

Fires in Residential Board and Care or Assisted Living Properties: Selected incidents published since 2009

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Fires in Residential Board and Care or Assisted Living Properties: Selected incidents published since 2009

The following incident descriptions were previously published in NFPA publications from 2009 to January 2016. These reports illustrate what *can* happen; they should not be considered typical or representative.

Heated towels result in fire in assisted living facility, Texas

Hot grease-laden towels taken from a dryer were blamed for a fire in an assisted living facility that caused significant structural damage.

The fire could have been avoided if fire sprinklers had been installed, according to the local fire chief. “One sprinkler probably would have contained the fire until the fire department arrived,” the chief said.

The single-story, wood-frame building had a brick veneer and covered an area of approximately 62,147 square feet. The steel-truss roof had a wood deck and asphalt roof surface. Smoke detectors were located throughout the building and connected to a fire alarm panel that was monitored by a central station alarm company. The building had 60 residents ranging in age from 80 to 100. The automatic fire detection system worked as designed to alert residents and staff to the fire.

The fire began in a kitchen storage room, where the pile of towels had ignited and spread to other combustibles. Smoke from the fire triggered the fire alarm, which summoned the fire department at 10 p.m. Firefighters extinguished the fire with a hose line. The fire did not affect the residential area of the building and no injuries were reported.

Investigators found that towels laden with grease had been cleaned and placed in the dryer. The hot towels retained enough heat to self-ignite. Evidence of grease remaining on the towels may have contributed to the ignition sequence.

The property, valued at slightly more than \$2.2 million, had structural losses of \$800,000 and contents losses of \$50,000. The fire chief stated the building is being remodeled with a fire sprinkler system installed throughout.

Kenneth J. Tremblay, “Firewatch,” *NFPA Journal*, January/February 2016

Fire in assisted living home claims lives of two residents, California

Two women died in a fire in a single-family house that was being used as a residence for adults with cognitive disabilities.

The one-story, wood-frame building, which was 63 feet long and 40 feet wide, had a stucco exterior. Battery-operated smoke alarms had been installed in the bedrooms and hallway. There were no sprinklers.

The fire started on the bed in the caretaker's bedroom, when a fault in an electrical device ignited paper and a bedspread. A smoke alarm sounded in the room and alerted the caretaker, who was cooking breakfast. She placed a wet towel over the flames on the bed and, thinking she had extinguished the fire, left the room.

Several minutes later, the smoke alarms sounded again, and the caretaker assumed they were the result of residual smoke. However, the fire had reignited and spread to nearby combustibles, then out of the room into a hallway and garage.

The caretaker called 911 and was trying to reenter the building when the fire department arrived.

The two victims, a 53-year-old woman and a 46-year-old woman, were asleep and did not respond to the alarm. Both died of smoke inhalation. One firefighter received a burn injury.

Damage to the structure, the value of which was not reported, was estimated at \$250,000. Damage to its contents was estimated at \$125,000.

Kenneth J. Tremblay, "Firewatch," *NFPA Journal*, September/October 2015

Sprinkler douses fire started by ignition of oily rags in trash can, Washington

Oily rags in an open trash can in the kitchen of an assisted-living facility spontaneously ignited, starting a fire that spread to a wall until heat activated a sprinkler.

The three-story, wood-frame building, which measured 100 feet(30 meters), contained 80 unites in addition to common spaces. The building's fire alarm system monitored the water flow of the wet-pipe sprinkler, which was installed in compliance with the local code.

A building occupant who heard the fire alarm activate discovered the fire in the kitchen and tried unsuccessfully to extinguish the blaze using a dry chemical portable fire extinguisher. By the time firefighters arrived at 9 p.m., however, a single sprinkler head had already extinguished the fire. Investigators determined that someone had improperly disposed of oily rags in the regular trash and that they had ignited spontaneously.

The sprinkler spared the building significant fire damage, keeping losses to \$5,000. There were no injuries.

Kenneth J. Tremblay, 2014, " Firewatch", *NFPA Journal*, November/December 32.

Sprinklers extinguish fire in assisted-living facility, Alabama

A 63-year-old woman on home oxygen was smoking when she fell asleep in her apartment at an assisted-living facility and her bedding and mattress ignited. The facility was equipped with a wet-pipe sprinkler system, and two sprinklers activated, alerting the occupants and extinguishing the fire. The apartment in the two-story, wood-frame facility building covered approximately

624 square feet (58 square meters). In addition to the sprinkler system, there was a water flow alarm monitored by a fire alarm and notification system.

The fire department received the automatic alarm at 6:49 a.m. and additional phone reports of a possible fire with water coming from the apartment door. When firefighters arrived six minutes later, they found that the sprinkler system had extinguished the fire.

Investigators determined that the woman, who suffered smoke inhalation and a burn to one of her shoulders, fell asleep while she was smoking in bed. The sprinklers limited damage to the building, valued at \$600,000, and its contents, valued at \$200,000, to an estimated \$75,000 and \$25,000, respectively.

Kenneth J. Tremblay, 2014, "Firewatch", *NFPA Journal*, September/October 33 .

Sprinkler controls fire in group home, Minnesota

A group home sustained only minor damage when a sprinkler activated and controlled a fire that started in a clothes dryer in the basement laundry room.

The two-story, wood-frame house, which covered an area of 1,779 square feet (165 square meters), had an NFPA 13D residential sprinkler system. Smoke alarms were also present, although the type and coverage was not reported.

When firefighters arrived three minutes after the 10:53 p.m. 911 call, they found that the staff and the four residents had already evacuated the building without injury. Entering the smoky basement with a 1 3/4-inch hose line, they found that a sprinkler had prevented flames from spreading from the clothes dryer to any other combustibles nearby.

Investigators determined that clothing in the dryer ignited, but their report did not provide any details as to what might have caused the ignition.

The fire caused an estimated \$10,000 in structural damage to the property and \$2,000 in damage to its contents. Some of the home's residents were relocated to temporary housing, while others were sent to stay with their relatives.

Kenneth J. Tremblay, 2014, "Firewatch", *NFPA Journal*, January/February 35.

Four dead in residential care facility, Texas

A fire in this two-story residential care facility for physically disabled residents was reported at 10:40 p.m. on an August evening. The facility covered 3,000 square feet (279 square meters) and was made of unprotected wood-frame construction.

Smoke detection equipment was present. The type and coverage was not reported, but they did not operate; the reason why was not reported. There was no automatic suppression equipment. No information about the fire origin or path was reported.

Firefighters initiated an offensive attack to allow for search and rescue for the occupants who were reported missing. In addition to the four residents who died, nine others evacuated uninjured.

Adapted from Stephen G. Badger's 2012 report, *Catastrophic Multiple-Death Fires in 2012*, NFPA Fire Analysis and Research, Quincy, MA.

Five Dead in Board and Care Fire, California

A fire in a one-story, residential board-and-care facility for adults with mobility and cognitive impairments that covered 3,000 square feet (279 square meters) was reported at 11:49 p.m. on a May night. The facility was of unprotected wood-frame construction.

The activation of the battery-operated smoke alarms was not determined. There was no automatic suppression equipment.

The fire broke out in a bedroom, and heavy smoke and flames were showing when firefighters arrived. Six people were reported trapped in the structure when firefighters arrived. All five victims were found in bedrooms. Three other occupants, including two staff members, were injured.

Adapted from Stephen G. Badger's 2012 report, *Catastrophic Multiple-Death Fires for 2011*, NFPA Fire Analysis and Research, Quincy, MA.

Sprinkler controls fire in laundry room dryer, Wisconsin

A fire in the laundry room of an eight-unit residential board and care facility resulted in water and smoke damage. However, a sprinkler prevented significant losses when it kept the fire under control until firefighters arrived.

The single-story, wood-frame facility was built on a concrete slab and had a wooden roof covered with metal. The automatic fire detection system was monitored by a central station alarm company, and the wet-pipe sprinkler system had monitored water flow alarms.

The fire began in the removable lint trap of a gas-powered clothes dryer. As the flames spread to the dryer's contents and its plastic parts, the smoke and heat activated the detection and suppression systems at 8:31 p.m. This alerted the fire department, as well as the residents and the staff, who immediately began their evacuation procedures.

Upon arrival, firefighters found light smoke by the open front door and discovered that the fire in the laundry room was being held in check by the sprinkler. One crew closed the door to the laundry room until they positioned a hose line, which they used to extinguish the blaze. Other crews helped the staff move residents to the north end of the building until the fire was brought under control.

The combined damage to the building, which was valued at \$804,000, and its contents was estimated at \$13,000. One woman was treated during the incident and later transported to the hospital.

Kenneth J. Tremblay, 2012, "Firewatch," *NFPA Journal*, March/April, 18.

Sprinklers Stop Fire in Residential Board and Care Facility, Arizona

A caregiver and all the occupants of a residential board and care facility escaped injury when two sprinklers extinguished a fire that began when the staffer left a pan of grease heating unattended on the stove.

The single-story, wood-frame facility occupied a converted single-family home. It had a wet-pipe sprinkler system, installed in accordance with NFPA 13R, that provided coverage in all living areas and was monitored by a central station alarm company. Smoke alarms were present in the great room and resident sleeping rooms, but they did not operate because they were not near the kitchen.

The facility housed nine people who suffered from Alzheimer's disease. At the time of the fire, they were being cared for by a single staff member, who put the pan on the electric stove and went to watch television. The heat from the stove ignited the grease, and flames spread to the cabinets and walls before the sprinklers in the kitchen extinguished the fire.

The fire department received a water flow alarm at 2:45 a.m. and responded to find that the sprinklers had already extinguished the fire. Firefighters tried to control the flow of water from the two operating sprinklers, but they were concealed so that the traditional method of placing a wooden block in the sprinkler to limit flow was not possible. The water department was contacted and turned off the water so firefighters could plug the sprinklers.

The caregiver admitted that he had started heating some grease and then gone to another room to watch television. During the interview, investigators thought he appeared to be impaired by alcohol, which may have contributed to the start of the fire. They referred the matter to law enforcement for further evaluation.

None of the residents was injured. One was picked up by family, and the other eight were transferred to similar facilities under the same ownership.

The home, valued at \$250,000, and its contents, valued at \$175,000, sustained a combined loss of \$30,000.

Kenneth J. Tremblay, 2012, "Firewatch," *NFPA Journal*, January/February 18.

Sprinklers control clothes dryer fire, Missouri

A single sprinkler activated and held an early morning fire in the laundry room at a residential board-and-care facility in check until firefighters arrived to extinguish it.

The facility, which occupied a one-story, single-family, wood-frame house, had hardwired smoke alarms that operated during the fire and a wet-pipe sprinkler system. Neither system was connected to a central station alarm company and provided only local alarms. At the time of the fire, six residents and one staff member occupied the facility.

The staff member heard noise coming from the dryer in the laundry room, as well as what sounded to her like a circuit breaker tripping, and went to investigate. When she saw the fire, she immediately alerted the occupants and evacuated them before she called 911 at 2:19 a.m. Firefighters arriving minutes later discovered a single sprinkler controlling the fire and used their hose lines to extinguish the blaze.

Investigators found that the piping supplying the three sprinklers in the laundry room was full of rust that blocked the flow of water, but a section of pipe feeding the kitchen remained operational and a fourth sprinkler in the adjacent kitchen operated and controlled the flames.

The value of the facility and the extent of the damage were not reported. There were no injuries.

Kenneth J. Tremblay, 2010, "Firewatch", *NFPA Journal*, November/December, 25.

Four Dead in Board and Care Fire, New York

A fire in this one-story board and care occupancy of unprotected wood-frame construction that covered 4,280 square feet (398 square meters) was reported at 5:30 p.m. At the time of the fire, there were nine residents and two staff members present.

A building fire alarm system was installed consisting of smoke detectors in sleeping areas and most common spaces. Heat detectors were installed in the kitchen, laundry room, and shower room as well as in the attic space. A wet-pipe sprinkler system designed to meet the requirements of NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes* was also provided. Two sprinkler heads operated as designed, though they were not effective as the fire started outside the structure and spread inside.

The fire originated in a plastic trash container on an attached porch. The fire spread into the attic and then throughout the rest of the building. The cause was not determined but investigators reported that human activity was involved in some way.

Although both systems operated, the origin of the fire prevented either system from having an early impact on the fire. Several residents had been relocated and evacuated before deteriorating fire conditions prevented further rescue attempts. Some of the residents who were evacuated out of the building returned to what they deemed the safety of their familiar space and died while others who had been staged in a mudroom at the main entrance simply did not escape.

Adapted from Stephen G. Badger's 2010 report, *Catastrophic Multiple-Death Fires for 2009*, NFPA Fire Analysis and Research, Quincy, MA.

Medical oxygen intensifies fire started by smoking materials, Georgia

Firefighters arriving at a 40-unit board-and-care facility seven minutes after receiving a 3:51 a.m. water flow alarm found that a sprinkler had already extinguished the fire, which began when the woman living in the unit dropped a cigarette on her upholstered lift chair. They removed the woman, who had been unable to open her door, without incident.

The sprinkler was part of a monitored wet-pipe sprinkler system that protected the three-story, wood-frame facility. The building, which covered almost 30,000 square feet (2,700 square meters), was also equipped with a fire detection system.

Investigators, who found evidence of improperly discarded cigarettes throughout the apartment, believe that the chair in which the woman dropped the cigarette was saturated with the home oxygen she was using. She had left the operating nasal cannula over the chair's arm when she got up to use the bathroom and returned to find the oxygen tubing and chair ablaze. She tried unsuccessfully to extinguish the flames with a pail of water before trying to leave the unit.

Damage was limited to the room of origin. The woman was not injured.

Ken Tremblay, 2010, "Firewatch", *NFPA Journal*, September/October, 31-32.

Staff Extinguishes Small Fire in Assisted-Living Facility, Florida

Six occupants of an assisted-living facility suffered smoke inhalation injuries in a fire that began when the battery of a laptop computer overheated and ignited the computer's plastic casing. Fortunately, the facility's staff easily confined the fire to the room of origin using a portable fire extinguisher.

The one-story, wood-frame facility, which covered an area of almost 16,000 square feet (1,500 square meters), had a monitored fire detection system that provided coverage in the common spaces and individual rooms. The building was also equipped with a wet-pipe sprinkler system.

The fire activated the alarm, alerting a staff member who responded with a fire extinguisher, as other staff members began evacuating the building. The occupant of the room of fire origin called 911; the alarm company reported the incident, as well.

Firefighters quickly responded to the alarm and helped the staff treat the injured residents. The sprinklers failed to operate because the fire was so small and so quickly extinguished.

The building, valued at \$1.4 million was not damaged. Damage to its contents was estimated at \$1,000.

Ken Tremblay, 2010, "Firewatch", *NFPA Journal*, May/June, 40+42.

Smoking on Oxygen Injures One, Pennsylvania

A resident of a board-and-care facility was burned and his bedding damaged by a fire started by a cigarette. The occupant, whose age was not reported, was smoking while using oxygen.

The four-story facility was 119 feet (36 meters) long and 46 feet (14 meters) wide. The building did not have sprinklers, although a fire detection system monitored by a central station alarm company provided full coverage. Each unit and all common areas had smoke detectors that worked as designed.

The fire department received the alarm from the alarm company at 3:40 p.m. Arriving firefighters found that a staff member had successfully extinguished the fire on the resident's bed using a 10-pound (5-kilogram) dry chemical fire extinguisher. The staff had been alerted to the fire by the fire detection system.

The structure, valued at \$300,000, sustained approximately \$2,000 in damage.

Ken Tremblay, 2009, "Firewatch", *NFPA Journal*, September/October, 25.

Sprinklers Control Fire, Nebraska

A single sprinkler controlled a fire in a thirteenth-floor apartment in an assisted-living facility, saving the life of an 84-year-old man who used a wheelchair.

The 14-story, 100-unit residence was constructed of steel with a wood interior. A wet-pipe sprinkler system provided full coverage, as did smoke and heat detectors, all of which were monitored by a central station monitoring service.

The fire started when a malfunctioning heating and air conditioning unit ignited its plastic housing, and the flames spread from the unit to plastic blinds, a clock radio, and a nearby couch. The smoke and heat activated the fire detection and suppression systems, alerting the central station, which notified the fire department at 11:55 a.m.

The alarm system woke the sleeping man, who managed to get into his wheelchair. During his attempt to leave the room, however, he became disoriented and could not find his way out. Responding firefighters found him in his bedroom.

The sprinkler system was credited with limiting property damage to an estimated \$60,000

Kenneth J. Tremblay, 2009, "Firewatch," *NFPA Journal*, July/August, 18.

Sprinkler Extinguishes Bedding Fire, Arizona

A sprinkler in the bedroom of an assisted-living facility extinguished a fire that began when the room's wheelchair-bound occupant ignited his bedding while lighting a cigar. The sprinkler triggered the system's central station alarm, and the monitoring company notified the fire department.

The single-story building, constructed of concrete block walls with a wood roof covered in asphalt shingles, had a wet-pipe sprinkler system. Smoke detectors located in the hallways operated as designed.

Arriving firefighters, who received the alarm at 8:53 p.m., found the fire extinguished. They treated the room's 82-year-old occupant, who had suffered burns on his legs, and took him to the hospital, where he contracted a fatal infection.

The \$3-million structure sustained \$5,000 in structural damage, as well as \$3,000 in damage to its contents, valued at \$750,000.

Kenneth J. Tremblay, 2009, "Firewatch," *NFPA Journal*, May/June, 42.

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 by 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 <http://www.nfirs.fema.gov/>. Copies of the paper forms may be downloaded from [http://www.nfirs.fema.gov/documentation/design/NFIRS Paper Forms 2008.pdf](http://www.nfirs.fema.gov/documentation/design/NFIRS_Paper_Forms_2008.pdf).

NFIRS has a wide variety of data elements and code choices. The NFIRS database contains coded information. 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 impossible 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, methodological and definitional changes can occur. *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.*

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 50,000 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 and 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 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, so no one can say with confidence that they are or are not serious problems. But there is enough reason for concern so that a second database -- the NFPA 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 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 specific basic analytical rules used for this procedure. "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. A copy of the article is available online at <http://www.nfpa.org/osds> or through NFPA's One-Stop Data Shop.

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.

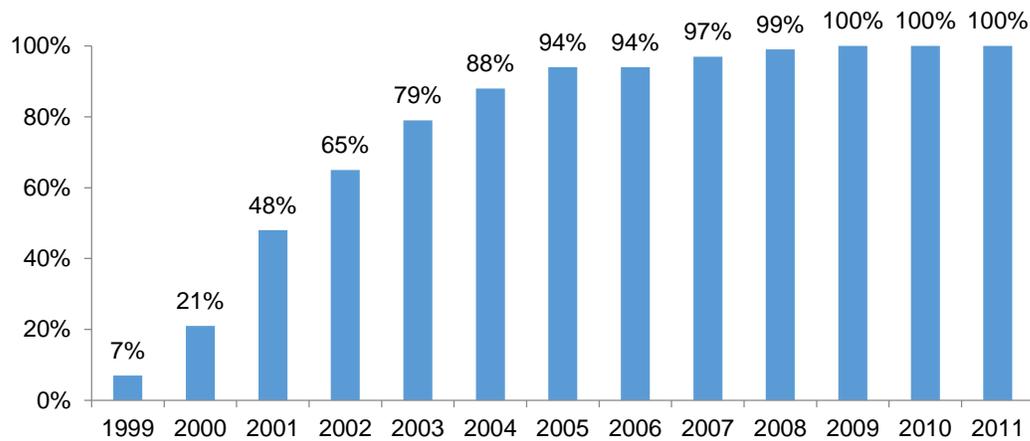
Figure A.1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

From 1999 data on, analyses are based on scaling ratios using only data originally collected in NFIRS 5.0:

$$\frac{\text{NFPA survey projections}}{\text{NFIRS totals (Version 5.0)}}$$

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.

Because this analysis focused on fatalities only, no distinction was made between confined and non-confined fires.

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.*

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.

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 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.

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.

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.

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

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

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
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

Equipment was not analyzed separately for confined fires. Instead, each confined fire incident type was listed with the equipment or as other known equipment.

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.

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.

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.