

HOME CANDLE FIRES

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Abstract

Reported home candle fires have tripled since their low in 1990. Two-fifths started in the bedroom, while the living room, family room, or den was the leading area of origin for candle fire deaths. Half of the home candle fires occurred when some type of combustible was too close to the candle; an unattended or abandoned candle was a factor in 18% of these fires. Falling asleep was a factor in 12% of the incidents.

Key Words: Fire statistics, Fire causes, Candles, Residential fires, Home fires

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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

During 2002, candles in U.S. homes caused an estimated 18,000 reported structure fires, 130 civilian deaths, 1,350 civilian injuries, and \$333 million in estimated direct property damage. (Homes include one- and two-family dwellings, apartments and manufactured housing.)

The number of reported home candle fires stabilized from 2001 to 2002, after rising 15% from 2000 to 2001. From 1980, the first year of available data, to 1990, these fires had been falling, but they started climbing in 1991. The year 2002 was the first since 1995 that has not been a new high. The 18,000 reported in 2001 and 2002 is more than three times the 5,500 reported in 1990. The number of home candle fire deaths dropped back to the 2000 level after a sharp spike in 2001.

The share of home fires started by candles has increased over the past decade as the number of reported home fires generally decreased and reported home candle fires increased. In 2001 and 2002, candles caused 5% of reported home fires. Only 1% of home candle fires were caused by candles from 1980 through 1993.

During the four-year period of 1999-2002:

- Two-fifths (40%) of the home candle fires started in the bedroom, resulting in 30% of the associated civilian deaths. The 17% of home candle fires that started in the living room, common room, or den caused 36% of the fatalities.
- Candle fires start with a variety of items. A mattress or bedding was the item first ignited in 12% of the home candle fires and 27% of the home candle fire deaths. Cabinetry was first ignited in 10% of these fires, and 9% started when a curtain, blind or drapery ignited. Only 6% started with interior wall covering, but these fires caused 17% of the deaths. Five percent started with upholstered furniture, but these fires caused 13% of the home candle fire deaths.
- Fourteen percent of the home candle fires occurred in December, almost twice the monthly average of 8%.
- Falling asleep was a factor in 12% percent of the home candle fires and 25% of the associated deaths.

Factors contributing to ignition in 1999-2002:

- Half (50%) of the home candle fires occurred when some form of combustible material was left or came too close to the candle.
- Eighteen percent started after candles were abandoned or left unattended.
- Five percent were started by people (usually children) playing with the candle.

Ninety-one percent of all reported structure fires started by candles occurred in homes.

An NFPA study of news clips and fire service reports about identified fatal home candle fires in 1997 and 1998 revealed that candles used for light in the absence of electrical power caused about one of every three of the studied fatal home candle fires. About one in four (24%) of the fatal home candle fires occurred in homes in which the power had been shut off. Seven percent (7%) of the fatal fires occurred during temporary power outages.

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Home Candle Fires

Home Candle Fires Stabilized after Decade of Increases.

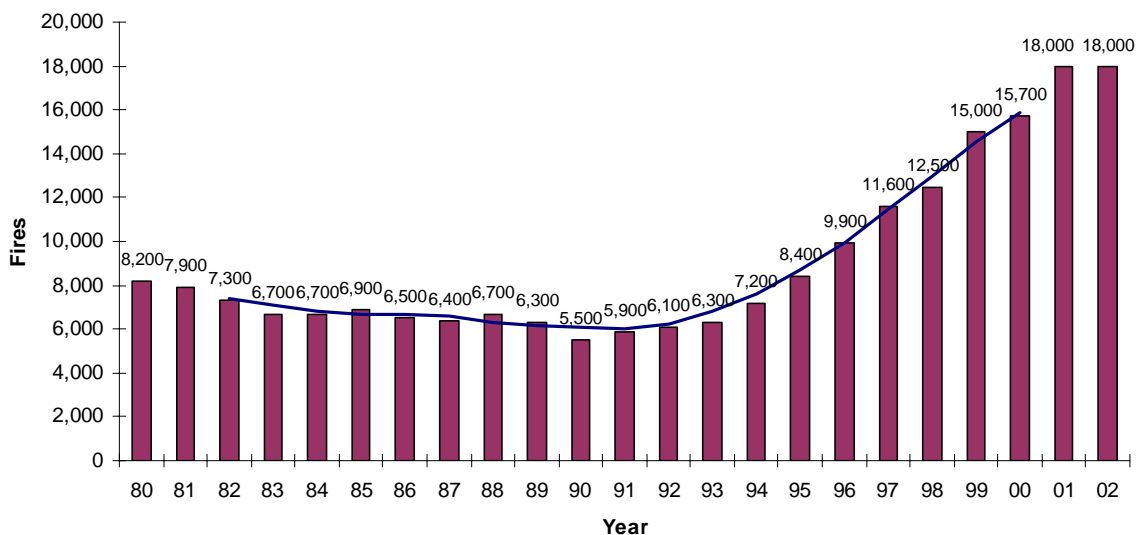
An estimated 18,000 reported home candle fires caused 130 civilian deaths in 2002.

During 2002, an estimated 18,000 home structure fires started by candles were reported to local fire departments. (Homes include dwellings, duplexes, manufactured housing and apartments.) These fires resulted in an estimated 130 civilian deaths, 1,350 civilian injuries and an estimated direct property loss of \$333 million.

The number of home candle fires has finally stabilized.

As Figure 1 shows, the number of reported home candle fires stabilized from 2001 to 2002, after rising 15% from 2000 to 2001. In 1980, candles started an estimated 8,200 home fires. Candle fires generally declined in the 1980s, falling to a low of 5,500 in 1990. They started climbing in 1991. The year 2002 was the first since 1995 that has not seen a new high. The 18,000 reported in 2001 and 2002 is more than three times the 5,500 reported in 1990. Table 1 shows the candle fire and loss experience from 1980-2002. Rolling five-year averages are shown by the solid line beginning with the 1980-1984 average above the 1982 column.

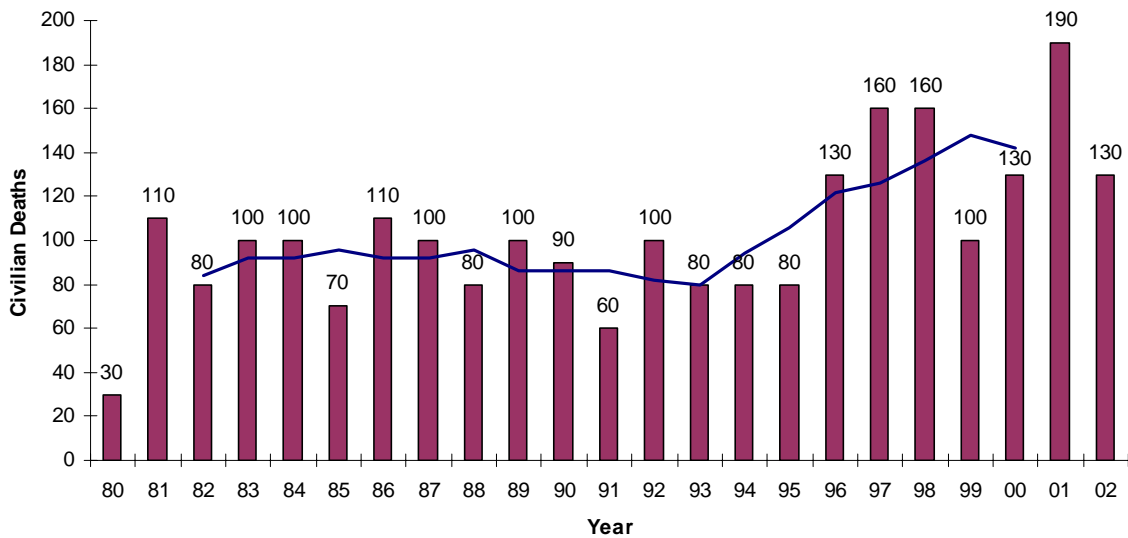
Figure 1. Home Candle Fires by Year: 1980-2002



Source: NFIRS and NFPA survey

The number of home candle fire deaths dropped back to the 2000 level of 130 after a sharp spike in 2001. Figure 2 shows that the number of deaths has fluctuated considerably but that these deaths have generally been more frequent in recent years than in the 1980s and early 1990s.

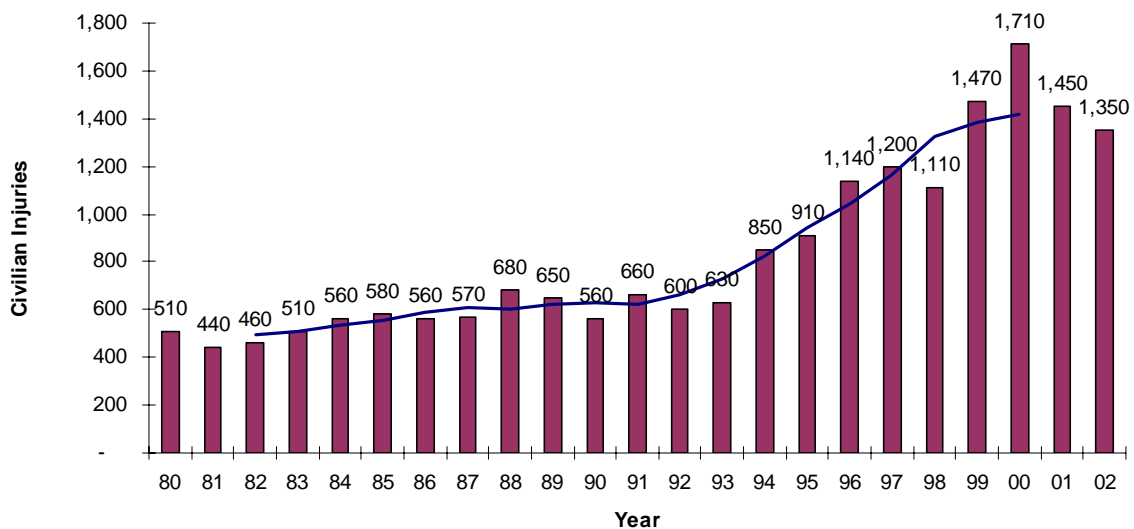
Figure 2. Civilian Deaths from Home Candle Fires by Year: 1980-2002



Source: NFIRS and NFPA survey

Civilian injuries from home candle fires reported to the fire service fell 7% from 1,450 in 2001 to 1,350 in 2002. This is the second decline in a row. However, the rolling five-year averages shown by the solid line in Figure 3 depict a generally upward trend. The U.S. Consumer Product Safety Commission (CPSC) estimates that between July 1, 2002 and June 30, 2003, hospital emergency rooms treated 3,400 patients for fire injuries caused by candles, twice the number reported to the fire service. The CPSC also estimates that only one-third of the candle fire injuries treated at emergency rooms were incurred at fires attended by the fire department.¹

Figure 3. Civilian Injuries from Home Candle Fires by Year: 1980-2002

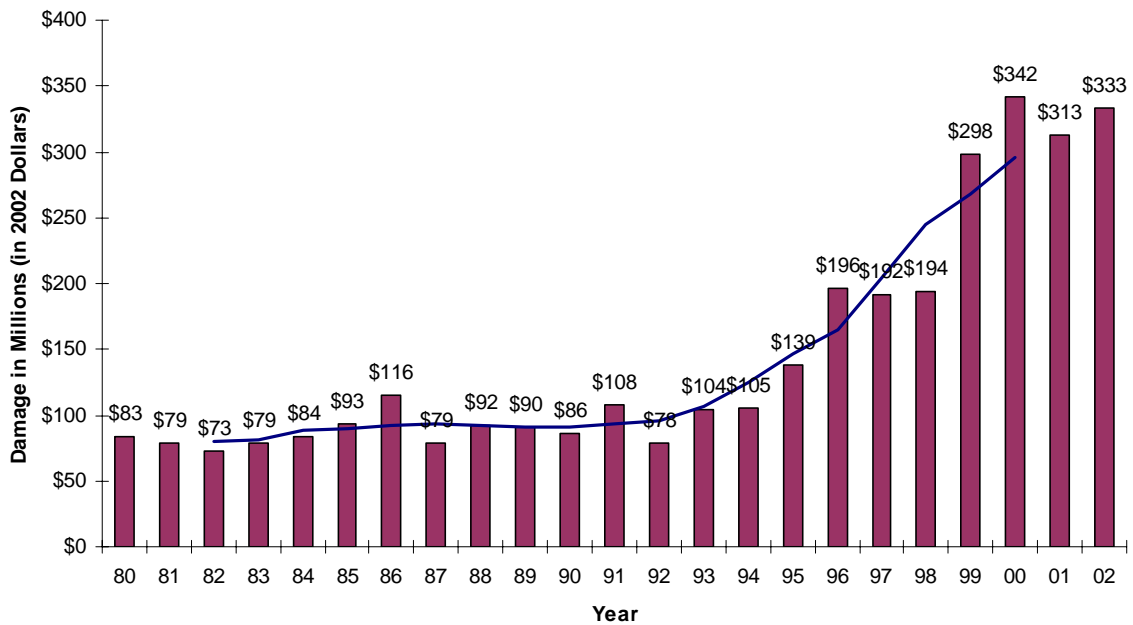


Source: NFIRS and NFPA survey

¹ David Miller, *Estimates of Fire Injuries Treated in Hospital Emergency Departments*, Washington, DC., CPSC, January 2005, pp. 8-9, available on-line at <http://www.cpsc.gov/LIBRARY/NEISSFire.pdf>.

Direct property damage from home candle fires, adjusted for inflation, rose 24% from an estimated \$270 million in 2001 to \$333 million in 2002. Table 1 and Figure 4 show that direct property damage, when adjusted for inflation, was fairly stable through the 1980s and early 1990s. It rose to a new level in 1996-1998, jumped sharply from 1998 to 1999, and peaked in 2000.

Figure 4. Property Damage from Home Candle Fires by Year: 1980-2002



Source: NFIRS and NFPA survey

The share of home structure fires started by candles has been growing.

Partly because total home fires have declined so much since 1980 and partly because candle fires have increased in recent years, the share of fires started by candles has jumped from 1% in the early 1980’s to 5% in 2001 and 2002. (See Table 2.) In 2002, candles caused 5% of the civilian home fire deaths, 10% of the civilian home fire injuries, and 6% of the direct property damage in reported home fires.

National Candle Association collects statistics on the candle market.

According to the National Candle Association (NCA), retail candle sales in the United States are estimated at \$2 billion per year, excluding accessories such as holders. In the United States, more than 350 commercial, religious and institutional organizations manufacture candles. A typical manufacturer offers between 1,000 and 2,000 specific varieties of candles. The NCA reports that candles are used in seven out of ten households in this country. Women use candles more often than men do and make 96% of all candle purchases. Candle use is more frequent among younger adults than older adults. Roughly 35% of the candle business is seasonal around the Christmas holiday. Forty-two percent (42%) of the candle users said they most often burned candles in the living room, 18% used

candles most frequently in the kitchen, and 13% most commonly used them in the bedroom. The three most commonly purchased candles are, in descending order, tea lights, cylindrical candles about 1.5 inches in diameter and 0.5 inches high), votive candles, and container candles.²

How Candle Fire Statistics Are Obtained

National estimates were derived from NFIRS and the NFPA survey.

The statistics in this report are national estimates derived from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) in combination with NFPA's annual fire department survey. State agencies and local fire departments began implementing NFIRS Version 5.0 in 1999. Data that was collected in an earlier version was converted to Version 5.0. Some conversions were straightforward and many data elements stayed fairly stable. In other sections, logic and definitions changed significantly, making it harder to track trends. In Version 4.1, candles were identified by form of heat of ignition code 44. In Version 5.0, candles are identified by heat source code 66, and the conversion is direct. Detailed information about NFIRS can be obtained from <http://www.usfa.fema.gov/>. This report shows causal information, expressed in annual averages, for the four-year period for 1999-2002. A detailed explanation of how national estimates are calculated can be found in Appendix A.

Detailed Patterns of Home Candle Fires

The following statistics are extracted from 1999-2002 data. During that four-year period, an estimated average of 16,700 reported home candle fires caused an estimated 140 civilian fire deaths, 1,500 civilian fire injuries and \$311 million in direct property damage. When adjusted for inflation, property damage averaged \$321 million per year from these fires.

Where do candle fires start?

Forty percent (40%) of home candle fires started in bedrooms. These fires caused 30% of the associated deaths. Seventeen percent (17%) started in common rooms, living rooms, family rooms or dens, resulting in 36% of the deaths. Fourteen percent (14%) started in bathrooms, 8% began in kitchens; 3% started unclassified function areas; and 3% started in dining rooms or bar areas.

What do candles ignite?

Candle fires start with a variety of items. A mattress or bedding was the item first ignited in 12% of the home candle fires and 27% of the home candle fire deaths. Cabinetry was first ignited in 10% of these fires; 9% started when a curtain, blind or drapery ignited; and 9% began with unclassified furniture or utensils. Only 6% started with interior wall covering but these fires caused 17% of the fatalities. Five percent (5%) started with upholstered furniture; these incidents caused 13% of the home candle fire deaths.

² Information was found at the National Candle Association's web site, <http://www.candles.org/CandleIndustry/index.htm>, on August 19, 2005.

Other leading items first ignited in home candle fires were:

- Unclassified items were first ignited in 5%;
- Linen other than bedding (towels, tablecloths, etc.) in 4%;
- Decorations for special events in 4%;
- Clothing in 4%;
- Magazines, newspapers, and writing paper in 4%; and
- Floor coverings or surfaces were first ignited in 4% of these fires.

See Table 4 for more detailed information about the item first ignited in home candle fires.

How big is the candle problem in terms of the different materials ignited?

Kimberly D. Rohr's report, *Products First Ignited in U.S. Home Fires*,³ provides information on the frequency of different heat sources in fires involving different kinds of materials.

Candles provided the heat of ignition in:

- 53% of the decoration fires;
- 36% of the curtain and drape fires;
- 21% of the cabinetry fires;
- 18% of the linen other than bedding (towels, tablecloths, etc.) fires;
- 13% of the paper and magazine fires;
- 12% of the toy and game fires;
- 11% of the fires starting with unfinished fabrics and goods that are not made up;
- 10% of the mattress and bedding fires;
- 9% of the upholstered furniture fires;
- 8% of the Christmas tree fires;
- 7% of the floor covering fires;
- 7% of the appliance housing or casing fires;
- 7% of the interior wall covering fires;
- 6% of the fires starting with clothing worn by a person;
- 6% of the box, bag and barrel fires; and
- 5% of the fires starting with clothing that was not being worn.

How do they start?

This question sounds deceptively simple, but pieces of the answer can be found in several different variables. Ninety-three percent (93%) of the home candle fires were unintentional, 2% were intentional, and 2% resulted from the failure of the equipment or heat source. That could refer to a holder or the candle itself. An act of nature was blamed for 1% of the fires. See Table 5 for more details.

Obviously, more specific information about how the candle and the item first ignited came together would be helpful in preventing these fires. In the past, the NFIRS field for ignition factor captured that detail. In NFIRS 5.0, fire departments are now allowed to enter up to two factors contributing to ignition. Some of the former ignition factor choices are now

³ Kimberly D. Rohr, *Products First Ignited in U.S. Home Fires*, Quincy, MA: NFPA, Fire Analysis and Research Division, April 2005.

captured in other fields, including cause and human factor contributing to ignition. Some of the codes have changed slightly, resulting in somewhat different leading factors.

In half (50%) of the home candle fires reported originally in Version 5.0 of NFIRS in 1999-2002, the fire started because the candle was too close to some combustible material. The candle was unattended, abandoned or discarded in 18% of the incidents. Unclassified misuse of the material or product was a factor in 11% of these fires, an unclassified factor contributed in 6%, and 5% of the incidents were caused by people, often children, playing with candles. A more detailed listing of factors contributing to ignition can be found in Table 6. These percentages include a proportional share of fires in which the factor contributing to ignition was coded as “none,” “undetermined,” or was not reported at all.

“Human factors contributing to ignition” is a new field in NFIRS 5.0. Table 7 shows that in 12% of the home candle fires, 25% of the associated civilian deaths and 26% of the civilian fire injuries originally documented in NFIRS 5.0, the occupants were asleep when the fire occurred. In 20% of the fires, an unattended or unsupervised person was a factor. However, it is possible that in at least some of these fires, the “unattended” actually refers to the candle. No human factors contributed to 59% of the fires, 41% of the civilian deaths and 49% of the civilian injuries.

Flame damage was confined to the room of origin in four-fifths of these fires.

Table 8 shows the extent of flame damage in home candle fires. In one out of four fires (24%), the damage was confined to the object of origin. In slightly more than half (53%) of the incidents, flame damage extended beyond the original object but was confined to the room of origin. Flame damage extended beyond the room of origin in only 22% of the fires.

Who Are the Victims of Home Candle Fires?

Young school-age children had higher death risk from candle fires.

Table 9 shows the age distribution of the general population during 2000, the age distribution of people injured and killed by home candle fires during 1999-2002, and the relative risk of death or injury from home candle fires compared to the age group’s share of the general population. The relative risk was calculated by dividing the percentage of fire deaths (or injuries) per age group by the percentage of the general population in that age group. A relative risk of 1.0 means that the percentage of deaths or injuries matches the percentage of the population.

Almost half (47%) of the people killed by home candle fires were under the age of 20; only 26% of the home fire fatalities of all causes were that young. The distribution of ages among the injured is more consistent with that seen in fires of all causes.

For most fire causes, the high-risk age groups are children under age five and older adults age 65 or over. Children under five faced the highest risk of death from home candle fires; older adults over 65 faced a risk only slightly higher than the general population.

Children five to nine faced a risk of death from a home candle fire that was twice that of the general population and twice the relative risk of death from fires of all causes combined. Those 85 or older faced the same risk as children ages five to nine but their relative risk of death from home candle fires was only 60% of their relative risk of death from home fires of all causes.

Males accounted for 57% of home fire fatalities and 53% of injuries from fires of all causes. However, 52% percent of the people killed by home candle fires were female, as were 54% of the injured. Statistics about deaths and injuries from all fire causes were obtained from the NFPA report, *Characteristics of Home Fire Victims*.⁴

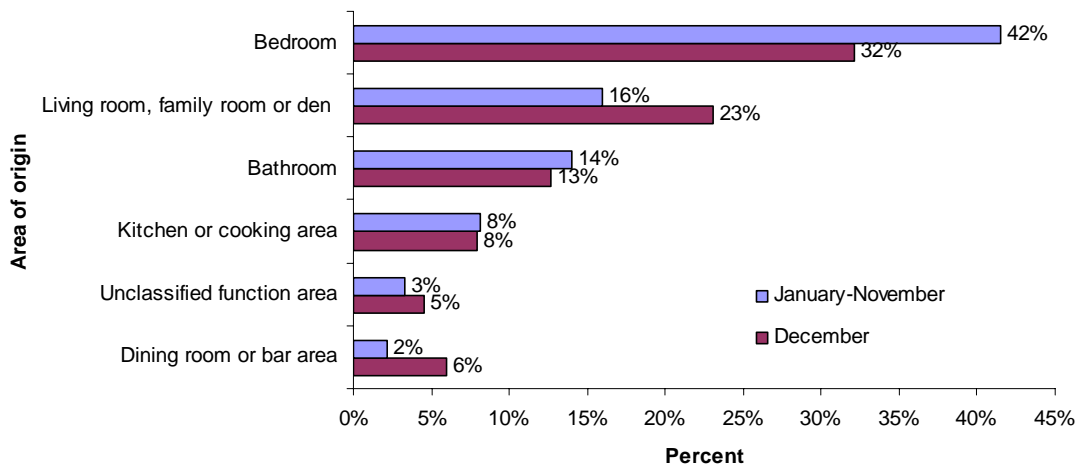
When Do Candle Fires Occur?

December was the peak month.

Table 10 shows that 14% of home candle fires occurred in December. This was almost twice the 8% monthly average. Christmas was the peak day, with an estimated 180, or 1.1%, of the 16,700 home candle fires in 1999-2002. (If all days had an equal share of the fires, the daily share would be $1/365.25 = 0.3\%$. The actual Christmas share was four times the baseline rate.) Ten percent of the home structure fires on Christmas were started by candles, twice the candle share for the full year. New Year's Day and Christmas Eve tied for second with 130 home candle fires each day. January was the second ranking month in number of home candle fires. July and August had the smallest number of these fires.

Table 11 shows that home candle fires were most common on Saturdays and Sundays. Table 12 shows that the period from 6:00 to 8:59 p.m. was the peak period for home candle fires. The period from 9:00 to 11:59 p.m. ranked second and the interval from 3:00 to 5:59 p.m. ranked third. The smallest share of these fires occurred between 6:00 and 8:59 a.m.

Figure 5. Leading Areas of Origin in Home Candle Fires 1999-2002: January-November vs. December



⁴ John R. Hall, Jr., *Characteristics of Home Fire Victim*, Quincy, MA: NFPA, Fire Analysis and Research Division, July 200, pp. 2-3.

December candle fires follow a somewhat different pattern.

Although bedrooms were the leading areas of origin for home candle fires all year, Figure 5 shows that this pattern was not as pronounced in December. From January through November, 42% of the candle fires started in bedrooms. Only 32% of the December candle fires started there. In December, 23% of the home candle fires started in living rooms, family rooms or dens, compared to 16% during the rest of the year. Six percent of the December home candle fires began in the dining room compared to 2% during the rest of the year.

Table 13 shows that decorations were the leading item first ignited in December. During the rest of year, decorations ranked thirteenth. This is consistent with the industry pattern of seasonal business. It also suggests that seasonal candle fires often involve combustible seasonal decorations that would not have been present at other times of the year. In other words, the heightened candle fire risk around the Christmas and New Year's holidays reflects a combination of increased candle use and a more combustible environment around those candles.

Candle Fires by Occupancy

Nine out of ten candle fires occurred in homes.

During 1999-2002, candle fires started an estimated annual average of 18,400 structure fires in properties of all types. These fires caused an average of 140 civilian fire deaths, 1,570 civilian fire injuries, and an estimated \$337 million in direct property damage. Ninety-one percent (91%) of the reported structure fires started by candles occurred in homes (one- and two-family dwellings, manufactured housing and apartments). Seventy percent of the fires began in one- and two-family dwellings while 21% began in apartments. Two percent occurred in mercantile or business properties. Table 14 provides more detail on candle fires in different occupancies.

Candles Used for Light

Candles used for light is a specific problem.

NFPA's Fire Incident Data Organization (FIDO) provides more detail on certain fires. While the collection is not complete or representative, information is available through FIDO that is not available through NFIRS. In 1997 and 1998, a clipping service was asked to notify NFPA of all fatal fires in the U.S. Additional information on the causes and circumstances was sought from fire departments. Sixty-eight fatal home candle fires during this time were identified. Some of these fires killed more than one person. These incidents were reviewed to determine the role of power problems in candle fire fatalities.

According to reports from the fire service, fire investigators or the newspapers, the power had been shut off in 16, or 24%, of the fatal candle fires. In five other cases (7%), candles were used during a temporary power outage. In another case, a blown fuse caused the victim to believe her power had been shut off for non-payment as she couldn't

remember paying the bill, and in one case, no explanation was given for the lack of power. Adding these incidents together, a lack of electrical power was a factor in 23, or one-third, of the fatal home candle fires in this group. Some of the candle fires from *NFPA Journal's* "Fire Watch" series and most of the catastrophic (multiple fire death) candle fires at the back of this report involve candles used for light due to lack of power, due to either a temporary situation or a termination of service. In a study done for NFPA in the fall of 2004, 24% of the 77% of the respondents who said they use candles, or 18% of the total respondents, reported that they used candles when the power goes out.⁵ In March of 2005, 11 people died in a Louisiana two-story town-house apartment fire that started when a tea candle in a window ignited an upper bunk mattress in a second floor bedroom. One occupant tried to extinguish the fire and carry the mattress downstairs and outside. He set it down on cardboard boxes after encountering difficulties with the lock. The family had moved in the prior evening and did not yet have electricity. They had placed tea lights in window sills around the apartment for light.

Advice for using candles safely and special additional advice for situations in which candles must be used as emergency light sources are found on page 16. However, people who cannot afford to pay their electric bills are unlikely to be able to afford flashlights and batteries. Prolonged power outages may exhaust battery supplies. Developing strategies to address this problem is a challenge for all life safety educators, and a particular challenge for groups such as NFPA's Center for High Risk Outreach that work with people at high risk of fire.

CPSC's Candle Fire Pilot Study, NEISS Candle Data, and Recalls

CPSC conducted pilot study of candle fires.

The U.S. Consumer Product Safety Commission (CPSC) conducted 79 in-depth investigations of candle fires between August 2000 and March 2001 (inclusive) as part of a pilot study on the topic. The study sought data on causes, types of candle, scent characteristics, reason for candle use, frequency of candle use, room in which candle was used, surface on which candle was placed, presence of the consumer in the room and home at the time of incident, object ignited and the amount of time the candle was burning before the ignition. The pilot was done to ascertain how much detail could be obtained about these fires. Some of the highlights are summarized here.⁶

- Based on 55 incidents with known causes, 47% were caused by combustibles too close to the candle (without further elaboration), the candle fell over in 9% of the fires, was knocked over by a pet in 9%, and was just said to be knocked over in another 9%. Five percent were caused by a child playing with a candle and 4% started after the candle burned down.

⁵ Harris Interactive, *Fire Prevention Week Survey*, conducted for National Fire Protection Association (Public Affairs Division), Fall 2004, Pp. 22-23, available at <http://www.nfpa.org/assets/images/Public%20Education/FPWsurvey.pdf>.

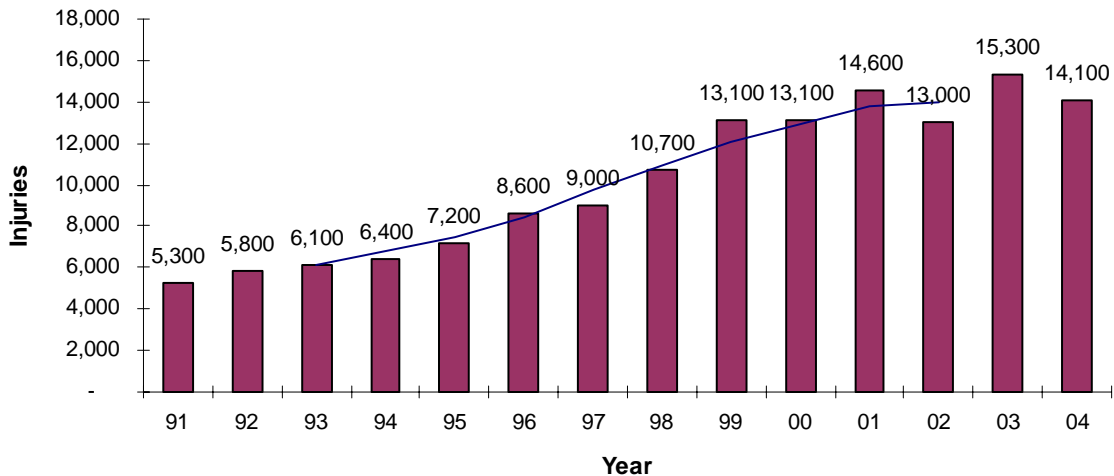
⁶ Signe Hiser, *Candle Fires Pilot Study Summary*, Washington, DC., CPSC, September 2001, available online at <http://www.cpsc.gov/LIBRARY/FOIA/FOIA02/os/Candles3.pdf>.

- Filled candles (candles produced and used in the same vessel) accounted for 27% of the 48 known types of candles, 25% were pillar or column candles, dinner or taper candles accounted for 15%, 8% were freestanding, and votive candles accounted for another 8% of the incidents.
- In 37% of the 41 incidents in which the reason for candle use was known, candles were used for fragrance. In 20% of the cases, candles were used for religious purposes. They were used for light in 17% of the fires, for aromatherapy in 7%, for ambience in 5%, and for heat in 5% of the fires.
- In cases in which the surface was known (53 incidents), candles were placed on tables in 19% of the fires, on dressers in 15%, on nightstands in 15%, on bookcases, cabinets or shelves in 9%, on coffee tables or end tables in 9% and held by a child in 6% of the fires.
- In seventy percent of the fires, someone was home at the time of the fire (based on 63 cases with known data). Someone was in the room with the candle in only 15% of the fires (based on 82 fires with known data).

Many candle-related injuries are not caused by fire.

According to estimates from the U.S. Consumer Product Safety Commission’s (CPSC’s) National Electronic Injury Surveillance System (NEISS), candles, candle sticks and other candle holders were involved in an estimated 14,100 injuries seen at emergency rooms in 2004, almost three times the 5,300 in 1991. Figure 6 shows the injuries seen by year and five-year rolling averages.

Figure 6. Candle-Related Injuries Seen at Hospital Emergency Rooms: 1991-2004

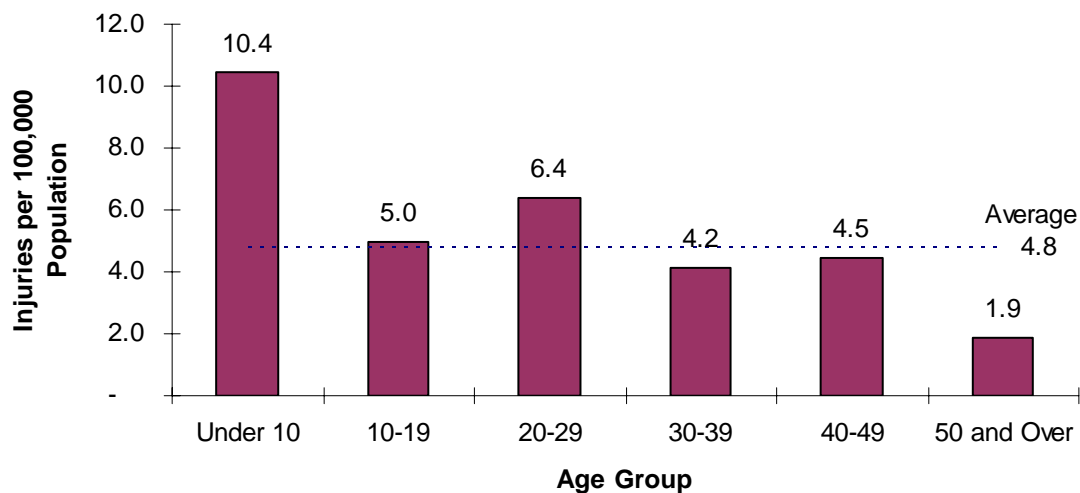


Source: NEISS estimates as reported in *Candle Fires Pilot Study Summary*, by Signe Hiser, CPSC, September 2001 for 1991-2000, NEISS estimates obtained for product code 463 (candles, candlesticks and other candleholders from <http://www.cpsc.gov/library/neiss.html> in August 2004 for 2001-2003, and July 2005 for 2004.

Forty percent of the victims in 2004 were male, and 60% were female. Forty-six percent (42%) of the candle-related injuries that year were lacerations, 16% were thermal burns, and 12% were scald burns. Some of the lacerations were caused by sharp or broken candleholders; some occurred while candles were being trimmed or wax was being removed from candleholders. Scald burns tended to be from the hot wax or the candle product itself. Two percent of the injuries were incurred while someone was blowing out the candle. In some cases, a person’s hair caught on fire, and in others, wax or other candle product blew back into the victim’s face or eye.

Twenty-nine percent of the emergency room patients seen for candle-related injuries were under 10 years old. Overall, there were 4.8 candle-related emergency room visits per 100,000 population in 2004. Figure 7 shows that the injury rate for individuals under ten was twice that of the general population. Young adults between 20 and 29 had the second highest rate of these injuries. The rate was lowest for those 50 and older.

Figure 7. Emergency Room Visit Rates in 2004 for Candle-Related Injuries, by Age Group



Source: NEISS estimates obtained for product code 463 (candles, candlesticks and other candleholders from <http://www.cpsc.gov/library/neiss.html> in August 2004. Population estimates for 2002 were obtained from Table 11. “Resident Population by Age and Sex: 1980 to 2002” from the U.S. Census Bureau’s *Statistical Abstract of the United States: 2003*.

CPSC has recalled several candles and candle-related products.

The CPSC has issued a number of recalls of candles and candle-related products since 1994.⁷ The flames on some candles grew excessively high. In some cases, candleholders

⁷ An August 3, 2005 search on ‘candle’ at the U.S. Consumer Product Safety Commission’s website at <http://www.cpsc.gov/cgi-bin/recalldb/prod.asp> found these press releases about recalls: 05-215, 05-207, 05-200, 05-183, 05-159, 05-143, 05-119, 05-098, 05-089, 04-146, 04-101, 04-081, 04-061, 04-059, 04-057, 04-049, 04-048, 04-046, 03-199, 03-0161, 03-052, 03-029, 03-015, 03-014, 03-001, 02-173, 02-091, 02-090, 02-089, 02-079, 02-075, 02-074, 02-053, 02-052, 02-007, 01-509, 01-508, 01-160, 01-118, 01-101, 01-053b, 00-145b, 00-107c, 00-044, 00-040, 00-004, 99-070, 99-096, 99-101, 99-126, 98-021, 98-039, 98-040, 98-044, 98-105, 98-114, 98-119, 98-162, 97-005, 97-017, 97-019, 97-044, 96-008, 96-046, 96-051, 96-158, 96-195, 95-026, 95-046, 95-108, and 94-007A.

or containers could overheat and shatter or catch on fire. Some candleholders had flammable paint. Other candles had material inside them that could catch on fire.

1999 Massachusetts Candle Study Sought More Detailed Information

The National Fire Incident Reporting System (NFIRS) provides considerable information about candle fires. NFIRS data showed that candle fires were increasing, that they start most often in the bedroom, and that candle fires peak in December. The Massachusetts Office of the State Fire Marshal and the NFPA worked together on a special study of 1999 Massachusetts candle fires. Information was collected on the age of the individual who was using the candles, what type of candle was involved, and whether the candleholder was a factor. The Massachusetts fire service completed special forms on 220 fires, or more than 70% of the candle fires reported that year.

Massachusetts teenagers had a disproportionate number of candle fires.

Two-thirds of the people using candles in these fires were between 20 and 64 years old. However, teenagers faced the greatest relative risk of a candle fire. Although they comprised only 9% of the Massachusetts population, they accounted for 21% of the fires, meaning they were more than twice as likely to have a candle fire as the population in general.

About two-thirds of the candle users in the Massachusetts fires were female. Although females were in the majority in all age groups, the distribution ranged from about three-fifths female for teenagers and young adults; four-fifths in the middle age group, and about nine-tenths female among candle users over 65. When Massachusetts teenagers were the candle users, three of every four candle fires started in the bedroom. This study asked first if the candle was unattended, and then asked for the cause separately. Three-quarters of the fires occurred when candles were unattended. Interestingly, there was relatively little difference between the causes seen for unattended and attended candle fires.

Forty percent (40%) of the Massachusetts candle fires were caused by combustibles too close to the candle. In 35% of the cases, the candle burned down too low. The candle tipped over (on its own) in 10% of the incidents, and was knocked over (by a person, pet or other object) in 7% of the fires. The holder broke in 3% of the cases.

In half of the Massachusetts fires in which information about the candleholder was provided, the holder was made of glass, china, crystal, or pottery. No holders were used in 16% of the fires. The holders were metal in 12% of the incidents, and plastic or polystyrene in another 12%. Candleholders were made of wood in 4% of these incidents.⁸

⁸ Marty Ahrens and Jennifer Mieth, "A Special Study of Massachusetts Candle Fires During 1999," available at <http://www.state.ma.us/dfs/lifesafe/masscandle.pdf>.

ASTM's Candle-Related Standards

ASTM issued standards relating to candles

ASTM International (formerly the American Society for Testing and Materials) develops consensus standards for “materials, products, systems and services.” As candle fires (and candle sales) increased during the 1990s, it became clear that standards were needed for candles and associated products. As of 1997, no uniform standards existed for candle manufacturers to test or label their products. ASTM subcommittee F15.45 was created to address candle safety issues. Its first meeting was held in August 1997. Jim Becker described the committee’s history and provided background on candle-related standards in his March 2003 article in *Standardization News*.⁹ ASTM standards on candles include:

F1972-99, Standard Guide for Terminology Relating to Candles and Associated Accessory Items, establishes standard terms and definitions for common types of candles and associated products.

F2058-00, Standard Specification for Cautionary Labeling for Candles Burned in a Home describes labeling requirements, including minimum size, formatting specifications, and the minimum words of "Warning: To Prevent Fire Burn candle within sight. Out of the reach of children and pets. Never on anything that can catch fire."

F2179-02, Standard Specification for Annealed Soda-Lime Silicate Glass Containers That Are Produced for Use as Candle Containers provides for minimum requirements and testing options for containers of this type when they are expected to be used for candles. Containers should be able to withstand a change in temperature without cracking or breaking.

F2417-04, Standard Specification for Fire Safety for Candles addresses issues of candle stability, flame height, end of useful life and secondary ignition. (Some types of candles are excluded from this standard.) This standard replaces the earlier provisional standard.

F2326-04, Standard Test Method for Collection and Analysis of Visible Emissions from Candles as They Burn addresses smoke and burn behavior of most types of indoor candles.¹⁰

NASFM Petitioned CPSC to Adopt Candle Standards.

Like NFPA standards, the ASTM standards are not mandated by ASTM, but can be referenced or incorporated into contracts, regulation, laws, codes and procedures. In light of the increase in candle fires, the National Association of State Fire Marshals (NASFM) petitioned to have the U.S. Consumer Product Safety Commission (CPSC) for mandatory

⁹ Becker, Jim. Candles: Answering your Burning Questions,” *Standardization News*, March 2003, online at http://www.astm.org/SNEWS/MARCH_2003/becker_mar03.html.

¹⁰ ASTM International. For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

standards for candles and accessories.¹¹ They propose that the standards be largely based on ASTM's *PS59-Provisional Specification for Fire Safety for Candles* with additional requirements for candles not covered by that standard. (This standard has since been finalized and replaced with *F2417-04, Standard Specification for Fire Safety for Candles*.) NFPA supports this proposal. Bob Higgins, president of the National Candle Association, testified against the petition at the Senate Committee Hearing on Commerce, Science and Transportation on July 14, 2004. He noted that their members account for 90% of all candles manufactured in the United States and that his organization has worked closely with ASTM and CPSC to develop the ASTM standards. His organization advocated the continued use of ASTM standards as voluntary standards, maintaining that standards are better at incorporating latest technology than regulations. He also stressed the importance of consumer education and behavior in preventing candle fires.¹²

Other Countries Are Also Concerned about Candle Safety

Candle fires have also increased in the U.K.

Table 15 shows that in the United Kingdom, home candle fires have almost tripled from 700 in 1992 to 2,000 in 2002, going from 1% of reported home fires to 3% during that time.¹³ In a 2002-2003 survey of the British population, 5% of the people who had domestic fires (fires anywhere in or on the householder's property) reported they were caused by candles; 8% of these candle fires were attended by fire brigades.¹⁴

A special U.K. Department of Trade and Industry and Home Office report on *The Safety and Use of Candles and Tea Lights* compiled a wide variety of information about candle fires and candle injuries.¹⁵ In 1998, 43% of the U.K.'s unintentional home candle fires started in the bedroom and 31% started in living rooms, family rooms or dens.

The authors cite the 1997 report of the U.K.'s Home and Leisure Accident Surveillance System (HASS and LASS) of hospital accident data which estimated that 1,300 injuries were caused by candles and candle wax and 500 were caused by candlesticks. The number of injuries caused by candles and candle wax in particular increased steadily from 1992 to 1998, the last year of data shown. During 1989-1998, 39% of these injuries were flame burns, 26% were burns from hot wax, 3% were other burns, and smoke inhalation caused 16% of the injuries. Lacerations obtained while trimming candles or

¹¹ *Federal Register*, Vol. 69, No. 66, Tuesday, April 6, 2004, "Petition Requesting Mandatory Fire Safety Standards for Candles and Candle Accessories (Petition No. CP 04-1/HP 04-1)," online at <http://www.cpsc.gov/businfo/frnotices/fr04/candle.pdf>.

¹² Testimony of Bob Higgins, president, National Candle Association, Full Committee Hearing: Home Products Fire Safety, Senate Committee on Commerce, Science and Transportation. July 14, 2004, online at http://commerce.senate.gov/hearings/testimony.cfm?id=1267&wit_id=3680.

¹³ Office of the Deputy Prime Minister, *Fire Statistics United Kingdom, 2002*, 2004, London, U.K., pp. 62, 65. Available online at http://www.odpm.gov.uk/stellent/groups/odpm_fire/documents/page/odpm_fire_028815-01.hcsp. Candles were listed under accidental causes. "Dwelling" is used in the United Kingdom to refer to properties called "homes" in NFPA analyses. The percentage is based on candle fires as a share of reported dwelling fires of all causes, including malicious.

¹⁴ Office of the Deputy Prime Minister. *Fires in the Home: Findings from the 2002/3 British Crime Survey*, 2004, London, U.K. pp. 11, 14. Available online at http://www.odpm.gov.uk/stellent/groups/odpm_fire/documents/page/odpm_fire_027486.pdf

¹⁵ Department of Trade and Industry and Home Office. *The Safety and Use of Candles and Tea Lights*, 2000, pp. 36-48. Available online at http://www.dti.gov.uk/homesafetynetwork/bs_rcand.htm.

removing wax accounted for 13% of the cases. Statistics from the Dutch Injury Surveillance System were also included. In 1997 to 1998, an estimated 360 people were treated at hospital Accident and Emergency departments for injuries caused by candles and tea warmers. Twenty-nine percent (29%) of these injuries were caused by fires or flames, 24% were caused by cutting or piercing objects, and 21% were caused by hot liquid or steam.

The authors also referenced statistics from the Swedish Rescue Service, noting that candles were listed as the preliminary cause of an estimated 263, or 4% of all dwelling fires in Sweden during 1998.

Increasing Candle Safety

Specific information is needed to develop effective prevention strategies.

We need to know more about the circumstances of these fires and the people who are having these fires to develop and target our educational messages effectively. Candles used for religious purposes are likely to be used differently and in different places than candles used for fragrance or ambience. Manufacturers and regulators also need to know if product issues are significant problems. The Massachusetts study provided some information on fires in one state, but more studies are needed, particularly for issues regarding specific types of candles or candleholders. The CPSC study was a pilot, with a relatively small number of incidents but greater detail more actively sought. The ASTM documents provide standard definitions, tests and minimum warning wording, in effect, an agreed upon starting place from which to build. While responsible manufacturers follow ASTM's voluntary standards, mandatory standards would provide the consumer with greater protection and make enforcement easier.

Updated NFPA brochure -- "Candle with Care" – is now available

In response to the growing problem of candle fires, NFPA developed "Candle with Care," a brochure focusing on candle safety. The revised brochure may be ordered by calling NFPA's catalog at 1-800-344-3555 or on-line at <http://www.nfpacatalog.org/>. A sample of the brochure may be obtained by calling NFPA's "Fax on Demand" at 1-877-252-8145 and selecting brochure # 139.

Educational Message Advisory Committee developed basic candle messages.

The Educational Messages Advisory Committee, a group of fire safety experts who help NFPA's education division form educational messages met in August 2003 and 2004. This group was convened to review current educational messages and determine if research is needed to validate the message. The group developed the following basic messages for candle safety:

- Keep candles at least 12 inches from anything that can burn.
- Use sturdy, safe candleholders.
- Never leave a burning candle unattended. Blow out candles when you leave a room.
- NFPA discourages the use of candles in bedrooms and sleeping areas.
- Use a flashlight, not a candle for emergency lighting.

- Be careful not to splatter wax when extinguishing a candle.

These messages are short and simple. When additional information is required, some or all of the following expanded points may be useful.

Remember: A candle is an open flame. It can easily ignite any combustibles nearby. *Keep a careful eye on candles.*

- Extinguish all candles when leaving the room or when going to sleep.
- Keep candles away from items that can catch fire such as clothing, books, paper, curtains, Christmas trees, flammable decorations or anything else that may burn.
- Make sure candles are placed on a stable piece of furniture in sturdy holders that won't tip over. Candles should fit in the holders securely and holders should be made from material that can't burn.
- Make sure the candle holder is big enough to collect dripping wax.
- Don't place lit candles in windows, where blinds or curtains can close over or come in contact with them.
- Place candles away from spots where they could be knocked over by children or pets.
- Keep candles and all open flames away from flammable liquids.
- When purchasing or using candles, consider what would happen if the candle burned low. Could it burn the candle holder or decorative material nearby? Extinguish taper and pillar candles when they get within two inches of the holder or decorative material. Votives and filled candles should be extinguished before the last ½ inch of wax starts to melt.
- Fire experts discourage the use of candles in bedrooms, where almost half of all home candle fires start. If you must burn candles in the bedroom, keep them away from bedding, curtains and blinds, wallpaper, upholstered furniture, piles of clothing, and newspapers and magazines, and monitor them carefully.
- Avoid candles with combustible items embedded in them.

Where young children are present:

- Keep candles up high out of the reach of children.
- Never leave a child unattended in a room with a candle. A child should not sleep in a room with a lit candle.
- Keep all matches and lighters up high and out of the sight and reach of children, preferably in a locked cabinet.

Power outages are special situations.

Flashlights and other lights generated by batteries are much safer light sources than candles. Keep working flashlights on hand. If you do use candles during power outages,

- Avoid carrying a lit candle. When you carry a candle, you are carrying something that could start a fire. If you need to look for something in a closet or confined area, use a flashlight or wait.
- Never use a candle for light when checking pilot lights or fueling equipment such as a kerosene heater or lantern. The flame may ignite the fumes.
- Extinguish all candles when leaving the home or when going to sleep.
- Don't allow children to use candles for light without supervision.

Table 1.
Candle Fires in the Home by Year
1980-2002

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	Adjusted Loss in Millions of 2002 Dollars
1980	8,200	30	510	\$38	\$83
1981	7,900	110	440	\$40	\$79
1982	7,300	80	460	\$39	\$73
1983	6,700	100	510	\$44	\$79
1984	6,700	100	560	\$49	\$84
1985	6,900	70	580	\$56	\$93
1986	6,500	110	560	\$70	\$116
1987	6,400	100	570	\$50	\$79
1988	6,700	80	680	\$60	\$92
1989	6,300	100	650	\$62	\$90
1990	5,500	90	560	\$63	\$86
1991	5,900	60	660	\$82	\$108
1992	6,100	100	600	\$61	\$78
1993	6,300	80	630	\$84	\$104
1994	7,200	80	850	\$87	\$105
1995	8,400	80	910	\$118	\$139
1996	9,900	130	1,140	\$171	\$196
1997	11,600	160	1,200	\$171	\$192
1998	12,500	160	1,110	\$176	\$194
1999	15,000	100	1,470	\$276	\$298
2000	15,700	130	1,710	\$327	\$342
2001	18,000	190	1,450	\$308	\$313
2002	18,000	130	1,350	\$333	\$333
1980-2002 Annual average	9,100	100	830	\$120	\$146
1999-2002 Annual average	16,700	140	1,500	\$311	\$321

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, civilian deaths and injuries are rounded to the nearest ten, and direct property damage is rounded to the nearest million. A proportional share of fires in which the heat source was unknown or unreported is included in these totals.

Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey. Inflation adjustments were based on “purchasing Power of the Dollar” custom table from Bureau of Labor Statistics at <http://www.bls.gov/cpi/>. (Accessed on June 23, 2005).

Table 2.
Candle Fires in the Home as a Share of All Home Structure Fires
1980-2002

Year	Home Fires	Home Candle Fires	Percent of Home Fires Started by Candles
1980	733,000	8,200	1.1%
1981	711,000	7,900	1.1%
1982	659,000	7,300	1.1%
1983	627,000	6,700	1.1%
1984	606,000	6,700	1.1%
1985	607,000	6,900	1.1%
1986	567,000	6,500	1.2%
1987	537,000	6,400	1.2%
1988	538,000	6,700	1.2%
1989	500,000	6,300	1.3%
1990	455,000	5,500	1.2%
1991	466,000	5,900	1.3%
1992	459,000	6,100	1.3%
1993	458,000	6,300	1.4%
1994	439,000	7,200	1.6%
1995	414,000	8,400	2.0%
1996	417,000	9,900	2.4%
1997	395,000	11,600	2.9%
1998	370,000	12,500	3.4%
1999	371,000	15,000	4.1%
2000	366,000	15,700	4.3%
2001	380,000	18,000	4.7%
2002	382,000	18,000	4.7%
1980-2002 Annual average	498,000	9,100	1.8%
1999-2002 Annual average	375,000	16,700	4.5%

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Home fires are rounded to the nearest thousand while home candle fires are rounded to the nearest hundred. A proportional share of fires in which the heat source was unknown or unreported is included in the candle fires. Homes include dwellings, duplexes, manufactured housing and apartments. Source: NFIRS and NFPA survey.

Table 3.
Area of Origin in Home Candle Fires
1999-2002 Annual Averages

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Bedroom	6,700	(40%)	40	(30%)	790	(53%)	\$141	(45%)
Living room, family room, or den	2,800	(17%)	50	(36%)	280	(19%)	\$62	(20%)
Lavatory or bathroom	2,300	(14%)	10	(6%)	90	(6%)	\$22	(7%)
Kitchen	1,400	(8%)	10	(4%)	70	(5%)	\$14	(5%)
Unclassified function area	600	(3%)	10	(8%)	50	(3%)	\$12	(4%)
Dining room	400	(3%)	0	(3%)	40	(2%)	\$8	(2%)
Unclassified	200	(1%)	0	(2%)	10	(1%)	\$6	(2%)
Unclassified structural area	200	(1%)	0	(0%)	20	(1%)	\$4	(1%)
Closet	200	(1%)	0	(1%)	20	(1%)	\$6	(2%)
Exterior balcony or open porch	200	(1%)	0	(0%)	10	(0%)	\$5	(1%)
Crawl space or substructure space	200	(1%)	0	(2%)	10	(1%)	\$3	(1%)
Wall assembly or concealed space	200	(1%)	0	(0%)	10	(1%)	\$2	(1%)
Personal service area	100	(1%)	0	(0%)	10	(1%)	\$2	(1%)
Hallway, corridor or mall	100	(1%)	0	(1%)	10	(1%)	\$1	(0%)
Laundry room or area	100	(1%)	0	(0%)	10	(0%)	\$4	(1%)
Garage or vehicle storage area*	100	(1%)	0	(0%)	10	(1%)	\$1	(0%)
Office	100	(1%)	0	(0%)	0	(0%)	\$2	(1%)
Other known area	900	(5%)	10	(7%)	50	(3%)	\$15	(5%)
Total	16,700	(100%)	140	(100%)	1,500	(100%)	\$311	(100%)

* Does not include dwelling garages coded as a separate property.

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, civilian deaths and injuries are rounded to the nearest ten, and direct property damage is rounded to the nearest million. Property damage has not been adjusted for inflation. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Candle fires in which the area of origin was unknown or not reported have been allocated proportionally among fires with known area of origin. Totals may not equal sums due to rounding. Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey.

Table 4.
Item First Ignited in Home Candle Fires
1999-2002 Annual Averages

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Mattress or bedding	1,900	(12%)	40	(27%)	350	(23%)	\$49	(16%)
Cabinetry, including built-in cabinetry	1,600	(10%)	10	(6%)	110	(7%)	\$29	(9%)
Curtain, blind, drapery or tapestry	1,500	(9%)	0	(3%)	130	(9%)	\$29	(9%)
Unclassified furniture or utensils	1,500	(9%)	0	(0%)	130	(9%)	\$32	(10%)
Interior wall covering	1,000	(6%)	20	(17%)	60	(4%)	\$17	(5%)
Upholstered furniture	900	(5%)	20	(13%)	140	(10%)	\$29	(9%)
Unclassified item first ignited	800	(5%)	10	(6%)	50	(3%)	\$10	(3%)
Linen other than bedding	700	(4%)	0	(3%)	50	(3%)	\$11	(3%)
Decoration for special event	700	(4%)	10	(4%)	40	(3%)	\$11	(4%)
Clothing	700	(4%)	10	(7%)	60	(4%)	\$14	(4%)
Magazine, newspaper or writing paper	700	(4%)	10	(4%)	50	(3%)	\$12	(4%)
Floor covering or surface	600	(4%)	0	(4%)	40	(3%)	\$9	(3%)
Multiple forms of material	600	(3%)	0	(2%)	50	(3%)	\$12	(4%)
Appliance housing or casing	400	(3%)	0	(1%)	40	(2%)	\$3	(1%)
Unclassified adornment, decoration or recreational material	400	(3%)	0	(0%)	30	(2%)	\$4	(1%)
Box, carton, bag, basket or barrel	300	(2%)	0	(0%)	20	(1%)	\$4	(1%)
Unclassified soft goods or wearing apparel	300	(2%)	0	(0%)	30	(2%)	\$6	(2%)
Rubbish, trash or waste	200	(1%)	0	(0%)	10	(1%)	\$3	(1%)
Structural member or framing	200	(1%)	0	(0%)	10	(1%)	\$5	(2%)
Unclassified structural component or finish	200	(1%)	0	(0%)	10	(1%)	\$3	(1%)
Non-upholstered furniture	100	(1%)	0	(0%)	10	(1%)	\$3	(1%)
Flammable or combustible liquid or gas, including accelerants, and atomized or vaporized liquid	100	(1%)	0	(1%)	40	(3%)	\$2	(1%)
Book	100	(1%)	0	(0%)	0	(0%)	\$1	(0%)
Exterior sidewall covering or finish	100	(1%)	0	(0%)	0	(0%)	\$4	(1%)
Toy or game	100	(1%)	0	(0%)	0	(0%)	\$1	(0%)
Other known item	700	(4%)	0	(0%)	40	(2%)	\$8	(3%)
Total	16,700	(100%)	140	(100%)	1,500	(100%)	\$311	(100%)

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, civilian deaths and injuries are rounded to the nearest ten, and direct property damage is rounded to the nearest million. Property damage has not been adjusted for inflation. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Candle fires in which the item first ignited was unknown or not reported have been allocated proportionally among fires with known item first ignited. Totals may not equal sums due to rounding. Homes include dwellings, duplexes, manufactured housing and apartments.
Source: NFIRS and NFPA survey.

Table 5.
Causes of Home Candle Fires
1999-2002 Annual Averages

Cause	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	15,600	(93%)	130	(94%)	1,440	(97%)	\$289	(93%)
Intentional	400	(2%)	0	(3%)	20	(1%)	\$10	(3%)
Failure of equipment or heat source	300	(2%)	0	(0%)	10	(1%)	\$2	(1%)
Act of nature	100	(1%)	0	(0%)	0	(0%)	\$2	(1%)
Unclassified cause	400	(2%)	0	(2%)	10	(1%)	\$8	(3%)
Total	16,700	(100%)	140	(100%)	1,500	(100%)	\$311	(100%)

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, civilian deaths and injuries are rounded to the nearest ten, and direct property damage is rounded to the nearest million. Property damage has not been adjusted for inflation. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Candle fires in which the cause was unknown or not reported have been allocated proportionally among fires with known cause. Totals may not equal sums due to rounding.

Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey.

Table 6.
Factors Contributing to Ignition in Home Candle Fires
NFIRS Version 5.0 Data Only
1999-2002 Annual Averages

Factor Contributing	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Heat source too close to combustibles	50%	44%	50%	52%
Unclassified misuse of material or product	11%	9%	12%	11%
Abandoned or discarded material or product	11%	0%	9%	8%
Equipment unattended	7%	15%	8%	6%
Unclassified factor contributed to ignition	6%	10%	6%	7%
Playing with heat source	5%	5%	4%	5%
Collision, overturn or knock down	2%	5%	1%	2%
Improper container or storage	2%	0%	2%	1%
Unclassified fire spread or control	1%	0%	1%	1%
Unclassified operational deficiency	1%	3%	1%	1%
Animal	1%	5%	1%	2%
Unintentionally turned on or not turned off	1%	0%	1%	0%
Exposure fire	1%	0%	0%	0%

Note: These are percentages of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. Percents were used without numbers because the fraction of data reported directly in Version 5.0 and not converted from Version 4.1 is still relatively small and may not be representative. In NFIRS 5.0, multiple entries may be recorded for factors contributing to ignition. Fires in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 3%, deaths - 17%, injuries – 2%, property damage – 3%) or fires with “none” (fires - 19%, deaths - 6%, injuries – 12%, property damage – 15%) generally equaled or exceeded those for undetermined (fires - 3%, deaths - 4%, injuries – 4%, property damage – 3%) suggesting that this type of allocation would be most appropriate. Percentages were calculated on the total number of fires, not number of mentions. Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey.

Table 7.
Home Candle Fires by Human Factor Contributing to Ignition
NFIRS Version 5.0 Data Only
1999-2002 Annual Averages

Factor Contributing	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Unattended or unsupervised person	20%	16%	16%	19%
Asleep	12%	25%	26%	16%
Age was a factor	5%	4%	7%	6%
Possibly impaired by alcohol or drugs	1%	2%	2%	1%
Multiple persons involved	1%	2%	2%	1%
Possibly mentally disabled	1%	0%	1%	0%
Physically disabled	0%	2%	0%	0%
None	59%	41%	49%	57%
Not reported	4%	17%	2%	4%

Note: These are percentages of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. Percents were used without numbers because the fraction of data reported directly in Version 5.0 and not converted from Version 4.1 is still relatively small and may not be representative. In NFIRS 5.0, multiple entries may be recorded for human factors contributing to ignition. Percentages were calculated on the total number of fires, not number of mentions. Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey.

Table 8.
Extent of Flame Damage in Home Candle Fires
1999-2002 Annual Averages

Extent of Flame Damage	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined to object of origin	4,100	(24%)	20	(12%)	220	(15%)	\$21	(7%)
Confined to room of origin	8,900	(53%)	20	(16%)	730	(49%)	\$82	(26%)
Confined to floor of origin	1,300	(8%)	20	(14%)	190	(13%)	\$54	(17%)
Confined to building of origin	2,100	(13%)	70	(49%)	300	(20%)	\$133	(43%)
Extended beyond building of origin	300	(2%)	10	(9%)	50	(4%)	\$21	(7%)
Total	16,700	(100%)	140	(100%)	1,500	(100%)	\$311	(100%)

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. 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 million. Property damage has not been adjusted for inflation. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Candle fires in which the extent of flame damage was unknown or not reported have been allocated proportionally among fires with known extent of flame damage. Totals may not equal sums due to rounding.

Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey.

Table 9.
Relative Risk of Civilian Death and Injury by Age in Home Candle Fires
1999-2002 Annual Averages

Age Group	Population in Millions	Percent Population	Civilian Deaths	Relative Death Risk	Civilian Injuries	Relative Injury Risk
0-4	19.2	(6.8%)	20 (17%)	2.5	90 (6%)	0.9
5-9	20.6	(7.3%)	20 (16%)	2.1	60 (4%)	0.5
10-19	40.7	(14.5%)	20 (14%)	1.0	280 (19%)	1.3
20-34	58.9	(20.9%)	10 (9%)	0.4	430 (29%)	1.4
35-49	65.2	(23.2%)	20 (13%)	0.5	360 (24%)	1.0
50-64	41.9	(14.9%)	20 (16%)	1.1	180 (12%)	0.8
65-74	18.4	(6.5%)	10 (8%)	1.2	20 (2%)	0.2
75-84	12.4	(4.4%)	10 (4%)	1.0	50 (3%)	0.7
85+	4.2	(1.5%)	0 (3%)	2.1	20 (2%)	1.1
Total	35.0	(100.0%)	140 (100%)	1.0	1,500 (100%)	1.0
Over 65		(12.4%)	20 (15%)	1.2	100 (6%)	0.5

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Population is rounded to the nearest hundred thousand. Civilian deaths and injuries are rounded to the nearest ten. Proportional shares of home fire deaths and injuries in which the heat source was unknown or unreported are included in this table. Civilian deaths and injuries in which the victim's age was unknown or not reported have been allocated proportionally among casualties with known age. Totals may not equal sums due to rounding.

The relative risk is the ratio obtained when the age group's share of deaths or injuries is divided by the group's share of the population.

Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey. Population estimates for 2000 were used and obtained from Table 11, "Resident Population by Age and Sex: 1980 to 2002" from the U.S. Census Bureau's *Statistical Abstract of the United States: 2003*.

Table 10.
Home Candle Fires by Month
1999-2002 Annual Averages

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	1,800	(11%)	20	(14%)	190	(13%)	\$37	(12%)
February	1,400	(8%)	10	(9%)	150	(10%)	\$28	(9%)
March	1,500	(9%)	10	(7%)	130	(9%)	\$30	(9%)
April	1,300	(8%)	0	(3%)	100	(7%)	\$25	(8%)
May	1,200	(7%)	10	(10%)	100	(7%)	\$22	(7%)
June	1,100	(7%)	20	(15%)	90	(6%)	\$19	(6%)
July	1,000	(6%)	10	(6%)	90	(6%)	\$18	(6%)
August	1,000	(6%)	10	(6%)	80	(6%)	\$21	(7%)
September	1,100	(7%)	10	(5%)	90	(6%)	\$20	(6%)
October	1,400	(8%)	0	(3%)	110	(7%)	\$24	(8%)
November	1,500	(9%)	10	(10%)	140	(9%)	\$25	(8%)
December	2,300	(14%)	20	(12%)	210	(14%)	\$41	(13%)
Total	16,700	(100%)	140	(100%)	1,500	(100%)	\$311	(100%)
Monthly average	1,400	(8%)	10	(8%)	120	(8%)	\$26	(8%)

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, civilian deaths and injuries are rounded to the nearest ten, and direct property damage is rounded to the nearest million. Property damage has not been adjusted for inflation. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Totals may not equal sums due to rounding. Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey.

**Table 11.
Home Candle Fires by Day of Week
1999-2002 Annual Averages**

Day of Week	Fires		Civilian		Civilian		Direct	
			Deaths	Injuries	Injuries	Property Damage (in Millions)		
Sunday	2,700	(16%)	20	(11%)	220	(15%)	\$45	(14%)
Monday	2,300	(14%)	10	(10%)	220	(14%)	\$45	(14%)
Tuesday	2,200	(13%)	10	(8%)	180	(12%)	\$42	(13%)
Wednesday	2,100	(13%)	20	(16%)	220	(14%)	\$42	(14%)
Thursday	2,200	(13%)	20	(18%)	220	(15%)	\$41	(13%)
Friday	2,400	(14%)	20	(16%)	220	(15%)	\$46	(15%)
Saturday	2,700	(16%)	30	(21%)	220	(15%)	\$51	(16%)
Total	16,700	(100%)	140	(100%)	1,500	(100%)	\$311	(100%)
Daily average	2,400	(14%)	20	(14%)	210	(14%)	\$44	(14%)

**Table 12.
Home Candle Fires by Time Period
1999-2002 Annual Averages**

Time Period	Fires		Civilian		Civilian		Direct	
			Deaths	Injuries	Injuries	Property Damage (in Millions)		
Midnight – 2:59 a.m.	1,900	(11%)	40	(26%)	280	(19%)	\$40	(13%)
3:00 – 5:59 a.m.	1,400	(9%)	40	(29%)	220	(15%)	\$34	(11%)
6:00 – 8:59 a.m.	1,200	(7%)	20	(16%)	160	(11%)	\$25	(8%)
9:00 – 11:59 a.m.	1,600	(10%)	0	(1%)	130	(9%)	\$31	(10%)
Noon – 2:59 p.m.	2,200	(13%)	10	(4%)	130	(9%)	\$45	(15%)
3:00 – 5:59 p.m.	2,500	(15%)	0	(1%)	170	(12%)	\$44	(14%)
6:00 – 8:59 p.m.	3,100	(19%)	20	(12%)	200	(14%)	\$46	(15%)
9:00 – 11:59 p.m.	2,600	(16%)	20	(11%)	190	(13%)	\$45	(15%)
Total	16,700	(100%)	140	(100%)	1,500	(100%)	\$311	(100%)
Average	2,100	(13%)	20	(13%)	190	(13%)	\$39	(13%)

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, civilian deaths and injuries are rounded to the nearest ten, and direct property damage is rounded to the nearest million. Property damage has not been adjusted for inflation. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Totals may not equal sums due to rounding. Homes include dwellings, duplexes, manufactured housing and apartments.

Source: NFIRS and NFPA survey.

Table 13.
Item First Ignited in Home Candle Fires: January-November and December
1999-2002 Annual Averages

January-November	Fires		December	Fires	
Mattress or bedding	1,700	(12%)	Decoration for special event	270	(11%)
Cabinetry, including built-in cabinetry	1,400	(10%)	Unclassified furniture or utensils	240	(11%)
Curtain, blind, drapery or tapestry	1,400	(10%)	Cabinetry, including built-in cabinetry	200	(9%)
Unclassified furniture or utensils	1,300	(9%)	Mattress or bedding	200	(9%)
Interior wall covering	800	(6%)	Curtain, blind, drapery or tapestry	160	(7%)
Upholstered furniture	800	(5%)	Interior wall covering	140	(6%)
Unclassified item first ignited	700	(5%)	Linen other than bedding	120	(5%)
Clothing	600	(4%)	Unclassified item first ignited	120	(5%)
Linen other than bedding	600	(4%)	Upholstered furniture	110	(5%)
Magazine, newspaper or writing paper	600	(4%)	Clothing	80	(4%)
Floor covering or surface	500	(4%)	Multiple forms of material	80	(4%)
Multiple forms of material	500	(3%)	Magazine, newspaper or writing paper	80	(3%)
Decoration for special event	500	(3%)	Floor covering or surface	70	(3%)
Unclassified adornment, decoration or recreational material	400	(3%)	Appliance housing or casing	60	(3%)
Appliance housing or casing	400	(3%)	Unclassified adornment, decoration or recreational material	60	(2%)
Box, carton, bag, basket or barrel	300	(2%)	Unclassified soft goods or wearing apparel	50	(2%)
Unclassified soft goods or wearing apparel	300	(2%)	Box, carton, bag, basket or barrel	40	(2%)
Rubbish, trash or waste	200	(1%)	Rubbish, trash or waste	30	(1%)
Structural member or framing	200	(1%)	Non-upholstered furniture	20	(1%)
Unclassified structural component or finish	100	(1%)	Unclassified structural component or finish	20	(1%)
Flammable or combustible liquid or gas, including accelerants, and atomized or vaporized liquid	100	(1%)	Christmas tree	20	(1%)
Non-upholstered furniture	100	(1%)	Book	20	(1%)
Book	100	(1%)	Light vegetation, including grass	20	(1%)
Exterior sidewall covering or finish	100	(1%)	Structural member or framing	10	(1%)
Toy or game	100	(1%)	Unclassified storage supplies	10	(1%)
Other known item	600	(4%)	Toy or game	10	(1%)
			Other known item	90	(4%)
January-November total	14,400	(100%)	December total	2,330	(100%)
January-November monthly average	1,300				

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires in January-November are rounded to the nearest hundred and December fires are rounded to the nearest ten. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Candle fires in which the item first ignited was unknown or not reported have been allocated proportionally among fires with known item first ignited. Totals may not equal sums due to rounding. Homes include dwellings, duplexes, manufactured housing and apartments.
Source: NFIRS and NFPA survey.

**Table 14.
Candle Fires by Occupancy Class
1999-2002 Annual Averages**

Occupancy	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Residential	17,300	(93.8%)	140	(98%)	1,550	(99%)	\$319	(95%)
One- or two family dwelling	12,800	(69.5%)	120	(81%)	1,120	(71%)	\$241	(71%)
Multi-family dwelling	3,900	(21.1%)	20	(16%)	370	(24%)	\$70	(21%)
Unclassified residential	200	(1.2%)	0	(2%)	10	(1%)	\$3	(1%)
Dormitory, fraternity or barrack	100	(0.8%)	0	(0%)	30	(2%)	\$3	(1%)
Hotel or motel	100	(0.7%)	0	(0%)	10	(1%)	\$1	(0%)
Boarding or rooming house	100	(0.3%)	0	(0%)	0	(0%)	\$0	(0%)
Mercantile and Business	400	(2.1%)	0	(0%)	10	(0%)	\$6	(2%)
Bank, post office or business office	100	(0.7%)	0	(0%)	0	(0%)	\$2	(1%)
Specialty shop	100	(0.4%)	0	(0%)	0	(0%)	\$1	(0%)
Storage	200	(1.1%)	0	(0%)	0	(0%)	\$2	(0%)
Unclassified storage	100	(0.5%)	0	(0%)	0	(0%)	\$0	(0%)
Vehicle storage,* garage or fire station	100	(0.4%)	0	(0%)	0	(0%)	\$1	(0%)
Assembly	200	(1.0%)	0	(0%)	0	(0%)	\$3	(1%)
Religious or funeral property	100	(0.5%)	0	(0%)	0	(0%)	\$2	(1%)
Educational	100	(0.5%)	0	(0%)	0	(0%)	\$1	(0%)
Outside or special property	100	(0.3%)	0	(0%)	0	(0%)	\$1	(0%)
All other, unclassified, and unknown-type property use	200	(1.2%)	0	(2%)	0	(0%)	\$5	(1%)
Total	18,400	(100.0%)	140	(100%)	1,570	(100%)	\$337	(100%)

* Does not include fires in which an attached residential garage is coded as a dwelling with the garage as the area of origin.

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. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, civilian deaths and injuries are rounded to the nearest ten, and direct property damage is rounded to the nearest million. Property damage has not been adjusted for inflation. A proportional share of fires in which the heat source was unknown or unreported is included in these totals. Totals may not equal sums due to rounding.

Source: National estimates based on NFIRS and NFPA survey.

Table 15.
Home Candle Fires in the United Kingdom: 1992-2002

Year	Fires	Percent of Home Fires
1992	700	1%
1993	900	1%
1994	1,000	2%
1995	1,300	2%
1996	1,500	2%
1997	1,600	2%
1998	1,800	3%
1999	2,000	3%
2000	2,100	3%
2001	2,000	3%
2002	2,000	3%
1992-2002 Annual average	1,500	2%

Source: Office of the Deputy Prime Minister, *Fire Statistics United Kingdom, 2002, 2004*, London, U.K. ,pp. 62, 65. Available online at http://www.odpm.gov.uk/stellent/groups/odpm_fire/documents/page/odpm_fire_028815-01.hcsp Candles were listed under accidental causes. “Dwelling” is used in the U.K. to refer to what is called “home” in the U.S. The percentage is based on candle fires as a share of reported dwelling fires of all causes, including malicious.

Appendix A: How National Estimates Statistics Are Calculated

Estimates are made using the National Fire Incident Reporting System (NFIRS) of the Federal Emergency Management Agency's (FEMA's) United States Fire Administration (USFA), supplemented by the annual stratified random-sample survey of fire experience conducted by the National Fire Protection Association (NFPA), which is used for calibration.

Databases Used

NFIRS provides annual computerized databases of fire incidents, with data classified according to a standard format based on the NFPA 901 Standard. Roughly three-fourths of all states have NFIRS coordinators, who receive fire incident data from participating fire departments and combine the data into a state database. These data are then transmitted to FEMA/USFA. Participation by the states, and by local fire departments within participating states, is voluntary. NFIRS captures roughly one-third to one-half of all U.S. fires each year. More than one-third of all U.S. fire departments are listed as participants in NFIRS, although not all of these departments provide data every year.

The strength of NFIRS is that it 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. (The NFPA survey separates fewer than 20 of the hundreds of property use categories defined by NFPA 901 and solicits no cause-related information except for incendiary and suspicious fires.) NFIRS also captures information on the avenues and extent of flame spread and smoke spread and on the performance of detectors and sprinklers.

The NFPA survey is based on a stratified random sample of roughly 3,000 U.S. fire departments (or just over one of every ten fire departments in the country). 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 by the NFPA 901 Standard; (2) the number of on-duty firefighter injuries, by type of duty and nature of illness; and (3) 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 NFPA survey begins with the NFPA Fire Service Inventory, a computerized file of about 30,000 U.S. fire departments, which is the most complete and thoroughly validated such listing in existence. The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities protect fewer people per department and are less likely to respond to the survey, so a large 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.

Projecting NFIRS to National Estimates

To project NFIRS results to national estimates, one needs at least an estimate of the NFIRS fires as a fraction of the total so that the fraction can be inverted and used as a multiplier or scaling ratio to generate national estimates from NFIRS data. But NFIRS is a sample from a universe whose size cannot be inferred from NFIRS alone. Also, participation rates in NFIRS are not necessarily uniform across regions and sizes of community, both of which are 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.

There are separate projection formulas for four major property classes (residential structures, non-residential structures, vehicles, and other) and for each measure of fire severity (fire incidents, civilian deaths, and civilian injuries, and direct property damage).

For example, the scaling ratio for 2002 civilian deaths in residential structures is equal to the total number of 2002 civilian deaths in residential structure fires reported to fire departments, according to the NFPA survey (2,695), divided by the total number of 2002 civilian deaths in residential structure fires reported to NFIRS (1,029). Therefore, the scaling ratio is $2,695/1,029 = 2.62$.

The scaling ratios for civilian deaths and injuries and direct property damage are often significantly different from those for fire incidents. Except for fire service injuries, average severity per fire is generally higher for NFIRS than for the NFPA survey. Use of different scaling ratios for each measure of severity is equivalent to assuming that these differences are due either to NFIRS under-reporting of small fires, resulting in a higher-than-actual loss-per-fire ratio, or possible biases in the NFIRS sample representation by region or size of community, resulting in severity-per-fire ratios characteristic only of the oversampled regions or community sizes.

Note that this approach also means that the NFPA survey results for detailed property-use classes (e.g., fires in storage structures) may not match the national estimates of the same value.

Calculating National Estimates of Particular Types of Fires

Most analyses of interest involve the calculation of the estimated number of fires not only within a particular occupancy but also of a particular type. The types that are mostly frequently of interest are those defined by some ignition-cause characteristic. The six cause-related characteristics most commonly used to describe fires are: form of the heat that caused the ignition, equipment involved in ignition, form or type of material first ignited, the ignition factor that brought heat source and ignited material together, and area of origin. Other characteristics of interest are victim characteristics, such as ages of persons killed or injured in fire.

For any characteristic of interest in NFIRS, some reported fires have that characteristic unknown or not reported. If the unknowns are not taken into account, then the propensity to report or not report a characteristic may influence the results far more than the actual patterns on that characteristic. For example, suppose the number of fires remained the same for several consecutive years, but the percentage of fires with cause unreported steadily declined over those years. If the unknown-cause fires were ignored, it would appear as if fires due to every specific cause increased over time while total fires remained unchanged. This, of course, does not make sense.

Consequently, most national estimates analyses allocate unknowns. This is done by using scaling ratios defined by NFPA survey estimates of totals divided by only those NFIRS fires for which the dimension in question was known and reported. This approach is equivalent to assuming that the fires with unreported characteristics, if known, would show the same proportions as the fires with known characteristics. For example, it assumes that the fires with unknown ignition factor contain the same relative shares of child-playing fires, incendiary-cause fires, short circuit fires, and so forth, as are found in the fires where ignition factor was reported.

Rounding Errors

The possibility of rounding errors exists in all our calculations. One of the notes on each table indicates the extent of rounding for that table, e.g., deaths rounded to the nearest one, fires rounded to the nearest hundred, property damage rounded to the nearest hundred thousand dollars. In rounding to the nearest one, functional values of 0.5 or more are rounded up and functional values less than 0.5 are rounded down. For example, 2.5 would round to 3, and 3.4 would round to 3. In rounding to the nearest one, a stated estimate of 1 could be any number from 0.5 to 1.49, a roughly threefold range.

The impact of rounding is greatest when the stated number is small relative to the degree of rounding. As noted, rounding to the nearest one means that stated values of 1 may vary by a factor of three. Similarly, the cumulative impact of rounding error - the potential gap between the estimated total and the sum of the estimated values as rounded - is greatest when there are a large number of values and the total is small relative to the extent of rounding.

Suppose a table presented 5-year averages of estimated deaths by item first ignited, all rounded to the nearest one. Suppose there were a total of 30 deaths in the 5 years, so the total average would be $30/5 = 6$.

In case 1, suppose 10 of the possible items first ignited each accounted for 3 deaths in 5 years. Then there would be 10 entries of $3/5 = 0.6$, rounded to 1, and the sum would be 10, compared to the true total of 6.

In case 2, suppose 15 of the possible items first ignited each accounted for 2 deaths in 5 years. Then there would be 15 entries of $2/5 = 0.4$, rounded to 0, and the sum would be 0, compared to the true total of 6.

Here is another example: Suppose there were an estimate of 7 deaths total in 1992 through 1996. The 5-year average would be 1.4, which would round to 1; the number we would show as the total. Each death would represent a 5-year average of 0.2.

If those 7 deaths split as 4 deaths in one category (e.g., smoking) and 3 deaths in a second category (e.g., heating), then we would show $4 \times 0.2 = 0.8$ deaths per year for smoking and $3 \times 0.2 = 0.6$ deaths per year for heating. Both would round to 1, there would be two entries of 1, and the sum would be 2, higher than the actual rounded total.

If those 7 deaths split as 1 death in each of 7 categories (quite possible since there are 12 major cause categories), then we would show 0.2 in each category, always rounding to 0, and the sum would be 0, lower than the actual rounded total. The more categories there are, the farther apart the sum and total can -- and often do -- get.

Note that percentages are calculated from unrounded values, and so it is quite possible to have a percentage entry of up to 100%, even if the rounded number entry is zero.

Appendix B.
Candle Fires Previously Published in *NFPA Journal's* "Fire Watch" Series

- Tremblay, Kenneth J. "Candle Fire Damages Home: Pennsylvania," *NFPA Journal*, 98, no. 6 (2004), pp. 16-17.
- Tremblay, Kenneth J. "Alarm Alerts Occupant: Maine," *NFPA Journal*, 98, no. 5 (2004), p. 19.
- Tremblay, Kenneth J. "Smoke Alarm Alerts Napping Woman to Candle Fire," Wisconsin," *NFPA Journal*, November/December 2004 Online Exclusive at <http://www.nfpa.org/publicColumn.asp?categoryID=&itemID=21673&src=NFPAJournal> on August 3, 2005.
- Tremblay, Kenneth J. "Candle Ignites Fatal Fire: Georgia," *NFPA Journal*, 97, no. 6 (2003), pp. 14-15.
- Tremblay, Kenneth J. "Candle Ignites Decorative Linen over Bed: Florida" *NFPA Journal*, 97, no. 4 (2003), p. 14.
- Tremblay, Kenneth J. "Unattended Candle Fire Damages Apartment: Massachusetts," *NFPA Journal*, 97, no. 3 (2003), p. 16.
- Tremblay, Kenneth J. "Candle Ignites Fatal Fire: Michigan," *NFPA Journal*, 97, no. 2 (2003), p. 22.
- Tremblay, Kenneth J. "Three Boys Die in Unattended-Candle Fire: Minnesota," *NFPA Journal*, 96, no. 5 (2002), p. 18.
- Tremblay, Kenneth J. "Unattended Candle Sparks Fires, Killing Three: Indiana," *NFPA Journal*, 96, no. 1 (2002), p. 20.
- Tremblay, Kenneth J. "Four Die When Candle Ignites Curtains: Kentucky," *NFPA Journal*, 96, no. 1 (2002), p. 20.
- Tremblay, Kenneth J. "Candle Fire Kills Two: Washington," *NFPA Journal*, 95, no. 6 (2001), p. 21.
- Tremblay, Kenneth J. "Two Die after Candle Ignites Plastic Bathtub: Massachusetts," *NFPA Journal*, 95, no. 5 (2001), pp. 24-25.
- Tremblay, Kenneth J. "Children Playing with Candle Leads to Three Deaths: Indiana," *NFPA Journal*, 94, no. 5 (2000), p. 22.
- Tremblay, Kenneth J. "Candle Used during a Hurricane Ignite Fire, Killing Two: Maryland," *NFPA Journal*, 94, no. 5 (2000), p. 22.
- Tremblay, Kenneth J. "Unattended Candle Ignites Fire in Senior Housing: Kentucky," *NFPA Journal*, 93, no. 6 (1999), p. 19.
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- Tremblay, Kenneth J. "Fire Spreads through Apartment Building: New Jersey," *NFPA Journal*, 93, no. 2 (1999), p. 24.
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- Tremblay, Kenneth J. "Candle Ignites Deadly Blaze: Connecticut," *NFPA Journal*, 91, no. 5 (1997), pp. 21-22.
- Tremblay, Kenneth J. "Candle Ignites Blaze that Kills Four Children: California," *NFPA Journal*, 90, no. 6 (1996), p. 22.
- Tremblay, Kenneth J. "Three Die in Apartment Fire: Arizona," *NFPA Journal*, 89, no. 6 (1995), p. 37.
- Tremblay, Kenneth J. "Four Children Die in Fire Started by Candle: North Carolina," *NFPA Journal*, 89, no. 1 (1995), p. 34.

Appendix B.

Candle Fires Previously Published in *NFPA Journal's* "Fire Watch" Series (Continued)

Courtney, Neil. "Two Die when Candle Ignites Gasoline during Power Outage" *Fire Journal*, 85, no. 4 (1991), p. 26.

Courtney, Neil. "Four Die when Candle Ignites Flammable Liquid: Massachusetts" *Fire Journal*, 84, no. 3 (1990), p. 26.

Candle Fire Damages Home: Pennsylvania

A candle used to light a single-family house that had no electricity or gas fell onto a living room couch and started a fire that spread to the upper floors and along the home's exterior siding, threatening several exposures. The two-and-a-half-story, wood-framed house, which was built on a grade, had no fire detection equipment.

The fire department received a 911 call from one of the house's occupants at 4:18 a.m. and arrived minutes later to find heavy fire venting to the exterior from two floors. Although the incident commander could only account for three of the four people thought to be in the house, he couldn't commit interior crews because the flames were too intense. Fortunately, the missing occupant showed up shortly after firefighters began battling the blaze, which they eventually extinguished with the help of mutual-aid companies summoned by a second alarm.

Investigators determined that the fire began in the first-floor living room after the missing man and his girlfriend went out, apparently leaving a candle burning on a tray on the couch. Burn patterns indicated that the fire burned horizontally and vertically throughout the house and vented through the windows to the exterior siding. Despite a lack of smoke alarms, the three other occupants, who were asleep on upper floors, woke up during the fire and escaped. They were treated for burns at a hospital. A firefighter who suffered minor burns was treated at the scene.

Damage to the house, valued at \$50,000, is estimated at \$30,000, and damage to its contents, valued at \$6,000, is estimated at \$5,000.

Tremblay, Kenneth J., *NFPA Journal*, 98, no.5 (2004), pp. 16-17.

Alarm Alerts Occupant: Maine

An unattended candle ignited window curtains of a second floor bedroom. Smoke and heat triggered a smoke alarm allowing one occupant to investigate the cause and shut the door to the room of origin.

The occupant had left a candle burning in his bedroom unattended, as he slept on a couch in another part of the home. The candle's flame came into contact with the curtains causing a fire that spread to other combustibles in the room. When firefighters arrived, fire was coming from a rear window. The room of origin suffered heavy fire damage with significant smoke and heat damage to the rest of the second floor. The home valued at \$200,000 with contents of \$40,000 suffered structural losses of \$50,000 and contents losses of \$10,000. There were no injuries.

Tremblay, Kenneth J., *NFPA Journal*, 98, no.5 (2004), p. 19.

Smoke Alarm Alerts Napping Woman To Candle Fire: Wisconsin

A smoke alarm alerted a sleeping occupant to a fire started by a candle in an unoccupied bedroom. The occupant of the house, a 56-year-old woman, suffered singed hair and minor facial burns while exiting the fire. The fire occurred in a single-family, single-story manufactured home constructed of wood framing with asphalt roof shingles. The dwelling, which was 70 feet (23.3 meters) long and 14 feet (4.2 meters) wide, had a single, battery-operated smoke alarm near the bedrooms. There were no sprinklers.

The fire department received a 911 call at 5 p.m. and arrived to find smoke and flames coming from one end of the home. Crews advanced a hose line to the rear bedroom and extinguished the flames. The woman told police at the scene that she was napping in another part of the house when the smoke alarm sounded and she went to investigate. Finding smoke and heat coming from the bedroom door, she gathered her pets and evacuated the home.

The woman told investigators that she had left a candle burning in the bedroom and one of her cats might have knocked it over. The heaviest damage occurred at the corner of the bedroom near the remains of a shelving unit, where firefighters also found was a plate that had been used as a candleholder and a large piece of candle wax. The property, valued at \$10,000, suffered losses of \$5,000. Damage to the contents, valued at \$2,000, was estimated at \$700.

Tremblay, Kenneth J., *NFPA Journal*, Online Exclusive, November/December 2004.

<http://www.nfpa.org/publicColumn.asp?categoryID=&itemID=21673&src=NFPAJournal>

Candle Ignites Fatal Fire: Georgia

Four members of a household of 10 died in a house fire started by a candle they'd been using for light because the utility company shut off their electricity for non-payment.

The single-family, wood frame house was 45 feet (14 meters) long and 20 feet (6 meters) wide. The first floor of the unsprinklered, two-story structure consisted of a living room, kitchen, dining room, bedroom and bathroom; there were five bedrooms and a bathroom on the second floor. After the fire, investigators found a smoke alarm on the floor under debris, but they don't know whether it operated.

The fire was reported at 12:35 a.m. Firefighters arrived to find fire and heavy smoke coming from the house and discovered neighbors using a ladder to help six of the occupants escape from the second floor. All six suffered smoke inhalation injuries and were taken to area hospitals. The injured included a 9-day-old boy, a 4-year-old boy, a 6-year-old girl, a 9-year-old boy, and two adults ages 25 and 21.

Firefighters found one of the victims, an adult, in the second-floor hallway, another adult and a child in a second-floor bedroom, and a second child in another bedroom. The 7-year-old girl, 4-year-old boy, 50-year-old woman, and 72-year-old woman had died of smoke inhalation.

Investigators determined that the 50-year-old woman, who was mentally impaired, occupied the bedroom in which the fire began after a candle she was using ignited combustibles.

Fire damage was limited to part of the second-floor hallway and the woman's bedroom, although the rest of the house incurred heavy smoke and water damage. The home, valued at \$39,000, suffered \$10,000 in damages. Its contents, valued at \$20,000, suffered \$5,000 in damage. There were no firefighter injuries.

Tremblay, Kenneth, J., *NFPA Journal*, 97, no.6 (2003), pp. 14-15.

Candle Ignites Decorative Linen Over Bed: Florida

When a candle ignited bedding in a condominium on the top floor of an 11-story building, the occupants had the presence of mind to close the front door when they left the unit, thus limited smoke damage to the condominium.

The unsprinklered, 85-unit concrete structure measured 195 feet (59 meters) by 50 feet (15 meters). Standpipe system and portable fire extinguishers were located throughout the building, and there were smoke alarms and manual pull stations in the common areas. Because the fire was confined to the unit of origin, however, smoke didn't reach the common areas so the internal fire alarm system didn't sound.

The fire began when a lit candle on a bedside table tipped over and ignited the bed's decorative linen canopy. The burning linen fell onto the bed, igniting the bedding and the mattress, then spread to other combustibles in the room. The residents tried to extinguish the fire themselves, but the flames spread so quickly they called 911 at 12:44 a.m. and left the unit.

When they encountered arriving firefighters in the lobby, the unit's residents told the crews where the fire was and what was burning. An engine and rescue company attached hose lines to the standpipe on the fire floor and entered the condo to extinguish the fire, conduct a primary search and ventilate the unit. Firefighters also evacuated the building's top four floors.

Although the condo's occupants closed the unit's front door, they left the bedroom door open, allowing heat and smoke to damage the rest of the unit. Structural damage was estimated at \$10,000 and damage to the unit's contents was estimated at \$50,000. No one was injured.

Tremblay, Kenneth, J., *NFPA Journal*, 97, no.4 (2003), p. 14.

Unattended Candle Fire Damages Apartment: Massachusetts

An unattended candle left in an entertainment center in the living room of a fourth-floor apartment ignited the room's furniture. Fortunately, a sprinkler extinguished the fire as it began to spread up the wall.

The five-story building, originally a mill, had a hard-wired fire detection system and wet-pipe sprinkler system, both connected to the municipal fire alarm system.

Firefighters received the alarm at 3:50 p.m. and arrived three minutes later to find that the sprinkler system had activated. Fire companies responding to the fourth floor reported smoke in the hallway and the sound of water running in the locked apartment. By the time they entered the unit, the sprinkler had extinguished the blaze.

The apartment's resident told investigators that she'd come home from work during a break to do some cooking and lit the candle to mask the odor. When she left to go back to work, she forgot to extinguish the candle, the heat from which eventually broke the glass candleholder. Molten wax dripping down the front and back of the entertainment center ignited the cardboard covering its back, and the fire spread up the wall until the sprinkler extinguished it.

Smoke damage in the unit of origin and common areas of the fourth floor, and fire damage to the entertainment center, its contents, and the wall behind it were estimated at \$10,000. There were no injuries.

Tremblay, Kenneth J., *NFPA Journal*, 97, no.3 (2003), p. 16.

Candle Ignites Fatal Fire: Michigan

A 24-year-old man died in a fire that apparently began when a candle he left burning on a wooden shelf in his basement bedroom ignited wooden wall paneling after he fell asleep. The early morning fire burned undetected until another member of the family on the first floor smelled smoke. The single-family home's two smoke alarms failed to activate because their batteries were dead.

The exterior of the two-story, wood-frame building was partially faced with brick, and the roof was covered with asphalt shingles. In addition to the bedrooms in the basement and on the first floor, there was a master bedroom on the second floor.

Firefighters responding to a 3:27 a.m. telephone call reporting the fire noted smoke coming from a side door and saw the blaze burning in the basement through a window. They mounted an interior attack and began searching the basement for the victim whom they discovered on a mattress on his bedroom floor. He was taken to the hospital, where he later died.

Discovering the remains of a candleholder, a candle and the shelf, which had been attached to the wall enclosing the stairs to the first floor, the fire investigator determined that the candle ignited the wall paneling, and the resulting fire burned through the wall to the stairwell. He concluded that the location of the unapproved basement bedroom, with its single path of egress, and the non-functioning smoke alarms which failed to provide early warning of the fire directly contributed to the victim's death.

Three occupants escaped unharmed. Property damage to the dwelling, valued at \$175,000, came to \$45,000, while damage to its contents, valued at \$100,000, was estimated at \$25,000.

Tremblay, Kenneth J., *NFPA Journal*, 97, no.2 (2003), p. 22.

Three Boys Die In Unattended-Candle Fire: Minnesota

A candle left burning in the living room of a wood-frame house ignited combustibles, and heat and smoke spread to the second floor, where it fatally injured three sleeping boys. Smoke alarms on the second floor and in the basement were useless because their batteries were missing.

The two-story unsprinklered house, which was 52 feet (16 meters) long and 24 feet (7 meters) wide, had a 24-foot (7-meter) by 24-foot (7-meter) detached garage at one end. The house contained two apartments, a one-bedroom unit in the basement and a three-bedroom unit on the first and second floors. There were no smoke alarms installed on the first floor.

At 1:47 a.m., the police notified the fire department of a house fire with people trapped. A 40-year-old woman was standing outside when firefighters arrived, screaming that her babies were still inside and that there were people in the basement.

Fire crews advanced a 1 ¾-inch hose line through the front door to attack the blaze and search for trapped occupants. A second crew searching the basement apartment discovered that the occupants had already evacuated and that the fire hadn't spread to the basement. On the second floor, however, firefighters found two boys in one bedroom and a third boy in another bedroom. The boys, two 10-year-olds and an 11-year-old were taken to the hospital, where they were pronounced dead.

Three Boys Die In Unattended-Candle Fire: Minnesota (Continued)

Investigators determined that the fire began in the living room near the front door when an unattended candle ignited nearby combustibles. The remains of a chair, a cabinet, and magazines were found near a steel candle holder. The fire spread up and out through the doors, living room wall spaces, and stairs. The house, valued at \$75,000, and its contents, valued at \$50,000, were total losses.

Tremblay, Kenneth J., *NFPA Journal*, 96, no.5 (2002), p. 18.

Unattended Candle Sparks Fire, Killing Three: Indiana

A 23-year-old woman and her two daughters, aged 11 months and 2 years, died when wind from an open window blew curtains across an unattended candle, spreading flames to nearby combustibles. The interior walls which were composed of 1 1/8-inch plywood paneling on wood studs contributed to flame spread.

The house had two smoke alarms, one battery-operated, and the other hardwired. Both were inoperable. There were no sprinklers.

The single-story, two-family, wood-frame house had a pitched roof covered with asphalt shingles. Each unit was 24 feet (7 meters) wide and 29 feet (8 meters) long and contained two bedrooms, a living room, an eat in kitchen, and a bathroom.

A passerby discovered the fire and called 911 at 9:45 a.m. Firefighters found the 11-month-old girl in a crib in the living room, which was involved in flames, dead from smoke inhalation and burns. Her mother and sister were found next to a bed, dead of smoke inhalation.

All three had been napping when the fire broke out. The mother was a heavy sleeper which may have kept her from waking up and detecting the fire.

The dwelling, valued at \$130,000, sustained \$75,000 in damage. Contents, valued at \$35,000, sustained \$25,000 in losses.

Tremblay, Kenneth J., *NFPA Journal*, 96, no.1 (2002), p. 20.

Four Die When Candle Ignites Curtains: Kentucky

A man and his three children died during an early-morning fire in their manufactured home when hot wax from an unattended candle dripped on curtains and the floor, igniting them. Candles were being used for illumination because the power was off.

The single-story, wood-and-steel-frame home, paneled in wood, was 12 feet (4 meters) wide and 65 feet (20 meters) long. It had no sprinklers and no smoke alarms.

A neighbor discovered the fire and called 911 at 12:09 a.m. Fire crews arrived 12 minutes later.

Initially informed that the house was vacant, firefighters began a defensive attack. About five minutes after their arrival, a neighbor reported that he thought people were inside. By this time additional resources arrived, allowing them to begin an interior attack. When they entered the house they found the body of a 6-year-old girl in one bedroom and those of her 27-year-old father, 3-year-old sister and 7-year-old brother in the second bedroom.

Four Die When Candle Ignites Curtains: Kentucky (Continued)

The blaze started in the living room at one end of the house and spread up the wall and into the hallway to the bedrooms. It appeared that the victims had been trying to escape when they succumbed to smoke inhalation. Dollar losses weren't reported.

Tremblay, Kenneth J., *NFPA Journal*, 96, no.1 (2002), p. 20.

Candle Fire Kills Two: Washington

An unattended candle sparked a blaze that killed two teenaged girls trapped in a bathroom that had only one exit.

The single-story, wood frame house, which had three bedrooms, 1 ½ baths, a kitchen and a living room covered nearly 1,200 square feet (111 square meters). A single-station smoke alarm was present but wasn't operational. There were no sprinklers.

Firefighters were dispatched to the scene at 2:07 a.m. and arrived four minutes later to find the house fully involved in flames and two girls trapped. Resources were divided into fire attack, ventilation, and search and rescue as entry teams began to attack the fire from exterior positions. Crews advanced two hose lines into the front of the house to control the blaze and search for the girls. A third hose line was positioned at the rear of the house to fight a porch fire fueled by stored tires.

The girls, aged 15 and 16, weren't found during a primary search. Crews found them during a secondary search in a bathroom off a bedroom at the center of house, which had previously been used as a beauty parlor. The bathroom had been added later, but neither the bedroom nor the bathroom provided a secondary exit from the house. The only exit was blocked by fire, heat, and smoke.

A 13-year-old girl who survived said she left an unattended candle burning in a plastic container. Heat from the flame melted the container and ignited a wooden headboard, as drop-down flames spread to the bedding and other combustibles. The girl discovered the fire only after the house had filled with smoke and heat, and she and the only adult present escaped.

Contributing to the delay in alarm was a lack of an operating smoke alarm. The alarm wasn't working when it had been tested two weeks before the fire, and the situation hadn't been corrected.

The house, valued at \$100,000, and its contents valued at \$20,000, were a total loss.

Tremblay, Kenneth J., *NFPA Journal*, 95, no.6 (2001), p. 21.

Two Die After Candle Ignites Plastic Bathtub: Massachusetts

An unattended candle started an apartment fire that killed two children and injured three occupants. The fire burned rapidly, producing heavy black smoke, after the candle ignited a plastic bathtub enclosure.

The second-floor apartment was in a three-story building containing one 1,275-squarefoot (118-square-meter) unit on each floor. The wood-frame building had asbestos on the exterior walls and an asphalt roof. Each apartment had three bedrooms, a bathroom, a kitchen, and front

Two Die After Candle Ignites Plastic Bathtub: Massachusetts (Continued)

and rear porches. Smoke alarms were present, but the type and their locations in the apartments weren't reported and it isn't known if they operated. There were no sprinklers.

A passerby saw smoke on the second floor and called 911 at 11:10 p.m. Firefighters arrived within four minutes to find that the blaze had spread from the second-floor bathroom into the hallway and kitchen. Firefighters from three engines, two ladder companies, and a rescue company brought the fire under control and made several rescue attempts. However, two girls, ages 9 and 5, died, and two other children, ages 7 and 11, were injured, as was a 35-year-old woman.

Investigators determined that a candle in a glass container had been lit and placed on the shelf of the tub enclosure. Heat from the candle ignited the tub enclosure, which burned vigorously, involving the entire bathroom. A closed door initially contained the heat and smoke, but flames broke through the door and into the hall and kitchen.

The fire department conducted flame testing on a similar tub enclosure from another apartment in the building. The sample began to melt within 20 seconds of exposure to an open flame, burning quickly and producing a significant amount of black smoke until it was nearly consumed by the flames.

The building, valued at \$91,000, sustained estimated losses of \$50,000. Content losses weren't reported. Two firefighters received minor injuries.

Tremblay, Kenneth J., *NFPA Journal*, 95, no.5 (2001), pp. 24-25.

Children Playing With Candle Leads To Three Deaths: Indiana

Despite a mother's effort to rescue her 2-year-old twins, all three died in a fire in their home after the twin's lit a candle in their plastic playhouse in the first-floor living room. When the playhouse ignited, the boy and girl ran upstairs to hide in a bedroom.

The mother, who was in the kitchen, noticed the fire was burned trying to extinguish it, and went upstairs to get the twins. The fire spread up to the second floor, when the mother opened a window to call for help.

The wood-frame, two-family duplex covered approximately 600 square feet (56 square meters). It had no sprinklers. A single smoke alarm in the attic was useless during the incident.

A neighbor saw the woman hanging out of the second-floor window calling for help and dialed 911 at 12:03 p.m. Responding firefighters could see white smoke coming from the home turn black as they approached.

After extinguishing the fire, fire crews found the bodies of the mother and one of the twins in a closet with the door partially ajar. The other twin was found outside the closet. All three had succumbed to smoke inhalation and burns. Firefighters rescued a third child, age 3 months, who survived with smoke inhalation and burn injuries. The baby was found on a bed, wrapped in a blanket.

The home, valued at \$65,000, and its contents, valued at \$10,000 sustained losses estimated at \$30,000 and \$10,000, respectively. No firefighters were injured.

Tremblay, Kenneth J., *NFPA Journal*, 94, no.5 (2000), p. 22.

Candles Used During A Hurricane Ignite Fire, Killing Two: Maryland

After their electricity was cut off, a family stockpiled candles in anticipation of Hurricane Floyd. An 8-year-old boy, who often woke during the night to read, lit four candles and dropped one on his bed, igniting the bedding and a box of matches. His delay in telling his mother allowed the fire to spread.

The unsprinklered unit was one of two in a two-story, wood-frame duplex that measured 25 by 25 feet (8 by 8 meters). The three bedrooms were on the second floor, along with two bathrooms and an office. Smoke alarms in the second floor hallway didn't operate, although the reason wasn't reported.

The power company had intentionally cut power to the area due to the advancing storm, and the family had prepared for the outage by stocking up on candles. The father wasn't home during the incident, as he had to work, but the mother and her four sons, ages 10, 8, 7, and 5 had all fallen asleep in the master bedroom.

At some point during the night, the 8-year-old awoke and took four candles from his parents' room so he could read. As he moved one of the candles, it fell onto his bed, igniting it. Unfortunately, the boy tried to extinguish the fire before alerting the others, and by the time he woke his mother, the blaze was well advanced. The 8-year-old, his mother, and his 7-year-old brother managed to escape, but the other two boys were still in the house when firefighters arrived.

A call was made to 911 at 3:51 a. m. from a neighbor's home, possibly by one of the family members who escaped. Even though the call came at the height of the storm, firefighters responded within eight minutes, only to find the 5- and 10-year-old dead of smoke inhalation in their parent's bedroom. The three surviving family members also suffered smoke inhalation injuries.

The dwelling, valued at \$125,000, suffered a loss of \$60,000. Its contents, valued at \$50,000, sustained \$25,000 in damage.

Tremblay, Kenneth J., *NFPA Journal*, 94, no.5 (2000), p. 22.

Unattended Candle Ignites Fire In Senior Housing: Kentucky

Smoke filled this complex for older adults when an unattended candle ignited combustibles in a bedroom. The fire killed a 74-year-old occupant of the room of origin and filled the apartment with black smoke, causing extensive smoke damage. A smoke detection system detected the fire, which was too small to activate sprinklers.

The six-story building was constructed of protected steel and concrete. It had a monitored smoke detection system and a wet-pipe sprinkler system, as well as portable extinguishers in the hallways.

An automatic alarm activation at 2:48 p.m. prompted a private alarm company to dispatch the fire department. En route, dispatch updated the crews, confirming a fire in an occupied apartment. Arriving four minutes after the alarm, firefighters found the alarms operating and noted light smoke. Directed by bystanders to a first-floor apartment, firefighters saw heavy smoke when they opened the door and quickly closed it again.

Unattended Candle Ignites Fire In Senior Housing: Kentucky (Continued)

Firefighters set up two attack lines using two standpipe connections and advanced into the apartment to begin search and rescue operations. They discovered a small fire in a bedroom and removed the occupant, who was on the bedroom floor. Firefighters gave the victim to a medic unit for treatment. Meanwhile, the interior crews broke windows to ventilate and extinguish the remaining fire. Additional units, which were called as smoke filled the first floor hallway and spread to the second floor, began to evacuate residents.

The fire was started by a candle left burning on a nightstand. The 74-year-old woman in the apartment of origin was handicapped and infirm, and the candle was often used to mask odors caused by a medical condition. She died of burns and smoke inhalation after being transported to the hospital.

According to firefighters, the smoke alarms in the apartment weren't sounding when they entered, and it appears that the slow-burning fire didn't produce enough heat to activate the sprinklers.

Damage to the building was estimated at \$15,000. Many of the occupants were treated for smoke inhalation but refused transport to the hospital.

Tremblay, Kenneth J., *NFPA Journal*, 93, no.6 (1999), p. 19.

Candle Fire Kills One: Washington

A 48-year-old man died in a fire that started when a candle ignited combustibles in his bedroom in a single-family house that had no smoke detectors.

Residents of the one-story, wood-frame dwelling had been using candles the evening before the fire during a power failure. The power was restored during the night, and most of the candles had been extinguished, but apparently one was left burning in the victim's bedroom.

The victim and other residents of the house had been up and talking early in the morning, but by 7 a.m., the victim was in his room alone, with the door shut and barricaded for privacy. At 7:44 a.m., a next door neighbor detected the blaze and called the fire department. Firefighters arrived within four minutes to find smoke coming through a broken sliding glass door, and a man spraying water through the door with a garden hose.

Firefighters quickly extinguished the blaze. Firefighters found the victim in his bedroom, partially on the bed. His burns indicated that he had tried to stand but the intense heat in the room had caused him to fall back onto the bed.

Investigators determined that the blaze began on the dresser, where a candle ignited combustibles that then fell to the floor and ignited clothing behind and beside the dresser. Flames then spread up the wall. Other occupants of the house became aware of the fire when they noticed smoke seeping from around the bedroom door. They tried to alert the victim, but the heat and the blocked bedroom door prevented them from reaching him.

Fire damage was confined to the room of origin, but smoke spread throughout the house. Property damage was estimated at \$16,000.

Tremblay, Kenneth J., *NFPA Journal*, 93, no.4 (1999), p. 19.

Fire Spreads Through Apartment Building: New Jersey

Three occupants and several firefighters were injured in an apartment building fire that spread through fire doors that had been propped open.

The five-story, 50-unit building, which was part of a larger complex, was of unprotected ordinary construction and measured approximately 150 by 150 feet. It contained hardwired smoke detectors and manual pull stations, as well as self-closing doors that opened into protected stairwells. It had no sprinklers.

Wind blowing through an open, second-floor bedroom window caused curtains to billow and knock a lighted candle from a dresser onto a bed, igniting the bedding and several stuffed animals. The apartment's occupant tried unsuccessfully to extinguish the blaze with a pot of water while her son called 911 at 4:14 p.m. When the two finally fled the apartment, they left the door open for firefighters.

As the fire grew, it spread into the hallway, where the stairwell doors had been wedged open with a chock, enabling smoke and flames to spread to the upper floors. Firefighters also found flames traveling in voids accessed through holes in the walls that had been covered for appearance, not for fire protection. This complicated extinguishment. Eventually, fire spread to all five floors, damaging the entire building.

Loss estimates weren't reported. Six firefighters and three occupants were injured.

Tremblay, Kenneth J., *NFPA Journal*, 93, no.2 (1999), p. 24.

Candle Fire Kills Four: Texas

An adult and three children died when a candle tipped over onto a love seat and ignited a fire in a single-family home. The occupants were using the candles for light because the utilities had been shut off.

The single-story structure of unprotected, wood-frame construction measured 50 by 30 feet (15.2 by 9.1 meters). Two unmounted smoke detectors were found, but neither had batteries. There were no sprinklers.

A 44-year-old man was sleeping on a sofa in the living room, and three children, ages 5, 4, and 3, were asleep in another room when a neighbor noticed the fire and called 911 at 11:00 p.m.

Investigators determined that a candle had fallen onto a love seat in the living room and ignited the upholstery. The fire smoldered for about an hour.

The adult's body was found in the living room. He had died of burns and smoke inhalation. Firefighters were able to rescue the three children, but all three died later of smoke inhalation.

Damage to the property, valued at \$15,000, and its contents, valued at \$5,000 was estimated at \$7,000 and \$3,000 respectively.

Tremblay, Kenneth J., *NFPA Journal*, 92, no.5 (1998), p. 17.

Candle Ignites Deadly Blaze: Connecticut

Three people died when a candle ignited a blaze in a two-story, four-unit apartment building.

The unit of origin, which measured 60 by 25 feet, was constructed of concrete block walls and wood joist floors and a wood roof covered with asphalt shingles. The first floor contained a kitchen, a utility/laundry room, and a living room. Two bedrooms and a bathroom were located on the second floor. A single-station, battery-operated smoke detector located at the top of the stairs was missing its battery. There were no sprinklers.

At the time of the fire, the building was experiencing a power failure. Two girls, ages 6 and 7, were playing on the first floor, and four adults and two other children were on the second floor. The 7-year-old was using a candle to light a first-floor closet to look for toys when she accidentally ignited clothing. The girl told her mother, who tried to extinguish the fire.

Firefighters responded to a 7:54 a.m. call to 911 found fire visible in all windows on both floors. Staging an aggressive interior attack, they extinguished the blaze in 12 minutes using multiple hose lines. During their search, firefighters found two adults, ages 65 and 75, on a bedroom floor and the 7-year-old girl who started the fire hiding behind a closed second-floor bathroom door. All three had died of smoke inhalation.

Investigators determined that the mother had tried unsuccessfully for several minutes to extinguish the fire and had escaped with the 6-year-old girl, leaving a rear door open. Fire and smoke spread upstairs, as the father gathered two other children and tried to wake the other two adults. Breaking a second-floor bedroom window, he dropped the children to the ground, then jumped. Open windows and doors allowed the flames to spread rapidly, exposing the remaining occupants to heat and smoke.

Damage to the apartment, valued at \$210,000, was estimated at \$125,000. Its contents, valued at \$35,000, were a total loss. The father was injured while jumping from the window, and a firefighter was hurt when a ceiling collapsed on him.

Tremblay, Kenneth J., *NFPA Journal*, 91, no.5 (1997), pp. 21-22.

Candle Ignites Blaze That Kills Four Children: California

A candle that was being used for light in a single-family home ignited a fire that killed four children under age 7. Earlier in the day, the utility company had shut off the family's electricity due to extended nonpayment of bills.

The single-story dwelling of unprotected, wood-frame construction had a wood truss roof covered by asphalt shingles. The home, which measured 46 by 22 feet, contained three bedrooms, one bathroom, a combination living and dining room, a kitchen, and an attached garage. The only smoke detector, which was hardwired with a backup power source, was located in the central hallway. However, it failed to operate because the electricity had been shut off and the battery was missing. The dwelling had no sprinklers.

The family was sleeping when, shortly after 10:00 p.m., the mother awoke and smelled smoke. Upon investigating, she found a fire in the living room and ran to the neighbors for help. She returned five minutes later and re-entered the dwelling, where she rescued two children from one bedroom. However, she was unable to reach four others in two other bedrooms.

A neighbor called 911 at 10:37 p.m., and firefighters arrived within four minutes to find flames coming from the house. Advancing a hose line to the front door, they knocked down the

Candle Ignites Blaze That Kills Four Children: California (Continued)

heavy fire in the living room and kitchen in two or three minutes. Using a second hose line, firefighters were able to control the blaze in 20 to 30 minutes, but not before it damaged adjacent exposures.

Two teams of firefighters conducted a primary search and quickly found the four children. Resuscitation efforts began immediately, and all seven occupants were transported to the hospital. The four children who'd been trapped, ages 1, 4, 5, and 7 died, and the mother and her two other children, ages 2 and 8, suffered smoke inhalation injuries.

Fire investigators determined that a candle left unattended in the first-floor living room started the blaze when it ignited a macramé hanger. The burning hanger dropped onto an upholstered couch, and flames spread to other combustibles in the living room and eventually to the kitchen. Investigators believe the fire burned for approximately 10 minutes before it was detected. This delay, added to the five-minute delay in alarm as the mother sought help from a neighbor, allowed flames to spread to ceiling/roof voids, causing the wood roof trusses to collapse into the burning room before firefighters arrived.

Damage to the structure valued at \$115,000, and its contents, valued at \$45,000 was estimated at \$65,000.

Tremblay, Kenneth J., *NFPA Journal*, 90, no.6 (1996), p. 22.

Three Die In Apartment Fire: Arizona

A 46-year-old mother and her two children, ages 6 and 2 died in a blaze that started when one of the children accidentally knocked over a candle.

The fire spread as the adult tried to extinguish it before calling 911. The two-bedroom, 800-square-foot apartment was located on the second floor of a 20-unit complex of unprotected, ordinary construction with masonry walls and wood-framed floors and roof. The apartment had a hardwired smoke detector in the hallway near the bedrooms. There were no sprinklers.

The mother called 911 at 7:09 on Christmas night, but didn't make it clear that there was a fire. Therefore, police arrived first and called the fire department. Police found the woman inside the apartment and pulled her outside to the balcony. She had third degree burns on her face and chest, and was pronounced dead at the scene.

Two of the arriving firefighters stretched a hose line to the apartment and knocked down the heavy fire in the living room. They then searched the two bedrooms, bathroom, and living room, where one of them saw a child's head behind a couch. They moved the couch and found the two children, who had no pulses and second-degree burns over their entire bodies. The children were given CPR and medical treatment at the scene before being flown to a medical center, where they died of their injuries.

Investigators determined that one of the children was riding his bicycle in the living room and knocked over a lighted candle. The flame ignited combustibles, and the blaze spread as the occupant tried to extinguish it with water from a kitchen sink. Investigators couldn't determine why the smoke detector which was found melted below its installed location hadn't operated.

Damage to the building and its contents, which were valued at \$256,000, was estimated at \$29,000.

Tremblay, Kenneth J., *NFPA Journal*, 89, no.6 (1995), p. 37.

Four Children Die In Fire Started By Candle: North Carolina

A candle that was being used to provide light in a house that had no electricity on the second floor started a blaze that killed four children. Lack of smoke detectors delayed detection.

The two-story, single-family home was of unprotected wood-frame construction. The 1,800-square-foot dwelling did not contain any smoke detectors or automatic sprinklers. The second floor, where five children slept, did not have electricity.

When the children were put to bed at night, candles were routinely left burning until they fell asleep. Around 10:00 p.m., a 2-year-old took a candle from the room in which the children were sleeping and placed it on stored clothing and bedding in an unoccupied bedroom. The combustibles eventually ignited, and the fire spread from the bedroom to the attic and through a doorway into the children's bedroom.

An 8-year-old girl detected the blaze, yelled to the others that there was a fire, and ran downstairs. Despite attempts by family members to rescue the other children, ages 9 months to 9 years, all four died.

The fire vented through windows and destroyed the entire second floor, causing approximately \$30,000 in damages to the structure, which was valued at \$70,000.

Tremblay, Kenneth J., *NFPA Journal*, 89, no.1 (1995), p. 34.

Two Die When Candle Ignites Gasoline During Power Outage: Florida

A 29-year-old woman and her 12-year-old stepdaughter were killed by a fire that was ignited accidentally in the family's manufactured home.

The two victims, along with the 35-year-old father, were in the bathroom filling a portable, liquid-fuel-fired lantern with gasoline after thunderstorms had interrupted electrical power in the area. The 12-year-old was holding a lighted candle for illumination, and one of the adults was pouring fuel from a 1-gallon container into the lantern. The gasoline accidentally spilled onto the clothing of the woman and the girl and was ignited by the candle's open flame.

The ensuing fire also caused the remaining fuel in the gas can to explode; the force of the blast blew the man out of the room. He was able to escape from the home with two other children – a boy, 14, and a girl, 8. Once outside, the father, who sustained burns to one arm, ran to a neighbor's house and called the volunteer fire department at 8:20 p.m.

The fire department first asked for help from several other county fire departments. This proved valuable because the remote location of the fire forced the use of booster-tank water exclusively, and the first department's water was exhausted before the fire was controlled.

One department reportedly refused to respond, claiming that it could not arrive in time to save anyone in a "trailer." As a result of this incident, a contract was signed mandating response to all structure fires.

The manufactured home and its contents, valued at \$5,800, were a complete loss. It had no automatic detection or suppression equipment.

Courtney, Neil, *Fire Journal*, 85, no. 4 (1991), p. 26.

Four Die When Candle Ignites Flammable Liquid: Massachusetts

Four people died in a fast-moving fire that began in the cellar and swept through the upper floors of this 2 ½-story wood-frame duplex.

One of the two units was occupied by a 57-year-old woman who operated a state-sanctioned foster-care home, her son-in-law, his wife, and five foster children. The building had smoke detectors on each floor, but it had no sprinkler protection.

Three of the five foster children, ages 4, 10, and 11, were preparing to run away when the fire broke out. They were descending a cellar stairway around 12:10 a.m., illuminating their way with a candle when one of them knocked one or more glass vessels containing illegally stored flammable liquids from their perch on the stairs. The containers fell to the floor and broke open. The child who was holding the candle also fell, dropping the candle which ignited the spilled liquid. The three children escaped unscathed, but the fire quickly spread up the cellar stairway and into the main section of the house.

The smoke detectors performed satisfactorily, but the fast-moving fire trapped four of the occupants before they could escape. Firefighters removed the bodies of the owner and the two foster children who had not been running away from a second-floor bedroom and found the woman's 31-year-old son-in-law, who was handicapped with a back injury, in a stairwell leading to an attic bedroom. The victims were taken to various hospitals where they died of severe smoke inhalation and burns shortly after arrival.

The deceased man's 27-year-old wife was also taken to a medical facility, where she was treated for injuries she sustained when she jumped from an attic window.

The two-alarm fire did an estimated \$125,000 in damage to the house.

Courtney, Neil, *Fire Journal*, 84, no. 3 (1990), p. 26.

Appendix C.

Candle Fire Summaries Previously Published in NFPA's Catastrophic Fire Studies

- Badger, Stephen G. "Catastrophic Multi-Death Fires of 2003," *NFPA Journal*, 98, no. 5 (2004), p. 69.
- McCarthy, Robert S. *Catastrophic Multiple Death Fires in the United States – 2001*, Quincy, MA: National Fire Protection Association, 2002, p. 11.
- McCarthy, Robert S. "Catastrophic Fires of 2000," *NFPA Journal*, 95, no. 5 (2001), p.76.
- McCarthy, Robert S. "1999 Catastrophic Fires," *NFPA Journal*, 94, no. 5 (2000), pp. 58-59.
- Tremblay, Kenneth J. and Rita F. Fahy. "Catastrophic Fires," *NFPA Journal*, 92, no. 5 (1998), pp .49-50.
- Tremblay, Kenneth J. "1996 Catastrophic Fires," *NFPA Journal*, 91, no. 5 (1997), p. 49.
- Tremblay, Kenneth J. "Catastrophic Fires of 1994," *NFPA Journal*, 89, no. 5 (1995), pp. 53, 59.
- Tremblay, Kenneth J. "Catastrophic Fire Deaths: The Numbers Are Back Up," *NFPA Journal*, 88, no. 5 (1994), p. 97.
- Tremblay, Kenneth J. "Catastrophic Fires and Deaths Drop in 1992," *NFPA Journal*, 87, no. 5 (1993), pp. 64, 67.

Location, Date, Time of Alarm, Number of Deaths	Occupancy Type, Construction Type, Number of Stories	Smoke Detectors and other Fire Protection Devices	Fire Origin and Path	Contributing Factors and Victim Locations
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North Carolina July 2003 1:14 a.m. 6 deaths (two under age six)	One-story single-family single-wide manufactured home of unprotected wood-frame construction.	Partial coverage smoke alarms operated and alerted the occupants.	An unattended lit candle ignited combustibles.	Two victims were trapped under a partially collapsed ceiling. The other four were attempting to escape. Six people survived this fire in a bedroom with a closed door.
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Stephen G. Badger, "Catastrophic Multi-Death Fires of 2003," *NFPA Journal*, 98, no.5 (2004), p. 69.

Georgia June 2001 4:26 a.m. Six (one under age six)	One-story, single-family dwelling of unprotected ordinary construction.	None	The fire began in the den when candles left unattended on a coffee table ignited curtains, wall coverings and other furnishings. The fire blocked the front door, the only exit from the structure.	The occupants were using candles for lighting after the utilities were shut off. Time of day meant everyone was at home and asleep. There were no smoke alarms present to alert the occupants of fire. Three victims were found in the southeast bedroom; one in the southwest bedroom; one in the kitchen; and the other was found outside.
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McCarthy, Robert, S., *Catastrophic Multiple Death Fires in the United States-2001*, NFPA, Quincy MA (2002), p. 11.

Maryland June 2000 4:18 a.m. Five (two under age 6)	Three-story, single-family dwelling of unprotected ordinary construction.	None	A candle left sitting on a stereo speaker ignited the speaker, stereo, and CDs. The fire quickly spread to the walls and combustibles, traveling down the hall and up the stairwell to the third floor.	Everyone was asleep at the time of the fire and there were no smoke alarms present to warn the victims. The fire blocked the exits and there were bars on the second-floor windows. The dwelling's gas and electric service had been disconnected and the occupants were using candles for light. All five victims were found in a second-floor bedroom.
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McCarthy, Robert, S., "Catastrophic Fires of 2000," *NFPA Journal*, 95, no.5 (2001), p. 76.

Texas December 12, 1999 4:40 a.m. Five (two under age 6)	Single-family manufactured home; unprotected wood-frame construction; one story.	None	A candle ignited a tapestry in the living room, and the resulting fire spread throughout the home.	Firefighters found the victims in the bedrooms at each end of the manufactured home.
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McCarthy, Robert, S., "1999 Catastrophic Fires," *NFPA Journal*, 94, no.5 (2000), p. 58.

Location, Date, Time of Alarm, Number of Deaths	Occupancy Type, Construction Type, Number of Stories	Smoke Detectors and other Fire Protection Devices	Fire Origin and Path	Contributing Factors and Victim Locations
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Massachusetts December 3, 1999 6:13 p.m. Six firefighters	Vacant cold storage warehouse; heavy timber construction; five stories.	Unknown	The fire started when a homeless couple knocked over a candle. Two firefighters became lost searching for the two occupants, and four others died searching for their colleagues.	This vacant building was a known hangout for homeless people. The interior of the building was maze-like, and fire conditions changed rapidly.
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McCarthy, Robert, S., "1999 Catastrophic Fires," *NFPA Journal*, 94, no.5 (2000), p. 59.

California June 1, 1997 1:16 a.m. 5 deaths (one under age 6)	Single-family dwelling; unprotected, wood-frame construction; one story.	None	Decorative candles left burning in a first-floor living room ignited a wood bar, and flames spread to wood wall paneling. An open sliding door provided unlimited ventilation as the fire spread throughout the house.	A 27-year-old woman and four children, ages 9, 7, 6, and 2, were found in escaping positions.
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Tremblay, Kenneth, J. and Rita F. Fahy, "Catastrophic Fires," *NFPA Journal*, 92, no.5 (1998), pp. 49-50.

Mississippi February 3, 1996 7 deaths (1 under age 6)	Single-family dwelling; unprotected, wood-frame construction; one story.	None	Due to a power outage caused by an ice storm, a candle was being used for light. The candle was left burning overnight in the living room and ignited a couch. Fire spread through the entire dwelling before neighbors detected it.	Four adults, ages 60, 44, 23, and 20, died, along with two teenager's ages 15 and 13. A 1-year-old girl also died. All of the victims were found in their bedrooms.
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Tremblay, Kenneth, J., "1996 Catastrophic Fires," *NFPA Journal*, 91, no.5 (1997), p. 49.

Location, Date, Time of Alarm, Number of Deaths	Occupancy Type, Construction Type, Number of Stories	Smoke Detectors and other Fire Protection Devices	Fire Origin and Path	Contributing Factors and Victim Locations
Maryland February 26, 1994 11:41 a.m. 9 deaths (3 under age 6)	Single-family dwelling; unprotected ordinary construction; two stories.	None	A candle placed too close to a sofa bed ignited bedding. The fire spread to combustibles stored in the front room on the first floor and traveled up the stairway to the second floor.	<p>Residents were using candles because the electricity was shut off for nonpayment. Although it had been unrelated to the fire, lack of an operating central heating system led occupants to use a natural gas stove in the kitchen for heat.</p> <p>Paths of egress were limited because furniture and boxes of clothing were stored in the front and middle first-floor rooms.</p> <p>Fourteen people from three families lived in the dwelling. All but two were home at the time of the fire.</p> <p>A 14-year-old boy sleeping on the sofa bed detected the fire and escaped out a rear door. The other survivors were a 2-year-old boy, whose mother dropped him from a second-floor window, and the mother, who jumped from the same window. All the fatalities were located on the second floor.</p>

Tremblay, Kenneth, J., "Catastrophic Fires of 1994," *NFPA Journal*, 89, no.5 (1995), p. 53.

Location, Date, Time of Alarm, Number of Deaths	Occupancy Type, Construction Type, Number of Stories	Smoke Detectors and other Fire Protection Devices	Fire Origin and Path	Contributing Factors and Victim Locations
Mississippi April 3, 1994 5:25 a.m. 5 deaths	Single-family dwelling; unprotected ordinary construction; one story.	None	A candle left burning on a table ignited combustibles in a living room. Flames were intensified by ventilation from a door left open by an escaping occupant and from a window fractured by the heat.	<p>The electrical power to the area was shut off for the scheduled repair of transmission lines damaged during an ice storm. The occupants arrived home at night during the outage and used candles for light, leaving one lit as a night light.</p> <p>A 16-year-old boy woke to the fire and tried to extinguish it. He yelled for other family members to get out and escaped through the front door, leaving it open. There were no other survivors.</p> <p>Two adults, ages 45 and 42, and three children, two age 12 and one age 18, died in the blaze.</p>

Tremblay, Kenneth, J., "Catastrophic Fires of 1994," *NFPA Journal*, 89, no.5 (1995), p. 59.

Arizona November 5, 1993 5:25 a.m. 6 deaths (2 under age 6)	Single-family dwelling; unprotected ordinary construction; one story.	A single smoke detector was located in the kitchen. The improperly placed detector did not have a battery.	Candles being used for lighting were left unattended when the family retired for the night and eventually burned away, igniting combustibles, such as clothing and papers. The fire spread into the kitchen, and smoke traveled undetected throughout the house.	News accounts of the fire stated that the electricity had been shut off due to nonpayment.
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Tremblay, Kenneth, J., "Catastrophic Fire Deaths: The Numbers Are Back Up," *NFPA Journal*, 88, no.5 (1994), p. 97.

Location, Date, Time of Alarm, Number of Deaths	Occupancy Type, Construction Type, Number of Stories	Smoke Detectors and other Fire Protection Devices	Fire Origin and Path	Contributing Factors and Victim Locations
Pennsylvania October 2, 1992 5:04 a.m. 5 deaths (5 under age 6)	Single-family dwelling; unprotected ordinary construction; two stories	None	A candle placed in a wall-mounted medicine cabinet in a second-floor bathroom was being used for light because the electrical power had been shut off due to lack of payment. Two children, ages 5 and 6, either were playing with or accidentally knocked over the candle, which ignited combustibles in the room. The fire spread into the hallway, blocking the occupants' exit from the second floor.	The children returned to their bedrooms without waking the adults. Five children under age 6 were trapped in one bedroom and died. Three adults and two children in two other bedrooms climbed onto porch roofs and escaped.

Tremblay, Kenneth, J., "Catastrophic Fire and Deaths Drop in 1992," *NFPA Journal*, 87, no.5 (1993), p. 64.

Pennsylvania August 1, 1992 4:00 a.m. 4 deaths (1 under age 6)	Single-family dwelling, unprotected ordinary construction, three stories, vacant	None	A candle being used by squatters ignited adjacent combustibles in a second-floor bedroom. The fire spread to an interior stairway and vertically to the third floor, where the victims were found.	The property was abandoned. It did not have electricity, heat, or water utilities and was in very poor condition. The 38-year-old mother, who had evidence of PCP, a controlled substance, in her blood; a 13-year-old; a 10-year-old; and a 3-year-old died. A 17 year-old escaped by jumping from a third-floor window.
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Tremblay, Kenneth, J., "Catastrophic Fire and Deaths Drop in 1992," *NFPA Journal*, 87, no.5 (1993), p. 67.