

**POSSIBLE IMPAIRMENT BY ALCOHOL OR DRUGS
AS A CONTRIBUTING FACTOR
IN HOME FIRE DEATHS**

**Marty Ahrens
November 2009**



**National Fire Protection Association
Fire Analysis and Research Division**

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Abstract

Based on data reported by the fire service, NFPA estimates that possible impairment by alcohol or drugs was a factor contributing to an average of 430, or 15%, of home fire deaths annually in 2003-2006. Although this percentage is lower than that typically found in studies based autopsy reports, data from the fire service about the fire deaths with alcohol involvement provides for a more detailed understanding of the circumstances of the fires and victim demographics. Seventy-one percent of the victims were male. Eighty-eight percent were over 14 and under 65 years of age. Forty-five percent of these deaths resulted from fires started by smoking materials. At the time of the incident, 46% of the victims were in the area of origin and involved in the ignition.

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 department experience survey.

Keywords: fire statistics, home fires, alcohol, residential 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.

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Executive Summary

“Possibly impaired by alcohol” was identified as a contributing factor in an annual average of 350, or 12%, of home fire deaths from 2003 to 2006. “Possibly impaired by other drug or chemical” was a contributing factor in 150, or 5%, of the deaths. In some cases, both of these factors were cited. In all, a possible impairment by either alcohol or drugs was a factor in an average of 430, or 15%, of all home fire deaths.

In this analysis, national estimates derived from the U.S. Fire Administration’s National Fire Incident Reporting System (NFIRS) and NFPA’s annual fire department experience survey are used to show the causes and circumstances of home fire deaths of victims with either “possibly impaired by alcohol” or “possibly impaired by other alcohol or drug” coded as a human factor contributing to fatal injury.

When possible drug or alcohol impairment was a factor contributing to home fire death, 71% of the victims were male. Men were more likely to be drinkers and to drink in larger quantities than women. Eighty-eight percent of these victims were between 15 and 64 years of age, inclusive. Older adults were less likely to be current drinkers or to drink heavily.

In fire deaths in which alcohol or drug impairment was a possible factor, 45% of the deaths resulted from fires started by smoking materials (i.e., lighted tobacco products but not matches or lighters). Heating equipment was involved in 15% of these deaths, and cooking equipment in 14%. Ten percent of the victims died from fires that were intentionally set.

When possible alcohol or drug impairment contributed to the death, 46% of the victims with were in the area of origin at the time the incident began *and* involved in ignition. This was true for 40% of home fire victims overall. Only 37% of the possibly impaired victims were outside of the area of origin when the fire started.

Upholstered furniture was first ignited in 28% of the deaths and mattresses or bedding in 14% of the fatalities when possible alcohol or drug impairment contributed to the fatal injury. These are the leading items first ignited in overall home deaths and, more specifically, in deaths resulting from fires started by smoking. In more than half (53%) of the upholstered furniture deaths with possible alcohol or drug impairment, the victim was involved in the ignition and in the area of origin when the fire started.

Twenty-eight percent of the deaths in which possible alcohol or drug impairment was a factor resulted from fires that started in the living room, family room, or den; 21% from fires that began in a bedroom; and 15% died from fires that started in the kitchen.

When possible alcohol or drug impairment was a contributing factor, 41% of the people who died in home fires were fatally injured while they slept. Nine percent of the victims were acting irrationally compared to only 5% of overall home fire victims.

Properly installed and maintained smoke alarms are necessary to provide a warning of any fire to all occupants. Home fire sprinkler systems provide even greater protection. These systems respond quickly to reduce the heat, flames, and smoke from a fire regardless of what the occupant does. Sprinklers can control or contain the fire until help arrives. More information about home fire sprinklers may be found at <http://www.firesprinklerinitiative.org/>.

Possible Impairment by Alcohol or Drugs as a Contributing Factor in Home Fire Deaths

Introduction

Possible impairment by alcohol or drugs was a contributing factor in 15% of home fire deaths.

“Possibly impaired by alcohol” was identified as a contributing factor in an annual average of 350, or 12%, of home fire deaths from 2003 to 2006. “Possibly impaired by other drug or chemical” was a contributing factor in 150, or 5%, of the deaths. In some cases, both of these factors were cited. In all, a possible impairment by either alcohol or drugs was a factor in an average of 430, or 15%, of all home fire deaths. “Possibly impaired by alcohol or drugs” was cited as a factor contributing to the fire’s *ignition* in slightly more than half (55%) of the deaths in which a possible impairment due to alcohol or drugs (or both) contributed to the *fatal injury*. Determination of possible impairments were made by the fire service and were typically based on evidence at the scene or from interviews. Autopsy results were often unavailable when these reports were filed.

Studies based on autopsy reports have typically found higher percentages of fire victims with alcohol impairment. More than one-third (36%) of Minnesota’s fire victims in 1996-2002 had blood alcohol levels of at least 0.1.¹

This analysis examines the causes and circumstances of home fire deaths in which possible impairment by alcohol or drugs was a factor contributing to the fatal injury and contrasts these deaths with overall home fire fatalities. Other sources are used to provide contextual information about use of alcohol, drugs, and medication.

Methodology

Statistics about U.S. home fire deaths were derived from NFIRS 5.0 and NFPA’s fire department survey.

The fire statistics in this analysis are national estimates of fire deaths reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies. 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 department experience survey.

“Possibly impaired by alcohol” and “possibly impaired by other drug or chemical” are two of the code choices in the field “human factors contributing to injury” in the NFIRS Civilian Casualty module. Details on the methodology are provided in Appendix A and B. Unless otherwise specified, fire statistics are annual averages for 2003-2006.

Except for property use and incident type, fires with unknown or unreported data were allocated proportionally in calculations of national estimates. Fire deaths are rounded to the nearest ten. Sums may not equal totals due to rounding errors.

¹ U.S. Fire Administration/National Fire Data Center, *Case Study: Contribution of Alcohol to Fire Fatalities in Minnesota*, Topical Fire Research Series, Volume 3, Issue 4, July 2003, online at <http://www.usfa.fema.gov/inside-usfa/nfdc/pubs/tfrs.shtm>.

Patterns of Alcohol and Drug Use

CDC found that three-fifths of adults in the U.S. were current drinkers.

Using data from the 2002-2004 National Health Interview Surveys (NHIS), Adams and Schoenborn of the Centers for Disease Control and Prevention (CDC) found that 61% of non-institutionalized U.S. adults were current drinkers who have had at least one drink in the past 12 months.² Two-thirds (68%) of U.S. men were current drinkers, as were 56% of women. Roughly 5% of the adults were considered heavier drinkers. The definition of heavier drinker varied by gender. In this study, women who drank more than seven drinks weekly were considered heavier drinkers, as were men who had more than 14 drinks weekly. Six percent of men and 4% of women were heavier drinkers.

Thirty-one percent of U.S. adults, including 40% of men and 20% of women, had at least five drinks in one day in the past year. Fourteen percent, including 21% of the men and 7% of the women, had at least five drinks on at least one of the past 12 days. The authors note that five or more drinks in one day is another measure of heavy or “at risk” drinking. It is not the same as binge drinking which refers to five or more drinks in one sitting or in a two-hour period. Whites of both genders were more likely than Black or African Americans to drink at all and to be heavier drinkers. The percentage of population who drank at all increased with education and income. However, the highest percentages of heavier drinking and of drinking at least five drinks in one day were found in men with General Educational Development high school equivalency diplomas (GEDs). People who lived in the South were less likely to be drinkers. Midwesterners were more likely to have had at least five drinks in one day.

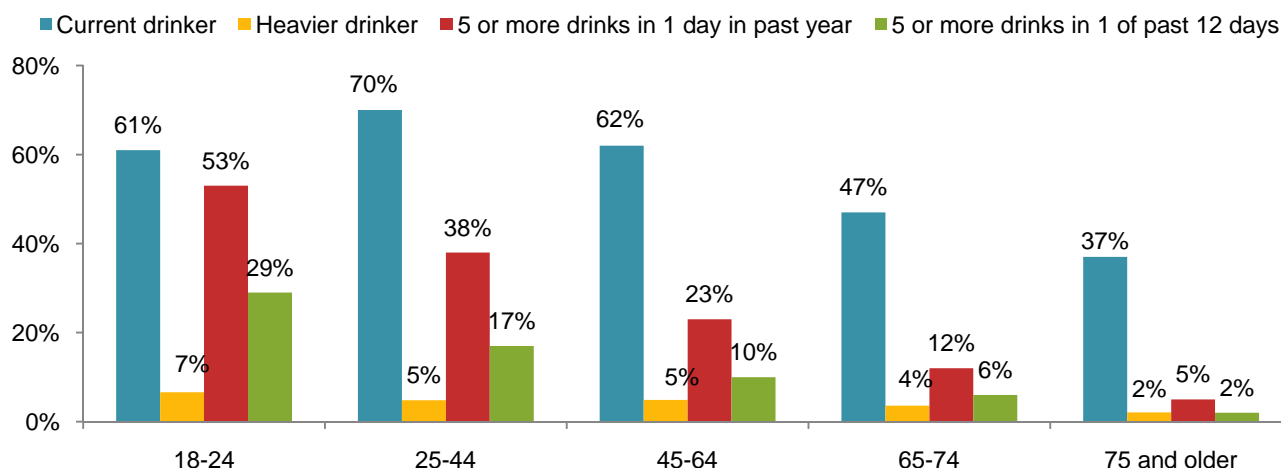
In a 2008 report on fire death rates by state, John Hall noted that a *negative* correlation was found between states with the highest percentage of people over 12 who had used alcohol in the past month and with states with the highest unintentional fire death rates per million population. Most of the high fire death rate states were in the Southeast.³

Adams and Schoenborn also found that the percentage population who have had at least one drink in the previous year peaks at 70% among people 25 to 44 years of age. Figure 1 shows that the portion of drinkers was lower in each successive age group. The percentage of people who are heavier drinkers, and who have more than five drinks in one day in either the past year or the past 12 days peaked among the 18-24 age group. The percentages were generally lower in the successive age groups. The National Survey on Drug Use and Health found that in 2005, 42% of young adults 18-25 years of age had indulged in binge drinking in the past month.

² P.F. Adams and C.A. Schoenborn. *Health Behaviors of Adults: United States, 2002-2004*. Centers for Disease Control and Prevention. National Center for Health Statistics, Vital Health Statistics, 10(230), 2006, Chapter 3.

³ John R. Hall, Jr. *U.S. Unintentional Fire Death Rates by State*, Quincy, MA: 2008, pp. 3-4.

Figure 1. Drinking Patterns by Age Group among U.S. Adults 18 and Older in 2002-2004



Source: Adams and Schoenborn, 2006.

One-fifth of the population had at least three different prescriptions in the past month.

CDC researchers also found that 20% of the non-institutionalized U.S. population had three or more drugs prescribed in the previous month during 2001 to 2004. Almost half had at least one drug prescription.⁴ The rate of visits per 100 population to the doctor or hospital outpatient department in 2004-2005 with at least one medication prescribed was 20 for narcotic analgesics for pain relief and 35 for antidepressants. In a 2005 poll done for the National Sleep Foundation, W B & A Market Research found that 7% of the U.S. population used prescription medications at least a few nights a month to help them sleep; 9% used over-the-counter sleep aids.⁵

The National Survey on Drug Use and Health discovered that in 2005, 8% of the population had used an illicit drug at least once in the past month.⁶ Six percent had used marijuana, 1% had used cocaine, and less than 1% had used each of the other types of illicit drugs listed. Three percent had used prescription psychotherapeutic drugs for non-medical purposes. Two percent used prescription pain relievers, 1% used tranquilizers, and less than 1% used stimulants or sedatives. Fifty-two percent had consumed alcohol in the past month while 23% had engaged in binge drinking.

⁴ Centers for Disease Control and Prevention, National Center for Health Statistics. *Health, United States, 2008*, Hyattsville, MD: 2009, p. 5, p. 366.

⁵ W B & A Market Research. *2005 Sleep in America Poll: Summary of Findings*, prepared for the National Sleep Association, 2005, p. 33.

⁶ U.S. Census Bureau. *Statistical Abstract of the United States: 2008* (127th Edition), Washington, DC 2007, Table 195. "Drug Use by Type of Drug and Age Group."

Fire Victims with Possible Alcohol or Drug Impairment

Almost three-quarters of the victims with possible alcohol or drug impairment were male.

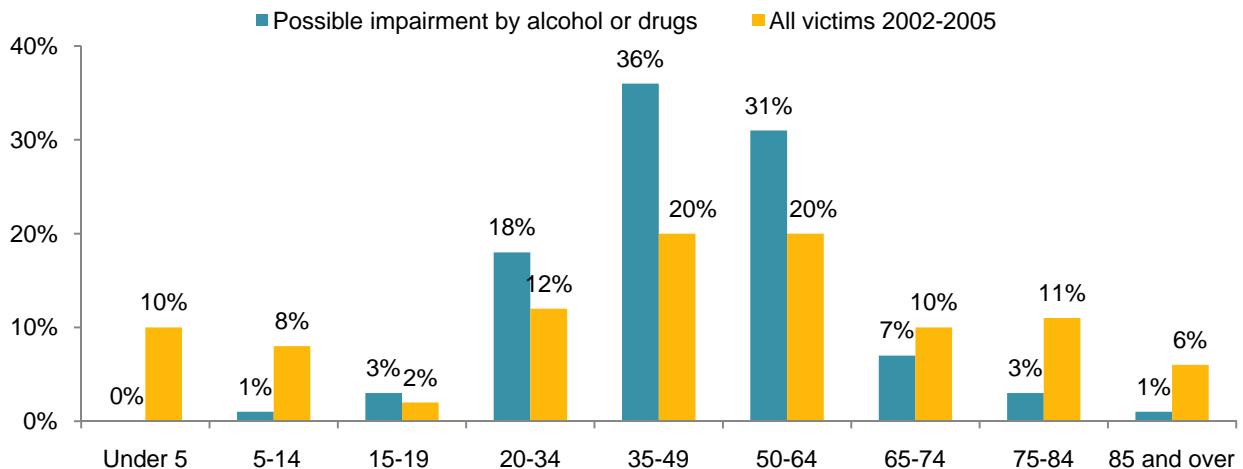
Table 1 shows that when a possible impairment by alcohol or drugs contributed to the fatal fire injury, 71% of the victims were male. This is 15 percentage points higher than the 56% of male home fire victims overall and consistent with the findings that men are more likely to drink at all and to drink heavily than are women..

Table 2 shows that 78% of the victims with possible alcohol or drug impairment as a contributing factor were fatally injured in fires in one- or two-family homes. Twenty-two percent died as a result of apartment fires. Only 16% of all home fire victims died as a result of apartment fires while 84% were killed by fires in one-or two-family homes.

Children and older adult victims were less likely to have been impaired by alcohol or drugs.

Figure 2 shows that compared to overall home fire deaths, a possible impairment by alcohol or drugs was more likely to have contributed to the deaths of people between 15 and 64 (88% of the victims), inclusive, than to have contributed to the deaths of young children or older adults. None of the victims with this possible impairment factor were under five although young children in this age group accounted for 10% of overall home fire victims. Table 3 shows that possible impairment by alcohol or drugs was a contributing factor in the deaths of only 11% of the adults 65 or over. This age group accounted for 27% of overall home fire deaths.⁷ These victim age patterns are consistent with the age patterns of drinking behavior reported by Adams and Schoenborn in their 2006 report on adult health behaviors. (See Figure 1.)

Figure 2. Ages of Home Fire Victims with Possible Impairment by Alcohol or Drugs as a Factor Contributing to Fatal Injury: 2003-2006

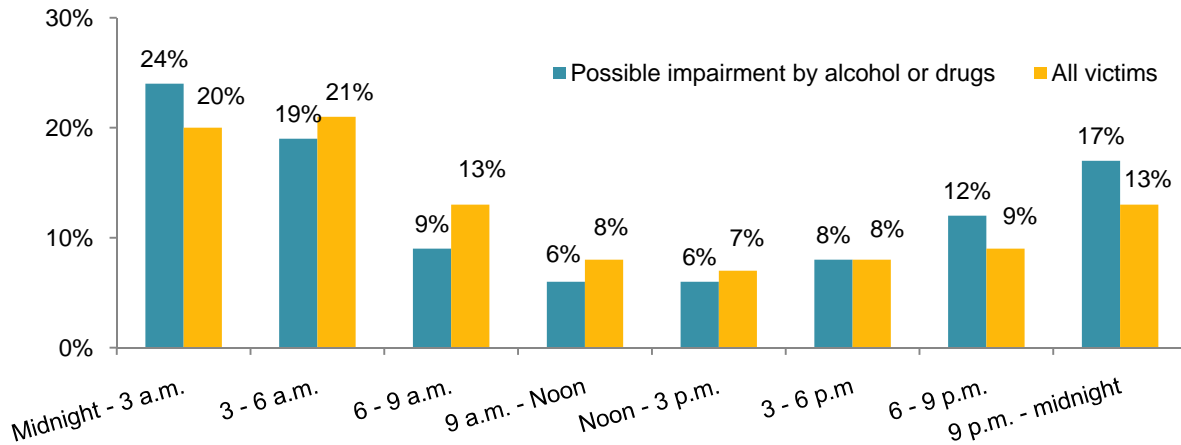


⁷ Jennifer D. Flynn. *Characteristics of Home Fire Victims*, Quincy, MA: NFPA, 2008, p. 8.

43% of the deaths with possible alcohol or drug impairment as a contributing factor resulted from fires reported between midnight and 6:00 a.m.

Table 4 shows that when possible impairment by alcohol or drugs was a factor contributing to home fire death, 43% of every five such deaths occurred during the hours of midnight to 6:00 a.m. Figure 3 shows that this is consistent with the 42% of home deaths overall that occurred during these hours.

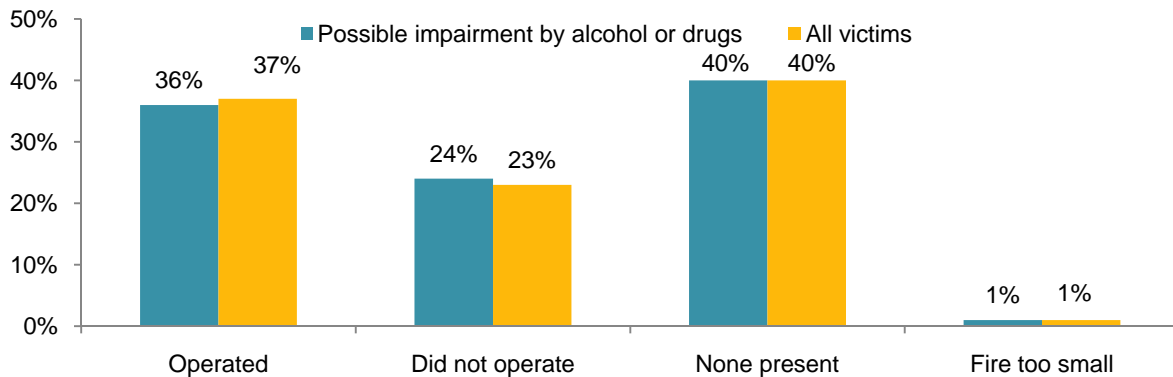
Figure 3. Home Fire Victims with Possible Impairment by Alcohol or Drugs as a Factor Contributing to Fatal Injury, by Hour of Alarm: 2003-2006



Little difference is seen in smoke alarm status when possible impairment was a factor in fatal injury and in home fire deaths overall.

Sixty percent of the victims of fatal home fires were killed in properties with at least one smoke alarm present, the same percentage seen for victims in whom possible impairment by alcohol or drugs played a role.⁸ Figure 4 shows that the performance of the smoke alarms for possible impairment victims and the home fire victims overall differed by at most one percentage point. Table 5 provides estimates of smoke alarm status for victims who were possibly impaired.

Figure 4. Home Fire Victims with Possible Impairment by Alcohol or Drugs as a Factor Contributing to Fatal Injury, by Smoke Alarm Status: 2003-2006



⁸ Marty Ahrens. *Smoke Alarms in U.S. Home Fires*, Quincy, MA: NFPA, 2009, p. 3.

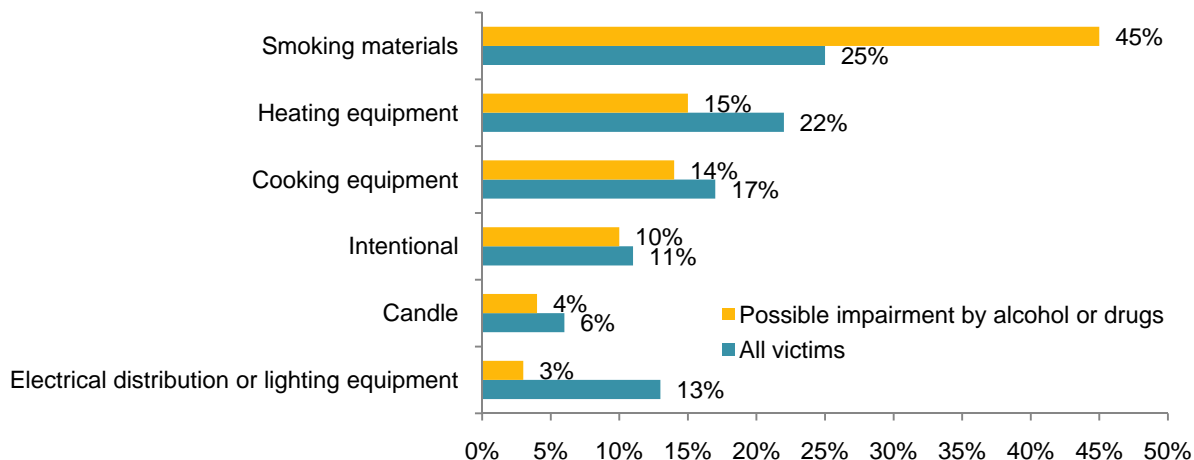
In her 2001 literature review, Dorothy Bruck noted that several factors, including alcohol, marijuana, and medication can decrease the likelihood of waking to a sounding smoke alarm. Other factors such as sleep deprivation, background noise, and the high frequency hearing loss that often accompanies aging also lower the probability of waking. Children are also less likely to wake to these signals. Arousal thresholds vary widely from individual to individual.⁹ In a 2004 paper, Ball and Bruck found that even a blood alcohol concentration of 0.05 significantly reduced the likelihood of waking to a standard smoke alarm or any of the alternate auditory alarm signals.¹⁰ It is doubtful that possible impairment by alcohol would be cited as a factor contributing to the fatal injury when the blood alcohol level was below the legal limit.

Almost half of the victims with possible alcohol or drug impairment died from fires started by smoking materials.

Figure 5 and Table 6 show that in fire deaths in which possible impairment by alcohol or drugs was a factor, 45% of the deaths were the result of fires started by smoking materials (i.e., lighted tobacco products but not matches or lighters), compared to 25% of all home fire deaths. Heating equipment was involved in 15% of these possible alcohol or drug impairment deaths, and heating equipment was involved in 22% of these possible alcohol or drug impairment deaths, and cooking equipment in 14%. Ten percent of these victims died in fires that were intentionally set.

Figure 5 and Table 6 were derived from several different fields in NFIRS. When the causes come from different fields, they are not mutually exclusive. More detail is provided about equipment involved in ignition in Table 7, heat sources in Table 8, and factor contributing to ignition in Table 9.

Figure 5. Home Fire Victims with Possible Impairment by Alcohol or Drugs as a Factor Contributing to Fatal Injury, by Major Fire Causes: 2003-2006



⁹ Dorothy Bruck, “The Who, What, Where and Why of Waking to Fire Alarms: A Review,” *Fire Safety Journal*, Volume 36 (2001), pages 623-639.

¹⁰ Michelle Ball and Dorothy Bruck, “The Effect of Alcohol upon Response to Fire Alarm Signals in Sleeping Adults,” *Proceedings of the 3rd International Symposium on Human Behavior in Fire 2004*, London, England, Interscience Communications Limited 2004, pp. 291-301.

When equipment was mentioned as the cause, it means the equipment provided the heat of ignition. Table 7 shows that fixed or portable space heaters were involved in 12% of the deaths when possible alcohol or drug impairment was a factor contributing to the fatal injury.

Table 9 shows that a heat source too close to something combustible was a factor in one-fifth (18%) of the fire deaths in which possible alcohol or drug impairment was a factor.

The leading items first ignited in these deaths were upholstered furniture and mattresses or bedding.

Figure 6 shows that the two leading items first ignited in fire deaths with possible alcohol or drug impairment as a contributing factor were the same as for home fires overall. Table 10 shows that when possible impairment by alcohol or drugs was a contributing factor to the fatal injury, upholstered furniture was first ignited in 28% of the deaths while mattresses or bedding were first ignited in 14%. These items are also the leading items first ignited in overall fatal home fire injuries resulting from smoking.¹¹ In 53% of the upholstered furniture deaths with possible alcohol or drug impairment as a contributing factor, the victim was involved in the ignition and in the area of origin. In an additional 10%, the victim was in the area of origin but not involved in ignition.

Figure 6. Home Fire Victims with Possible Impairment by Alcohol or Drugs as a Factor Contributing to Fatal Injury, by Item First Ignited: 2003-2006

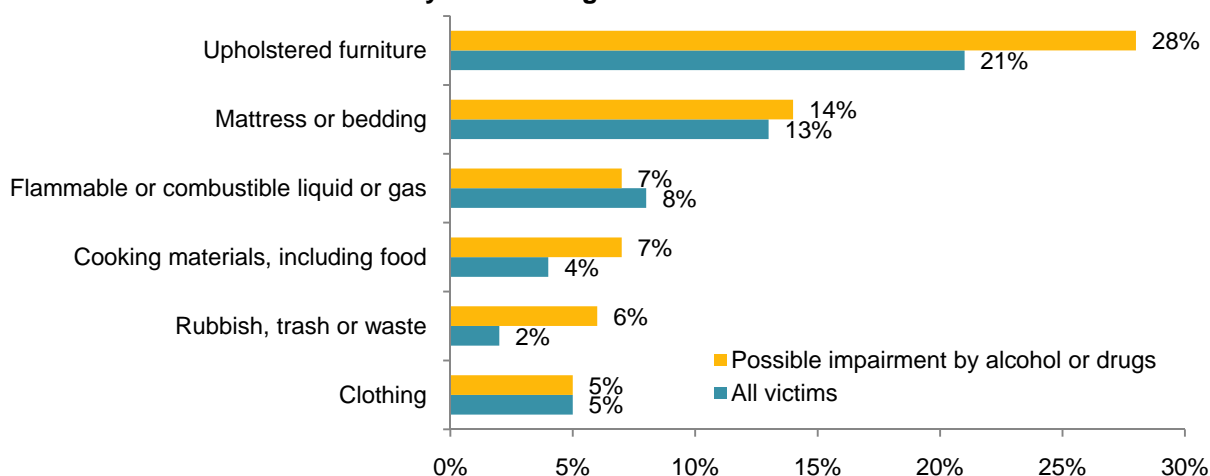


Table 11 shows that when possible alcohol or drug impairment was a contributing factor, 56% of the victims were fatally injured in fires in which the item first ignited was made of some type of fabric or textile.

¹¹ John R. Hall, Jr., *U.S Smoking Material Fire Problem*, Quincy, MA: NFPA, p. 18, 2008.

One-quarter of the possible alcohol or drug impairment factor deaths resulted from fires beginning in the living room, family room or den and another quarter from fires starting in the bedroom.

Table 12 shows that when possible impairment by alcohol or drugs contributed to the fatality, 28% of the deaths resulted from fires that started in a living room, family room, or den; 21% from fires that began in the bedroom; and 15% died from fires that started in the kitchen.

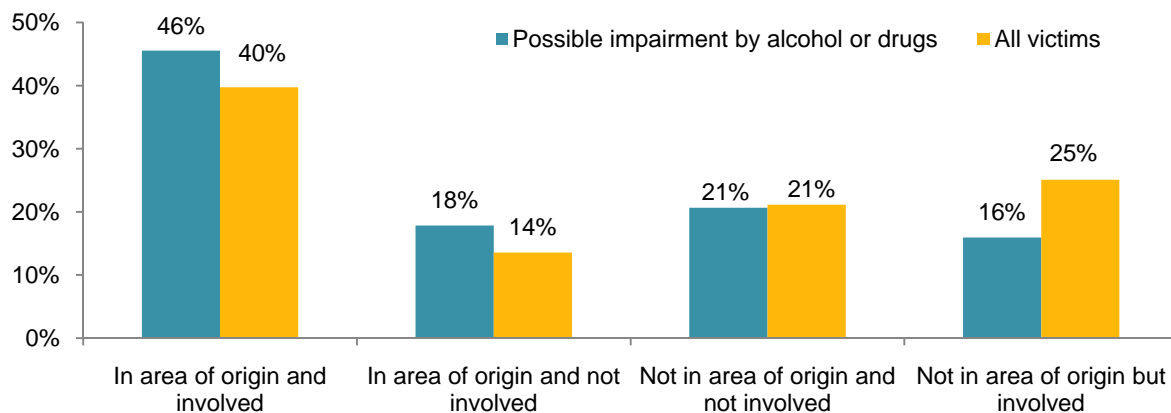
Almost one-third of these victims died in fires with flame damage confined to the room of origin.

Table 13 shows that when possible alcohol or drug impairment contributed to the fatal injury, 8% of the victims died from fires that were confined to the object of origin and 23% died from fires that spread beyond the first object but were confined to the room of origin. Combining the two, 30% of these victims died from incidents in which fire spread was limited to the room of origin. This is eight percentage points higher than the 22% of overall home fire deaths resulting from fires with flame damage confined to the room where the fire started.

Almost two-thirds of the victims with possible alcohol or drug impairment as a contributing factor were in the area of origin when the fire started.

Table 14 shows that when possible alcohol or drug impairment contributed to the death, 46% of the victims were in the area of origin at the time the incident began and involved in ignition. This was true for 40% of home fire victims overall. Figure 7 shows that 18% of the possible alcohol or drug impairment victims were in the area of origin but not involved in ignition. Only 37% were not in the area of origin.

Figure 7. Home Fire Victims with Possible Impairment by Alcohol or Drugs as a Factor Contributing to Fatal Injury, by Victim Location and Involvement in Ignition: 2003-2006

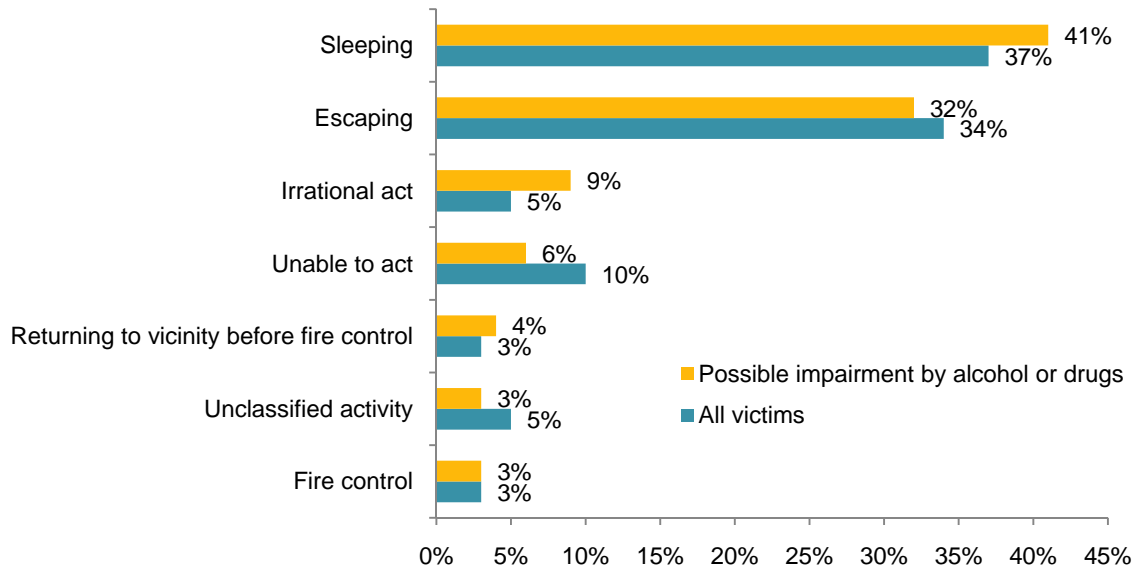


When possible alcohol or drug impairment contributed to the death, two-fifths of the victims were sleeping when fatally injured.

Table 15 shows that when possible alcohol or drug impairment was a contributing factor, 41% of the people who died in home fires were fatally injured while they slept. Figure 8 shows 9% of the victims were acting irrationally compared to only 5% of overall home fire victims. In his 2004 article on the number of home fire deaths that might be prevented if people had more time to escape, John Hall used narrative information from NFPA’s files to provide more information

about how some of the NFIRS definitions were used. He noted that “irrational act” and “unable to act” were rarely due to the behavioral or incapacitating effects of smoke or fire.¹²

Figure 8. Home Fire Victims with Possible Impairment by Alcohol or Drugs as a Factor Contributing to Fatal Injury, by Activity when Injured: 2003-2006



Symptom patterns were similar for victims who were possibly impaired by alcohol or drugs and overall home fire victims.

Table 15 shows that, according to fire department reports, when possible alcohol or drug impairment was a factor contributing to the fatal injury, 45% of the home fire victims had suffered burns and smoke inhalation. This was very similar to the 46% of overall home fire victims showing both symptoms.

Possible alcohol impairment was a factor in 82% of the deaths in which possible impairment by either alcohol or drugs, or both, contributed to the fatal fire injury

Table 16 shows that when possible impairment by alcohol or drugs was a factor contributing to the fatal injury, 82% of the victims were possibly impaired by alcohol, while 36% were possibly impaired by some other drug, chemical, or medication. Sleep was a contributing factor in 39% of these deaths, unconscious in 7%, physical disability in 6%, and possible mental disability was also a factor in 6% of the deaths in which possible impairment by alcohol or drugs was a factor.

Fire Safety

Properly installed and maintained smoke alarms are necessary to provide a warning of any fire to all occupants. Home fire sprinkler systems provide even greater protection. These systems respond quickly to reduce the heat, flames, and smoke from a fire even if the individual does not immediately respond. They can control or contain the fire until help arrives. More information about home fire sprinklers may be found at <http://www.firesprinklerinitiative.org/>.

¹² John R. Hall, Jr., "How Many People Can Be Saved from Home Fires if Given More Time to Escape?" *Fire Technology*, 40(2), 2004, pp. 117-126.

Table 1.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Gender
2003-2006 Annual Averages

Gender	Civilian Deaths
Male	300 (71%)
Female	120 (29%)
Total	430 (100%)

Table 2.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Occupancy
2003-2006 Annual Averages

Occupancy	Civilian Deaths
One-or two-family home	330 (78%)
Apartment	100 (22%)
Total	430 (100%)

Table 3.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Age Group
2003-2006 Annual Averages

Age Group	Civilian Deaths
Under 5	0 (0%)
5 - 14	0 (1%)
15 - 19	10 (3%)
20 - 34	80 (18%)
35 -49	150 (36%)
50 - 64	130 (31%)
65- 74	30 (7%)
75 -84	10 (3%)
85 and over	10 (1%)
Total	430 (100%)
65 and over	46 (11%)

Note: Deaths are rounded to the nearest 10. An entry of zero may mean zero or the average rounded to zero. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 4.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Hour of Alarm
2003-2006 Annual Averages

Hour of Alarm	Civilian Deaths	
Midnight - 2:59 a.m.	100	(24%)
3:00 - 5:59 a.m.	80	(19%)
6:00 - 8:59 a.m.	40	(9%)
9:00 - 11:59 a.m.	20	(6%)
Noon - 2:59 p.m.	20	(6%)
3:00 - 5:59 p.m.	30	(8%)
6:00 - 8:59 p.m.	50	(12%)
9:00 - 11:59 p.m.	70	(17%)
Total	430	(100%)
Average	50	(13%)

Table 5.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Smoke Alarm Status
2003-2006 Annual Averages

Smoke Alarm Status	Civilian Deaths	
Present	260	(60%)
<i>Operated</i>	150	(36%)
<i>Did not operate</i>	100	(24%)
<i>Fire too small to operate</i>	10	(1%)
None present	170	(40%)
Present	430	(100%)

Note: Deaths are rounded to the nearest 10. An entry of zero may mean zero or the average rounded to zero. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 6.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Major Cause
2003-2006 Annual Averages

Major Cause*	Civilian Deaths	
Smoking materials (lighted tobacco products)	190	(45%)
Heating equipment	60	(15%)
Cooking equipment	60	(14%)
Intentional	40	(10%)
Candle	20	(4%)
Electrical distribution or lighting equipment	10	(3%)

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

Table 7.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Equipment Involved in Ignition
2003-2006 Annual Averages

Equipment Involved in Ignition*	Civilian Deaths	
No equipment involved	250	(59%)
Range or cooktop	60	(14%)
Fixed or portable space heater	50	(12%)
Air conditioner	10	(3%)
Lamp, bulb or lighting equipment	10	(3%)
Furnace or central heating unit	10	(2%)
Oxygen administration equipment	10	(2%)
Stereo equipment	10	(1%)
Wood burning kit	10	(1%)
Other known equipment	10	(3%)
Total	430	(100%)

*Fire deaths in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among deaths with known equipment involved. Fire deaths in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Fires in which the equipment was partially unclassified (i.e., unclassified kitchen or cooking equipment, unclassified heating, cooling or air condition equipment, etc.) were allocated proportionally among fires that grouping (kitchen or cooking equipment; heating, cooling or air conditioning equipment, etc.).

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 8.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Heat Source
2003-2006 Annual Averages

Heat Source	Civilian Deaths	
Smoking materials	190	(45%)
Radiated or conducted heat from operating equipment	40	(10%)
Unclassified heat from powered equipment	30	(8%)
Hot ember or ash	30	(6%)
Unclassified heat source	30	(6%)
Lighter	20	(5%)
Candle	20	(4%)
Unclassified hot or smoldering object	20	(4%)
Spark, ember or flame from operating equipment	20	(4%)
Arcing	10	(3%)
Other known heat source	20	(5%)
Total	430	(100%)

* The statistics on smoking materials, matches, lighters, candles, and flames or torches used for lighting include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material.

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 9.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Factor Contributing to Ignition
2003-2006 Annual Averages

Factor Contributing to Ignition	Civilian Deaths	
Abandoned or discarded material	130	(31%)
Heat source too close to combustible	80	(18%)
Unclassified misuse of material	70	(17%)
Unclassified factor contributed to ignition	50	(12%)
Equipment unattended	30	(7%)
Electrical failure or malfunction	30	(6%)
Flammable liquid or gas spilled	10	(3%)
Flammable liquid used to kindle fire	10	(3%)
Equipment not being operated properly	10	(2%)
Unclassified operational deficiency	10	(2%)
Accidentally turned on or not turned off	10	(1%)
Other known factor	20	(6%)
Total entries*	460	(108%)
 Total	 430	 (100%)

*Multiple entries are allowed resulting in sums greater than totals. Fire deaths in which the factor contributing to ignition was coded as "none," unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition.

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 10.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Item First Ignited
2003-2006 Annual Averages

Item First Ignited	Civilian Deaths	
Upholstered furniture	120	(28%)
Mattress or bedding	60	(14%)
Flammable or combustible liquid or gas	30	(7%)
Cooking materials, including food	30	(7%)
Rubbish, trash or waste	30	(6%)
Clothing	20	(5%)
Multiple items first ignited	20	(4%)
Unclassified furniture or utensil	20	(4%)
Floor covering rug, carpet or mat	10	(3%)
Structural member or framing	10	(3%)
Interior wall covering, excluding drapes	10	(3%)
Magazine, newspaper or writing paper	10	(2%)
Unclassified soft goods or wearing apparel	10	(2%)
Cabinetry	10	(2%)
Unclassified structural component or finish	10	(1%)
Unclassified item first ignited	10	(1%)
Other known item	30	(7%)
Total	430	(100%)

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 11.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Type of Material First Ignited
2003-2006 Annual Averages

Type of Material First Ignited	Civilian Deaths	
Fabric or textile	240	(56%)
Multiple types of material	30	(7%)
Sawn wood, including all finished lumber	30	(7%)
Paper, including cellulose and waxed paper	10	(3%)
Unclassified flammable or combustible liquid	10	(3%)
Fat, grease, butter, margarine or lard	10	(2%)
Unclassified wood or paper	10	(2%)
Gasoline	10	(2%)
Unclassified type of material first ignited	10	(2%)
Fiberboard, particleboard, or hardboard	10	(2%)
Plastic	10	(2%)
Unclassified flammable gas	10	(2%)
Food, excluding fat and grease	10	(2%)
Other known type	20	(5%)
Not required*	10	(3%)
Total	430	(100%)

* In Version 5.0 of NFIRS, type of material first ignited is not required when organic materials such as vegetation or food, or general items such as electrical wire, cable insulation, rubbish, waste, dust, etc. were first ignited.

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 12.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Area of Fire Origin
2003-2006 Annual Averages

Area of Fire Origin	Civilian Deaths	
Living room, family room or den	120	(28%)
Bedroom	90	(21%)
Kitchen	70	(15%)
Unclassified function area	60	(14%)
Unclassified structural area	10	(3%)
Exterior balcony or unenclosed porch	10	(2%)
Wall assembly or concealed space	10	(2%)
Crawl space or substructure space	10	(2%)
Unclassified means of egress	10	(1%)
Unclassified area of origin	10	(1%)
Multiple areas of origin	10	(1%)
Other known area	40	(9%)
Total	430	(100%)

Table 13.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Extent of Flame Damage
2003-2006 Annual Averages

Extent of Flame Damage	Civilian Deaths	
Confined to object of origin	30	(8%)
Confined to room of origin	100	(23%)
Confined to floor of origin	50	(11%)
Confined to building of origin	210	(50%)
Extended beyond building of origin	40	(9%)
Total	430	(100%)

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 14.
Fatal Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Victim's Location at Time of Incident
2003-2006 Annual Averages

Victim's Location at Time of Incident	Civilian Deaths	
In area of origin and not involved	80	(18%)
Not in area of origin and not involved	90	(21%)
Not in area of origin but involved	70	(16%)
In area of origin and involved	190	(46%)
Unclassified	0	(1%)
Total	430	(100%)

Table 15.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Activity when Injured
2003-2006 Annual Averages

Activity when Injured	Civilian Deaths	
Sleeping	180	(41%)
Escaping	140	(32%)
Irrational act	40	(9%)
Unable to act	20	(6%)
Returning to vicinity of fire before control	20	(4%)
Unclassified activity	10	(3%)
Fire control	10	(3%)
Rescue attempt	10	(2%)
Total	430	(100%)

Table 16.
Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Primary Apparent Symptom
2003-2006 Annual Averages

Primary Apparent Symptom	Civilian Deaths	
Burns and smoke inhalation	190	(45%)
Smoke inhalation	180	(42%)
Thermal burns only	20	(4%)
Cardiac arrest	10	(3%)
Unclassified symptom	10	(2%)
Alcohol impairment	10	(1%)
Gunshot or projectile wound	10	(1%)
Other known symptom	10	(1%)
Total	430	(100%)

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 17.
Fatal Home Fire Victims with Possible Impairment by Alcohol or Drugs
as a Factor Contributing to Fatal Injury, by Human Factors Contributing to Fatal Injury
2003-2006 Annual Averages

Other Human Factor*	Civilian Deaths	
Possibly impaired by alcohol	350	(82%)
Asleep	160	(39%)
Possibly impaired by other drug or chemical	150	(36%)
Unconscious	30	(7%)
Physically disabled	20	(6%)
Possibly mentally disabled	20	(6%)
Unattended or unsupervised person	10	(1%)
Total deaths	430	(100%)
Total entries*	750	(176%)

*Multiple human factors contributing to injury may be entered. This table is based on the deaths in which possible alcohol or drug impairment was a factor and provides estimates of the frequency of other factors mentioned for the same deaths.

Note: Deaths are rounded to the nearest 10. Percentages are calculated prior to rounding. Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Appendix A.

How National Estimates Statistics Are Calculated

The statistics in this analysis are estimates derived from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual survey of U.S. fire departments. NFIRS is a voluntary system 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 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.

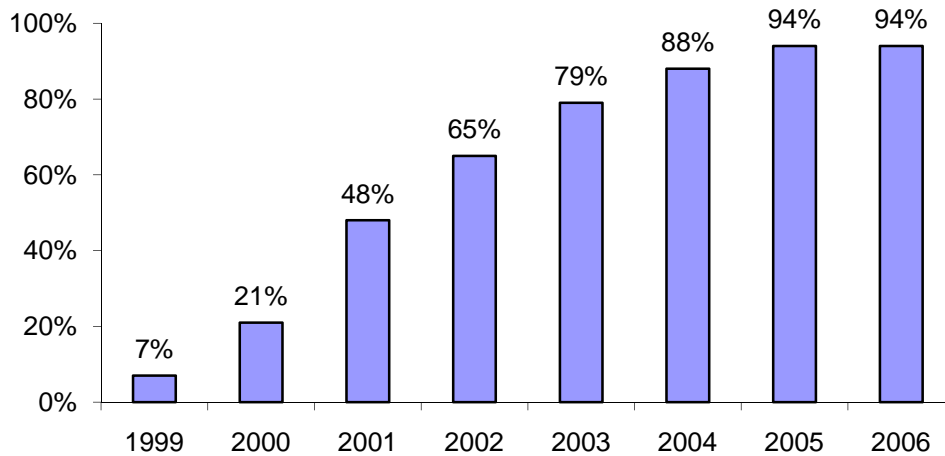
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific 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 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 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 1. Fires Originally Collected in NFIRS 5.0 by Year



For 2002 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 (typically 10-20%). 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.

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, 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.

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 electrical failure or malfunction (factor contributing to ignition 30-39) are combined and shown as “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.

Type of Material First Ignited (TMI). This field is required only if the Item First Ignited falls within the code range of 00-69. NFPA has created a new code “not required” for this field that is applied when Item First Ignited is in code 70-99 (organic materials, including cooking materials and vegetation, and general materials, such as electrical wire, cable insulation, transformers, tires, books, newspaper, dust, rubbish, etc..) and TMI is blank. The ratio for allocation of unknown data is:

(All fires – TMI Not required)

(All fires – TMI Not Required – Undetermined – Blank)

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

All fires

(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. (Confined fire incident types are not discussed here)

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	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
Wiring, switch or outlet	210	Unclassified electrical wiring
	211	Electrical power or utility line
	212	Electrical service supply wires from utility
	214	Wiring from meter box to circuit breaker
	216	Electrical branch circuit
	217	Outlet, receptacle
	218	Wall switch
Power switch gear or overcurrent protection device	215	Panel board, switch board, circuit breaker board
	219	Ground fault interrupter
	222	Overcurrent, disconnect equipment
	227	Surge protector
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

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.”

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.

Inflation. Property damage estimates are not adjusted for inflation unless so indicated.

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 department 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 descriptions of fatal fires that mentioned possible impairment by alcohol, drugs or medication. Included are short articles from the “Firewatch” or “Bi-monthly” columns in *NFPA Journal* or its predecessor *Fire Journal* and incidents from either the large-loss fires report or catastrophic fires report.

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.

Four Dead in Home Lacking Operating Smoke Alarms, Ohio

Two smoke alarms, one located on the second floor and another in a third-floor attic space, were found without batteries upon investigation of a house fire that killed four people. The fire was started unintentionally when food left on an operating gas-fired stove ignited and spread to cabinets and other combustibles. Two victims were located on the first floor, and two others, a two-year-old boy and his mother, were found in the second-floor hallway.

The fire occurred in one of two units of a duplex, two and one-half stories in height and measuring 36 feet (11 meters) by 28 feet (8.5 meters). Constructed of wood framing with an asphalt shingle roof, the exterior siding was vinyl. The battery-operated smoke alarms were found in the attic and another in debris of the second floor hallway. Neither smoke alarm had batteries within the unit. There were no sprinklers.

Reported to the fire department at 11:21 p.m., firefighters responded within five minutes of the 911 call made by neighbors. On arrival, fire could be seen coming from a failed kitchen window at the rear of the building and all doors to the home were secured. Forcing open the front door, firefighters advanced a hose line from the unburned area toward the kitchen located in the rear. Two victims were found in the living room, a 68-year-old male and a 57-year-old female, located near the stairs to the upper floor. During the search of the home, two more victims were located on the second floor including a 26-year-old female. She was located in the hallway between two bedrooms and was found kneeling over her 2-year-old son.

Investigators determined an aluminum pan had been placed on the rear burner of the gas-fired stove and left unattended. The burning food and melted aluminum pan appeared to ignite wooden cabinets overhead and spread from the kitchen to the dining room and living room, traveling vertically up the stairs to the second floor. The home, valued at \$75,000, with contents of \$30,000, was a total loss. All the victims died of smoke inhalation and the adult male victim may have been impaired by alcohol at the time of the incident.

Kenneth J. Tremblay, 2007, “Firewatch,” *NFPA Journal*, September/October 28-29.

Outside Fire Spreads to Porch and Concealed Space of Home, Oklahoma

A 21-year old male playing with fire on a porch apparently ignited combustibles that smoldered and reignited before spreading undetected. Fire burning in concealed spaces of the porch roof and into the interior of the home allowed it to spread undetected. The occupant died of smoke inhalation and was under the influence of alcohol at the time of his death.

The fire occurred in a two-story, single-family dwelling that had an interconnected hardwired smoke detection system... Investigators believe the fire spread to concealed spaces above the ceiling, delaying detection.

Fire spreading in a false ceiling in the living space also allowed vertical fire spread to the second floor and attic. The home valued at \$70,000 with \$10,000 in contents was a total loss. There were no firefighter injuries during the incident.

Kenneth J. Tremblay, 2007, "Firewatch," *NFPA Journal*, July/August 26-27.

Smoking Material Fire Kills Two, Illinois

A 32-year-old woman and her 4-year-old daughter died in their single-family home when a fire started by careless smoking or the careless disposal of smoking materials spread from the first-floor family room throughout the house.

Smoke alarms had been installed on the first and second floors of the two-story, wood-frame house, and a single sprinkler fed by a domestic water source protected the furnace room in the basement.

A neighbor saw smoke coming from the second floor of the house and called 911 at 3:54 p.m. By the time firefighters arrived, the fire was well advanced on all floors, and they were unable to reach the two victims.

Investigators determined that the fire began in a sleep sofa. It consumed the mattress and structural framing before burning through the floor into the basement and spreading smoke and superheated gases throughout the dwelling.

The woman, who had picked her child up at pre-school at noon and returned home, was impaired by alcohol or some other substance and was unable to respond to the emergency.

Kenneth J. Tremblay, 2006, "Firewatch," *NFPA Journal*, January/February, 18.

Candle Fire in Basement Apartment Kills Man, Nebraska

A candle left burning on the floor in a rented basement room that had no smoke alarm started a fire that eventually burned itself out, but not before fatally injuring the room's occupant.

The fire occurred in a single-story, wood framed house with two living units on the first floor. Each unit also had a bedroom in the basement that was rented out to a single occupant. The only smoke alarm in the unsprinklered house, which measured 50 feet (15.2 meters) by 20 feet (6 meters), was in the first-floor hallway near sleeping areas.

One of the basement renters smelled smoke and alerted the other occupants before calling the fire department at 6:08 a.m. He did not know whether the other basement renter, a 28-year-old man, was home at the time but told first responders he might be.

Fire crews arriving six minutes later found light smoke coming from the building but could see no fire. When they searched the lower level, they found that the blaze in the victim's room had nearly extinguished itself. Searching further, they found the man leaning against a clothes dryer in his room, overcome by smoke.

Investigators determined that the candle ignited a sofa and that the fire spread to a table and other combustibles, producing heavy smoke. The coroner's report stated that the victim died of severe carbon monoxide poisoning and had levels of an illegal substance and alcohol in his blood at the time of his death. All the house's other occupants, who were sleeping at the time, escaped unharmed.

Damage to the \$200,000 structure was approximately \$6,000.

Kenneth J. Tremblay, 2006, "Firewatch," *NFPA Journal*, January/February, 18.

Embers From Charcoal Grill Ignite Deadly Fire, Massachusetts

A 19-year-old man died when embers from a charcoal grill started a fire on a third-floor porch that spread into his apartment, trapping him.

The three-story, wood-frame building, which measured 60 feet by 40 feet (18 meters by 12 meters), contained three apartments. Local smoke alarms installed outside the apartments' kitchens and in the building's rear stairwell operated, waking the occupants of a rear bedroom, allowing them to escape. There were no sprinklers.

A neighbor called 911 to report the fire around 6:00 a.m. Once firefighters extinguished the blaze investigators determined that embers from the charcoal grill ignited a couch on the porch. The fire grew rapidly, breaking through the kitchen door and spreading into the apartment hall to the bedrooms. A fire wall kept the blaze from spreading to an attached building.

The building, valued at \$990,000, and its contents, valued at \$48,000, sustained \$480,000 and \$18,000 in property damage, respectively. Alcohol intoxication was cited as a factor in the victim's death. One firefighter was injured.

Kenneth J. Tremblay, 2008, "Firewatch," *NFPA Journal*, May/June, 21.

Cigarette Starts Fatal Fire, Minnesota

A 67-year-old woman died as a result of a fire in her apartment that began when a cigarette she dropped ignited paper on the floor. The three-story, wood-frame apartment building, which was 325 feet (99 meters) long and 75 feet (23 meters) wide, had a wood truss roof that was covered by asphalt shingles.

A central station alarm company monitored smoke detectors in the common hallways and heat detectors in all the units. The heat detection system operated properly. Hardwired smoke detectors had also been installed in the apartments, but they did not have battery backup. The building had a standpipe connection but no sprinklers.

Firefighters responding to a 5:27 a.m. call from the alarm company found smoke coming from a rear-facing balcony on the third floor. The first-due engine company connected to a hydrant to support the standpipe system, while other crews attached a hose line to the standpipe and advanced to the apartment of origin. Forcing the door, they entered the one-bedroom unit and found flames travelling across the ceiling. They played the hose stream on the flames and extinguished the fire.

Firefighters found the victim lying on the floor against her bed, unconscious but still breathing. They took her to the hospital, where doctors discovered she had suffered smoke inhalation and second- and third-degree burns to her right side, upper torso, and face. She was transferred to a burn center but died a week later.

Investigators determined that the fire began in the living room near an upholstered chair when the woman dropped a cigarette on paper on the floor nearby. The resulting fire spread to the chair and other items before it was extinguished.

Autopsy results indicated that the woman had a blood alcohol level of .189, which may have contributed to her death. The investigators believe she fell asleep, dropped her cigarette, awoke during the fire, and tried unsuccessfully to escape. The apartment's smoke alarm may not have operated, since investigators found that the circuit to which it was wired had tripped.

The building was valued at \$3 million, and its contents were valued at \$1 million. Damage to the building is estimated at \$20,000, while damage to the contents is estimated at \$10,000. There were no other deaths or injuries.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, July/August 20-21.

Montana, 1999

Two men were killed when a cigarette ignited a living room couch in a second-floor apartment of this three-story building. The 37-year-old occupant of the unit of origin, impaired by alcohol, tried unsuccessfully to fight the fire, and then was overcome by smoke while trying to escape. A 47-year-old developmentally disabled man allegedly slept through the building alarm and efforts by the manager to warn occupants by knocking on doors. He also died.

Source: NFPA's Fire Incident Data Organization (FIDO)

Alcohol a Factor in Death, Texas

A 58-year-old man died of smoke inhalation in a house fire that investigators believe was caused by a discarded cigarette.

The one-story, wood-frame, single-family home, built on a concrete slab foundation, had a brick veneer and an asphalt-shingled roof. Firefighters found a battery-operated smoke alarm on the wall in the hallway, but it had no battery. There were no sprinklers.

A neighbor who smelled smoke called 911 at 11:05 p.m., and the single engine the fire department sent to investigate called for a full first-alarm assignment. Responding firefighters, who forced the front door after seeing fire venting from the rear of the home, discovered that the fire was confined to the living room and extinguished it before it spread any further. They discovered the victim during a primary search and took him to the hospital, where he was pronounced dead.

Investigators determined that a discarded cigarette started the fire in an upholstered chair. Near the chair, they discovered several coffee cans holding cigarette butts, as well as several alcohol containers. Alcohol was a contributing factor in the victim's death.

The house and its contents, together valued at \$85,000, sustained damage estimated at \$75,000.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, November/December, 18-19.

Woman Dies After Clothing Ignites, California

A 42-year-old woman, impaired by alcohol and medication, died of smoke and burn injuries when her clothing caught fire while she was in the utility room. She walked into the kitchen for help, allowing the fire to spread, and collapsed in the kitchen as the home's other occupants tried unsuccessfully to extinguish her burning clothing.

The exterior walls of the single-family, wood-frame dwelling, which covered 1,152 square feet (107 square meters), were faced with stucco. There were no sprinklers, and investigators could not determine whether the home's battery-operated smoke alarms sounded.

Firefighters arrived within three minutes of the call, and their initial offensive was pulled back until they knocked the heavy fire down. Crews then re-entered the home using multiple hose lines and found the victim in the kitchen, where she had succumbed to products of combustion.

Investigators determined that the fire started in the utility room, but they were unable to determine whether her clothing or the contents of the utility room ignited first.

The fire heavily damaged the contents of the utility room, garage, and master bedroom, as well as the kitchen and other areas of the home. Estimated damages to both the structure and its contents were placed at \$350,000. All other occupants escaped unharmed.

Ken Tremblay, 2009, "Firewatch", *NFPA Journal*, September/October, 23.

No Smoke Alarms in Fatal Fire, Illinois

A 32-year-old woman and a 35-year-old man died in an early morning fire that started in the basement and spread to the upper floors, heavily damaging their single-family home. A neighbor discovered the fire at 4:42 a.m.

The two-story, single-family home, which was 66 feet (20 meters) long and 24 feet (7 meters) wide, was constructed of wood framing and had an asphalt-shingled roof. There were no sprinklers, and investigators could not locate smoke alarms at any level.

The fire began near the electrical panel on the west wall of the basement. During the investigation, an electrical engineer noted that wiring had short circuited and caused insulation to burn before the fire spread to nearby combustibles.

The house, valued at \$149,000, and its contents, valued at \$70,000, were destroyed. Toxicology results showed the victims were impaired before the fire by alcohol and other substances. Two firefighters were injured during fireground operations.

Ken Tremblay, 2009, "Firewatch", *NFPA Journal*, September/October, 25-26.

Candle is Cause of Fatal Fire, Illinois

A 47-year old woman died when an unattended bedroom candle sparked a fire that spread to other areas of the home before being detected.

The fire occurred in a single-story ranch constructed of wood framing with an asphalt shingle roof. A battery-operated smoke alarm was installed in the hallway by the bedroom and operated during the fire. There were no sprinklers. A passerby called 911 at 12:33 a.m. to report the fire. Firefighters arrived a minute later and found the home well involved. Investigators determined that a candle left burning on a

nightstand fell over and ignited bedding. A fan may have spread the fire from the bedroom to the hallway and living rooms where the victim was located.

The victim was medicated and sleeping in a sitting position just outside the room of origin. The victim died of smoke inhalation. The building valued at \$30,000 was a total loss and \$10,000 worth of contents suffered \$8,000 in loss. There were no other injuries.

Kenneth J. Tremblay, 2007, "Firewatch," *NFPA Journal*, May/June 26.