RESEARCH

Structure Fires in Residential Board and Care Facilities

July 2016

Marty Ahrens

Abstract

During 2009-2013, U.S. fire departments responded to an estimated average of 1,830 structure fires in residential board and care facilities or similar properties per year. These fires caused annual averages of six civilian deaths, 46 civilian injuries, and $8.4 million in direct property damage. Cooking caused 83% of the fires in these properties. The vast majority of fires in these properties are small. Only 4% spread beyond the room of origin. Because definitions of these properties vary by organization and jurisdiction, a property might be considered board and care in one area but not in another.

These estimates are based on data 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 fire experience survey.

Keywords: fire statistics, residential board and care fires, assisted living fires

Acknowledgements

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

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

For more information about the National Fire Protection Association, visit www.nfpa.org or call 617-770-3000. To learn more about the One-Stop Data Shop go to www.nfpa.org/osds or call 617-984-7451.

Copies of this analysis are available from:

National Fire Protection Association
One-Stop Data Shop
1 Batterymarch Park
Quincy, MA 02169-7471
www.nfpa.org
E-mail: osds@nfpa.org
Phone: 617-984-7451

NFPA No. USS40

Contents

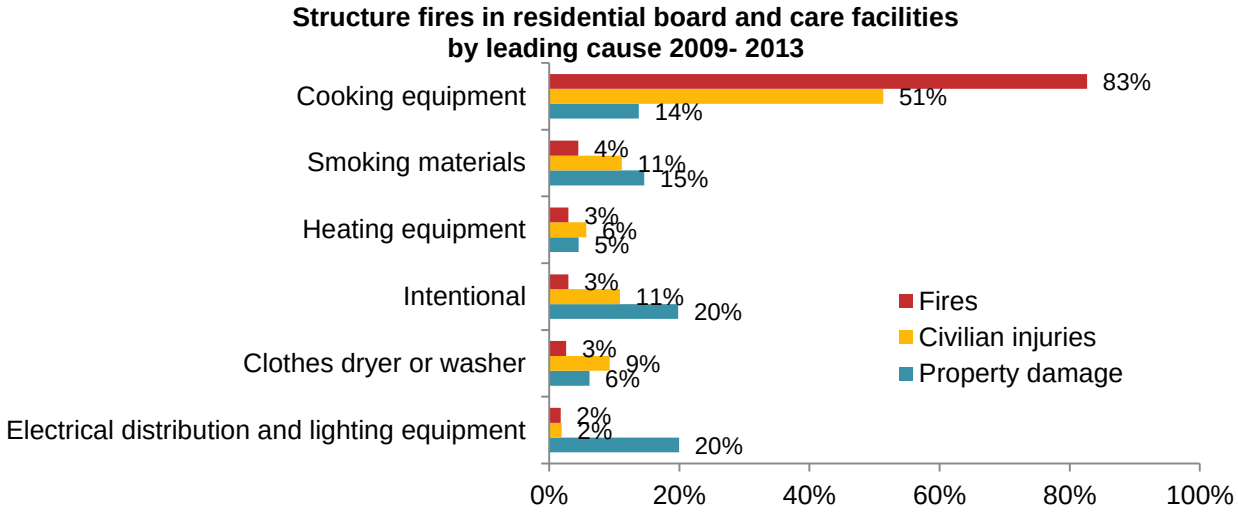
List of Tables and Figures

RESEARCH

STRUCTURE FIRES IN RESIDENTIAL BOARD AND CARE FACILITIES FACT SHEET

During 2009-2013, U.S. fire departments responded to an estimated average of 1,830 structure fires in residential board and care facilities or similar properties per year. These fires caused annual averages of:

- 6 civilian deaths
- 46 civilian injuries
- $8.4 million in property damage



- Cooking equipment was involved in 83% of the fires in these properties, including three-quarters (77%) of board and care fires coded as cooking fires confined to the object of origin.
- Overall, 88% of fires in these properties did not spread beyond the object of origin.
- Fires in residential board and care facilities peaked between 4:00 and 6:00 pm.
- NFPA's 2013 report, *U.S. Experience with Sprinklers*, shows that in 2007-2011, sprinklers were present in 46% of reported fires in these properties. The death rate per thousand reported fires was 88% lower and direct property damage was 57% lower in properties with wet pipe sprinklers than in facilities with no automatic extinguishing systems.

Definitions of board and care facilities vary by state and organization. In the National Fire Incident Reporting System (NFIRS), this category includes assisted living and halfway houses. Nursing homes are NOT included.

Source: NFPA, Fire Analysis & Research Division, www.nfpa.org

NFPA, 1 Batterymarch Park, Quincy, MA 02169, www.nfpa.org
Fire Analysis & Research Division, osds@nfpa.org

.

Structure Fires in Residential Board and Care Facilities

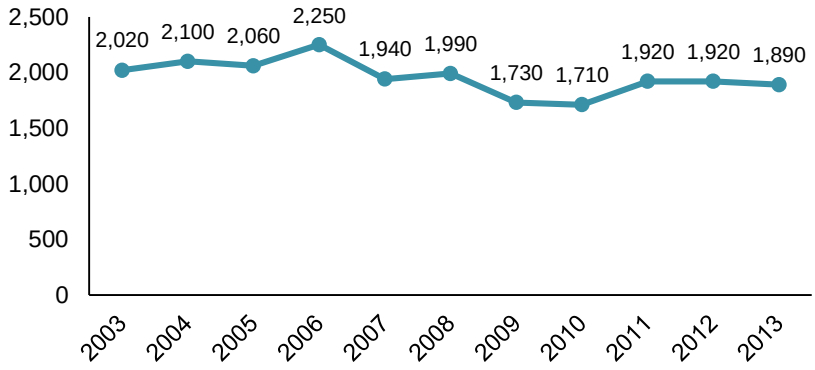
During 2009-2013, U.S. fire departments responded to an estimated average of 1,830 structure fires in residential board and care facilities. These fires caused an average of six civilian deaths, 46 civilian injuries and $8.4 million dollars per year. The statistics in this analysis are estimates derived from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS) and NFPA's annual fire experience survey.

NFIRS property use code 459 captures residential board and care properties. Different jurisdictions and organizations may use different terms to describe these properties. Section 3.3.190.12 of the 2015 edition of *NFPA 101: Life Safety Code*® (www.nfpa.org/101) defines a residential board and care occupancy as "an occupancy used for lodging and boarding of four or more residents, not related by blood or marriage to the owners or operators, for the purpose of providing personal care services." Version 5.0 of NFIRS groups it with other residential properties. While most firefighters entering the NFIRS data electronically will only see the abbreviated label, the full definition in the *National Fire Incident Reporting System Complete Reference Guide* reads "459. Residential board and care. Includes long-term care facilities, halfway houses, and assisted-care housing facilities. Excludes nursing facilities (311)."

In earlier versions of NFIRS, a property use code specific to this occupancy did not exist. It appeared that these were sometimes considered boarding or rooming houses and sometimes assigned to one of the "care of aged" occupancies. NFPA's investigation reports on fires in these facilities are grouped with health care.

Estimates of reported fires have been fairly stable in the past few years. Figure 1 and Table 1 show that these fires hit their lowest points in 2009 and 2010 but returned to levels close to those in 2007 and 2008.

Figure 1
Structure Fires in Residential Board and Care Facilities
By Year



These fires were more frequent on weekends and between 4:00 and 6:00 p.m. Table 2 shows that during 2009-2013, fires in these facilities were most common in January. Table 3 shows that 17% of the fires occurred on Saturday while 16% were on Sunday. Table 4 shows that 10% the fires were reported between 5:00 and 6:00 p.m.; 9% occurred between 4:00 and 5:00 p.m. These incidents were less common between midnight and 7:00 a.m.

Data Sources, Definitions and Conventions Used in this Report

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

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

What are "confined" and "non-confined" fires?
NFIRS 5.0 includes a category of structure fires collectively referred to as "confined fires," identified by incident type. These include confined cooking fires, confined chimney or flue fires, confined trash fires, confined fuel burner or boiler fires, confined commercial compactor fires, and confined incinerator fires (incident type 113-118). Losses are generally minimal in these fires, which by definition, are assumed to have been limited to the object of origin. Although causal data is not required for these fires, it is sometimes present.

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

Estimates were based on the details in the raw NFIRS data and a multiplier based on residential structure estimates from the NFPA fire experience survey/residential structure fires in NFIRS. During the five-year period of 2009-2013, a total of 6,472 structure fires in these facilities that caused 18 civilian deaths, 130 civilian injuries, and $24.2 million in direct property were reported to NFIRS, including 5,280 fires with confined fire incident types and 1,192 with non-confined fire incident types.

Additional information
Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Except for trend tables, property damage has not been adjusted for inflation. Estimates of fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Additional details on the methodology may be found in Appendix A and B.

Cooking equipment was involved in five out of six fires (83%) in these properties during 2009-2013. Cooking also caused half (51%) of the injuries. More than three-quarters (77%) of all reported fires in these facilities had incident types indicating cooking fires confined to the object or vessel of origin. Table 5 and Figure 2 show that smoking materials caused 4% of the fires and 11% of the injuries.

Each of three major causes caused 3% of the fires: heating equipment, intentional, and clothes dryers or washers. Eleven percent of the injuries resulted from intentional fires. These causes were pulled from several different data elements. Appendix B describes the methodology used.

Figure 2.
Structure Fires in Residential Board and Care Facilities
By Leading Cause
2009-2013 Annual Averages

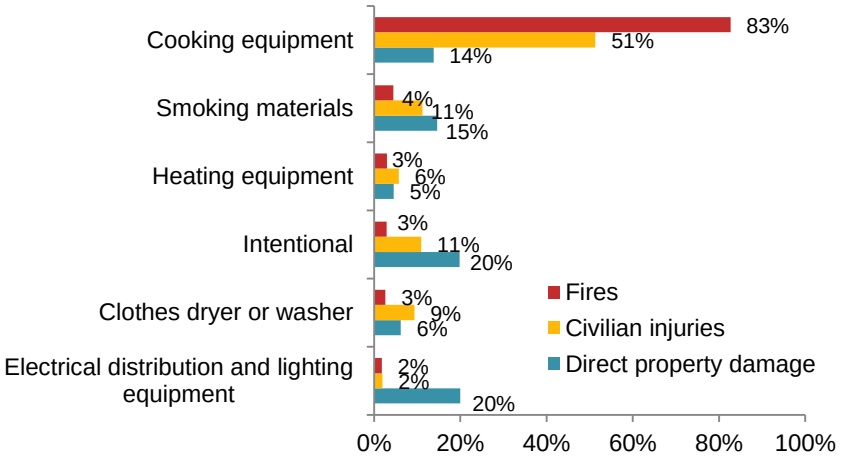


Table 6 shows the type of equipment involved in ignition of fires in residential board and care facilities. Most fires were caused by cooking equipment (as discussed above). No equipment at all was involved in 4% of the fires. Table 7 shows that the cause of ignition (a data element in NFIRS) was unintentional in three-quarters (76%) of these fires. Six percent were due to the failure of equipment or a heat source.

One-quarter (27%) of the fires were coded as having "equipment unattended" as a factor contributing to their ignition, an abandoned material or product was a factor in 14%, 11% were due to an unclassified misuse of material or product, and in 10%, a heat source was too close to something that could catch fire. (See Table 8.)

Table 9 shows that some type of operating equipment was the heat source in more than two-thirds (69%) of these fires. Twenty-eight percent were started by radiated or conducted heat from operating equipment; 22% were ignited by unclassified heat from powered equipment; a spark, ember or flame from operating equipment started 17%, and arcing started 2%.

Three-quarters (77%) of these fires started in the kitchen or cooking area. This is consistent with cooking as the leading cause of fires in these properties. Table 10 shows that half (51%) of the injuries occurred in fires beginning in this area. Although the bedroom was the

second leading area of origin, it accounted for only 4% of fires. However, bedroom fires caused 29% of the injuries. Table 11 shows that three out of every five (60%) fires in these properties began with the ignition of cooking materials, including food. (See Table 11).

Most fires in residential board and care facilities were small. Table 12 shows that 88% did not spread beyond the object of origin, including 82% with incident types indicating a confined fire. Only 4% spread beyond the room of origin.

The fire death rate per 1,000 reported residential board and care fires was 5.7 when no automatic extinguishing equipment was present, roughly eight times the rate of 0.7 in fires with wet-pipe sprinklers. Residents of these facilities are a vulnerable population. Sprinklers are a critical defense against fire, reducing the death rate per 1,000 reported residential board and care fires by 88% in 2007-2011. Table A shows that sprinklers were present in 46% of the reported board and care fires, excluding fires in properties under construction and fires in properties with automatic extinguishing equipment that was not present in the fire area.[1] Ninety-one percent of the systems had wet-pipe sprinklers. In fires with wet pipe sprinklers, the average loss was $3,000 per fire. This was roughly half the $6,000 average loss in residential board and care fires with no automatic extinguishing equipment. These statistics were obtained from NFPA's 2013 report, *U.S. Experience with Sprinklers*.

Table A.
Sprinkler Systems in Reported Residential Board and Care Fires
Excluding Fires in Properties in Construction and
Fires in Which Automatic Extinguishing Equipment Was Present, but Not in Fire Area
2007-2011 Annual Averages

Share of reported residential board and care fires with sprinklers present	46%
Percent of sprinkler systems that were wet pipe	91%
Civilian deaths per 1,000 reported fires	
Without automatic extinguishing equipment	5.7
When wet-pipe sprinkler were present regardless of operation	0.7
Percent reduction	88%
Average loss per fire	
Without automatic extinguishing equipment	$6,000
When wet-pipe sprinklers were present regardless of operation	$3,000
Percent reduction	57%

In the 1980s and 1990s, NFPA investigated numerous deadly residential board and care fires. These investigation reports provide valuable lessons to assist in keeping these properties safe. These reports are available free of charge to NFPA members.

[1] John R. Hall, Jr., *U.S. Experience with Sprinklers*, Quincy, MA: National Fire Protection Association, Fire Analysis and Research Division, 2013.

A selection of incidents about fires in residential board and care facilities published in NFPA journal during the past few years are included in Appendix C. These incidents illustrate what can happen, but they are not a source to learn about what *typically* occurs. The incidents in this collection tend to be either more serious than usual or fires that were controlled by sprinklers.

Table 1.
Structure Fires in Residential Board and Care Facilities, by Year
2009-2013

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions)	
			As Reported	In 2013 Dollars
2003	2,020	74	$7.5	$9.5
2004	2,100	44	$20.2	$25.0
2005	2,060	55	$15.1	$18.0
2006	2,250	124	$4.4	$5.1
2007	1,940	51	$7.5	$8.4
2008	1,990	55	$7.8	$8.4
2009	1,730	35	$11.4	$12.4
2010	1,710	39	$9.1	$9.7
2011	1,920	68	$7.3	$7.6
2012	1,920	38	$7.5	$7.6
2013	1,890	49	$6.9	$6.9

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of NFIRS. Inflation adjustments were based on the Consumer Price Index Purchasing Power of the Dollar.
Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding

Table 2.
Structure Fires in Residential Board and Care Facilities, by Month
2009-2013 Annual Averages

Alarm Month	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
January	180	(10%)	5	(10%)	$1.2	(14%)
February	140	(8%)	5	(11%)	$0.6	(7%)
March	160	(9%)	2	(4%)	$0.7	(8%)
April	160	(9%)	7	(16%)	$1.1	(13%)
May	150	(8%)	4	(8%)	$0.9	(11%)
June	140	(7%)	3	(6%)	$0.5	(6%)
July	140	(7%)	3	(6%)	$0.5	(6%)
August	140	(8%)	2	(5%)	$0.6	(7%)
September	150	(8%)	4	(8%)	$0.5	(6%)
October	150	(8%)	2	(4%)	$0.3	(3%)
November	170	(9%)	4	(9%)	$0.4	(4%)
December	170	(9%)	6	(12%)	$1.2	(14%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)
Monthly average	150	(8%)	4	(8%)	$0.7	(8%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding

Table 3.
Structure Fires in Residential Board and Care Facilities
by Day of Week
2009-2013 Annual Averages

Day of Week	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	300	(16%)	10	(21%)	$2.0	(23%)
Monday	240	(13%)	3	(7%)	$1.5	(17%)
Tuesday	250	(14%)	5	(11%)	$1.2	(14%)
Wednesday	240	(13%)	5	(12%)	$1.1	(13%)
Thursday	240	(13%)	5	(11%)	$0.7	(9%)
Friday	250	(14%)	12	(26%)	$1.0	(11%)
Saturday	310	(17%)	6	(12%)	$1.1	(13%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)
Average by day	260	(14%)	7	(14%)	$1.2	(14%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding

Table 4.
Structure Fires in Residential Board and Care Facilities, by Alarm Hour
2009-2013 Annual Averages

Alarm Hour	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Midnight- 12:59 a.m.	40	(2%)	0	(0%)	$0.5	(6%)
1:00-1:59 a.m.	30	(1%)	0	(1%)	$0.3	(4%)
2:00-2:59 a.m.	30	(1%)	0	(1%)	$0.2	(2%)
3:00-3:59 a.m.	20	(1%)	3	(6%)	$0.4	(4%)
4:00-4:59 a.m.	20	(1%)	1	(1%)	$0.2	(2%)
5:00-5:59 a.m.	30	(2%)	1	(2%)	$0.1	(2%)
6:00-6:59 a.m.	40	(2%)	0	(1%)	$0.4	(5%)
7:00-7:59 a.m.	70	(4%)	1	(3%)	$0.2	(2%)
8:00-8:59 a.m.	90	(5%)	2	(4%)	$0.7	(8%)
9:00-9:59 a.m.	80	(5%)	2	(5%)	$0.1	(1%)
10:00-10:59 a.m.	80	(5%)	3	(5%)	$0.2	(2%)
11:00-11:59 a.m.	100	(5%)	1	(2%)	$0.5	(6%)
12:00-12:59 p.m.	110	(6%)	5	(11%)	$0.4	(4%)
1:00-1:59 p.m.	100	(5%)	3	(7%)	$0.9	(11%)
2:00-2:59 p.m.	100	(5%)	4	(10%)	$0.1	(1%)
3:00-3:59 p.m.	110	(6%)	4	(8%)	$0.4	(5%)
4:00-4:59 p.m.	160	(9%)	1	(2%)	$0.3	(4%)
5:00-5:59 p.m.	180	(10%)	3	(7%)	$0.3	(3%)
6:00-6:59 p.m.	130	(7%)	0	(1%)	$0.5	(6%)
7:00-7:59 p.m.	90	(5%)	4	(8%)	$0.3	(4%)
8:00-8:59 p.m.	80	(5%)	1	(2%)	$0.2	(3%)
9:00-9:59 p.m.	60	(4%)	2	(5%)	$0.4	(5%)
10:00-10:59 p.m.	50	(3%)	2	(5%)	$0.4	(4%)
11:00-11:59 p.m.	50	(3%)	1	(3%)	$0.4	(5%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)
Hourly average	80	(4%)	2	(4%)	$0.4	(4%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding

Table 5.
Residential Board and Care Facilities, by Leading Cause
2009-2013 Annual Averages

Leading Cause	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	1,520	(83%)	23	(51%)	$1.2	(14%)
Smoking materials	80	(4%)	5	(11%)	$1.2	(15%)
Heating equipment	50	(3%)	3	(6%)	$0.4	(5%)
Intentional	50	(3%)	5	(11%)	$1.7	(20%)
Clothes dryer or washer	50	(3%)	4	(9%)	$0.5	(6%)
Electrical distribution and lighting equipment	30	(2%)	1	(2%)	$1.7	(20%)

Source: NFIRS and NFPA annual fire experience survey
Note: This table summarizes findings from multiple fields, meaning that the same fire may be listed under multiple causes. See Appendix B for details.

Table 6.
Structure Fires in Residential board and Care Facilities
By Equipment Involved in Ignition
2009-2013 Annual Averages

Equipment	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	1,520	(83%)	23	(51%)	$1.2	(14%)
No equipment involved in ignition	80	(4%)	12	(26%)	$3.6	(43%)
Heating equipment	50	(3%)	3	(6%)	$0.4	(5%)
Clothes dryer	50	(3%)	4	(9%)	$0.5	(6%)
Contained trash or rubbish fire	50	(3%)	1	(2%)	$0.0	(0%)
Electrical distribution and lighting equipment	30	(2%)	1	(2%)	$1.7	(20%)
Fan	20	(1%)	1	(2%)	$0.7	(8%)
Other known equipment involved in ignition	40	(2%)	1	(2%)	$0.4	(4%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding
Non-confined and non-contained structure fires in which the equipment involved was unknown or not reported have been allocated proportionally among fires with known equipment involved. NFPA treats fires in which the equipment involved in ignition was coded as "no equipment involved" and heat source is not in the range of 40-99 (heat sources that were not equipment-related) as an additional unknown. Totals may not equal sums due to rounding errors.

Table 7.
Structure Fires in Residential Board and Care Facilities, by Cause of Ignition
2009-2013 Annual Averages

Cause	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	1,400	(76%)	38	(83%)	$5.2	(62%)
Non-confined	220	(12%)	24	(53%)	$5.1	(60%)
Confined	1,180	(64%)	14	(30%)	$0.1	(2%)
Unclassified cause	270	(15%)	0	(0%)	$0.3	(3%)
Non-confined	10	(0%)	0	(0%)	$0.3	(3%)
Confined	260	(14%)	0	(0%)	$0.0	(0%)
Failure of equipment or heat source	110	(6%)	3	(6%)	$0.9	(11%)
Non-confined	60	(4%)	3	(6%)	$0.9	(11%)
Confined	40	(2%)	0	(0%)	$0.0	(0%)
Intentional	50	(3%)	5	(11%)	$1.7	(20%)
Non-confined	30	(2%)	5	(11%)	$1.7	(20%)
Confined	20	(1%)	0	(0%)	$0.0	(0%)
Act of nature	10	(0%)	0	(0%)	$0.3	(4%)
Non-confined	10	(0%)	0	(0%)	$0.3	(4%)
Confined	0	(0%)	0	(0%)	$0.0	(0%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)
Non-confined	340	(18%)	32	(70%)	$8.3	(98%)
Confined	1,500	(82%)	14	(30%)	$0.1	(2%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding

Table 8.
Structure Fires in Residential Board and Care Facilities
by Factor Contributing to Ignition
2009-2013 Annual Averages

Factor Contributing	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Equipment unattended	500	(27%)	7	(16%)	$0.3	(4%)
Non-confined	30	(1%)	4	(9%)	$0.3	(4%)
Confined	470	(26%)	3	(7%)	$0.0	(0%)
Abandoned or discarded material or product	260	(14%)	6	(12%)	$1.5	(17%)
Non-confined	50	(3%)	6	(12%)	$1.4	(17%)
Confined	210	(11%)	0	(0%)	$0.0	(0%)
Unclassified misuse of material or product	200	(11%)	4	(9%)	$0.2	(2%)
Non-confined	40	(2%)	4	(9%)	$0.2	(2%)
Confined	160	(9%)	0	(0%)	$0.0	(0%)
Heat source too close to combustibles	190	(10%)	17	(37%)	$1.2	(14%)
Non-confined	50	(3%)	11	(23%)	$1.2	(14%)
Confined	140	(8%)	6	(13%)	$0.0	(0%)
Unclassified factor contributed to ignition	130	(7%)	0	(0%)	$0.3	(3%)
Non-confined	20	(1%)	0	(0%)	$0.2	(3%)
Confined	110	(6%)	0	(0%)	$0.0	(0%)
Unintentionally turned on or not turned off	120	(6%)	4	(8%)	$0.1	(2%)
Non-confined	10	(1%)	2	(5%)	$0.1	(1%)
Confined	100	(6%)	2	(3%)	$0.0	(0%)
Failure to clean	90	(5%)	0	(0%)	$0.1	(1%)
Non-confined	10	(1%)	0	(0%)	$0.1	(1%)
Confined	80	(4%)	0	(0%)	$0.0	(0%)
Electrical failure or malfunction	80	(4%)	4	(9%)	$1.1	(13%)
Non-confined	50	(3%)	4	(9%)	$1.1	(13%)
Confined	20	(1%)	0	(0%)	$0.0	(0%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding

Table 8.
Structure Fires in Residential Board and Care Facilities
by Factor Contributing to Ignition
2009-2013 Annual Averages (continued)

Factor Contributing	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Equipment not being operated properly	70	(4%)	2	(5%)	$0.0	(1%)
Non-confined	0	(0%)	2	(5%)	$0.0	(1%)
Confined	70	(4%)	0	(0%)	$0.0	(0%)
Mechanical failure or malfunction	70	(4%)	0	(0%)	$0.5	(6%)
Non-confined	30	(2%)	0	(0%)	$0.5	(6%)
Confined	40	(2%)	0	(0%)	$0.0	(0%)
Unclassified operational deficiency	50	(3%)	0	(0%)	$0.0	(0%)
Non-confined	0	(0%)	0	(0%)	$0.0	(0%)
Confined	40	(2%)	0	(0%)	$0.0	(0%)
Other known factor contributing to ignition	120	(7%)	4	(8%)	$3.4	(40%)
Non-confined	40	(2%)	1	(2%)	$3.4	(40%)
Confined	80	(4%)	3	(7%)	$0.0	(0%)
Total fires	1,830	(100%)	46	(100%)	$8.4	(100%)
Non-confined	340	(18%)	32	(70%)	$8.3	(98%)
Confined	1,500	(82%)	14	(30%)	$0.1	(2%)
Total factors*	1,860	(102%)	48	(105%)	$8.6	(102%)
Non-confined	350	(19%)	34	(75%)	$8.5	(101%)
Confined	1,520	(83%)	14	(30%)	$0.1	(2%)

*Multiple entries allowed in this field, so total factors add up to more than total fires.
Sums may not equal totals due to rounding. Fires in which the factor contributing to ignition was coded as none, unknown, or not reported were allocated proportionally among fires with known factor(s) contributing to ignition.
Source: NFIRS and NFPA annual fire experience survey.

Table 9.
Structure Fires in Residential Board and Care Facilities, by Heat Source
2009-2013 Annual Averages

Heat Source	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Radiated or conducted heat from operating equipment	520	(28%)	17	(37%)	$1.3	(15%)
Non-confined	70	(4%)	6	(14%)	$1.3	(15%)
Confined	450	(24%)	11	(23%)	$0.0	(0%)
Unclassified heat from powered equipment	400	(22%)	5	(10%)	$0.8	(9%)
Non-confined	60	(3%)	4	(9%)	$0.7	(8%)
Confined	340	(18%)	1	(2%)	$0.1	(1%)
Spark, ember or flame from operating equipment	310	(17%)	2	(4%)	$0.6	(8%)
Non-confined	20	(1%)	2	(4%)	$0.6	(7%)
Confined	290	(16%)	0	(0%)	$0.0	(0%)
Unclassified heat source	210	(12%)	3	(6%)	$0.4	(4%)
Non-confined	10	(1%)	2	(4%)	$0.3	(4%)
Confined	200	(11%)	1	(2%)	$0.0	(0%)
Unclassified hot or smoldering object	100	(5%)	1	(3%)	$0.8	(10%)
Non-confined	20	(1%)	1	(1%)	$0.8	(10%)
Confined	80	(4%)	1	(2%)	$0.0	(0%)
Smoking materials	80	(4%)	5	(11%)	$1.2	(15%)
Non-confined	40	(2%)	5	(11%)	$1.2	(15%)
Confined	40	(2%)	0	(0%)	$0.0	(0%)
Heat from direct flame or convection currents	40	(2%)	1	(3%)	$0.2	(3%)
Non-confined	10	(0%)	0	(1%)	$0.2	(3%)
Confined	40	(2%)	1	(2%)	$0.0	(0%)
Arcing	40	(2%)	1	(3%)	$0.8	(10%)
Non-confined	30	(2%)	1	(3%)	$0.8	(10%)
Confined	10	(1%)	0	(0%)	$0.0	(0%)
Lighter	40	(2%)	5	(11%)	$0.6	(8%)
Non-confined	20	(1%)	5	(11%)	$0.6	(8%)
Confined	10	(1%)	0	(0%)	$0.0	(0%)

Table 9.
Structure Fires in Residential Board and Care Facilities, by Heat Source
2009-2013 Annual Averages (continued)

Heat Source	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Other known heat source	100	(5%)	5	(11%)	$1.7	(20%)
Non-confined	50	(3%)	5	(11%)	$1.7	(20%)
Confined	50	(3%)	0	(0%)	$0.0	(0%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)
Non-confined	340	(18%)	32	(70%)	$8.3	(98%)
Confined	1,500	(82%)	14	(30%)	$0.1	(2%)

*The heat source was undetermined or partially unknown in all deaths in these properties during this period.
Source: NFIRS and NFPA Survey
Sums may not equal totals due to rounding.
Estimates of matches, lighters, smoking materials, and candles included a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material.

Table 10.
Structure Fires in Residential Board and Care Facilities, by Area of Origin
2009-2013 Annual Averages

Area of Origin	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	1,410	(77%)	23	(51%)	$2.0	(24%)
Non-confined	90	(5%)	10	(21%)	$1.9	(22%)
Confined	1,320	(72%)	14	(30%)	$0.1	(1%)
Bedroom	70	(4%)	13	(29%)	$0.9	(10%)
Non-confined	50	(3%)	13	(29%)	$0.9	(10%)
Confined	20	(1%)	0	(0%)	$0.0	(0%)
Laundry room or area	50	(3%)	1	(2%)	$0.3	(3%)
Non-confined	40	(2%)	1	(2%)	$0.3	(3%)
Confined	10	(1%)	0	(0%)	$0.0	(0%)
Lavatory, bathroom, locker room or check room	30	(2%)	1	(3%)	$0.3	(3%)
Non-confined	20	(1%)	1	(3%)	$0.3	(3%)
Confined	20	(1%)	0	(0%)	$0.0	(0%)
Unclassified area of origin	30	(2%)	0	(0%)	$0.2	(2%)
Non-confined	0	(0%)	0	(0%)	$0.2	(2%)
Confined	30	(1%)	0	(0%)	$0.0	(0%)
Other known area of origin	240	(13%)	7	(15%)	$4.8	(57%)
Non-confined	140	(8%)	7	(15%)	$4.8	(57%)
Confined	100	(6%)	0	(0%)	$0.0	(0%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)
Non-confined	340	(18%)	32	(70%)	$8.3	(98%)
Confined	1,500	(82%)	14	(30%)	$0.1	(2%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding.

Table 11.
Structure Fires in Residential Board and Care Facilities, by Item First Ignited
2009-2013 Annual Averages

Item First Ignited	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking materials, including food	1,100	(60%)	11	(23%)	$0.4	(5%)
Non-confined	40	(2%)	2	(5%)	$0.4	(4%)
Confined	1,050	(57%)	8	(18%)	$0.1	(1%)
Unclassified item first ignited	130	(7%)	2	(3%)	$0.6	(7%)
Non-confined	20	(1%)	0	(0%)	$0.6	(7%)
Confined	110	(6%)	2	(3%)	$0.0	(0%)
Household utensils	80	(5%)	3	(7%)	$0.0	(1%)
Non-confined	10	(0%)	1	(3%)	$0.0	(0%)
Confined	80	(4%)	2	(4%)	$0.0	(0%)
Appliance housing or casing	50	(3%)	1	(2%)	$0.4	(5%)
Non-confined	20	(1%)	1	(2%)	$0.4	(5%)
Confined	30	(2%)	0	(0%)	$0.0	(0%)
Rubbish, trash, or waste	40	(2%)	0	(1%)	$0.1	(1%)
Non-confined	10	(1%)	0	(1%)	$0.1	(1%)
Confined	30	(2%)	0	(0%)	$0.0	(0%)
Electrical wire or cable insulation	40	(2%)	1	(3%)	$0.2	(3%)
Non-confined	30	(1%)	1	(3%)	$0.2	(3%)
Confined	10	(1%)	0	(0%)	$0.0	(0%)
Clothing	30	(2%)	4	(9%)	$0.5	(6%)
Non-confined	20	(1%)	4	(9%)	$0.5	(6%)
Confined	20	(1%)	0	(0%)	$0.0	(0%)
Flammable or combustible liquid or gas, piping or filter	30	(2%)	0	(1%)	$0.3	(3%)
Non-confined	10	(0%)	0	(1%)	$0.3	(3%)
Confined	30	(1%)	0	(0%)	$0.0	(0%)
Magazine, newspaper or writing paper	30	(2%)	3	(6%)	$0.8	(10%)
Non-confined	10	(1%)	3	(6%)	$0.8	(9%)
Confined	20	(1%)	0	(0%)	$0.0	(0%)
Linen other than bedding	30	(2%)	2	(4%)	$0.1	(1%)
Non-confined	20	(1%)	1	(2%)	$0.1	(1%)
Confined	10	(1%)	1	(2%)	$0.0	(0%)

Table 11.
Structure Fires in Residential Board and Care Facilities, by Item First Ignited
2009-2013 Annual Averages (Continued)

Item First Ignited	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Other known item first ignited	270	(14%)	19	(41%)	$4.9	(58%)
Non-confined	160	(9%)	17	(37%)	$4.9	(58%)
Confined	100	(6%)	2	(4%)	$0.0	(0%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)
Non-confined	340	(18%)	32	(70%)	$8.3	(98%)
Confined	1,500	(82%)	14	(30%)	$0.1	(2%)

Source: NFIRS and NFPA annual fire experience survey.
Sums may not equal totals due to rounding.

Table 12.
Structure Fires in Residential Board and Care Facilities, by Extent of Flame Damage
2009-2013 Annual Averages

Extent of Flame Damage	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	1,500	(82%)	14	(30%)	$0.1	(2%)
Confined to object of origin	130	(7%)	9	(20%)	$0.9	(10%)
Confined to room of origin	140	(8%)	18	(39%)	$2.5	(29%)
Confined to floor of origin	20	(1%)	0	(1%)	$0.6	(7%)
Confined to building of origin	50	(3%)	3	(6%)	$3.5	(42%)
Extended beyond building of origin	10	(0%)	2	(4%)	$0.9	(10%)
Total	1,830	(100%)	46	(100%)	$8.4	(100%)

Source: NFIRS and NFPA Survey
Sums may not equal totals due to rounding.

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.

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 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.

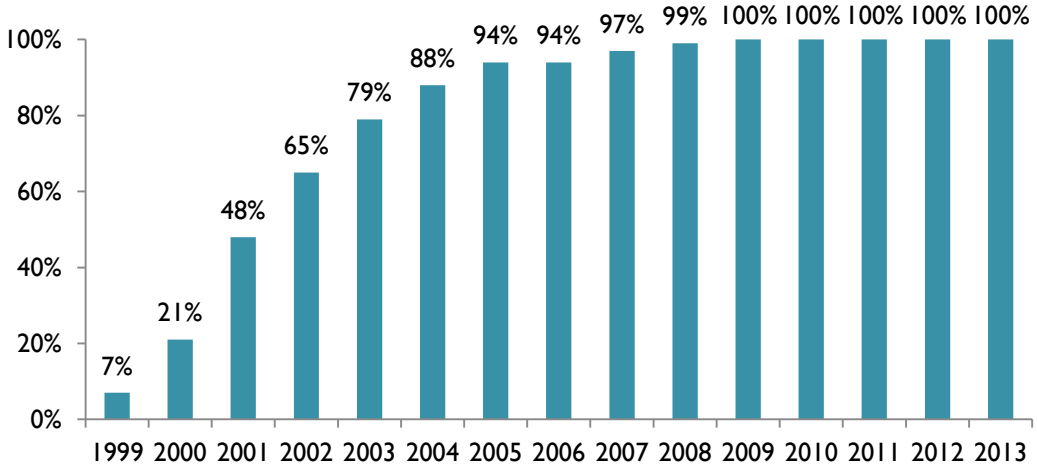
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific 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.

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



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

NFPA survey projections
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.

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

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

Although causal and other detailed information is typically not required for these incidents, it is provided in some cases. Some analyses, particularly those that examine cooking equipment, heating equipment, fires caused by smoking materials, and fires started by playing with fire, may examine the confined fires in greater detail. Because the confined fire incident types describe certain scenarios, the distribution of unknown data differs from that of all fires. Consequently, allocation of unknowns must be done separately.

Some analyses of structure fires show only non-confined fires. In these tables, percentages shown are of non-confined structure fires rather than all structure fires. This approach has the advantage of showing the frequency of specific factors in fire causes, but the disadvantage of possibly overstating the percentage of factors that are seldom seen in the confined fire incident types and of understating the factors specifically associated with the confined fire incident types.

Other analyses include entries for confined fire incident types in the causal tables and show percentages based on total structure fires. In these cases, the confined fire incident type is treated as a general causal factor.

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

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

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

In addition, the partially unclassified codes for broad equipment groupings (i.e., code 100 - heating, ventilation, and air conditioning, other; code 200 - electrical distribution, lighting and power transfer, other; etc.) were allocated proportionally across the individual code choices in their respective broad groupings (heating, ventilation, and air conditioning; electrical distribution, lighting and power transfer, other; etc.). Equipment that is totally unclassified is not allocated further. This approach has the same downside as the allocation of heat source 60 described above. Equipment that is truly different is erroneously assigned to other categories.

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

Code Grouping	**EII Code**	**NFIRS definitions**
Central heat	132	Furnace or central heating unit
	133	Boiler (power, process or heating)
Fixed or portable space heater	131	Furnace, local heating unit, built-in
	123	Fireplace with insert or stove
	124	Heating stove
	141	Heater, excluding catalytic and oil-filled
	142	Catalytic heater
	143	Oil-filled heater
Fireplace or chimney	120	Fireplace or chimney
	121	Fireplace, masonry
	122	Fireplace, factory-built
	125	Chimney connector or vent connector
	126	Chimney – brick, stone or masonry
	127	Chimney-metal, including stovepipe or flue
Fixed wiring and related equipment	210	Unclassified electrical wiring
	211	Electrical power or utility line
	212	Electrical service supply wires from utility
	213	Electric meter or meter box
	214	Wiring from meter box to circuit breaker
	215	Panel board, switch board or circuit breaker board
	216	Electrical branch circuit
	217	Outlet or receptacle
	218	Wall switch
	219	Ground fault interrupter
Transformers and power supplies	221	Distribution-type transformer
	222	Overcurrent, disconnect equipment
	223	Low-voltage transformer
	224	Generator
	225	Inverter
	226	Uninterrupted power supply (UPS)
	227	Surge protector
	228	Battery charger or rectifier
	229	Battery (all types)
Lamp, bulb or lighting	230	Unclassified lamp or lighting
	231	Lamp-tabletop, floor or desk
	232	Lantern or flashlight
	233	Incandescent lighting fixture

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

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.

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

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

Cooking equipment and heating equipment are calculated by summing non-confined fires identified by equipment involved in ignition and relevant confined fires. Confined fires will be shown if they account for at least 1% of the incidents. **Confined cooking fires** (cooking fires involving the contents of a cooking vessel without fire extension beyond the vessel) are identified by NFIRS incident type 113;

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

Contained trash or rubbish fires with no flame damage to structure or its contents are identified by incident type 118. No cause can be ascertained for these incidents, but they account for a substantial share of the incidents in some occupancies. When appropriate, these fires are generally shown at the bottom of a cause table.

Confined or contained fires (incident type 113-118) are excluded from the remaining estimates. Unknown data is allocated proportionally among non-confined fires. Reports on specific causal factors may include analysis of confined fires and consequently have higher estimates of specific causes.

Intentional fires are identified by fires with a "1" (intentional) in the field "cause." The estimate includes a proportional share of fires in which the cause was undetermined after investigation, under investigation, or not reported. All fires with intentional causes are included in this category regardless of the age of the person involved. Intentional include those of an incendiary nature and those resulting from a deliberate misuse of the heat source. No age restriction is applied.

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

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

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

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

Identified heating equipment (codes 120-199) includes central heat, portable and fixed heaters (including wood stoves), fireplaces, chimneys, hot water heaters, and heat transfer equipment such as hot air ducts or hot water pipes. Heat pumps are not included. Unclassified heating, ventilation and air condition equipment (code 100) is included here because a larger share of the whole category involved heating rather than air conditioning or ventilation equipment. A proportional share of fires involving unclassified heating, ventilation, and air conditioning equipment (code 100) are included here.

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

Torch, burner or soldering iron (codes 331-334) includes welding torches, cutting torches, Bunsen burners, plumber furnaces, blowtorches, and soldering equipment.

Clothes dryer or washer (codes 811, 813 and 814) includes clothes dryers alone, washer and dryer combinations within one frame, and washing machines for clothes.

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

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

Medical equipment (codes 410-419) includes: dental, medical or other powered bed, chair or wheelchair; dental equipment; dialysis equipment; medical monitoring and imaging equipment; oxygen administration equipment; radiological equipment; medical sterilizers, therapeutic equipment and unclassified medical equipment.

Mobile property (vehicle) describes fires in which some type of mobile property was involved in ignition, regardless of whether the mobile property itself burned. Mobile property includes: highway-type vehicles such as cars, trucks, recreational vehicles, and motorcycles; trains, trolleys and subways; boats and ships; aircraft; industrial, agricultural and construction vehicles; and riding lawn mowers, snow removal vehicles and tractors.

Exposures are fires that are caused by the spread of or from another fire. These fires are identified by factor contributing to ignition 71. This code is automatically applied for all fires with exposure numbers greater than zero. As with playing with fire, Fires in which the factor contribution to ignition was undetermined (UU), entered as none (NN) or left blank are considered unknown and allocated proportionally.

Appendix C: Selected Published Incidents

The following are selected published incidents in residential board and care facilities. Included are short articles from the "Firewatch" or "Bi-monthly" columns in *NFPA Journal* or it predecessor *Fire Journal* and incidents from either the large-loss fires report or catastrophic fires report. If available, investigation reports or NFPA Alert Bulletins are included and provide detailed information about the fires.

It is important to remember that this is anecdotal information. Anecdotes show what can happen; they are not a source to learn about what typically occurs.

NFPA's Fire Incident Data Organization (FIDO) identifies significant fires through a clipping service, the Internet and other sources. Additional information is obtained from the fire service and federal and state agencies. FIDO is the source for articles published in the "Firewatch" column of the *NFPA Journal* and many of the articles in this report.

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

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 and estimated $75,000 and $25,000, respectively.

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

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.

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 cause 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 2013 report, *Catastrophic Multiple-Death Fires in 2012*, NFPA Fire Analysis and Research, Quincy, MA.

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 operated 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.

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.

Five die in board and care fire, California
At 11:49 pm on a May night, the fire department was notified of 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). The building was of unprotected wood-frame construction.

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

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 dryer fire, South Carolina
A single sprinkler prevented a fire that started in a clothes dryer from spreading throughout a continuing care complex clubhouse.

The two-story, wood-frame clubhouse, which covered 10,000 square feet (929 square meters), had a steel-frame roof covered by a wooden deck and a rubber roof membrane. The building was protected throughout by a monitored smoke detection system and a wet-pipe sprinkler system.

Grease-laden cotton towels and mops heads used to clean the clubhouse's kitchen floor had been laundered and put in the dryer, the heat from which apparently ignited a greasy residue that remained on the towels after laundering. The fire was confined to the dryer, but the heat activated an overhead sprinkler 2 feet (0.6 meters) away. The sprinkler cooled the dryer and prevented other nearby materials from igniting. Firefighters completed extinguishment. Automatic fire doors operated and kept smoke spread to the area of origin. Because a number of floor drains were not working, water damaged several rooms and the hallway.

Property damage to the facility, valued at $1.5 million, was estimated at $43,000. There were no injuries.

Kenneth J. Tremblay, 2011, "Firewatch," *NFPA Journal*, January/February, 26.

Cigarette fire kills one, Indiana

A 46-year-old man who lived in an eight-unit assisted-living facility died of smoke inhalation during a fire started by improperly disposed of cigarettes.

The one-story, wood-frame apartment building had a wood roof covered by asphalt shingles. A hardwired ionization smoke detector had been installed, but it did not operate.

A passerby noticed the fire and called 911 at 11 a.m. Shortly afterward, firefighters arrived to find that the fire had almost burned itself out. While searching the premises, they discovered the body of the victim, who had succumbed to smoke near the rear doorway of the unit while trying to escape.

Investigators found smoking materials and ashtrays on the victim's bed and floor, and determined that the fire started 4 to 6 hours before it was detected when a smoldering cigarette ignited a recliner's arm rest. The fire spread to a closet and a shelf before burning itself out. Alcohol intoxication appears to have been a contributing factor in the victim's inability to escape.

Kenneth J. Tremblay, 2011, "Firewatch", *NFPA Journal*, July/August, 17.

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.

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.

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.

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.

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.