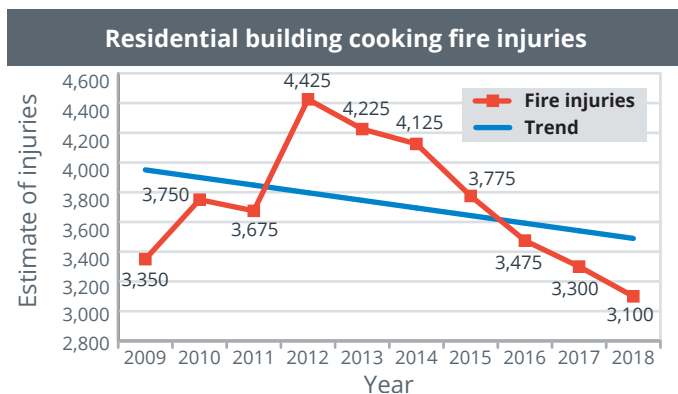
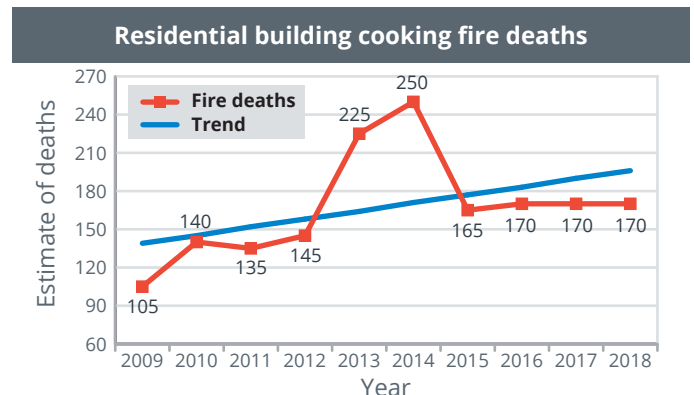
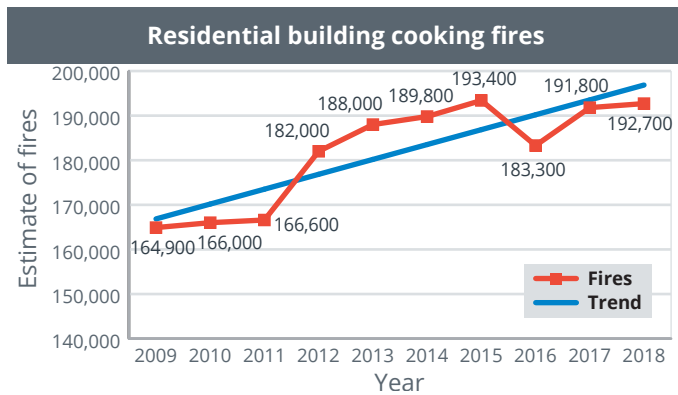
National estimates for residential building cooking fires and losses for 2018, the most recent year for which data are available, are as follows:

- 🔦 Fires: 192,700.
- 🔦 Deaths: 170.
- 🔦 Injuries: 3,100.
- 🔦 Dollar loss: \$451,800,000.

Overall trends for residential building cooking fires and losses for the 10-year period of 2009 to 2018 show the following:

- 🔦 An 18% increase in fires.
- 🔦 A 41% increase in deaths.
- 🔦 A 12% decrease in injuries.
- 🔦 A 19% increase in dollar loss. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)

The increases in some of these trends may be due to an NFIRS coding edit implemented in 2012.



Residential Building Intentional Fire Trends (2009-2018)

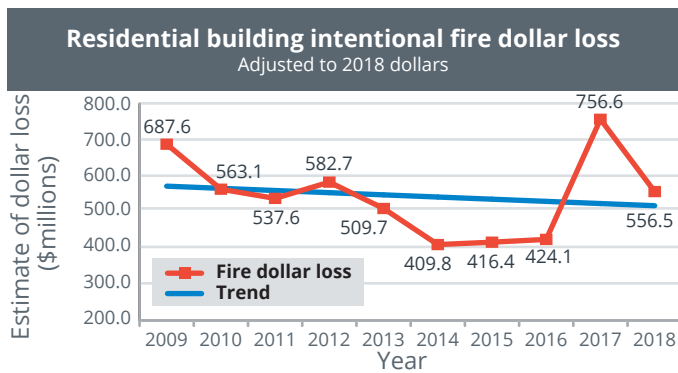
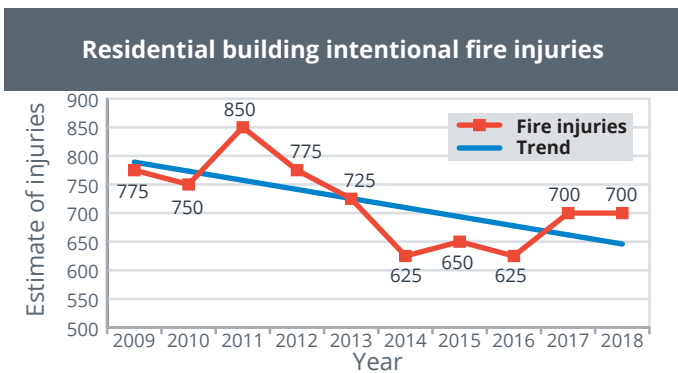
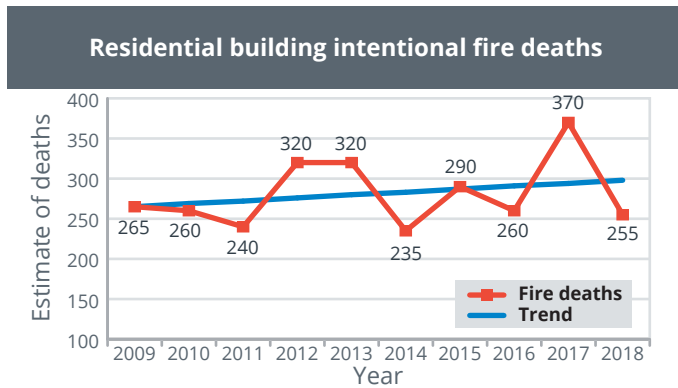
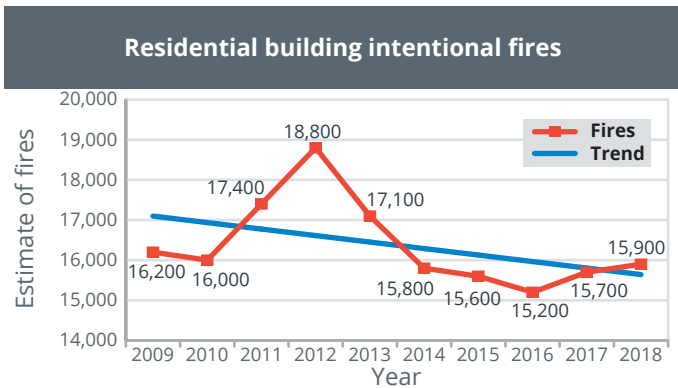
Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for residential building intentional fires and losses for 2018, the most recent year for which data are available, are as follows:

- 📍 Fires: 15,900.
- 📍 Deaths: 255.
- 📍 Injuries: 700.
- 📍 Dollar loss: \$556,500,000.

Overall trends for residential building intentional fires and losses for the 10-year period of 2009 to 2018 show the following:

- 📍 A 9% decrease in fires.
- 📍 A 12% increase in deaths. In 2017, 12 multifatality fire incidents (resulting in two or three deaths each) may have contributed to the increase in the estimate of fire deaths.
- 📍 An 18% decrease in injuries.
- 📍 A 9% decrease in dollar loss. A \$110,000,000 under-construction apartment complex fire in Waltham, Massachusetts, contributed to the 2017 dollar-loss peak. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)



Residential Building Electrical Malfunction Fire Trends (2009-2018)

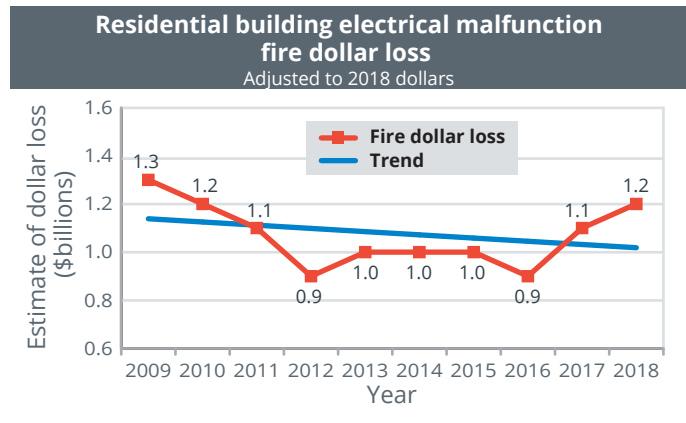
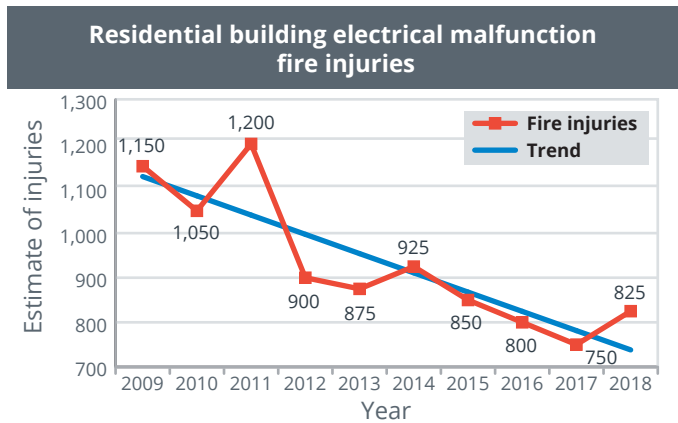
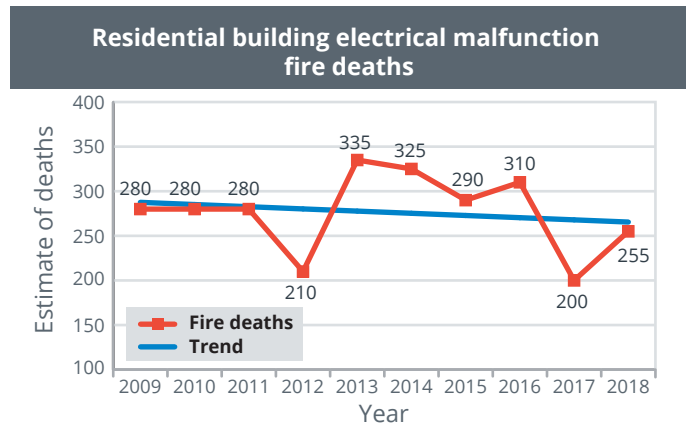
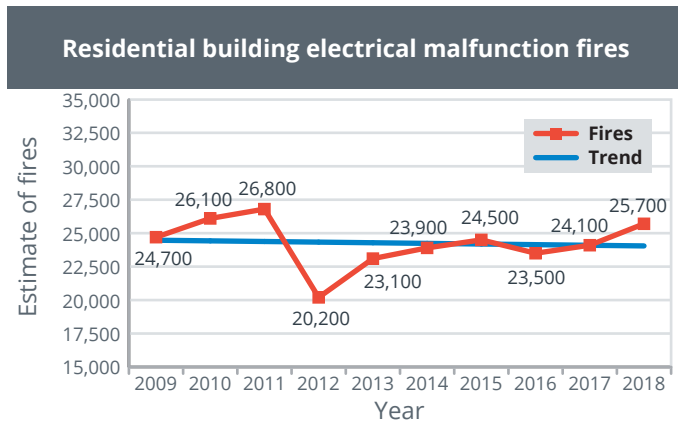
Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for residential building electrical malfunction fires and losses for 2018, the most recent year for which data are available, are as follows:

- 🔦 Fires: 25,700.
- 🔦 Deaths: 255.
- 🔦 Injuries: 825.
- 🔦 Dollar loss: \$1,227,400,000.

Overall trends for residential building electrical malfunction fires and losses for the 10-year period of 2009 to 2018 show the following:

- 🔦 A 2% decrease in fires.
- 🔦 An 8% decrease in deaths.
- 🔦 A 34% decrease in injuries.
- 🔦 An 11% decrease in dollar loss. There were 32 incidents with a reported dollar loss of \$1,000,000 or more which may have contributed to the continued increase in the estimate of fire dollar loss in 2018. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)



Residential Building Heating Fire Trends (2009-2018)

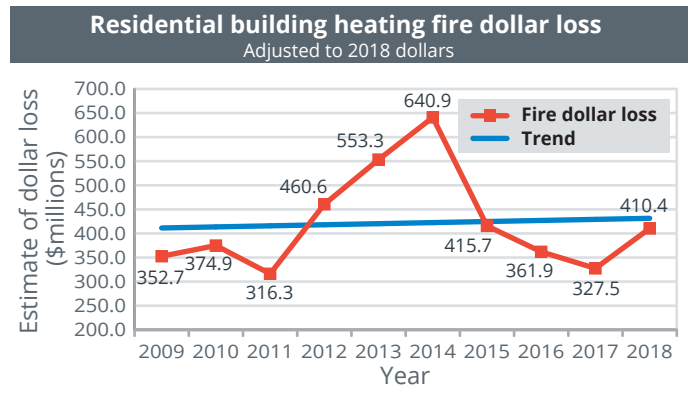
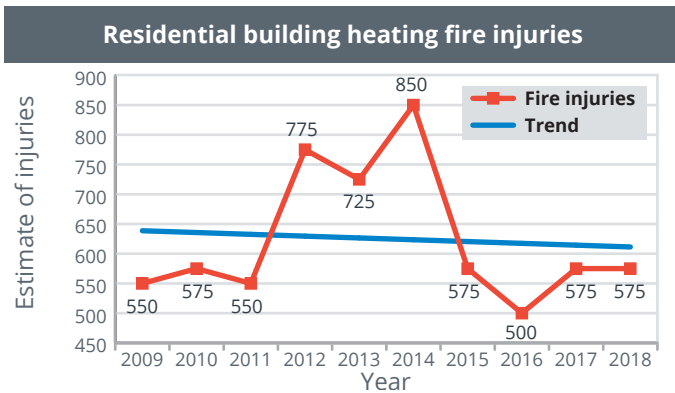
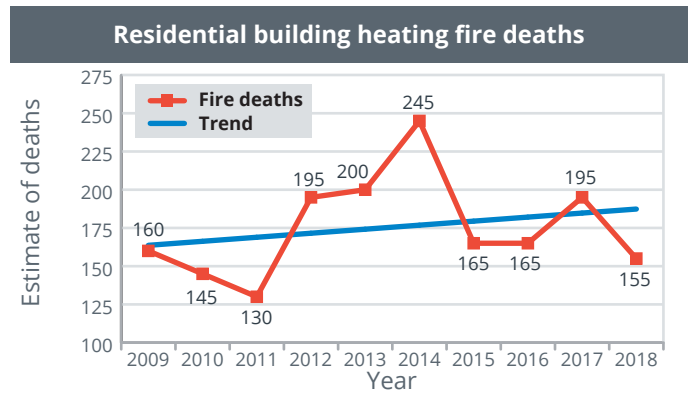
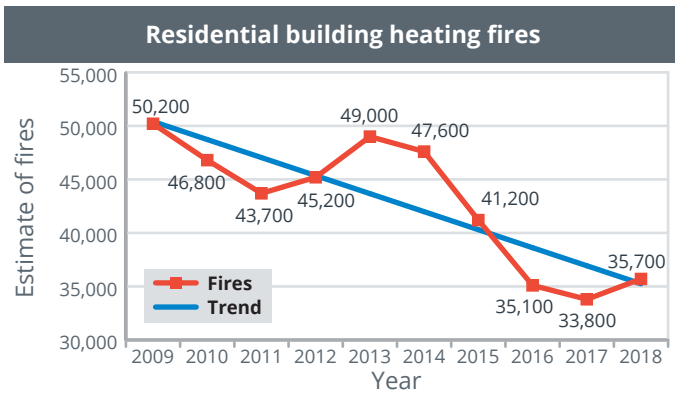
Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for residential building heating fires and losses for 2018, the most recent year for which data are available, are as follows:

- 🔦 Fires: 35,700.
- 🔦 Deaths: 155.
- 🔦 Injuries: 575.
- 🔦 Dollar loss: \$410,400,000.

Overall trends for residential building heating fires and losses for the 10-year period of 2009 to 2018 show the following:

- 🔦 A 30% decrease in fires.
- 🔦 A 15% increase in deaths. In 2014, there were 11 reported multifatality heating fires that contributed to the spike in fire deaths.
- 🔦 A 4% decrease in injuries.
- 🔦 A 5% increase in dollar loss. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)



Residential Building Cause Under Investigation Fire Trends (2009-2018)

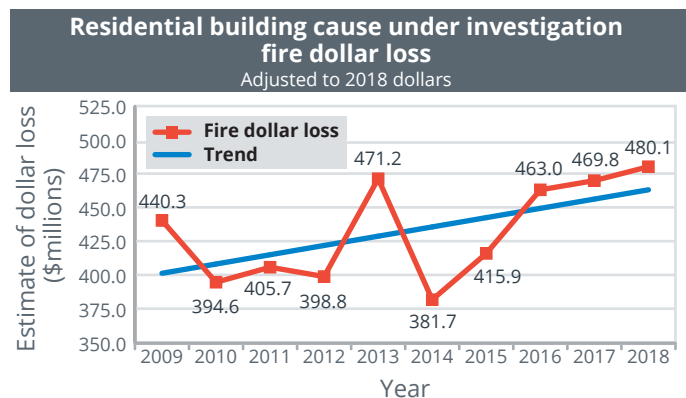
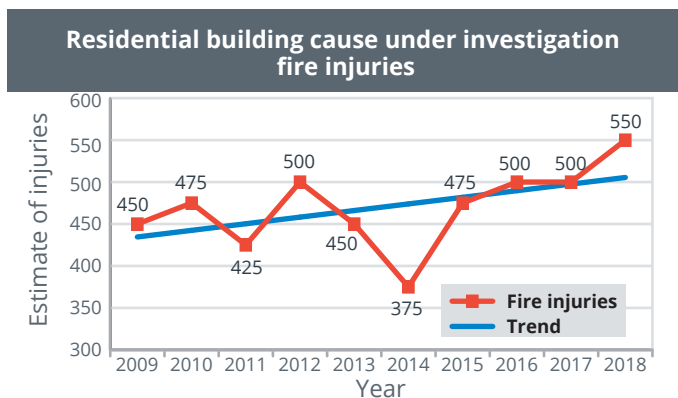
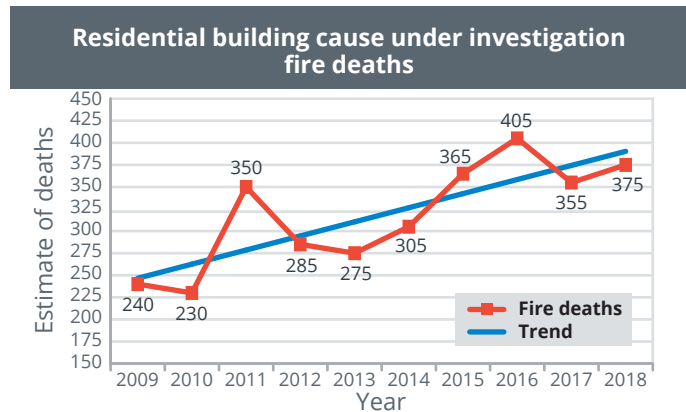
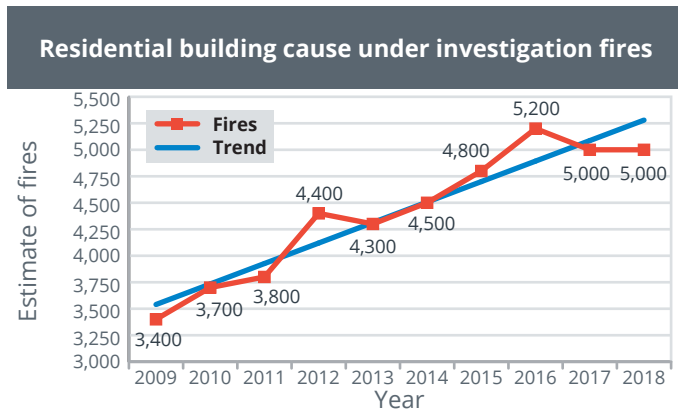
Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for residential building cause under investigation fires and losses for 2018, the most recent year for which data are available, are as follows:

- 🔦 Fires: 5,000.
- 👤 Deaths: 375.
- 👤 Injuries: 550.
- 💰 Dollar loss: \$480,100,000.

Overall trends for reported residential building cause under investigation fires and losses for the 10-year period of 2009 to 2018 show the following:

- 🔦 A 49% increase in fires.
- 👤 A 58% increase in deaths.
- 👤 A 16% increase in injuries.
- 💰 A 15% increase in dollar loss. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)



Residential Building Open Flame Fire Trends (2009-2018)

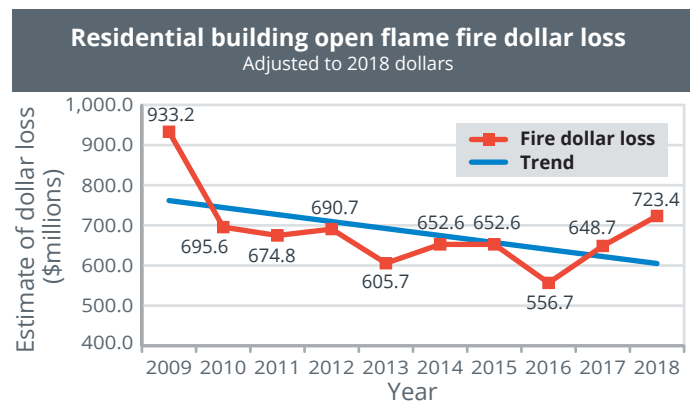
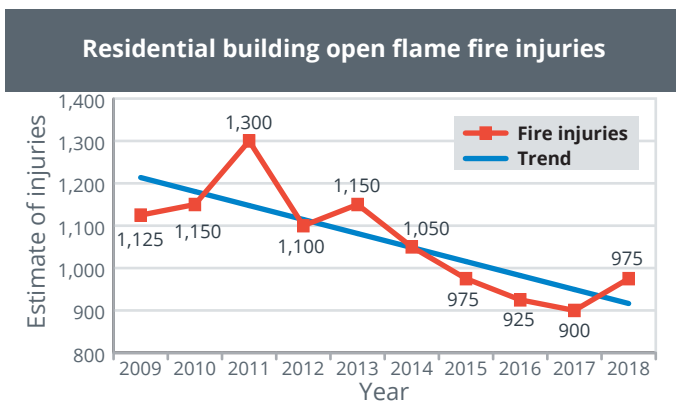
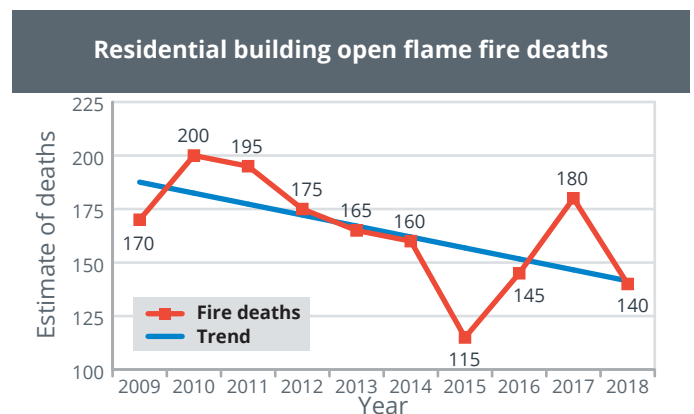
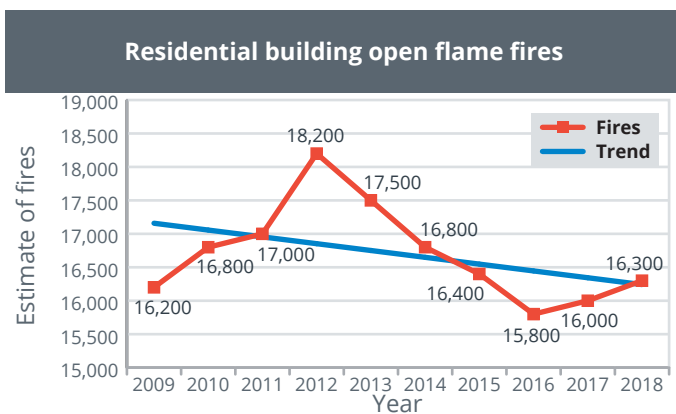
Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA's "National Estimates Methodology for Building Fires and Losses" (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for residential building open-flame fires and losses for 2018, the most recent year for which data are available, are as follows:

- 🔦 Fires: 16,300.
- 🔦 Deaths: 140.
- 🔦 Injuries: 975.
- 🔦 Dollar loss: \$723,400,000.

Overall trends for residential building open flame fires and losses for the 10-year period of 2009 to 2018 show the following:

- 🔦 A 5% decrease in fires.
- 🔦 A 25% decrease in deaths.
- 🔦 A 24% decrease in injuries.
- 🔦 A 21% decrease in dollar loss. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2018 value.)



Residential Building Smoking Fire Trends (2009-2018)

Fire estimate summaries present basic data on the size and status of the fire problem in the United States as depicted through data reported to the U.S. Fire Administration’s (USFA’s) National Fire Incident Reporting System. Each Fire Estimate Summary addresses the size of the specific fire or fire-related issue and highlights important trends in the data. Note: Fire estimate summaries are based on the USFA’s “National Estimates Methodology for Building Fires and Losses” (https://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf). The USFA is committed to providing the best and most current information on the U.S. fire problem and, as a result, continually examines its data and methodology. Because of this commitment, changes to data collection strategies and estimate methodologies occur, causing estimates to change slightly over time. Previous estimates on specific issues (or similar issues) may have been a result of different methodologies or data definitions used and may not be directly comparable to current estimates.

National estimates for residential building smoking fires and losses for 2018, the most recent year for which data are available, are as follows:

- 🔦 Fires: 7,700.
- 👤 Deaths: 390.
- 👤 Injuries: 700.
- 💰 Dollar loss: \$318,900,000.

Overall trends for residential building smoking fires and losses for the 10-year period of 2009 to 2018 show the following:

- 🔦 A 1% increase in fires.
- 👤 A 4% increase in deaths. In 2018, seven reported multifatality fire incidents (including one resulting in six deaths) may have contributed to the increase in the estimate of fire deaths.
- 👤 A 31% decrease in injuries.
- 💰 A 23% decrease in dollar loss. (Note: This overall constant dollar-loss trend takes inflation into account by adjusting each year’s dollar loss to its equivalent 2018 value.)

