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Federal Emergency Management Agency
United States Fire Administration
National Fire Data Center

U.S. Fire Administration Mission Statement

As an entity of the Federal Emergency Management Agency, the mission of the U.S. Fire Administration is to reduce life and economic losses due to fire and related emergencies through leadership, advocacy, coordination, and support. We serve the Nation independently, in coordination with other Federal agencies and in partnership with fire protection and emergency service communities. With a commitment to excellence, we provide public education, training, technology, and data initiatives.

Acknowledgments

The United States Fire Administration greatly appreciates the participation in the National Fire Incident Reporting System (NFIRS) of nearly 13,000 fire departments across the United States. The NFIRS data, on which the bulk of this report is based, are available through the work of the staffs of the various state agencies and state fire marshal's offices responsible for fire data collection and on each and every fire officer who fills out an NFIRS form. Without their efforts to collect data, this report could not exist. Although the NFIRS is wholly voluntary, the information collected on nearly one million fires each year represents the most comprehensive set of fire data and statistics in the world.

The National Fire Information Council (NFIC), a nonprofit organization of the state and metro participants in NFIRS, helps coordinate and specify requirements for NFIRS and its operation. NFIC represents an outstanding example of local, state, and federal cooperation on a major, long-term undertaking.

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The United States Fire Administration also thanks the many state fire marshals' offices or their equivalents for their assistance with, and input to, the state fire death data presented in Chapters 2 and 7.

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Executive Summary

Fire departments in the United States respond to an average of 2 million fire calls each year. This fire problem, on a per capita basis, is one of the worst in the industrial world. Thousands of Americans die each year, tens of thousands of people are injured, and property losses reach billions of dollars. There are huge indirect costs of fire as well—temporary lodging, lost business, medical expenses, psychological damage, pets killed, and others. To put this in context, the annual losses from floods, hurricanes, tornadoes, earthquakes, and other natural disasters combined in the United States average just a fraction of the casualties from fires. The public, the media, and local governments are generally unaware of the magnitude and seriousness of the fire problem to individuals and their families, to communities, and to the nation.

PURPOSE AND SCOPE

Each year, the National Fire Data Center (NFDC) of the U.S. Fire Administration (USFA) publishes a running 10-year statistical overview of the fires in the United States, with focus on the latest year in which data were available at the time of preparation. This report is designed to arm the fire service and others with information that motivates corrective action, sets priorities, targets specific fire programs, serves as a model for state and local analyses of fire data, and provides a baseline for evaluating programs.

This Twelfth Edition of *Fire in the Unites States* covers the 10-year period from 1989 to 1998, with emphasis on 1998. The primary source of data is from the National Fire Incident Reporting System (NFIRS). National Fire Protection Association (NFPA) annual survey results, mortality data from the National Center for Health Statistics (NCHS), data from State Fire Marshals Offices or their equivalents, and statistics from the U.S. Bureau of the Census and the Consumer Price Index are also used. Because of the time it takes for the states to send data to USFA from nearly 13,000 fire departments that participate in NFIRS, then edit and obtain corrections and analyze and display the results, the publication lags the date of data collection. Fortunately, the fire problem does not change very rapidly so the data are usually quite representative of the situation in the year of publication as well.

As usual in this series, this edition describes the overall national fire problem; examines aspects of the problem in residential and non-residential structures, vehicles, and outside fires; and addresses casualties sustained by firefighters in the

line of duty. Additionally, this report presents the number of fires and deaths in each state for 1998 and, where available, their 10-year trends.

Special analyses address the problem of fire as it relates to the very young and to older adults. These individuals are at higher-than-average risk from fire, a problem receiving high attention by the USFA.

THE NATIONAL FIRE PROBLEM

Annual deaths from fire in the United States were estimated at 12,000 in 1975, the year in which the USFA was established. At that time, a goal was set for reducing this number by half within a generation. This goal was met, and by 1998 civilian deaths were at their lowest level. In fact, in every measure (number of fires, deaths, injuries, and dollar loss) and in nearly every situation, the trends are continuing downward (Table 1). The large dollar loss due to outside fires is the result of two timber fires, one in 1992 ($300 million) and one in 1998 ($390 million).

TABLE 1. 10-YEAR TRENDS FOR PROPERTY FIRES AND LOSSES (PERCENT)

Property	Fires	Deaths	Injuries	Dollar Loss*
All Properties	**–13.1**	**–19.7**	**–20.2**	**–21.0**
Residential Properties	–21.9	–20.5	–18.5	–19.4
One-/Two-Family Dwellings	–25.1	–13.2	–23.2	–12.4
Apartments	–9.2	–25.0	–5.4	–1.1
Other Properties	–21.0	–66.5	–14.8	–14.6
Non-Residential Properties				
Structures	–17.3	–36.7	–27.7	–49.0
Mobile Properties	–10.6	–16.4	–35.5	+10.4
Outside (trees, refuse, etc.)	–13.8	–43.3	+17.4	+107.2

*Adjusted to 1998 dollars.
Sources: NFPA and Consumer Price Index

Nationally, the 10-year trend in the number of fires is down 13 percent. Deaths and injuries are down 20 percent. Dollar loss (adjusted for inflation to 1998 dollars) is down 21 percent (Figure 1).[1] Although this progress is encouraging, still more than 4,000 citizens die in fires. On average, nearly 100 firefighters die each year fighting fires and protecting lives. Injuries to civilians average 27,100 per year. Nearly twice that number of firefighters are injured in direct firefighting operations.

The number of fires reported to fire departments averaged nearly 2 million annually, resulting in a direct property loss of $9.8 billion a year. The total cost of fire is actually much higher, over $100 billion per year, when the cost of fire departments,

1 The calculation of trend percentages is explained on page 23.

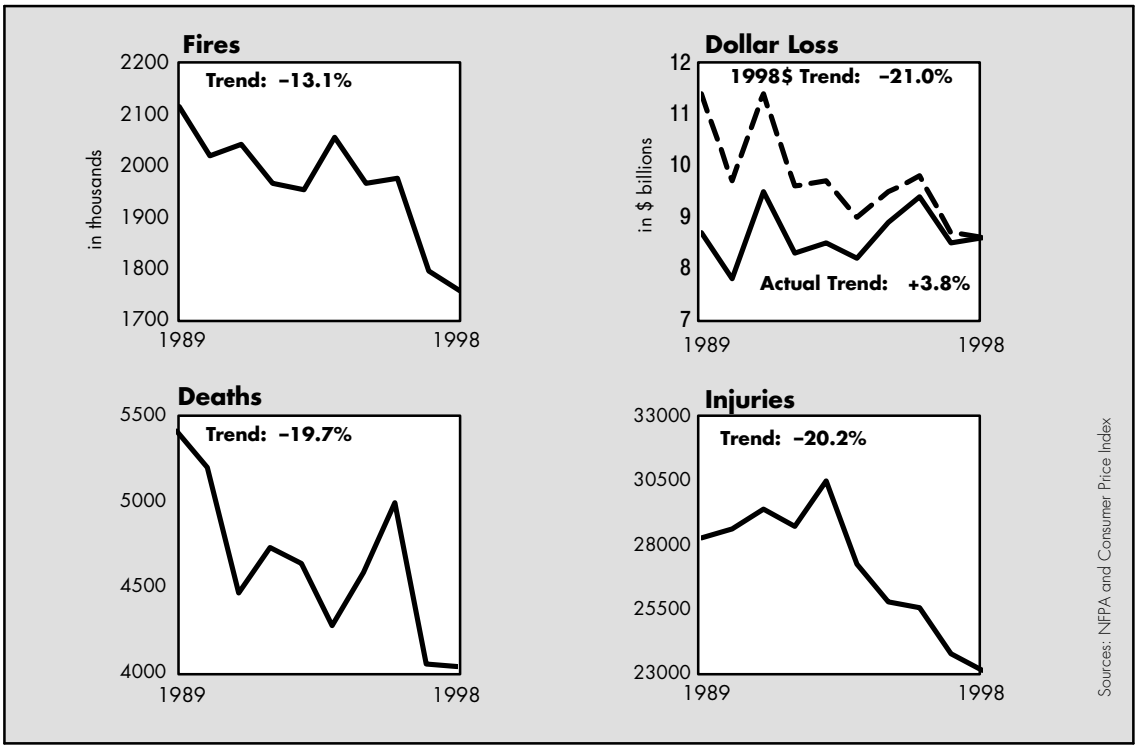


FIGURE 1. NATIONAL TRENDS IN FIRES AND FIRE LOSSES

built-in fire protection in buildings, insurance overhead, medical expenses, and other annual fire protection expenditures are included.

Figure 2 translates these data into per capita losses. On a per capita basis, the fire problem is down more sharply than in absolute numbers because the population increased. Fires are down by 21 percent per capita, deaths and injuries by 27 percent, and adjusted dollar loss by 28 percent. Each of these measures reached new lows in 1998. Nevertheless, the fire death rate in the United States (14.9 per million population in 1998) is two to three times higher than several European nations and about 20 percent higher than the European average. In general, the United States emphasizes the use of advanced fire suppression technology and fire service delivery mechanisms. Other nations place more emphasis on fire prevention than does the United States. The study and implementation of international approaches to fire prevention might suggest additional methods for further reducing the U.S. fire problem.

REGIONAL AND STATE PROFILES

The fire problem varies from region to region and state to state because of variations in climate, socioeconomic status, education, demographics, and other factors. The Southeast and Alaska consistently have the highest fire death rates in the United States and are among the highest regions in the world.

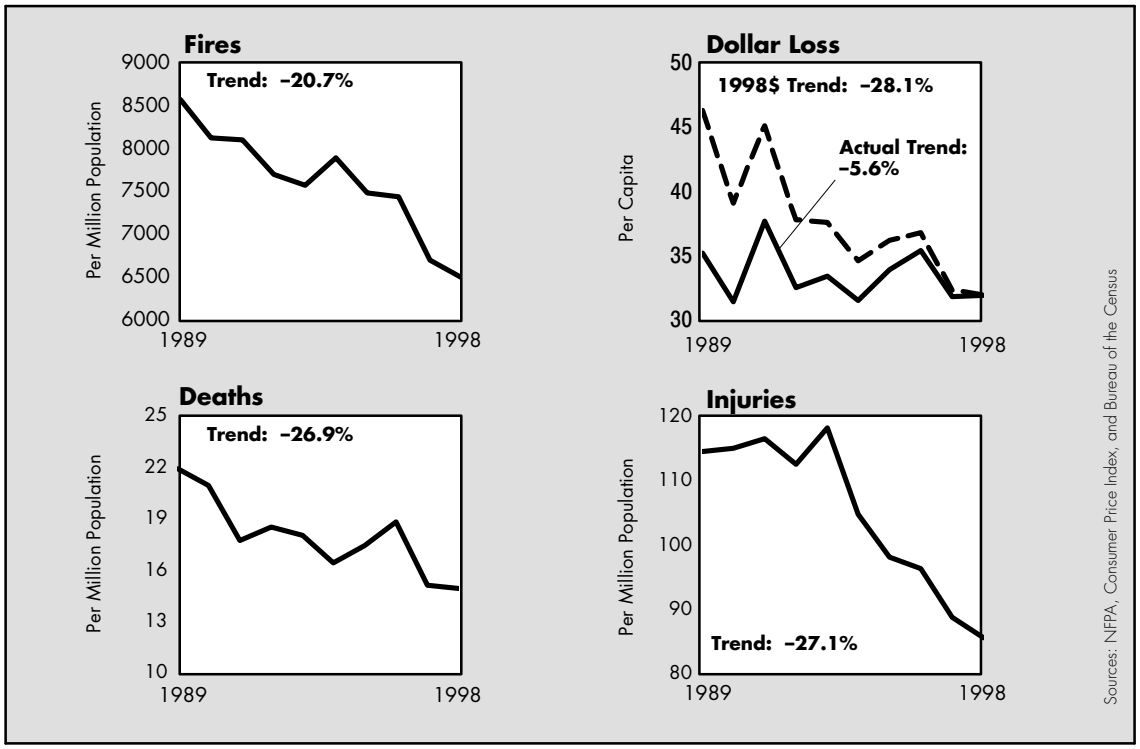


FIGURE 2. NATIONAL TRENDS IN PER CAPITA FIRES AND FIRE LOSSES

Ten states account for nearly half of the national total U.S. fire deaths (Pennsylvania, Michigan, California, Illinois, New York, Ohio, Texas, Georgia, Missouri, and Florida). Unless their fire problems are significantly reduced, the national total will be difficult to lower. Not surprisingly, these ten states are mostly high-population states. However, although California, New York, and Texas are the most populous states and have large numbers of fire deaths, their deaths per capita are well below the national average of 14.9 per million population.

The leading cause of fire deaths in 1998 in more than half the states was smoking; in another 30 percent of the states, either heating or arson was the leading cause. Cooking was the leading cause of residential fires in 29 of the 43 states that reported to NFIRS in one or more of the years 1996–98. Heating was the leading cause of fires in 10 states, most of which are in cold weather areas.

There has been great progress by states in lowering both the absolute number of deaths and the deaths per capita. As recently as 1996, 12 states (including the District of Columbia) had 25 or more deaths per million population; in 1998, only 5 states had 25 or more. Forty-two of the 51 states had downward trends for fire deaths, 22 of which had a 25 percent or greater decrease. The nine states that had an upward trend are low-population states where a change of one or two deaths can significantly alter the trend line.

HOMES AND OTHER PROPERTIES

Forty-three percent of all fire calls are for outside fires—by far the greatest portion among the five major property types (Figure 3). Many of these fires are intentionally set but do not cause much damage. About one in every four fire calls is to a vehicle fire. Depending on the data source, 70 to 80 percent of civilian deaths and injuries in 1998 stemmed from residential fires. Nearly half of all direct dollar losses are attributed to residential fires. Twice as many fires occur in residential structures as in non-residential structures, and they cause 41 percent of firefighter deaths and 68 percent of injuries. To achieve greatest impact, residences may be where fire prevention efforts should be targeted.

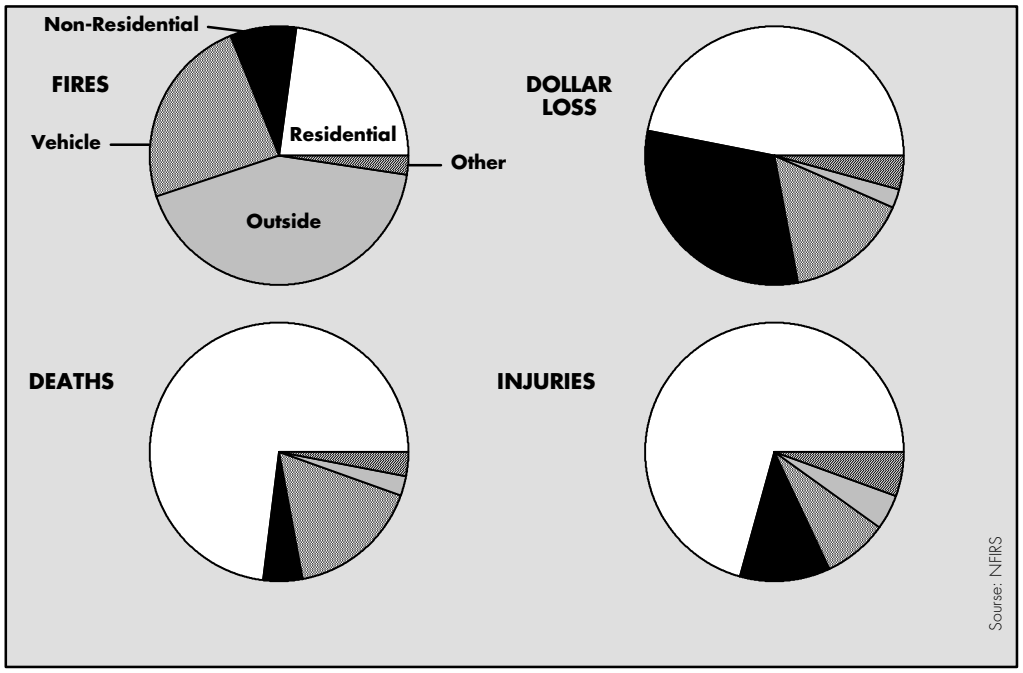


FIGURE 3. FIRES AND FIRE LOSSES BY GENERAL PROPERTY TYPE (1998)

Residential Properties

As defined in NFIRS, residential properties include homes—one- and two-family dwellings, apartments, and manufactured housing—as well as hotels/motels, dormitories, and other properties where people live temporarily. The majority of the U.S. population lives in a structure occupied by one or two families, and these properties dominate the 1998 residential statistics (Table 2). As was shown in Table 1, the 10-year trends in all categories of fire losses are down 19 to 22 percent. The number of injuries per fire is higher in apartments than in one- and two-family dwellings, probably because the total space and number of exits are significantly less in apartments than in houses. Deaths per fire in manufactured housing are higher than in

TABLE 2. DISTRIBUTION OF RESIDENTIAL FIRE LOSSES BY PROPERTY TYPE (1998) (PERCENT)

Residential Property Type	Fires	Deaths	Injuries	Dollar Loss
One-/Two-Family Dwellings	69.7	75.8	62.0	75.7
Apartments	23.1	15.3	30.7	18.3
Manufactured Housing	4.1	6.0	3.8	3.3
Other Residences	3.1	2.8	3.6	2.8

Source: NFIRS

other dwellings, even though the actual number of deaths dropped considerably in 1997 and 1998.

Cooking, incendiary/suspicious[2], and heating are the three leading causes of fires. These three causes have led in all years in which NFIRS data have been collected, though not in the same order. More than one-quarter of all fires and injuries are attributed to cooking, but cooking fires result in relatively fewer deaths (13 percent). However, cooking deaths were 3 percent higher in 1998 than in 1996. Most cooking fires come from unattended cooking rather than from equipment failures. Cooking injuries often occur when loose clothing such as bathrobes ignite or when the individual attempts to extinguish the fire. Greater public awareness of these problems, coupled with information about how to quickly extinguish a cooking fire, could reduce the incidence of such injuries.

Even though cooking is the leading cause of fire injuries, children playing fires are twice as injurious (Figure 4). For each one thousand fires, there are 110 children playing injuries versus 53 cooking injuries. Smoking, the leading cause of fire deaths, is also the most lethal at 25 deaths per thousand fires.

Two perceptible shifts have occurred in 10-year trends. Until 1990, heating was the leading cause of fires in homes, due to the surge in the use of alternative space heaters and wood heating in the late 1970s. In 1989, for example, there were 117,000 heating fires; by 1998, the number had dropped to 51,000. In one- and two-family dwellings, however, heating has been the leading or second leading cause in all years. These structures predominate in the use of alternative heating sources—especially the use of fireplaces—coupled with the fact that heating systems are usually maintained by homeowners rather than by professionals.

The other sharp decline has been in the number of smoking deaths, which reached a high in 1989 of 1,100 deaths and a low in 1998 of 782. Some but not all of this decline may be attributed to the reductions in smoking rather than from specific fire prevention activities. Still, smoking accounts for 24 percent of all residential fire deaths.

[2] This report often uses the word *arson* in lieu of the term *incendiary/suspicious,* although the former is based on a narrow legal definition.

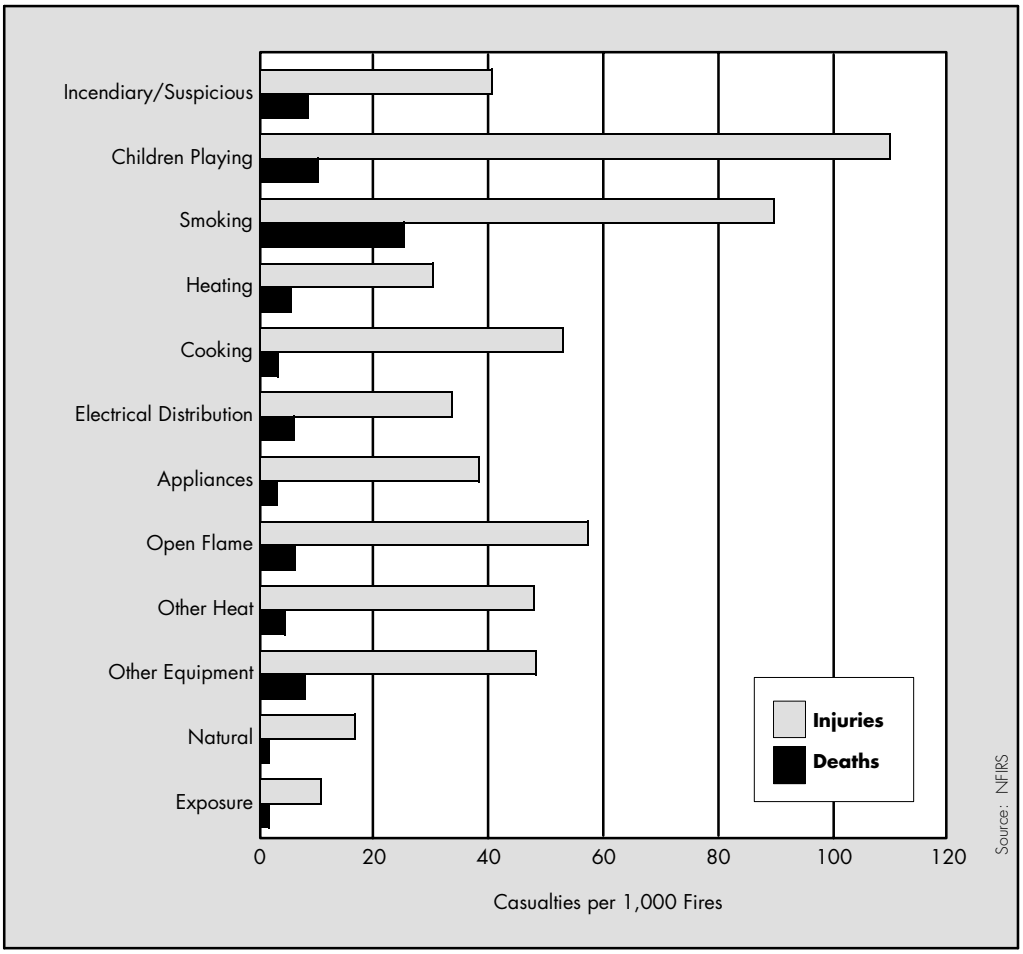


FIGURE 4. RESIDENTIAL CASUALTIES PER FIRE BY CAUSE

The rooms in which fires most often occur have remained consistent over the past 10 years. Kitchens, bedrooms, and lounge areas such as living rooms, dens, and family rooms are the areas of the home where most fires, deaths, and injuries occur (Figure 5). The kitchen is the area in which the most fires originate: 24 percent of all fires in one- and two-family dwellings and 48 percent in apartments. The bedroom is the second most common area of fire origin, where smoking and children playing are the most common causes. Forty-two percent of fire deaths in one- and two-family dwellings occur in the bedroom or lounge area, possibly because people fall asleep smoking in bed or on upholstered furniture. In apartments, 56 percent of deaths occur in these areas.

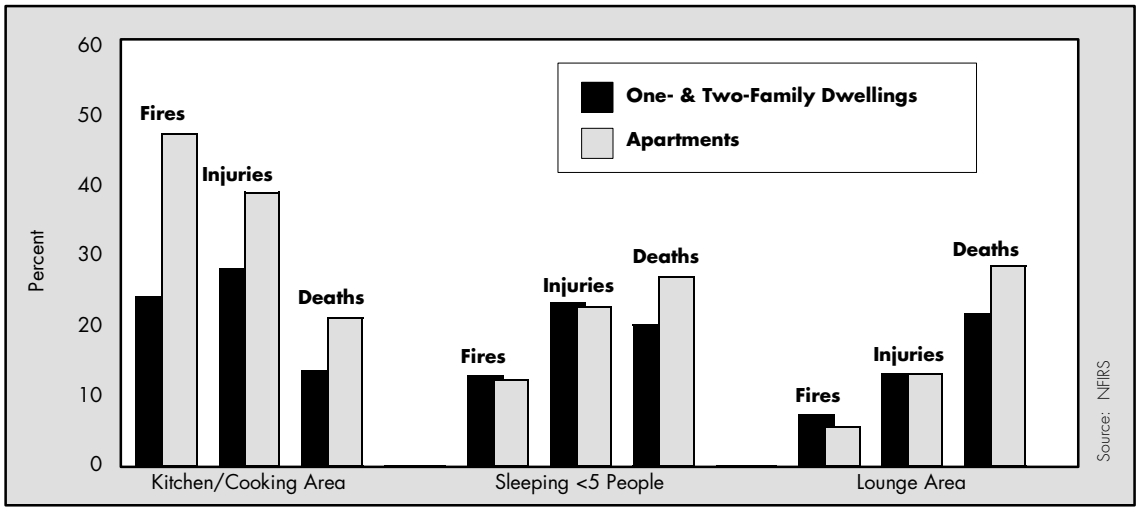


FIGURE 5. LEADING THREE LOCATIONS OF FIRE ORIGIN IN RESIDENCES (1998)

Non-Residential Properties

Non-residential properties include industrial and commercial properties, institutions, educational establishments, vacant and under construction properties, mobile properties, and outside properties. Each category has a much different profile and is discussed separately. The overall 10-year trends for non-residential properties have decreased considerably: fires, –17 percent; deaths, –37 percent; injuries, –28 percent; and adjusted dollar loss, –49 percent.

Structures. Much of the effort in fire prevention, both public and private, has focused on protecting non-residential structures. The results have been highly effective, especially relative to the residential fire problem. Over 10 years, non-residential structures accounted for 8–9 percent of all fires, 5–8 percent of deaths, and 12–14 percent of injuries. However, non-residential structures represent a much larger portion of total dollar loss, from 31 to 47 percent. This is because non-residential structures have greater values than residential structures. In 1998, damage to non-residential structures averaged $22,300 per fire, while residential structure losses averaged $11,500 (Table 3).

TABLE 3. NON-RESIDENTIAL STRUCTURE DOLLAR LOSS PER FIRE (1998)

Property Type	$ Loss/Fire
Public Assembly	$23,078
Eating, Drinking	19,768
Education	12,713
Institutions	4,466
Stores, Offices	29,161
Basic Industry	39,254
Manufacturing	50,311
Storage	23,378
Vacant, Construction	11,536
Outside Structures, Unknown	9,606

Source: NFIRS

Stores, offices, and storage buildings account for 36 percent of non-residential fires. Because the number of non-residential structure deaths (69) in 1998 represented only 1.5 percent of all 1998 deaths,

deaths by structure type vary considerably from year to year. Institutional and manufacturing fires caused 43 percent of non-residential injuries.

Arson is the leading cause of fires, deaths, and dollar loss (27–29 percent) and the second leading cause of injuries after "other equipment" injuries.

Vehicles and Other Mobile Properties. About one in four fires attended by the fire service involves vehicles, mainly cars and trucks. In 1998, the fire service responded to more vehicle fires than to residential fires. And this does not include the tens of thousands of fire department responses to vehicle accidents in which there was no fire.

From 1989 to 1998, vehicles averaged 24 percent of fires, 17 percent of deaths, 9 percent of injuries, and 13 percent of dollar loss. The number of vehicle fires and deaths have changed very little over 10 years. The 10-year trend for injuries, however, is down 27 percent, perhaps due in part to better safety features incorporated into newer vehicle designs. The dollar loss trend has increased 40 percent over the period, primarily due to the higher cost of new vehicles and their subsequent repair.

Sixty-four percent of deaths were caused by vehicle collision. More than two-thirds of mobile property fires in 1998 were attributed to mechanical or design problems. When looking at casualties per fire, however, mechanical/design is insignificant relative to collisions. Collisions result in 65 deaths and 56 injuries per 1,000 vehicle fires (Figure 6).

Arson accounts for 17 percent of vehicle fires, and this may be understated because many vehicle fires are not investigated as to cause. There can be a significant error in estimating fire deaths in vehicles because it is often difficult to determine (without autopsies) whether the fatality was the result of the mechanical forces or from the fire that ensued.

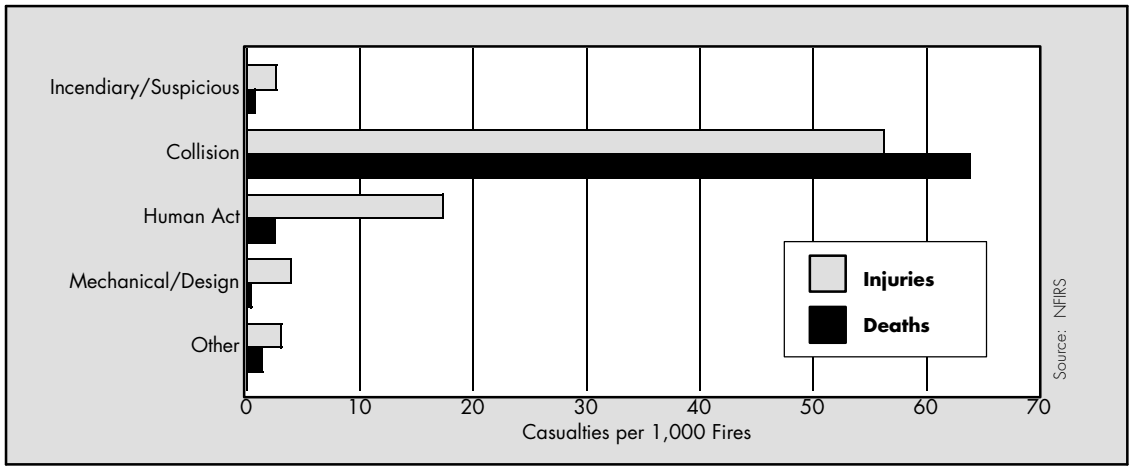


FIGURE 6. MOBILE PROPERTY CASUALTIES PER FIRE BY IGNITION FACTOR (1998)

The vehicle fire loss problem may be large enough to warrant adding vehicle fire prevention and possibly even accident prevention to other fire service public education programs.

Outside Properties. Outside fires, which include wildland fires, comprise 43 percent of 1998 fires. There has been a continuing downward trend in outside fires over the past 10 years (by 14 percent). Although outside fires have a small percentage of deaths, injuries, and dollar loss, their problem may be understated because many outside fires are not reported to NFIRS or to the NFPA annual survey.[3] Also, authorities have difficulty in determining the dollar loss of an outside fire. The 10-year trend for outside fire dollar loss has doubled (107 percent) due to huge dollar values assigned to two timber fires, one in 1992 and one in 1998.

As in all years, the leading cause of outside fires is arson, with many thought to be set by children. However, the cause of outside fires was not reported to NFIRS in 58 percent of the cases. Determining cause of outside fires is usually difficult or impossible, so the number of unknowns is unlikely to improve to any great degree.

ETHNIC, AGE, AND GENDER CHARACTERISTICS OF VICTIMS

Fire losses affect all groups and races, rich and poor, North and South, urban and rural. But the problem is higher for some groups than for others. African Americans and American Indians have significantly higher death rates per capita than the national average (Figure 7). African Americans comprise a large and disproportionate share of total fire deaths, accounting for 27 percent of fire deaths—twice as high as their share of the overall population.

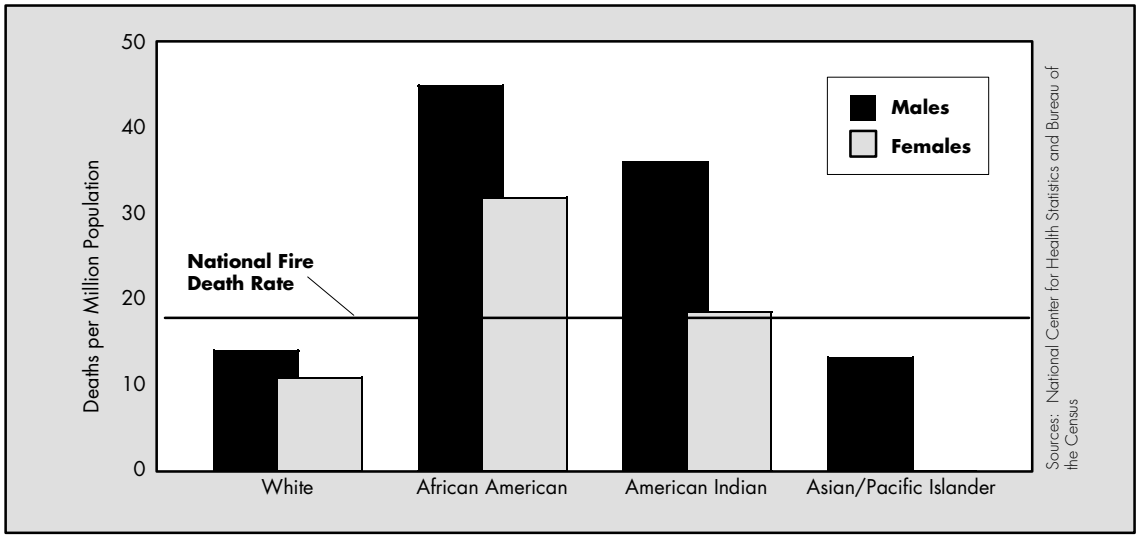


FIGURE 7. FIRE DEATHS PER CAPITA BY RACE AND GENDER (1997)

[3] The annual survey is published in the September/October issue each year in *NFPA Journal*.

Over the past 10 years, nearly twice as many men have died in fires as women, although the proportion has narrowed in recent years. In 1998, injuries per capita for males are one and one-half to two times the female rate until age 69; after 69, the longer lifespan of women means there are more in the population, and hence a higher proportion of injuries to the elderly are to women (Figure 8). The reasons for the disparity of fire injuries between men and women are not known for certain. Suppositions include the greater likelihood of men being intoxicated, the more dangerous occupations of men (most industrial fire fatalities are males), and the greater use of flammable liquids by men. In 1998, a higher percentage of females under age 15 and over age 60 died than did males. Males fire deaths, by contrast, are very much higher in the mid-life years (20–49). The pattern of injuries by gender and age is somewhat the same as the one for deaths.

People with limited physical and cognitive abilities, especially the very young and very old, are at a higher risk of death and injury from fire than other groups (Figure 9). Because of this, the USFA has set a goal to reduce fire deaths and injuries to children and older adults by 25 percent by the year 2005. A separate analysis of these two groups is documented in Chapter 6.

In 1998 alone, approximately 3,100 children under the age of 15 were injured and 750 were killed in fires. Children accounted for 13 percent of all fire injuries and 19 percent of all fire deaths. Approximately 2,550 older adults (65 and older) were injured and 1,035 killed. This group accounted for 11 percent of fire injuries and 26 percent of fire deaths. Most of these injuries and deaths occurred in the home.

Children under age 5 are 40 percent more likely to die in a fire than the general population. As the age of the child increases, the likelihood of dying in a fire decreases. African American and American Indian children are more than twice as likely to die in a fire than white or Asian children (Table 4). By a wide margin, the leading cause of residential fires that result in child injuries and fatalities is children playing. The victims, however, are not necessarily the instigators of the fire: more than half of children fatalities and injuries occur when the child is asleep.

As baby boomers enter retirement age, the U.S. demographic profile is expected to change dramatically. Over the coming decades, the older population will increase from its current 12.5 percent of the total population to nearly 20 percent. Therefore, a corresponding increase in fire deaths and injuries among older adults is likely.

The "youngest" older adults (age 65–74) are 1.6 times more likely to die in a fire than the general population. The "oldest" older adults (over age 84) have a relative risk of fire death of 4.6—nearly five times greater than the general population. Older African Americans have the highest risk of fire death—nine times that of the average population. Older American Indians have a fire death risk over three times that of the

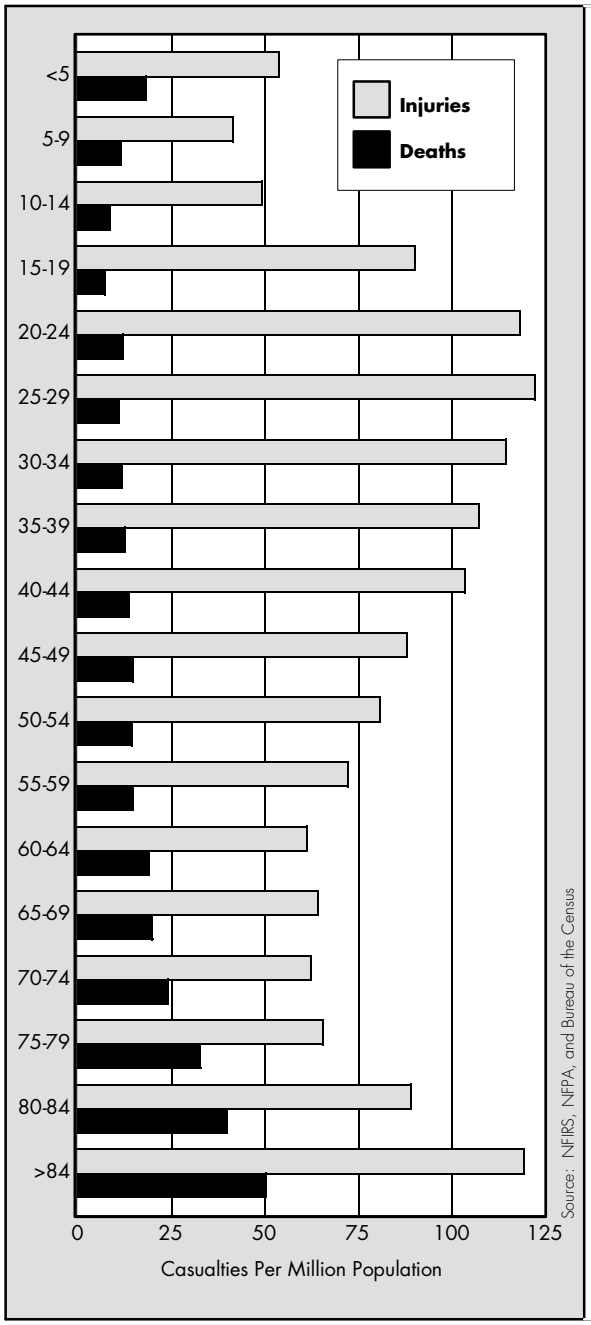


FIGURE 8. FIRE CASUALTIES PER CAPITA BY AGE (1998)

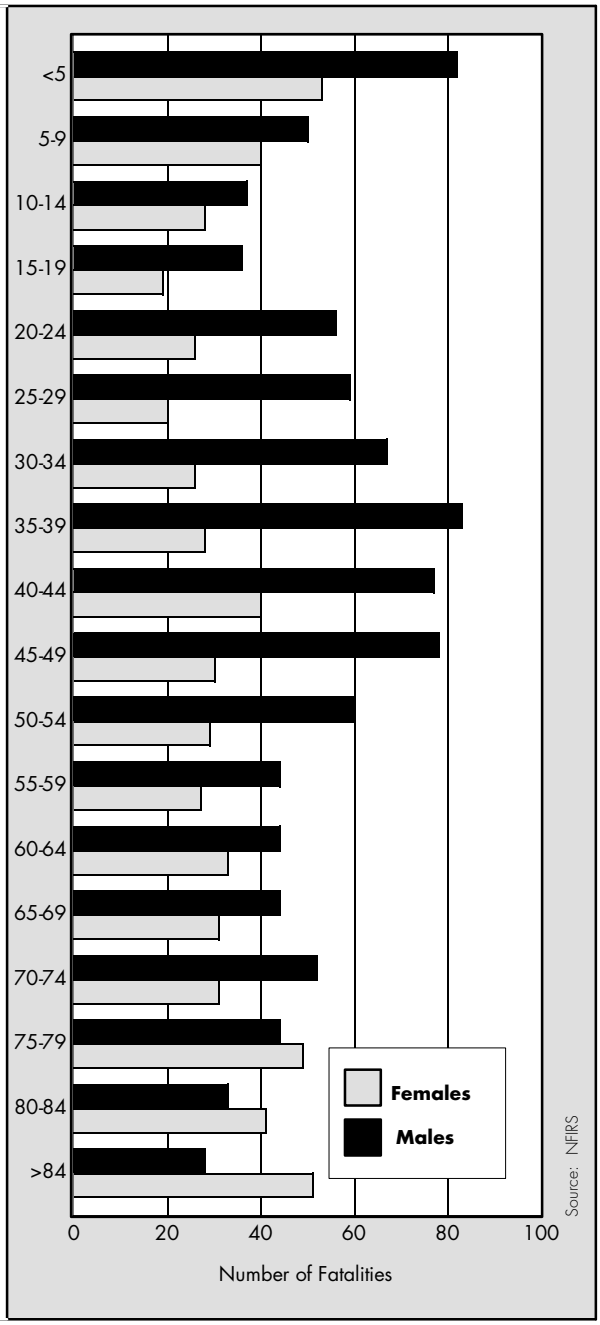


FIGURE 9. FIRE DEATHS BY AGE AND GENDER (1998)

TABLE 4. PER CAPITA FIRE DEATHS AND RELATIVE RISK TO CHILDREN AND OLDER ADULTS BY GENDER AND ETHNICITY (1997)

Gender/Ethnicity	Death Rate (per million population)		Relative Risk*	
	Children (<15)	Older Adults (>64)	Children (<15)	Older Adults (>64)
Total	14.3	41.0	0.8	2.3
Male	15.7	52.8	0.9	2.9
Female	12.9	32.7	0.7	1.8
White	10.2	34.1	0.6	1.9
African American	36.2	120.6	2.0	6.7
American Indian	26.9	58.5	1.5	3.3
Asian	8.4	20.3	0.5	1.1
White Male	11.6	44.3	0.6	2.5
African American Male	37.1	153.7	2.1	8.5
American Indian Male	26.6	107.4	1.5	6.0
Asian Male	11.8	28.8	0.7	1.6
White Female	8.6	26.8	0.5	1.5
African American Female	35.3	99.3	2.0	5.5
American Indian Female	27.3	22.6	1.5	1.3
Asian Female	4.9	14.0	0.3	0.8

*The general population has a relative risk of 1.0.

Sources: National Center for Health Statistics and Bureau of the Census.

general population. African American males over age 84 have the highest risk of all, 24 times that of the general population.

Smoking is the leading cause of death to older adults and the second leading cause of their injury, behind cooking. As with young children, a large proportion of older adult fatalities occur while the victim is asleep.

The high-risk groups merit special attention. But the rest of the population accounts for over half of all fire deaths, and it also needs attention to help reduce the total problem.

The injury profile by age differs from the death profile. Adults aged 20–44 and the elderly over 85 are at higher risk of fire injury relative to the rest of the population. It is believed that males in the 20-44 age group are greater risk takers than females during fires. Females aged over 69 have a significantly larger proportion of injuries than elderly males.

WHEN FIRES OCCUR

Fire incidence varies by time of day, month of year, and, in some situations, the day of the week. In residences, fires and injuries peak in the early evening when most cooking fires occur. Although fire incidence drops when people are asleep, many

fire deaths are associated with fires that start late at night or early morning. Smoking and arson are the primary causes of deaths that occur at night.

Fires and injuries peak in the afternoon and early evening in non-residential structures. Although conjecture, this might be because workers are tiring on their job and are more accident prone or careless. Non-residential fire deaths have no clear pattern by time of day due to their small number. Dollar losses are highest at night after businesses have closed; often arson is the probable cause.

The winter months are the peak period for fires and deaths in structures and vehicles. Heating fires in the winter add to the other types of year-round fires causes to cause the peak.

Outside fires peak on the weekends when more of the populace is at home. There is no discernable pattern for other categories of fires by day of week, contrary to the belief that fire incidents increase over weekends. The leading causes of residential fires (cooking, heating) are generally unaffected by the day of week.

SMOKE ALARMS AND SPRINKLERS

The greater use of smoke alarms is thought to account for a significant part of the decrease in reported fires and deaths over the past two decades. Over 90 percent of U.S. households now have at least one smoke alarm. However, households that have reported fires appear much less likely to have smoke alarms than others. Either people with alarms are more safety conscious or the alarms allow early detection and extinguishment so that the fires are not reported. Anecdotal information suggests that reported fires are more prevalent in older, less well cared for homes, and these are less likely to be equipped with an alarm. Table 5 shows the performance of smoke alarms in residential properties for the 70 percent of incident reports that included detector status.

TABLE 5. SMOKE ALARM PERFORMANCE IN RESIDENCES (1998) (PERCENT)

Residential Property Type	Present/ Operated		Present/Did Not Operate		No Alarm		Unknown	
	Fires	Deaths	Fires	Deaths	Fires	Deaths	Fires	Deaths
All Residences	26.6	17.8	16.0	11.8	27.8	32.6	29.6	37.8
One and Two Family	22.2	15.3	14.8	10.5	31.2	45.2	31.8	38.9
Apartments	39.4	31.4	20.2	18.6	17.7	17.6	22.7	32.4

Source: NFIRS

The fact that smoke alarms worked in 31 percent of apartments in which a death occurred (twice that of one-and two-family dwelling deaths) is troublesome. Explanations include the possibility that hallway or apartment alarms operated after the victims were overcome or that there are fewer ways to escape, especially on

higher floors. It also may be linked to the lower socioeconomic level of many apartment dwellers. This situation suggests the need to provide sprinklers in apartments and to emphasize fire prevention to their occupants.

Residential sprinklers were found in only 2.5 percent of homes that had reported fires in 1998. The actual number of sprinklers installed in residences may be underestimated since an operating sprinkler could have extinguished a fire and no call made to the fire department. A higher percentage of apartments were equipped with sprinklers than one- or two-family dwellings (6 percent vs. 0.5 percent). Use of sprinklers in apartments appears to be growing. Sprinklers are more prevalent in nonresidential structures (17 percent). Their use in buildings with reported fires increased by 4 percent since 1996.

The installation of sprinklers provides significant protection against fire. However, this conclusion cannot be drawn from NFIRS data alone since NFIRS combines properties of different size and values in the same property class. Sprinkler systems are more likely to be installed in large and highly valued properties than in small, inexpensive ones. One way around this problem is to compare losses when sprinklers were present and operated versus when they were present and did not operate. The presumption is that the places with sprinklers, whether they went off or not, are more similar to each other than to places that did not have sprinklers. In 1998, the losses per fire were nearly three times less when sprinklers operated than when they did not (Figure 10).

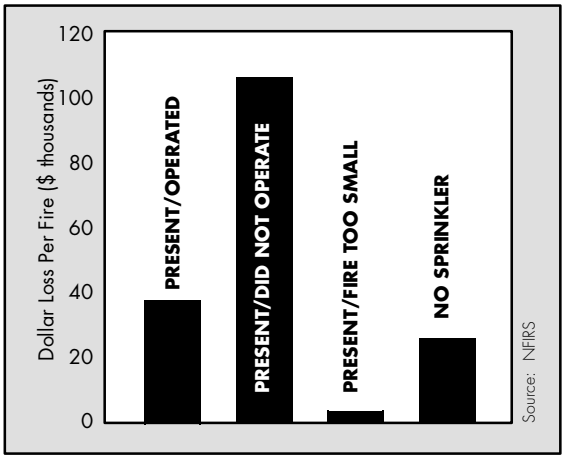


FIGURE 10. NON-RESIDENTIAL SPRINKLER PERFORMANCE: DOLLAR LOSS PER FIRE (1998)

FIREFIGHTER DEATHS AND INJURIES

In 1998, 91 firefighters died while on duty, of which 70 were directly associated with emergency incidents. Of these, 42 occurred directly from fireground activity—17 fighting residential structure fires, 11 fighting commercial fires, and 14 at other locations. The fatalities included 37 career firefighters and 54 volunteers. The 91 deaths is the third lowest total over the past 10 years (Figure 11). The trend continues its downward slope (17 percent).

Of the 91 firefighter deaths in 1998, 41 died from heart attacks and strokes. In fact, since 1995, 171 firefighters have succumbed in this manner. Nearly all of these

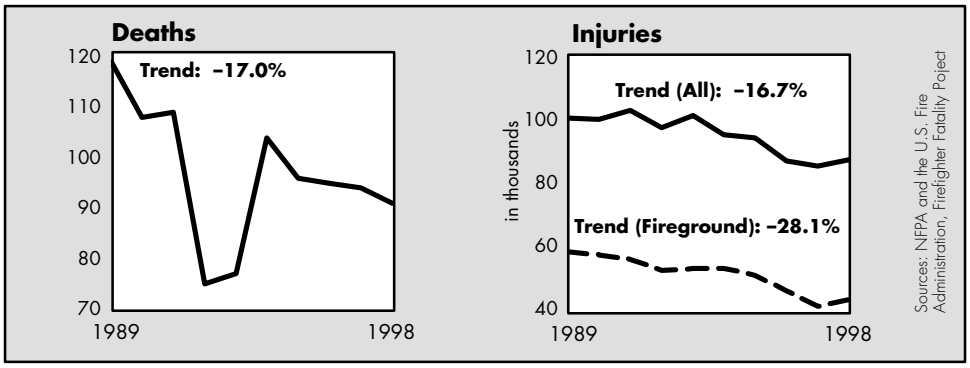


FIGURE 11. TRENDS IN FIREFIGHTER CASUALTIES

deaths were men over the age of 40. Many had preexisting medical conditions. (The U.S. Fire Administration has issued guidelines for promoting good health and ensuring that adequate medical care is available at every emergency scene.)[4]

In 1998, 87,500 firefighters were injured on duty, half of which were at the fireground. When compared to the 23,100 civilian injuries during this period, firefighters are at considerable risk. More than half of these injuries occurred in one- and two-family dwelling fires. Even so, the 10-year injury trend is down 17 percent.

THE NATIONAL PICTURE

This report clearly shows that the fire problem in the United States is improving. Ten-year trends are down. Deaths and injuries to civilians and firefighters are down. Per capita rates are down. Several factors have likely contributed to these trends:

- Smoke alarms, whose usage has become nearly universal over the past two decades.
- Sprinklers, which quickly combat incipient fires, especially in non-residential structures and recently in apartments. Public education programs could better inform homeowners of their value in residences.
- Fire codes, which have been strengthened.
- Construction techniques and materials, which have been specifically targeted to fire prevention.
- Public education at the community, county, state, and federal levels, which seems to be increasing.
- Firefighter equipment and training, which have improved.

If we could understand the relative importance of these factors to lessening the fire problem, resources could be better targeted to have the most impact.

[4] *Firefighter Fatalities in the United States in 1998*, U.S. Fire Administration, August 1999, pp. 35–36.

1 Introduction

The United States continues to have one of the most severe fire problems in the world relative to its population size. Many Americans are not aware of this nor of the nature of the fire problem.

This report is a statistical portrait of fire in the United States. It is intended for use by a wide audience, including the fire service, the media, researchers, industry, government agencies, and interested citizens. The report focuses on the national fire problem. The magnitude and trends of the fire problem, the causes of fires, where they occur, and who gets hurt are topics that are emphasized. One specific focus is on firefighter casualties—causes, types of injuries, etc.

This document is the twelfth major edition of *Fire in the United States* published by the U.S. Fire Administration. The previous editions included:

- First edition published in 1978; included 1975–76 fire data
- Second edition published in 1982; included 1977-78 fire data
- Third through fifth editions produced as working papers, but not published
- Sixth edition published in 1987; included 1983 fire data
- Seventh edition published in 1991, included 1983–87 fire data
- Eighth edition published in 1991; included 1983–90 fire data
- Ninth edition published in 1997; included 1985–94 fire data and focused on the residential/non-residential fire problem and on firefighter casualties
- Tenth edition published in 1998; included 1986–95 fire data and provided a state-by-state profile of fires and an examination of firefighter casualties
- Eleventh edition published in 1999; included 1987–96 fire data and focused on the residential/non-residential fire problem and on firefighter casualties

This twelfth edition addresses the 10-year period 1989–98. For the first time, this document includes analyses of all of the previous topics under one cover: the residential and non-residential fire problem, state-by-state profiles, and firefighter casualties.

SOURCES

The report is primarily based on the National Fire Incident Reporting System (NFIRS) data, but uses other sources as well, especially the National Fire Protection Association's (NFPA's) annual survey of fire departments, mortality data from the National Center for Health Statistics, and population data from the Bureau of the Census.

National Fire Incident Reporting System

The National Fire Incident Reporting System was started in 1975 as one of the first programs of the National Fire Prevention and Control Administration, which later became the U.S. Fire Administration (USFA). The basic concept of NFIRS has not changed since the system's inception. All states and all fire departments within them have been invited to participate on a voluntary basis. Participating fire departments collect a common core of information on fire and casualty reports using a common set of definitions. The data may be written by hand on paper forms or entered directly into a computer. Fire departments send these data as a bundle of paper reports, as an electronic file, or on a computer tape to their state fire data office, which edits and collates the data. Semiannually, the state's data are sent to the USFA. There, the data are further validated. Data summaries and error reports may be sent back to the states to correct suspicious, incorrect, or incomplete information. Data on individual fire incidents and casualties are preserved incident by incident at local, state, and national levels.

The system grew from an initial 6 states in 1976 to 40 states and the District of Columbia in 1984. Since 1985, the level of participation has remained relatively constant. A few states come in or leave the system each year. From 1995 to 1998, 39 states and the District of Columbia participated in NFIRS (Table 6). The number of fire departments participating within the states has grown to nearly 13,000 in 1998 (Figure 12). Within participating states, approximately 47 percent of the fire departments report (Table 7). The participating departments represent 38 percent of the more than 34,000 fire departments in the United States, a very large sample that enables us to make good estimates of various facets of the fire problem. Alhough participation in NFIRS is voluntary, some states do require their departments to participate in the state system. The long-range goal is voluntary participation by all states and the District of Columbia.

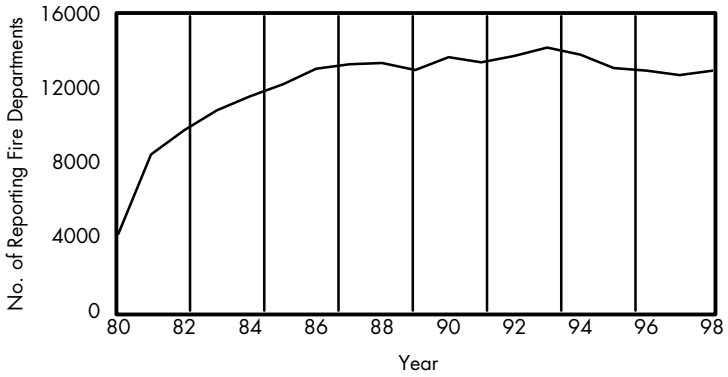


FIGURE 12. NFIRS PARTICIPATION (1980–1998)

Corresponding to the increased participation, the number of fires, deaths, and injuries and estimates of dollar loss reported to NFIRS also grew considerably from 1975 to 1995. By the mid 1980s, nearly one million incidents were being reported in NFIRS annually. In 1998, data on nearly 700,000 fire incidents were collected, roughly 39 percent of the estimated total responded to by fire departments.

TABLE 6. STATES PARTICIPATING IN NFIRS (1989–1998)

State	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Alabama	X	X	X	X	X	X	X	X	X	X
Alaska	X	X	X	X	X	X	X	X	X	X
Arizona	X	X			X	X	X			
Arkansas	X	X	X	X	X	X	X	X	X	X
California	X	X	X	X	X	X	X	X		X
Colorado	X	X	X	X	X	X	X	X	X	
Connecticut	X	X	X	X	X	X	X	X	X	X
Delaware	X	X					X	X	X	
District of Columbia	X		X	X	X	X	X	X	X	X
Florida	X	X	X	X	X	X	X	X	X	X
Georgia	X	X	X	X	X	X	X	X	X	X
Hawaii	X	X	X	X				X	X	X
Idaho	X	X	X	X	X	X	X	X	X	X
Illinois	X	X	X	X	X	X	X	X	X	X
Indiana	X	X	X	X	X				X	X
Iowa	X	X	X	X	X	X	X	X	X	X
Kansas	X	X	X	X	X	X	X	X	X	X
Kentucky	X	X	X	X	X	X	X	X	X	X
Louisiana	X	X	X	X	X	X	X	X	X	X
Maine	X	X							X	X
Maryland	X	X	X	X	X	X	X	X	X	X
Massachusetts	X	X	X	X	X	X	X	X	X	X
Michigan	X	X	X	X	X	X	X	X	X	X
Minnesota	X	X	X	X	X	X	X	X	X	X
Mississippi										
Missouri										
Montana	X	X	X	X	X	X		X	X	X
Nebraska	X	X	X	X	X	X	X	X	X	X
Nevada										X
New Hampshire	X	X	X	X	X	X	X	X	X	X
New Jersey	X	X	X	X	X	X	X	X	X	X
New Mexico						X		X		
New York	X	X	X	X	X	X	X	X	X	X
North Carolina										
North Dakota										
Ohio	X	X	X	X	X	X	X	X	X	X
Oklahoma			X	X	X	X	X	X	X	X
Oregon	X	X	X	X	X	X	X			
Pennsylvania										
Rhode Island	X	X	X	X	X	X	X			
South Carolina	X	X	X	X	X	X	X	X	X	X
South Dakota	X	X	X	X	X	X	X	X	X	X
Tennessee	X	X	X	X	X	X	X	X	X	X
Texas	X	X	X	X	X	X	X	X	X	X
Utah	X	X	X	X	X	X	X	X	X	X
Vermont	X	X	X	X	X	X	X	X	X	X
Virginia	X	X	X	X	X	X	X	X	X	X
Washington	X		X	X	X	X	X	X	X	X
West Virginia	X	X	X	X	X	X	X	X	X	X
Wisconsin	X	X	X		X	X	X	X	X	X
Wyoming	X	X	X	X	X	X	X	X	X	X
Total	43	41	41	40	41	41	40	40	40	40

TABLE 7. FIRE DEPARTMENTS PARTICIPATING IN NFIRS IN 1998

State	No. of Participating Fire Departments	No. of Fire Departments in State*	Fire Departments Reporting (percent)
Alabama	1	1,100	<0.1
Alaska	93	320	29
Arizona	0	350	0
Arkansas	439	985	45
California	249	1,186	21
Colorado	0	380	0
Connecticut	179	330	54
Delaware	0	64	0
District of Columbia	1	1	100
Florida	305	672	45
Georgia	127	750	17
Hawaii	3	4	75
Idaho	157	250	63
Illinois	823	1,199	69
Indiana	451	952	47
Iowa	557	870	64
Kansas	501	666	75
Kentucky	552	813	68
Louisiana	266	604	44
Maine	39	463	8
Maryland	331	365	91
Massachusetts	328	367	89
Michigan	907	1,079	84
Minnesota	641	793	81
Mississippi	0	754	0
Missouri	0	895	0
Montana	243	400	61
Nebraska	226	480	47
Nevada	13	210	6
New Hampshire	93	242	38
New Jersey	305	810	38
New Mexico	0	366	0
New York	1,495	1,800	83
North Carolina	0	1,316	0
North Dakota	0	388	0
Ohio	1,064	1,240	86
Oklahoma	87	883	10
Oregon	0	349	0
Pennsylvania	0	2,164	0
Rhode Island	0	82	0
South Carolina	141	640	22
South Dakota	230	359	64
Tennessee	196	662	30
Texas	509	2,300	22
Utah	169	250	68
Vermont	136	243	56
Virginia	263	596	44
Washington	58	650	10
West Virginia	433	446	97
Wisconsin	176	880	20
Wyoming	92	165	56
Total	12,879	34,133	38

* Data on the number of fire departments were provided by each State Fire Marshal Office or equivalent responsible organization.

There are, of course, many problems in assembling a real-world database, and NFIRS is no exception. Although NFIRS does not represent 100 percent of incidents reported to fire departments each year, the enormous sample size and good efforts by the fire service result in a huge amount of useful information. Because of the rapid advances in computer technology over the past 20 years, NFIRS has been revised to take advantage of these new capabilities and other improvements suggested by the participants. The new system, NFIRS 5.0, became operational in January 1999 and is being phased in around the nation.

Uses of NFIRS

NFIRS data are used extensively for major fire protection decisions. At the federal level, for example, the Consumer Product Safety Commission (CPSC) uses the data to identify problem products and to monitor corrective actions. The Department of Transportation uses NFIRS data to identify fire problems in automobiles, which has resulted in mandated recalls. The Department of Housing and Urban Development uses NFIRS to evaluate safety of manufactured housing (mobile homes). And of course the USFA uses the data to design prevention programs, to order firefighter safety priorities, to assist in the development of training courses at the National Fire Academy, and for a host of other purposes. Thousands of fire departments, scores of states, and hundreds of industries have used the data. The potential for even greater use remains. One of the purposes of this report is to give some idea of the types of information available from NFIRS. The information here is highly summarized; much more detail is available. USFA report, *Uses of NFIRS: The Many Uses of the National Fire Incident Reporting System,* further describes the uses of the data. It may be ordered directly from the USFA or is available online at http://www.usfa.fema.gov/nfdc/nfirsuse.htm.

NFPA and Other Data Sources

In addition to NFIRS, this report makes use of the summary numbers for fires, deaths, injuries, and dollar loss from the NFPA's annual survey of fire departments and NFPA's *Fire Command* and *Journal* articles on firefighter casualties.[1] It also uses data obtained from State Fire Marshal Offices or their equilavent, the National Center for Health Statistics, the Bureau of the Census, and the CPSC. The USFA gratefully acknowledges the use of their information. Data sources are cited for each graph and table in the report.

METHODOLOGY

An attempt was made to keep the data presentation and analysis as straightforward as possible. It was also the desire of the USFA to make the report widely accessible to many different users, so it avoids unnecessarily complex methodology.

[1] Throughout this report, the term *fire losses* refers to deaths, injuries, and dollar loss; the term *fire casualties* refers to deaths and injuries.

National Estimates

Most numbers in this report are scaled up national estimates or percentages, not just the raw totals from NFIRS. Many of the estimates are derived by computing a percentage of fires in a particular category using NFIRS and multiplying it by the total number of fires, deaths, injuries, or dollar loss from the NFPA annual survey. For example, the national estimate for the number of residential cooking fires was computed by taking the percentage of NFIRS residential fires (with known causes) that were attributed to cooking and multiplying it by the estimated total number of residential fires from the NFPA survey.

Ideally, one would like to have all of the data come from one consistent data source. But because the "residential population protected" is not reported to NFIRS by many fire departments and the reliability of that data element is suspect in many other cases, especially where a county or other jurisdiction is served by several fire departments that each report their population protected independently, this data element was not used. Instead, extrapolations of the NFIRS sample to national estimates are made using the NFPA survey for the gross totals of fires, deaths, injuries, and dollar loss.

One problem with this approach is that the proportions of residential, non-residential, mobile property, and outside fires and fire deaths differ between the large NFIRS sample and the NFPA survey sample. To be consistent with approaches being used by the CPSC and NFPA, we have used the NFPA estimates of fires, deaths, injuries, and dollar loss for residential, non-residential, mobile, and outside properties as a starting point. The details of the national fire problem below this level are based on proportions from NFIRS. One will not get the same numbers starting from the total NFIRS proportions of residential, non-residential, etc., as from the NFPA proportions. This inconsistency will remain until all estimates can be derived from NFIRS alone.

Unknowns

On a fraction of the incident reports or casualty reports sent to NFIRS, the desired information for many data items is either not reported or reported as "unknown." The total number of blank or "unknown" entries is often larger than some of the important subcategories. For example, 36 percent of residential fires with fatalities reported in 1998 do not have sufficient data reported to NFIRS to determine cause. The lack of data, especially for fatal fires, masks the true picture of the fire problem. Many prevention and public education programs use NFIRS data to target at-risk groups or to address critical problems, fire officials use the data in decisionmaking that affects the allocation of firefighting resources, and consumer groups and litigators use the data to assess product fire incidence. When the unknowns are large, the credibility of the data suffers. Fire departments need to be more aware of the effect of incomplete reporting.

Adjusted Percentages

In making national estimates, the unknowns should not be ignored. The approach taken in this report is to provide not only the "raw" percentages of each cause category, but also the "adjusted" percentages computed using only those incidents for which the cause was provided. This in effect

distributes the fires for which the cause is unknown in the same proportion as the fires for which the cause is known, which may or may not be approximately right. That is the best we can do without additional knowledge of the nature of the unknowns.

To illustrate: Children playing was reported as the fire cause for 3.4 percent of all reported residential fires in 1998; another 20.4 percent of reported fires had cause unknown. Thus, the percent of fires that had their cause reported was 100 – 20.4 = 79.6 percent. With the unknown causes proportioned like the known causes, the adjusted percent of residential fire fatalities caused by children playing can then be computed as 3.5 ÷ 79.6 = 4.4 percent.

Representativeness of the Sample

The percentage of fire departments participating in NFIRS varies from state to state, with some states not participating at all. To the best that USFA can determine, the distribution of participants is reasonably representative of the entire nation, even though the sample is not random. The sample is so large—39 percent of all fires—and so well distributed geographically and by size of community that there is no known major bias that will affect the results. Most of the NFIRS data exhibit stability from one year to another, without radical changes, as will be observed from the 10-year trend lines presented throughout this report. Results based on the full data set are generally similar to those based on part of the data, another indication of data reliability. Although improvements could be made—the individual incident reports could and should be filled out more completely and more accurately than they are today (as can be said about most real-world data collections as large as NFIRS), and all participating departments should have the same reporting requirements—the overall portrayal is a reasonably accurate description of the fire problem in the United States.

Trend Data

A frequently asked question is how much a particular aspect of the fire problem has changed over time. The usual response is in terms of a percentage change from one year to another. As we are dealing with real-world data that fluctuate from year to year, a percent change from one specific year to another can be misleading. This is especially true when the beginning and ending data points are extremes—either high or low. For example, in Figure 13, "Trends in Fires and Fire Losses," the percent change from 1989 of 5,410 deaths to 1998 of 4,035 deaths would be a decrease of 25.4 percent. Yet, if we were to choose 1991 as the beginning data point (4,465 deaths), this change would show a 9.6 percent decrease. As we are interested in *trends* in the U.S. fire problem, this edition of *Fire in the United States* reports the overall change in a data series as a trend. We have computed the best-fit linear trend line (which smooths fluctuations in the year-to-year data) and present the change over time based on this trend line. In this example, the overall 10-year trend is a decrease in deaths of 19.7 percent—not the 25 percent decrease calculated from only beginning and ending years.

Cause Categories

The causes of fires are often a complex chain of events. To make it easier to grasp the "big picture," 13 major categories of fire causes such as heating, cooking, and children playing are used by the U.S. Fire Administration here and in many other reports. The alternative is to present scores of detailed cause categories or scenarios, each of which would have a relatively small percentage of fires. For example, heating includes subcategories such as misuse of portable space heaters, wood stove chimney fires, and fires involving gas central heating systems. Experience has shown that the larger categories are useful for an initial presentation of the fire problem. It then can be followed by more detailed analysis.

The cause categories used in this project are listed in the same order on each graph to make comparisons easier from one to another. The order here also is the same as used in previous *Fire in the United States* editions. The particular order chosen was a combination of the ranking used in the cause sorting hierarchy and a desire to show the more important causes in the top half of the charts.

The cause categories used throughout the most of this report were designed to reflect the causes of structure fires—where the majority of fatal fire deaths occur. While these categories have usefulness for the other property types, there are limitations. For example, in vehicle fires, these limitations are such that the cause categories are not used.

An additional problem to keep in mind when considering the rank order of causes in this report is that sufficient data to categorize the cause were not reported to NFIRS for all fatal fires in the database. The rank order of causes might be different than shown here if the cause profile for the fires whose causes were not reported to NFIRS were substantially different from the profile for the fires whose causes were reported. However, there is no information to indicate that there is a major difference between the knowns and the unknowns, and so our present best estimate of fire causes is based on the distribution of the fires with known causes. The USFA is currently addressing this problem.

Fires are assigned to one of the 13 general cause groupings using a hierarchy of definitions, approximately as shown in Table 8.[2] A fire is included in the highest category into which it fits on the list. If it does not fit the top category, then the second one is considered, and if not that one, the third, and so on. For example, a fire caused by an arsonist using a match to ignite an accelerant is included in the incendiary or suspicious category and not in the open flame category. If the arsonist used a cigarette to ignite the fuse, the fire still is grouped with incendiary and suspicious fires and not with smoking fires.

[2] The exact hierarchy and specific definition in terms of the NFIRS code may be found on pages 2–201 to 2–203 of the 1990 *NFIRS System Documentation Manual*, Version 4.1. The actual hierarchy involves a large number of subcategories that are later grouped into the 13 major categories.

TABLE 8. HIERARCHY OF CAUSE GROUPINGS USED IN THIS REPORT

Cause Category*	Definition
Exposure	Caused by heat spreading from another hostile fire
Incendiary/Suspicious	Fire deliberately set or suspicious circumstances
Children Playing	Includes all fires caused by children playing with any materials contained in the categories below
Natural	Caused by Sun's heat, spontaneous ignition, chemicals, lightning, static discharge
Smoking	Cigarettes, cigars, pipes as accidental heat of ignition
Heating	Includes central heating, fixed and portable local heating units, fireplaces and chimneys, water heaters as source of heat
Cooking	Includes stoves, ovens, fixed and portable warming units, deep fat fryers, open grills as source of heat
Electrical Distribution	Includes wiring, transformers, meter boxes, power switching gear, outlets, cords, plugs, lighting fixtures as source of heat
Appliances (including air conditioning/ refrigeration)	Includes televisions, radios, phonographs, dryers, washing machines, vacuum cleaners, hand tools, electric blankets, irons, electric razors, can openers, dehumidifiers, water cooling devices, air conditioners, refrigeration equipment as source of heat
Other Equipment	Includes special equipment (radar, x-ray, computer, telephone, transmitters, vending machine, office machine, pumps, printing press), processing equipment (furnace, kiln, other industrial machines), service, maintenance equipment (incinerator, elevator), separate motor or generator, vehicle in a structure, unspecified equipment
Open Flame, Spark (heat from)	Includes torches, candles, matches, lighters, open fire, ember, ash, rekindled fire, backfire from internal combustion engine as source of heat
Other Heat	Includes fireworks, explosives, heat or spark from friction, molten material, hot material, all other fires caused by heat from fuel-powered objects, heat from electrical equipment arcing or overloading, heat from hot objects not covered by above groups
Unknown	Cause of fire undetermined or not reported

* Fires are assigned to a cause category in the hierarchical order shown. For example, if the fire is judged incendiary and a match was used to ignite it, it is classified as incendiary and not open flame because incendiary is higher on the list. One minor deviation: If the fire involves air conditioning or refrigeration, it is included in appliances and not in electrical distribution.

NFIRS fire data can be analyzed in many ways such as by the form of the heat of ignition, the material ignited, the ignition factor, or many other groupings. The hierarchy used in this report has proved useful in understanding the fire problem and targeting prevention, but other approaches are certainly useful too. Because the NFIRS database stores records fire by fire and not just in summary statistics, a very wide variety of analyses are possible.

Differences Between NFIRS and NFPA Data

There is an inconsistency between the NFIRS sample and the NFPA annual survey data: In nearly every year, the deaths reported to NFIRS are a larger fraction of the NFPA estimate of deaths than the NFIRS fires are of the NFPA estimate of fires. NFIRS injuries and dollar loss are even larger fractions of the NFPA totals than are deaths or fires. This issue is discussed further in Appendix A.

Unreported Fires

NFIRS only includes fires to which the fire service responded. In some states, fires attended by state fire agencies (such as forestry) are included; in other states, they are not.

NFIRS does not include fires from 10 states and many fire departments within participating states. However, if the fires from the reporting departments are reasonably representative, this omission does not cause a problem in making accurate national estimates for any but the smallest subcategories of data.

An enormous number of fires are not reported to the fire service at all. Most are small fires in the home or in industry which go out by themselves or are extinguished by the occupant. Based on a study done in the early 1970s, these unreported fires collectively cause a great deal of property loss and a large number of injuries requiring medical attention. The latest study of this problem was a 1984 report by CPSC.

Perhaps the most disturbing type of unreported fires are those not submitted by fire departments that are participating in NFIRS. Some departments submit information on most but not all of their fires. Sometimes the confusion is systematic, as when no-loss cooking fires or chimney fires are not reported. Sometimes it is inadvertent, such as when incident reports are lost or accidentally not all submitted. The information that is received is assumed to be the total for the department and is extrapolated as such. Although there was no measure of the extent of this problem in the past, the new NFIRS 5.0 provides fire departments with the capability to report this information in a simplified, more straightforward manner.

ORGANIZATION OF REPORT

This report is organized similarly to the Eleventh Edition of *Fire in the United States*. Chapter 2 presents an overview of the national fire problem in terms of the total number of fires, deaths, injuries, and dollar loss—the four principal measures used to describe the fire problem.

Chapters 3 and 4 address the residential and non-residential fire problem, respectively. Chapter 5 addresses firefighter casualties. Chapter 6 focuses on special topics bearing on the fire problem. Chapter 7 presents summaries and profiles of each state and the District of Columbia from fire data that are available. USFA resources that provide in-depth information on specific topics are listed at the end of most chapters.

Appendix A discusses the differences between NFPA and NFIRS data.

Most of the data are presented graphically for ease of comprehension. The specific data associated with the graphs are provided directly with the chart. In those instances in which it was impractical to provide the data, references are made to data tables that are presented in Appendix B.

This edition of *Fire in the United States* concludes with an index to the topics of this report.

2 The National Fire Problem

OVERVIEW

The United States has a severe fire problem, more so than is generally perceived. Nationally, there are millions of fires, thousands of deaths, tens of thousands of injuries, and billions of dollars lost—which make the U.S. fire problem one of great national importance. The indirect costs of fire increase the magnitude of economic loss tenfold.

Although we have made much progress in the last decade, the United States continues to have one of the highest per capita fire death rates in the world. The United States had an average of 4,637 fire deaths a year from 1989 to 1998 (Figure 13). There were 4,035 fire fatalities in 1998.

Injury statistics in Figure 13 are not as clear cut as the death totals because of ambiguity about the completeness of defining and reporting minor injuries and the fact that many injured people go directly to a medical care facility themselves without being reported to or treated by the fire department or local EMS responders. Civilian injuries from reported fires averaged 27,100 per year over the past 10 years. Firefighter injuries averaged 51,000 from those fires, as shown in Chapter 5, Figure 111. Past studies suggest that the number of civilian injuries associated with fires that are not reported to the fire service might be several times that of the number from reported fires, as discussed in Chapter 1. Fire-caused injuries to civilians trended down by 20 percent over the 10-year period. Injuries were down for the fifth consecutive year and in 1998 were at their lowest level (23,100) despite a 9.5 percent increase in the national population over this 10-year period.

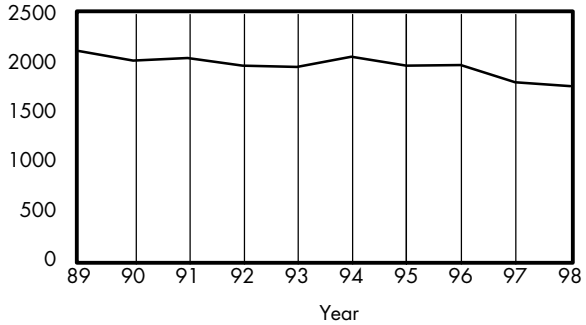
In terms of dollar loss, the estimated direct value of property destroyed in fires was $8.6 billion for 1998. The total cost of fire (direct losses, the cost of fire departments, built-in fire protection in new buildings, insurance overhead, and other annual fire protection expenditures) is much higher. The direct dollar loss increased 4 percent from 1989 to 1998, with the increase due to inflation. Using constant 1998 dollars, the loss was down by 21 percent over this period. Still, the direct dollar loss was enormously high at an average of $9.8 billion a year in adjusted 1998 dollars.

These casualties and losses come from an average of nearly 2 million fires annually. Fire incidents have declined 13 percent since 1989, with a sharp decline in 1997; 1998 had the fewest number of fires reported (1.8 million) since national fire data have been recorded.

When the U.S. Fire Administration was established in 1975, annual fire deaths were estimated at 12,000. The goal was to reduce deaths by 50 percent within 25 years; that goal was met.

On a per capita basis, the fire problem appears less severe today than 10 years ago, partially because the population has been increasing and partially because of the overall decline in numbers of reported fires and fire casualties. Over this 10-year period, reported fires averaged 7.6 per

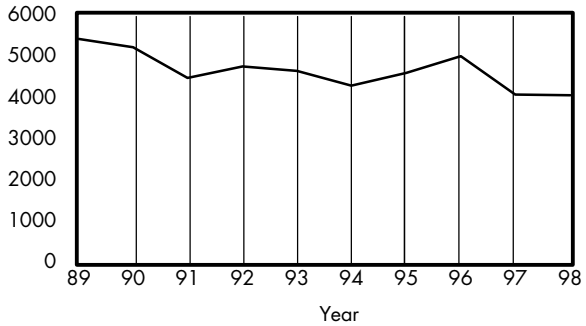
FIRES (in thousands)



1989	2,115	1994	2,055
1990	2,019	1995	1,966
1991	2,042	1996	1,975
1992	1,965	1997	1,795
1993	1,953	1998	1,756

10-Year Trend = -13.1%

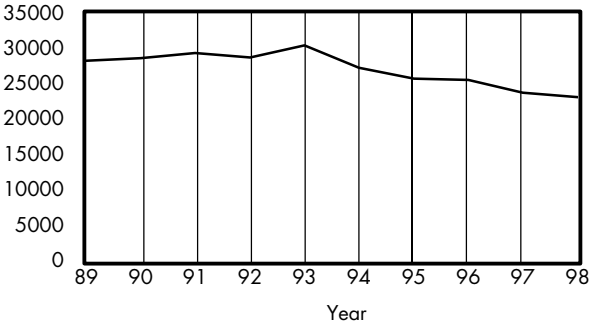
DEATHS



1989	5,410	1994	4,275
1990	5,195	1995	4,585
1991	4,465	1996	4,990
1992	4,730	1997	4,050
1993	4,635	1998	4,035

10-Year Trend = -19.7%

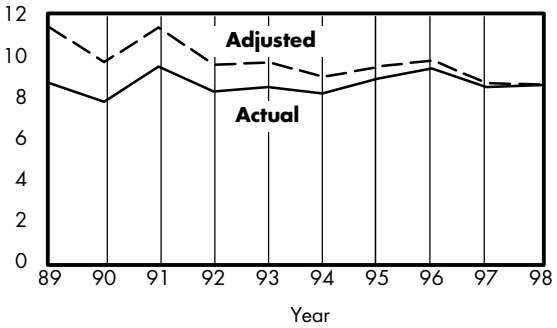
INJURIES



1989	28,250	1994	27,250
1990	28,600	1995	25,775
1991	29,375	1996	25,550
1992	28,700	1997	23,750
1993	30,475	1998	23,100

10-Year Trend = -20.2%

DOLLAR LOSS (in $ billions)



	Actual	Adjusted to 1998 Dollars
1989	$8.7	$11.4
1990	7.8	9.7
1991	9.5	11.4
1992	8.3	9.6
1993	8.5	9.7
1994	8.2	9.0
1995	8.9	9.5
1996	9.4	9.8
1997	8.5	8.7
1998	8.6	8.6

10-Year Actual Trend = +3.8%
10-Year Adjusted Trend = -21.0%

Sources: NFPA and Consumer Price Index

FIGURE 13. TRENDS IN FIRES AND FIRE LOSSES

thousand population (Figure 14). The fire death rate per million population has declined a significant 27 percent. In terms of injuries, the per capita rate was down 27 percent over 10 years, with most of the decline starting in 1993. In 1998, the 15 deaths per million population represented the lowest per capita death rate in NFPA survey history. Dollar loss per capita was $32, down nearly 6 percent unadjusted. When adjusted for inflation over the 10 years, however, this loss was down 28 percent.

THE BROADER CONTEXT

Fires constitute a much larger problem than is generally known. Deaths and injuries from all natural disasters combined—floods, hurricanes, tornadoes, earthquakes, etc.—are just a fraction of the annual casualties from fire. For example, deaths from disasters are on the order of 200 per year versus more than 4,000 deaths from fires.

Most fires are relatively small, and their cumulative impact is not easily recognized. Only a few fires each year have the huge dollar losses that are associated with tornados, hurricanes, or floods. The southern California wildland fires in the fall of 1993 resulted in over $800 million in losses. The Oakland East Bay Hills fire of October 1991 was estimated to have caused over $1 billion in losses. The Phillips petrochemical plant fire in the Houston ship channel in October 1989 caused several hundred million dollars in losses. But because most of the losses from fire are spread over the 2 million fires that are reported each year, the total loss is far more than the impression many people have of it from the anecdotal reporting of local fires in the media.

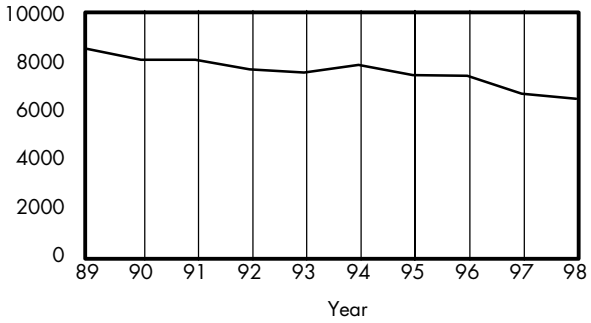
Fires also are an important cause of accidental deaths. The National Safety Council ranks fires as the fifth leading cause of accidental deaths, behind only vehicle accidents, falls, poisonings, and drownings.

Fire-related injuries to civilians and firefighters are reported with too much uncertainty to properly rank them with confidence, but it is clear that they number over 100,000 and possibly two or three times that many when injuries from unreported fires and unreported injuries from reported fires are taken into account. Burn injuries are particularly tragic because of the tremendous pain and suffering they cause. Serious burns tend to cause psychological damage as well as physical damage, and they may well involve not only the victims but also their family, friends, and fellow workers.

U.S. Fire Deaths Versus Other Nations

The United States has one of the most severe fire problems among the industrialized nations. Although our per capita death rate is nearly half what it was in the late 1970s, and down 27 percent since 1989, international data indicate that the United States still has a fire death rate two to three times that of several European nations and at least 20 percent higher than most. The average U.S.

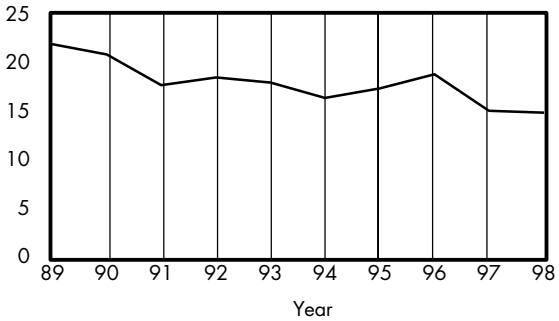
FIRES (per million population)



1989	8,570	1994	7,890
1990	8,120	1995	7,480
1991	8,100	1996	7,440
1992	7,700	1997	6,700
1993	7,570	1998	6,500

10-Year Trend = -20.7%

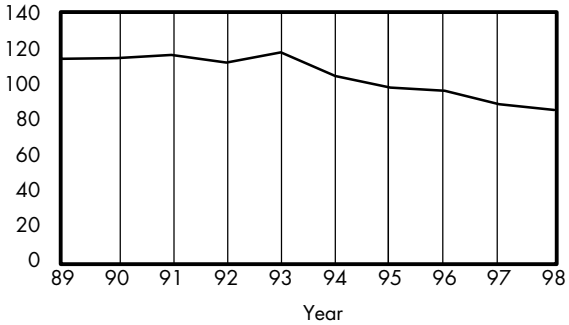
DEATHS (per million population)



1989	21.9	1994	16.4
1990	20.9	1995	17.4
1991	17.7	1996	18.8
1992	18.5	1997	15.1
1993	18.0	1998	14.9

10-Year Trend = -26.9%

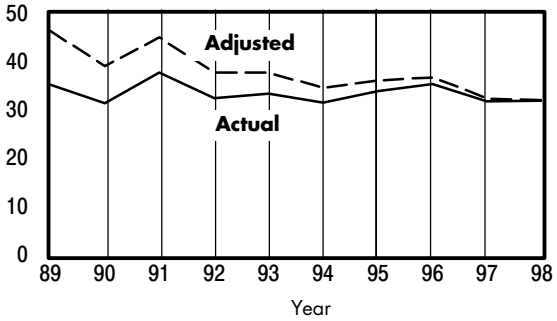
INJURIES (per million population)



1989	114.5	1994	104.7
1990	115.0	1995	98.1
1991	116.5	1996	96.3
1992	112.5	1997	88.7
1993	118.2	1998	85.5

10-Year Trend = -27.1%

DOLLAR LOSS (per capita)



	Actual	Adjusted to 1998 Dollars
1989	$35.2	$46.3
1990	31.4	39.1
1991	37.7	45.1
1992	32.5	37.8
1993	33.4	37.6
1994	31.5	34.6
1995	33.9	36.2
1996	35.4	36.8
1997	31.8	32.3
1998	31.9	31.9

10-Year Actual Trend = -5.6%
10-Year Adjusted Trend = -28.1%

Sources: NFPA, Consumer Price Index, and Bureau of the Census

FIGURE 14. TRENDS IN FIRES AND FIRE LOSSES PER CAPITA

fire death rate for 1995–1997 was reported at 18.6 deaths per million population.[1] Switzerland's rate was 4.3 per million population; Canada's was 14.6. In fact, of the 24 industrial nations that are examined by the World Fire Statistics Centre, the U.S. rate was higher than all but two—Finland and Hungary. This status has been virtually unchanged for the past decade.

The declining U.S. trend in fire death rate over the past 10 years is not a singular event; all countries except Hungary and Finland also trended downward. Furthermore, although commensurable statistical data are not available for all nations, the United States has many more residential fires on a per capita basis than any of the countries for which data are available. The United States has placed greater emphasis on fire suppression than other nations, but these nations tend to surpass the U.S. in practicing fire prevention. The United States would be well served by studying and implementing international fire prevention programs that have proved effective in reducing the number of fires and deaths. The United States has excellent building technology; public buildings generally have good records. It is the combination of safety built into homes and safety behavior in homes where we fall short of some nations. We have the technology in home sprinkler systems and knowledge of compartmentalization, but they are not widely used.

Total Cost of Fire

The total cost of fire to society is staggering—over $100 billion per year.[2] This includes the cost of adding fire protection to buildings, the cost of paid fire departments, the equivalent cost of volunteer fire departments ($20 billion annually), the cost of insurance overhead, the direct cost of fire-related losses, the medical cost of fire injuries, and other direct and indirect costs. Even if these numbers are high by as much as 100 percent, the total cost of fire ranges from $50 to $100 billion, still enormous, and on the order of 1 to 1.5 percent of the gross domestic product, which was $8.79 trillion in 1998.[3] Thus from an economic viewpoint, fire ranks as a significant national problem.

FIRE CASUALTIES BY POPULATION GROUP

The fire problem is more severe for some groups than others. People in the Southeast, males, the elderly, African–Americans, American Indians, and the very young all are at higher risk from fires than the rest of the population. These groups have remained at risk despite the continuing downward trends.

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[1] United Nations Economic and Social Council, as prepared by the World Fire Statistics Centre, *Geneva Association Information Newsletter,* October 2000. Using NFPA estimates and Bureau of the Census data, however, the 1995–1997 average U.S. fire death rate is computed at 17.1 per million population. The 1998 death rate is computed at 14.9 per million population.

[2] Meade, William P., *A First Pass at Computing the Cost of Fire in a Modern Society*, The Herndon Group, Inc., February 1991.

[3] U.S. Department of Commerce's Bureau of Economic Analysis.

State and Regional Profiles

Fire death rates for each state for the past 10 years are shown in Figure 15. An overlay plot on each state chart shows the national fire death rate. Eleven states are consistently above the national average and 12 states are consistently below it.

The rank order of state fire deaths per million population is shown in Figure 16. States with relatively small populations may move up and down on the list from year to year as a result of only a few deaths; their death rate is better viewed as an average over time. For example, the District of Columbia changed from one of the highest death rates in 1994 to among the lowest in 1995; in 1998, it jumped to the fourteenth highest death rate in the nation. Rhode Island went from best (1994) to worst (1995) and back to best (1998). The highest states were Alaska, Mississippi, Arkansas, Missouri, and Vermont. The lowest were Rhode Island, California, Texas, Colorado, and Utah.

Figure 17 shows the rank order of states in terms of the absolute number of fire deaths. Not surprisingly, large population states are at the top of the list. As in previous years, the 10 states with the most fire deaths account for nearly half of the national total. Unless their fire problems are significantly reduced, the national total will be difficult to lower.

The sum of the state death estimates in Figure 17 is over 600 deaths below the estimate of 4,035 from the NFPA survey for 1998. This difference may be due to some states underreporting their fire deaths (or not reporting them at all) or an overestimate from the extrapolation of the NFPA sample of fire departments, or a combination of both. A third source, the National Center for Health Statistics (NCHS) mortality data, shows 3,255 deaths due to fire and flames. This NCHS data category tends to undercount fire deaths from accidents due to collisions and the like by 5 to 10 percent. Nevertheless, the correspondence between the sources, while not exact, should be considered good.

The Southeast of the United States continues to have the highest fire death rate in the nation and one of the highest in the world. Figure 18 shows the states with the highest fire death rates for 1998. As can be seen from the map, blocks of contiguous states often have similar death rates. A special study on the commonality among these similar states might provide useful insights into the reasons for this.

Although the death rates of the southeastern states have decreased, all still have death rates in the two highest categories (more than 16 deaths per million population) with the notable exception of Florida. In addition to three states in the Southeast, Alaska and Vermont were in the highest fire death rate category in 1998. The Southeast and Alaska have been consistently among the highest fire death rate areas for many years.

At the other extreme are the states with no shading—less than 11 deaths per million population. This death rate is in the same range as the nations of Europe and the Far East. They tend to be states in the Southwest and West, but there are some noteworthy exceptions: Delaware, Florida, Indiana, New York, New Jersey, and Massachusetts all had a low year in 1998. California and Florida continue to have the lowest death rates among the high population states.

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figure 15

FIGURE 15. 10-YEAR FIRE DEATH RATE BY STATE COMPARED TO NATIONAL AVERAGE

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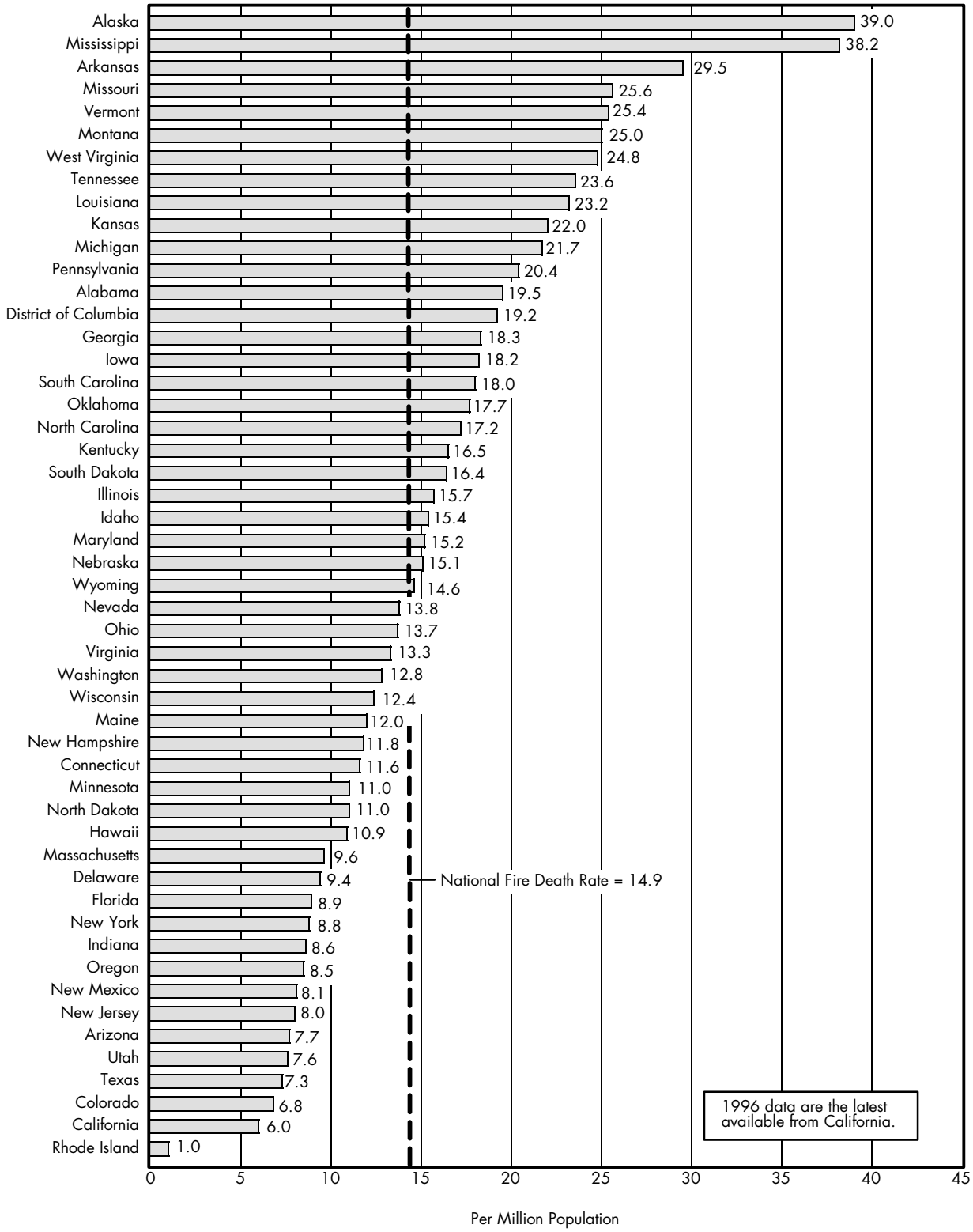
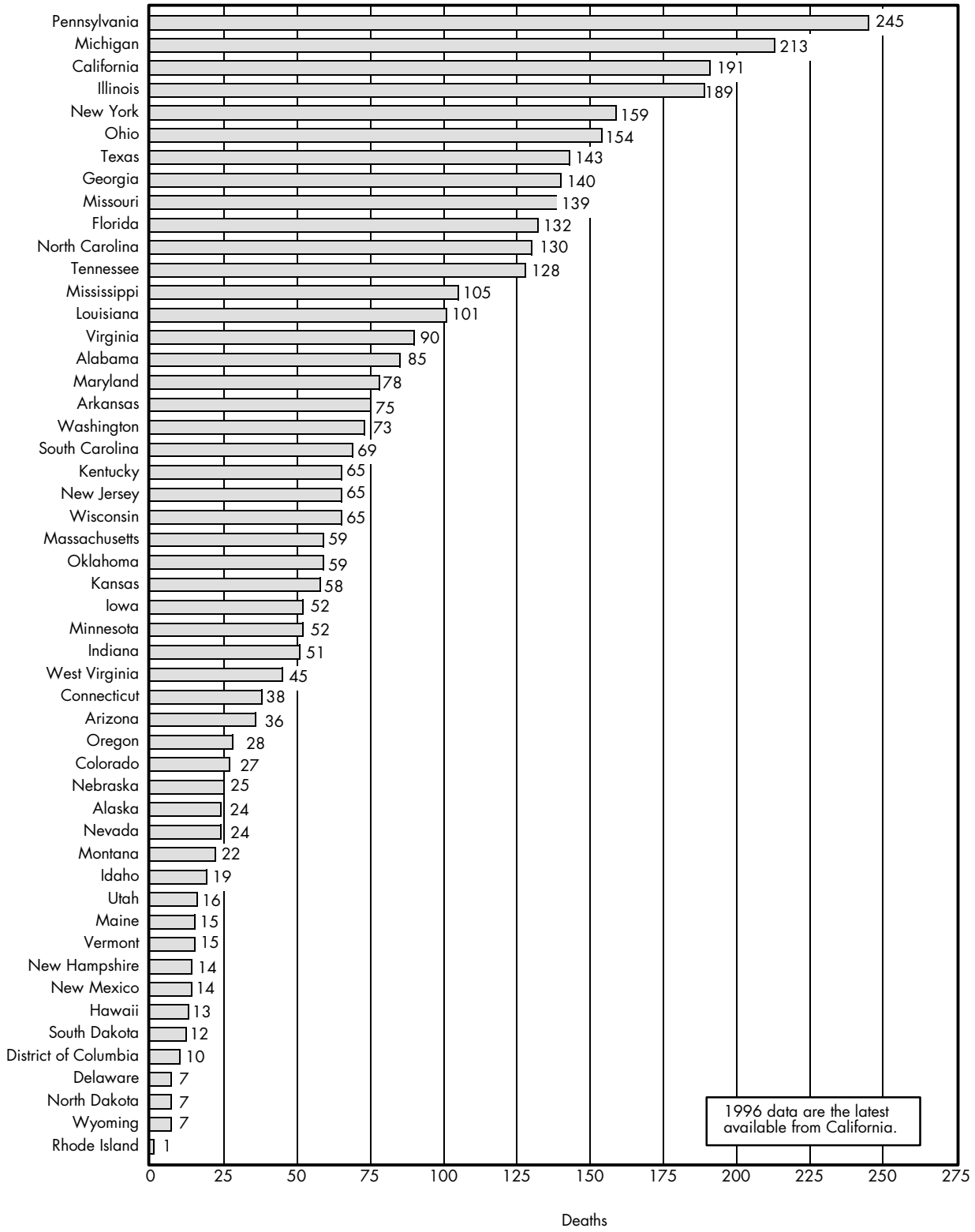
FIGURE 15.



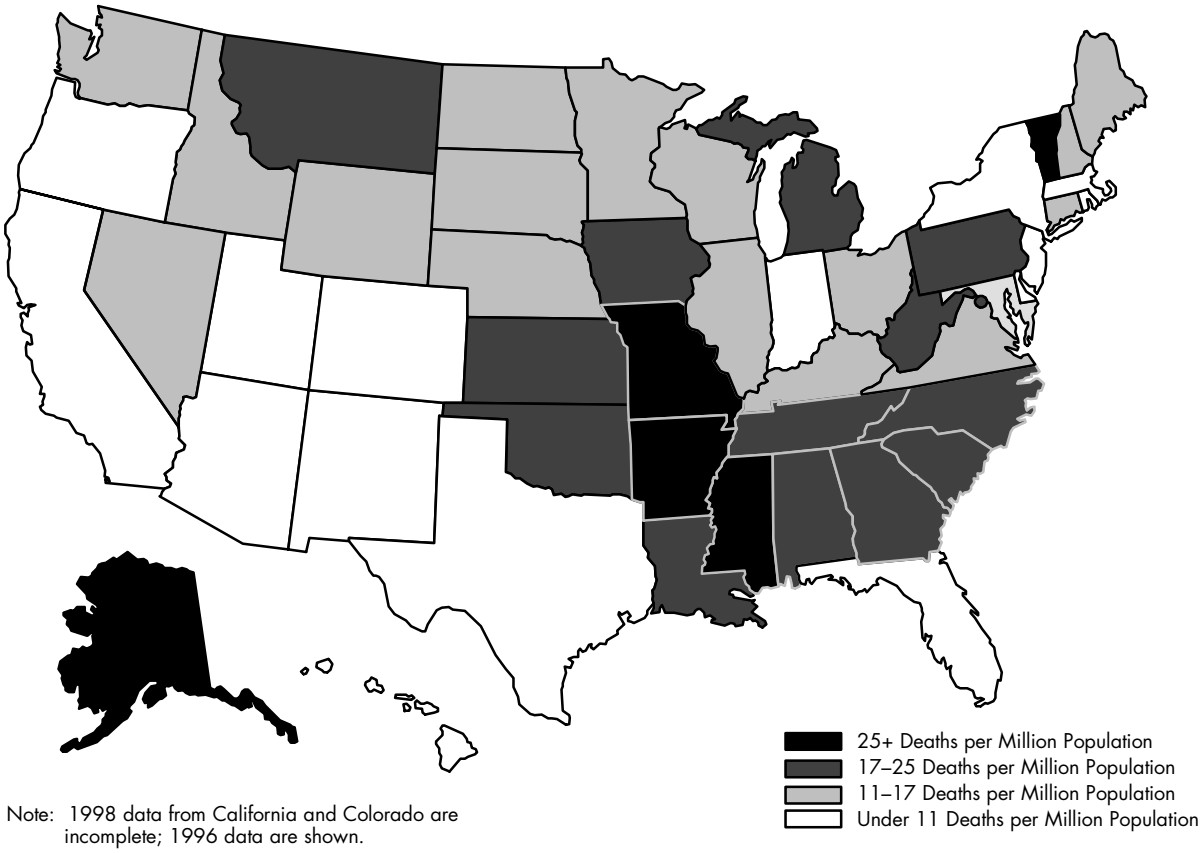
Source: State Fire Marshal Offices or equilavents

FIGURE 16. RANK ORDER OF STATES BY CIVILIAN FIRE DEATHS PER CAPITA (1998)



Source: State Fire Marshal Offices or equivalents.

FIGURE 17. RANK ORDER OF STATES BY CIVILIAN FIRE DEATHS (1998)



Note: 1998 data from California and Colorado are incomplete; 1996 data are shown.

Sources: State Fire Marshal Offices and the United States Fire Administration

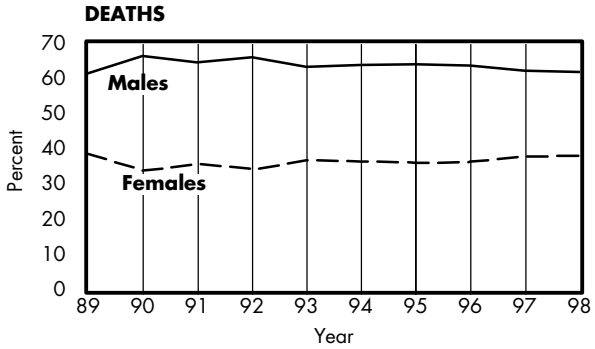
FIGURE 18. FIRE DEATH RATE BY STATE (1998)

Gender

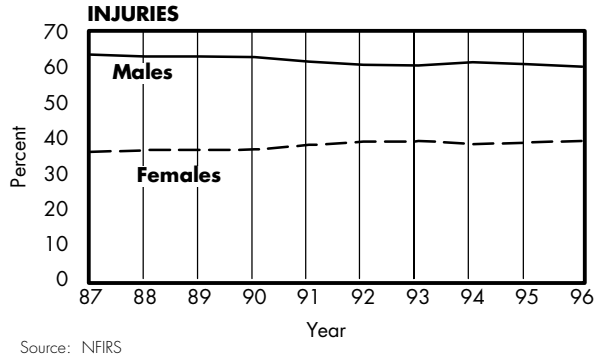
More men die in fires than women, although the relative difference has narrowed. Figure 19 shows that the high proportion of male-to-female fire deaths has been remarkably steady over the past 10 years. The difference was less in 1998 than in any previous year, but was still large. Males have a higher fire death rate per capita than females for all age groups. Males aged 20–50 had nearly three times the risk of death as women in 1998 (Figure 20).

Figure 19 also shows that the male-to-female ratio for fire injuries is similar to that for fire deaths except that the gender gap has narrowed since the late 1980s. Injuries per capita for males are more than one and one-half times the female rate until age 65 (Figure 20). For the very old (>84), the risk of injuries to males declined significantly from 1996 (142 per million in 1998 vs. 264 per million population in 1996).

The reasons for the disparity of fire injuries between men and women are not known for certain. Suppositions include the greater likelihood of men being intoxicated, the more dangerous occupations of men (most industrial fire fatalities are males), and the frequent handling of gasoline



	Males	Females		Males	Females
1989	61.4%	38.6%	1994	63.7	36.3
1990	66.2	33.8	1995	64.0	36.0
1991	64.4	35.6	1996	63.6	36.4
1992	65.9	34.1	1997	62.1	37.9
1993	63.2	36.8	1998	61.8	38.2



	Males	Females		Males	Females
1989	63.2%	36.8%	1994	61.6	38.4
1990	63.0	37.0	1995	61.1	38.9
1991	61.8	38.2	1996	60.4	39.6
1992	60.8	39.2	1997	58.7	41.3
1993	60.6	39.4	1998	58.9	41.1

Source: NFIRS

FIGURE 19. TRENDS IN MALE VS. FEMALE CASUALTIES

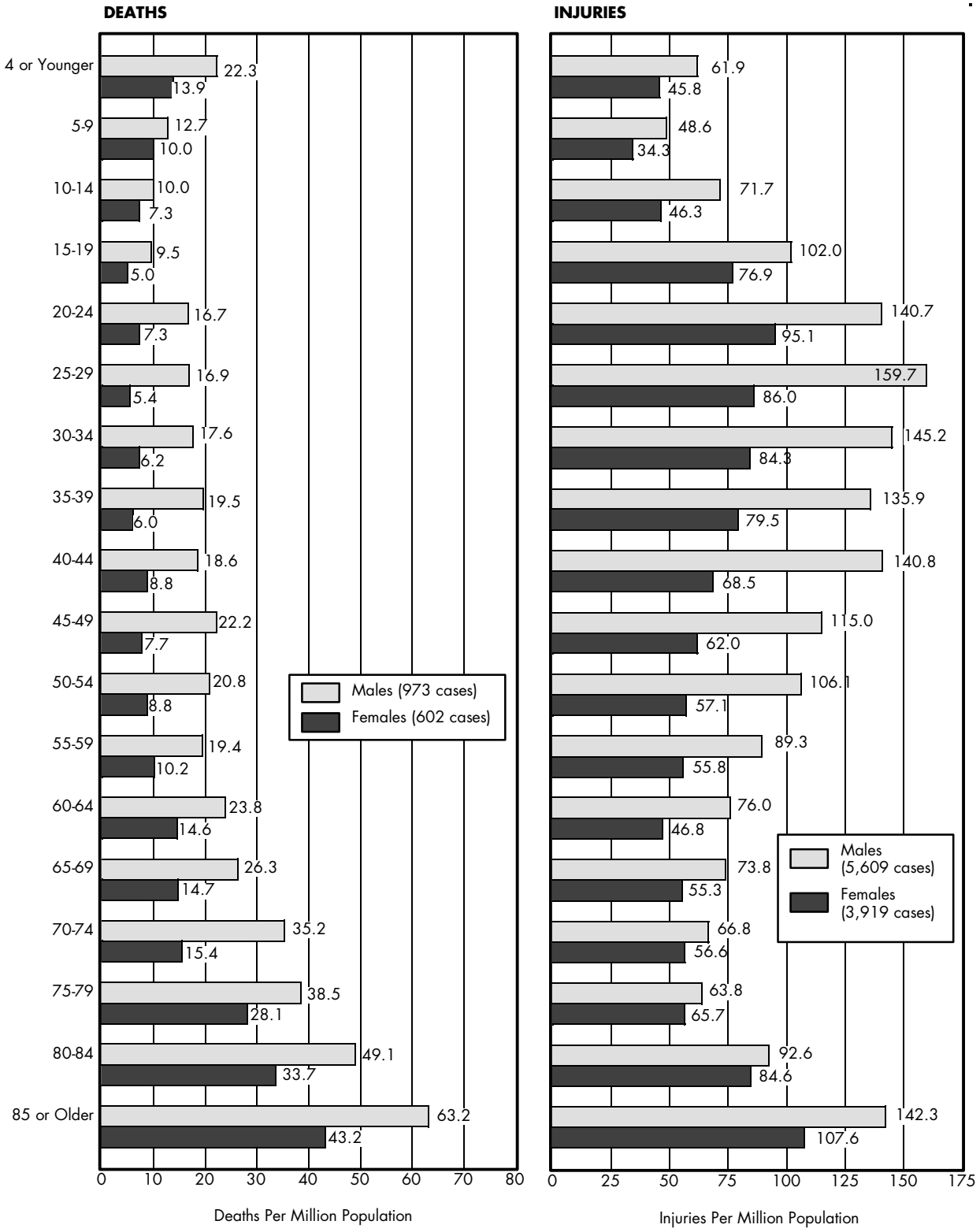
and other flammable liquids by men. We also know that men have more injuries trying to extinguish the fire and rescue people than do women.

Age

People over 59 have a much higher fire death rate than the average population, as shown in Figure 21. At the other end of the age spectrum, the very young (under 5) also have a higher-than-average problem, but not as high as the elderly. The relative risk of dying and being injured in a fire for various age groups is shown in Figure 22. Children under 5 have a much greater risk of death than other children; children over 5 have less than average risk. Risk of fire death drops off sharply between 5 and 19, then steadily increases until age 60. At age 60, the risk of death is above average and increases sharply as the population ages. These profiles have remained relatively constant from year to year.[4]

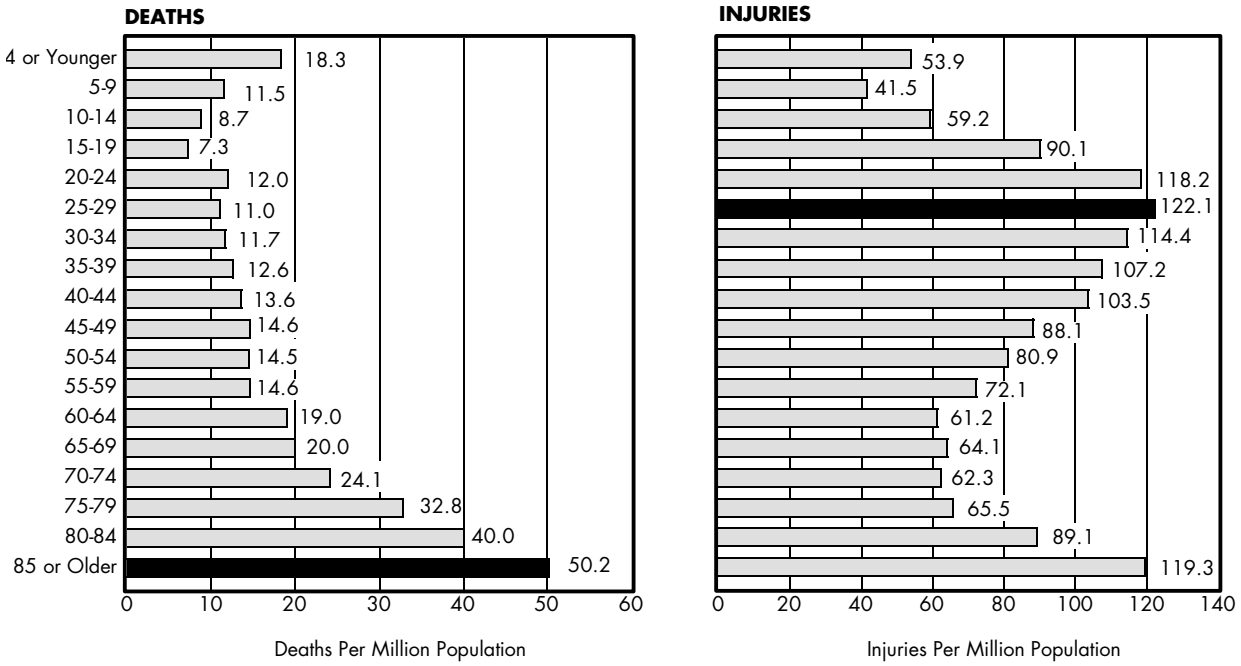
Contrary to what might be expected, the age profile of risk from injuries is very different from that for deaths. In 1998, the risk of injury in a fire was highest for adults aged 20–44 and the elderly over 85. The risk of injury is below average for children under age 15 and for those aged 50–79.

[4] For those interested in data reliability issues, there is some concern over the coding of the ages of infants less than 1 year old. Some code them as 1, some as 0, and some to the nearest integer of 0 or 1. Also, some fire departments or states fill in blank fields with zeros. Thus, the number of casualties with age 0 has been suspect. By dropping age profiles with 0's, the difference was small. This discrepancy has been corrected in NFIRS 5.0.



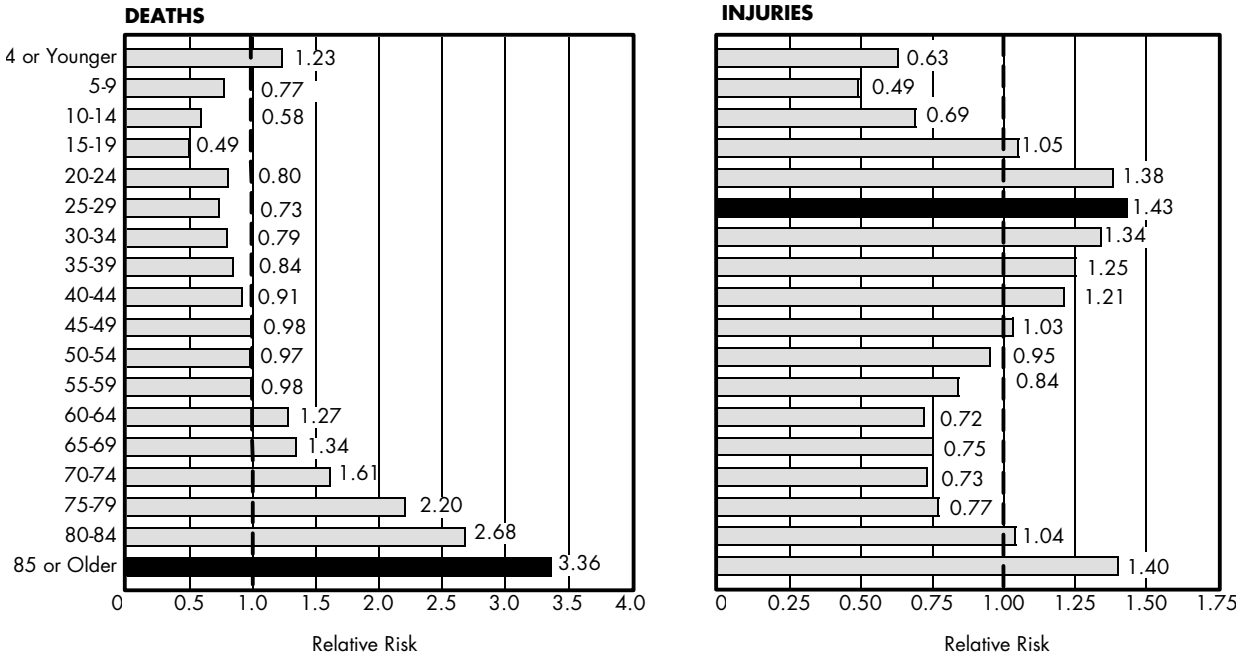
Sources: NFIRS, NFPA, and Bureau of the Census

FIGURE 20. CASUALTIES PER CAPITA BY AGE AND GENDER (1998)



Sources: NFIRS, NFPA, and Bureau of the Census

FIGURE 21. CASUALTIES PER CAPITA BY AGE (1998)



Note: The population as a whole has a relative risk of 1.

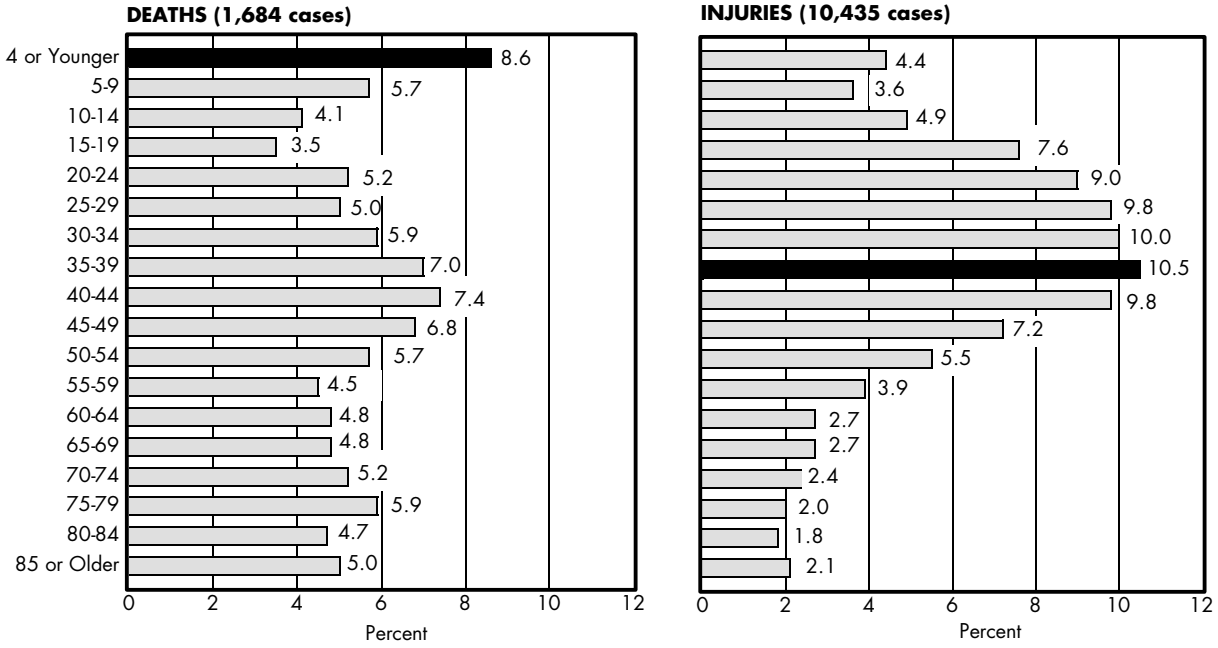
Sources: NFIRS, NFPA, and Bureau of the Census

FIGURE 22. RELATIVE RISK OF FIRE CASUALTIES BY AGE (1998)

Figure 23 shows the percent of 1998 fire deaths and injuries falling into each age group. (This is not the same as risk.) Those under age 5 account for 9 percent of the deaths with age reported—the highest proportion for any age group. Nevertheless, this represents a 3 percent improvement over 1996 for this young age group. Those 70 and above comprise 21 percent of the fire deaths. These two peak risk groups represent nearly one-third of all fire deaths. (A complete examination of the very young and of older adults is presented in Chapter 6.) On the other hand, two-thirds of fire deaths fall in age groups that are not at high risk. The bulk of fire deaths occur to the not so young and not so old. Programs aimed only at the highest risk groups will not reach the majority of potential victims.

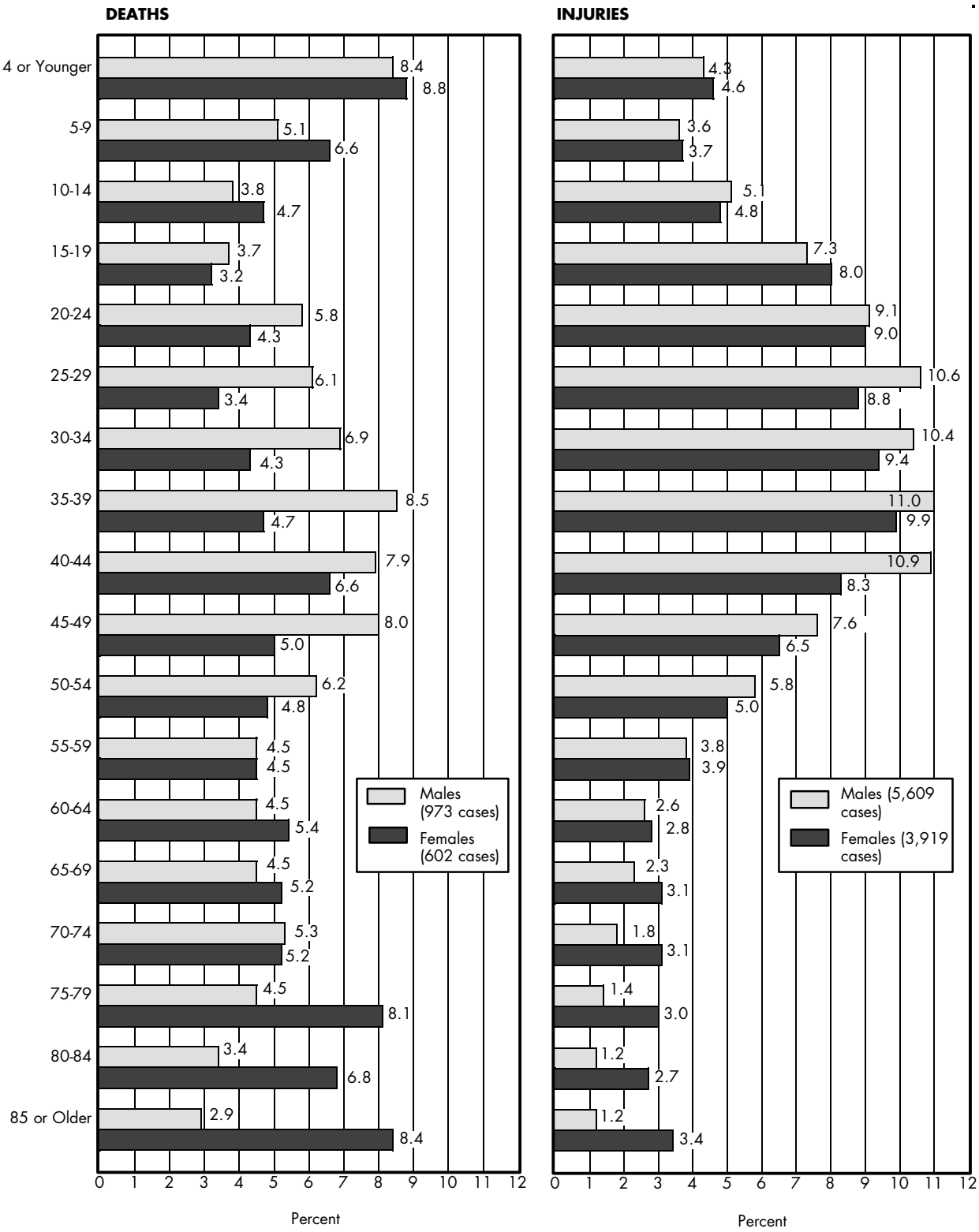
The injury age distribution tracks closely the relative risk profile by age, except for the elderly (Figure 23). Ages 20–44 account for half of the 1998 fire injuries. The young, under age 10, account for 8 percent; the elderly over age 70 account for 8 percent. Although the elderly are at high risk, there are fewer of them in the total population. If their risk continues to be the same, we could expect more and more elderly fire injuries and deaths as the elderly proportion of the population increases. In the meantime, the focus for injury prevention should be on adults 20–44. It is believed that males in this age group are greater risk takers during fires, resulting in a higher proportion of injuries.

The distribution of fire deaths by age is somewhat different for males versus females (Figure 24). A slightly larger proportion of female deaths in 1998 occurred in the young (through age 14) and again after age 60. Male fire deaths, by contrast, are higher in the mid-life years, ages 15 to 60. Elderly females have more than twice the proportion of both deaths and injuries than elderly males.



Source: NFIRS

FIGURE 23. FIRE CASUALTIES BY AGE (1998)



Source: NFIRS

FIGURE 24. FIRE CASUALTIES BY AGE AND GENDER (1998)

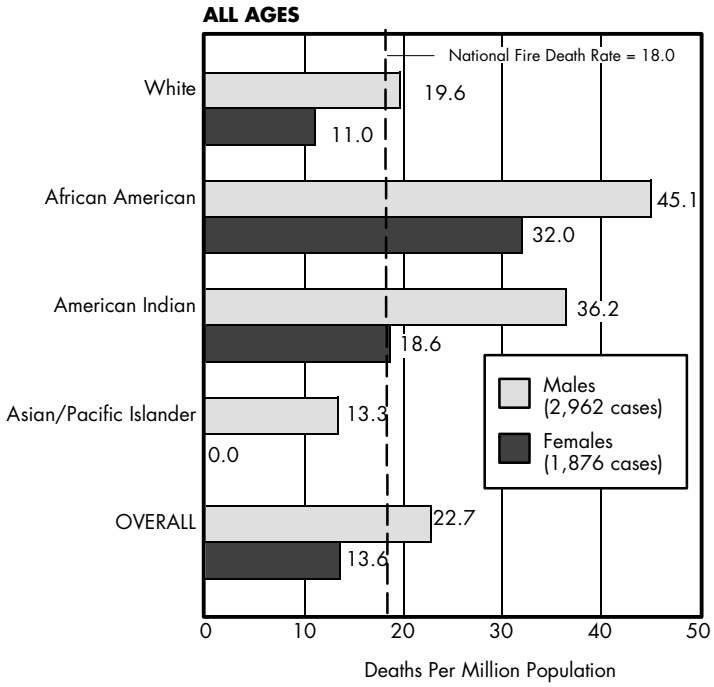
Ethnic Groups

The fire problem cuts across all groups and races, rich and poor, North and South, urban and rural. But it is higher for some groups than for others.

Data on "race" or ethnic group of victims are somewhat ambiguous in a society where many people are of mixed heritages. And many citizens, including firefighters, find it distasteful to report on race. On the other hand, there does seem to be a higher fire problem for some groups, and it can be helpful to identify their problems for use within their own communities and by fire educators.

African Americans and American Indians have significantly higher fire death rates per capita than the national average (Figure 25). African American fire death victims comprise a large and disproportionate share of total fire deaths—although African Americans comprise 13 percent of the population, they account for 27 percent of fire deaths.

As noted earlier, male fire death rates exceed that of females by 1.5 to 2 times, and the elderly of all ethnic groups have the highest fire death rates. The result of these statistics is that elderly African Americans have the highest fire death rate in the nation at more than 12 times the U.S. average fire death rate. This situation has worsened since 1996.



Sources: National Center for Health Statistics and Bureau of the Census

NO. OF FIRE DEATHS

Race	Males	Females	Total
White	2,127	1,248	3,375
African American	727	575	1,302
American Indian	42	22	64
Asian/Pacific Islander	66	31	97
Total	2,962	1,876	4,838

Notes:
(1) 1997 was the latest year data were available at the time this report was written.

(2) The overall totals are derived from the mortality data and differ from death totals presented in Figures 13 (NFPA survey data) and 17 (State Fire Marshals' data).

(3) Age was not recorded for 15 males and 1 female.

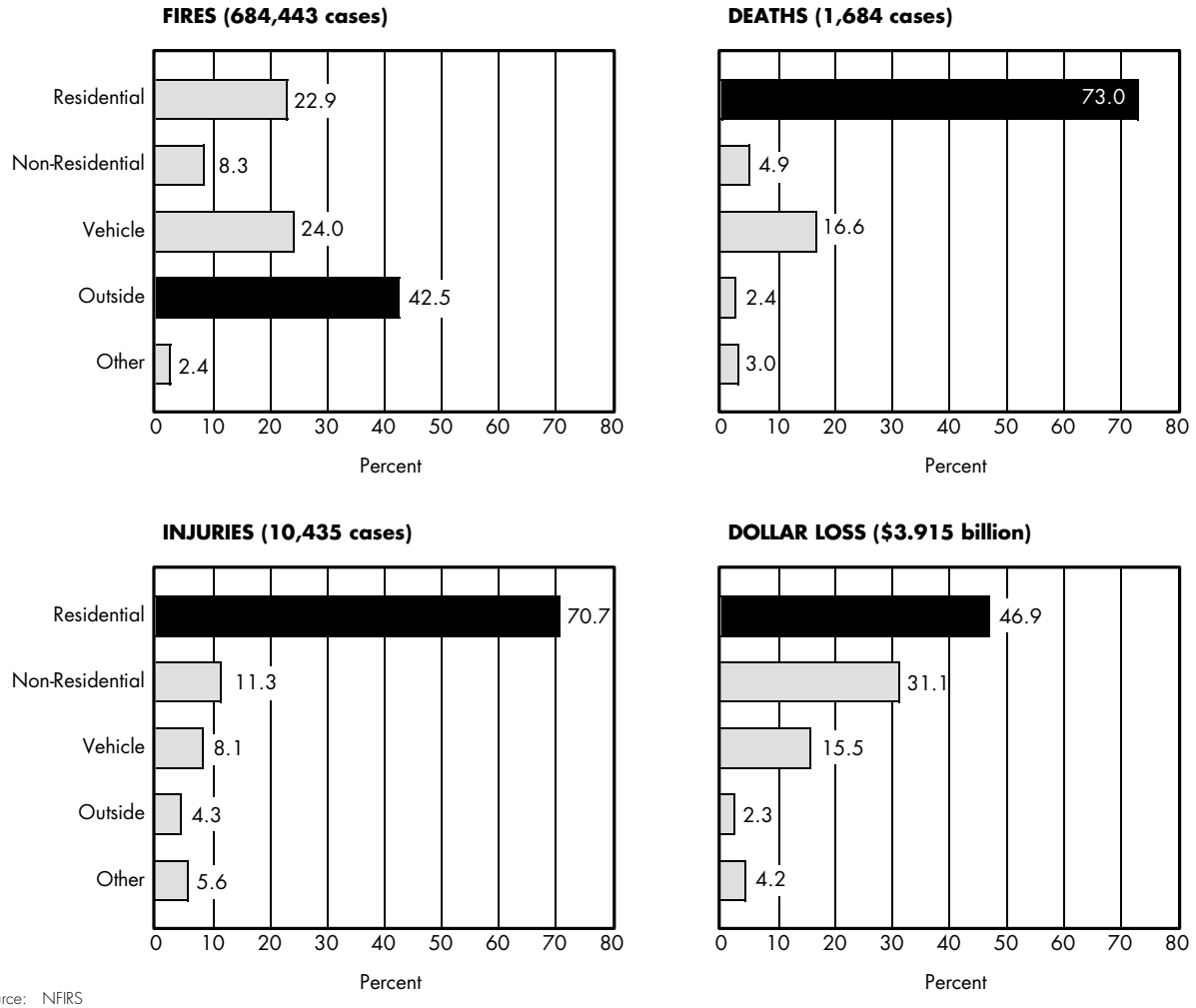
FIGURE 25. PER CAPITA DEATHS BY RACE AND GENDER (1997)

KINDS OF PROPERTIES WHERE FIRES OCCUR

This section describes the proportions of the fire problem by type of property: residential structures, non-residential structures, vehicles, outside properties, and other or unknown properties.[5]

Property Types

Over the years, there has been little change in the proportion of fires, deaths, injuries, and dollar loss by the type of property involved (Figure 26). In terms of numbers of fires, the largest category continues to be outside fires (43 percent)—in fields, vacant lots, trash, etc. Many of these fires are intentionally set but do not cause much damage. Residential and non-residential structure fires together comprise only about one-third of all fires. Residential fires outnumber non-residential



Source: NFIRS

FIGURE 26. FIRES AND FIRE LOSSES BY GENERAL PROPERTY TYPE (1998)

[5] The percentage of fire deaths in the major property types differs somewhat between NFIRS and the NFPA survey. These differences are discussed in Appendix A.

structure fires nearly three to one. What may surprise some is the large number of vehicle fires. In fact, one out of every four fires to which fire departments respond involves vehicles.

By far the largest percentage of deaths, 73 percent, occurs in residences, with the majority of these in one- and two-family dwellings. Vehicles accounted for the second largest percentage of fire deaths at 17 percent. Great attention is given to large, multiple death fires in public places such as hotels, nightclubs, and office buildings. But in fact, the major attention-getting fires that kill 10 or more people are few in number and constitute only a small portion of fire deaths. Firefighters generally are doing a good job in protecting public properties in this country. Furthermore, these properties are generally required by local codes to have built-in fire suppression systems. The area with the largest problem is where it is least suspected—in people's homes. More fire prevention efforts should be focused on this part of the overall fire problem.

Only 8 percent of the 1998 fire deaths occurred in commercial and public properties. Outside and other (unknown) fires, including wildfires, were a very small factor (3 percent) in fire deaths.

As Figure 26 shows, the picture is generally similar for fire injuries, with 71 percent of all injuries occurring in residences. Non-residential structures are the location of 11 percent of all fire injuries. Vehicles account for another 8 percent. Outside and other fires account for just 10 percent of the fire injuries.

The picture changes for dollar loss. Structures—residential and non-residential—are the leading properties for dollar loss. Together these categories account for 78 percent of all dollar loss. The proportion of dollar loss from outside fires may be understated because the destruction of trees, grass, etc., is given zero value in fire reports if it is not commercial cropland or timber.

Trends

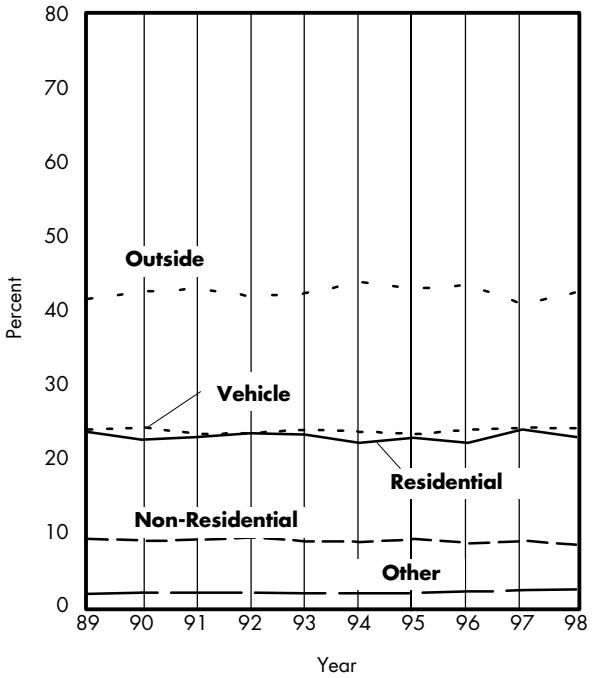
The fire problem by property type has remained quite steady over time. In terms of numbers of fires, the proportion of the problem due to outside properties, non-residential structures, and residential structures has declined slightly over the 10-year period. The trend of vehicle fires has risen just one-half percent, and although the proportion of other fires is small, it has trended upward 21 percent (Figure 27).

Over the 10-year period, residential property fires have consistently caused 70–75 percent of total fire deaths; the trend is flat. Non-residential structure fires represent a small, but increasing, proportion of deaths. The trend in the proportion of vehicle and other fire deaths, despite an increased share in 1998, has declined slightly. The proportion of outside fire deaths has declined substantially (44 percent).

Injuries in residential properties and outside fires have increased 7 and 18 percent, respectively; injury trends have decreased for the other three property types.

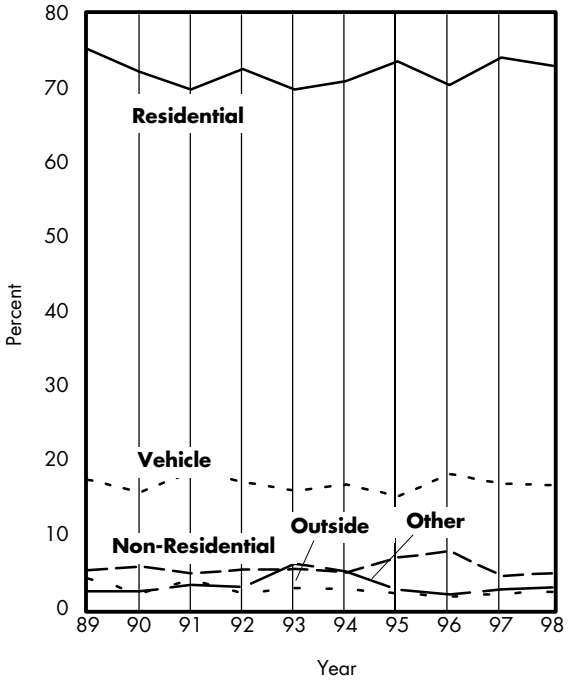
Dollar loss has greater trend fluctuations because this measure is highly sensitive to a few very large fires and whether they are included or omitted in the sample of fires on which estimates are

FIRES



	Residential	Non-Residential	Vehicle	Outside	Other
1989	23.6%	9.1%	23.9%	41.6%	1.7%
1990	22.5	8.9	24.2	42.6	1.9
1991	22.9	9.0	23.3	42.9	1.9
1992	23.4	9.3	23.5	41.9	1.9
1993	23.2	8.8	23.9	42.3	1.8
1994	22.1	8.7	23.6	43.8	1.8
1995	22.8	9.1	23.3	42.9	1.9
1996	22.1	8.5	23.9	43.5	2.0
1997	23.9	8.9	24.2	40.9	2.2
1998	22.9	8.3	24.0	42.5	2.4

DEATHS



	Residential	Non-Residential	Vehicle	Outside	Other
1989	75.2%	5.2%	17.3%	4.1%	2.4%
1990	72.2	5.7	15.7	2.1	2.4
1991	69.8	4.8	18.4	3.9	3.2
1992	72.6	5.3	17.1	2.1	2.9
1993	69.8	5.4	15.9	2.8	6.1
1994	70.9	4.9	16.7	2.6	5.0
1995	73.6	6.9	15.1	2.0	2.5
1996	70.4	7.8	18.1	1.7	1.9
1997	74.1	4.4	16.8	2.1	2.6
1998	73.0	4.9	16.6	2.4	3.0

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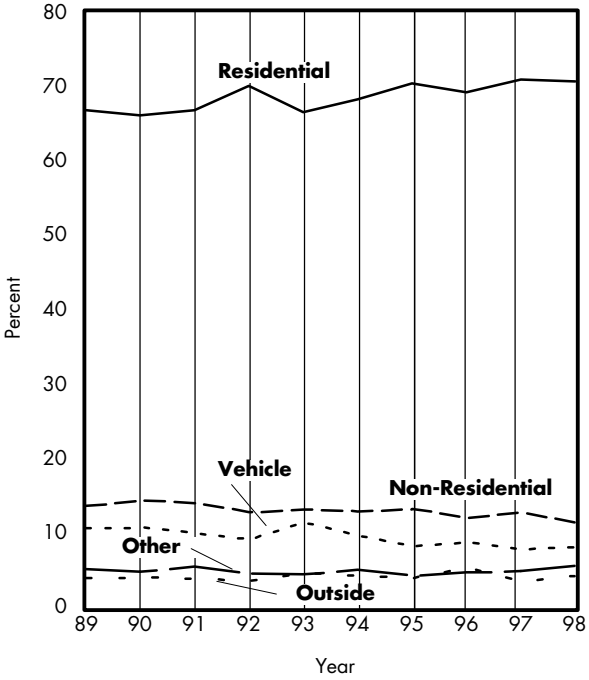
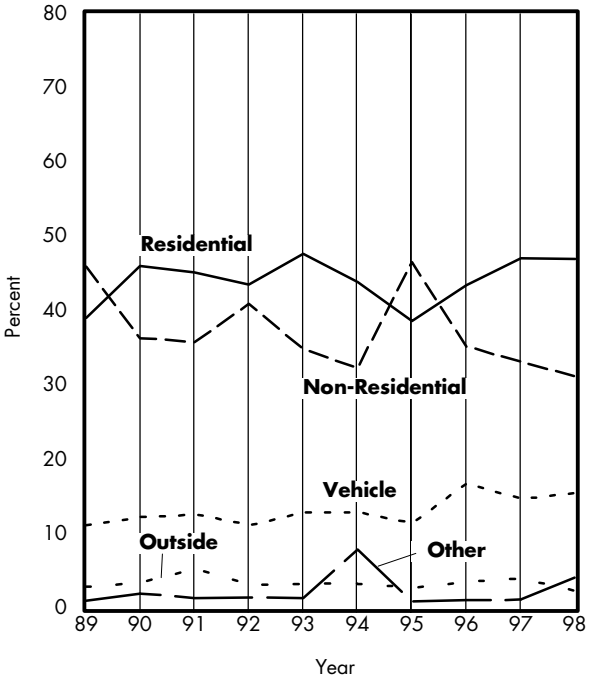
FIGURE 27. TRENDS IN FIRES AND FIRE LOSSES BY GENERAL PROPERTY TYPE

INJURIES



	Residential	Non-Residential	Vehicle	Outside	Other
1989	66.8%	13.6%	10.6%	3.9%	5.1%
1990	66.1	14.3	10.7	4.0	4.8
1991	66.8	14.0	9.9	3.7	5.5
1992	70.1	12.8	9.1	3.6	4.5
1993	66.5	13.1	11.4	4.6	4.4
1994	68.3	12.9	9.6	4.2	5.0
1995	70.4	13.2	8.2	3.9	4.3
1996	69.2	12.0	8.7	5.3	4.7
1997	70.9	12.8	7.8	3.5	4.9
1998	70.7	11.3	8.1	4.3	5.6

DOLLAR LOSS



	Residential	Non-Residential	Vehicle	Outside	Other
1989	39.0%	45.9%	11.1%	2.9%	1.0%
1990	46.0	36.3	12.3	3.5	1.9
1991	45.1	35.7	12.6	5.3	1.3
1992	43.5	40.9	11.1	3.1	1.4
1993	47.6	34.8	12.9	3.3	1.3
1994	43.8	32.2	12.9	3.2	7.9
1995	38.6	46.5	11.4	2.7	0.9
1996	43.4	35.1	16.7	3.6	1.1
1997	47.0	33.1	14.7	4.0	1.2
1998	46.9	31.1	15.5	2.3	4.2

Source: NFIRS

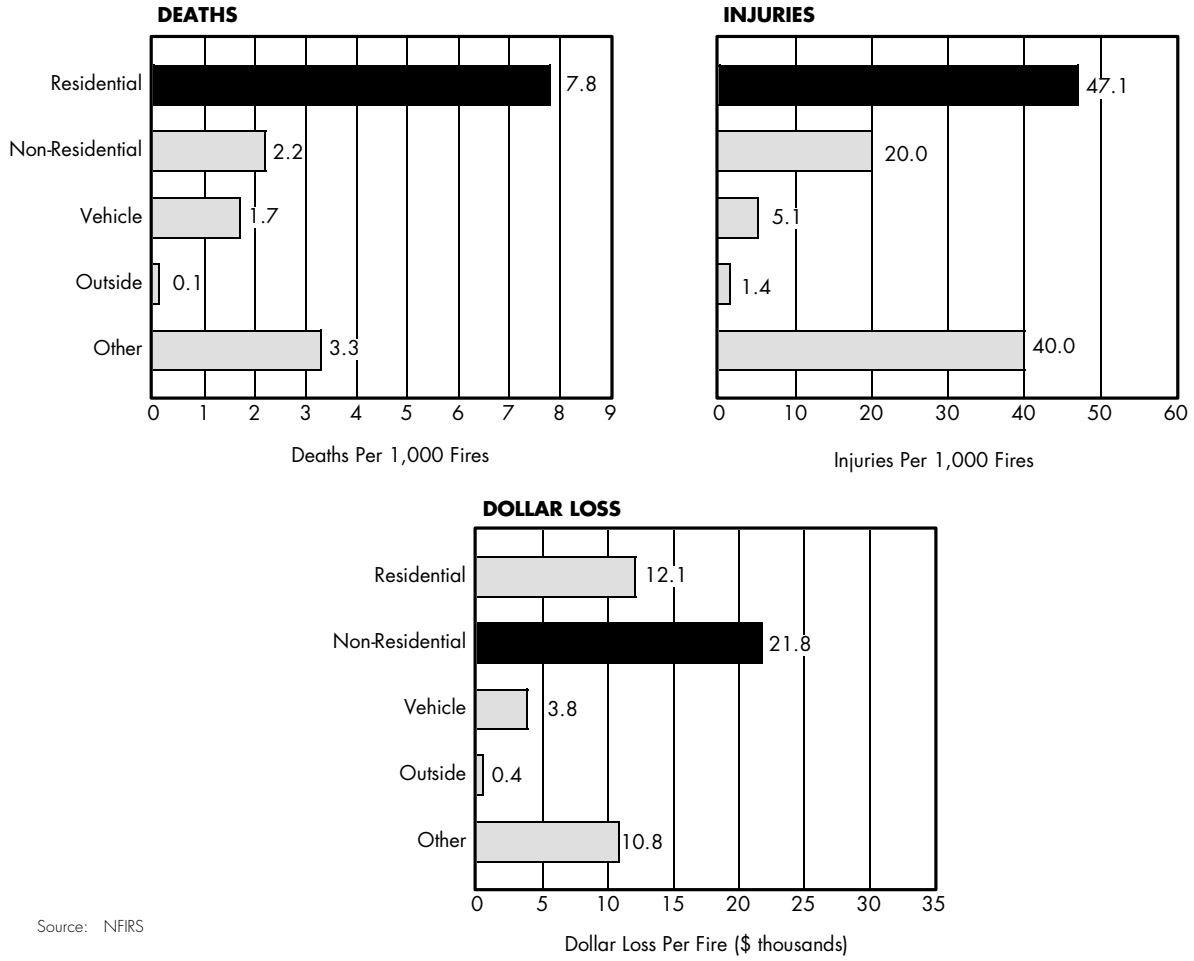
FIGURE 27. TRENDS IN FIRES AND FIRE LOSSES BY GENERAL PROPERTY TYPE (CONT'D)

based. The 10-year trends in structure and outside fire dollar losses have declined, but vehicle losses have trended upward 39 percent. Dollar losses in the other property type category have more than doubled over the 10-year period. This jump is due to a $300 million loss in 1992 and a $390 million loss in 1998, both as a result of large timber fires.

Losses

Figure 28 shows casualties and losses per fire. These indicators represent the severity of fires but are somewhat ambiguous because they can increase if there are more casualties or damage per fire (the numerators) or if fewer minor fires are reported (the denominators).

Residential fires have the highest number of deaths and injuries per fire—another important reason for prevention programs to focus on home fire safety. Non-residential structure fires have by far the highest dollar loss per fire.



Source: NFIRS

FIGURE 28. LOSSES PER FIRE BY GENERAL PROPERTY TYPE (1998)

The trends over the 10-year period are shown in Figure 29. Residential deaths per fire continued its 10-year decline (11 percent) and reversed its 1996 increase by declining 2 percent in terms of injuries per fire.

Non-residential deaths per fire increased (27 percent), but injuries per fire decreased (19 percent). Other fires (including unspecified property types) have relatively high deaths per fire but represents only small numbers of fires, fire deaths, and injuries; it is a miscellaneous category.

Dollar loss per fire (adjusted for inflation) changed significantly. Non-residential fires averaged $24,300 per fire over 10 years with wide fluctuations: from a low of $19,300 per fire in 1994 to a high of $30,900 per fire in 1995. The 10-year trend decreased 19 percent. Fire loss increased considerably for all other property types. Residential losses increased a significant 22 percent. Because of an uncharacteristic increase (sixfold) in other fires due to one large ($300 million) explosion in 1994 and another jump (threefold) in 1998, the dollar loss per other fire nearly doubled.

There are many possible reasons for increases in loss per fire in residential occupancies. It could reflect a more affluent society in part, but affluence has not increased as sharply as the losses per fire adjusted for inflation. More damage per fire also may be due to faster-spreading fires. One clue as to the underlying cause for the increase is that the percentage of residential fires that spread to the whole structure (that is, were not confined to the floor of origin) increased from 1989 to 1998. Another factor could be attributed to changes in staffing levels in many fire departments. All of the factors that contribute to the loss-per-fire increase are not clearly known, suggesting that further study is warranted.

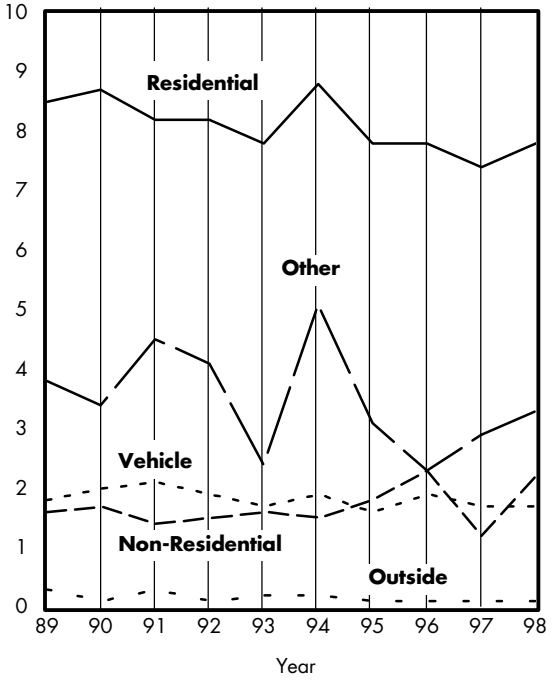
CAUSES OF FIRES AND FIRE LOSSES

Figure 30 shows the profile of the major causes of fires, fire deaths and injuries, and direct dollar loss in 1998 for all occupancies grouped together. The top three causes of civilian deaths are smoking (22 percent), incendiary and suspicious (or arson) (20 percent), and cooking (12 percent). These percentages are adjusted, which proportionally spreads the unknowns over the other 12 causes.[6] The leading cause of injuries is cooking (25 percent), followed by arson (13 percent) and open flame and smoking (10 percent).

The causes of fire deaths are similar for both sexes (Figure 31). The gap between men and women dying in arson fires in 1998 widened considerably (22 percent for males and 18 percent for females) over 1996, when there was little difference between the sexes. More women died in smoking, heating, electrical distribution, open flame, and exposure fires.

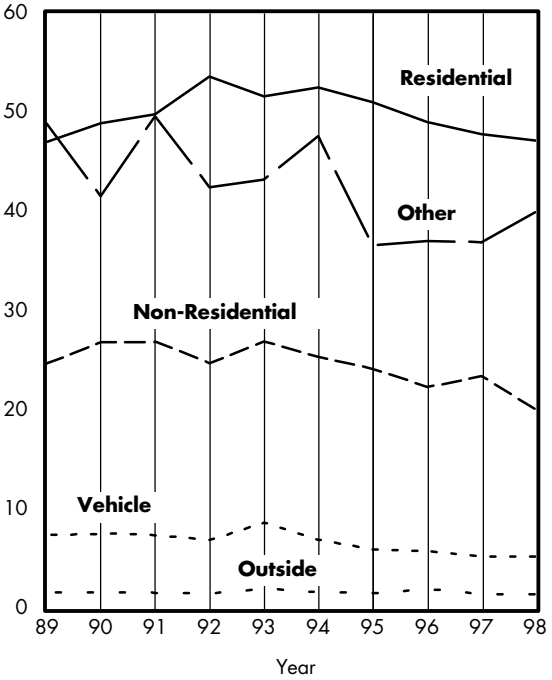
[6] The unknowns can be quite large. Fire departments are encouraged to update the cause determination, which sometimes is not included in the original incident report.

DEATHS (per 1,000 fires)



	Residential	Non-Residential	Vehicle	Outside	Other
1989	8.5	1.6	1.8	0.3	3.8
1990	8.7	1.7	2.0	0.1	3.4
1991	8.2	1.4	2.1	0.3	4.5
1992	8.2	1.5	1.9	0.1	4.1
1993	7.8	1.6	1.7	0.2	2.4
1994	8.8	1.5	1.9	0.2	5.1
1995	7.8	1.8	1.6	0.1	3.1
1996	7.8	2.3	1.9	0.1	2.3
1997	7.4	1.2	1.7	0.1	2.9
1998	7.8	2.2	1.7	0.1	3.3
10-Year Trend	**-11.1%**	**+26.5%**	**-13.9%**	**-62.4%**	**-26.3%**

INJURIES (per 1,000 fires)



	Residential	Non-Residential	Vehicle	Outside	Other
1989	47.0	24.7	7.4	1.6	48.8
1990	48.9	26.8	7.5	1.6	41.5
1991	49.8	26.9	7.3	1.5	49.6
1992	53.6	24.7	6.9	1.5	42.4
1993	51.6	26.9	8.6	2.0	43.2
1994	52.5	25.3	6.9	1.6	47.6
1995	51.0	24.1	5.9	1.5	36.6
1996	49.0	22.3	5.7	1.9	37.0
1997	47.8	23.4	5.2	1.4	36.9
1998	47.1	20.0	5.1	1.4	40.0
10-Year Trend	**-1.9%**	**-18.6%**	**-33.8%**	**-5.0%**	**-21.5%**

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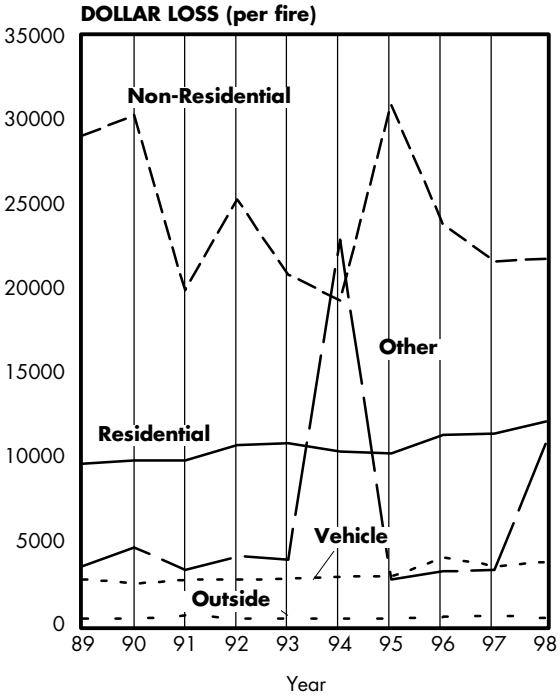
FIGURE 29. TRENDS IN LOSSES PER FIRE BY GENERAL PROPERTY TYPE



Source: NFIRS

	Residential	Non-Residential	Vehicle	Outside	Other
1989	$ 9,600	$29,100	$2,700	$400	$ 3,500
1990	9,800	30,300	2,500	400	4,600
1991	9,800	19,900	2,700	600	3,300
1992	10,700	25,300	2,700	400	4,100
1993	10,800	20,800	2,800	400	3,900
1994	10,300	19,300	2,900	400	22,900
1995	10,200	30,900	2,900	400	2,700
1996	11,300	23,800	4,000	500	3,200
1997	11,400	21,600	3,500	600	3,300
1998	12,100	21,800	3,800	400	10,800
10-Year Trend	**+22.4%**	**-18.6%**	**+55.2%**	**+6.9%**	**+90.3%**

FIGURE 29. TRENDS IN LOSSES PER FIRE BY GENERAL PROPERTY TYPE (CONT'D)

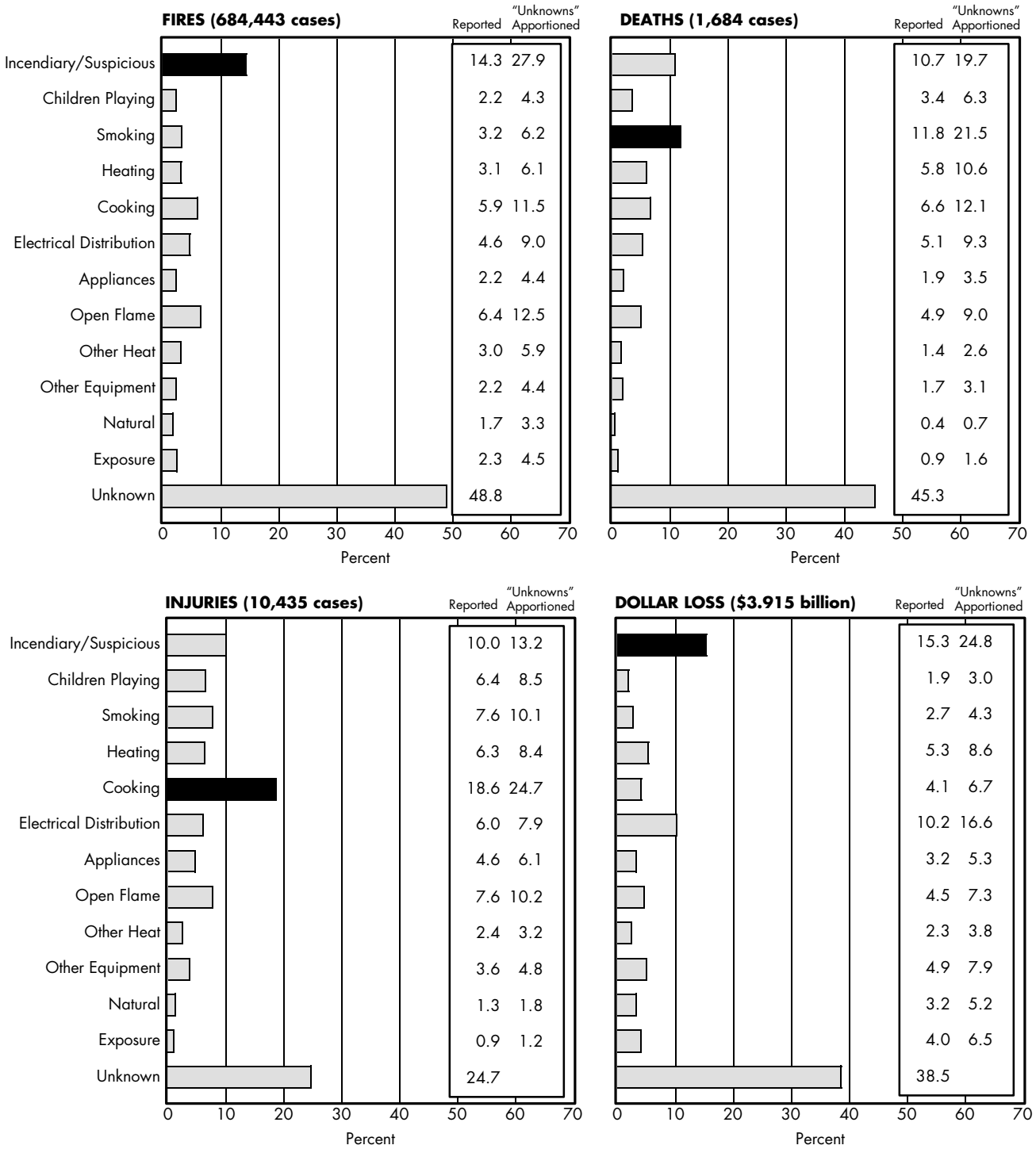
The differences between men and women injured in fires are relatively minor except for two categories. While the leading cause for both sexes is cooking, one-third more women are injured in cooking fires than men (31 vs. 21 percent). The next three leading causes of injury to women (arson, smoking, open flame, and children playing) combined account for slightly more injuries than cooking alone. Men are nearly three times as likely to be injured in other equipment fires as women. Arson is the second leading cause of fire injuries to men, followed by open flame and smoking. Arson is by far the leading cause of all fires and direct dollar loss.

USFA RESOURCES ON THE NATIONAL FIRE PROBLEM

The National Fire Data Center has a wealth of publications available free of charge that address the fire problem in the United States. Printed versions are available by writing or calling:

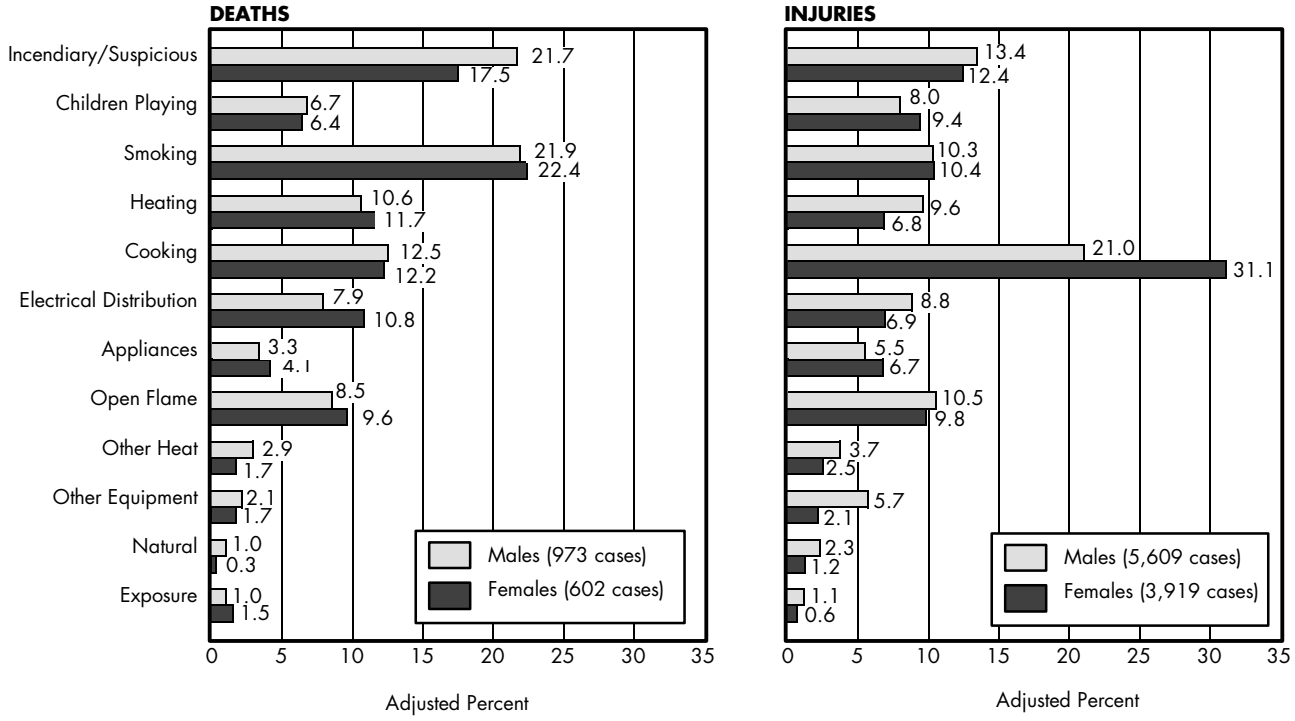
United States Fire Administration
Publications Center
16825 South Seton Avenue
Emmitsburg, Maryland 21727
(800) 561–3356

Or they may be ordered online at http://www.usfa.fema.gov/usfapubs. Please include the parenthetical publication number, if given, in your request.



Source: NFIRS

FIGURE 30. CAUSES OF FIRES AND FIRE LOSSES (1998)



Source: NFIRS

FIGURE 31. CAUSES OF FIRE CASUALTIES BY GENDER (1998)

The following reports provide insight to the magnitude of the fire problem in the United States; each can be downloaded at http://www.usfa.fema.gov/nfdc/reports.htm:

A Profile of Fire in the United States: 1987–1996 (Eleventh Edition) (#FA–193)
A Profile of Fire in the United States: 1986–1995 (Tenth Edition) (#FA–184)
A Profile of Fire in the United States: 1985–1994 (Ninth Edition) (#FA–175)
Fire in the United States: 1987–1996 (Eleventh Edition) (#FA–194)
Fire in the United States: 1986–1995 (Tenth Edition) (#FA–183)
Fire in the United States: 1985–1994 (Ninth Edition) (#FA–173)
Profile of the Urban Fire Problem in the United States (#FA–190)
A Profile of the Rural Fire Problem in the United States (#FA–181)
The Rural Fire Problem in the United States (#FA–180)
Multiple-Fatality Fires Reported to NFIRS 1994–1996 (#FA–201)
Establishing a Relationship Between Alcohol and Casualties of Fire (#FA–200)
A Profile of the Seasonal Nature of Fires
Arson in the United States (#FA–174)
Socioeconomic Factors and the Incidence of Fire (#FA–170)
Children and Fire in the United States: 1994–1997

A *Fire Risk* series of reports, also downloadable, identifies fire risks for four at-risk populations (http://www.usfa.fema.gov/safety/risks.htm):

Fire Risks for the Blind or Visually Impaired (#FA–205)
Fire Risks for the Deaf or Hard of Hearing (#FA–202)

Fire Risks for the Mobility Impaired (#FA–204)
Fire Risks for the Older Adult (#FA–203)

A *Topical Fire Research* series focuses on specific aspects of the national fire problem; download at http://www.usfa.fema.gov/nfdc/reports.htm:

Arson in the United States
Child Fire Casualties
Older Adults and Fire
Children and Fire
Halloween Fires
The Dangers of Fireworks

Two USFA reports have attracted nationwide attention. *America Burning* is probably the most widely quoted fire protection publication. This report sets the stage for national consciousness-raising about the need for as much focus on fire prevention as on fire suppression. *Fire Death Rate Trends: An International Perspective* (#FA–169) explores the magnitude and the nature of the fire death problem in the United States. It provides a statistical portrait of fire death rates for 14 industrialized nations and presents observations about key institutional and attitudinal differences between the United States and industrialized countries with significantly lower fire death rates.

The *Fire Data Analysis Handbook* describes statistical techniques for analyzing data typically collected in fire departments. The *Uses of NFIRS: The Many Uses of the National Fire Incident Reporting System* (#FA–171) details the variety and types of analyses possible using NFIRS data.

Other USFA printed reports and investigations that can be ordered from the Publications Center include:

Arson and Fire Investigation:

Arson Forum Report (#FA–134)
Arson Prosecution Issues (#FA–78)
Arson Resource Directory (#FA–74)
Basic Tools and Resources for Fire Investigators (#FA–127)
Establishing an Arson Strike Force (#FA–88)
Field Index Guide (Fire and Arson Investigators' Field Index Directory) (#FA–91)
Fire/Arson Investigation Training Resource Catalog (#FA–131)
Partnership for Arson Awareness and Prevention (#FA–209)
USFA Fire Burn Pattern Tests (#FA–178)
View of Management in Fire Investigation Units (Volumes 1 and 2) (#FA–93 and FA–116)

Juvenile Fire Problem:

Arson and Juveniles: Responding to the Violence (#TR095)
Children and Fire—A Growing Concern (#L–236)
Juvenile Firesetter Intervention Handbook (#FA–210)
Juvenile Firesetters—What You Can Do! (#L–240)
The Grems Case: How an Arson Case Was Solved and Prosecuted in Colorado, Aurora, CO (#TR047)
National Juvenile Firesetters/Arson Control and Prevention Program (NJF/ACPP) Executive Summary (Part 1 of 5) (#FA–148)
NJF/ACPP Guidelines for Implementation (Part 2 of 5) (#FA–147)
NJF/ACPP Juvenile Firesetter Early Intervention Program (Part 3 of 5) (#FA–146)

NJF/ACPP Trainer's Guide (Part 4 of 5) (#FA–149)
NJF/ACPP User's Guide (Part 5 of 5) (#FA–145)

Fire Data:

America Burning Revisited
An NFIRS Analysis: Investigating City Characteristics and Residential Fire Rates (#FA–179)
What is NFIRS? (National Fire Incident Reporting System)

Others:

After the Fire: Returning to Normal (#FA–46)
Directory of National Community Volunteer Fire Prevention Programs (#FA–92)
Fire Safety Education Resource Directory (#FA–172)
Fire Service Resource Guide (#FA–186)
Funding Alternatives for Fire and Emergency Services (#FA–141)
Get Alarmed South Carolina—Lessons Learned From Its Success (#TR044)
Leadership in Public Fire Safety Education—2000 (#FA–135)
Recruitment and Retention in the Volunteer Fire Service: Final Report (#FA–185)
Smoke Alarms: What You Need to Know
United States Fire Administration Brochure (#L–230)

In addition to the above, the National Fire Academy (NFA) offers the following courses for senior fire officers:

Executive Development Curriculum

Executive Development (#R123)
Strategic Management of Change (#R130)
Executive Leadership (#R125)
Leadership and Administration (#R810)

Management Science Curriculum

Fire Service Communications (#R107)
Organizational Theory in Practice (#R331)
Interpersonal Dynamics in Fire Service Organizations (#R332)

Planning and Information Management Curriculum

Fire Service Financial Management (#R333)
Executive Planning (#R506)
National Fire Incident Reporting Systems Program Management (#R499)
Fire Service Planning Concepts for the 21st Century (#R802)

The USFA offers a variety of self-study opportunities. These include self-study courses and simulations (CD–ROM). NFA courses are listed at http://www.usfa.fema.gov/nfa/tr_dist.htm.

Statistical information on the national fire problem (e.g., number and type of fires, deaths, and injuries) can be found at http://www.usfa.fema.gov/nfdc/statistics.htm.

The USFA Web site (http://www.usfa.fema.gov) also offers a wide variety of information on fire-related issues. This site also features sections on Press Releases, Fire Academy, Data Center, Fire Safety, Kids' Page, Wildfire, Arson Prevention, and NFIRS.

3 Residential Properties

OVERVIEW

The residential portion of the fire problem continues to account for the vast majority of civilian casualties: 73 percent of fire deaths and 71 percent of the injuries.[1] It also accounts for more firefighter deaths (41 percent) and injuries (73 percent) than any other property type. This section reviews the residential fire problem overall. Subsequent sections of this chapter present details of the fire problem for major subcategories of residential properties (one- and two-family dwellings, apartments, and other types).

The term *residential* as used in NFIRS includes what is commonly referred to as homes, whether they are one- or two-family dwellings or multifamily apartment buildings. It also includes manufactured housing, hotels and motels, residential hotels, dormitories, and much of what might be considered "halfway houses" for the care of people with problems but who are able to operate in the community. The term does not include institutions such as prisons, homes for the elderly, juvenile care facilities, or hospitals, though many people may reside in them for short or long periods of time.

Figure 32, based on the NFPA annual surveys of fire departments, shows the 10-year trend in residential fires, deaths, injuries, and dollar loss. As was true in the previous edition (1996), the overall trend continues downward in every area by 19 to 22 percent. The decreases would be even greater if they were weighted against the number of residences that existed in 1989 versus the much higher number in 1998. Even with this positive trend, an average of 3,800 civilians die each year in residential fires, and property losses exceed an average of $4 billion annually.

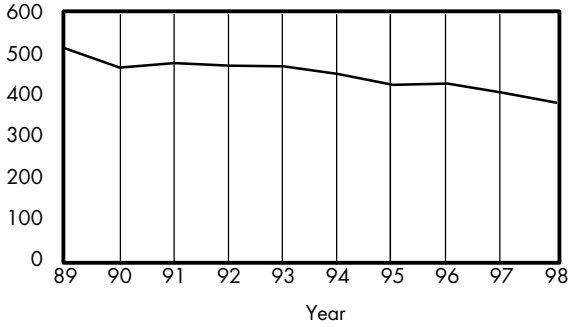
Types of Residences

Figure 33 shows the relative proportions of fires and losses among four residential categories in 1998. (Each of these categories is discussed in subsequent sections of this chapter.) The percentages shown are relatively consistent over each of the previous 9 years.

One- and two-family dwellings, where the majority of the U.S. population live, dominate the residential statistics: 70 percent of residential fires, 76 percent of residential deaths, 62 percent of residential injuries, and 76 percent of residential dollar loss.

[1] A second approach to making these estimates is to use the percentage of fires that are residential from NFIRS (shown in Figure 26, Chapter 2), scaled up (multiplied by) the NFPA estimate of total fires. The results would be somewhat different from those using the NFPA subtotals. We have used the NFPA residential totals for scaling residential fires because they are consistent with the total number of fires from NFPA. Better estimates from NFIRS will not be available until a more reliable method of estimating "population protected"is developed.

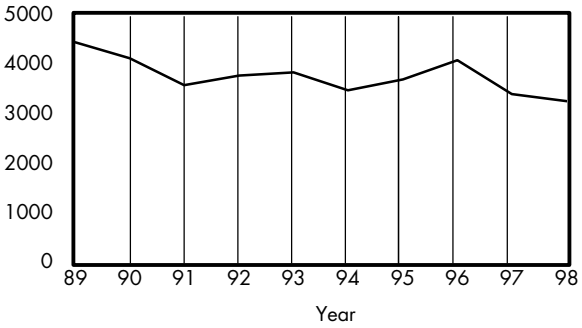
FIRES (in thousands)



1989	513.5	1994	451.0
1990	467.0	1995	425.5
1991	478.0	1996	428.0
1992	472.0	1997	406.5
1993	470.0	1998	381.5

10-Year Trend = -21.9%

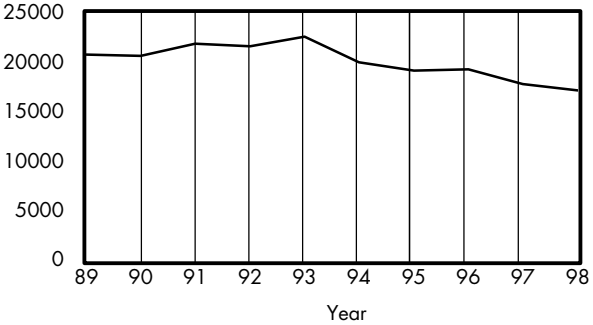
DEATHS



1989	4,435	1994	3,465
1990	4,115	1995	3,695
1991	3,575	1996	4,080
1992	3,765	1997	3,390
1993	3,825	1998	3,250

10-Year Trend = -20.5%

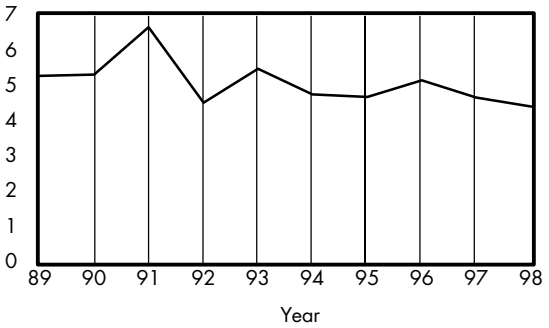
INJURIES



1989	20,750	1994	20,025
1990	20,650	1995	19,125
1991	21,850	1996	19,300
1992	21,600	1997	17,775
1993	22,600	1998	17,175

10-Year Trend = -18.5%

DOLLAR LOSS (in $ billions)*



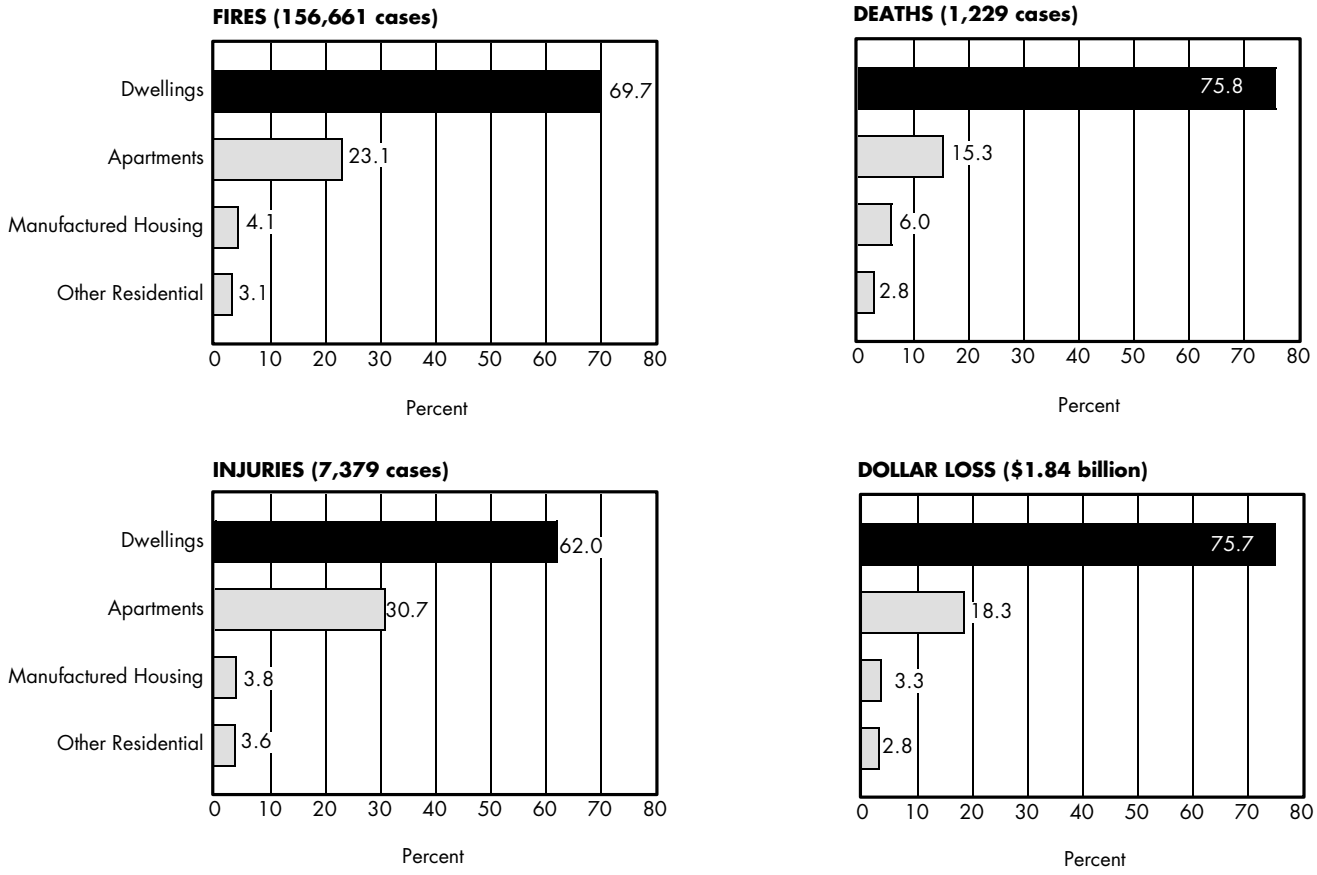
1989	$5.26	1994	$4.75
1990	5.30	1995	4.67
1991	6.64	1996	5.15
1992	4.51	1997	4.66
1993	5.46	1998	4.39

10-Year Trend = -19.4%

*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 32. TRENDS IN RESIDENTIAL FIRES AND FIRE LOSSES



Source: NFIRS

FIGURE 33. RESIDENTIAL FIRES AND FIRE LOSSES BY PROPERTY TYPE (1998)

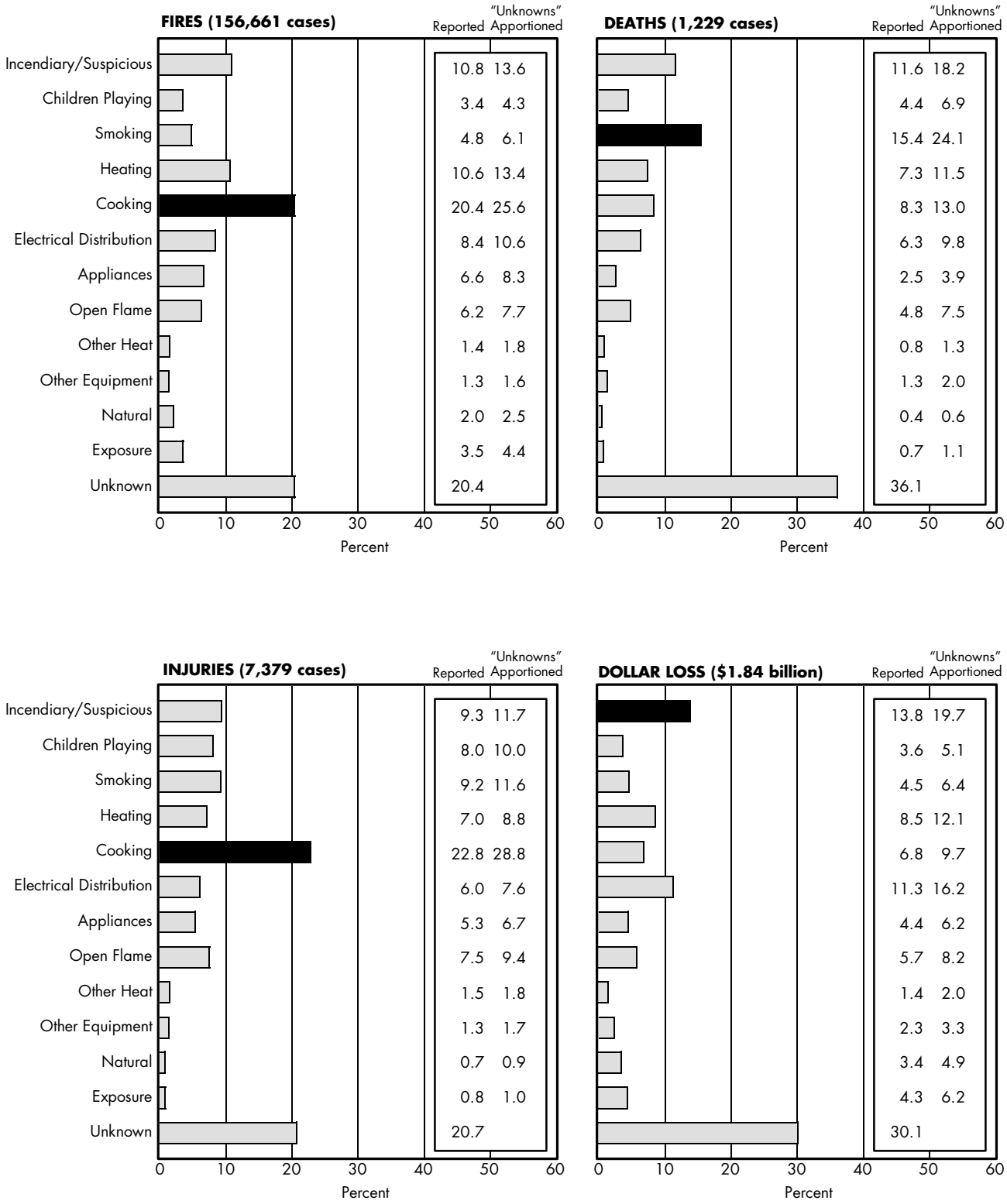
Apartments account for 23 percent of residential fires, 18 percent of residential dollar loss, 15 percent of residential deaths, and 31 percent of injuries. This relatively high incidence of injuries in apartments may be because the total space is significantly less in apartments than in dwellings, and people are more quickly exposed to fire products than in a house. But apartments are more often built to stricter codes. It is not clear why their death rate is less than single-family homes and their injury rate is higher.

Manufactured housing, separated from the dwelling category, includes mobile homes situated on semi-permanent sites. Death rates (deaths per fire) still are higher in manufactured housing than in other dwellings despite improvements in their safety.

Other residential properties (mostly hotel and motel fires) account for between 3 and 4 percent of the residential fire problem in the various measures.

Causes

Figure 34 shows the causes of fires, deaths, injuries, and dollar loss in 1998. These statistics are driven by the one- and two-family dwelling property type, which account for the majority of



Source: NFIRS

FIGURE 34. CAUSES OF RESIDENTIAL FIRES AND FIRE LOSSES (1998)

residential fires. The overall residential figures and those for one- and two-family dwellings (Figure 46) are quite similar. Larger differences from the overall residential causes will be found as one looks at the smaller subcategories of residences such as apartments and manufactured housing.

Cooking has been the leading cause of residential fires most of the years since the inception of NFIRS. Heating passed cooking for a few years in the late 1970s when there was a surge in the use of alternative space heaters and wood heating, but that problem has since subsided. Cooking is the leading cause of fire injuries, more than twice that of any other cause. Many cooking fires come from unattended cooking where grease or oil ignites or flammable materials in proximity to burners catch fire. These fires can be lessened by emphasizing the importance of vigilance while cooking and by informing the public on how to extinguish small cooking fires (e.g., cover with a pot lid, douse it with baking soda). Wearing loose-fitting clothing such as bathrobes can be dangerous around cooking areas. Cooking in 1998 is the third leading cause of fire deaths; it was fifth in 1996.

Incendiary and suspicious, which is called "arson" here even though that term has a narrower legal definition, has been the leading cause of dollar loss and the second leading cause of fires, deaths, and injuries in residences. That arson is so prominent a factor in the residential fire problem may be a surprise to many. There are a number of factors to residential arson fires—vandalism, revenge, fraud, and quarrels are common motives according to fire officials. Because of advances in criminal forensics, the use of arson to conceal crimes is yet another motive.[2] Part of the reason for the increase in the rank order of arson fires is the success in reducing accidental and careless fires, or detecting them early enough so that they are not reported to NFIRS.

Heating, the third leading cause of residential fires and dollar losses, includes those fires where the equipment involved in ignition is central heating, fireplaces, portable space heaters, fixed room heaters, wood stoves, and water heating. The central heating and water heater portions of the problem have remained relatively steady, while the portable space heater and wood burning stove portion of the problem, along with chimney fires, rose very sharply from the late 1970s to the early 1980s but has since abated.

As in all previous years, smoking is the leading cause of residential fire deaths (and fire deaths overall), accounting for nearly a quarter of all fatalities. In 1998, the percentage of smoking deaths decreased slightly. Smoking is third in injuries, sixth in dollar loss, and seventh in fires.

It is important to note that the leading causes are different depending on what measure is used, as can be seen from Figure 34. Table 9 displays the top three causes of each measure for 1998 and compares this ranking with those of 1994 and 1996.

[2] Motives are not reported to NFIRS, but are tabulated by some arson units.

TABLE 9. LEADING CAUSES OF RESIDENTIAL FIRES AND FIRE LOSSES (1998)

[Numbers in parentheses reflect the 1994/1996 rankings]

Rank	Fires	Deaths	Injuries	Dollar Loss
1	Cooking (1/1)	Smoking (1/1)	Cooking (1/1)	Arson (1/1)
2	Arson (3/3)	Arson (2/3)	Arson (3/3)	Electrical (3/3)
3	Heating (2/2)	Cooking (6/5)	Smoking (4/2)	Heating (2/2)

Sources: NFIRS and Ninth and Eleventh Editions, *Fire in the United States*

Trends of Residential Causes

Figure 35 (four pages) shows the trends in the causes of residential fires and fire losses over the years 1989–1998.[3] All of these trends would appear lower if presented as per capita rather than in the absolute because the population increased by an estimated 9.5 percent over the 10 years. Therefore, an upward trend that is less than the population increase or any downward trend reflects an improvement to the overall fire problem. One significant change is that, starting in 1994, the hotel/motel category began to be counted under other residences because the magnitude of the hotel/motel fire problem had dropped so much as to not merit a separate category. Therefore, certain trend data could not be reported for the hotel/motel category until 1994.

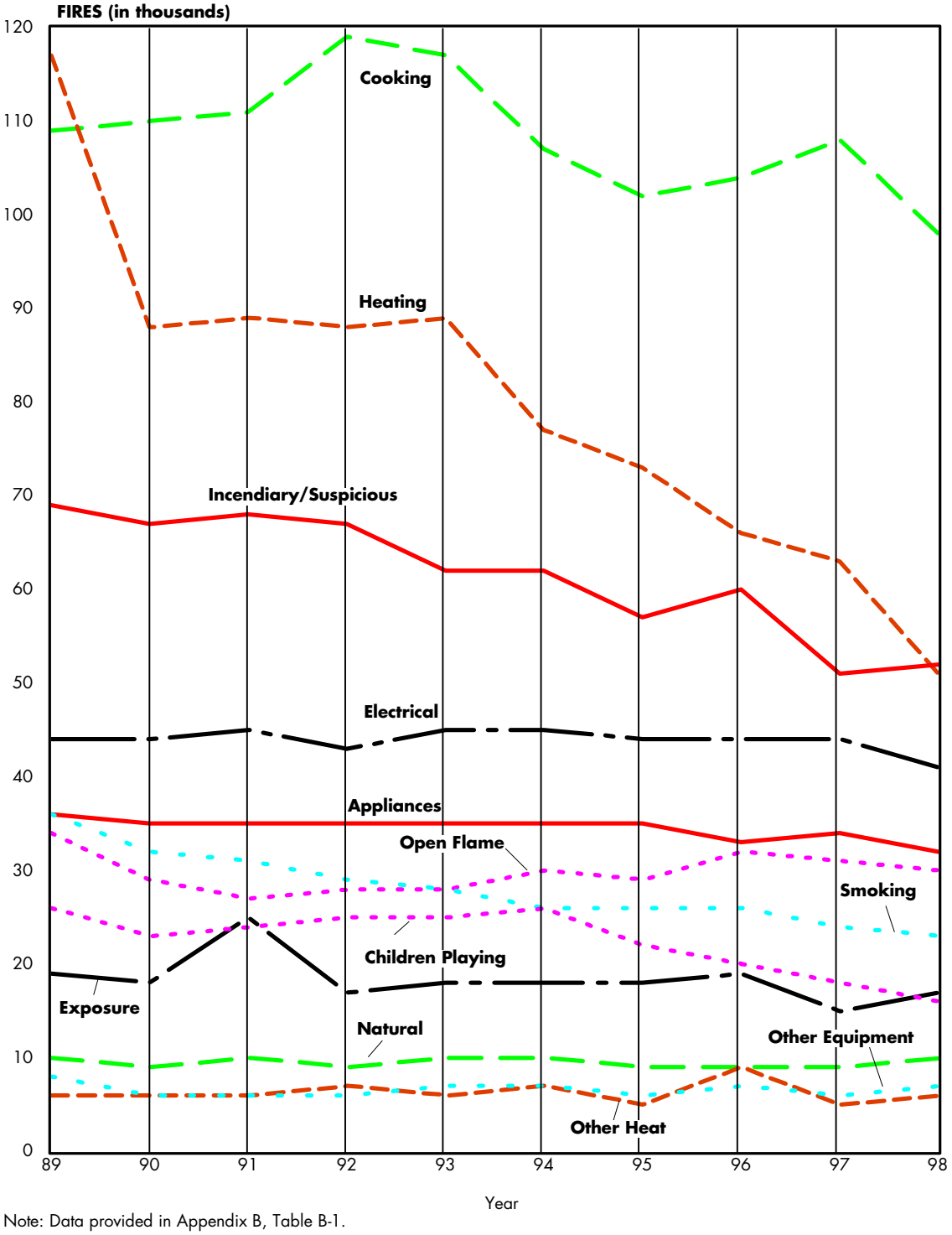
The number of heating fires has decreased by more than 50 percent over 10 years. In 1990, it dropped to second place, where it remained until 1998 when it dropped to third. There has been a modest downward trend in cooking fires, but they remain the leading cause by a widening margin. Arson fires, which had been in second place for 9 years, surpassed heating in 1998 as the second leading cause. Electrical distribution fires remain in fourth place with a curve that shows little 10-year fluctuation.

Smoking remains the leading cause of fire deaths. In 1998, smoking deaths dropped to their lowest point in 10 years (782), a decline of 26 percent since 1996, and a greater drop than any other cause. Arson is the second leading cause of deaths. Deaths from cooking fires jumped from fifth place in 1996 to third in 1998. An encouraging sign is that deaths from children playing show a steep downward trend over the 10 years.

Injuries from cooking fires are more than double those from any other cause. Smoking and arson injuries are essentially tied for second place in 1998. Injuries from children playing rank fourth in 1998, but have steadily declined from its 1992 high.

Dollar losses from fires fluctuate widely. Arson has always been the leading cause of dollar loss, although the gap between this cause and the next (electrical distribution) has narrowed.

[3] The data for each point on these figures are presented in Table B-1, Appendix B. Similar tables are presented in Appendix B for other graphs where data cannot conveniently be shown on the graph itself.



Note: Data provided in Appendix B, Table B-1.

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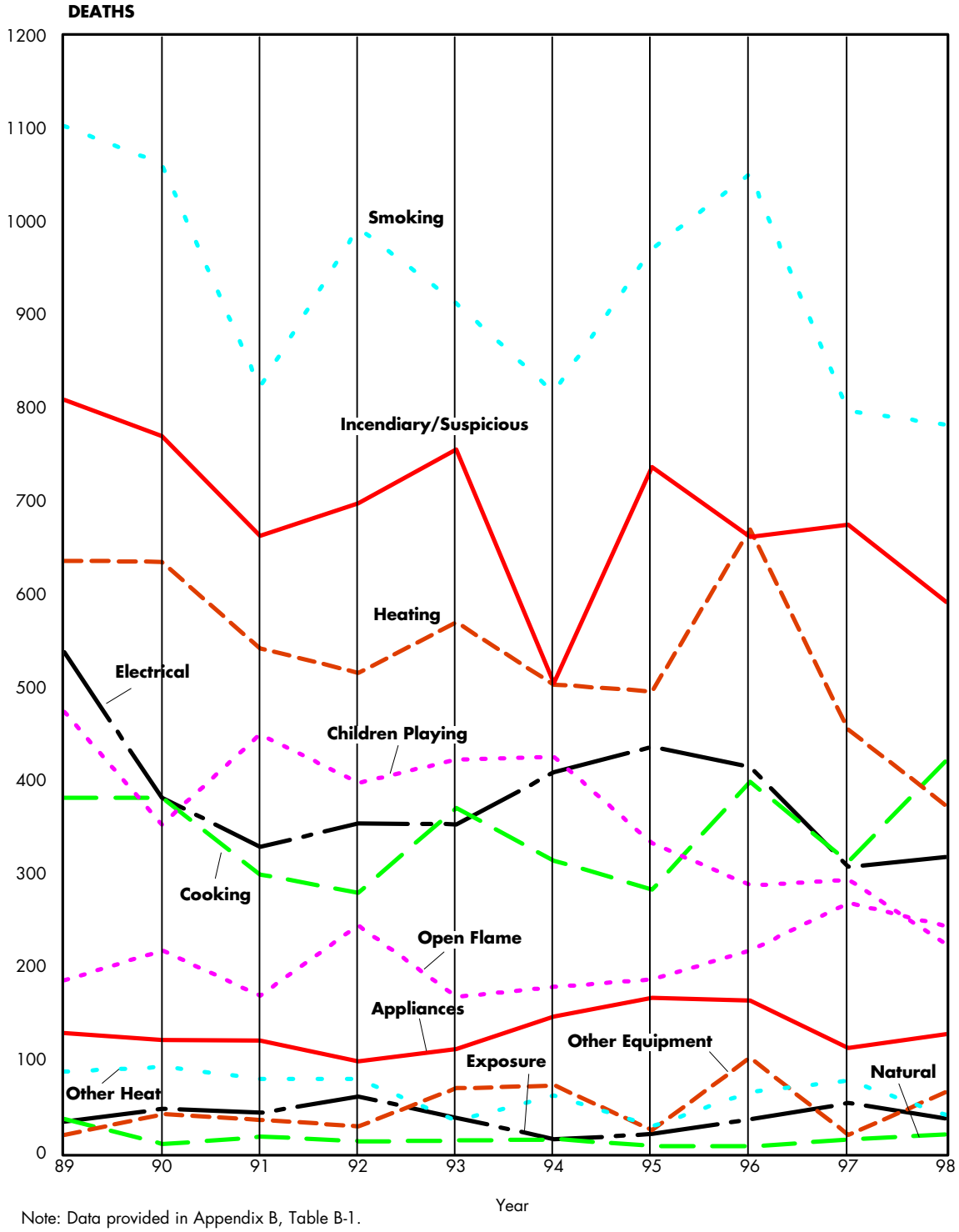
FIGURE 35. TRENDS IN CAUSES OF RESIDENTIAL FIRES AND FIRE LOSSES



Note: Data provided in Appendix B, Table B-1.

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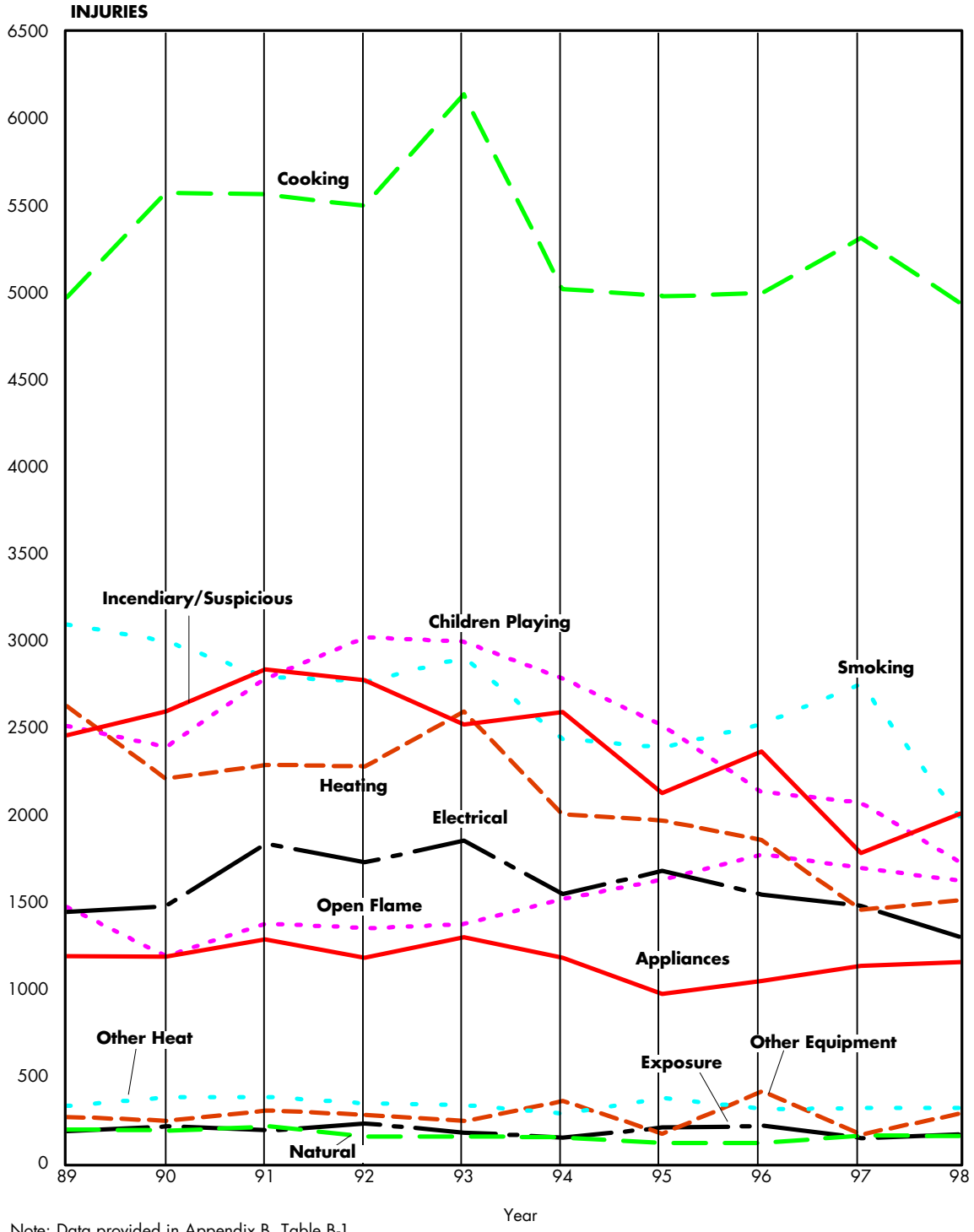
FIGURE 35. TRENDS IN CAUSES OF RESIDENTIAL FIRES AND FIRE LOSSES (CONT'D)



Note: Data provided in Appendix B, Table B-1.

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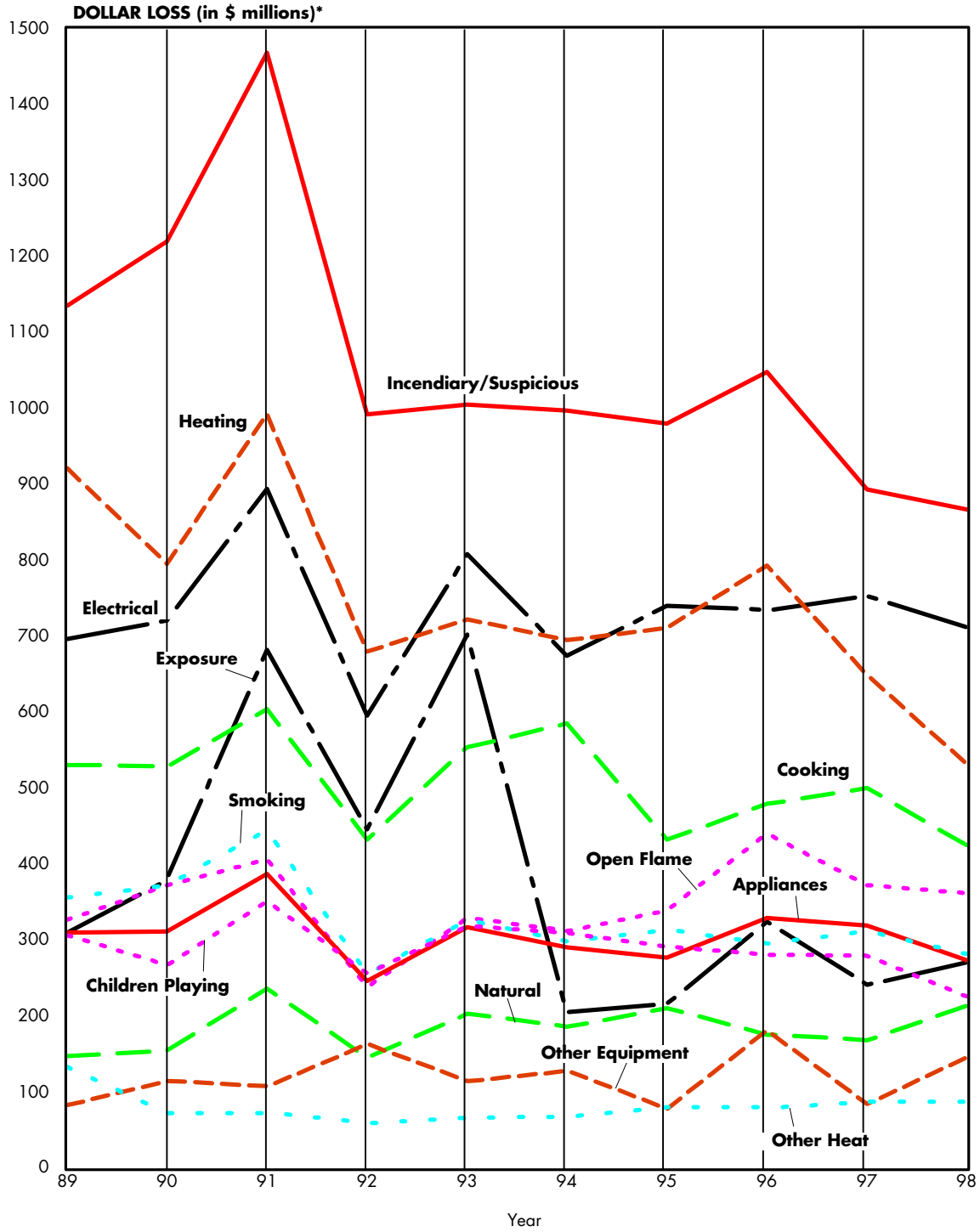
FIGURE 35. TRENDS IN CAUSES OF RESIDENTIAL FIRES AND FIRE LOSSES (CONT'D)



Note: Data provided in Appendix B, Table B-1.

*Adjusted to 1998 dollars

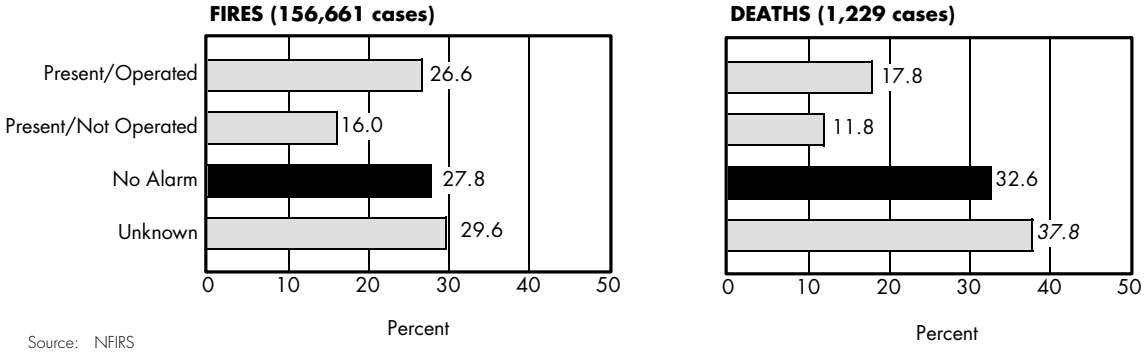
Sources: NFIRS, NFPA, and Consumer Price Index

FIGURE 35. TRENDS IN CAUSES OF RESIDENTIAL FIRES AND FIRE LOSSES (CONT'D)

Electrical distribution dollar loss has remained steady over the past 4 years.[4] Heating losses continue their sharp decline, dropping to third place in 1996.

Smoke Alarm Performance

The term "smoke alarm" encompasses a variety of devices intended to warn occupants of the presence of fire. It replaces the former term "smoke detector." Smoke alarms are thought to play a significant role in the decrease in reported fires and fire deaths since their installation and use began to increase in the mid 1970s. From national surveys, we know that more than 90 percent of U.S. households have at least one smoke alarm.[5] Only 43 percent of households that had fires were reported to have alarms (Figure 36). Considering only the incidents where smoke alarm performance was reported (adjusted for the unknowns), this percentage rises to 61 percent, still considerably less than the national average. That is, households without smoke alarms have disproportionately high reported fires, deaths, injuries, and dollar loss. On the positive side, the presence of smoke alarms in residences that have reported fires has risen 43 percent in the decade since 1989. Smoke alarms are less likely to have been installed in households with reported fires. Either people with alarms are more safety conscious or the alarms allow early detection and extinguishment so that the fires are not reported. Also, anecdotal evidence suggests that reported fires are more prevalent in older, less well cared for homes, and these are less likely to be equipped with an alarm.



Source: NFIRS

FIGURE 36. SMOKE ALARM PERFORMANCE IN RESIDENTIAL FIRES AND FIRE DEATHS (1998)

In 1998, alarms operated in 27 percent of fires. Looking at this percentage from the opposite perspective, there was no alarm, the alarm did not operate, or the presence of alarms was unknown in 73 percent of the reported household fires. When only incidents where smoke alarm performance was reported, the percent of operating smoke alarms rises to 38 percent. These numbers represent slight improvements since the publication of the previous (Eleventh) edition of this report.

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[4] When analyzing dollar loss trends, any precipitous increases must be checked to see if they might be due to errors in entering data for one or two fires. Often this happens when the data are entered on the incident report form left-adjusted instead of right-adjusted. A $100 fire can be entered as a $100,000,000 fire.

[5] *The Smoke Detector Operability Survey Report on Findings*, Consumer Product Safety Commission, Revised 1999.

When the "unknowns" of Figure 36 are apportioned to the other three categories, alarms were not present in 52 percent of the fatalities in 1998; an additional 19 percent of the deaths occurred in homes where smoke alarms were present but failed to operate. In 29 percent of fire deaths, an alarm did operate—8 percentage points higher than in 1996. This is somewhat disturbing since there is a widespread belief that an operating alarm will save lives. In some of these cases, the alarm may have gone off too late to help the victim, the victim may have been too inebriated or feeble to react, or the fire may have been too close to the victim. Such cases merit further study.

The presence or absence of alarms was not reported to NFIRS in 30 percent of all residential fires. For the 61 percent (unknowns apportioned) of cases when alarms were present in fires, their performance based on where they were installed is shown in Table 10.

TABLE 10. PERFORMANCE OF SMOKE ALARMS IN FIRES WHEN PRESENT (1998) ("UNKNOWNS" APPORTIONED)

Alarm Present	Present and Did Operate	Present but Did Not Operate	Total Present
In room of origin	22.2%	7.4%	29.6%
Not in room of origin	15.6	11.1	26.7
In room, but fire too small	N/A	4.3	4.3
Total	37.8%	22.8%	60.6%

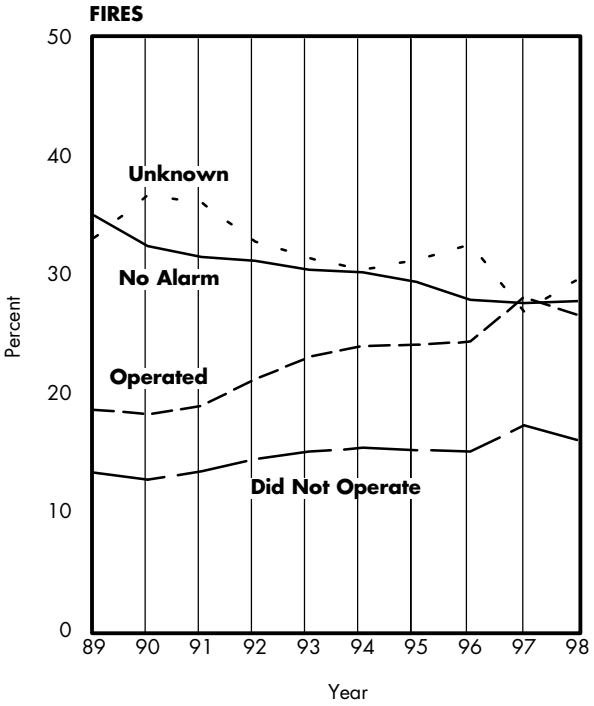
Source: NFIRS

Figure 37 shows the 10-year trends of alarm performance in fires and fire deaths. There has been an encouraging drop over 10 years in the percentage of both fires and deaths with no alarm present—20 percent for fires and 15 percent for deaths. Correspondingly, the trend where an alarm operated increased 54 percent for fires and 24 percent for deaths. However, the cases where an alarm was present but did not operate also increased, 28 and 18 percent for fires and deaths, respectively. Widespread public education programs that focus on the proper maintenance of alarms are needed to reverse this trend. A number of state fire department initiatives are focused directly on this problem (see Chapter 7). For example, a message is broadcast nationally when daylight savings time goes into effect reminding the public to check and maintain their alarms. These initiatives have all helped, but there are still many non-working alarms at the time of a fire.

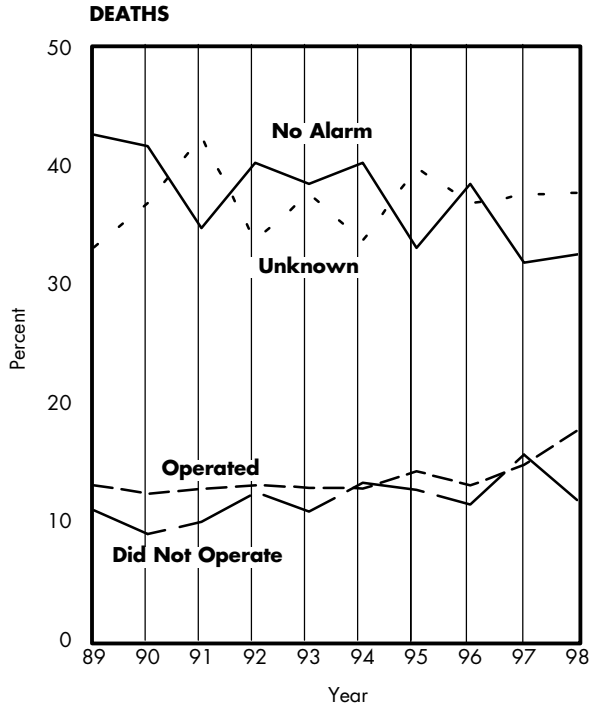
Residential Sprinklers

Residential sprinklers are found in only a small fraction of residences other than hotels, newer apartment buildings, and newer high-value custom homes today. It is no surprise that they are reported to be present in only a small percentage of residential fires nationally, though they represent a great potential in the future.

Sprinklers were reported to be present in 3,892 (2.5 percent) out of the 156,661 residential fires reported to NFIRS in 1998 (Figure 38). They operated in 1,246 cases and did not operate in 2,646 fires, the latter mostly because the fire was too small.



	No Alarm	Operated	Did Not Operate	Unknown
1989	35.0%	18.6%	13.3%	33.1%
1990	32.4	18.2	12.7	36.7
1991	31.5	19.0	13.4	36.1
1992	31.2	21.2	14.5	32.8
1993	30.4	23.1	15.1	31.4
1994	30.2	24.0	15.4	30.4
1995	29.4	24.1	15.2	31.3
1996	27.9	24.4	15.1	32.6
1997	27.6	28.1	17.3	26.9
1998	27.8	26.6	16.0	29.6
10-Year Trend				
	-19.8%	**+54.3%**	**+28.4%**	**-18.9%**



	No Alarm	Operated	Did Not Operate	Unknown
1989	42.7%	13.1%	11.0%	33.2%
1990	41.7	12.4	9.0	36.9
1991	34.8	12.8	10.0	42.5
1992	40.3	13.1	12.5	33.8
1993	38.5	12.9	10.9	37.7
1994	40.3	12.8	13.3	33.7
1995	33.1	14.3	12.7	39.9
1996	38.5	13.1	11.5	36.9
1997	38.5	13.1	11.5	36.9
1998	32.6	17.8	11.8	37.8
10-Year Trend				
	-15.2%	**+23.5%**	**+18.4%**	**+4.2%**

Source: NFIRS

FIGURE 37. TRENDS IN SMOKE ALARM PERFORMANCE IN RESIDENTIAL FIRES AND FIRE DEATHS

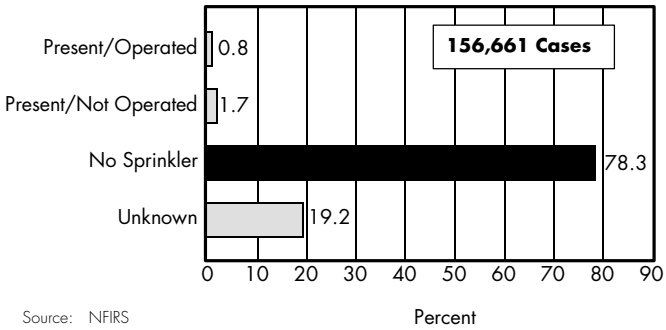
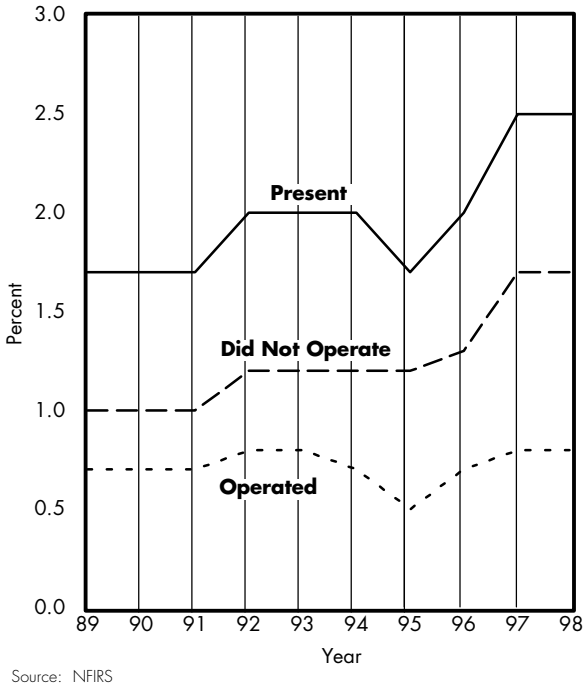


FIGURE 38. SPRINKLER PERFORMANCE IN RESIDENTIAL FIRES (1998)

The trend in use of residential sprinklers has been upward (Figure 39). They were reported as present in 2.5 percent of the residential fires in 1998 versus 1.7 percent in 1989; they operated in less than 1 percent of fires in 1998. The percentages are still minuscule—most homes are not equipped with sprinklers. The potential value of residential sprinklers has not been publicized to any great extent. If the public were more aware of the benefits of sprinklers, the number of newly built and renovated homes and apartments might increase.



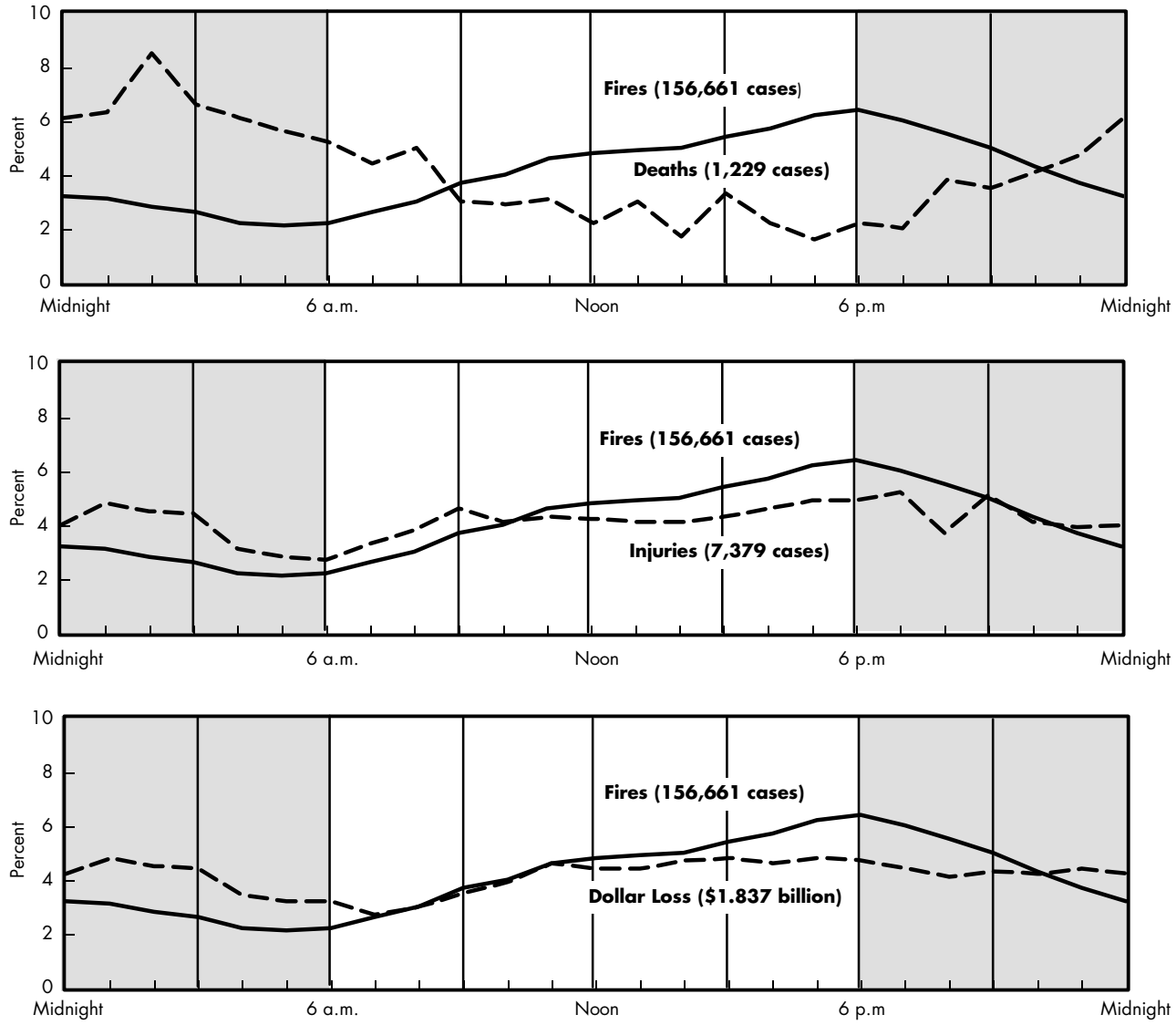
	Present	Operated	Did Not Operate
1989	1.7%	0.7%	1.0%
1990	1.7	0.7	1.0
1991	1.7	0.7	1.0
1992	2.0	0.8	1.2
1993	2.0	0.8	1.2
1994	2.0	0.7	1.2
1995	1.7	0.5	1.2
1996	2.0	0.7	1.3
1997	2.5	0.8	1.7
1998	2.5	0.8	1.7

FIGURE 39. TRENDS IN SPRINKLER PERFORMANCE IN RESIDENTIAL FIRES

When Fires Occur

Time of Day. Fires do not occur uniformly throughout the day, as shown in Figure 40. Residential fire incidents peak from 5:00 p.m. to 8:00 p.m., during dinner preparation. Although fire incidents drop when people sleep, deaths are at their highest late at night and early morning. Nearly half of residential fire deaths occur in fires that start from 11:00 p.m. to 6:00 a.m. The peak night hours are from 2:00 to 4:00 a.m. when most people are in deep sleep. A large portion of these early morning deaths are attributed to arson or smoking.

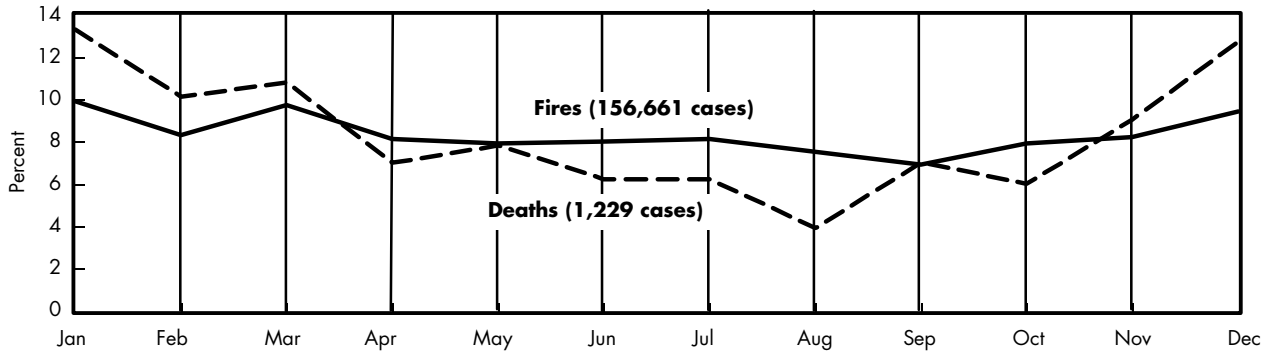
Fire injuries occur more uniformly throughout the day, peak slightly during dinner hours when people cook, and again in the early morning hours. The peak in dollar loss in 1998 closely follows the injury pattern.



Source: NFIRS

FIGURE 40. TIME OF DAY OF RESIDENTIAL FIRES AND FIRE LOSSES (1998)

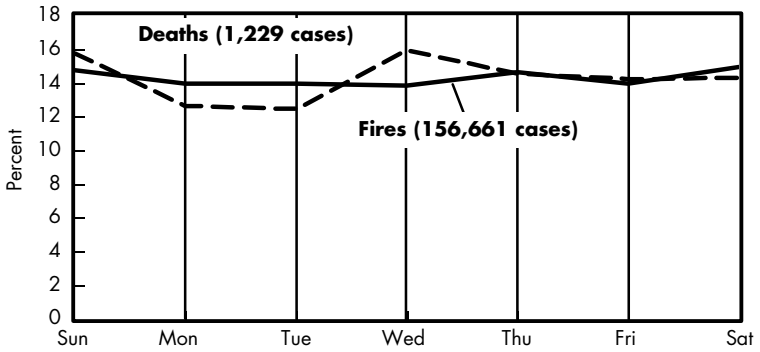
Month of Year. Residential fires and fire deaths are most frequent during winter months when heating systems add to other causes. Forty percent of all deaths occur in the quarter of the year from December through February (Figure 41). This is essentially the same pattern as in 1996.



Source: NFIRS

FIGURE 41. MONTH OF YEAR OF RESIDENTIAL FIRES AND FIRE DEATHS (1998)

Day of Week. The incidence of residential fires and fire deaths are fairly uniform over the entire week (Figure 42). In 1998, there was a spike in the number of 1998 deaths on Wednesday; no reason for this anomaly is known. Deaths did not increase over the weekend, contrary to popular assumption.



Source: NFIRS

FIGURE 42. DAY OF WEEK OF RESIDENTIAL FIRES AND FIRE DEATHS (1998)

ONE- AND TWO-FAMILY HOMES

One- and two-family homes are where two-thirds of the people in the United States reside. The residential fire profile is therefore dominated by this category. Manufactured housing (mobile homes) is included here in the profiles for one- and two-family homes. A separate examination of manufactured housing fires (and garage fires) is included at the end of this section.

Overview of Trends

The number of both fires and injuries in one- and two-family homes reached 10-year lows in 1998, as shown in Figure 43. All of the 10-year trends are downward—25 percent for fires, 13 percent for deaths, 23 percent for injuries, and 12 percent for dollar loss (adjusted to 1998 dollars).

Because the number of fires dropped faster than deaths or dollar losses, the statistics per fire worsened. Clearly, the increased use of smoke alarms has been a major factor in the reduction in the number of reported fires. Fires that are detected early are often extinguished before they are reported to the fire department, so the number of reported fires decreases. When alarms are not present, the fire burns longer before detection and does more damage.

When Fires Occur

Time of Day. Figure 44 mirrors Figure 40 (all residences). Fires and injuries in one- and two-family dwellings are highest between 5:00 and 8:00 p.m., when cooking fires sharply increase. Fire deaths, on the other hand, peak in the early morning hours, from midnight to 7:00 a.m. Deaths during this period are often caused by smoking fires that smolder for several hours and then rapidly increase in smoke production and open flames. Arson is also a major cause of deaths. The early morning hours are when most people are in deep sleep so they do not awake in time to escape. Dollar loss is fairly uniform throughout the day with peaks at 5:00–9:00 p.m. and lows at 5:00–9:00 a.m.

Month of Year. Fires and fire deaths in one- and two-family homes peak in mid winter (December–March), when heating fires add to the other types of year-round fires (Figure 45).

Causes

Cooking remains the leading cause of fires in one- and two-family dwellings for 1998, at 21 percent (adjusted) (Figure 46). Heating at 16 percent and arson at 13 percent are the next two leading causes. Since 1994, the difference between heating and cooking fires has widened, most likely because the use of wood stoves and kerosene heaters has diminished over the past 10 years.[6]

The leading cause of death in 1998 is smoking, as in all NFIRS years, at 21 percent. Most of the smoking deaths come from cigarettes dropped on upholstered furniture or bedding, often by someone who has been drinking. Arson is the second leading cause of death at 19 percent and heating is third at 13 percent. These three causes account for more than half of the total 1998 deaths.

Each year, one-quarter of all fire injuries are from cooking fires. This is more than twice the amount as the next leading cause. The most common cooking fires result from unattended cooking, when oil or grease catches fire, and from the ignition of loose clothing. Children playing and heating are second and third, respectively, at about 11 percent. These profiles are similar over 10 years.

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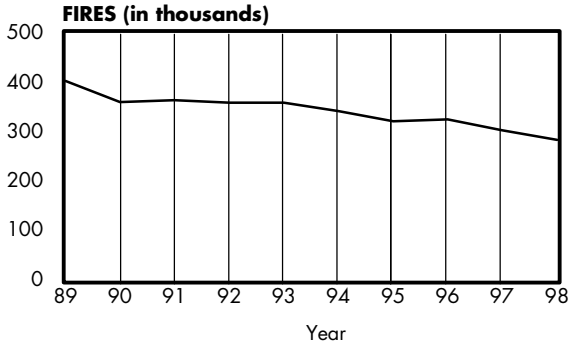
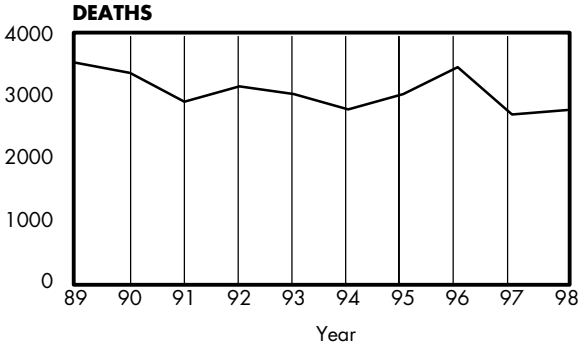
[6] The U.S. Department of Energy, Energy Information Administration, estimates that the percentage of one- and two-family dwellings using kerosene heaters decreased 33 percent from 1987 to 1997; those using wood stoves as a heating source decreased by 70 percent.



1989	402.5	1994	341.0
1990	359.0	1995	320.0
1991	363.0	1996	324.0
1992	358.0	1997	302.5
1993	358.0	1998	283.0

10-Year Trend = -25.1%

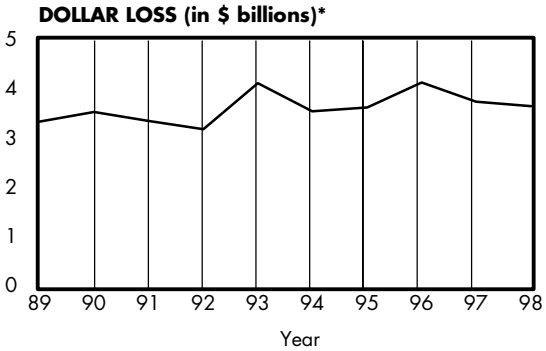


1989	3,545	1994	2,785
1990	3,370	1995	3,035
1991	2,905	1996	3,470
1992	3,160	1997	2,700
1993	3,035	1998	2,776

10-Year Trend = -13.2%

1989	15,225	1994	14,000
1990	15,250	1995	13,450
1991	15,600	1996	13,700
1992	15,275	1997	12,300
1993	15,700	1998	11,800

10-Year Trend = -23.2%



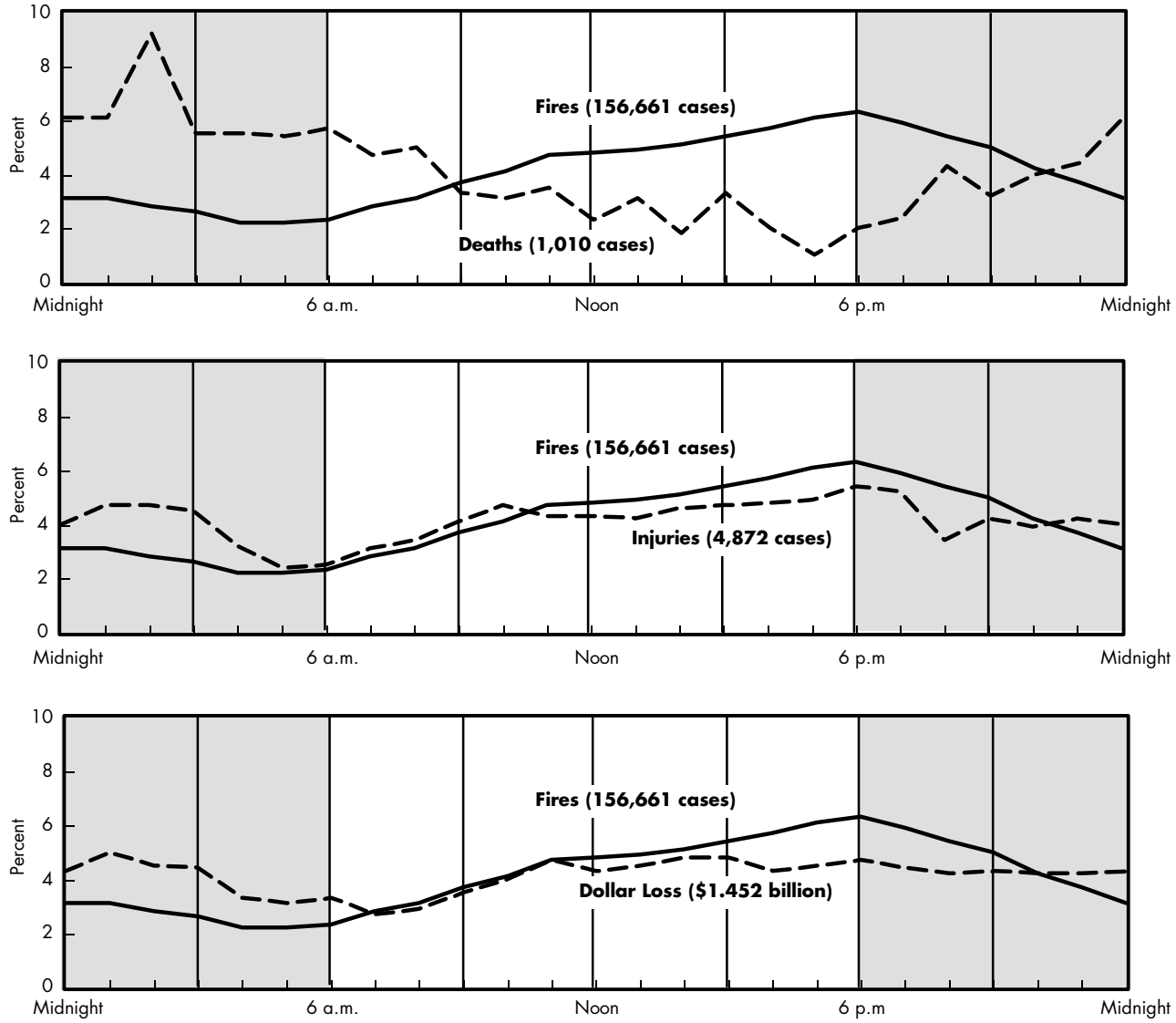
1989	$3.34	1994	$3.54
1990	3.53	1995	3.62
1991	3.35	1996	4.12
1992	3.18	1997	3.74
1993	4.11	1998	3.64

10-Year Trend = -12.4%

*Adjusted to 1998 dollars

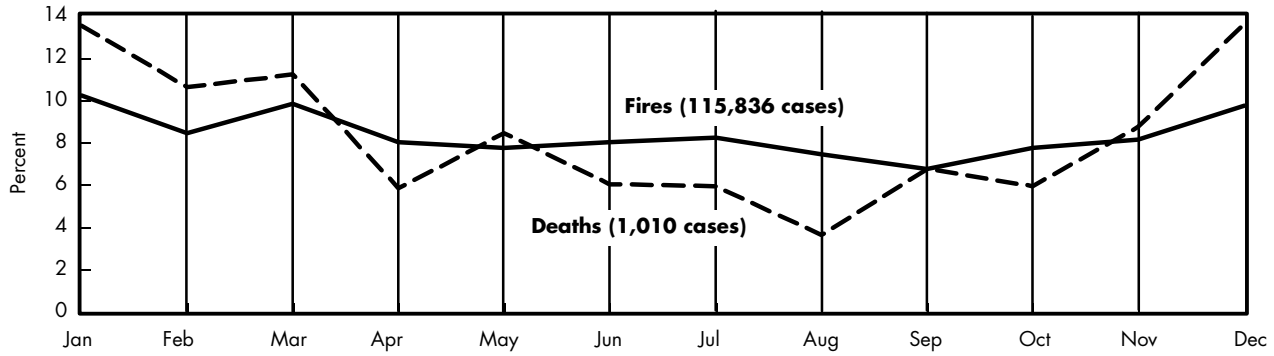
Sources: NFPA and Consumer Price Index

FIGURE 43. TRENDS IN ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE LOSSES



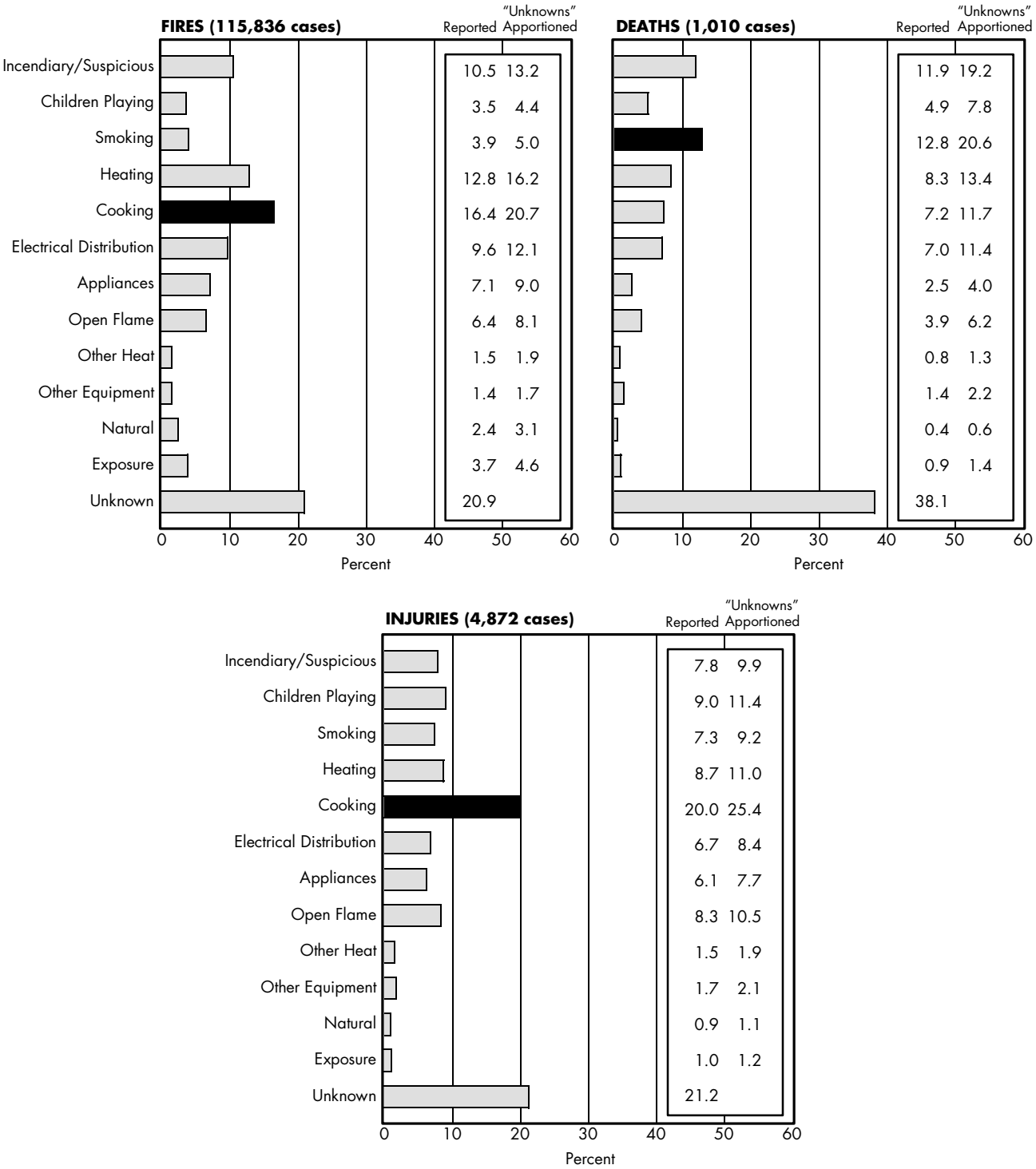
Source: NFIRS

FIGURE 44. TIME OF DAY OF ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE LOSSES (1998)



Source: NFIRS

FIGURE 45. MONTH OF YEAR OF ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE DEATHS (1998)



Source: NFIRS

FIGURE 46. CAUSES OF ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE CASUALTIES (1998)

Cause Trends

The 10-year trends for the leading causes of fires have remained relatively constant except for the dramatic decrease of heating fires (Figure 47).

Although the curves for the leading causes of deaths in one- and two-family homes are erratic, the top five causes have not changed noticeably over 10 years with the exception of heating deaths, which have declined markedly. Smoking deaths declined 18 percent between 1989 and 1998, although it continues as the leading cause of fire deaths.

Cooking has been the leading cause of fire injuries in all 10 years by a wide margin. Cooking injuries reached a peak in 1993, but have declined 22 percent since. Both children playing and heating injuries have also steadily declined.

Area of Fire Origin

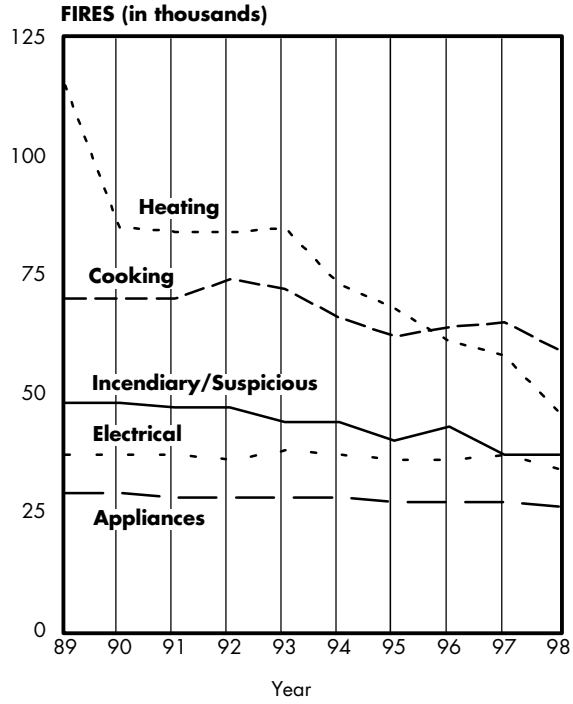
To help people visualize the fire problem more personally, it is useful to describe it in terms of where different types of fires occur in the home and what types of fires occur in each room. Figure 48 shows the leading rooms where fires originate in one- and two-family homes in 1998. In 10 years, there has been no change in ranking of the top three rooms for any of the three measures. Kitchens, bedrooms, and lounge areas (e.g., living rooms, family rooms) are the rooms where most fires originate—45 percent of fires, 56 percent of deaths, and 66 percent of injuries. Table 11 details the leading causes of fires, deaths, and injuries in each of the top locations of fire origin shown in Figure 48.

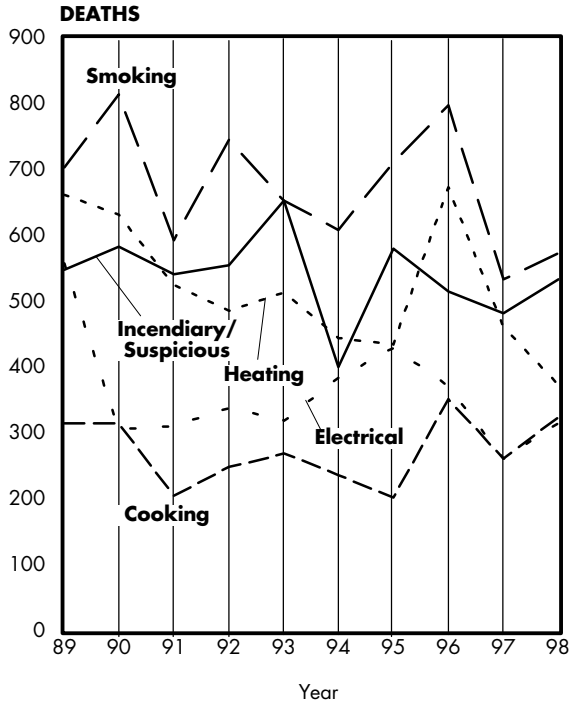
Nearly twice as many fires occur in the kitchen as in any other area, most obviously those caused by cooking. The second most common location of fire origin is the bedroom or sleeping area where children playing, open flame, and smoking are the three most common fire causes. Smoking fires in the bedroom have increased slightly since 1996. Lounge areas are third, with smoking, heating, and children playing as the primary causes. Chimney fires (fourth place) often result from creosote buildup that ignites when the chimney has not been cleaned often enough or well enough.

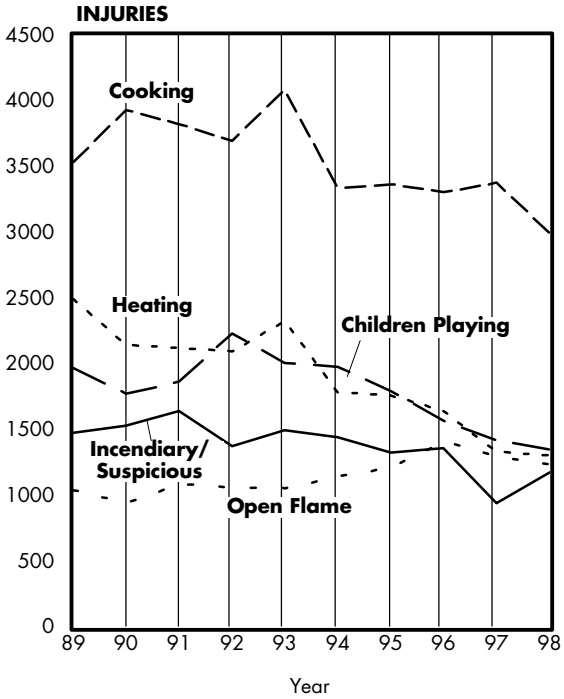
Garage/storage areas are not shown as one of the leading areas of fire origin, but they are actually more significant than imagined.[7] If storage/garage fires were accurately reported as residential fires, the total number of fires in dwellings would increase by about 10 percent. There were 23,300 such garage fires in 1998, the second highest total in 10 years. This portion of the residential fire problem is sometimes overlooked. A fuller portrait of garage fires is presented on page 83.

In one- and two-family dwellings, 42 percent of all deaths occur in lounge areas and bedrooms, possibly because people fall asleep smoking in bed or on upholstered furniture. More than

[7] In the version of the 1976 NFPA 901 reporting standard that is used in the National Fire Incident Reporting System, all residential garages were to be reported under storage properties. In later versions (e.g., NFPA 901, *Uniform Coding for Fire Protection*, 1981 and 1986), only detached garages are included in this category. Since not all reporting firefighters know that the old definition holds for NFIRS, and some never knew, there is some inconsistency in reporting these fires. The standard is under discussion for change in the future.



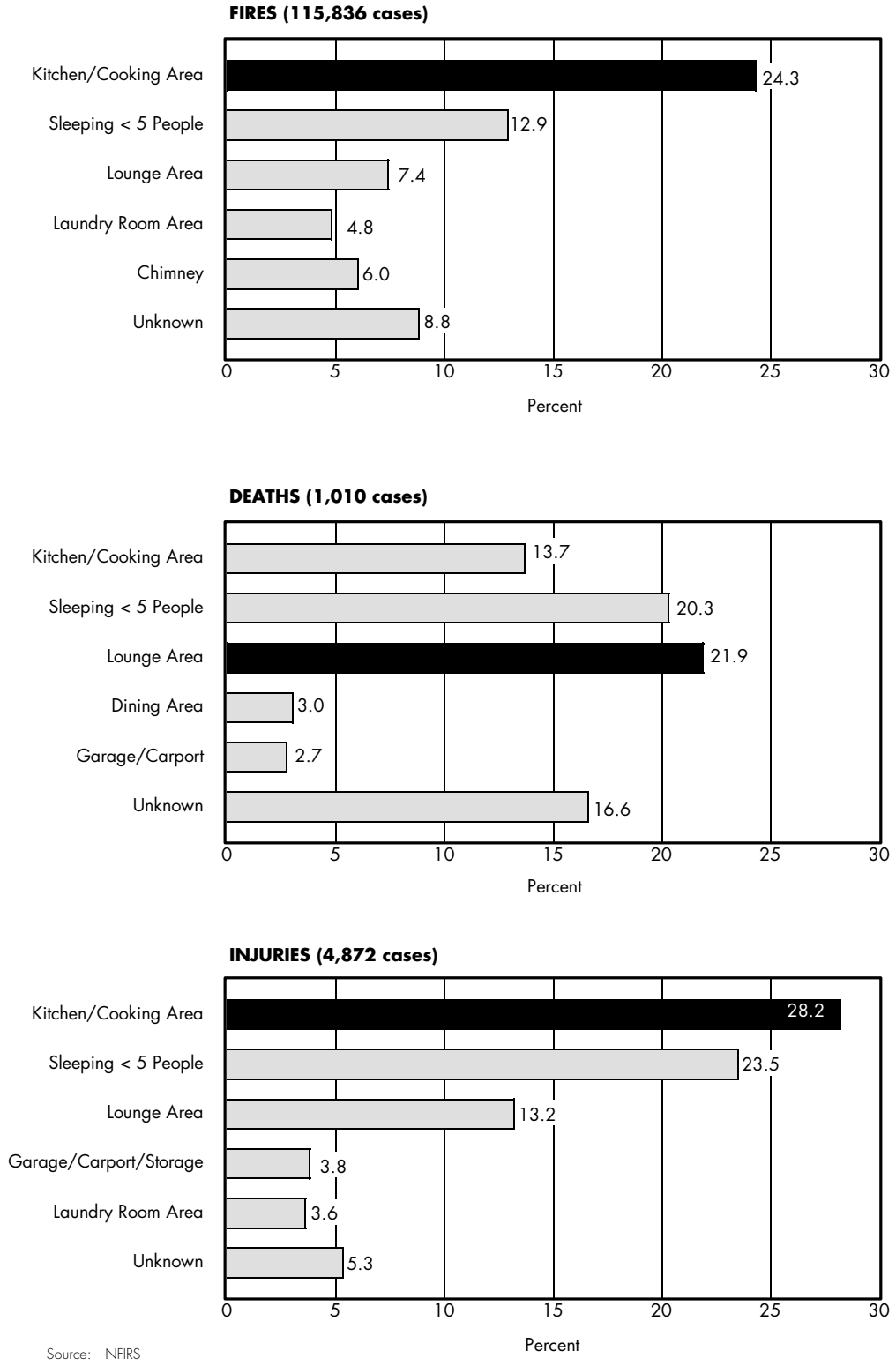




Note : Data for all 12 causes are provided in Appendix B, Table B-2.

Sources: NFIRS and NFPA

FIGURE 47. TRENDS IN LEADING CAUSES OF ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE CASUALTIES



Source: NFIRS

FIGURE 48. LEADING LOCATIONS OF FIRE ORIGIN OF ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE CASUALTIES (1998)

TABLE 11. LEADING CAUSES OF FIRE BY LOCATION IN ONE- AND TWO-FAMILY DWELLINGS (1998)

[The percents shown in parentheses represent (1) the actual number of reported causes/and (2) the unknown causes apportioned to these known causes]

FIRES				
Kitchen	**Sleeping Room <5**	**Lounge**	**Chimney**	**Laundry Room**
Cooking 17,935 (63.8%/75.6%)	Children Playing 2,215 (14.8%/18.5%)	Smoking 1,601 (18.7%/23.3%)	Incendiary/Suspicious 5,183 (74.4%/84.6%)	Appliances 3,484 (62.4%/70.8%)
Appliances 1,160 (4.1%/4.9%)	Open Flame 2,108 (14.1%/17.6%)	Heating 1,317 (15.4%/19.2%)	Other Equipment 433 (6.2%/7.1%)	Heating 451 (8.1%/9.2%)
Incendiary/Suspicious 998 (3.6%/4.2%)	Smoking 2,001 (13.4%/16.7%)	Children Playing 1,190 (13.9%/17.3%)	Electrical Distribution 219 (3.1%/3.6%)	Electrical Distribution 409 (7.3%/8.3%)
Total Fires: 28,096 **Unknowns: 4,378**	**Total Fires: 14,938** **Unknowns: 2,964**	**Total Fires: 8,543** **Unknowns: 1,683**	**Total Fires: 6,968** **Unknowns: 840**	**Total Fires: 5,587** **Unknowns: 666**
DEATHS				
Lounge	**Sleeping Room <5**	**Kitchen**	**Dining Area**	**Garage/Carport**
Smoking 47 (21.3%/32.4%)	Smoking 51 (24.9%/35.7%)	Cooking 64 (46.4%/64.6%)	Electrical Distribution 6 (20.0%/40.0%)	Other Equipment 8 (29.6%/40.0%)
Heating 24 (10.9%/16.6%)	Children Playing 23 (11.2%/16.1%)	Electrical Distribution 13 (9.4%/13.1%)	Smoking 5 (16.7%/33.3%)	Incendiary/Suspicious 5 (18.5%/25.0%)
Incendiary/Suspicious 20 (9.0%/13.8%)	Incendiary/Suspicious 18 (8.8%/12.6%)	Heating 7 (6.5%/7.1%)	Heating 2 (6.7%/13.3%)	Electrical Distribution 3 (11.1%/15.0%)
Total Deaths: 221 **Unknowns: 76**	**Total Deaths: 205** **Unknowns: 62**	**Total Deaths: 138** **Unknowns: 39**	**Total Deaths: 30** **Unknowns: 15**	**Total Deaths: 27** **Unknowns: 7**
INJURIES				
Kitchen	**Sleeping Room <5**	**Lounge**	**Garage/Carport**	**Laundry Room**
Cooking 924 (67.3%/82.1%)	Children Playing 236 (20.6%/25.3%)	Smoking 94 (14.6%/19.5%)	Incendiary/Suspicious 32 (17.1%/20.1%)	Appliances 87 (49.4%/58.8%)
Appliances 35 (2.6%/3.1%)	Open Flame 181 (15.8%/19.4%)	Heating 76 (11.8%/15.7%)	Other Equipment 21 (11.2%/13.2%)	Heating 28 (15.9%/18.9%)
Heating 26 (1.9%/2.3%)	Smoking 154 (13.5%/16.5%)	Children Playing 75 (11.6%/15.5%)	Electrical Distribution 18 (9.6%/11.3%)	Electrical Distribution 12 (6.8%/8.1%)
Incendiary/Suspicious 26 (1.9%/2.3%)				
Total Injuries: 1,372 **Unknowns: 247**	**Total Injuries: 1,144** **Unknowns: 211**	**Total Injuries: 645** **Unknowns: 162**	**Total Injuries: 187** **Unknowns: 28**	**Total Injuries: 176** **Unknowns: 28**

Note: Data here are NFIRS raw counts, not national estimates. Percentages shown are column percentages (e.g., percentages of kitchen fires, not percentages of cooking fires).

Source: NFIRS

half of all injuries occur in the kitchen and bedroom; cooking and children playing are the leading causes, respectively.

Slicing the problem a slightly different way, Table 12 shows the leading causes of fires, deaths, and injuries (from Figure 46) by where these fires start. Cooking fires in the home overwhelmingly start in the kitchen (95 percent). For heating fires, the chimney accounts for 35 percent of the fires and heating equipment for another 17 percent. Arson fires in the home had the highest frequencies

TABLE 12. LEADING LOCATIONS OF FIRE ORIGIN BY CAUSE IN ONE- AND TWO-FAMILY DWELLINGS (1998)

[The percents shown in parentheses represent (1) the actual number of reported locations/and (2) the unknown locations apportioned to these known locations]

FIRES				
Cooking	**Heating**	**Incendiary/ Suspicious**	**Electrical Distribution**	**Appliances**
Kitchen 17,935 (94.6%/94.9%)	Chimney 5,183 (34.9%/35.3%)	Sleeping Room <5 2,108 (17.4%/19.9%)	Sleeping Room <5 2,215 (19.9%/20.2%)	Laundry Room 3,484 (42.2%/42.6%)
Exterior Balcony/ Open Porch 209 (1.1%/1.1%)	Heating Equipment 2,483 (16.7%/16.9%)	Lounge 1,317 (10.9%/12.4%)	Lounge 1,190 (10.7%/10.9%)	Kitchen 1,160 (14.1%/14.2%)
Garage/Carport 121 (0.6%/0.6%)	Lounge 1,601 (10.8%/10.9%)	Kitchen 998 (8.2%/9.4%)	Kitchen 987 (8.9%/9.0%)	Sleeping Room <5 957 (11.6%/11.7%)
Total Fires: 18,951 **Unknowns: 45**	**Total Fires: 14,838** **Unknowns: 146**	**Total Fires: 12,105** **Unknowns: 1,490**	**Total Fires: 11,112** **Unknowns: 169**	**Total Fires: 8,254** **Unknowns: 67**
DEATHS				
Smoking	**Incendiary/ Suspicious**	**Heating**	**Cooking**	**Electrical Distribution**
Sleeping Room <5 51 (39.5%/39.8%)	Lounge 20 (16.7%/22.5%)	Lounge 24 (27.3%/27.6%)	Kitchen 64 (87.7%/87.7%)	Sleeping Room <5 16 (22.5%/22.9%)
Lounge 47 (36.4%/36.7%)	Sleeping Room <5 18 (15.0%/20.2%)	Sleeping Room <5 16 (18.2%/18.4%)	Exterior Balcony/ Open Porch 6 (8.2%/8.2%)	Kitchen 13 (18.3%/18.6%)
Dining Area 5 (3.9%/3.9%)	Kitchen 7 (5.8%/7.9%)	Heating Equipment/ Water Heater Areas 9 (10.2%/10.3%)	Heating Equipment/ Water Heater Areas 2 (2.7%/2.7%)	Lounge 9 (12.7%/12.9%)
	Exterior Balcony/ Open Porch 7 (5.8%/7.9%)	Hallway/Corridor 9 (10.2%/10.3%)		
Total Deaths: 129 **Unknowns: 1**	**Total Deaths: 120** **Unknowns: 31**	**Total Deaths: 84** **Unknowns: 1**	**Total Deaths: 73** **Unknowns: 0**	**Total Deaths: 71** **Unknowns: 1**
INJURIES				
Cooking	**Children Playing**	**Heating**	**Open Flame**	**Incendiary/ Suspicious**
Kitchen 924 (94.8%/94.9%)	Sleeping Room <5 236 (53.9%/54.0%)	Heating Equipment/ Water Heater Areas 89 (21.0%/21.3%)	Sleeping Room <5 181 (45.0%/45.3%)	Sleeping Room <5 86 (22.5%/25.7%)
Lounge 14 (1.4%/1.4%)	Lounge 75 (17.1%/17.2%)	Lounge 76 (18.0%)/18.2%)	Lounge 62 (15.4%/15.5%)	Lounge 58 (15.2%/17.4%)
Garage/Carport 8 (0.8%/0.8%)	Closet 26 (5.9%/5.9%)	Sleeping Room <5 70 (16.5%/16.8%)	Lavatory/Locker Room/ Cloakroom 30 (7.5%/7.5%)	Garage/Carport 32 (8.4%/9.6%)
Court/Terrace/Patio 8 (0.8%/0.8%)				
Total Injuries: 975 **Unknowns: 1**	**Total Injuries: 438** **Unknowns: 1**	**Total Injuries: 432** **Unknowns: 6**	**Total Injuries: 402** **Unknowns: 2**	**Total Injuries: 354** **Unknowns: 6**

Note: Data here are NFIRS raw counts, not national estimates. Percentages shown are column percentages (e.g., percentages of cooking fires, not percentages of kitchen fires).

Source: NFIRS

of occurrence in bedrooms and lounge areas. Electrical fires were most frequently reported in bedrooms, but large numbers were also in lounge and kitchen areas.

Smoking deaths occur most often in bedrooms and lounges (76 percent), often where the victims fall asleep on upholstered furniture or where the cigarette ignites the bedding material. Heating fire deaths are also from fires started in lounge areas and bedrooms. Portable and fixed space heaters play a big role here. Most arson and electrical distribution fire deaths are also in lounge areas and bedrooms. Cooking fire deaths occur almost exclusively in the kitchen.

Cooking fire injuries are obviously almost all from fires in the kitchen. Heating fire injuries occur almost equally in heating equipment areas, lounges (which include most fireplaces), and bedrooms. As with deaths (and not coincidentally with fires), over half of children playing fire injuries occurred in bedrooms. Parent and care providers need to be particularly vigilant in the supervision of young children. Open flame injuries occur predominately in bedrooms and lounge areas (61 percent). For the first time in 1998, smoking was not one of the top five causes of injuries.

Smoke Alarm Performance

In 1998, alarms were present in 54 percent ("unknowns" apportioned) of homes that had fires, a 2 percent increase since 1996 (Figure 49). Alarms also were present in 42 percent of homes that had a fatality. In one-quarter of all fire death cases, the alarm operated, a troublesome statistic since alarms are purported to save lives. This may require further investigation.[8]

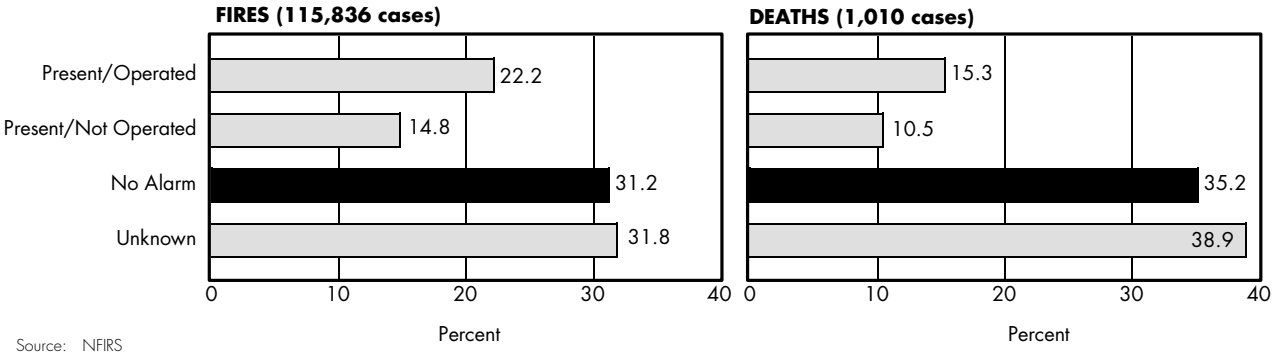


FIGURE 49. SMOKE ALARM PERFORMANCE IN ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE DEATHS (1998)

One- and two-family homes in which fires occur have, proportionally, fewer alarms installed than in apartments that experience fires. This may be because apartment smoke alarms are often provided by landlords and more often required by law than in single-family homes. (See page 90 for more on apartments.)

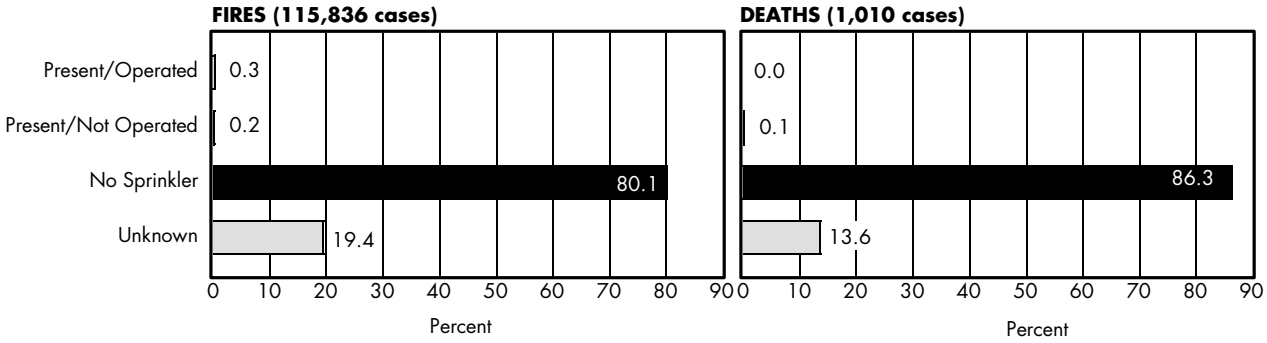
[8] For example, were the victims physically unable to escape the blaze or were they simply not awakened by the sound of the alarm?

When present, alarms operated less often in homes than in apartments, perhaps because homes are usually larger than individual apartment units and fires are more spread out relative to the alarms, or perhaps because homeowners who are solely responsible for the alarm maintenance (e.g., battery replacement) are more likely to forgo maintenance than landlords who are liable.

There was no alarm in 46 percent ("unknowns" apportioned) of 1998 fires and 58 percent of homes that had fire deaths. Both of these numbers represent an improvement (decrease) over 1996.

Sprinkler Performance

Sprinklers were present in less than 1 percent of fires or fire deaths in one- and two-family dwellings in 1998 (Figure 50). This is an insignificant amount. However, no deaths were reported in those cases when sprinklers were present and operated. These numbers are essentially unchanged from 1996.



Source: NFIRS

FIGURE 50. SPRINKLER PERFORMANCE IN ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE DEATHS (1998)

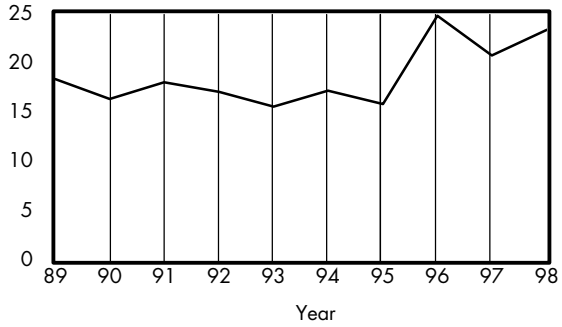
Residential Garages

Not all residential garage fires are reported as they are supposed to be. A substantial number are reported as part of residential fires. The definition in the widely used early manual (1976) on NFPA 901 required that both attached and detached residential garages be included in the storage category. More recent versions of the 901 standard that are not in use by NFIRS require only detached garage fires to be included in the storage category. Undoubtedly, there is confusion in the field. To further complicate matters, the residential garage data often are overlooked or ignored altogether in discussions of residential fires.

Figure 51 shows the trends in fires and fire losses for residential garages in fixed property use NFIRS category #881, "residential parking garages." Garage fires totaled 23,300 in 1998. The 10-year trend increased 37 percent idue to a significant increase in the number of reported garage fires from 1996 to 1998.

Because the numbers of deaths from garage fires are small, ranging from 11 to 19 each year, there is considerable year-to-year variation; the 10-year downward trend is 16 percent. Garage fires account for less than 1 percent of fire deaths in one- and two-family dwellings.

FIRES (in thousands)



1989	18.3	1994	17.1
1990	16.3	1995	15.8
1991	18.0	1996	24.7
1992	17.0	1997	20.7
1993	15.5	1998	23.3

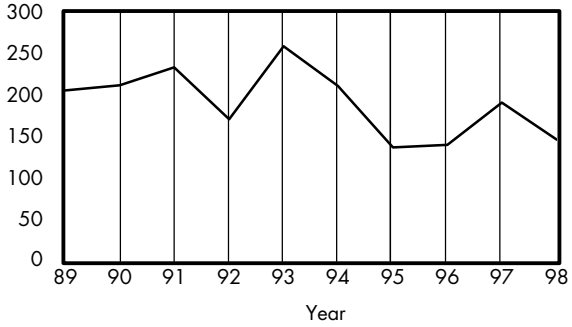
10-Year Trend = +37.2%

DEATHS

1989	15	1994	11
1990	18	1995	14
1991	17	1996	16
1992	19	1997	16
1993	16	1998	14

10-Year Trend = -15.5%

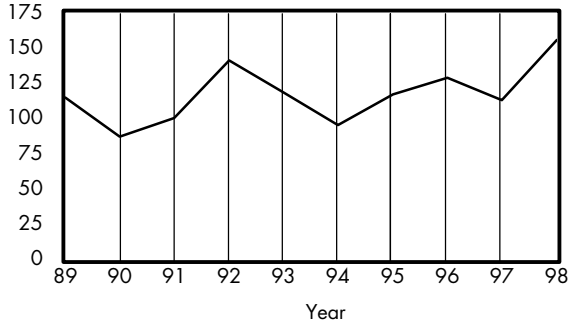
INJURIES



1989	206	1994	211
1990	212	1995	137
1991	234	1996	140
1992	171	1997	191
1993	259	1998	146

10-Year Trend = -31.5%

DOLLAR LOSS (in $ millions)*



1989	$114.4	1994	$ 95.1
1990	87.0	1995	116.6
1991	99.8	1996	128.5
1992	140.8	1997	112.7
1993	118.3	1998	155.4

10-Year Trend = +32.4%

*Adjusted to 1998 dollars

Sources: NFIRS, NFPA, and Consumer Price Index

FIGURE 51. TRENDS IN RESIDENTIAL GARAGE FIRES AND FIRE LOSSES

Garage fire injuries account for just over 1 percent of all dwelling fire injuries. They continue a downward trend—a 32 percent decrease. Dollar loss, about 3 percent of the total loss in dwelling fires, hit a new high in 1998, which caused a 32 percent increase in the 10-year trend.

Arson is the leading cause of garage fires and deaths, nearly twice the number of the next leading cause—exposures to house or outside fires (Figure 52). Heating is the leading cause of garage injuries.

The past confusion about coding garage fires has not distorted the residential fire profiles in any significant way, but it does lead to understating the residential fire problem by 2 to 8 percent, depending on the measure used.

Manufactured Housing

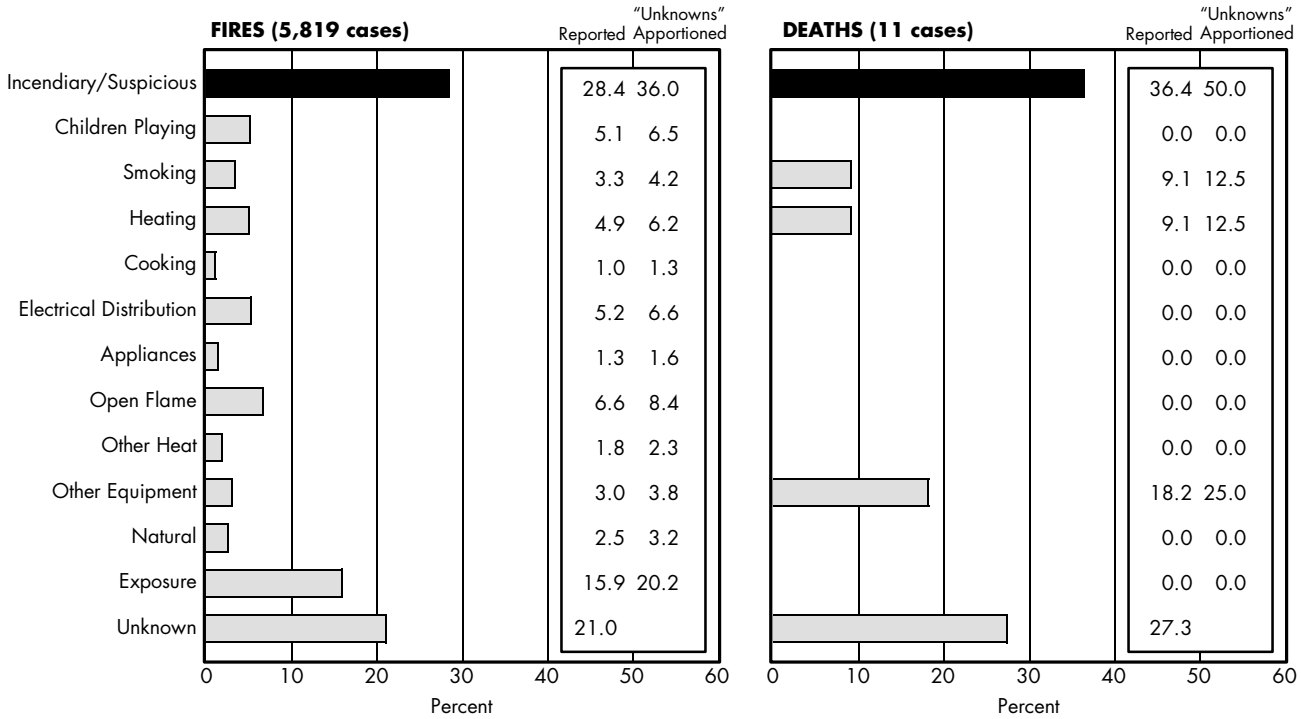
Manufactured housing is a special category of one- and two-family dwellings. Although only 7 percent of the U.S. population lives in manufactured housing,[9] it has represented a severe fatality problem over the past 10 years—nearly double the fatality rate per fire compared to other homes. This caused the U.S. Department of Housing and Urban Development (HUD) in 1976 to establish strict standards for improving the fire safety of such homes (often called "mobile homes"). The HUD standard clearly made an impact. However, the manufactured housing fire problem is still significant.

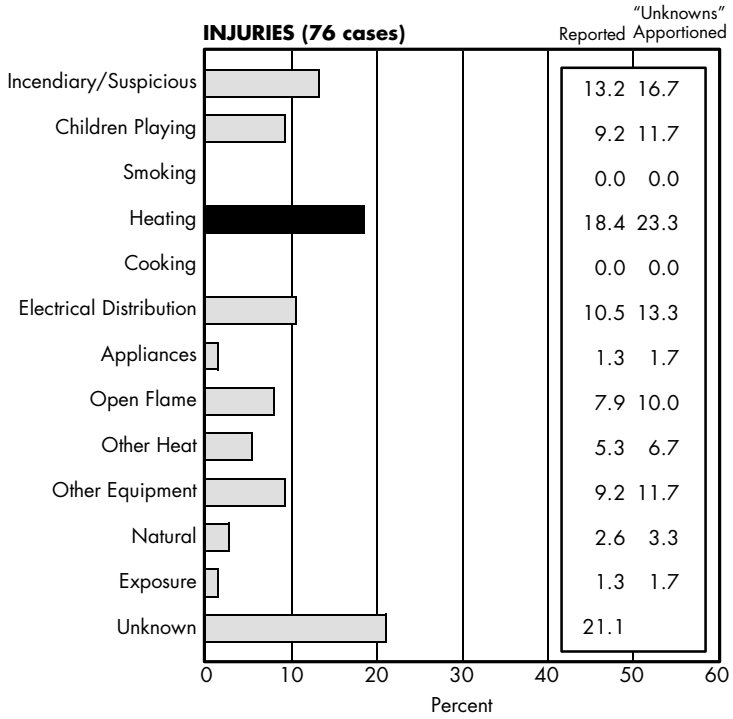
Figure 53 shows the magnitude and downward trends in manufactured housing fires. Despite an increase in the manufactured housing stock, fires in them decreased by 20 percent, deaths by 29 percent, injuries by 28 percent, and adjusted dollar loss by 24 percent over the last 10 years. These decreases are similar to other single-family dwelling trends, except for dollar loss, which had a much sharper decline for manufactured housing. In fact, in 1998 each manufactured housing fire statistic reached 10-year lows.

All of the reasons for these sharp declines are speculative. The 1976 HUD fire safety standards have played a part, causing manufacturers to incorporate more fire-resistant materials in these structures. More smoke alarms may be in use in manufactured housing. The decline might also have been affected by a change in behavior of manufactured housing dwellers. This topic should be investigated more closely to determine whether there are lessons from manufactured housing improvements that could be applied to other types of residences and to reinforce whatever is working.

Figure 54 shows the manufactured housing death and injury trends based on 1,000 fires. Deaths per fire spiked in 1995 and 1996, but fell to a new low in 1998. Injuries and dollar loss per fire have also decreased. These decreases reversed the upward 10-year trends of 1996 to downward trends in 1998—15 percent for fires, 10 percent for injuries, and 5 percent for dollar loss.

[9] U.S. Census Bureau, American Housing Survey.

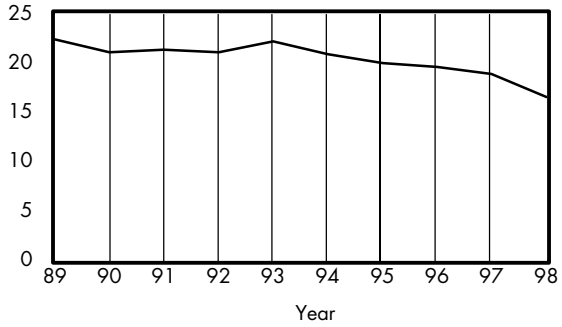




Source: NFIRS

FIGURE 52. CAUSES OF RESIDENTIAL GARAGE FIRES AND FIRE CASUALTIES (1998)

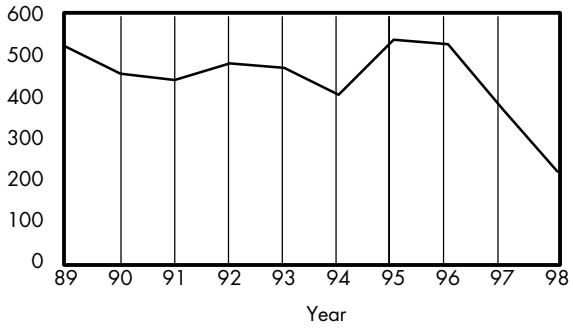
FIRES (in thousands)



1989	22.3	1994	20.8
1990	21.0	1995	19.9
1991	21.3	1996	19.5
1992	21.0	1997	18.8
1993	22.1	1998	16.5

10-Year Trend = -19.7%

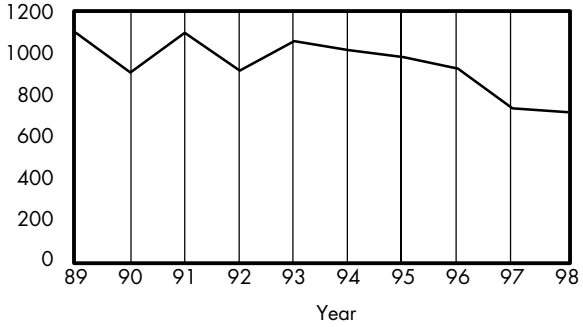
DEATHS



1989	521	1994	405
1990	457	1995	539
1991	441	1996	528
1992	481	1997	372
1993	471	1998	220

10-Year Trend = -29.0%

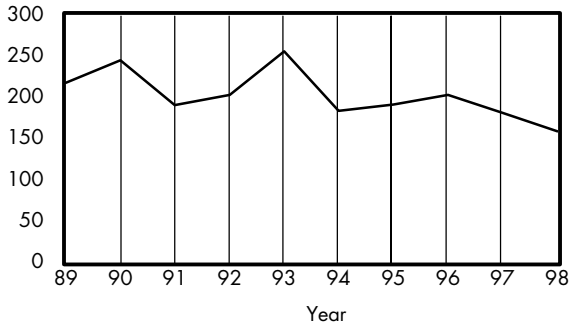
INJURIES



1989	1,103	1994	1,018
1990	910	1995	986
1991	1,101	1996	930
1992	920	1997	736
1993	1,061	1998	717

10-Year Trend = -27.5%

DOLLAR LOSS (in $ millions)*



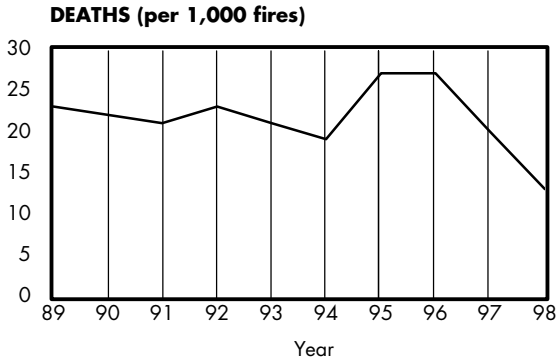
1989	$217.0	1994	$182.8
1990	244.8	1995	190.9
1991	189.9	1996	202.8
1992	202.1	1997	180.5
1993	255.0	1998	158.1

10-Year Trend = -23.8%

*Adjusted to 1998 dollars

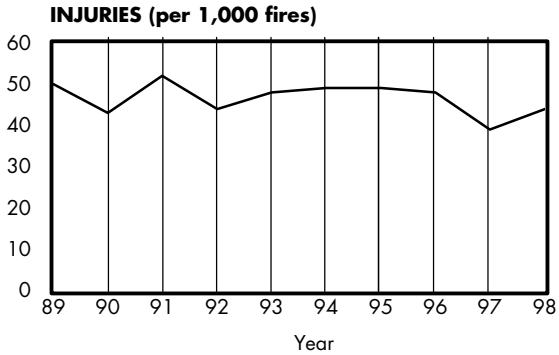
Sources: NFPA and Consumer Price Index

FIGURE 53. TRENDS IN MANUFACTURED HOUSING FIRES AND FIRE LOSSES



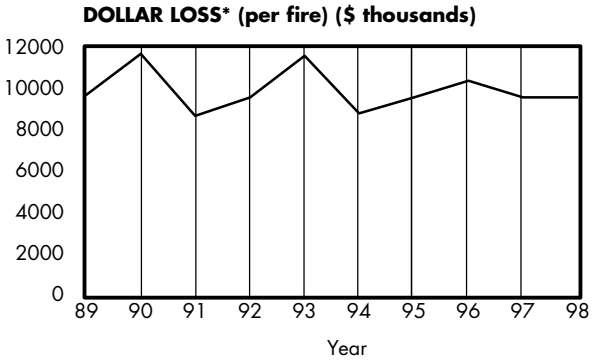
1989	23	1994	19
1990	22	1995	27
1991	21	1996	27
1992	23	1997	20
1993	21	1998	13

10-Year Trend = -15.0%



989	50	1994	49
1990	43	1995	49
1991	51	1996	48
1992	48	1997	39
1993	48	1998	44

10-Year Trend = -10.3%



1989	$ 9,700	1994	$ 8,800
1990	11,700	1995	9,600
1991	8,700	1996	10,400
1992	9,600	1997	9,600
1993	11,600	1998	9,600

10-Year Trend = -5.4%

*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 54. TRENDS IN PER FIRE LOSS IN MANUFACTURED HOUSING

The 1998 cause profiles for manufactured housing fires and deaths are shown in Figure 55. Electrical distribution is the leading cause of fires in manufactured housing, with arson, cooking, and heating systems close behind.

For fire deaths, arson and cooking lead other causes at 22 percent each. Smoking deaths in manufactured housing dropped from first in 1996 to sixth in 1998. (Smoking is the leading cause of deaths in one-and two-family residences.) The cause of manufactured housing fires and deaths was not reported in a large number of cases.

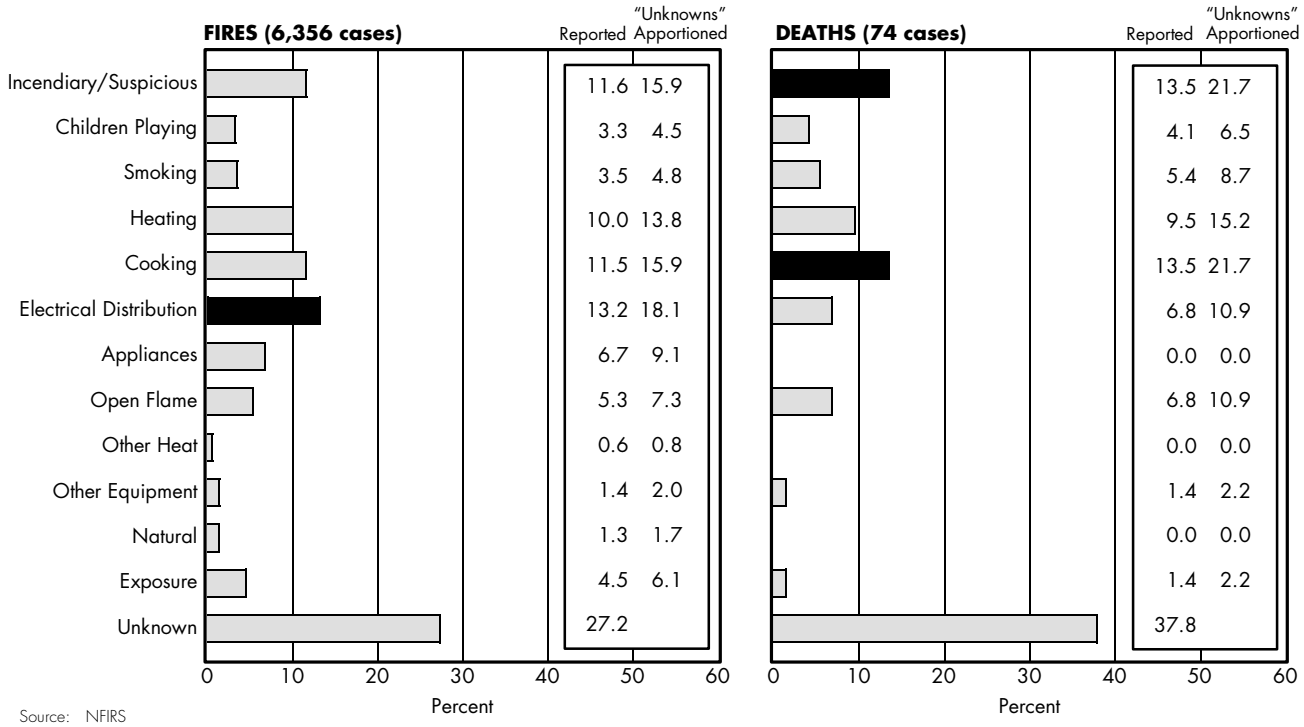


FIGURE 55. CAUSES OF MANUFACTURED HOUSING FIRES AND FIRE DEATHS (1998)

Figure 56 presents smoke alarm performance in manufactured housing for 1998. Overall, smoke alarm performance in manufactured housing is similar to that of other one- and two-family residences. Smoke alarms were present in a smaller proportion of fires in manufactured housing (45 percent, "unknowns" apportioned) than in all one- and two-family dwellings. They were present in a larger proportion of fire deaths (53 percent). This increase in the proportion of fire deaths may reflect the generally smaller size of manufactured housing. Although a victim may be physically closer to an exit, a fire can cover more relative area, making exiting more difficult.

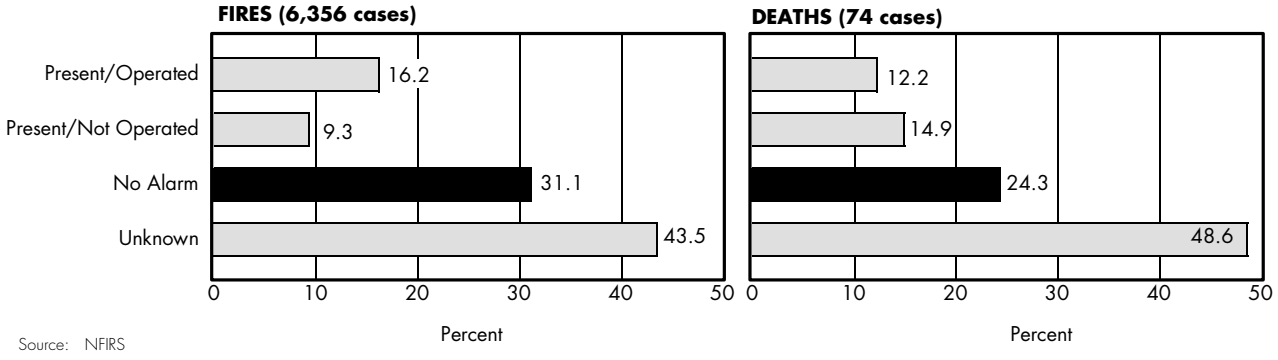


FIGURE 56 SMOKE ALARM PERFORMANCE IN MANUFACTURED HOUSING FIRES AND FIRE DEATHS (1998)

When present, smoke alarms operated in 64 percent of fires, comparable to other one- and two-family homes. Alarms were not installed in 55 percent of fires. Moreover, in over 70 percent of manufactured home fires, there were no operating alarms.

APARTMENTS

Multifamily dwellings, referred to as apartments in this report, tend to be more regulated by building codes than one- and two-family dwellings. Most apartments are rental properties, often falling under more stringent fire prevention statutes. In many communities, apartments also have a significantly different socio-economic mix of residents compared to single-family dwellings. They may have more low-income families in housing projects or more high-income families in luxury highrises, or they may be centers of living for the elderly. In large cities, all of these groups are represented in apartments.

Because apartment buildings have large clusters of similar people, prevention programs can be specially tailored to the cause profiles of apartment buildings in different areas of the community.

Trends

Figure 57 shows the 10-year trends in apartment fires and losses. The number of apartment fires dropped 9 percent, whereas one- and two-family dwelling fires dropped at nearly three times this rate. The trend for deaths was down 25 percent, nearly double that of one- and two-family dwellings. Injuries trended down 5 percent, whereas they fell 23 percent for dwellings. Adjusted dollar losses were down a scant 1 percent in apartments, compared with a 12 percent decrease in one- and two-family dwellings.

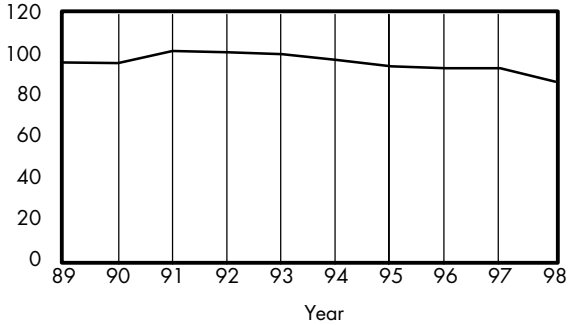
Compliance with stricter building codes and the presence of smoke alarms may be holding down the life loss in apartment fires, which reached a new low in 1998. More detailed study of socio-economic and demographic changes over time might help explain some of the changes in fire incidence.

Causes

The fire problem in apartments is generally similar to that of one- and two-family dwellings with the exception of one major category: heating-related fires. Because apartments generally have central heating systems that are professionally maintained, heating-related fires from misuse and poor maintenance are significantly less in apartments than in single-family dwellings. This changes the proportions of the causes for apartments, with heating becoming less significant and the other causes moving up in importance.

In terms of numbers of reported fires, cooking in apartments leads by a factor of three over the second leading cause (Figure 58). Cooking accounts for 42 percent of all apartment fires. Arson is a distant second at 14 percent, and smoking third at 9 percent. This profile has remained unchanged since 1994.

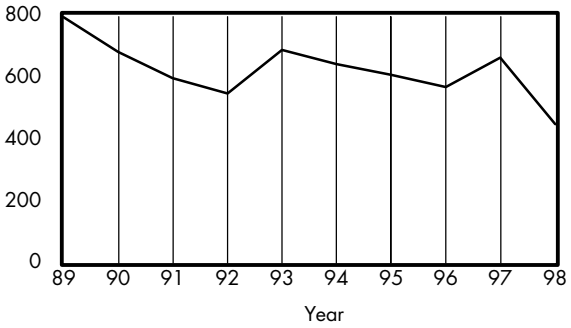
FIRES (in thousands)



1989	96.0	1994	97.0
1990	95.5	1995	94.0
1991	101.5	1996	93.0
1992	101.0	1997	93.0
1993	100.0	1998	86.5

10-Year Trend = -9.2%

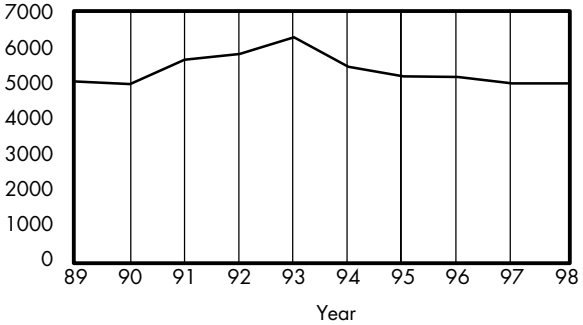
DEATHS



1989	790	1994	640
1990	680	1995	605
1991	595	1996	565
1992	545	1997	660
1993	685	1998	445

10-Year Trend = -25.0%

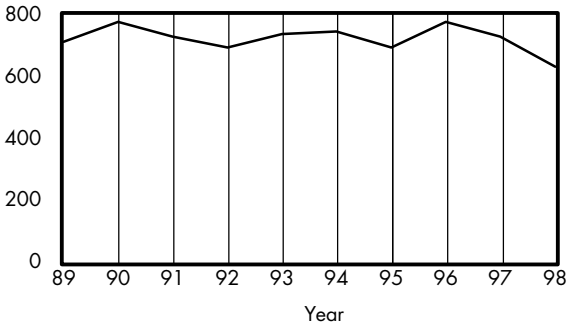
INJURIES



1989	5,050	1994	5,475
1990	4,975	1995	5,200
1991	5,675	1996	5,175
1992	5,825	1997	5,000
1993	6,300	1998	5,000

10-Year Trend = -5.4%

DOLLAR LOSS (in $ millions)*



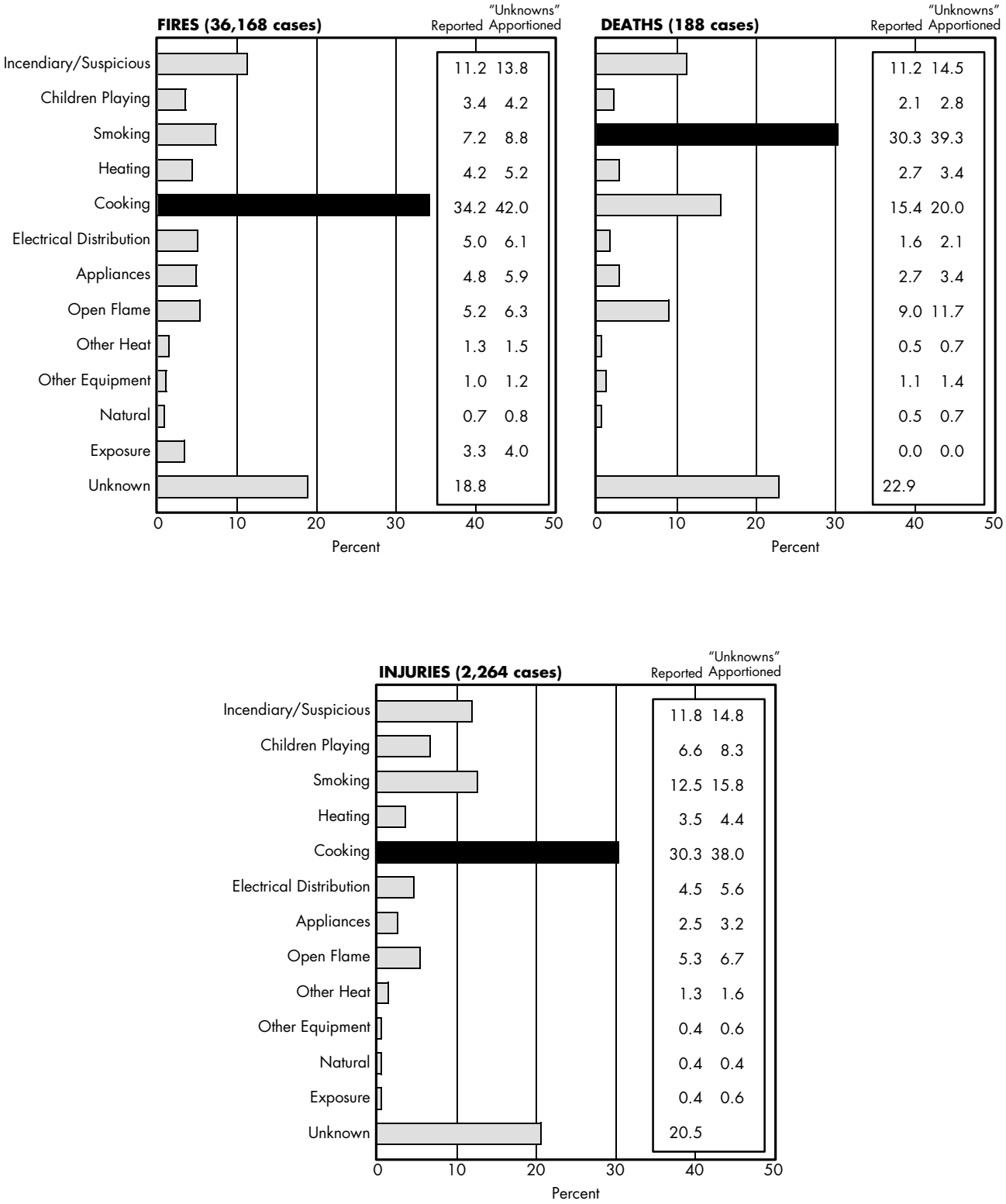
1989	$711.2	1994	$745.7
1990	777.0	1995	694.1
1991	728.8	1996	777.1
1992	693.6	1997	729.2
1993	736.6	1998	631.0

10-Year Trend = -1.1%

*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 57. TRENDS IN APARTMENT FIRES AND FIRE LOSSES



Source: NFIRS

FIGURE 58. CAUSES OF APARTMENT FIRES AND FIRE CASUALTIES (1998)

The leading cause of deaths in apartments is smoking, accounting for 39 percent of deaths. Second is cooking (20 percent), and third is arson (15 percent). These three causes account for three-quarters of all fire deaths in apartments; all other causes are relatively small, including heating. Deaths from open flame nearly doubled over 1996, but there was a threefold drop in children playing deaths.

For fire injuries, cooking was first at 38 percent, smoking second at 16 percent, and arson third at 15 percent. These three causes account for more than two-thirds of all injuries.

Figure 59 shows the trends in the leading causes of apartment fires and casualties from 1989 to 1998. The leading causes of apartment fires have not shifted significantly over the past 10 years. Cooking is still the leading cause of apartment fires and injuries by a wide margin. Smoking continues as the leading cause of apartment deaths, but the 10-year trend is down. Deaths from arson and children playing dropped sharply in 1998.

In terms of 10-year trends for the leading causes of apartment fires, cooking has decreased 13 percent and arson has decreased 18 percent. Because of the relatively small number of apartment deaths, the year-to-year curves fluctuate. Smoking deaths trended up 3 percent while arson and children playing deaths declined 49 and 50 percent, respectively. Cooking injuries were up 1 percent and open flame injuries up 35 percent. Injuries declined for arson (18 percent), children playing (23 percent), and smoking (24 percent).

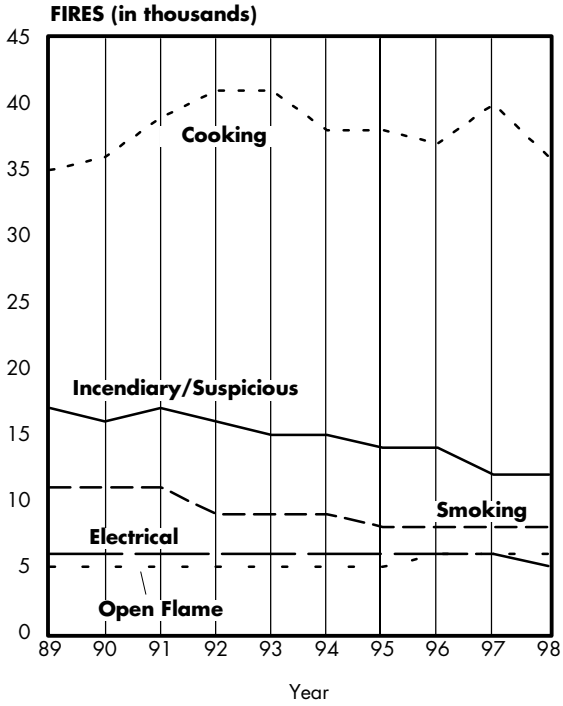
The above data suggest that fire prevention programs aimed at apartment dwellers might emphasize the risk of smoking and the danger of leaving cooking unattended.

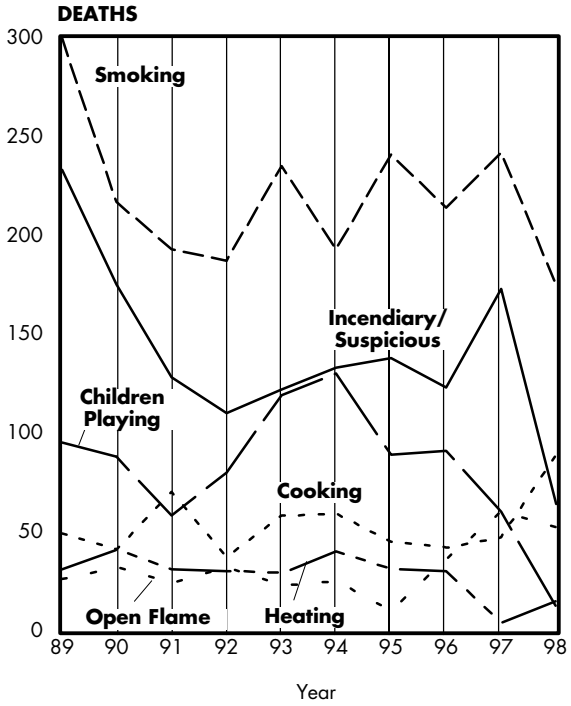
Smoke Alarm Performance

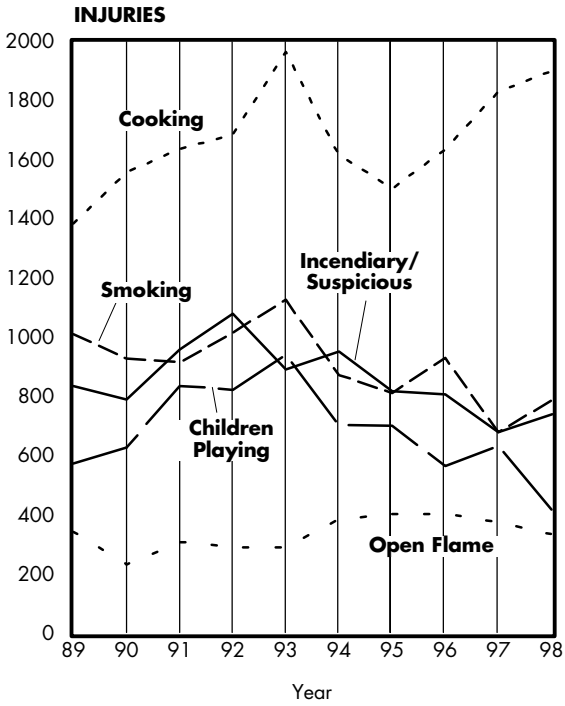
Figure 60 shows the performance of apartment smoke alarms in 1998. Alarms were present in 77 percent of apartment fires ("unknowns" apportioned). Alarms are more likely to be installed in apartments, where they are provided by landlords, than in dwellings, where the occupants/owners provide and maintain them.

The usage of alarms in apartments where fires occur (77 percent) is considerably below the national average of 90 percent of households having alarms. This is disturbing because most codes require smoke alarms in multiunit housing.

Smoke alarms were present and operating in 47 percent ("unknowns" apportioned) of fire deaths in apartments. This is 4 percent higher than in 1996. Why alarms worked and people still died may be a subject for further study. One possibility is that hallway alarms or alarms in other apartments operated after the victims were overcome. Also, apartments have fewer ways to escape, especially apartments on higher floors; at night, escaping from an apartment can be particularly confusing when people are awakened suddenly. This situation suggests the need to emphasize fire prevention to apartment dwellers. Also, the installation of sprinklers could prove highly beneficial in apartments.



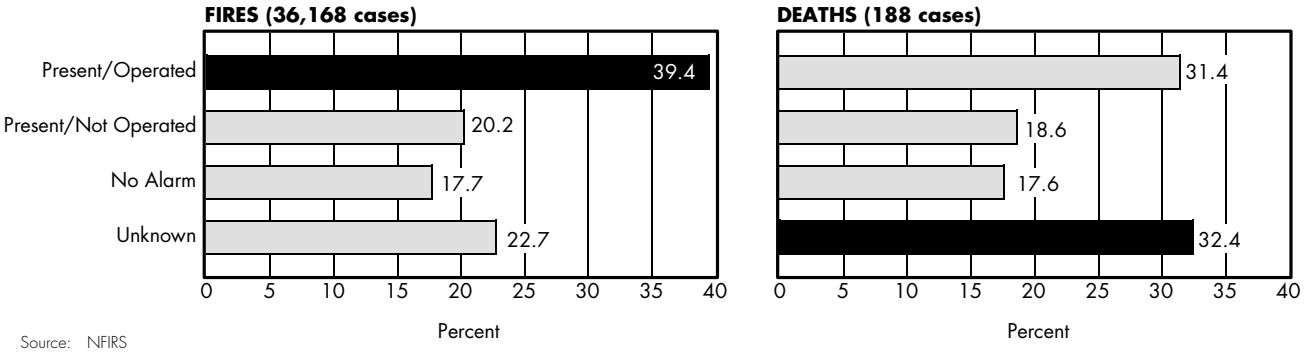




Note: Data for all 12 causes are provided in Appendix B, Table B-3.

Sources: NFIRS and NFPA

FIGURE 59. TRENDS IN LEADING CAUSES OF APARTMENT FIRES AND FIRE CASUALTIES



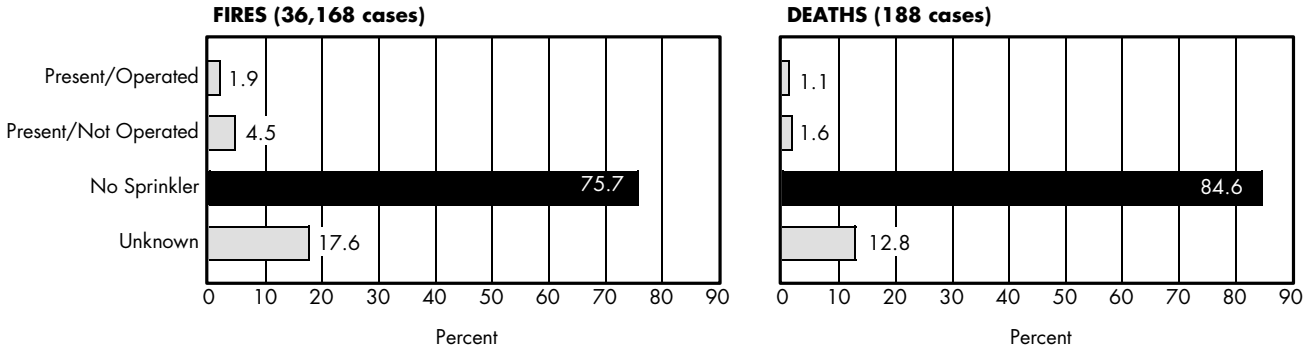
Source: NFIRS

FIGURE 60. SMOKE ALARM PERFORMANCE IN APARTMENT FIRES AND FIRE DEATHS (1998)

Alarms were present but did not operate in 28 percent ("unknowns" apportioned) of deaths. This is 56 percent higher than the rate of nonworking alarms with fatalities in one- and two-family dwellings. These statistics are unexpected as apartment alarms are more likely to be hardwired into the electrical system and professionally maintained than alarms in dwellings.

Sprinkler Performance

There were few fire deaths reported in apartment buildings where sprinklers were present and operating (Figure 61), but it is not known from NFIRS data whether the sprinklers were in the apartment of fire origin or were installed in common areas such as hallways. Overall, there are more sprinklers present in apartment fires than in dwelling fires, but the percentage is still small in 1998—8 percent ("unknowns" apportioned). Nevertheless, sprinkler installation in apartments has been slowly increasing, 6 percent since 1990.

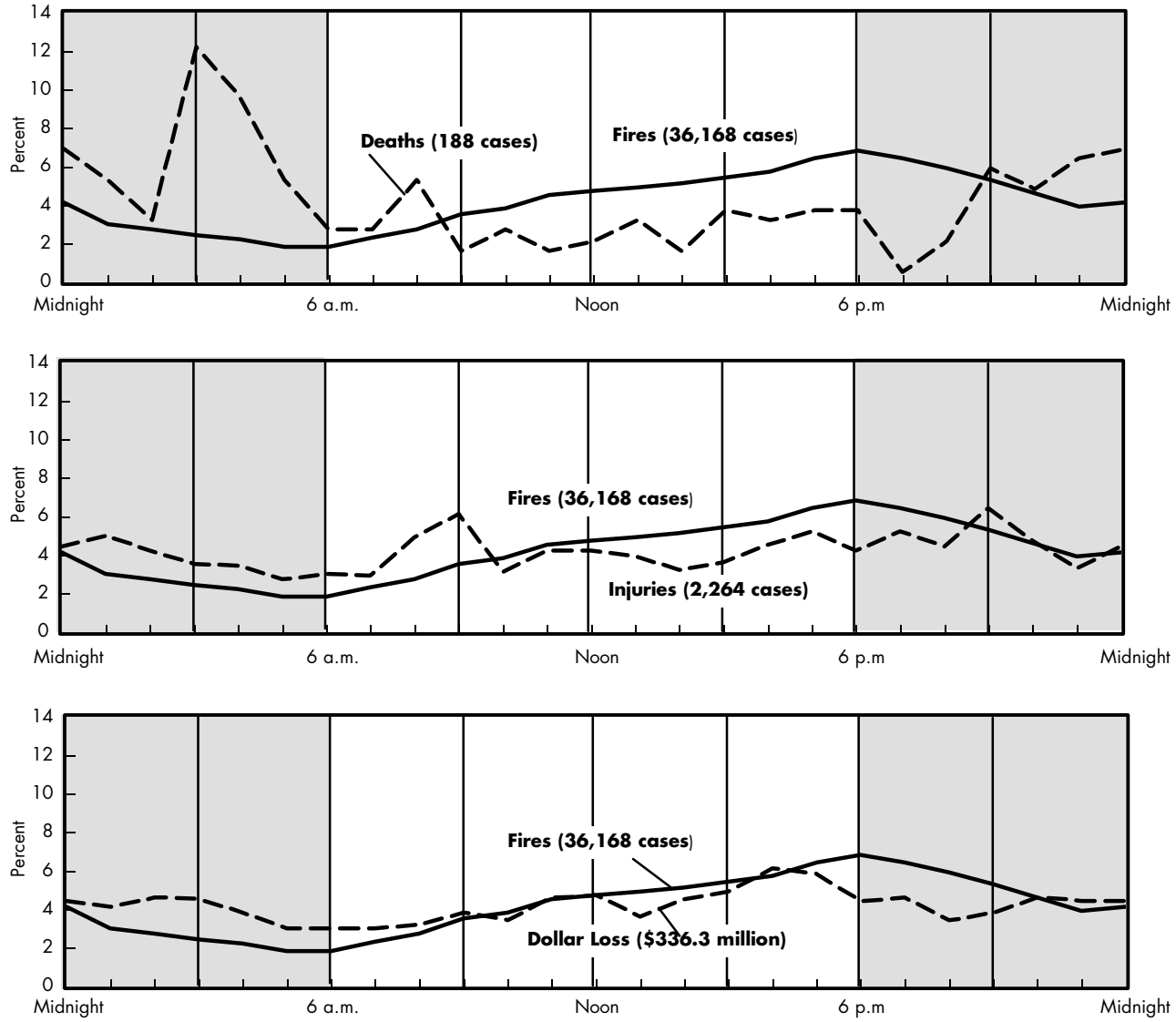


Source: NFIRS

FIGURE 61. SPRINKLER PERFORMANCE IN APARTMENT FIRES AND FIRE DEATHS (1998)

When Fires Occur

Time of Day. Figure 62 shows the alarm times for fires, deaths, injuries, and dollar loss in apartment fires. The profiles are not as smooth as those for one- and two-family dwellings due to the smaller numbers of incidents involved.



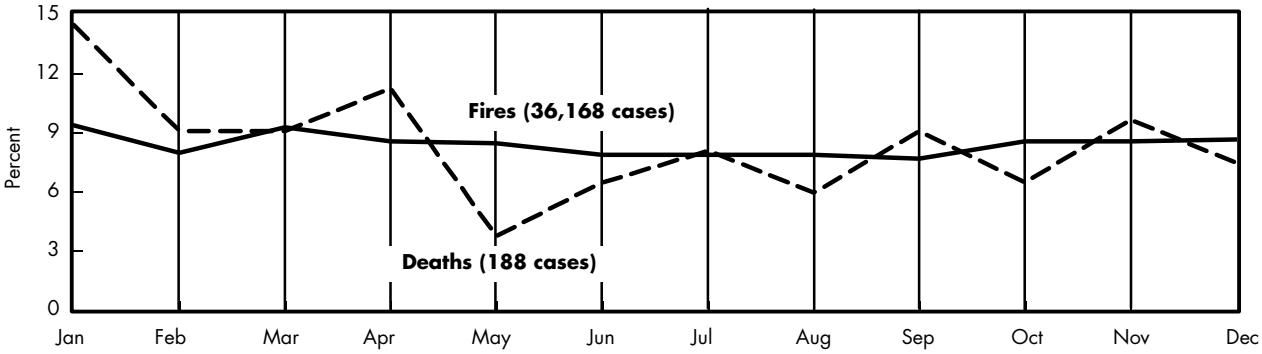
Source: NFIRS

FIGURE 62. TIME OF DAY OF APARTMENT FIRES AND FIRE LOSSES (1998)

As in one- and two-family residences, apartment fires peak from 5:00 to 8:00 p.m.—the cooking period—and are at a low from 3:00 to 7:00 a.m. The early morning hours are the most dangerous in terms of fire deaths, especially those associated with latent smoldering fires from smoking in the 8-hour period 10:00 p.m. to 6:00 a.m.; 56 percent of all deaths occur in this timeframe. The reason for the large spike in deaths between 3:00 and 4:00 a.m. is unknown.

Injuries are spread somewhat evenly throughout the day, with a peak at 9:00 to 10:00 a.m. and another from 9:00 to 10:00 p.m. Dollar loss is also fairly uniform throughout the day, closely following the curve for fires.

Month of Year. Fires in apartments are more uniform throughout the year than in dwellings because of the reduced role that heating plays (Figure 63). Still, they are somewhat more common in winter than in summer, perhaps because of heating fire problems in low-income apartments and increased indoor activity such as children playing. Other seasonal factors in addition to heating probably play a role in winter fires and deaths, such as the presence of dry Christmas trees, the use of holiday candles, or simply the greater propensity to stay indoors.



Source: NFIRS

FIGURE 63. MONTH OF YEAR OF APARTMENT FIRES AND FIRE DEATHS (1998)

Room of Fire Origin

Figure 64 shows the leading rooms where apartment fires originated in 1998. As in every year for the past 10, the kitchen is the most common place for a fire and injury; lounge areas and bedrooms are the most common rooms where a fatal fire starts because of smoking on upholstered furniture. Although the leading apartment locations of all three measures are the same as in one- and two-family dwellings, apartment kitchens have twice the percentage of fires and 11 percent more injuries.

Table 13 shows the leading locations of fire origin from Figure 64 and the leading causes of apartment fires in those locations. Table 14 is the reverse, showing the leading causes of fire by the three leading locations. Although the leading causes differ somewhat in apartments versus dwellings, the rooms for each cause are generally similar.

OTHER RESIDENTIAL PROPERTIES

Other residential properties include rooming houses, dormitories, home hotels, halfway houses, hotels and motels, and miscellaneous and unclassified properties reported as residences. Prior to 1994, the other residential properties category did not include hotels and motels in the yearly NFPA estimates of fires and fire losses; hotel/motel fires were reported separately. Since 1994, however, hotels and motels have been included as part of the other residential category. In this edition of *Fire in the United States*, other residential fires and fire losses have been recompiled to present a consistent series that includes hotels and motels. Therefore, the trends shown here are

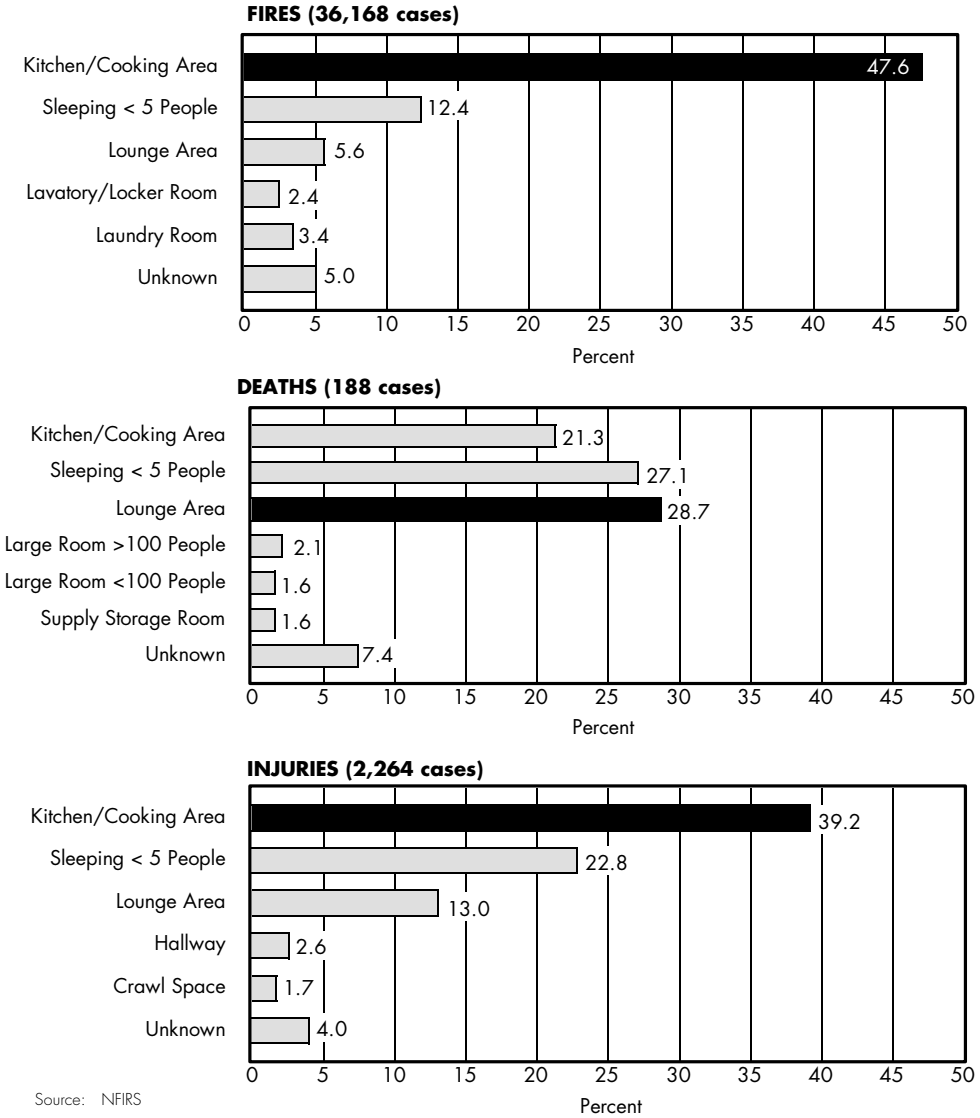


FIGURE 64. LEADING LOCATIONS OF FIRE ORIGIN OF APARTMENT FIRES AND FIRE CASUALTIES (1998)

compatible only with the previous edition of *Fire in the United States* (Eleventh). The other residential properties category does not include homes for the elderly, prisons, orphanages, or other "institutions"; these have their own categories and are addressed in Chapter 4.

Trends

Figure 65 shows that the number of deaths in the other residential category rose and fell over the 10-year period, spiking in 1993 due to the Branch Davidian Compound fire in Waco, TX (47 deaths) and the Paxton "Hotel"[10] fire in Chicago (20 deaths). Fire deaths ranged from 105 to 30 a year, with new lows in 1997 and 1998. Injuries ranged from 600 to 375 (again a new low in 1998),

[10]This hotel is actually a permanent place of residence.

TABLE 13. LEADING CAUSES OF FIRE BY LOCATION IN APARTMENTS (1998)

[The percents shown in parentheses represent (1) the actual number of reported causes/and (2) the unknown causes apportioned to these known causes]

FIRES				
Kitchen	**Sleeping Room <5**	**Lounge**	**Laundry Room**	**Lavatory/ Locker Room**
Cooking 11,993 (69.7%/85.6%)	Smoking 769 (17.2%/20.5%)	Smoking 494 (24.6%/29.1%)	Appliances 681 (55.4%/62.3%)	Open Flame 205 (23.2%/26.6%)
Incendiary/Suspicious 396 (2.3%/2.8%)	Children Playing 728 (16.3%/19.4%)	Incendiary/Suspicious 309 (15.4%/18.2%)	Incendiary/Suspicious 165 (13.4%/15.1%)	Electrical Distribution 125 (14.2%/16.2%)
Appliances 293 (1.7%/2.1%)	Incendiary/Suspicious 689 (15.4%/18.4%)	Open Flame 245 (12.2%/14.4%)	Heating 68 (5.5%/6.2%)	Smoking 100 (11.3%/13.0%)
Total Fires: 17,198 **Unknowns: 3,182**	**Total Fires: 4,467** **Unknowns: 723**	**Total Fires: 2,010** **Unknowns: 314**	**Total Fires: 1,229** **Unknowns: 136**	**Total Fires: 883** **Unknowns: 113**
DEATHS				
Lounge	**Sleeping Room <5**	**Kitchen**		
Smoking 25 (46.3%/55.6%)	Smoking 23 (45.1%/62.2%)	Cooking 27 (67.5%/79.4%)		
Open Flame 10 (18.5%/22.2%)	Open Flame 4 (7.8%/10.8%)	Smoking 4 (10.0%/11.8%)		
Incendiary/Suspicious 5 (9.3%/11.1%)	Children Playing 3 (5.9%/8.1%)	[3 causes are tied with 1 death]		
	Appliances 3 (5.9%/8.1%)			
Total Deaths: 54 **Unknowns: 9**	**Total Deaths: 51** **Unknowns: 14**	**Total Deaths: 40** **Unknowns: 6**		
INJURIES				
Kitchen	**Sleeping Room <5**	**Lounge**	**Hallway/ Corridor/Mall**	**Crawl Space**
Cooking 664 (74.9%/87.8%)	Children Playing 109 (21.2%/27.8%)	Smoking 111 (37.6%/49.8%)	Incendiary/Suspicious 47 (79.7%/85.5%)	Incendiary/Suspicious 8 (21.1%/44.4%)
Appliances 21 (2.4%/2.8%)	Smoking 95 (18.4%/24.2%)	Incendiary/Suspicious 27 (9.2%/12.1%)	Heating 4 (6.8%/7.3%)	Heating 4 (10.5%/22.2%)
Smoking 18 (2.0%/2.4%)	Incendiary/Suspicious 57 (11.0%/14.5%)	Electrical Distribution 23 (7.8%/10.3%)	Electrical Distribution 2 (3.4%/3.6%)	Electrical Distribution 4 (10.5%/22.2%)
Total Injuries: 887 **Unknowns: 131**	**Total Injuries: 517** **Unknowns: 125**	**Total Injuries: 295** **Unknowns: 72**	**Total Injuries: 59** **Unknowns: 4**	**Total Injuries: 38** **Unknowns: 20**

Note: Data here are NFIRS raw counts, not national estimates. Percentages shown are column percentages (e.g., percentages of kitchen fires, not percentages of cooking fires).

Source: NFIRS

and adjusted dollar loss from $160 to $89 million. The 10-year trends for all measures were down by double digits, with deaths plummeting 67 percent.

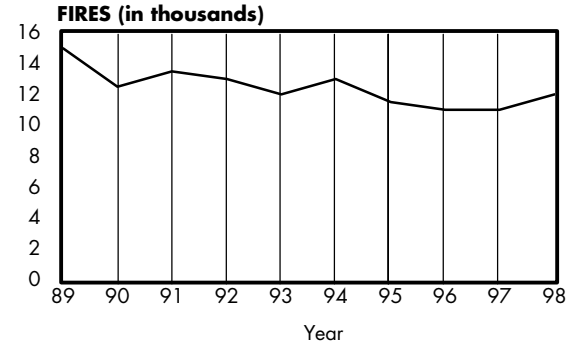
TABLE 14. LEADING LOCATIONS OF FIRE ORIGIN BY CAUSE IN APARTMENTS (1998)

[The percents shown in parentheses represent (1) the actual number of reported locations/and (2) the unknown locations apportioned to these known locations]

FIRES				
Cooking	**Incendiary/ Suspicious**	**Smoking**	**Open Flame**	**Electrical Distribution**
Kitchen 11,993 (97.1%/97.3%)	Sleeping Room <5 689 (17.0%/18.0%)	Sleeping Room <5 769 (29.7%/30.1%)	Sleeping Room <5 486 (26.1%/26.4%)	Sleeping Room <5 486 (27.0%/27.4%)
Exterior Balcony/ Open Porch 94 (0.8%/0.8%)	Hallway/Corridor 397 (9.8%/10.4%)	Lounge 494 (19.1%/19.3%)	Lounge 245 (13.1%/13.3%)	Lounge 231 (12.9%/13.0%)
Dining Area 43 (0.3%/0.3%)	Kitchen 396 (9.8%/10.3%)	Kitchen 203 (7.8%/7.9%)	Kitchen 211 (11.3%/11.5%)	Kitchen 145 (8.1%/8.2%)
Total Fires: 12,356 **Unknowns: 24**	**Total Fires: 4,059** **Unknowns: 232**	**Total Fires: 2,590** **Unknowns: 35**	**Total Fires: 1,864** **Unknowns: 25**	**Total Fires: 1,797** **Unknowns: 25**
DEATHS				
Smoking	**Cooking**	**Incendiary/ Suspicious**	**Open Flame**	
Lounge 25 (43.9%/43.9%)	Kitchen 27 (93.1%/93.1%)	Lounge 5 (23.8%/27.8%)	Lounge 10 (58.8%/62.5%)	
Sleeping Room <5 23 (40.4%/40.4%)	Supply Storage Room 2 (6.9%/6.9%)	Sleeping Room <5 2 (9.5%/11.1%)	Sleeping Room <5 4 (23.5%/25.0%)	
Kitchen 4 (7.0%/7.0%)		Interior Stairway 2 (9.5%/11.1%)	Dining Area 1 (5.9%/6.3%)	
		Exterior Wall Surface 2 (9.5%/11.1%)	Lavatory/Locker Room 1 (5.9%/6.3%)	
Total Deaths: 57 **Unknowns: 0**	**Total Deaths 29** **Unknowns: 0**	**Total Deaths: 21** **Unknowns: 3**	**Total Deaths: 17** **Unknowns: 1**	
INJURIES				
Cooking	**Smoking**	**Incendiary/ Suspicious**	**Children Playing**	**Open Flame**
Kitchen 664 (96.9%/97.1%)	Lounge 111 (39.1%/39.6%)	Sleeping Room <5 57 (21.3%/23.4%)	Sleeping Room <5 109 (72.7%/72.7%)	Sleeping Room <5 46 (38.3%/38.7%)
Product Storage Area 4 (0.6%/0.6%)	Sleeping Room <5 95 (33.5%/33.9%)	Hallway/Corridor/Mall 47 (17.6%/19.3%)	Lounge 16 (10.7%/10.7%)	Lounge 22 (18.3%/18.5%)
Exterior Balcony/ Open Porch 4 (0.6%/0.6%)	Kitchen 18 (6.3%/6.4%)	Lounge 27 (10.1%/11.1%)	Closet 7 (4.7%/4.7%)	Lavatory/Locker Room 14 (11.7%/11.8%)
Court/Terrace/Patio 4 (0.6%/0.6%)				
Total Injuries: 685 **Unknowns: 1**	**Total Injuries: 284** **Unknowns: 4**	**Total Injuries: 267** **Unknowns: 23**	**Total Injuries: 150** **Unknowns: 0**	**Total Deaths: 120** **Unknowns: 1**

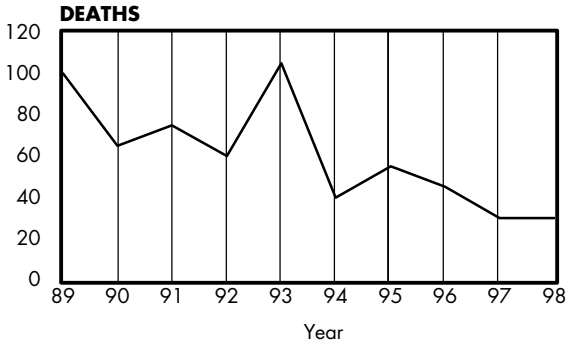
Note: Data here are NFIRS raw counts, not national estimates. Percentages shown are column percentages (e.g., percentages of cooking fires, not percentages of kitchen fires).

Source: NFIRS



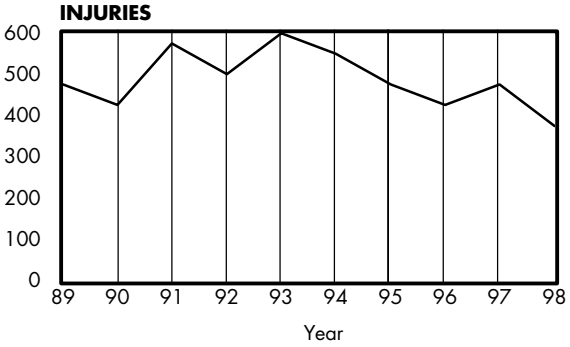
1989	15.0	1994	13.0
1990	12.5	1995	11.5
1991	13.5	1996	11.0
1992	13.0	1997	11.0
1993	12.0	1998	12.0

10-Year Trend = -21.0%



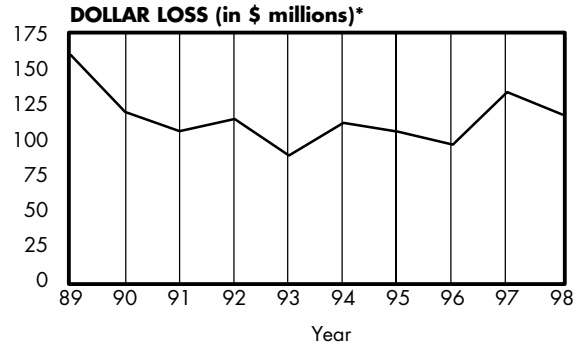
1989	100	1994	40
1990	65	1995	55
1991	75	1996	45
1992	60	1997	30
1993	105	1998	30

10-Year Trend = -66.5%



1989	475	1994	550
1990	425	1995	475
1991	575	1996	425
1992	500	1997	475
1993	600	1998	375

10-Year Trend = -14.8%



1989	$160.4	1994	$112.2
1990	119.7	1995	105.9
1991	106.5	1996	96.6
1992	115.0	1997	134.1
1993	89.1	1998	118.0

10-Year Trend = -14.6%

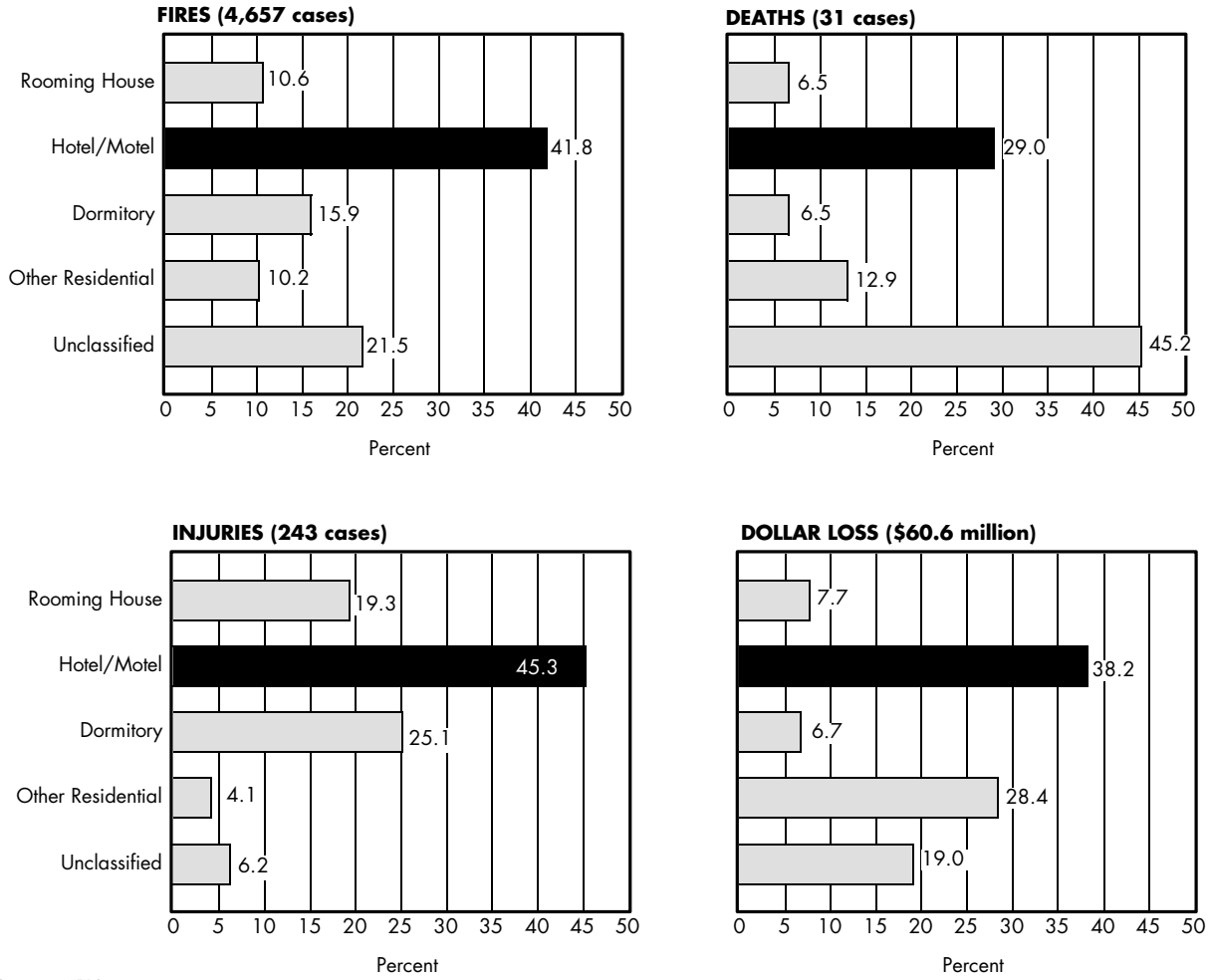
*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 65. TRENDS IN OTHER RESIDENTIAL PROPERTY FIRES AND FIRE LOSSES

Property Types

Figure 66 shows that hotels and motels in 1998 accounted for more fires, deaths, injuries, and dollar loss than all of the miscellaneous other residential categories combined, but far less than one- and two-family dwellings or apartments.

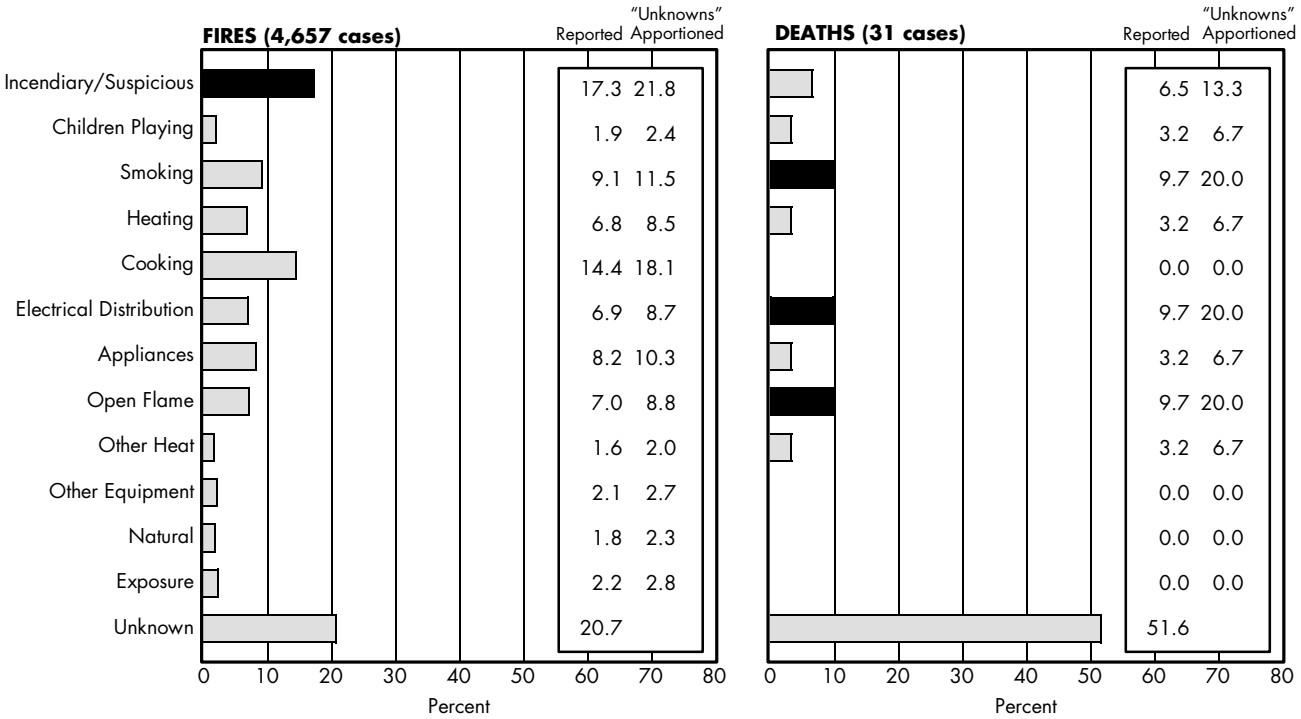


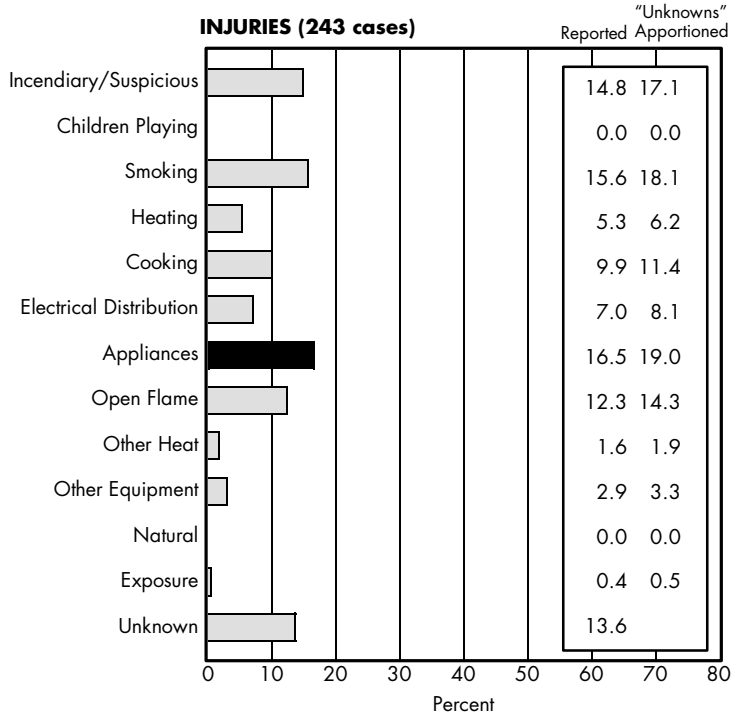
Source: NFIRS

FIGURE 66. OTHER RESIDENTIAL PROPERTY FIRES AND FIRE LOSSES BY PROPERTY TYPE (1998)

Causes

As in 1990, 1994, and 1996, arson was the leading cause of fires in other residential occupancies in 1998 (Figure 67). Because of the relatively small numbers of deaths and injuries, no one cause stands out from the others. Additionally, the cause of death was not reported in more than half of the cases.





Source: NFIRS

FIGURE 67. CAUSES OF OTHER RESIDENTIAL PROPERTY FIRES AND FIRE CASUALTIES (1998)

Hotels and Motels

Because of the large reduction in the number of hotel and motel fires and fire losses, NFPA no longer tabulates this residential category separately. Although national numbers are no longer available for hotels and motels, NFIRS data are still tabulated separately and allow for the determination of the causes of hotel and motel fires, deaths, and injuries.

Causes. Cooking is the leading cause of fires in hotels/mobels, but these usually originate in the hotel's centralized restaurant, not in the guest rooms (Figure 68). Most other fires originate in guest rooms. Here, the leading causes tend to be careless acts that guests can commit in hotel rooms. These acts are often intentional acts (arson, the second leading cause) by employees or guests. Other causes are appliance fires and smoking fires. Heating fires are less a cause in hotels than in other dwellings because heating systems are centralized and professionally maintained.

Only 9 hotel fire deaths were reported to NFIRS in 1998. Arson and appliances are tied as the leading cause of hotel injuries.

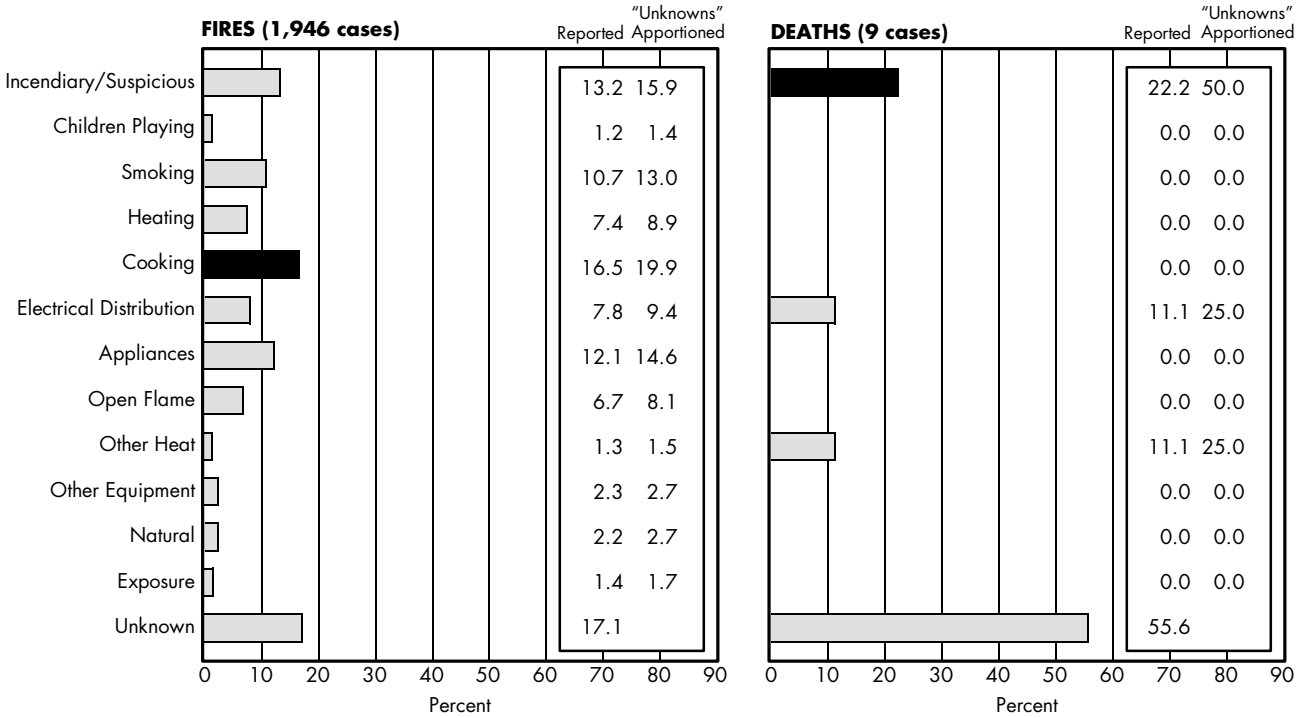
Trends. Causes of hotel and motel fires, deaths, and injuries change from year to year because of the small numbers of fires, deaths, and injuries associated with this residential category. Table 15 compares the top three causes of fires, deaths, and injuries from four editions of *Fire in the United States* in which these data were presented.

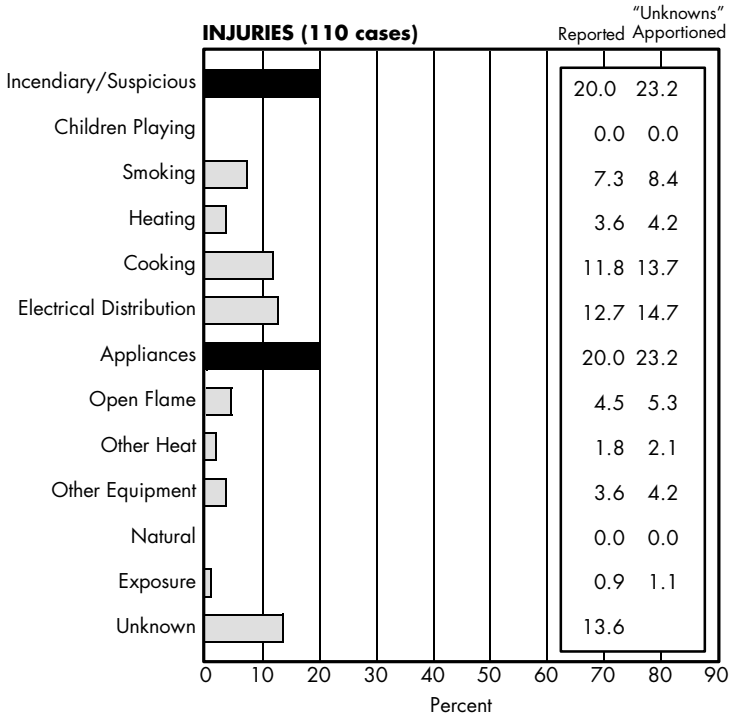
Although the causes shift from year to year, arson, smoking, cooking, and appliances are recurring causes in hotel and motel fires, deaths, and injuries. The hotel and motel industry has instituted major changes such as built-in fire protection systems and employee fire-awareness programs that have been instrumental in the overall decline of hotel and motel fire statistics.

TABLE 15. LEADING CAUSES OF HOTEL AND MOTEL FIRES AND CASUALTIES

Rank	1990	1994	1996	1998
FIRES				
1	Arson	Arson	Cooking	Cooking
2	Smoking	Cooking	Arson	Arson
3	Cooking	Appliances	Smoking	Appliances
DEATHS				
1	Arson/Smoking	Smoking	Smoking	Arson
2	Heating	Cooking/ Electrical Distribution/ Other Heat	Arson	Electrical Distribution/ Other Heat
3	Children Playing	N/A	Other Equipment	N/A
INJURIES				
1	Arson	Smoking	Arson	Arson/Appliances
2	Smoking	Arson	Smoking	Electrical Distribution
3	Cooking	Cooking	Appliances	N/A

Source: NFIRS





Source: NFIRS

FIGURE 68. CAUSES OF HOTEL/MOTEL FIRES AND FIRE CASUALTIES (1998)

USFA RESOURCES ON FIRES IN RESIDENCES

The vast majority of civilian fire deaths and injuries continue to occur in residences. Residential occupancies also account for the largest annual dollar loss, and more firefighter injuries occur fighting fires in residences than in any other property type. For these reasons, the USFA has a variety of initiatives that focus on reducing residential fires and the deaths and injuries that they cause.

Public fire education is a cornerstone of USFA's fire prevention programs. USFA continues to provide public fire education programs to the state and local levels by developing public education tools, public awareness campaigns, and technical materials. USFA also promotes school system acceptance of fire safety education in K–12 and encourages private sector commitment and support for community fire prevention.

Many of the following topics are addressed at USFA's Web site http://www.usfa.fema.gov.

Publications

To support and encourage public fire education, USFA has developed a series of public awareness campaign kits. Each campaign kit has a variety of high-quality, ready-to-use materials for use by educators, community organizations, fire departments, and the private sector. Most campaigns promote home fire safety, primarily in one- and two-family dwellings where 70–75 percent of residential fires, deaths, and dollar loss occur.

The USFA also produces a number of materials designed to improve the quantity and quality of public fire education efforts throughout the country. *Leadership in Public Fire Safety Education—2000* (#FA–135) presents the findings of a national public education conference held at the National Emergency Training Center. The *Directory of National Community Volunteer Fire Prevention Programs* (#FA–92) is a catalog of local fire safety education programs addressing such issues as fire and burn prevention in the home, eliminating hazards, surviving and escaping fire, equipping the home with smoke alarms and fire extinguishers, and properly using home heating devices. *America Burning* and the updated version, *America Burning Revisited*, emphasize the importance of fire prevention and put it on the same level of importance as fire suppression. The *Juvenile Firesetter Intervention Handbook* (#FA–210) offers concrete strategies on how to recognize a problem, interview children and their families, educate children not to set fires, and determine when a case calls for referral to a mental health professional. And finally, USFA offers the *Fire Safety Education Resource Directory* (#FA–172) as a compendium of materials that may be useful in building and supplementing a public education program for fire safety.

Many other valuable reports and books are produced and endorsed by USFA. The following list is by no means exhaustive, but it is intended to highlight some of the USFA literature not cited in other chapters:

Board and Care Facility Evacuation Guide
Escape From Fire—Once You're Out Stay Out! (#L–192)
Get Out and Stay Alive Fire Safety Brochure (#L–234)
Is Your Home Fire Safe? Door Knob Hanger (#L–227)

Protecting Your Family From Fire (#FA–130)
Rural Arson Control (#FA–87)
The Rural Fire Problem in the United States (#FA–180)

Two children's publications pertaining to fire safety are:

Let's Have Fun With Fire Safety: Exty and Hydro's Activity Book (#FA–189)
Sesame Street Fire Safety Station Kit (#FA–165)

These USFA publications are available by writing to:

United States Fire Administration
Publications Center
16825 South Seton Avenue
Emmitsburg, MD 21727

Please include the parenthetical publication number, if given, in your request.

Documents may also be ordered via the USFA Web site http://www.usfa.fema.gov/usfapubs or through the USFA Publications Center's toll-free number (800) 561–3356. USFA publications are free of charge.

The *Topical Fire Research* series for residential fires problem can be downloaded from http://www.usfa.fema.gov/nfdc/reports.htm, including:

Candle Fires in Residential Structures
Christmas/Christmas Tree Fires
Dormitory Fires
Fraternity and Sorority House Fires
Heating Fires in Residential Structures
Portable Heating Fires in Residential Structures
Residential Structure Fires on Agricultural Properties
Smoke Alarm Performance in Residential Structure Fires
Winter Residential Fires

National Fire Academy Courses

In the 20-year history of its National Fire Academy (NFA), the USFA has educated more than 1,300,000 people in fire-related courses. The NFA works to enhance the ability of the fire service and allied professions to deal more effectively with fire and related emergencies. Courses are delivered on campus at the resident facility in Emmitsburg, Maryland, and off campus throughout the nation in cooperation with state and local fire training officials and local colleges and universities. An initiative begun in 1992 offers NFA resident courses on a regional basis.

Although issues related to fires in residences and fire prevention are addressed in numerous academy courses, several offerings include these issues as a major topic. The key to fire prevention is education. NFA offers several courses in how to educate the public on life safety issues such as *Presenting Effective Public Education Programs* (#R116). This is a 5-day course that provides fundamental knowledge, skills, and attitudes to deliver fire and life safety educational programs in the

community. Other courses include *Management of Fire Prevention Programs* (#R225), *Discovering the Road to High-Risk Audiences* (#R119), *Developing Fire and Life Safety Strategies* (#R352), and *Community Education Leadership* (#R343 and #R816).

Strategic Analysis of Community Risk Reduction (#R309) is a 2-week course that provides senior fire executives with vital information necessary to implement community-wide, risk-reduction activities. The course includes contemporary approaches that emergency service organizations can use successfully to compete for dwindling resources, mechanisms to gather and analyze critical life safety data, and proven actions to target community injury reduction.

Arson is a critical problem in residential fires. The NFA offers senior courses in arson prevention issues. *Management for Arson Prevention and Control* (#R207) focuses on innovative concepts and practical skills for managing a synergistic response to arson prevention and control. NFA also offers numerous courses in both the management and the technical sides of fire prevention. Other courses include *Fire/Arson Investigation* (#R205)*, Fire Cause Determination for Company Officers*, (#R811), and *Interviewing–Interrogation Techniques and Courtroom Testimony* (#R208).

To complement the full range of duties of fire officers and firefighters, the NFA offers such courses as *Code Management: A Systems Approach* (#R101). Although requiring previous fire prevention experience, this course focuses on the management of code development, evaluation, and enforcement processes. *Fire Inspection Principles* (#R220) provides the student with the fundamental information, ability, and comprehension to conduct both basic and intermediate-level fire safety inspections. *Principles of Fire Protection: Structures and Systems* (#R222) provides the student with the advanced understanding, expertise, and demeanor to conduct detailed fire safety inspections, analyze the level of fire and life safety in buildings, and understand operating principles, application, acceptance and testing, and inspection of fire protection systems and equipment. Other courses include *Fire Service Course Design* (#R114), *Training Program Management* (#R342), and *Challenges for Local Training Officers* (#R815).

Information on NFA course offerings can be obtained at http://www.usfa.fema.gov/nfa. Or for additional descriptions of course offerings, eligibility, and application procedures, write to:

U.S. Fire Administration
National Fire Academy
16825 South Seton Avenue
Emmitsburg, MD 21727

Campaign Materials

The USFA has developed a series of public awareness campaign kits containing high-quality materials for use by educators, community organizations, fire departments, and the private sector. The current public education initiative, *Fire Stops With You*, is a compilation of 5 years' worth of research that targets fire safety through empowerment: the individual's behavior is what must be

addressed to prevent fire. It includes radio and print public service announcements (PSAs), factsheets, and technical reports.

Most campaigns promote home fire safety, primarily in one- and two-family houses. A recent campaign, *Home Fire Safety: Act On It,* was developed in cooperation with the Sleep Products Safety Council, the National Association of Broadcasters, the National Board of Realtors, and the "Just Say No" campaign. It contains materials on general home fire safety themes, and includes radio and print PSAs, sample letters to the editor, a fill-in-the-blank press release, factsheets, and a resource guide. The factsheets and other fire safety information can be downloaded from http://www.usfa.fema.gov/safety.

Major Fires Investigations

The USFA also conducts special studies to address specific problems and current issues facing the nation's fire and rescue service. The technical reports produced under the Major Fires Investigations series analyze major or unusual fires with emphasis on sharing lessons learned. They are directed primarily at chief officers, training officers, fire marshals, and investigators as a resource for training and prevention.

One- and Two-Family Dwellings:

Children Left Home Alone: Eleven Die in Two Fires, Detroit, MI, February 1993 (#TR070)
CPSC Guide To Home Wiring Hazards
Eight Children and Two Adults Die in Rural House Fire, Remer, MN, January 1989 (#TR028)
Eight-Fatality Row House Fire: Lessons Learned from Residential Fires With Five or More Fatalities, Chester, PA, December 1992 (#TR067)
Four House Fires That Killed 28 Children, September–December 1987 (#TR020)
Nine-Fatality Mobile Home Fire, Maxton, NC, November 1989 (#TR037)
Power Off to Hard-Wired Detector in Nine-Fatality House Fire, Peoria, IL, April 1989 (#TR031)
Seven-Fatality Christmas Tree Fire, Canton, MI, December 1990 (#TR046)
Seven-Fatality Fire at Remote Wilderness Lodge, Grand Marais, MN, July 1991 (#TR055)

Apartments:

Apartment Building Fire—East 50th Street, New York City, January 1988 (#TR019)
Apartment Complex Fire, 66 Units Destroyed, Seattle, WA, September 1991 (#TR059)
Fire, Police, and EMS Coordination at Apartment Building Explosion, New York City, November 1992 (#TR068)
Kona Village Apartments Fire, Bremerton, WA, November 1997 (#TR121)
Operational Considerations for Highrise Firefighting (#TR082)
Nine-Fatality Apartment House Fire, Ludington, MI, February 1993 (#TR072)
Old Buckingham Station, Chesterfield, VA, May 1995 (#TR105)
Schomberg Plaza Fire, New York City, Harlem, March 1987 (#TR004)

Hotels and Motels:

Doubletree Hotel Fire, New Orleans, LA, July 1987 (#TR008)
Five-Fatality Residential Motel Fire, Thornton, CO, January 1997 (#TR104)
LaPosada Hotel Fire, McAllen, TX, February 1987 (#TR001)
National Guard Plane Crash at Hotel Site, Evansville, IN, February 1992 (#TR064)
Nine Elderly Fire Victims in Residential Hotel, Miami Beach, FL, April 1990 (#TR041)

Ramada Inn Air Crash and Fire, Wayne Township, IN, October 1987 (#TR014)
St. George Hotel Complex 16 Alarm Fire, Brooklyn, NY, August 1995 (#TR108)

The USFA has worked diligently in the implementation of PL 101–391, The Hotel/Motel Fire Safety Act of 1990. By working closely with the American Hotel and Motel Association and the National Association of State Fire Marshals, USFA provided a range of support services to states to help them identify facilities that meet the fire safety requirements of the Act. Links to these associations are at the USFA Web site (http://www.usfa.fema.gov/hotel).

Other Residential Properties:

Board and Care Facility Evacuation Guide
Class A Foam for Structural Firefighting (#TR083)
College Dormitory Fires in Dover, Delaware, and Farmville, Virginia, April 1987 (#TR006)
Compressed Air Foam Use for Structural Fire Fighting: A Field Test, Boston Fire Department, June 1993 (#TR074)
Fire-Safe Student Housing: A Guide for Campus Housing Administrators
Hospital Fire Kills Four Patients, Southside Regional Medical Center, Petersburg, VA, December 1994 (#TR080)
Shenandoah Retirement Home Fire, Roanoke County, VA, December 1989 (#TR038)
Sixteen-Fatality Fire in Highrise Residence for the Elderly, Johnson City, TN, December 1989 (#TR039)
Spanish/English Door Knob Hanger
Success Story at Retirement Home Fire, Sterling, VA, December 1989 (#TR040)
Ten Elderly Fire Victims From Intermediate Care Facility Fire, Colorado Springs, CO, March 1991 (#TR–050)
Ten-Fatality Board and Care Facility Fire, Detroit, MI, June 1992 (#TR066)
Twelve-Fatality Nursing Home Fire, Norfolk, VA, October 1989 (#TR034)
Two-Fatality Board and Care Facility Fire, Salvation Army Rehabilitation Center, Miami, FL (#TR090)
Winter Fires—Safety Tips for the Home (#L–097)

Residential Sprinklers

The USFA has done extensive research to develop installation and application standards for quick-acting residential sprinklers and has conducted a variety of demonstrations of the quick-response sprinkler technology to demonstrate the practicality of these systems. The USFA also worked with Factory Mutual and Underwriters Laboratories to design and test new limited-water-supply fire sprinkler systems for manufactured housing.

An Ounce of Prevention (#FA–76) is an 18-page booklet for homeowners, insurance underwriters, building designers and developers, legislators, and building officials. The booklet provides a comprehensive discussion of why and how the combination of automatic sprinklers and early warning systems in all types of buildings can have a major impact on fire-related deaths injuries and property loss. Another report of note is *Home Fire Protection—Residential Fire Sprinkler Systems* (#FA–43), a five-page pamphlet for the general public explaining the merits of home sprinklers and the financial and insurance benefits.

Other USFA reports on residential sprinklers include:

Backflow Protection for Residential Sprinkler Systems
Board and Care Homes: Sprinklered vs. Nonsprinklered
Reducing America's Fire Losses With Residential Fire Sprinkler Systems

4 Non-Residential Properties

This chapter addresses non-residential properties over the 10-year period from 1989 to 1998, with specific focus on 1998. Significant changes from the last published statistics on non-residential properties—the Eleventh Edition, 1987–1996—are noted. Non-residential properties are discussed in three segments: structures, vehicles, and outside/other fires.

The non-residential property category includes industrial and commercial properties, institutions (such as hospitals, nursing homes, prisons), educational establishments (from preschool through university), mobile properties, and properties that are vacant or under construction. Each category corresponds to one of the major divisions of the *NFPA 901 Uniform Coding for Fire Protection* system used by NFIRS. Each is quite different, and their cause profiles and magnitudes need to be examined separately.

NON-RESIDENTIAL STRUCTURES

Magnitude and Trends

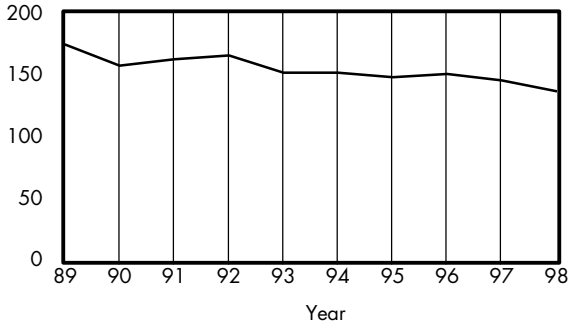
Significant public and private fire prevention efforts have focused on protecting non-residential structures. The results have proven effective in the main, especially relative to the residential fire problem. Non-residential structures annually account for only 8–9 percent of fires, 4–7 percent of deaths, and 11–14 percent of injuries (Chapter 2, Figure 27). These properties, however, account for a disproportionally large annual dollar loss, 31–47 percent.

An average of 154,000 fires occur in non-residential structures each year. These result in an average of 187 deaths, 2,963 injuries, and $2.9 billion in property loss per year. Figure 69 shows that the trend for each of these measures is down significantly (fires, 17 percent; deaths, 37 percent; injuries, 28 percent; and dollar loss, 49 percent). In absolute numbers, fires, injuries, and dollar loss reached new lows in 1998.

Deaths increased from the 1997 low of 120 to 170 in 1998. The two high peaks were in 1990 (285 deaths) and 1995 (290 deaths). The latter can be attributed to the 165 people killed in the bombing of the Federal Building in Oklahoma City in 1995, and the former can be attributed to 87 people killed in a 1990 New York City social club fire.

Figure 70 shows the relative magnitude of the fire problem in non-residential structures by each of ten property categories. Nearly half of the reported non-residential property fires in 1998 were at stores and offices, storage facilities, and outside or unknown structures. This follows the same pattern as in 1994 and 1996. Fires at these property types resulted in 52 percent of the non-residential structure deaths.

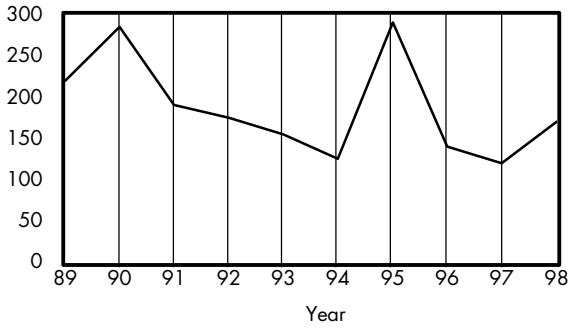
FIRES (in thousands)



1989	174.5	1994	151.5
1990	157.0	1995	148.0
1991	162.5	1996	150.5
1992	165.5	1997	145.5
1993	151.5	1998	136.6

10-Year Trend = -17.3%

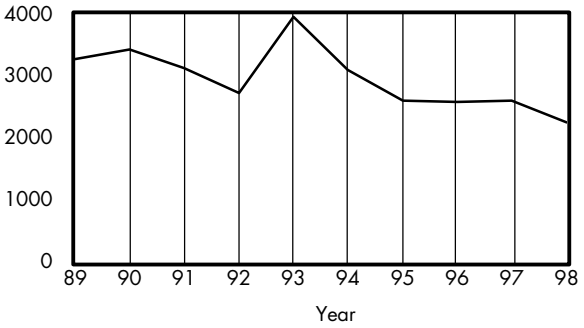
DEATHS



1989	220	1994	125
1990	285	1995	290
1991	190	1996	140
1992	175	1997	120
1993	155	1998	170

10-Year Trend = -36.7%

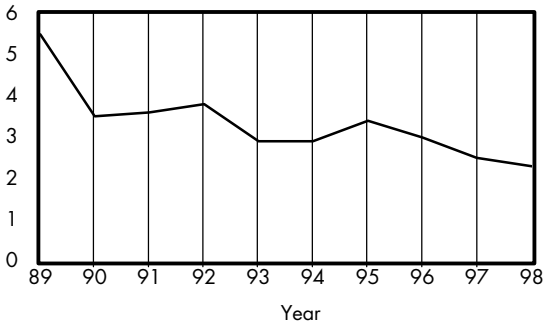
INJURIES



1989	3,275	1994	3,100
1990	3,425	1995	2,600
1991	3,125	1996	2,575
1992	2,725	1997	2,600
1993	3,950	1998	2,250

10-Year Trend = -27.7%

DOLLAR LOSS (in $ billions)*



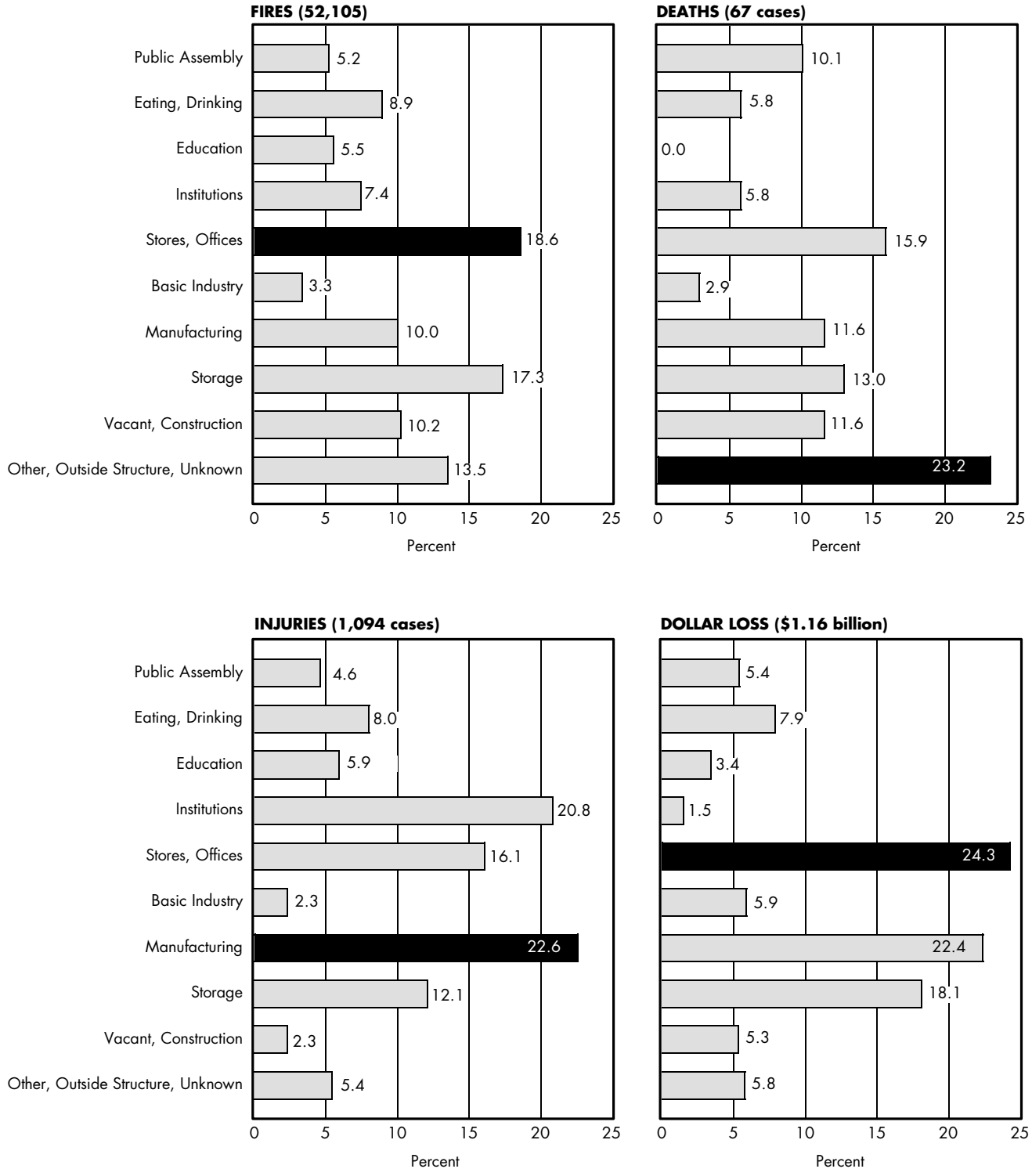
1989	$5.5	1994	$2.9
1990	3.5	1995	3.4
1991	3.6	1996	3.0
1992	3.8	1997	2.5
1993	2.9	1998	2.3

10-Year Trend = -49.0%

*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 69. TRENDS IN NON-RESIDENTIAL STRUCTURE FIRES AND FIRE LOSSES



Source: NFIRS

FIGURE 70. NON-RESIDENTIAL STRUCTURE FIRES AND FIRE LOSSES BY PROPERTY TYPE (1998)

Store and office structures have the most fires and highest dollar losses. Injuries are greatest in manufacturing property fires. The second leading structure in terms of number of fires is storage properties, which ranked first in 1996. Storage facilities also had the highest number of fatalities in 1996, but dropped to third in 1998.

Sixty-five percent of the economic loss results from three structure types: stores and offices, manufacturing plants, and storage facilities. As shown in Table 16, the loss per manufacturing fire is $50,000. Industrial fires result in the second highest loss per fire at $39,000.

The low rank ordering of some property categories should not obscure the fact that all of the categories have thousands of fires, multimillions of dollar loss, and hundreds of casualties. All parts of the fire problem need to be addressed. The relative magnitudes might help suggest where the greatest effort is needed.

TABLE 16. NON-RESIDENTIAL STRUCTURE DOLLAR LOSS PER FIRE (1998)

Property Type	$ Loss/Fire
Public Assembly	$23,078
Eating, Drinking	19,768
Education	12,713
Institutions	4,466
Stores, Offices	29,161
Basic Industry	39,254
Manufacturing	50,311
Storage	23,378
Vacant, Construction	11,536
Outside Structures, Unknown	9,606

Source: NFIRS

When Fires Occur

Time of Day. Non-residential structure fires peak in the afternoon from noon to 6 p.m. (Figure 71). Perhaps this is when workers are tiring on their job and are more accident prone or careless, but that is speculation. Non-residential structure fires are a heterogeneous category, and the time of day when each of its different component property types peak may not agree with the overall picture. The incidence of all fires has the smoothest curve because it is based on the largest sample.

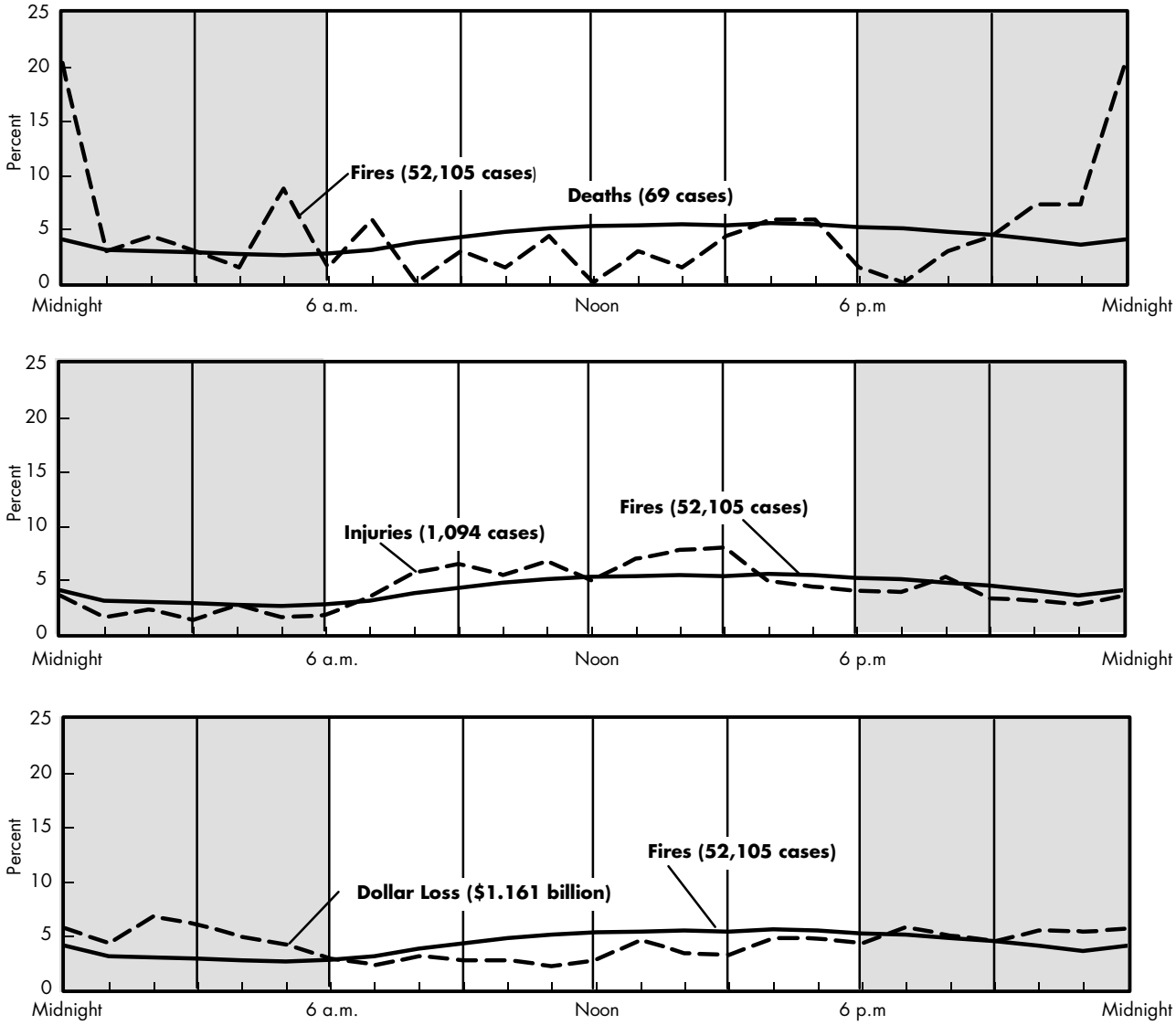
Fire deaths fluctuate wildly by time of day because of the relatively small number of deaths in most 1-hour intervals. Twenty-one percent of fatalities (or 14 deaths) were recorded between midnight and 1 a.m. in 1998. This spike is unique from previous editions of this report. It is not known whether a large portion of these deaths were from one or two major fires.

Injuries roughly track the time of fires. Injuries peak at 3–4 p.m., 4 hours later than in 1996. Fire injuries are low at night and early morning when the majority of the workforce is at home.

Peak dollar losses occur after hours, especially between 10 p.m. and 5 a.m. The leading cause, incendiary or suspicious, occurs mostly at night. These fires often cause significant damage before they are detected and reported to the fire department.

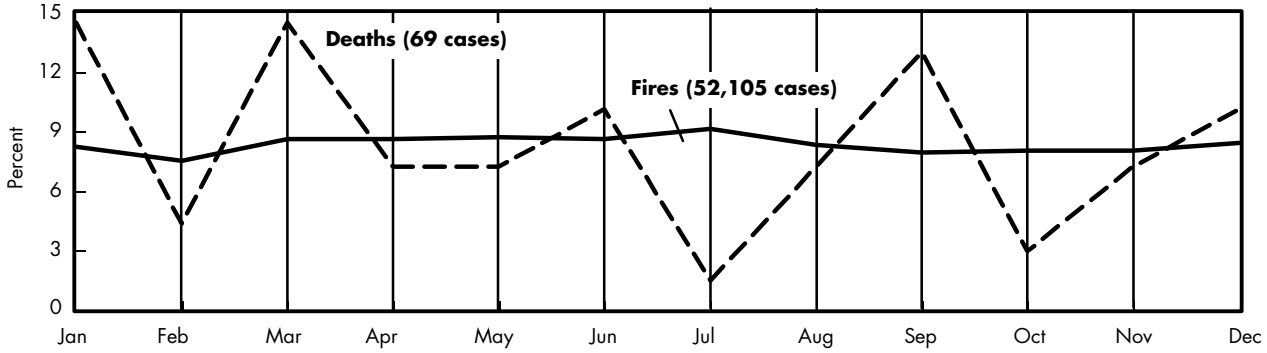
Month of Year. Fires in non-residential properties continue to be relatively uniform throughout the year (Figure 72). The pattern for deaths is erratic because of their relatively small numbers.

Day of Week. Non-residential fires are nearly uniform by weekday, but drop off on weekends when fewer people are at work (Figure 73). This point is further illustrated by the death trend, where less than 12 percent of deaths occur over weekends. However, the patterns for fire in the different subcategories, such as restaurants, would probably be less steady throughout the week.



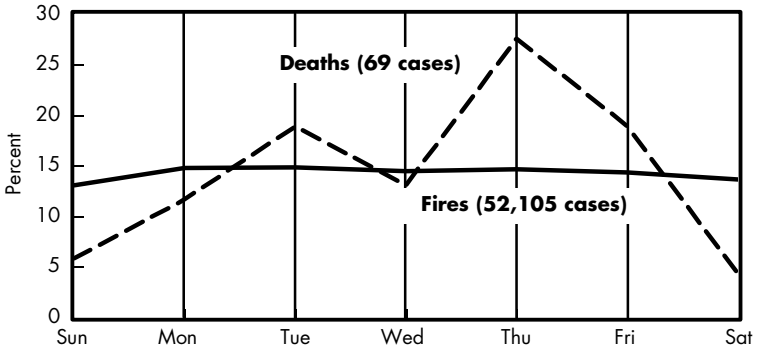
Source: NFIRS

FIGURE 71. TIME OF DAY OF NON-RESIDENTIAL STRUCTURE FIRES AND FIRE LOSSES (1998)



Source: NFIRS

FIGURE 72. MONTH OF YEAR OF NON-RESIDENTIAL STRUCTURE FIRES AND DEATHS (1998)



Source: NFIRS

FIGURE 73. DAY OF WEEK OF NON-RESIDENTIAL STRUCTURE FIRES AND DEATHS (1998)

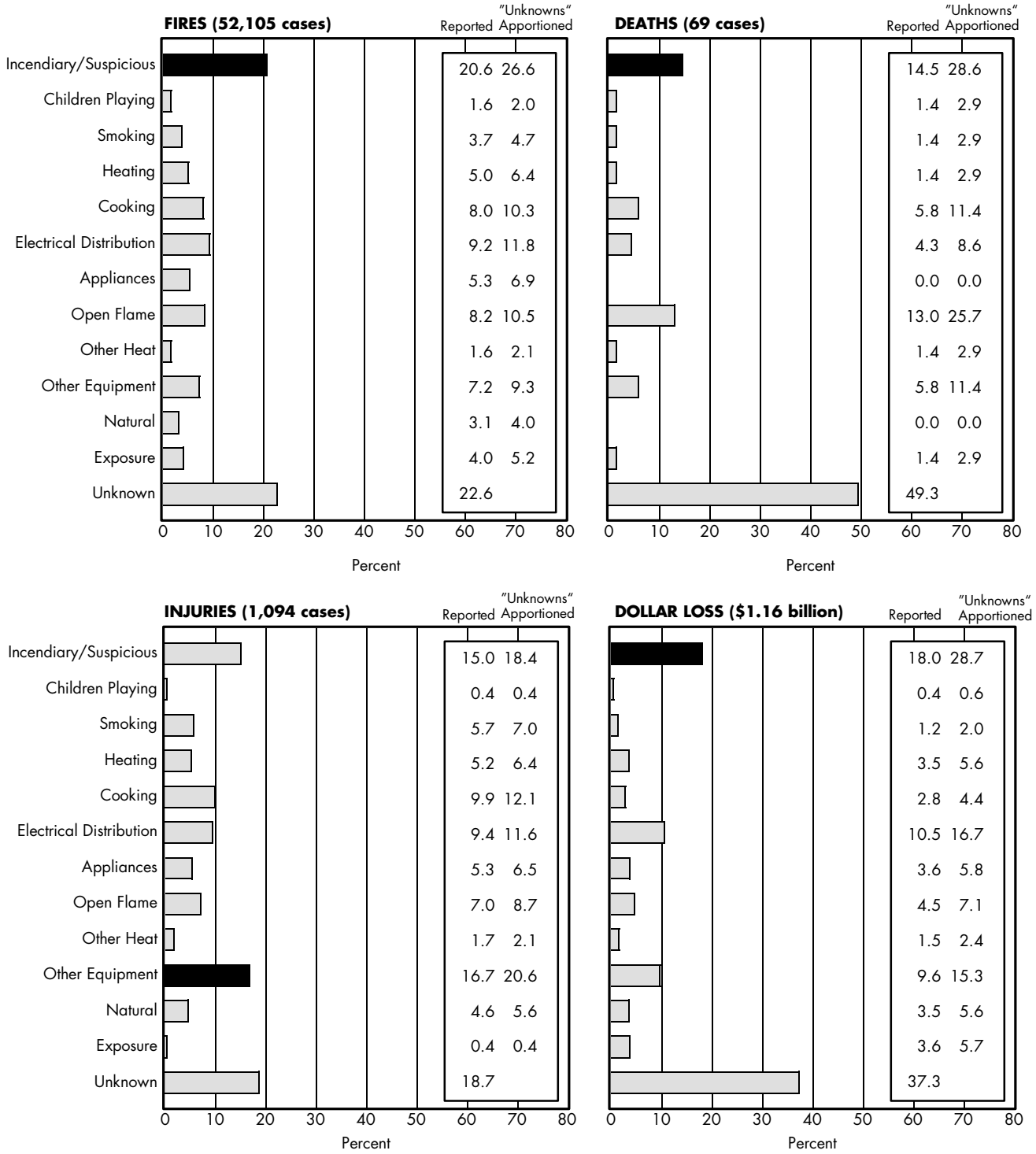
Causes

Since the inception of NFIRS, incendiary/suspicious has been by far the leading cause of non-residential fires (Figure 74). Arson also accounts for 29 percent (adjusted for unknowns) of both dollar loss and deaths. Historically, arson has accounted for the highest dollar loss and, like the overall number of fires, it has trended downward. An encouraging statistic is that only 3 percent of deaths are caused by smoking. This represents a significant decrease from the 9 percent in 1996. The incidents, injuries, and dollar loss associated with smoking, however, remain the same as in prior years despite increased smoking bans in work structures.

The 10-year trends of non-residential fires, deaths, injuries, and dollar loss by cause are shown in Figure 75. In most years, arson was the leading cause in all fire and fire loss categories. The causes for deaths fluctuate considerably because of the smaller numbers of cases involved. Without question, arson is the major problem in non-residential occupancies, accounting for more than twice the number of fires as any other cause.

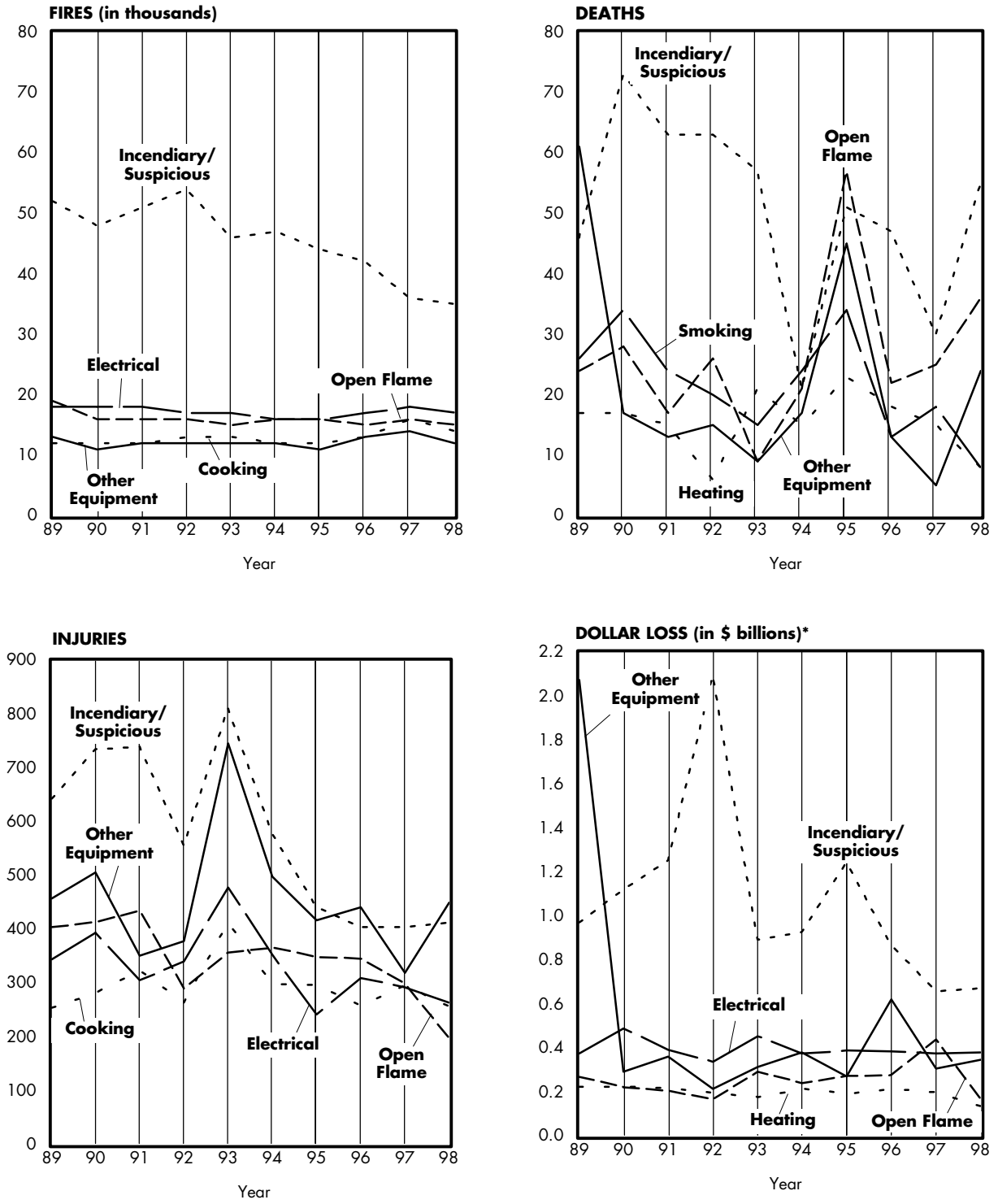
Causes by Detailed Property Type

The number of fires and dollar loss in the ten non-residential occupancy categories are shown in Figures 76–85. With minor variations, the data in 1996 are similar to each of the preceding 9 years. Table 17 compares the leading cause of fires and dollar loss in 1994, 1996, and 1998 by each property type. In 1998, arson was the leading cause of fires and dollar loss in most property types. Electrical distribution and open flame were also major contributors to fires and losses, and cooking was a factor in those non-residential structures that had kitchens.



Source: NFIRS

FIGURE 74. CAUSES OF NON-RESIDENTIAL STRUCTURE FIRES AND FIRE LOSSES (1998)



Note: Data for all 12 causes are provided in Appendix B, Table B-4.

*Adjusted to 1998 dollars

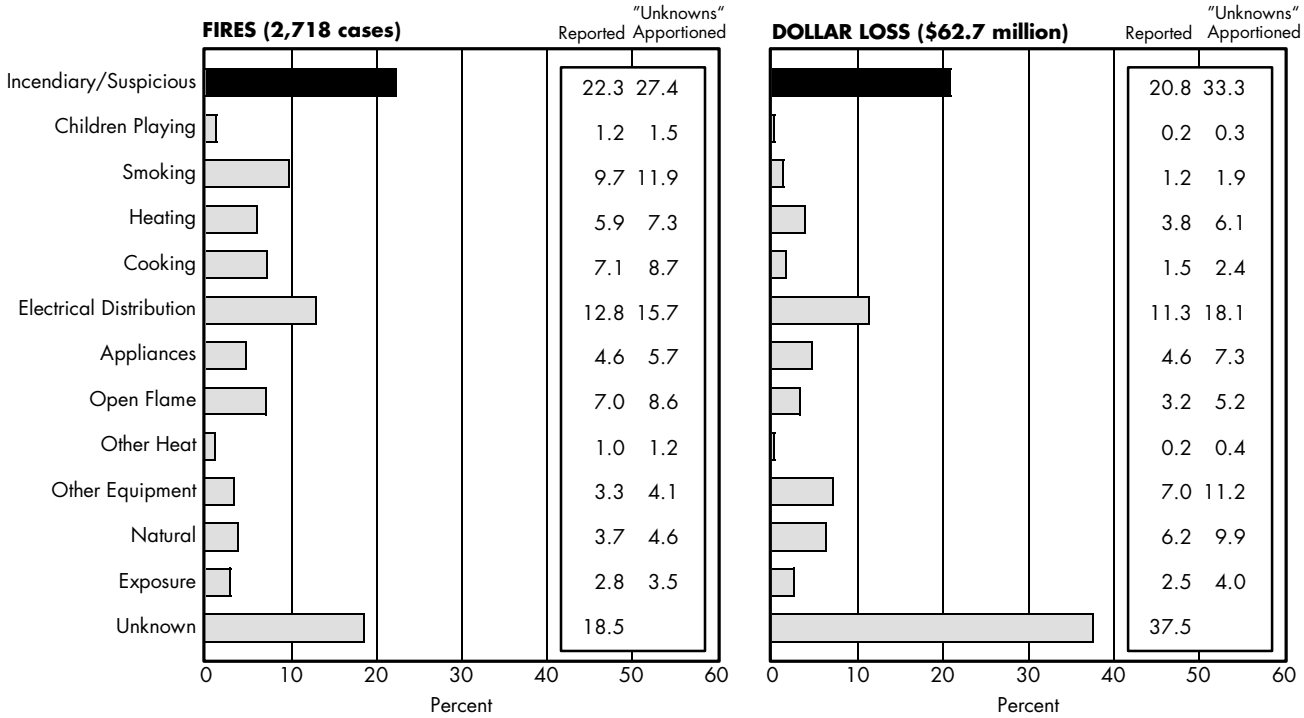
Sources: NFIRS and NFPA

FIGURE 75. TRENDS IN LEADING CAUSES OF NON-RESIDENTIAL STRUCTURE FIRES AND FIRE LOSSES

TABLE 17. COMPARISON OF LEADING CAUSES OF NON-RESIDENTIAL STRUCTURE FIRES AND DOLLAR LOSS

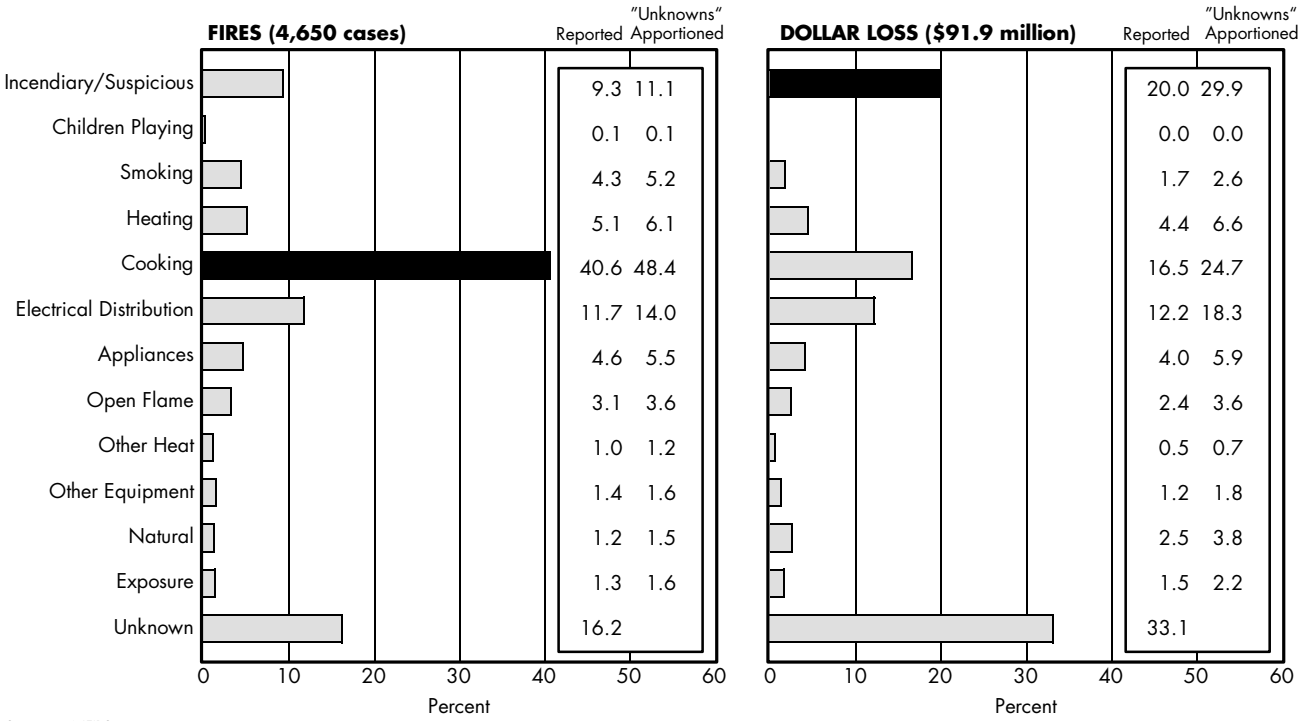
Property Type	Fires			Dollar Loss		
	1994	1996	1998	1994	1996	1998
Public Assembly	Arson	Arson	Arson	Arson	Arson	Arson
Eating, Drinking	Cooking	Cooking	Cooking	Arson	Cooking	Arson
Education	Arson	Arson	Arson	Arson	Arson	Arson
Institutions	Arson	Arson	Arson	Arson	Arson	Arson
Stores, Offices	Arson	Electrical Distribution	Electrical Distribution	Arson	Arson	Arson
Basic Industry	Electrical Distribution	Electrical Distribution	Other Equipment	Electrical Distribution	Other Equipment	Appliances
Manufacturing	Other Equipment	Other Equipment	Other Equipment	Other Equipment	Other Equipment	Other Equipment
Storage	Arson	Arson	Arson	Arson	Other Equipment	Arson
Vacant, Construction	Arson	Arson	Arson	Arson	Arson	Arson
Outside Structures, Unknown	Arson	Arson	Arson	Arson	Arson	Arson

Source: NFIRS



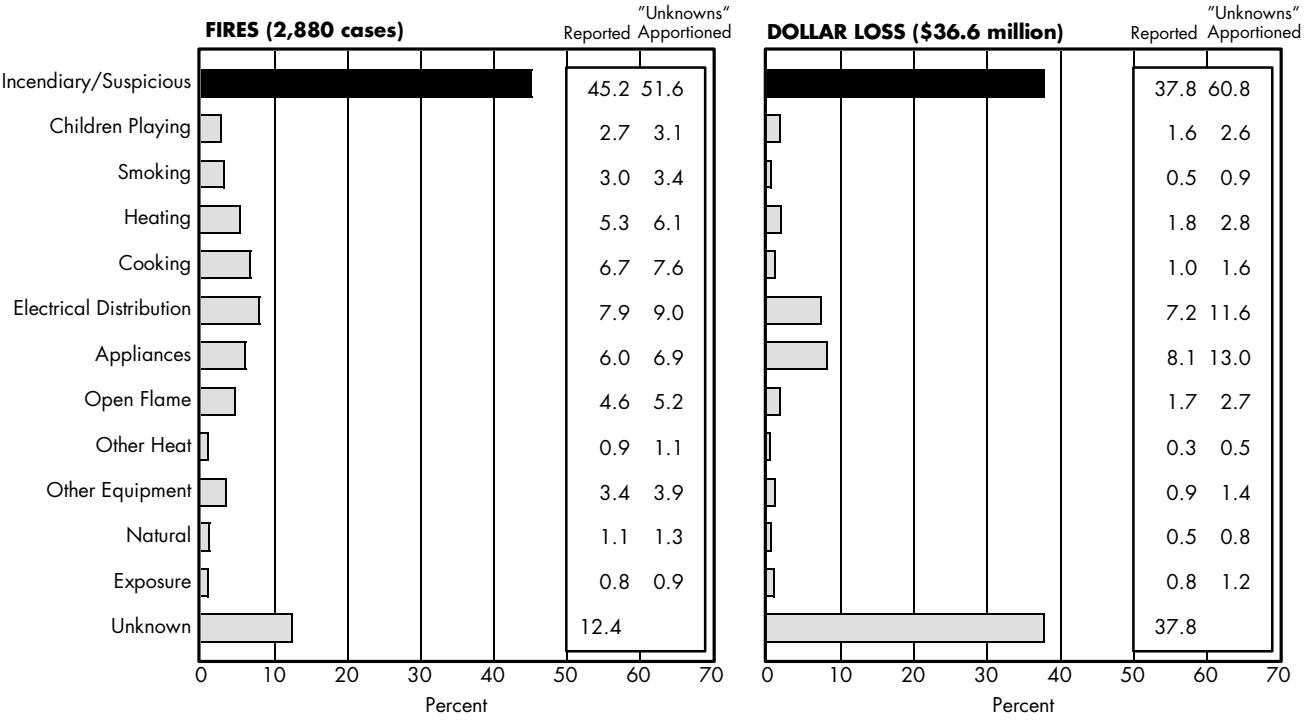
Source: NFIRS

FIGURE 76. CAUSES OF PUBLIC ASSEMBLY STRUCTURE FIRES AND DOLLAR LOSS (1998)



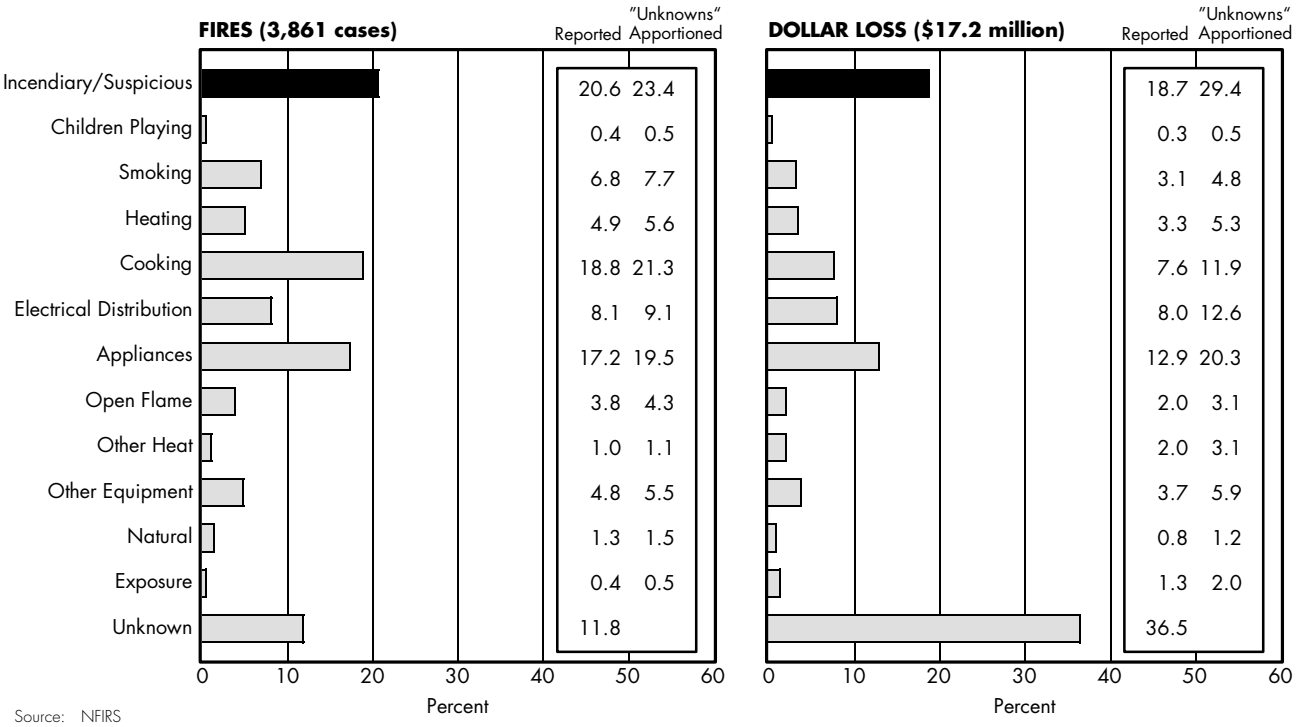
Source: NFIRS

FIGURE 77. CAUSES OF EATING AND DRINKING ESTABLISHMENT FIRES AND DOLLAR LOSS (1998)



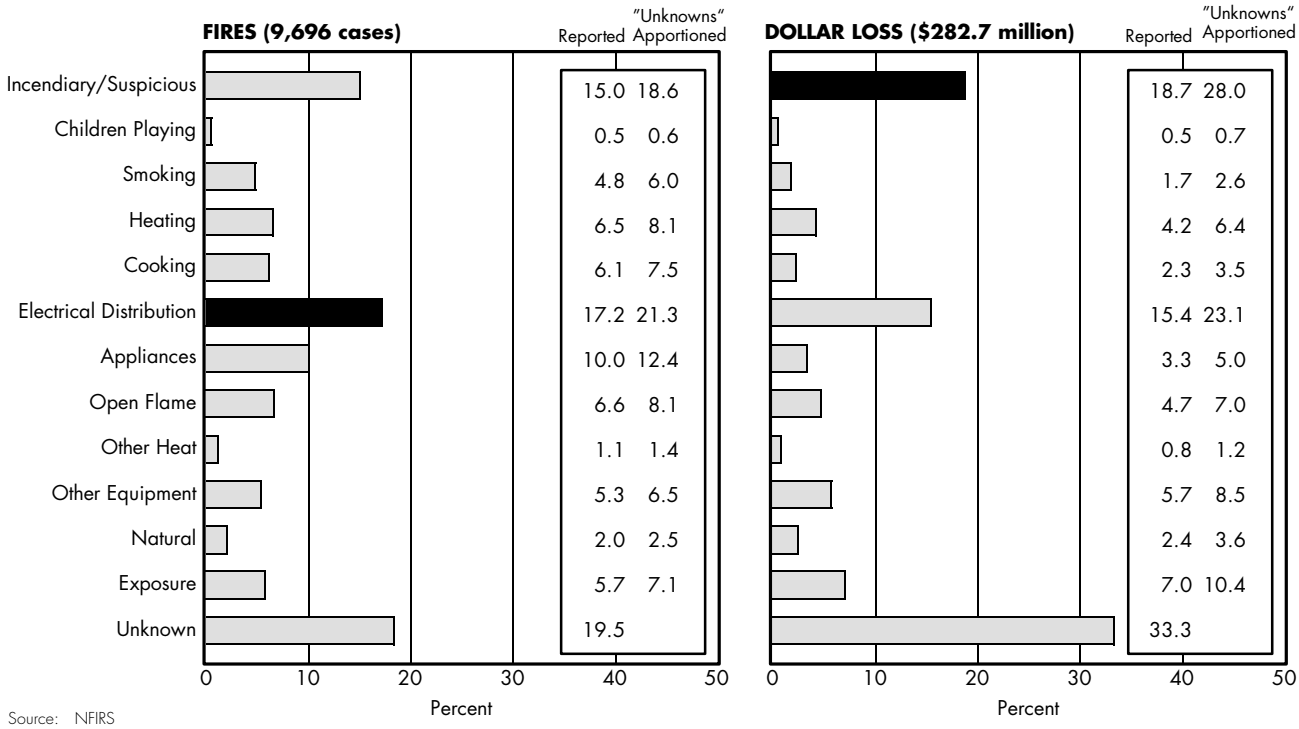
Source: NFIRS

FIGURE 78. CAUSES OF EDUCATION STRUCTURE FIRES AND DOLLAR LOSS (1998)



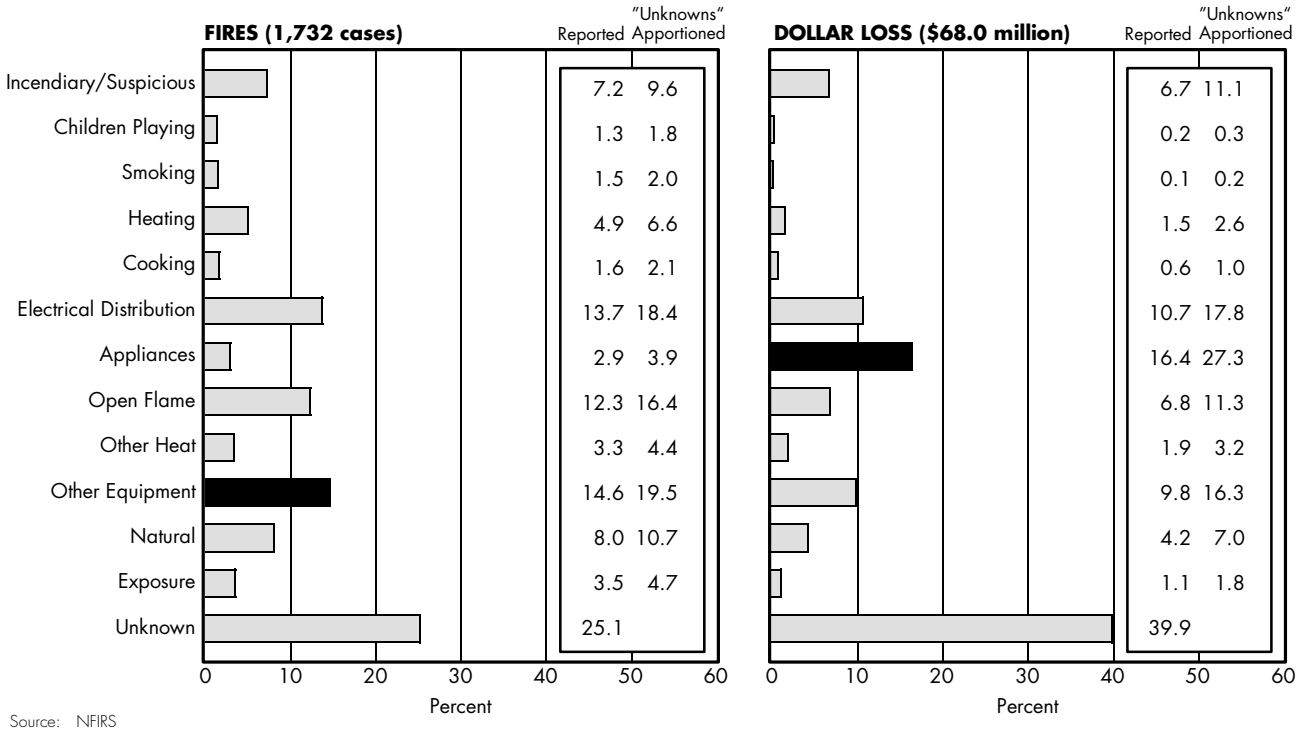
Source: NFIRS

FIGURE 79. CAUSES OF INSTITUTIONAL STRUCTURE FIRES AND DOLLAR LOSS (1998)



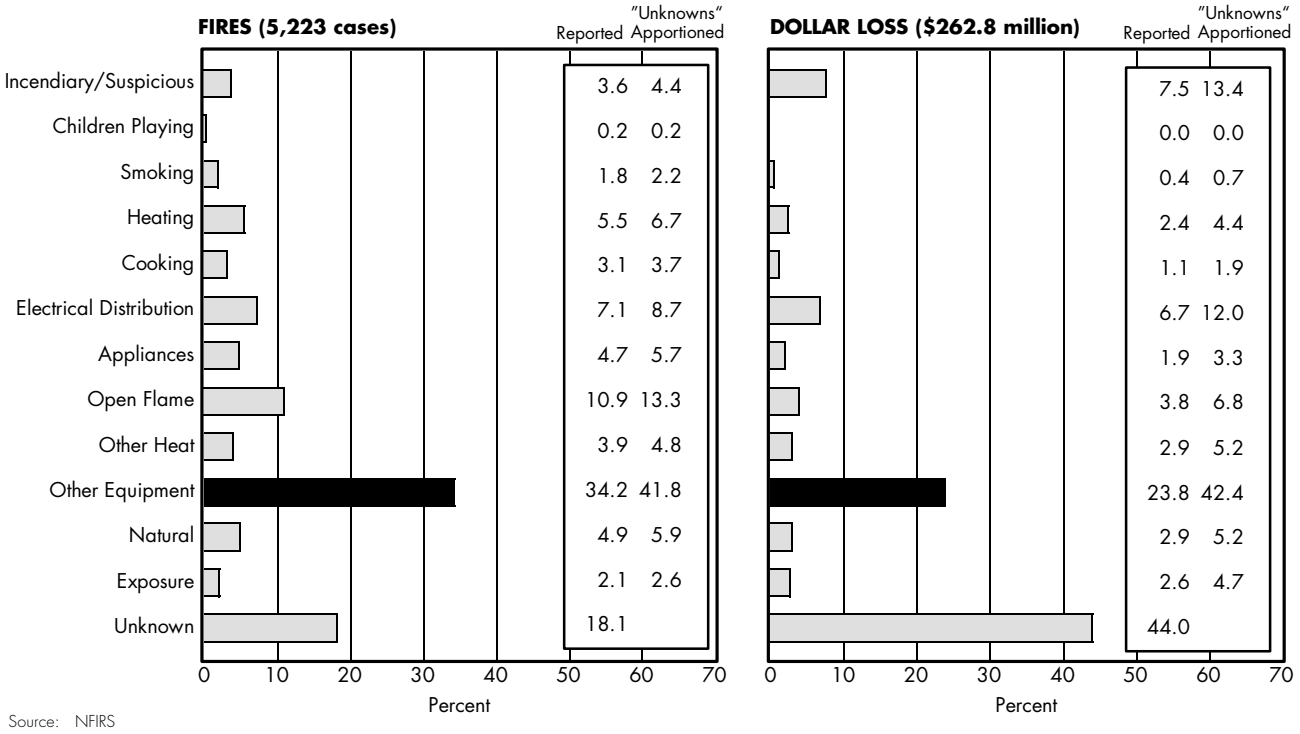
Source: NFIRS

FIGURE 80. CAUSES OF STORE AND OFFICE FIRES AND DOLLAR LOSS (1998)



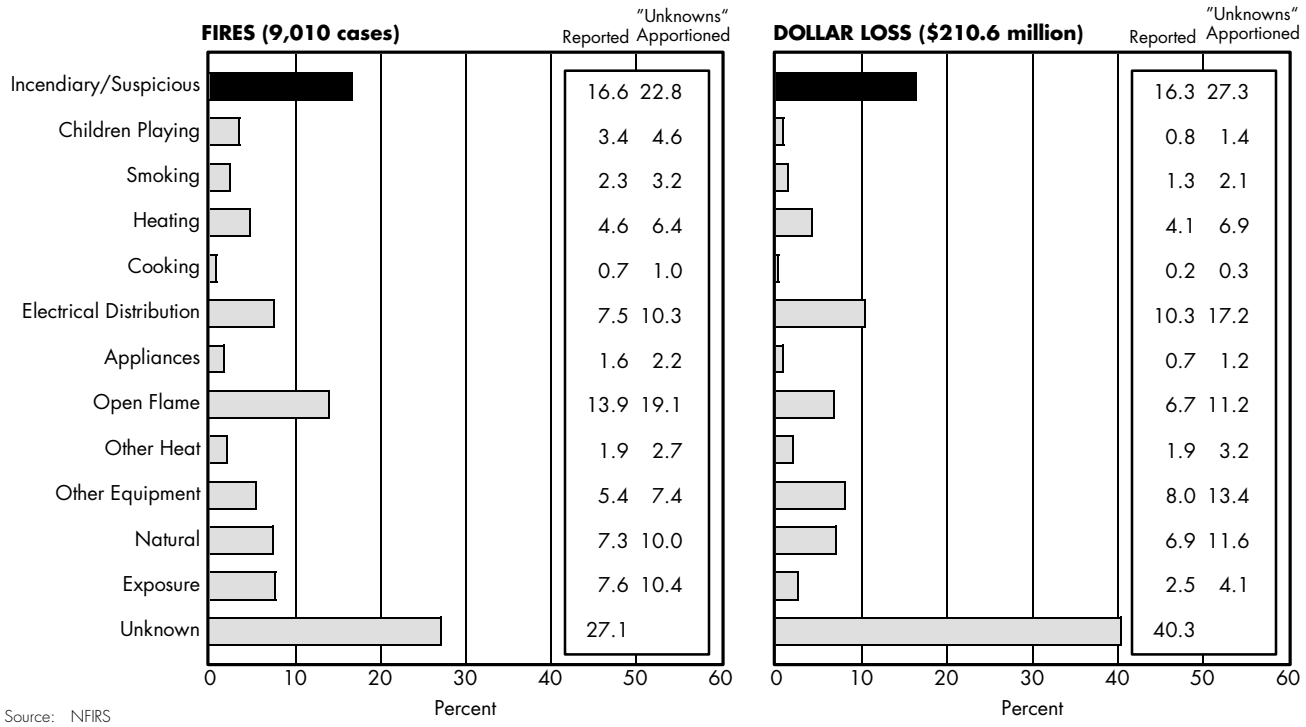
Source: NFIRS

FIGURE 81. CAUSES OF BASIC INDUSTRY STRUCTURE FIRES AND DOLLAR LOSS (1998)



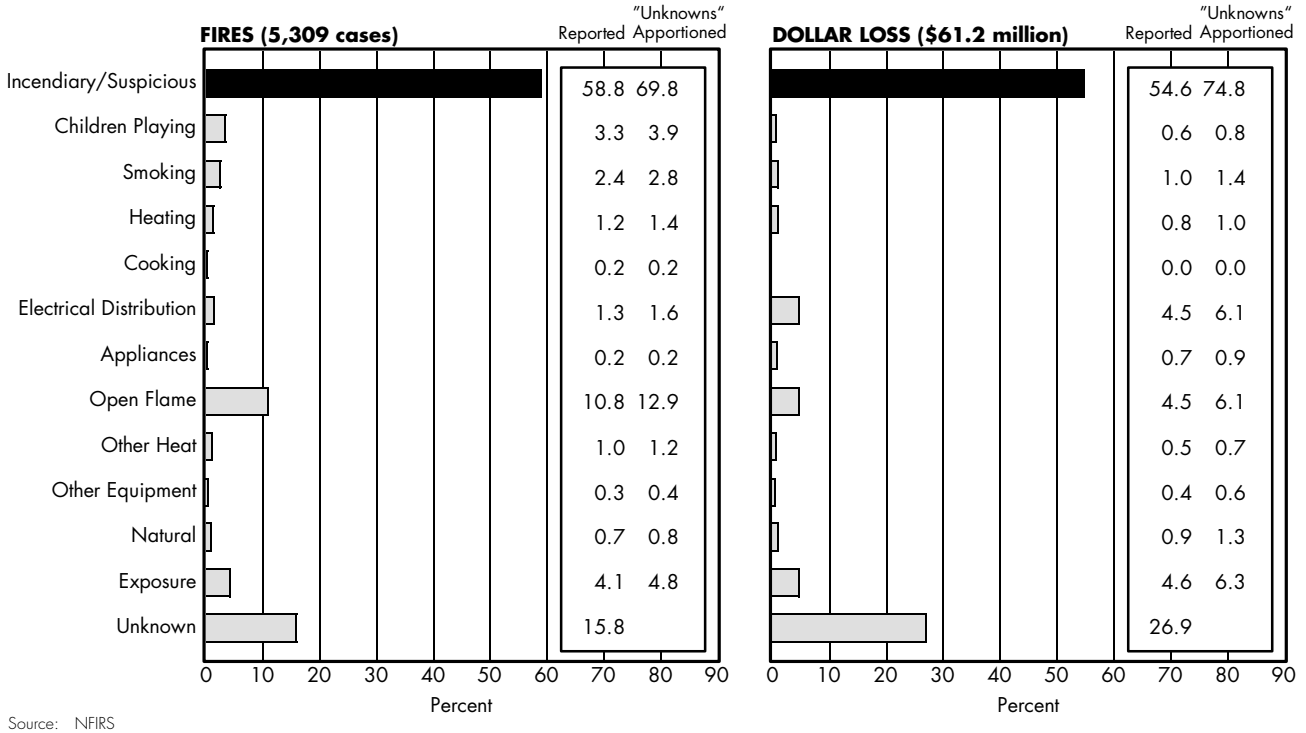
Source: NFIRS

FIGURE 82. CAUSES OF MANUFACTURING STRUCTURE FIRES AND DOLLAR LOSS (1998)



Source: NFIRS

FIGURE 83. CAUSES OF STORAGE STRUCTURE FIRES AND DOLLAR LOSS (1998)



Source: NFIRS

FIGURE 84. CAUSES OF VACANT AND CONSTRUCTION STRUCTURE FIRES AND DOLLAR LOSS (1998)

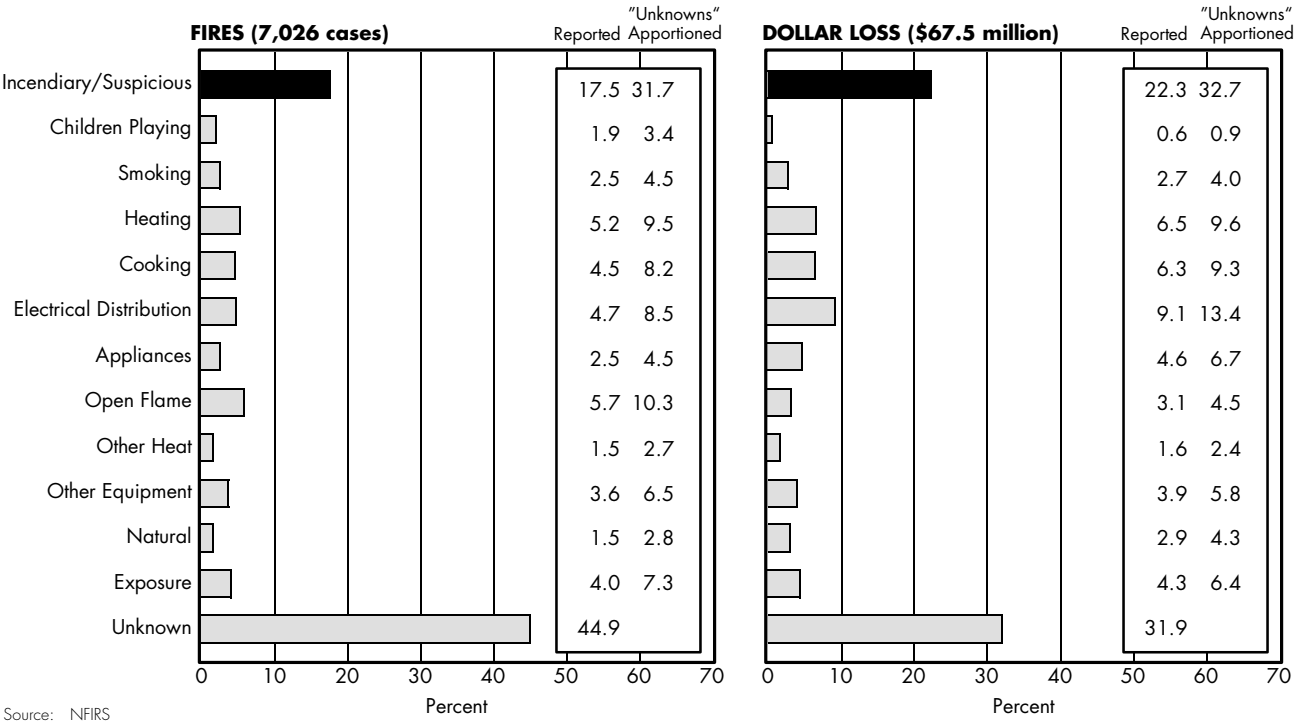


FIGURE 85. CAUSES OF OUTSIDE STRUCTURE AND UNKNOWN FIRES AND DOLLAR LOSS (1998)

Sprinkler Performance

Sprinkler systems with partial or complete coverage were present at 17 percent (unadjusted) of non-residential structure fires (Figure 86). Over 10 years, the percentage of structure fires where sprinklers were present has increased considerably (Figure 87)—50 percent since 1989. But the percentage of fires in structures where sprinklers were present is still small. Of course, operating sprinklers often may extinguish the fire so that it is not reported.

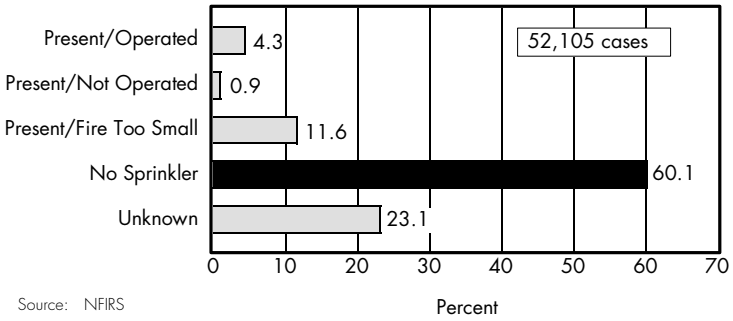
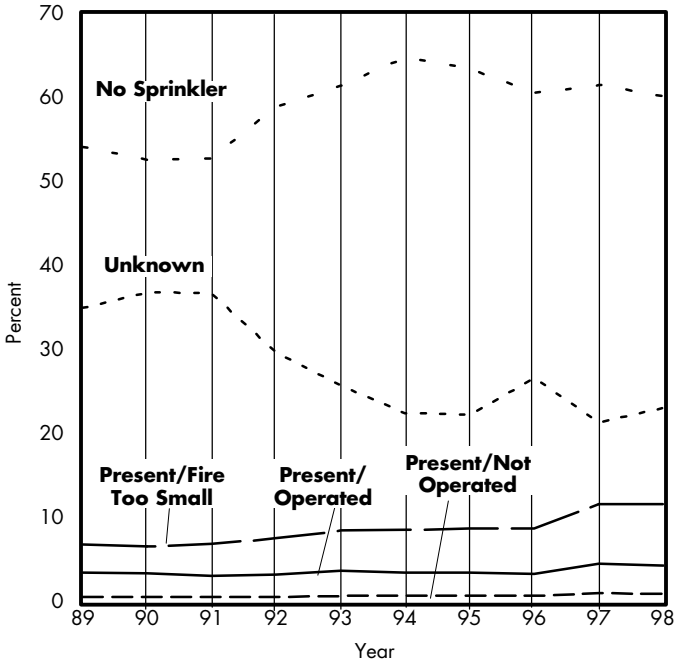


FIGURE 86. SPRINKLER PERFORMANCE IN NON-RESIDENTIAL STRUCTURE FIRES (1998)



	Present/ Operated	Present/Not Operated	Present/Fire Too Small	No Sprinkler	Unknown
1989	3.5%	0.6%	6.8%	54.1%	35.0%
1990	3.4	0.6	6.6	52.6	36.8
1991	3.1	0.6	6.9	52.8	36.7
1992	3.2	0.6	7.6	58.9	29.7
1993	3.7	0.7	8.5	61.4	25.7
1994	3.5	0.7	8.6	64.8	22.4
1995	3.5	0.7	8.7	63.4	22.2
1996	3.3	0.7	8.7	60.6	26.6
1997	4.5	1.0	11.6	61.5	21.4
1998	4.3	0.9	11.6	60.1	23.1
10-Year Trend	**+29.6%**	**+67.3%**	**+81.2%**	**+17.3%**	**-44.2%**

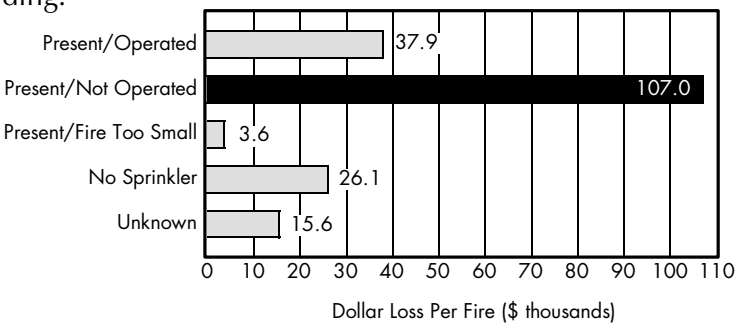
Source: NFIRS

FIGURE 87. TRENDS IN SPRINKLER PERFORMANCE IN NON-RESIDENTIAL STRUCTURE FIRES

Although installed in 11–17 percent of non-residential structures with fires, sprinklers were reported to have operated only 3–4 percent of the time. In 12 percent of fires, sprinkler systems were in place, but systems failed to activate because the fires were too small or in a part of the building away from the sprinklered area.

How effective are sprinklers? Comparisons need to be made for similar properties with similar fire loads, with and without sprinklers, but NFIRS data alone are insufficient for this comparison. Since NFIRS combines properties of different size and values in the same fixed property class, the data need to be viewed cautiously. Sprinkler systems are more likely to be installed in large and highly valued properties than in small, inexpensive ones. The sprinkler system in a large warehouse may do an excellent job of containing a fire and yet the loss for the fire may be larger than for a fire in an unsprinklered small storage building.

One way around this problem is to compare losses when sprinklers were present and operated versus when they were present and did not operate for a reason other than the fire being too small (that is, the cases where sprinklers failed or the fires were not near the sprinklered area) (Figure 88). The presumption is that



Source: NFIRS

FIGURE 88. SPRINKLER PERFORMANCE IN NON-RESIDENTIAL STRUCTURE DOLLAR LOSS PER FIRE (1998)

the places with sprinklers, whether they went off or not, are more similar to each other than to places that did not have sprinklers. As shown in figure, the losses per fire were nearly three times less when sprinklers operated than when they did not. The difference in 1998 is much greater than in 1996 when the dollar loss per fire was just slightly higher when sprinklers did not operate. The effectiveness of sprinklers in the properties where they are installed has a high economic payoff.

VEHICLES AND OTHER MOBILE PROPERTIES

Transportation fires account for a larger portion of the fire problem than many people realize. From 1989 to 1998, vehicles averaged 17 percent of fire deaths overall, 9 percent of fire injuries, 13 percent of fire losses, and 24 percent of all reported fires—nearly one in every four fires (Chapter 2, Figure 27).

The vast majority of fires, casualties, and property losses from mobile property involves cars and trucks, with cars clearly dominating this group. Fire departments respond to about as many fires involving vehicles as they do involving residences.

Overview of Trends

The trends in mobile property fires, fire deaths, injuries, and dollar losses are shown in Figure 89. The number of fires continues to decrease (11 percent) according to NFPA. Fire deaths and injuries have trended down sharply (16 and 36 percent, respectively). The downward trend of mobile property fire deaths would have been even greater, but in 1996 the aviation industry suffered two catastrophes: the ValueJet crash in May, killing 109 people, and the TWA crash in July, resulting in 230 deaths. These two disasters account for nearly 48 percent of the 710 mobile property fire-related deaths reported in the NFPA 1996 annual survey.

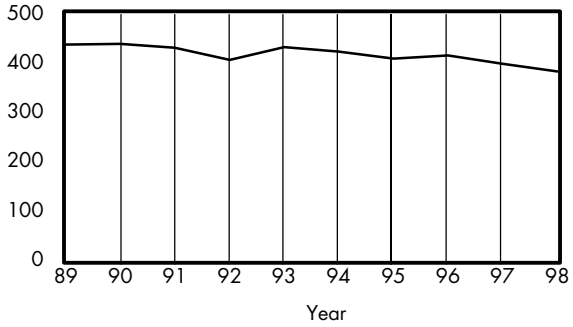
Types of Vehicles

Figure 90 shows that the vast majority of mobile property fires and losses are from highway vehicles. The complexity and ambiguity in counting losses associated with accidents are described in a later section titled "Special Data Problems."

Although the 10-year trend in highway vehicle fires, deaths, and injuries show substantial decreases, the dollar loss has trended up 14 percent. This may be due to the rising cost of automobiles and trucks.

Figure 91 gives more details on the relative proportions of the reported fire problem by type of vehicle in 1998. Automobiles and other passenger vehicles such as vans and buses outnumber trucks by nearly three to one in fire deaths, three and one-half to one in injuries, and nearly four to one in property loss. Automobiles are involved in more than seven times as many fires as trucks. On a per-incident basis, trucks have the more serious problem, but there are vastly more car fires than truck fires. These statistics are relatively unchanged from 1996.

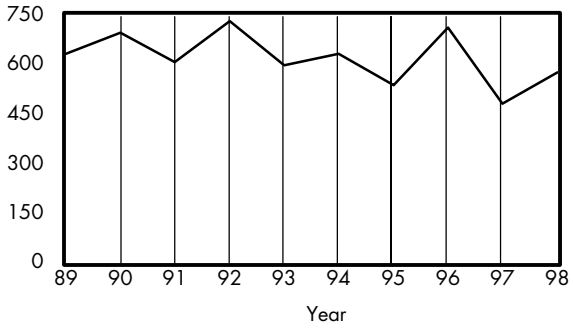
FIRES (in thousands)



1989	436	1994	422
1990	437	1995	407
1991	429	1996	414
1992	405	1997	397
1993	421	1998	381

10-Year Trend = -10.6%

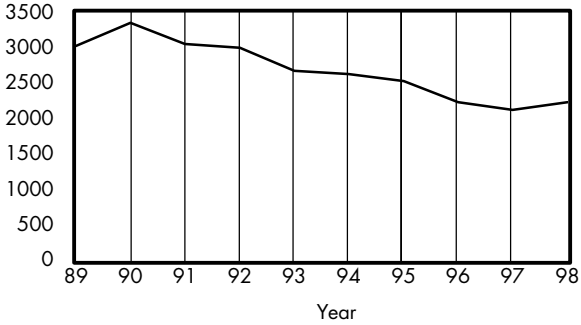
DEATHS



1989	630	1994	630
1990	695	1995	535
1991	605	1996	710
1992	730	1997	480
1993	595	1998	575

10-Year Trend = -16.4%

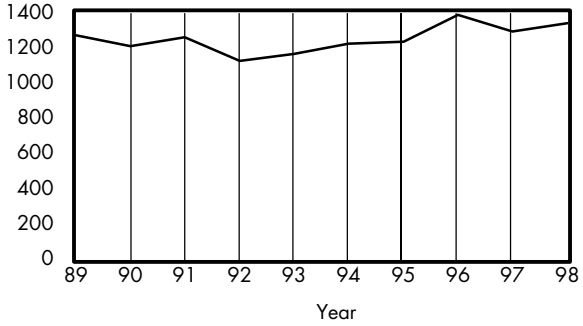
INJURIES



1989	3,025	1994	2,625
1990	3,350	1995	2,525
1991	3,050	1996	2,225
1992	3,000	1997	2,125
1993	2,675	1998	2,225

10-Year Trend = -35.7%

DOLLAR LOSS (in $ millions)*



1989	$1,266	1994	$1,222
1990	1,206	1995	1,232
1991	1,255	1996	1,385
1992	1,121	1007	1,289
1993	1,162	1998	1,337

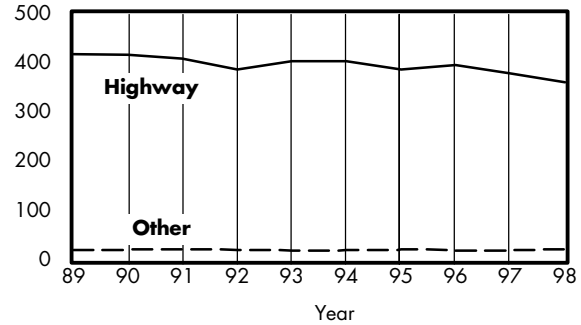
10-Year Trend = +10.4%

*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 89. TRENDS IN MOBILE PROPERTY FIRES AND FIRE LOSSES

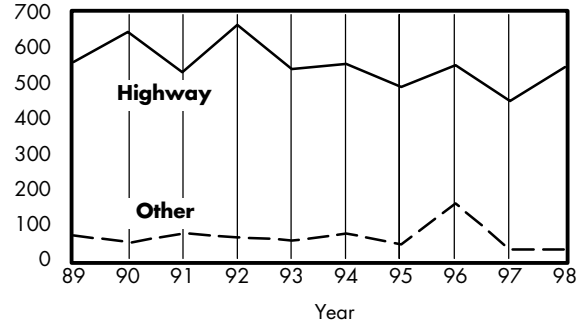
FIRES (in thousands)



	Highway	Other		Highway	Other
1989	416	20	1994	402	20
1990	415	22	1995	386	21
1991	407	22	1996	395	19
1992	386	20	1997	377	20
1993	402	19	1998	359	23

10-Year Highway Trend = -11.0%
10-Year Other Trend = +0.5%

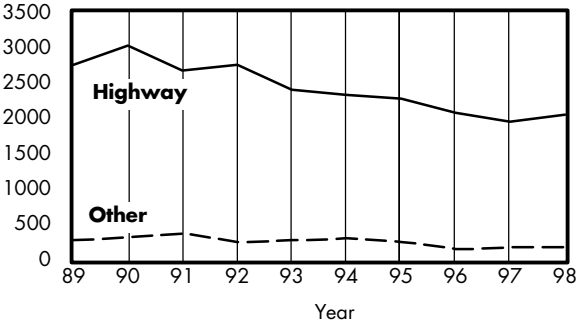
DEATHS



	Highway	Other		Highway	Other
1989	560	70	1994	555	75
1990	645	50	1995	490	45
1991	530	75	1996	550	160
1992	665	65	1997	450	30
1993	540	55	1998	545	30

10-Year Highway Trend = -17.2%
10-Year Other Trend = -9.1%

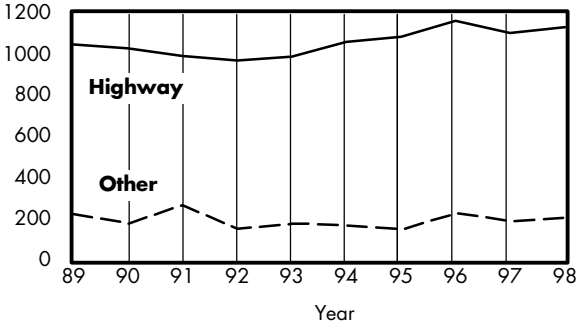
INJURIES



	Highway	Other		Highway	Other
1989	2,750	275	1994	2,325	300
1990	3,025	325	1995	2,275	250
1991	2,765	375	1996	2,075	150
1992	2,750	250	1997	1,950	175
1993	2,400	275	1998	2,050	175

10-Year Highway Trend = -34.7%
10-Year Other Trend = -49.2%

DOLLAR LOSS (in $ millions)*



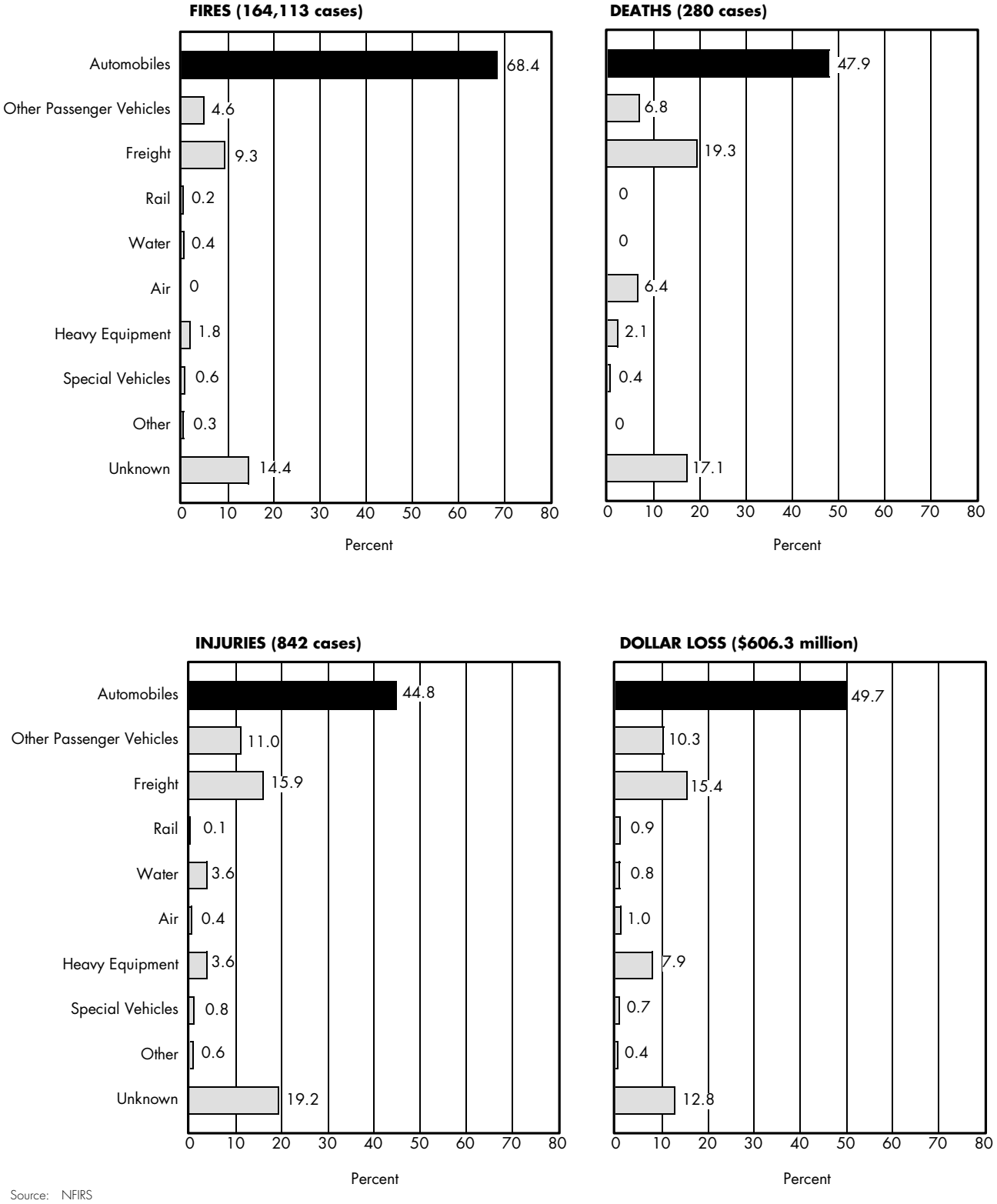
	Highway	Other		Highway	Other
1989	$1,045	$221	1994	$1,057	$165
1990	1,029	177	1995	1,083	149
1991	990	266	1996	1,160	224
1992	969	152	1997	1,101	188
1993	987	175	1998	1,129	208

10-Year Highway Trend = +13.9%
10-Year Other Trend = -7.3%

*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 90. TRENDS IN HIGHWAY VS. OTHER MOBILE PROPERTY FIRES AND FIRE LOSSES



Source: NFIRS

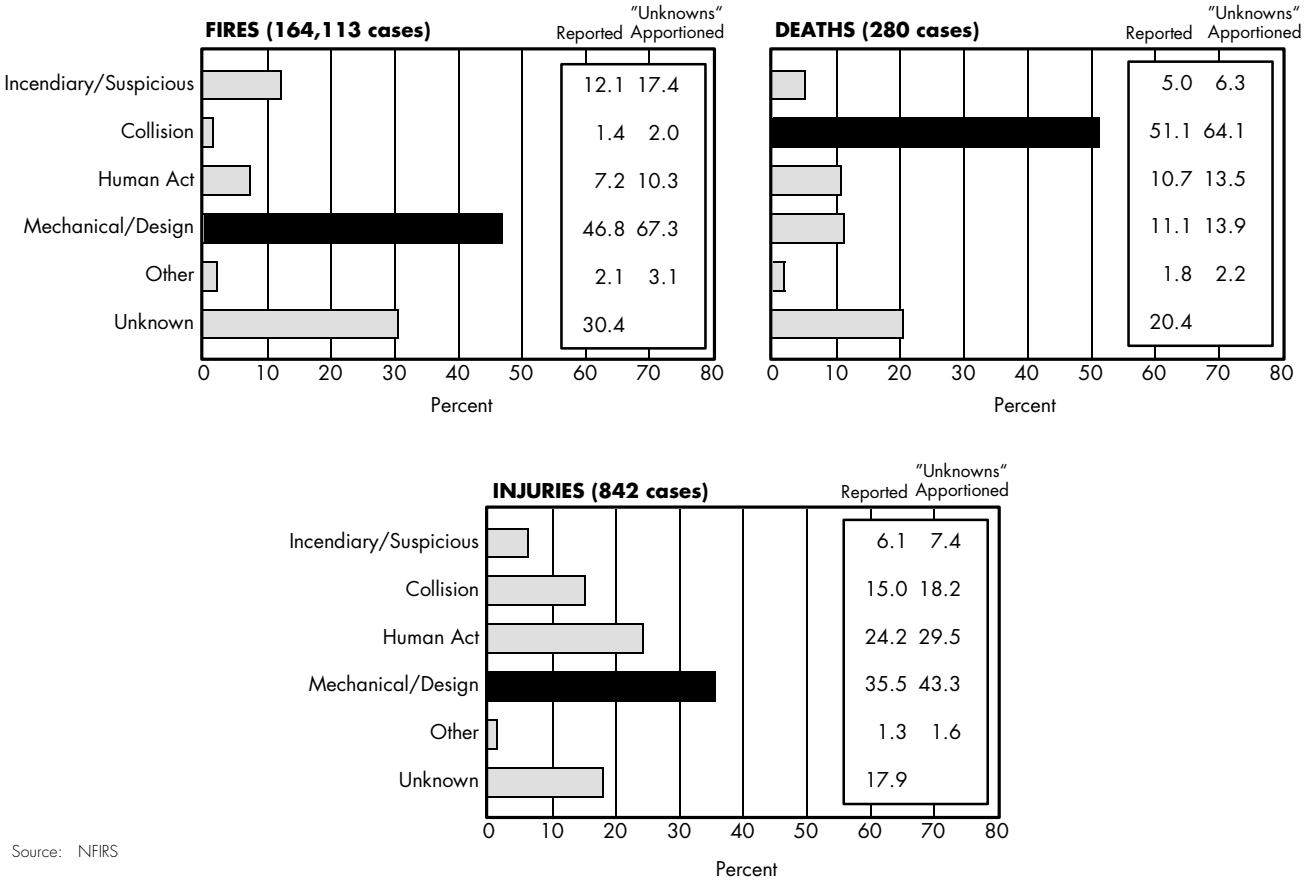
FIGURE 91. MOBILE PROPERTY FIRES AND FIRE LOSSES BY VEHICLE TYPE (1998)

Causes

For the most part, vehicle fires have one of four origins: the aftermath of a collision, the result of a mechanical failure, the result of an act of carelessness, or the result of arson. Most vehicle deaths are from trauma following a collision; only 2 percent of collision deaths are the result of fire. However, 64 percent of mobile property fire deaths occur in vehicle collisions (Figure 92). Preventing such fires is largely the purview of the U.S. Department of Transportation, state and local motor vehicle agencies, and the police, but fire departments are almost always called to the scene when there is a fire or the potential of a fire.

Adjusted for unknowns, 67 percent of all fires in vehicles and 43 percent of the associated injuries come from mechanical or design problems such as broken fuel lines, faulty catalytic converters, blown tires, and overheating.

Fires of incendiary or suspicious origin account for 17 percent of mobile property fires. Many vehicle fires are not even investigated for arson, though some insurance companies are at least investigating the most suspicious or obviously incendiary fires before paying insurance claims.



Source: NFIRS

FIGURE 92. IGNITION FACTORS FOR MOBILE PROPERTY FIRES AND FIRE CASUALTIES (1998)

However, the arson problem may well be understated because of the limited effort spent on investigation of these incidents.

Carelessness (human act) includes causes such as cigarettes dropped on the upholstery, distractions such as eating or cell phone use, parking over dry leaves with a hot catalytic converter, and misuse of flammable liquids, especially gasoline, while servicing or maintaining the car. Carelessness accounts for 14 and 30 percent of vehicle fire deaths and injuries, respectively, though only 10 percent of fires.

In each of the past 10 years, the top ignition factors for fires (mechanical/design), deaths (collision), and injuries (mechanical/design) have remained the same (Figure 93). Fire deaths from collisions fluctuate from year to year, but the 10-year trend is down 21 percent. Fires and injuries from mechanical or design factors dropped to their lowest levels in 1998.

Because automobile fires are such a large part of the entire mobile property fire problem, the cause profiles for automobile fires in 1998 are very similar to those for mobile properties (Figure 94 compared to Figure 92).

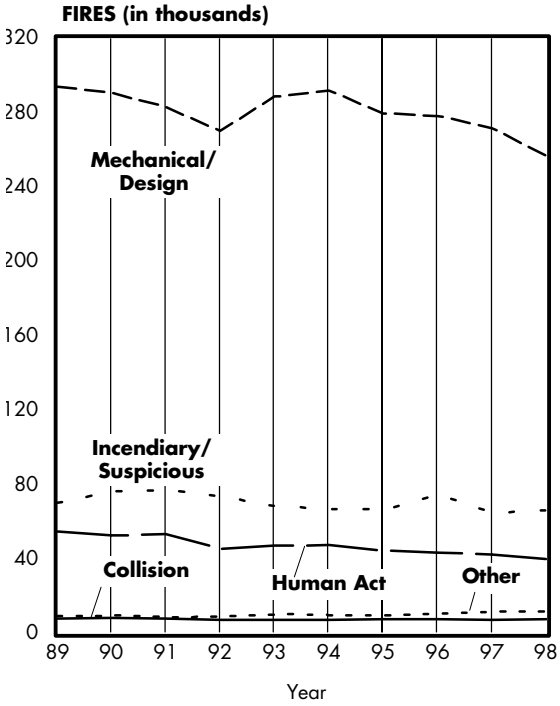
Special Data Problems

When there are fatalities associated with a mobile property accident such as a collision between two cars, it is often difficult to determine whether the fatalities were the result of the mechanical forces or the fire that ensued. Because of the very large number of vehicle fatalities occurring in this country each year and the frequency of fires associated with these accidents, there can be a significant error in estimating the total number of fire deaths if this problem is not carefully addressed. A fire fatality should be counted only if a person was trapped and killed by the fire, rather than killed on impact and subsequently exposed to the fire.

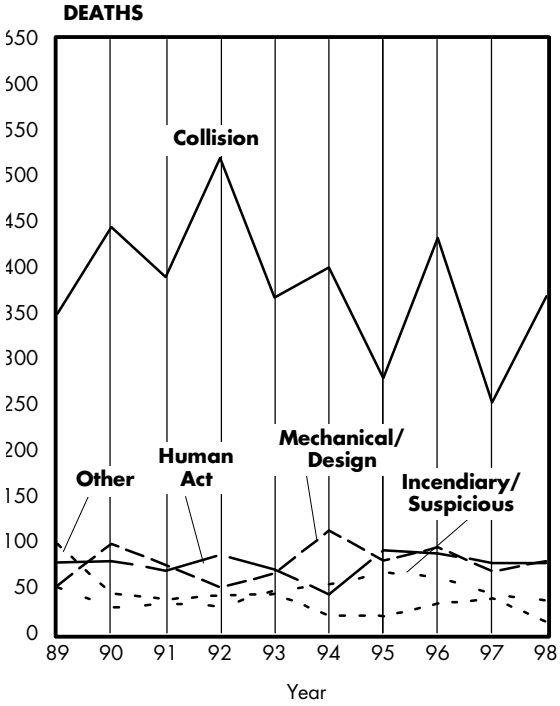
OUTSIDE AND OTHER PROPERTIES

The outside and other properties category includes all fires that are not structure or vehicle fires. In NFIRS terminology, this includes fires where the type of situation found either is outside of the structure where the burning material has a value or where the fire is confined to trees, brush, grass, or refuse. A subset of outside fires is wildland fires. Grouped in the "other" category are fires whose situation found is not classified, flammable liquid spills out of doors with ensuing fires, and explosions.

Outside fires comprise 43 percent of all fires (Chapter 2, Figure 27). This proportion has remained steady over 10 years. Although large in number, they accounted for only 2 percent of fire deaths in 1998, 4 percent of reported injuries, and 2 percent of reported property losses. These numbers may not, however, reflect the true nature of the problem because of underreporting and the difficulty in setting a price tag on outside fires. Also, many wildland fires are not reported to agencies reporting to NFIRS or to the NFPA annual survey.



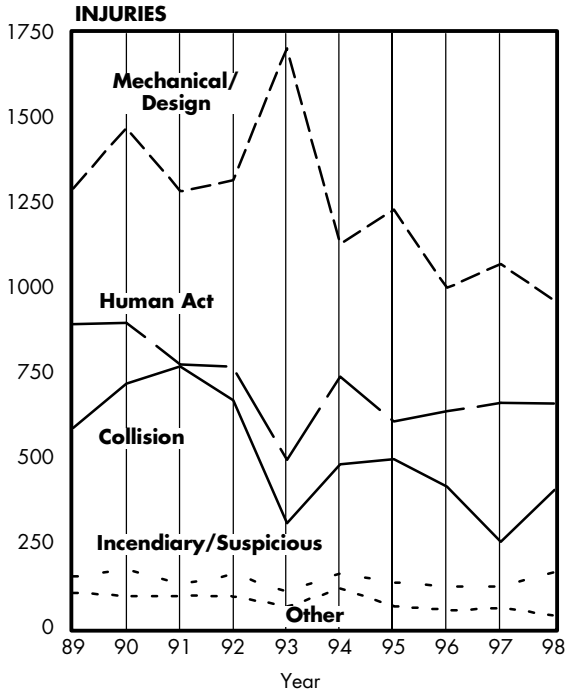
	Incendiary/ Suspicious	Collision	Human Act	Mechanical/ Design	Other
1989	70.1	7.9	54.7	293.7	9.2
1990	76.2	8.1	52.5	290.3	9.4
1991	76.9	7.6	53.1	282.6	8.4
1992	73.4	6.9	45.4	270.1	9.2
1993	68.1	6.9	46.9	288.4	10.2
1994	66.5	7.1	47.3	291.6	9.5
1995	66.2	7.4	44.1	279.3	9.5
1996	74.4	7.4	43.1	277.9	10.6
1997	64.6	7.2	42.3	271.4	11.5
1998	66.4	7.5	39.3	256.2	11.7
10-Year Trend	**-11.0%**	**-6.7%**	**-26.5%**	**-8.6%**	**+30.5%**



	Incendiary/ Suspicious	Collision	Human Act	Mechanical/ Design	Other
1989	51	350	78	53	98
1990	29	444	79	98	44
1991	33	390	69	75	38
1992	30	520	86	51	42
1993	48	367	70	66	44
1994	54	400	43	113	20
1995	67	279	91	80	19
1996	62	432	88	95	33
1997	43	253	77	68	39
1998	36	369	77	80	13
10-Year Trend	**+31.3%**	**-21.2%**	**+4.4%**	**+20.6%**	**-78.2%**

Continued on next page

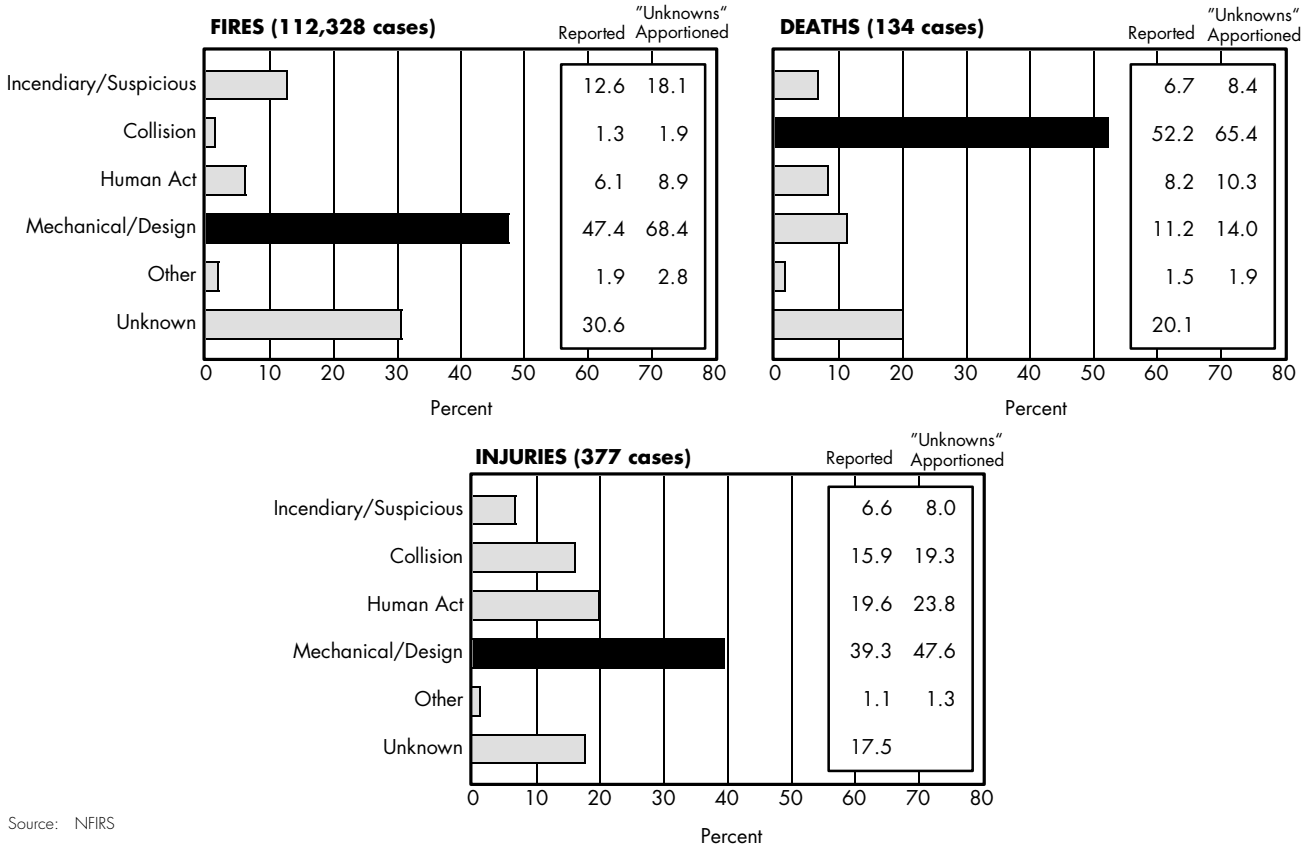
FIGURE 93. TRENDS IN IGNITION FACTOR CAUSES OF MOBILE PROPERTY FIRES AND FIRE CASUALTIES



	Incendiary/ Suspicious	Collision	Human Act	Mechanical/ Design	Other
1989	151	588	892	1,292	103
1990	172	717	896	1,471	94
1991	128	769	774	1,284	95
1992	158	669	766	1,316	92
1993	107	308	494	1,703	63
1994	161	480	738	1,130	116
1995	133	495	606	1,229	63
1996	121	415	637	1,000	52
1997	123	253	662	1,069	59
1998	164	406	657	963	35
10-Year Trend	**-10.3%**	**-54.5%**	**-32.0%**	**-29.9%**	**-56.2%**

Sources: NFPA and NFIRS

FIGURE 93. TRENDS IN IGNITION FACTOR CAUSES OF MOBILE PROPERTY FIRES AND FIRE CASUALTIES (CONT'D)



Source: NFIRS

FIGURE 94. IGNITION FACTORS FOR AUTOMOBILE FIRES AND FIRE CASUALTIES (1998)

Overview of Trends

Figure 95 shows the trends in outside and other fires. The numbers of reported outside fires are enormous—averaging 800,000 each year. Over 10 years, an average of 67 deaths resulted each year from outside fires plus miscellaneous other properties not covered elsewhere; injuries averaged 1,350. Although deaths have a significant 10-year downward trend of 45 percent, this is due primarily to the fluctuations in the small numbers of deaths; injuries have trended upward 17 percent. Dollar loss for outside properties trended upward by 107 percent, due largely to the enormous jump in 1998. This 1998 total loss reflects a $390 million timber loss in Florida wildfires. The spike in 1992 reflects a $300 timber loss.

Estimating dollar loss for outside fires is difficult. To illustrate this problem, consider Figure 96, derived from unscaled (raw) NFIRS data. NFPA estimates a dollar loss range from $110 to $497 million. The estimated dollar loss reported in NFIRS for slightly less than half as many fires is in the same range, from $130 to $297 million. Which is correct? Both are based on estimates and neither may be definitive. Note that the large timber fires reported by NFPA are not reported in NFIRS.

Property Types

Figure 97 shows the relative proportions of the three components of reported outside fires for 1998. Trees, brush, and grass fires account for the greatest number of fires and fire losses. In a large portion of deaths, injuries, and dollar losses, however, the outside property type is unknown.

When Fires Occur

Time of Day. Figure 98 shows a very interesting and clear profile for when outside fires are reported. At 8 a.m., fires begin to increase. They steadily rise to a peak at 4 p.m., at which time they steadily drop until 6 a.m.

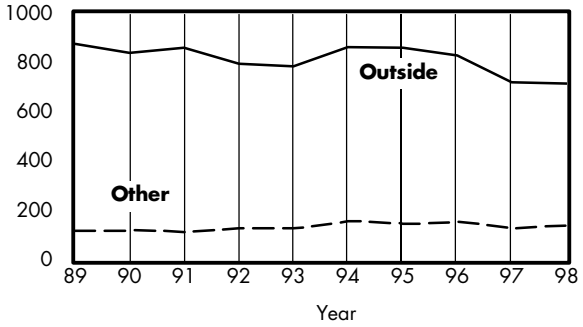
Month of Year. Outside fires are usually lowest in the fall and winter months and highest during spring and summer (Figure 99). As in 1994 and 1996, July was the month with the highest number of fires. An increase in brush fires may be the cause of the July peak. In recent years, local and state governments have placed more rigorous restrictions on burning leaves, which might account for the low autumn numbers. Wetter-than-usual weather, too, may have played a role. What is known is that wildland fires tend to have two peaks—one in the spring and one in the fall.

Day of Week. Outside fires are highest on the weekend, a time when more people are outdoors (Figure 100). This pattern is unchanged over 10 years.

Causes

As in all years, the leading cause of all forms of outside fires is arson, with many thought to be set by children. Figure 101 shows the cause profiles for each outside fire category. A high percentage of outside fires have unknown causes and, as discussed under the following "Special Data Problems," there is little that can be done to improve this reporting. The 1998 statistics have changed very little over 10 years.

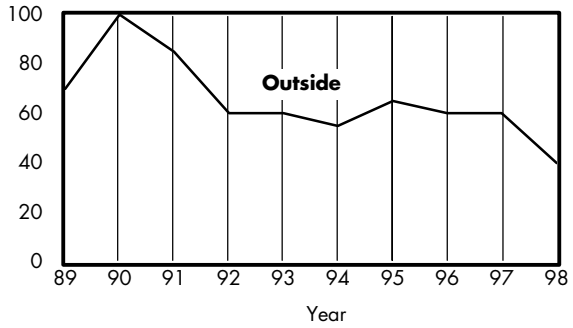
FIRES (in thousands)



	Outside	Other		Outside	Other
1989	873.5	118.0	1994	861.5	157.0
1990	838.5	120.0	1995	858.5	147.0
1991	859.5	113.0	1996	828.5	154.5
1992	793.5	128.5	1997	719.0	127.0
1993	783.5	127.0	1998	715.0	142.0

10-Year Outside Trend = -13.8%
10-Year Other Trend = +25.8%

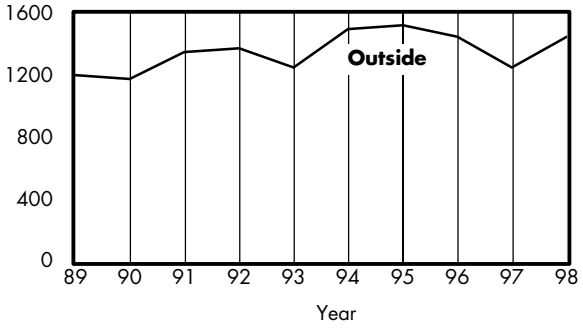
DEATHS



1989	70	1994	55
1990	100	1995	65
1991	95	1996	60
1992	60	1997	60
1993	60	1008	40

10-Year Outside Trend = -45.3%

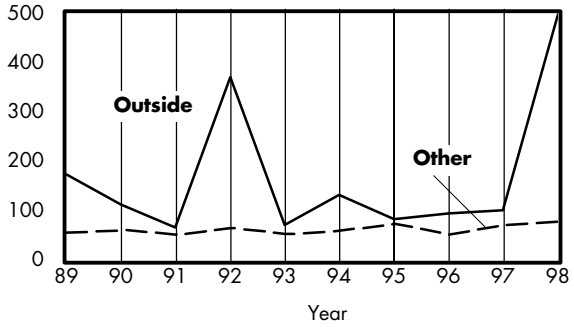
INJURIES



1989	1,200	1994	1,500
1990	1,175	1995	1,525
1991	1,350	1996	1,450
1992	1,375	1997	1,250
1993	1,250	1998	1,450

10-Year Outside Trend = +17.4%

DOLLAR LOSS (in $ millions)*



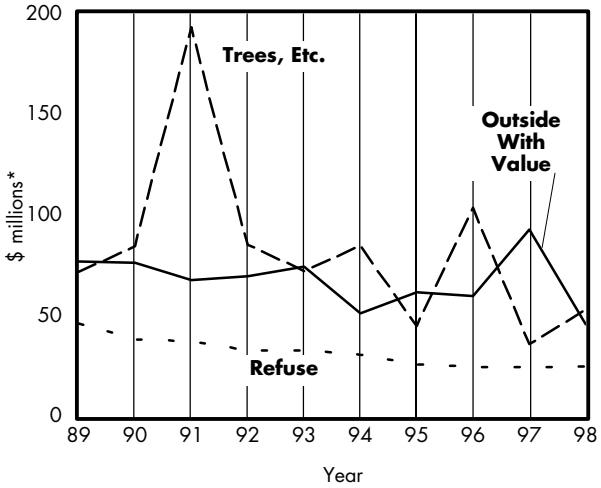
	Outside	Other		Outside	Other
1989	$173.5	$55.2	1994	$132.0	$58.3
1990	112.2	59.9	1995	82.4	73.8
1991	65.8	51.5	1996	94.5	50.9
1992	369.5	63.9	1997	100.5	71.1
1993	71.1	53.0	1998	497.0	78.0

10-Year Outside Trend = +107.2%
10-Year Other Trend = +32.5%

*Adjusted to 1998 dollars

Sources: NFPA and Consumer Price Index

FIGURE 95. TRENDS IN OUTSIDE AND OTHER PROPERTY TYPE FIRES AND FIRE LOSSES



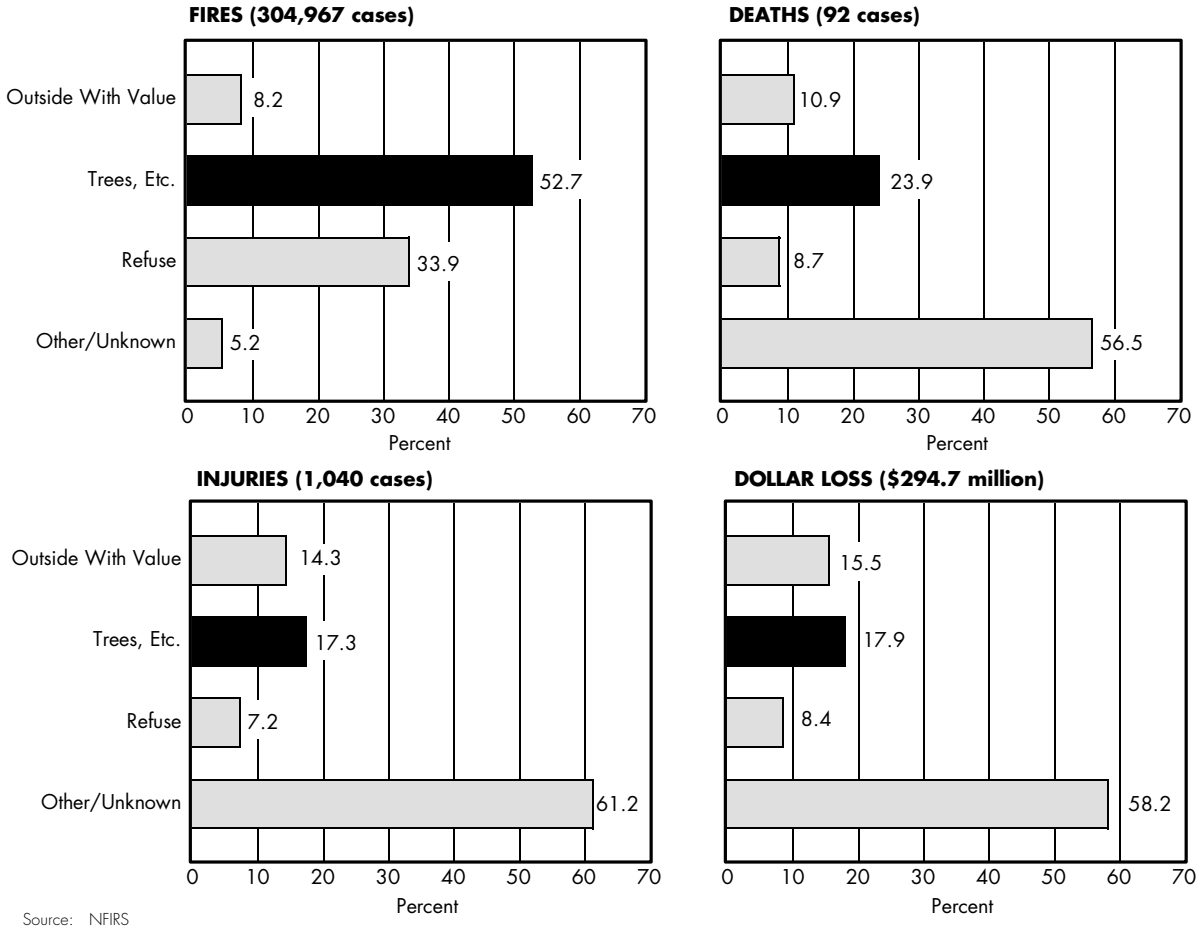
Sources: NFIRS and Consumer Price Index

	Outside With Value	Trees, Etc.	Refuse
1989	$76.7	$ 71.7	$45.8
1990	76.0	84.4	38.0
1991	67.4	192.7	37.1
1992	69.3	84.7	32.4
1993	74.2	72.0	32.4
1994	51.1	84.7	30.3
1995	61.3	44.5	25.6
1996	59.4	103.3	24.2
1997	92.6	35.8	24.3
1998	45.6	52.7	24.9

10-Year Outside With Value Trend = -18.5%
10-Year Trees, Etc. Trend = -52.1%
10-Year Refuse Trend = -40.3%

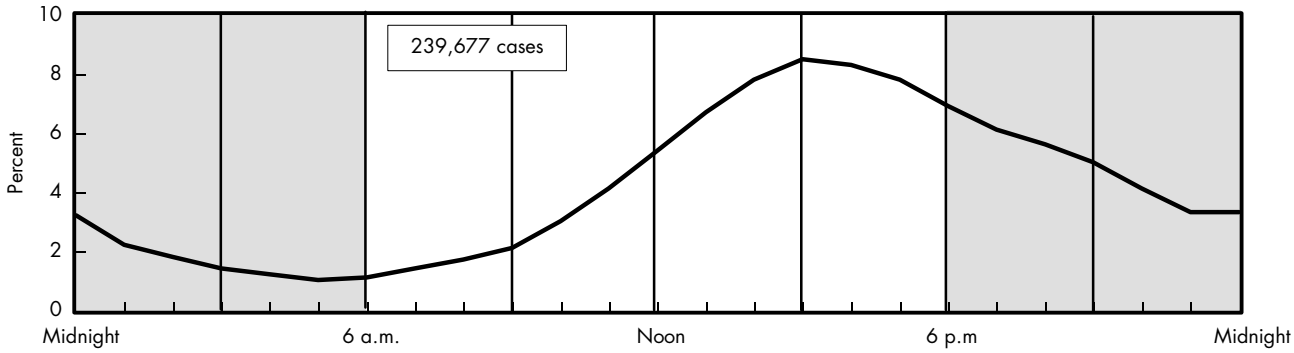
*Adjusted to 1998 dollars

FIGURE 96. TRENDS IN OUTSIDE FIRE DOLLAR LOSS BY PROPERTY TYPE



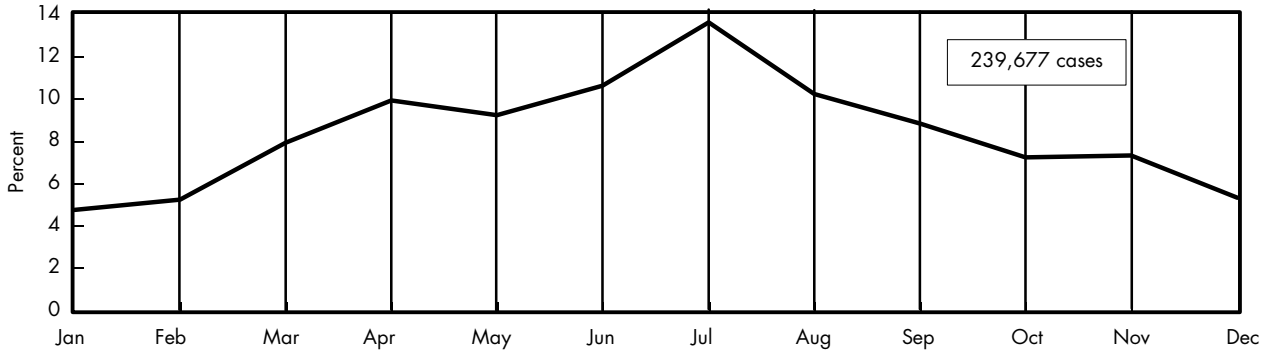
Source: NFIRS

FIGURE 97. OUTSIDE FIRES AND FIRE LOSS BY PROPERTY TYPE (1998)



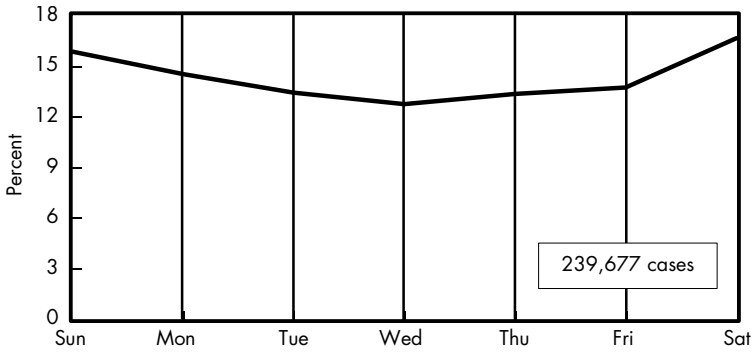
Source: NFIRS

FIGURE 98. TIME OF DAY OF OUTSIDE AND OTHER FIRES (1998)



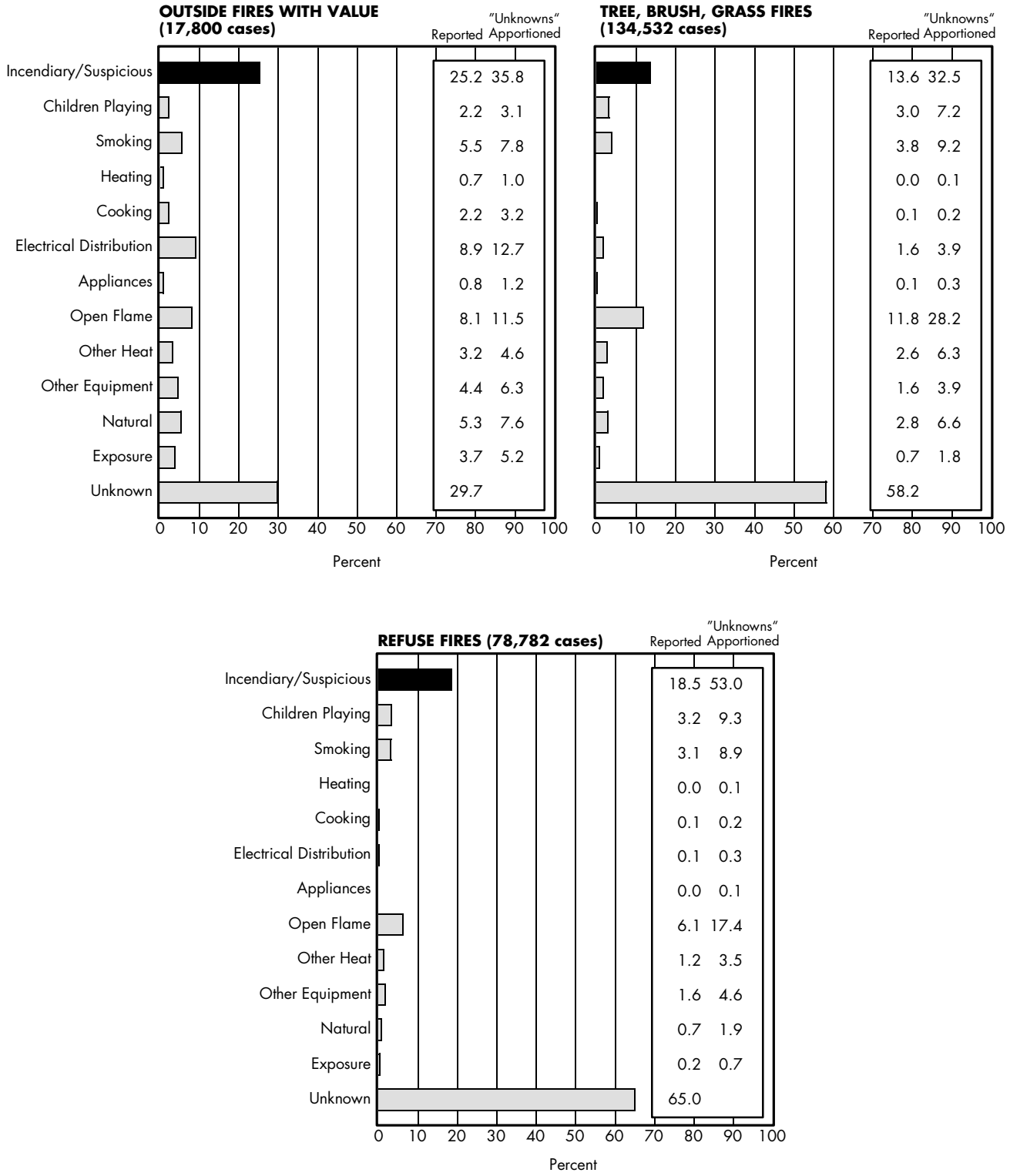
Source: NFIRS

FIGURE 99. MONTH OF YEAR OF OUTSIDE AND OTHER FIRES (1998)



Source: NFIRS

FIGURE 100. DAY OF WEEK OF OUTSIDE AND OTHER FIRES (1998)



Source: NFIRS

FIGURE 101. CAUSES OF OUTSIDE FIRES BY PROPERTY TYPE (1998)

For outside fires with value, 36 percent (adjusted for unknowns) of fires are attributed to arson. The rest of the fires are scattered across many categories, with electrical distribution, open flame, smoking, and natural (e.g., lightning strikes) as other contributing causes.

Among the known causes of tree, brush, and grass fires, the two that stand out are open flame, which includes open fires used for cooking, and arson. These two causes account for 61 percent of fires with cause. Following these, but at much lower rates, are smoking and children playing.

More than half of the reported causes of refuse fires were reported as arson, with another 17 percent from open flame (e.g., matches) and 9 percent each from both children playing and smoking. Note that refuse fires set inside buildings are structural fires, even if they do no damage, and are reported as part of the property type in which they occur.

Special Data Problems

Setting a value for outside fire damage is a perennial problem. It is difficult to assign a dollar value to grass, tree, and rubbish fires, yet the damage from these fires often requires labor beyond that of the fire department to clean up and restore the area. They also cause esthetic problems that are intangible. Some outside fires spread to structural properties and may be reported as structural fires rather than an outside fire with exposure to structures. Outside fires can have other indirect costs, such as the financial impact on agricultural communities where a fire destroys crops.

Forest fires and other wildfires to which local departments are not called will not be reported to NFIRS if the state or federal agency with principal authority for fighting the fire does not participate in NFIRS. To more fully analyze outside fires, NFIRS data need to be complemented with data from these other agencies. This is an area that merits further study, which the USFA is pursuing.

Another significant problem with data on outside fires is determining their cause. Often the area of origin is obliterated, the people involved have fled, and one is not sure exactly what caused the fire—an unattended campfire, a discarded match or cigarette, lightning strikes, children playing, or even an intentionally set fire. Thus, the percent of causes determined as unknown is especially high for this category of fires.

USFA RESOURCES ON FIRES IN NON-RESIDENTIAL PROPERTIES

The USFA conducts special studies to address specific problems and current issues facing the nation's fire and rescue service. The technical reports produced under the Major Fires Investigations series analyze major or unusual fires with emphasis on sharing lessons learned. They are directed primarily to chief fire officers, training officers, fire marshals, and investigators as a resource for training and prevention.

The *Topical Fire Research* series for non-residential fires problem can be downloaded from http://www.usfa.fema.gov/nfdc/reports.htm:

2000 Wildland Fire Season
Agricultural Storage Fires
Daycare Center Fires
Fires in Medical Facilities (Hospitals)
Non-Residential Educational Institutions
Wildland Fires: A Historical Perspective
Agricultural Fires
Construction Site Fires
Fire Station Fires
Landfill Fires
Subway Fires

Major Fire Investigation reports on fires and other non-residential property incidents include:

$15 Million Sight and Sound Theater Fire and Building Collapse, Lancaster County, PA (#TR097)
Broward Marine Fire, Ft. Lauderdale, FL (#TR101)
Chicken Processing Plant Fires, Hamlet, NC, and North Little Rock, AR, September 1991 (#TR057)
Conservative Approach to Chemical Plant Fire, Ventura County, CA, April 1989 (#TR029)
Crash of Two Subway Trains on the Williamsburg Bridge, New York City, NY (#FA–163F)
Derailment of the Sunset Limited, Big Bayou Canot, AL (#FA–163B)
East Bay Hills Fire, Oakland–Berkeley, CA, October 1991 (#TR060)
Evacuation of Nanticoke, PA, Due to Metal Processing Plant Fire, March 1987 (#TR005)
Fire and Explosions at Rocket Fuel Plant, Henderson, NV, May 1988 (#TR021)
Fire Apparatus/Train Collision, Catlett, VA, September 1989 (#TR–048)
Fire Department Response to Biological Threat at B'nai B'rith Headquarters, Washington, DC (#TR114)
Fires Involving Medical Oxygen Equipment (#TR107)
Five-Fatality Highrise Office Building Fire, Atlanta, GA, November 1989 (#TR033)
Gasoline Tanker Incidents in Chicago, IL, and Fairfax County, VA: Case Studies in Hazardous Materials Planning, March/May 1989 (#TR032)
Hazardous Materials Response Technology Assessment (#FA–199)
Highrise Office Building Fire, One Meridian Plaza, Philadelphia, PA, February 1991 (#TR049)
Indianapolis Athletic Club Fire, Indianapolis, IN, February 1992 (#TR063)
Industrial Plastics Fire Major Triage Operation, Flint, MI, November 1988 (#TR025)
Industrial Silo Fire and Explosion, Iredell County, NC, December 1997 (#TR122)
Interstate Bank Building Fire, Los Angeles, CA, May 1988 (#TR022)
Live Oak/Milstar Complex and Carpet Service Center, LaGrange, GA, January 1995 (#TR086)
Logan Valley Mall Fire, Altoona, PA (#TR085)
Major Propane Gas Explosion and Fire, Perryville, MD, July 1991 (#TR053)
Major Ship Fire Extinguished by Carbon Dioxide, Seattle, WA, September 1991 (#TR058)
Manufacturing Mill Fire, Methuen, MA, December 1995 (#TR110)
Massive Leak of Liquified Chlorine Gas, Henderson, NV, May 1991 (#TR052)
Multi-Agency Ocean Rescue Disaster Plan and Drill, Broward County, FL (#TR079)
New York City Bank Building Fire: Compartmentation vs. Sprinklers, New York, January 1993 (#TR071)
Phillips Petroleum Chemical Plant Explosion and Fire, Pasadena, TX, October 1989 (#TR035)
Safety and Health Considerations for the Design of Fire and Emergency Medical Services Stations (#FA–168)
Scrap and Shredded Tire Fires, December 1998 (#TR093)
Search and Rescue Operations Following the Northridge Earthquake, Los Angeles, CA (#FA–163C)
Search and Rescue Operations in California During Flooding (#FA–163E)
Search and Rescue Operations in Georgia During Major Floods (#FA–163D)
Sherwin–Williams Paint Warehouse Fire, Dayton, OH, May 1987 (#TR009)
Sprinklered Records Storage Facility, Chicago, IL, October 1996 (#TR106)

Sprinklers Control Arson Fire in Rack-Storage Warehouse, Mt. Prospect, IL, October, 1988 (#TR030)
Swimming Pool Chemical Plant Fire, Springfield, MA, June 1988 (#TR027)
Ten Million Dollar Marina Fire, Bohemia Bay, MD, January 1989 (#TR026)
The Hazards Associated With Agricultural Silo Fires, August 1998 (#TR096)
Tire Fires: A Report to Congress (#FA–187)
Urban Wildlands Fire, Pebble Beach, CA, May 1987 (#TR007)
Wanton Violence at Columbine High School, Littleton, CO, April 1999 (#TR128)
World Trade Center Bombing: Report and Analysis, February 1993 (#TR076)

Other works published by USFA of interest to the non-residential fire problem include:

Arson Prevention—For America's Churches and Synagogues (#L–239)
Arson Victims (#FA–177)
Board Up Procedures (#L–247)
Church Mutual Protection Series—Fire Safety at Your Worship Center (#L–238)
Church Threat Assessment Guide (#FA–207)
Compressed Air Foam Use for Structural Fire Fighting: A Field Test, Boston Fire Department, June 1993 (#TR074)
Confined Space Rescue on SS Gem State, Tacoma, WA (#FA–163A)
Emergency Procedures for Employees with Disabilities in Office Occupancies (English, Braille, Cassette, and Spanish; #FA–154, #FA–154B, #FA–154C, #FA–154S, respectively)
Fire Protection in the Wildfire/Urban Interface
Motor Vehicle Fires—What You Need to Know (#L–202)
New Technologies in Vehicle Extrication (FA–152)
NFPA 912 Fire Protection in Places of Worship, 1993 Edition (#FA–208)
Planning for Water Supply and Distribution in the Wildland/Urban Interface
Protecting Structures From Arson (L–241)
Report of the Operation Urban Wildfire Task Force (#FA–115)
Rural Arson Control (#FA–87)
Technical Rescue Program Development Manual (#FA–159)
Technical Rescue Technology Assessment (#FA–153)
Wildfire Strikes Home Second Edition
Wildlands Fire Management: Federal Policies and Their Implications for Local Fire Departments, 1998 (#TR045)
Wildfire—Are You Prepared? (#L–203)

These USFA publications are free of charge by writing to:

United States Fire Administration
Publications Center
16825 South Seton Avenue
Emmitsburg, MD 21727

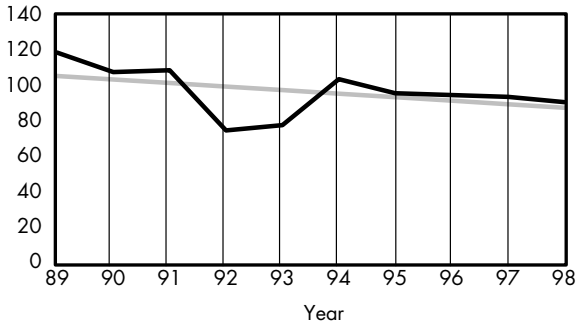
Please include the parenthetical publication number, if given, in your request. Documents may also be ordered at http://www.usfa.fema.gov/usfapubs or through the USFA Publications Center's toll-free number (800) 561–3356.

5 Firefighter Casualties

The number of firefighter deaths and injuries (casualties) continued a 20 -year decline, although currently at a slower rate than in the past. In 1998, 91 firefighters died while on duty, which included firefighting activities, emergency medical services (EMS) incidents, and training accidents;[1] 87,500 firefighters were injured while on duty. This chapter presents the details of these casualties, focusing especially on 1998, the last year in which data were available.

DEATHS

In every year until 1992, more than 100 firefighters died in the line of duty. The peak was in 1978 when 171 firefighters died. The fewest deaths (75) were recorded in 1992. The 91 deaths that occurred in 1998 represent the third lowest total over the past 10 years (Figure 102). Deaths have been in a narrow range (91 to 104) for the past 5 years, so the actual downward 10-year trend of 17 percent is not as sharp as it was in the early 1990s. Over 10 years, an annual average of 99 firefighters have died.



1989	119	1994	104
1990	108	1995	96
1991	109	1996	95
1992	75	1997	94
1993	77	1998	91

10-Year Trend = -17.0%

Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 102. TRENDS IN FIREFIGHTER DEATHS

The 91 fatalities represented 37 career firefighters and 54 volunteers (Table 18). Nine deaths occurred during wildland firefighting operations. One Air Force airman died in a vehicle collision while enroute to a wildland fire near a remote airfield. Seventeen female firefighters were killed on duty from 1994 to 1997, but none died in 1998.

[1] The 91 on-duty fatalities in 1998 do not include two firefighters who died during the year from injuries sustained in 1989 and 1996, respectively.

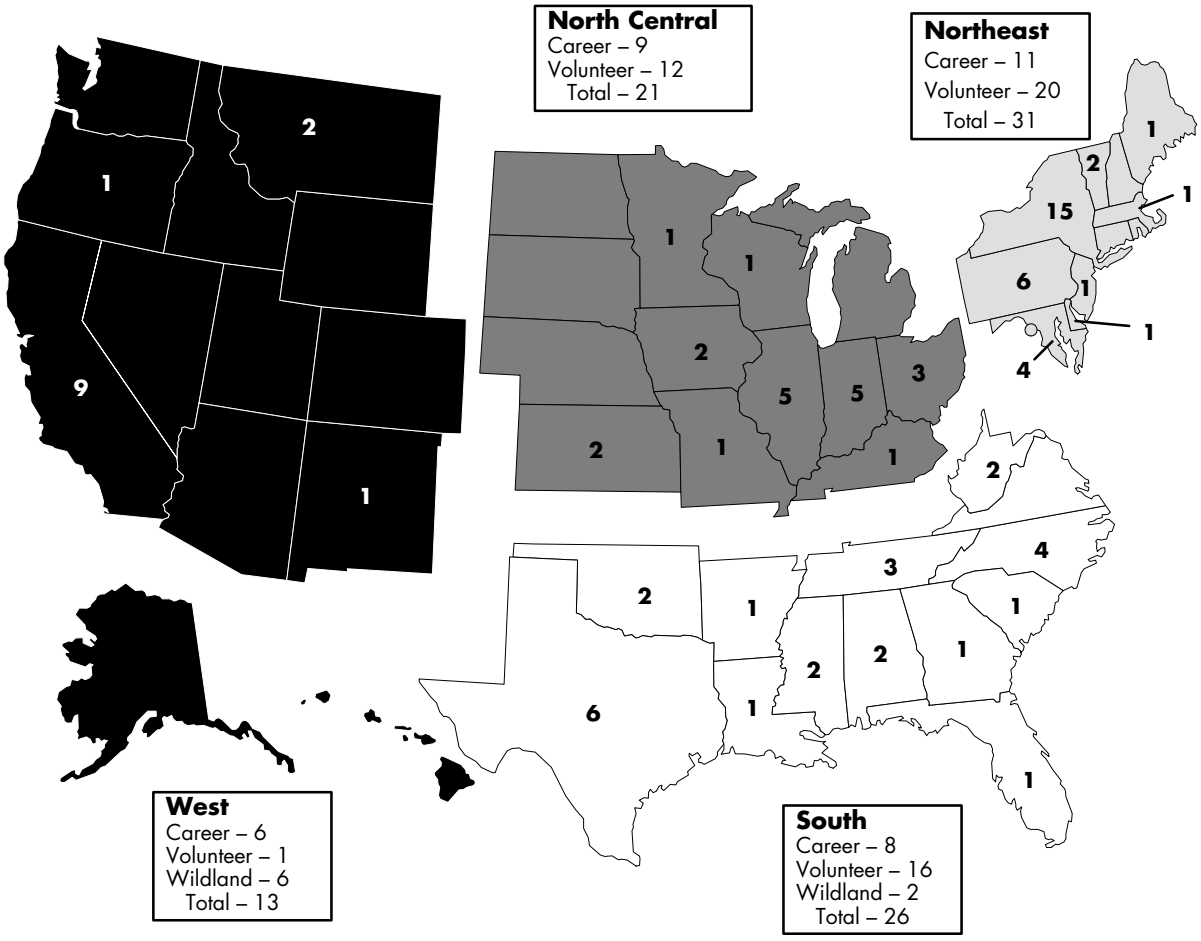
Region

Firefighter deaths in 1998 were distributed as follows: 46 deaths in urban/suburban areas, 38 in rural areas, and 7 in federal or state parks/wildland areas. Figure 103 shows these deaths by area of the country and by individual state. Thirty-three states had at least one firefighter fatality. New York had the highest number of deaths (15) followed by California (9). Indiana had a disproportionately high number of firefighter deaths (5) in relation to its population.

TABLE 18. FIREFIGHTER DEATHS (1998)

Firefighter Type/Gender	Fatality
Firefighter	
Volunteer	54
Career	37
Wildland Firefighter	
Career/Military	4
Volunteer	3
Seasonal/Part Time	2
Municipal/Local Fire Departments	
Career	33
Volunteer	49
Men	91
Women	0

Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

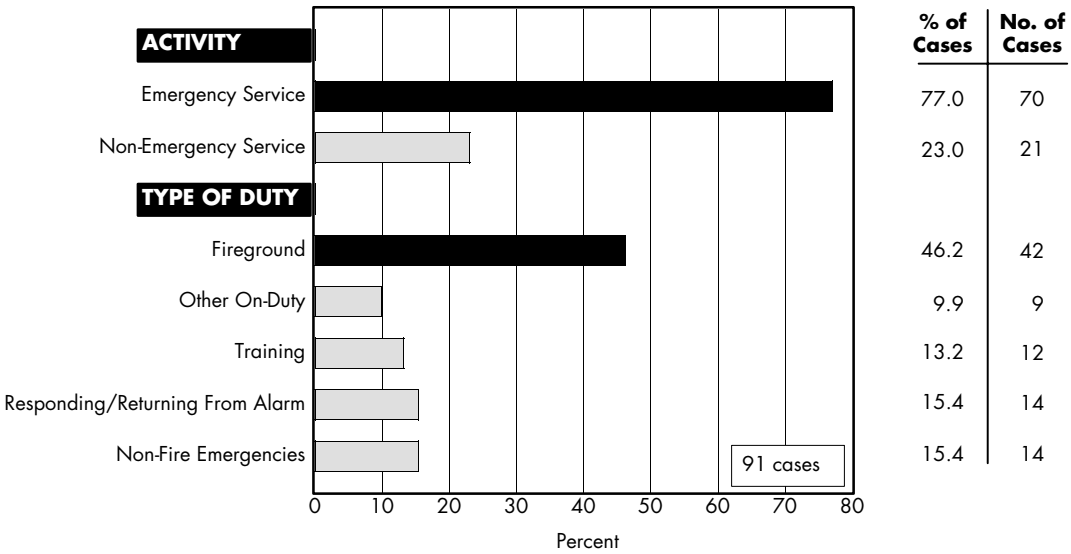


Sources U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 103. FIREFIGHTER DEATHS BY REGION AND STATE (1998)

Activity and Type of Duty

On-duty firefighter activities are divided into two categories, emergency and non-emergency. Emergency activities include responding to an emergency, activities performed while at the emergency scene, or returning from or immediately following the emergency incident. Seventy died during emergency incidents (Figure 104). The rest (21) occurred during non-emergency duties, which include training, administrative activities, or performing other functions not related to an emergency incident.



Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 104. FIREFIGHTER DEATHS BY ACTIVITY AND TYPE OF DUTY (1998)

As in all years since such data were recorded, the largest number of deaths (42) in 1998 occurred during fireground operations (Figure 104). Of these fireground deaths, 17 resulted from heart attacks on the emergency scene, 14 from asphyxiation, 7 from internal trauma, 2 from burns, 1 from stroke, and 1 from loss of blood due to a partial leg amputation.

The second leading category or activity resulting in firefighter deaths is responding to or returning from an emergency. Fourteen firefighters died in 1998 , 8 in motor vehicle collisions and 6 from heart attacks.

An additional 14 firefighters died in non-fire emergencies: 5 from heart attacks, 3 in a helicopter crash during a medical transport, 4 struck by vehicles while working a vehicle accident scene, 1 drowned while attempting a rescue, and 1 who was attempting to remove a fallen tree.

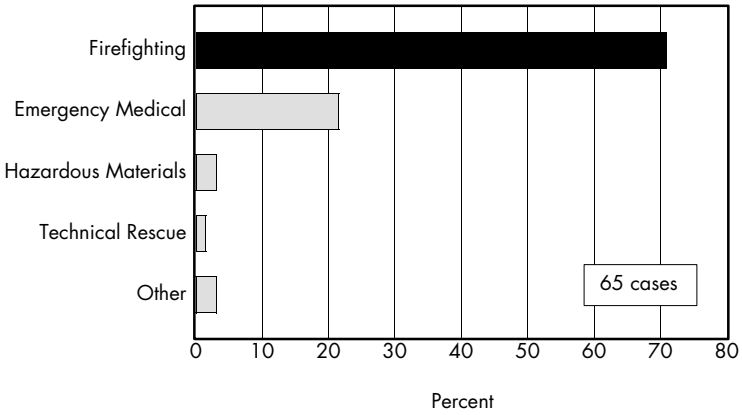
More than twice the number of firefighters died (12) in 1998 during training exercises than in any of the previous 3 years. Eight deaths were from heart attacks, 1 from a stroke/seizure after striking his head on a self-contained breathing aparatus (SCBA) maze, 1 fell from a pickup truck, 1 was struck

by a vehicle at the scene of a drill, and 1 during a vehicle collision while on the way to a paramedic training class.

Of the 9 deaths that occurred during non-emergency duty activities, 3 died from heart attacks, 2 were electrocuted as they repositioned a metal ladder, 1 died in a vehicle collision, 1 died when a tractor he was using to maintain a fire road rolled over, 1 died of a cardiovascular attack (CVA) while on duty, and 1 died when a blood clot lodged in his lung.

Type of Emergency Duty

As shown in Figure 105, the overwhelming number of emergency duty firefighter deaths in 1998 related directly to firefighting activities (46). The total of 65 deaths were apportioned as follows: 46 to fire-related duty, 14 during EMS calls, 2 in association with hazardous materials emergencies, 1 during a technical rescue, and 2 while preparing for or participating in searches for lost persons.



% of Cases	No. of Cases
70.8	46
21.5	14
3.1	2
1.5	1
3.1	2

Sources U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

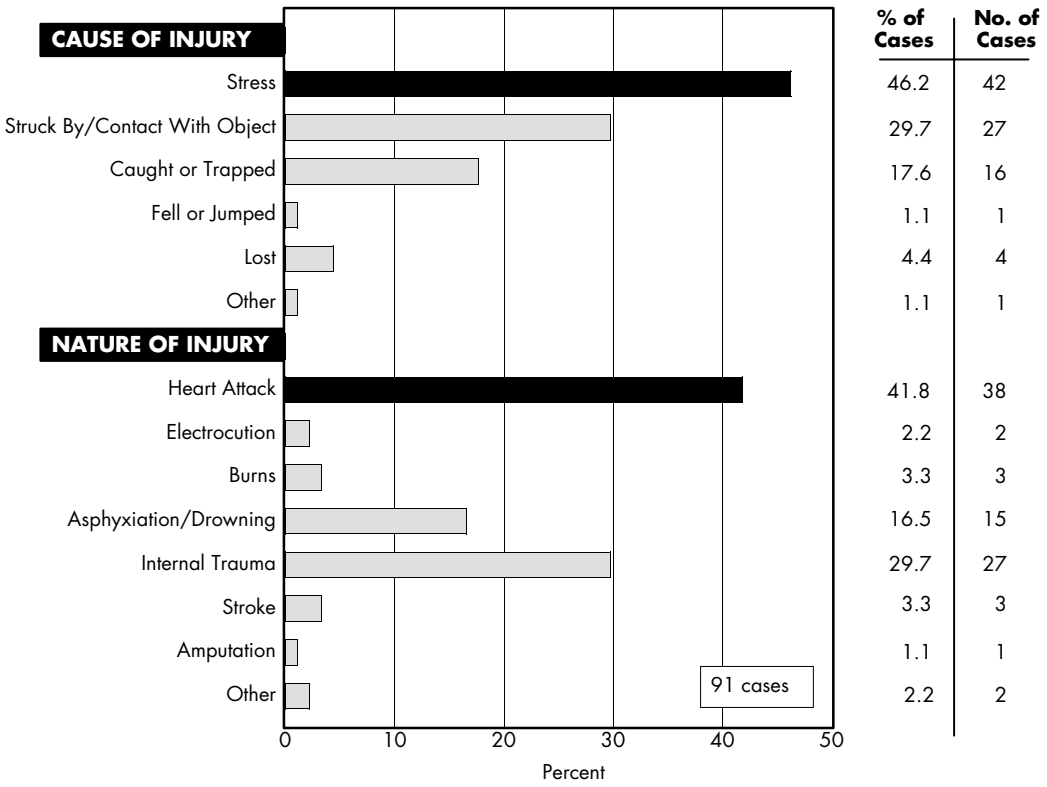
FIGURE 105. FIREFIGHTER DEATHS DURING EMERGENCY DUTY (1998)

Cause and Nature of Fatal Injury or Illness

The word *cause* refers to the action, lack of action, or circumstances that directly resulted in the fatal injury; the word *nature* refers to the medical nature of the fatal injury or illness, or what is often referred to as the cause of death. A fatal injury usually is the result of a chain of events, the first of which is recorded as the cause. For example, if a firefighter is struck by a collapsing wall, becomes trapped in the debris, runs out of air before being rescued, and dies of asphyxiation, the cause of the fatal injury is recorded as "struck by collapsing wall" and the nature of the fatal injury is "asphyxiation." Likewise, if a wildland firefighter is overrun by a fire and dies of burns, the cause of death would be listed as "caught/trapped," and the nature would be "burns." This follows the convention used in NFIRS casualty reports, which are based on NFPA fire reporting standards.

Figure 106 shows the distribution of deaths both by cause and by nature of fatal injury or illness. As in all previous years, the most frequent cause (42 deaths) in 1998 was stress or overexertion. Fire-

fighting has been shown to be one of the most physically demanding activities that the human body performs, and the nature of most stress-related deaths was from heart attacks (38). The other 4 deaths included 3 from strokes (or CVA) and 1 from a gastric hemorrhage. Thirteen of the 42 deaths reported as stress/exertion occurred during non-emergency operations.



Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 106. FIREFIGHTER DEATHS BY CAUSE AND NATURE OF INJURY (1998)

The second leading cause of firefighter fatalities was being struck by or coming in contact with an object. Of the 27 firefighters killed, 17 were involved in vehicle accidents (including 3 in airplane crashes and 3 in a helicopter crash), 5 were struck by vehicles while on emergency scenes, 2 were killed by an explosion of a propane truck, 1 was killed by a falling parapet, and 2 were electrocuted. The nature of most of these deaths was internal trauma, which is the second leading nature of death. At least 6 of the 11 firefighters killed in vehicle collisions were not wearing seat belts.

The other 10 firefighters who were struck by or came into contact with an object included 2 electrocuted while repositioning a ladder that came in contact with an electrical line, 2 struck by pieces of a propane tank that exploded, 5 struck by other motor vehicles, and 1 struck by a falling parapet wall as he opened doors at a recycling warehouse.

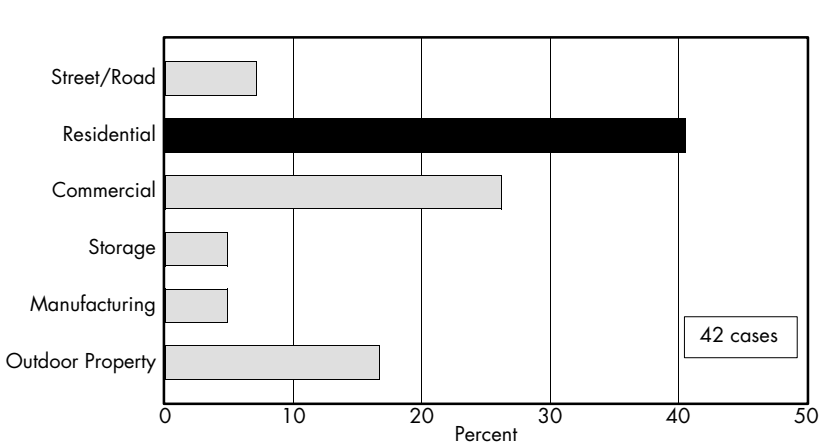
Sixteen firefighter fatalities were caused by being caught or trapped, more than twice the number who died in 1996. Of these, 5 died after becoming trapped by collapses, 8 were trapped by rapid fire progress, 1 drowned while attempting a rescue, 1 was trapped by the movement of a fallen tree he was removing from the roadway, and 1 was crushed between a utility pole and a pumper.

The remaining causes of firefighter deaths included 4 who died when they became lost inside of burning structures, 1 who fell from a fire department pickup truck bed while setting up for competition training, and 1 who died of a blood clot that lodged in the lung.

After heart attack and internal trauma, the next leading nature of death was from asphyxiation. Drowning accounted for 1 death, and 14 were during structural firefighting, 9 of which occurred in only four incidents.

Fireground Deaths

Figure 107 shows the distribution of the 42 fireground deaths in 1998 by fixed property use. Thirty-two firefighters died in structure fires. Of these, residential occupancies accounted for the most, 17. Two firefighters died in 1998 in a storage facility, 11 in commercial structures, and 2 in a manufacturing plant fire. Residential properties consistently account for 70–80 percent of all structure fires and a similar percentage of the civilian fire deaths each year. It is not that residential fires are more dangerous, but rather that they are more common. Firefighter deaths per fire, however, are higher in non-residential than in residential structures.



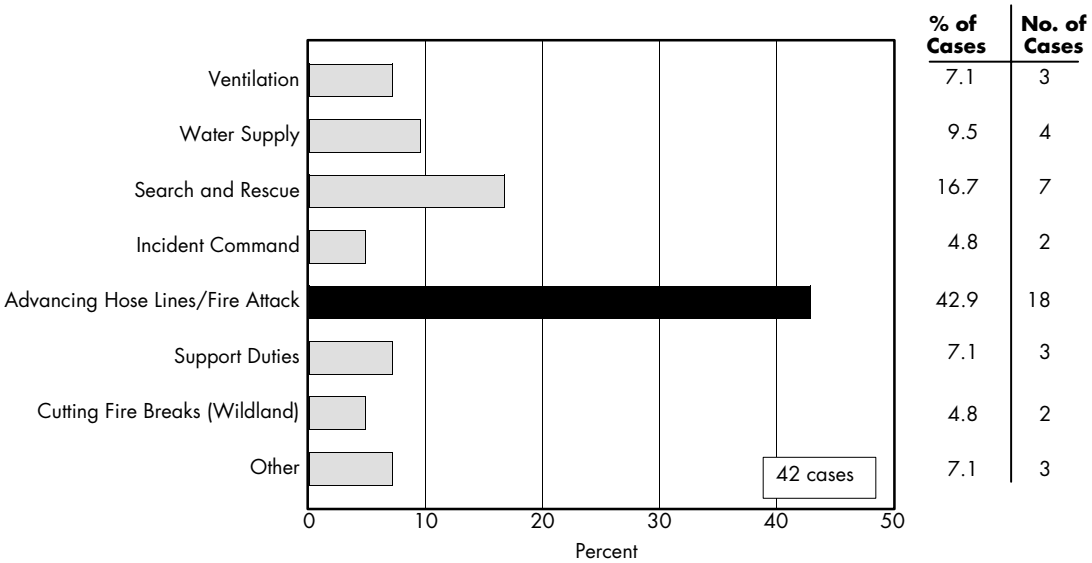
	% of Cases	No. of Cases
Street/Road	7.1	3
Residential	40.5	17
Commercial	26.2	11
Storage	4.8	2
Manufacturing	4.8	2
Outdoor Property	16.7	7

Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 107. FIREFIGHTER DEATHS ON FIREGROUND BY FIXED PROPERTY USE (1998)

Outdoor properties and "street/road" accounted for 10 firefighter deaths. Three deaths were the result of wildland firefighting aircraft crashes, 3 were from heart attacks at the scene of vehicle fires, 1 died of burns when his bulldozer was overrun by fire, 1 died of a heart attack while filling brush trucks with water, 1 died of a heart attack after working a wildland fire for an extended period of time, and 1 was crushed between his pumper and a utility pole as the truck was being relocated at a wildland fire.

Figure 108 illustrates the activities the 42 firefighters were engaged in at the time they sustained their fatal fireground injuries or illnesses. Eighteen firefighters died in 1998 while engaged in traditional engine company duties of fire attack and advancing hose lines. This is 3 deaths fewer than in 1997. Nine of these deaths occurred in structural firefighting, 2 were killed in explosions, 3 were killed in wildland firefighting aircraft crashes, 2 were killed at wildland fires, 1 died at a dumpster fire, and 1 died at a vehicle fire.



Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 108. FIREFIGHTER DEATHS ON FIREGROUND BY TYPE OF ACTIVITY (1998)

Seven firefighters were performing search-and-rescue operations inside burning structures when they were killed (two higher than in 1996 and 1997). Two were trapped in a collapse of a residential structure fire as they searched for a fire victim, 3 were overcome by rapid fire progress while searching a high-rise apartment building, 1 was killed searching for fire in a supermarket, and 1 was killed as he attempted to rescue another firefighter in an automobile salvage yard storage building.

Three firefighters died while performing support duties—six fewer than in 1996. All 3 deaths occurred while the firefighters were performing ventilation duties: 1 fell through the roof at a structural fire, 1 had entered a residential structure by ground ladder when he succumbed to a heart attack, and 1 was prying open the hood of a car when he had a heart attack.

Two firefighters died while cutting fire breaks, 1 when his bulldozer was overrun by fire and 1 of a heart attack. Two died while performing incident command tasks, 1 at a car fire and 1 at a structure fire.

Age of Firefighters

Table 19 shows the distribution of firefighter deaths by age and by nature and cause of death. Younger firefighters were more likely to have died as a result of traumatic injuries from an apparatus accident or after becoming caught or trapped during firefighting operations; trauma and asphyxiation were responsible for most of their deaths. Stress was more of a contributing factor in firefighter deaths as age increased. Heart attacks accounted for 65 percent of deaths of firefighters older than 40.

TABLE 19. AGE OF FIREFIGHTER AT TIME OF DEATH BY CAUSE AND NATURE (1998)

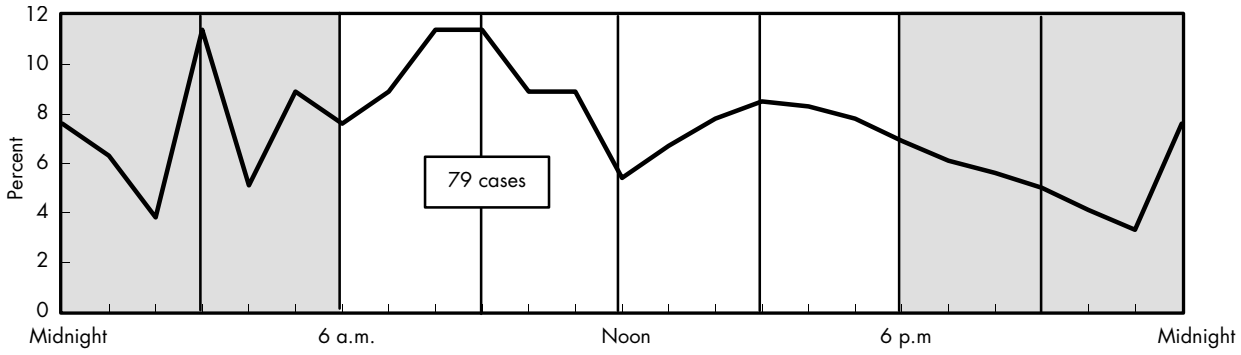
	Age										Total
	Under 21	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	Over 60	
CAUSE											
Stress	0	0	0	2	0	8	10	7	9	6	42
Collision	1	4	1	4	2	0	1	0	2	2	17
Struck/Contact With Object	0	1	1	0	1	1	2	2	2	0	10
Caught/Trapped	0	2	3	1	5	2	1	0	1	1	16
Fell or Jumped	1	0	0	0	0	0	0	0	0	0	1
Lost	0	2	1	0	1	0	0	0	0	0	4
Other	0	0	0	1	0	0	0	0	0	0	1
Total	2	9	6	8	9	11	14	9	14	9	91
NATURE											
Heart Attack	0	0	0	1	0	7	10	6	8	6	38
Electrocution	0	0	1	0	0	0	1	0	0	0	2
Burns	0	1	0	0	2	0	0	0	0	0	3
Asphyxiation/Drowning	2	4	4	1	4	1	1	0	0	0	15
Internal Trauma	0	4	1	4	3	2	2	2	5	2	27
Stroke	0	0	0	0	0	1	0	1	1	0	3
Amputation	0	0	0	0	0	0	0	0	0	1	1
Other	0	0	0	2	0	0	0	0	0	0	2
Total	2	9	6	8	9	11	14	9	14	9	91

Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

When Deaths Occur

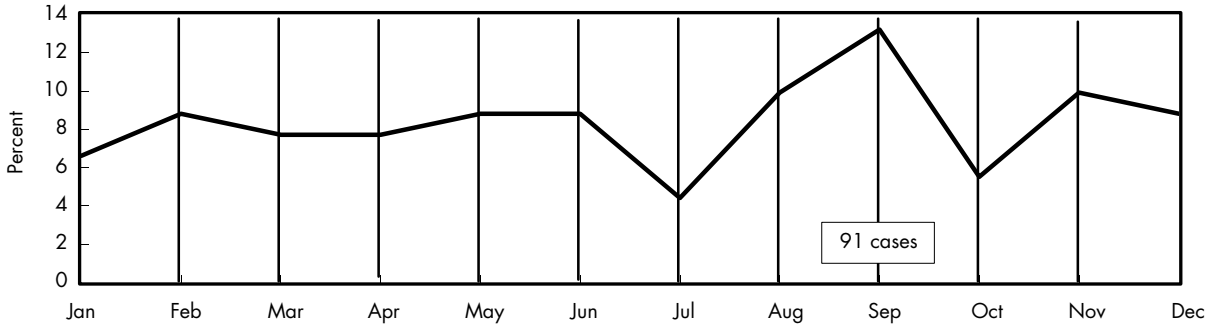
Time of Alarm. The distribution of 1998 deaths by time of day is shown in Figure 109. (Time of day was not reported in 12 cases.) Eighteen firefighters died between 5 and 9 p.m. For structural firefighting deaths only, 71 percent occurred between 8 p.m. and 8 a.m. Contrary to what might be expected, most firefighter deaths do not occur late at night.

Month of Year. Figure 110 shows firefighter fatalities by month of the year in 1998. Firefighter deaths peaked in September; the fewest fatalities occurred in July and October. Other than the fact that wildland fires occur in the wildland season, no significant trends were identified.



Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 109. FIREFIGHTER DEATHS BY TIME OF ALARM (1998)



Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 1998*

FIGURE 110. FIREFIGHTER DEATHS BY MONTH OF YEAR (1998)

Firefighter Health

Each year, heart attacks and strokes take a terrible toll on firefighters (41 firefighters or 46 percent of all 1998 deaths). In fact, from 1995 through 1998, 171 firefighters succumbed to heart attacks and strokes. Nearly all of these deaths are men over the age of 40. In 1998, 19 of the 41 firefighters who died had pre-existing conditions such as prior heart problems, bypass surgery, or diabetes.

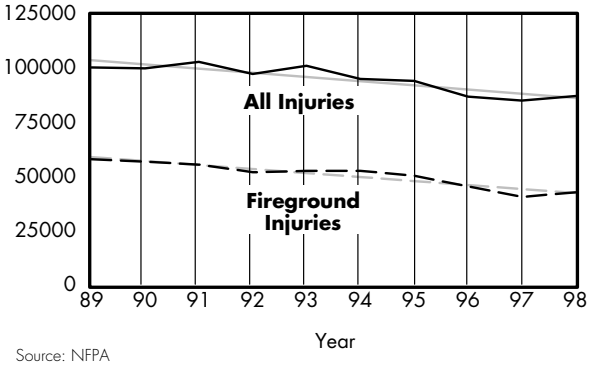
The USFA recommends the implementation of effective firefighter health and wellness programs to reduce the incidence of heart attacks and strokes. Such programs and procedures include:

- The Fire Service Joint Labor Management Wellness–Fitness Initiative developed by the International Association of Firefighters (IAFF) and the International Association of Fire Chiefs (IAFC).
- The Candidate Physical Ability Test, which is a method of testing the health of recruits, also developed by the IAFF and IAFC.
- Periodic medical evaluations of all firefighters.

- Medical care available at the scene of every emergency incident.
- An automatic external defibrillator (AED) available at the fire scene.

INJURIES

Twice as many firefighters are injured each year performing fireground duties as there are fire injuries to the civilian population (43,000[2] versus 23,100 in 1998) from reported fires. In all, 87,500 firefighters were injured while on duty.[3] The 10-year trend, however, in both total firefighter injuries and fireground injuries continued downward trends (Figure 111)—17 and 28 percent, respectively. Most of the improvement in reducing firefighter injuries have come in the last 5 years of the 1990s. This section examines firefighter injuries from a number of different perspectives with the objective of highlighting areas of concern that could lead to corrective action. Most of the statistics presented are from the NFIRS database.



Source: NFPA

	All Injuries	Fireground		All Injuries	Fireground
1989	100,700	58,300	1994	95,400	52,900
1990	100,300	57,100	1995	94,500	50,600
1991	103,300	55,800	1996	87,100	45,700
1992	97,700	52,300	1997	85,400	40,920
1993	101,500	52,900	1998	87,500	43,080

10-Year All Injuries Trend = -16.7%
10-Year Fireground Injuries Trend = -28.1%

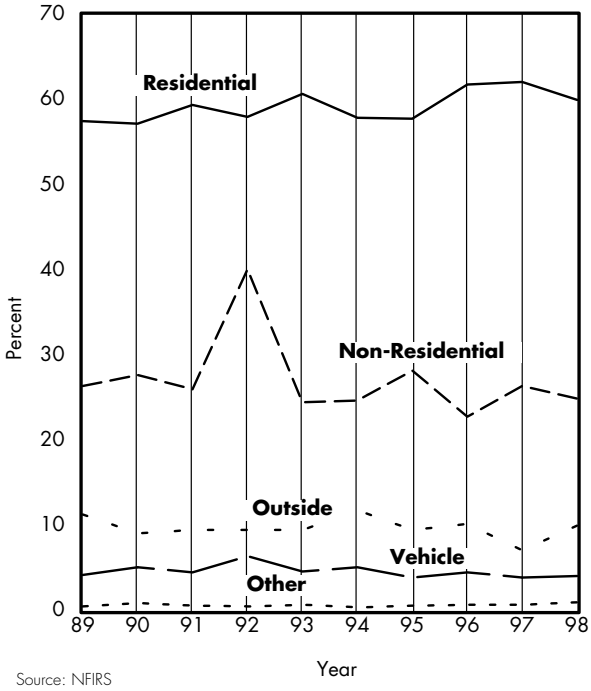
FIGURE 111. TRENDS IN FIREFIGHTER INJURIES

Injuries by Property Type

Eighty-five percent of firefighter injuries reported to NFIRS in 1998 are associated with structure fires. Of these, nearly two and a half times as many injuries occur in residential structures as in non-residential structures (Figure 112). Residential structure fires account for 60 percent of firefighter injuries. The proportion of residential to non-residential injuries has been quite consistent over the 10-year period 1989–1998. Outside, vehicle, and other fires combined represent 15 percent of firefighter injuries.

[2] NFPA reports fireground injuries as 43,080. To this should be added a portion of the injuries categorized as responding to or from an incident (which includes, but is not limited to fires).

[3] On-duty activities include both fireground and non-fireground operations.



	Residential	Non-Residential	Vehicle	Outside	Other
1989	57.5%	26.4%	4.2%	11.3%	0.5%
1990	57.2	27.7	5.1	9.1	0.9
1991	59.4	26.0	4.5	9.5	0.6
1992	58.0	40.1	6.4	9.5	0.5
1993	60.7	24.5	4.6	9.5	0.7
1994	57.9	24.7	5.1	11.8	0.5
1995	57.8	28.2	3.9	9.5	0.6
1996	61.8	22.8	4.5	10.2	0.7
1997	62.1	26.4	3.9	7.1	0.7
1998	60.0	24.9	4.1	10.0	1.0

FIGURE 112. TRENDS IN FIREFIGHTER INJURIES BY GENERAL PROPERTY TYPE

Figure 113 is a more detailed picture of the relative proportion of firefighter injuries by type of structure. Just over half of all firefighter injuries occur in structures at one- and two-family dwelling fires. Apartment fires account for another 18 percent.

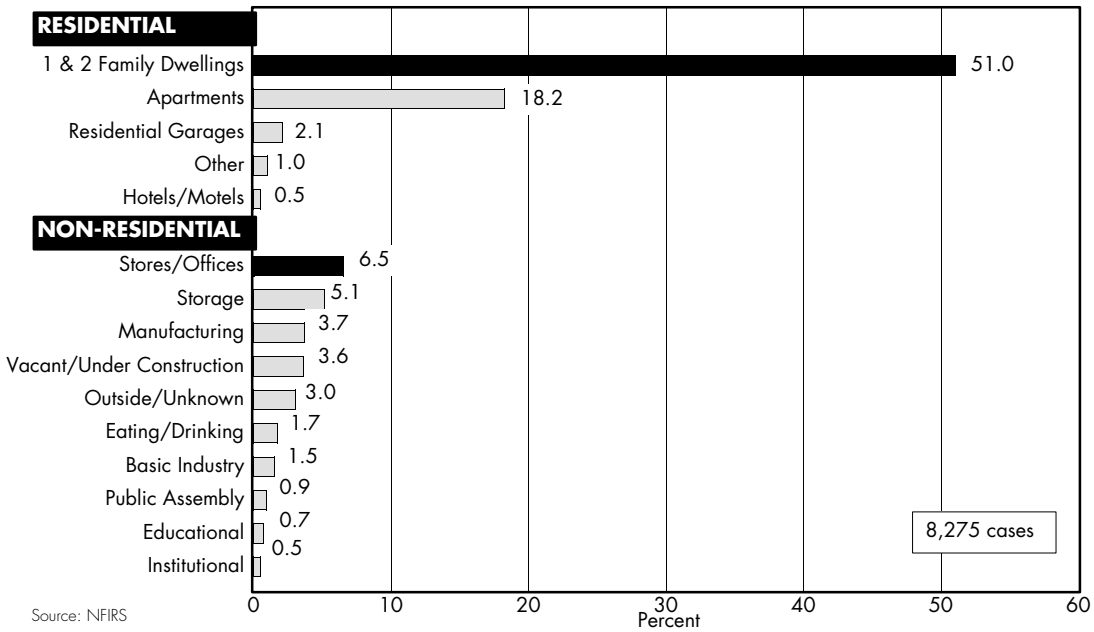
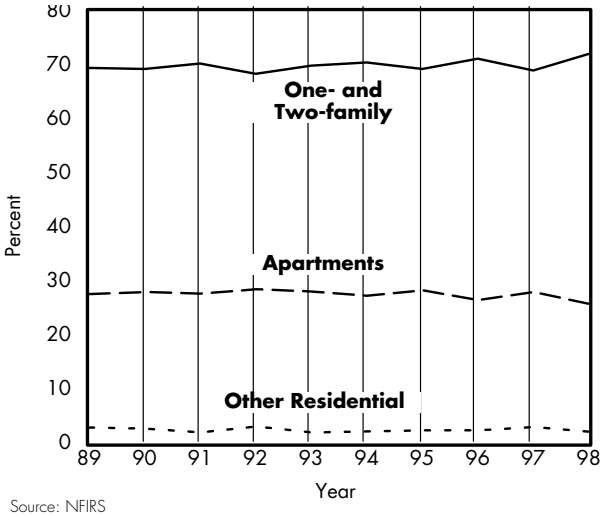


FIGURE 113. FIREFIGHTER INJURIES BY PROPERTY TYPE (1998) (STRUCTURE FIRES ONLY)

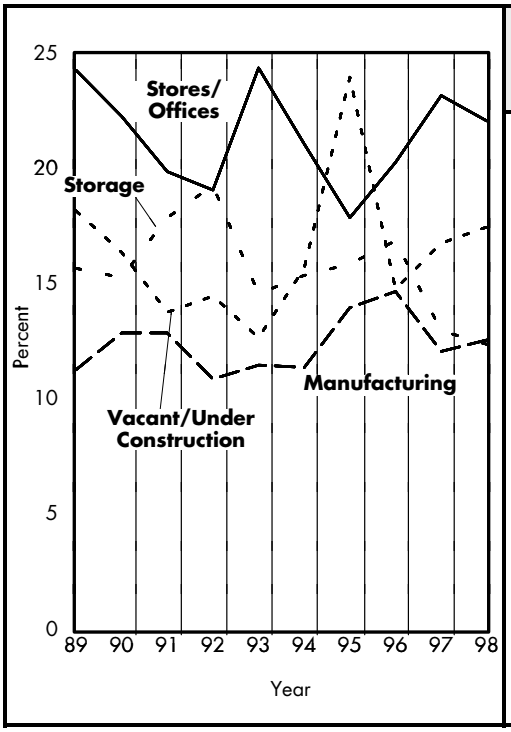
The proportions of injuries by property type are similar over 1989–1998. Figures 114 and 115 show these proportions for residential and non-residential properties. The percentage of firefighter injuries in one- and two-family residential fires reached a new high (72 percent) in 1998 and a new low (26 percent) in apartments. Stores/offices have been the leading non-residential structures in which firefighters have been injured in 9 out of the last 10 years. Storage, manufacturing, and vacant/construction fires combined caused 43 percent of non-residential firefighter injuries in 1998.



Source: NFIRS

	One- and Two-Family	Apartments	Other Residential
1989	69.5%	27.6%	2.9%
1990	69.3	28.0	2.7
1991	70.3	27.7	2.0
1992	68.4	28.5	3.1
1993	69.9	28.1	2.0
1994	70.5	27.3	2.2
1995	69.3	28.3	2.4
1996	71.2	26.5	2.4
1997	69.0	28.0	3.0
1998	72.1	25.8	2.1

FIGURE 114. TRENDS IN FIREFIGHTER INJURIES IN RESIDENTIAL STRUCTURE FIRES



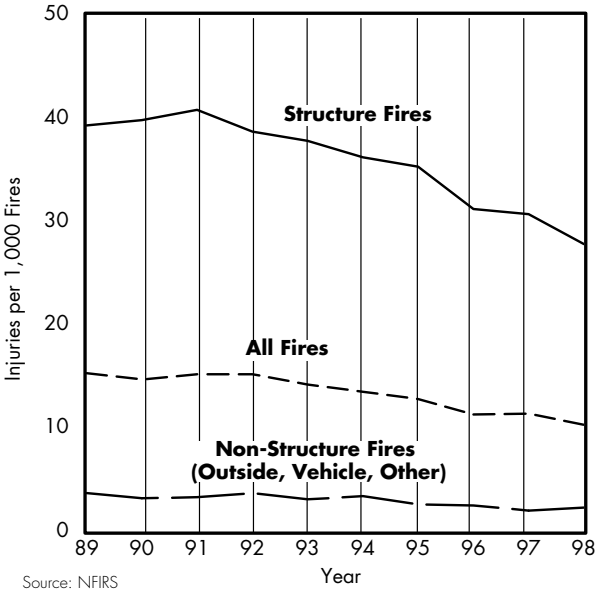
Type of Non-Residential Structures	Percent of Injuries in Fires									
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Public Assembly	5.0	5.4	5.3	4.6	4.0	3.7	3.8	4.3	4.2	2.9
Eating, Drinking	5.8	7.6	5.5	7.4	5.5	6.0	5.7	7.6	6.1	5.9
Educational	3.3	3.3	2.4	3.6	2.2	2.6	1.7	2.8	2.2	2.5
Institutions	1.5	2.1	3.0	2.8	2.7	3.1	1.1	1.3	2.8	1.6
Stores, Offices	24.3	22.3	19.9	19.1	24.4	21.1	17.9	20.3	23.2	22.1
Basic Industry	4.1	3.0	2.8	2.8	2.2	3.5	2.1	2.2	1.8	5.0
Manufac-turing	11.3	12.9	12.9	10.9	11.5	11.4	14.0	14.7	12.1	12.6
Residential Garage	5.3	4.9	8.6	6.6	7.3	7.7	4.8	5.5	7.0	7.2
Storage	18.2	16.4	13.8	14.5	12.7	15.7	24.0	14.8	16.8	17.5
Vacant, Construction	15.7	15.3	17.9	19.3	14.6	15.4	15.9	16.9	13.0	12.4
Outside Structure, Unknown	5.6	6.8	7.8	9.4	12.8	9.7	9.0	9.4	10.7	10.3

Sources: NFIRS and NFPA

FIGURE 115. TRENDS IN FIREFIGHTER INJURIES BY TYPE OF NON-RESIDENTIAL STRUCTURE FIRES

Injuries per Fire

Firefighter injuries per fire have been trending downward over 10 years—33 percent in all fires, 26 percent in structure fires, and 41 percent in non-structure fires (Figure 116).[4] Firefighters are nearly 10 times more likely to be injured in structure fires than in all other fires combined.



Source: NFIRS

Injuries Per 1,000 Fires	Structure Fires	All Fires	Non-Structure Fires
1989	39.3	15.3	3.7
1990	39.8	14.7	3.2
1991	40.8	15.2	3.3
1992	38.7	15.2	3.7
1993	37.8	14.2	3.1
1994	36.2	13.5	3.4
1995	35.3	12.8	2.6
1996	31.2	11.3	2.5
1997	30.7	11.4	2.0
1998	27.8	10.3	2.3
10-Year Trend	**-25.9%**	**-32.6%**	**-41.4%**

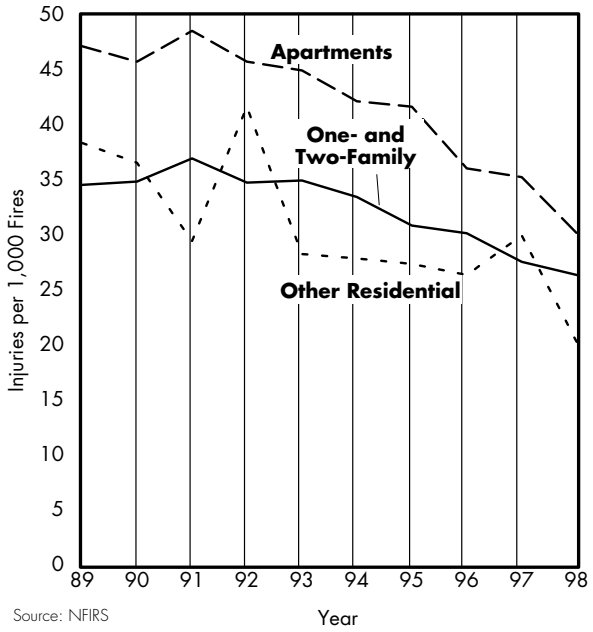
FIGURE 116. TRENDS IN PER FIRE INJURY TO FIREFIGHTERS BY TYPE OF FIRE

The decline of firefighter injuries in residential fires is further displayed in Figure 117. In 1998, firefighter injuries per fire in all three types of residences reached their 10-year lows. The injury rate for hotel/motel fires and other residential structures is down sharply (39 percent), but both of these categories fluctuate considerably from year to year because of small sample sizes. All residential properties have less risk of firefighter injury per fire than basic industry, manufacturing, vacant/under construction, stores/offices, and storage fires (Figure 118) . These five non-residential properties average 44 injuries per 1,000 fires.

The reduction in the total number of firefighter injuries appears to be due to a reduction in injuries per fire rather than a reduction in the number of fires. Either the nature of fires changed or the safety practices or equipment changed. This fact might warrant further investigation.

Vacant properties have long been a firefighting concern (Figure 119). In the mid 1970s, the most dangerous fires were those in vacant properties and properties under construction; they continue as high-risk sites. The layout of these structures is often unfamiliar and continually changing from week to week. Fire defenses built into such structures are often not working or working only partially. Also,

[4] The 1987–1996 NFPA *Fire Command* and NFPA *Journal* articles on firefighter injuries show a downward trend in injuries; however, little change was noted in the injury rate over the 10-year period 1987–1996. The NFPA firefighter injury rate on the fireground averaged 23 injuries per 1,000 fires during this period—twice that of the NFIRS data.



Injuries Per 1,000 Fires	One-/Two-Family	Apartments	Other Residential
1989	34.6	47.2	38.4
1990	34.9	45.8	36.6
1991	37.0	48.6	29.5
1992	34.8	45.8	41.7
1993	35.0	45.0	28.3
1994	33.5	42.2	27.9
1995	30.9	41.7	27.4
1996	30.2	36.1	26.4
1997	27.6	35.3	30.0
1998	26.4	30.2	20.3
10-Year Trend	**-25.2%**	**-33.1%**	**-38.5%**

FIGURE 117. TRENDS IN PER FIRE INJURY TO FIREFIGHTERS IN RESIDENTIAL STRUCTURES

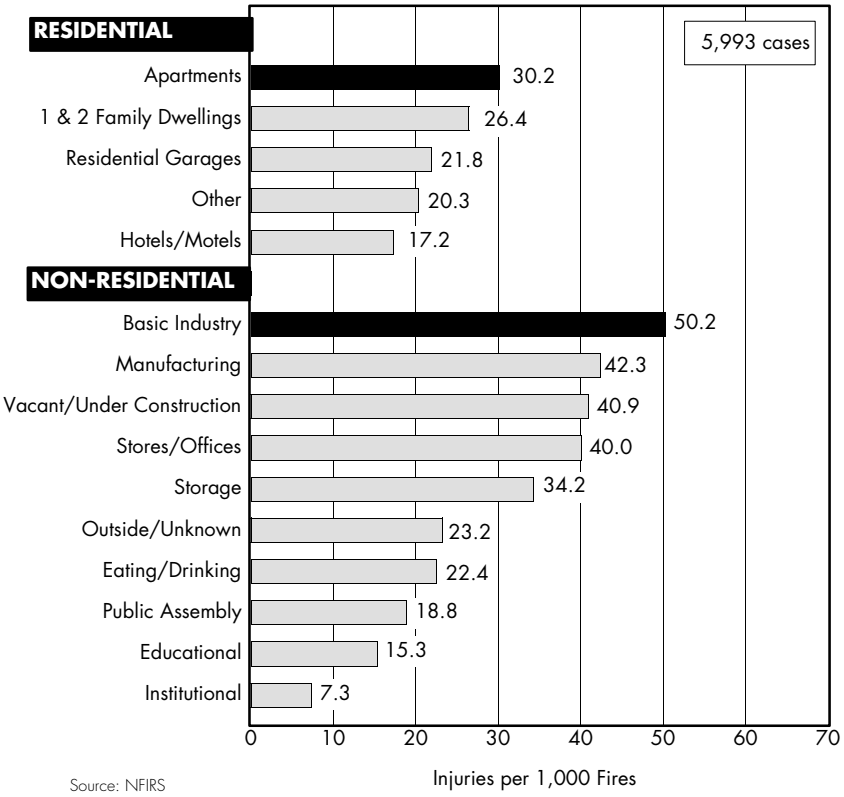
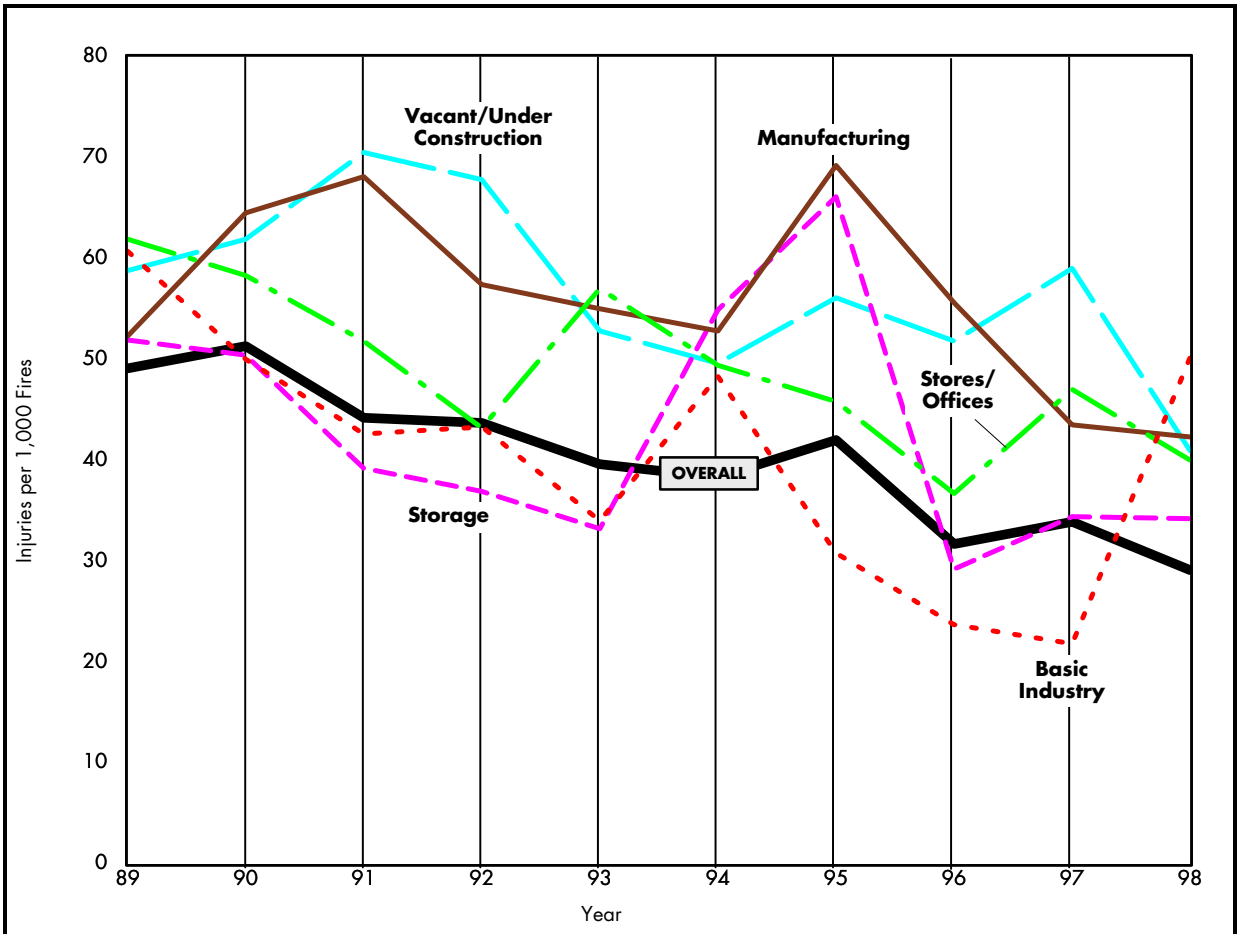


FIGURE 118. PER FIRE INJURY TO FIREFIGHTERS IN STRUCTURES (1998)



Type of Non-Residential Structures	Number of Injuries Per 1,000 Fires									
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Public Assembly	56.8	60.4	58.1	49.5	39.5	36.2	41.1	31.4	36.2	18.8
Eating, Drinking	36.2	46.7	34.1	43.4	29.8	32.6	32.4	31.1	26.5	22.4
Educational	33.8	34.3	22.5	38.8	16.6	19.5	12.9	17.2	14.3	15.3
Institutions	8.8	12.7	18.6	17.2	15.0	18.1	7.3	6.3	13.4	7.3
Stores, Offices	61.9	58.3	51.8	43.2	57.0	49.4	45.8	36.7	47.0	40.0
Basic Industry	60.7	50.0	42.6	43.3	34.0	48.3	30.8	23.7	21.8	50.2
Manufacturing	52.3	64.5	68.1	57.4	55.0	52.8	69.2	55.6	43.5	42.3
Storage	51.9	50.4	39.2	36.9	33.2	54.9	66.1	29.2	34.4	34.2
Vacant, Construction	58.8	61.9	70.5	67.8	52.8	49.6	56.1	51.8	59.0	40.9
Outside Structure, Unknown	25.0	30.8	28.7	29.3	37.5	29.3	25.3	19.5	26.8	23.2
Average	49.1	51.3	44.2	43.7	39.6	38.3	38.7	31.7	49.6	49.6

Sources: NFIRS and NFPA

FIGURE 119. TRENDS IN PER FIRE INJURY TO FIREFIGHTERS IN NON-RESIDENTIAL STRUCTURES

there are many pitfalls where a misstep can cause serious injury. Many of these fires are started when no one is around and the fire gets considerable headway before the fire department is called. This combination continues to make these properties hazardous—in 1998, 41 firefighters were injured per thousand fires, slightly fewer than in basic industry and manufacturing structures fires. A promising sign is that injuries at vacant/under construction structures are at their lowest level over the past

10 years (41 injuries per 1,000 fires). When fighting fires in vacant properties today, there is less of an inclination to risk firefighters' lives. On the other hand, injuries per fire in basic industry properties more than doubled over their 1996 and 1997 levels. For non-residential properties in general, the injury rate per fire fluctuates widely from year to year.

Age

Figure 120 shows the profile of firefighter injuries by age for all property types. Over the past 3 years, one-third of all injuries occurred to firefighters aged 30–39. The types of injuries incurred by firefighters vary with age. Typically, the leading cause of injury among younger firefighters relates to smoke inhalation, and among older firefighters strains and sprains are more common injuries. These results relate to physical fitness variations with age, to the effect of age on assignments, and perhaps to the bravado of younger firefighters.

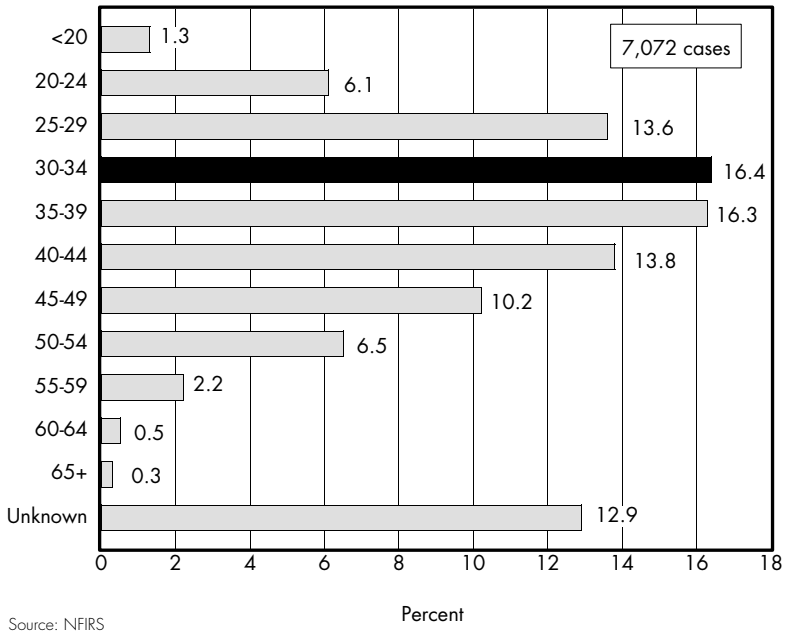


FIGURE 120. FIREFIGHTER INJURIES BY AGE (1998)

When Injuries Occur

Time of Day. Slightly more firefighter injuries occur after noon than before (52 percent with 9 percent unknown) (Figure 121). However, there is no sharp peak. The times that are most hazardous to civilians (evening meal times for injuries) are not the same as the times firefighters get injured.

Month of Year. Firefighter injuries are somewhat higher in the winter (December–March) when residential fires peak (and conditions are more severe in much of the nation) and again in June–August when fire incidence peaks and the warmer weather intensifies the stress effects of fire-fighting (Figure 122).

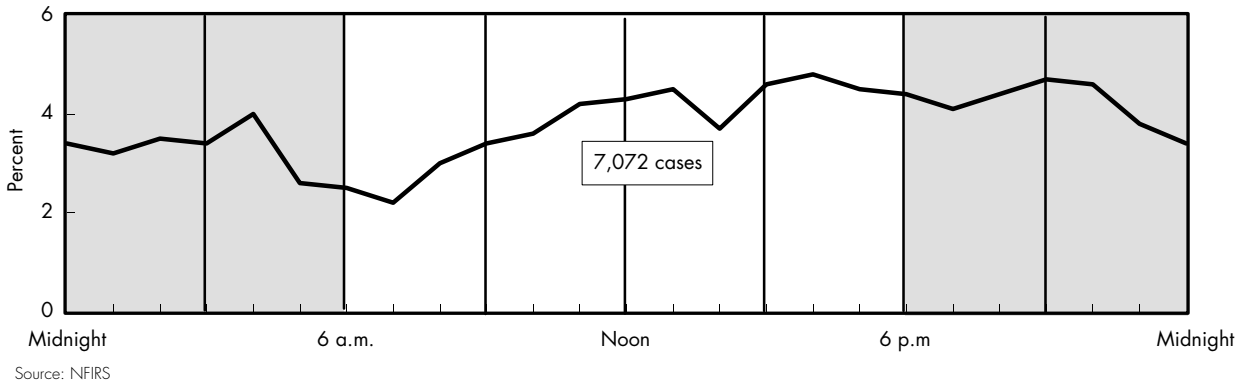


FIGURE 121. FIREFIGHTER INJURIES BY TIME OF DAY (1998)

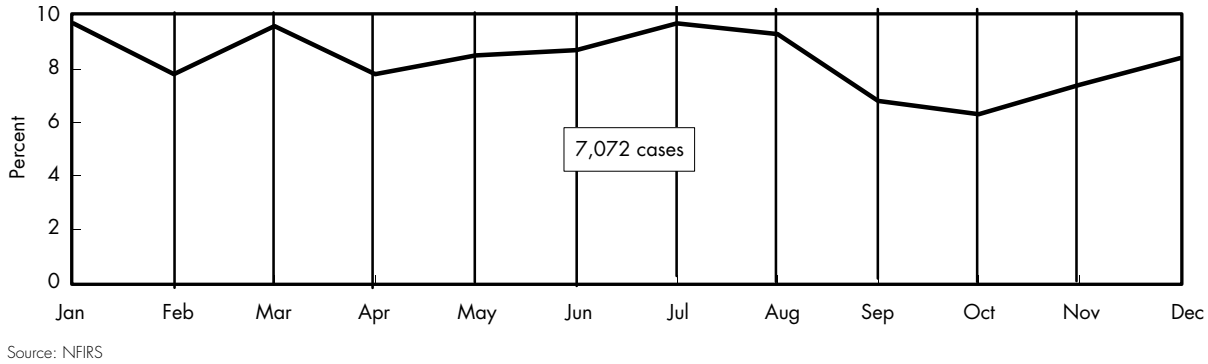


FIGURE 122. FIREFIGHTER INJURIES BY MONTH OF YEAR (1998)

Part of Body Injured

The most common firefighter injuries in 1998 were to the torso (trunk) and arms/hands, followed closely by legs/ feet (Figure 123). All areas of the body are vulnerable, including internal injuries from smoke inhalation.

Causes

As shown in Figure 124, the largest category by far of firefighter injuries associated with fires was reported to be contact with or exposure to flames or smoke (34 percent of injuries, adjusted for the unknowns/others, the same as in 1996). The second highest category was overexertion and strains (24 percent), followed by fell or slipped (19 percent). No cause was reported for 18 percent of the injuries.

Where Injuries Occur

According to NFIRS, 91 percent (adjusted) of the 1998 firefighter injuries associated with reported fires occur on the scene above ground (Figure 125). This percentage is nearly equally divided between injuries occurring inside and outside the structure. Significantly smaller percentages are reported as occurring while en route to the fire scene or below ground level. (As a reminder,

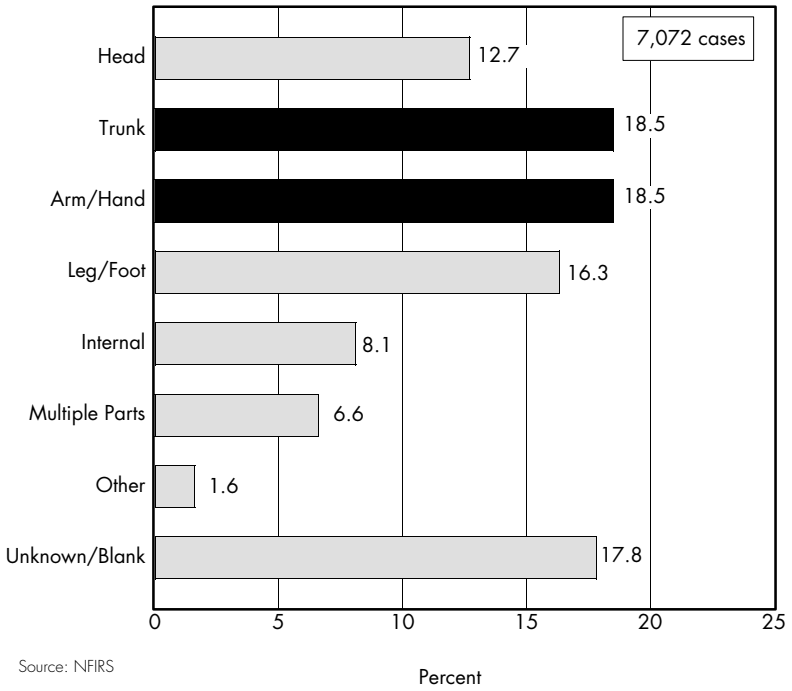


FIGURE 123. FIREFIGHTER INJURIES BY PART OF BODY INJURED (1998)

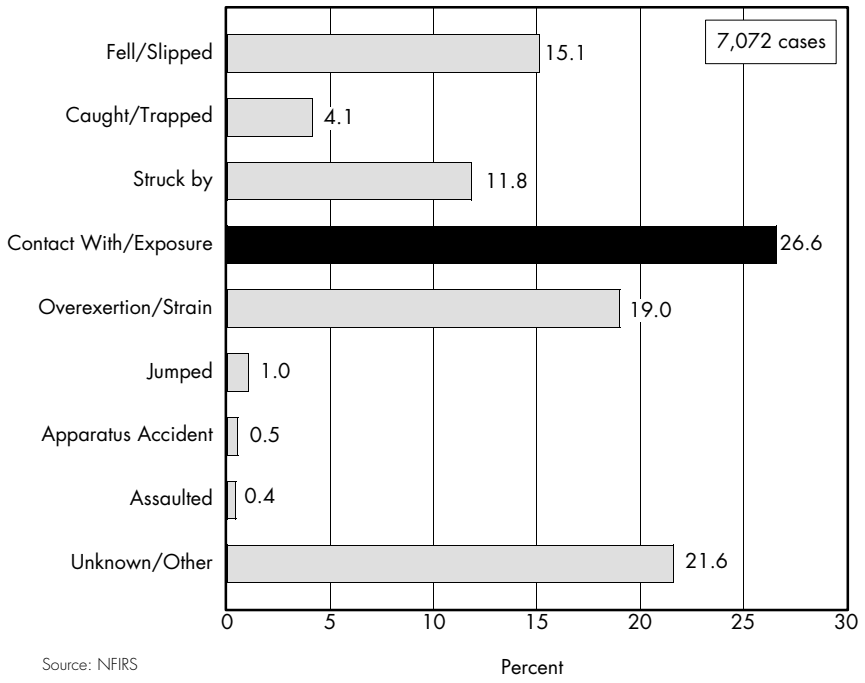


FIGURE 124. FIREFIGHTER INJURIES BY CAUSE (1998)

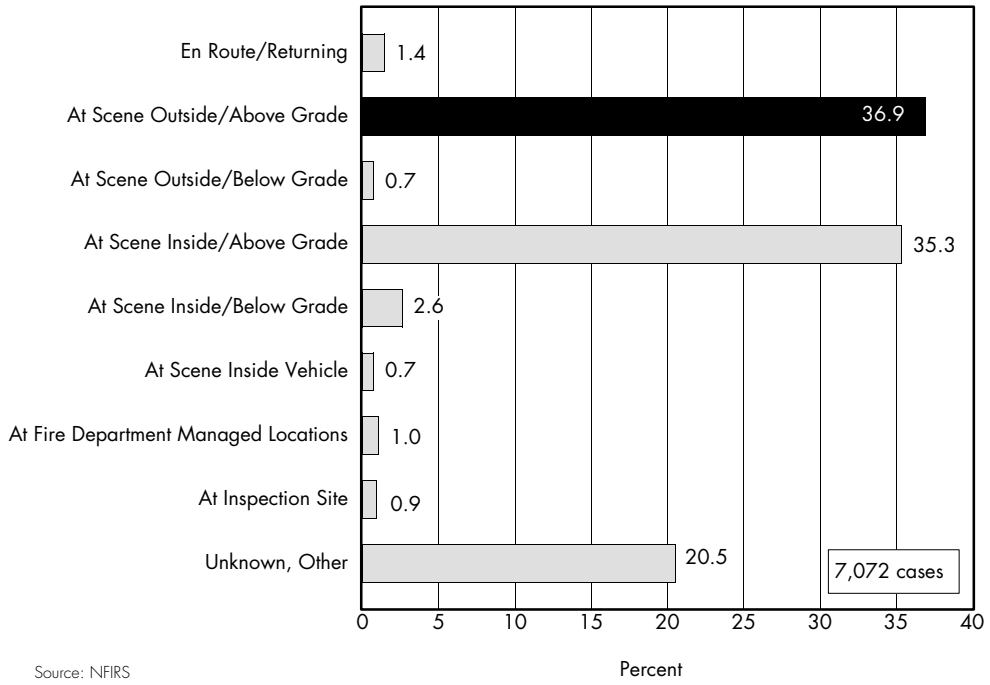


FIGURE 125. FIREFIGHTER INJURIES (ALL FIRES) BY WHERE INJURY OCCURS (1998)

there also are many firefighter injuries not associated with fires, which are not included here.) Location was not reported in 22 percent of the cases.

The striking point here is that many firefighter injuries (47 percent) occur in areas outside the fire building, a place where the firefighter may feel relatively safe. There often are more firefighters operating outside the fire building and exposed to injury than there are inside. At-scene outside structure fires include vehicle fires, which contribute to this high incidence of injuries.

Type of Activity When Injured

More than half of firefighter injuries occurred while extinguishing the fire; suppression support accounted for 26 percent (Figure 126).

Nature of Injury

Heart attacks, internal trauma, and asphyxiation combined account for only 16 percent (adjusted) of firefighter injuries (Figure 127). (Internal trauma is included in the "other" category.) These same categories accounted for 89 percent of firefighter fatalities. In 1998, sprains and strains and cuts and wounds accounted for 44 percent of injuries. Burns and pain combined accounted for an additional 29 percent.

Type of Medical Care

Over half of the reported fire injuries associated with fires in 1998 were treated at hospitals (Figure 128). Another 45 percent were treated but not transported.

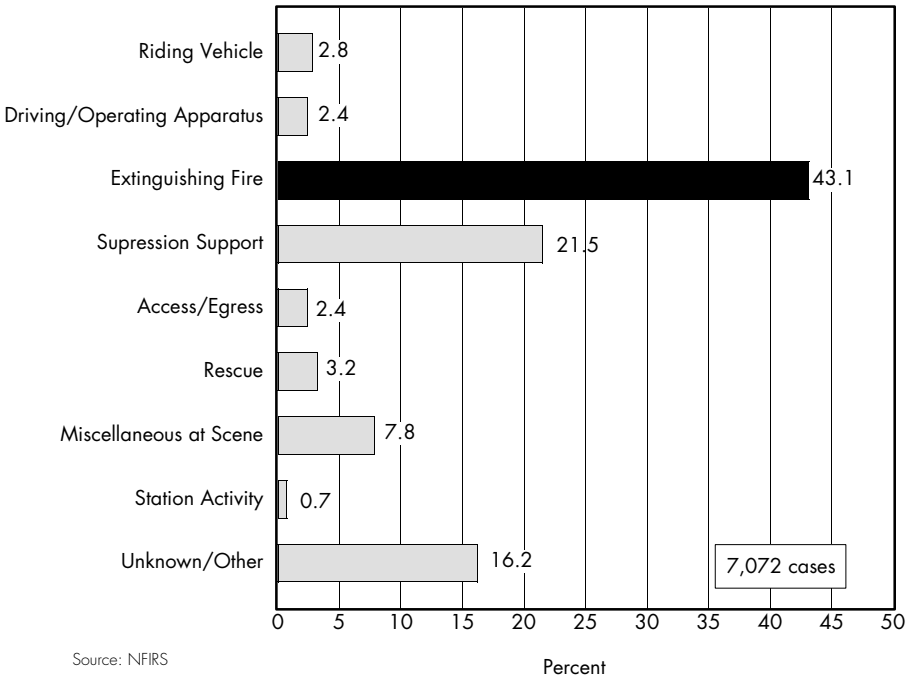


FIGURE 126. FIREFIGHTER INJURIES BY TYPE OF ACTIVITY (1998)

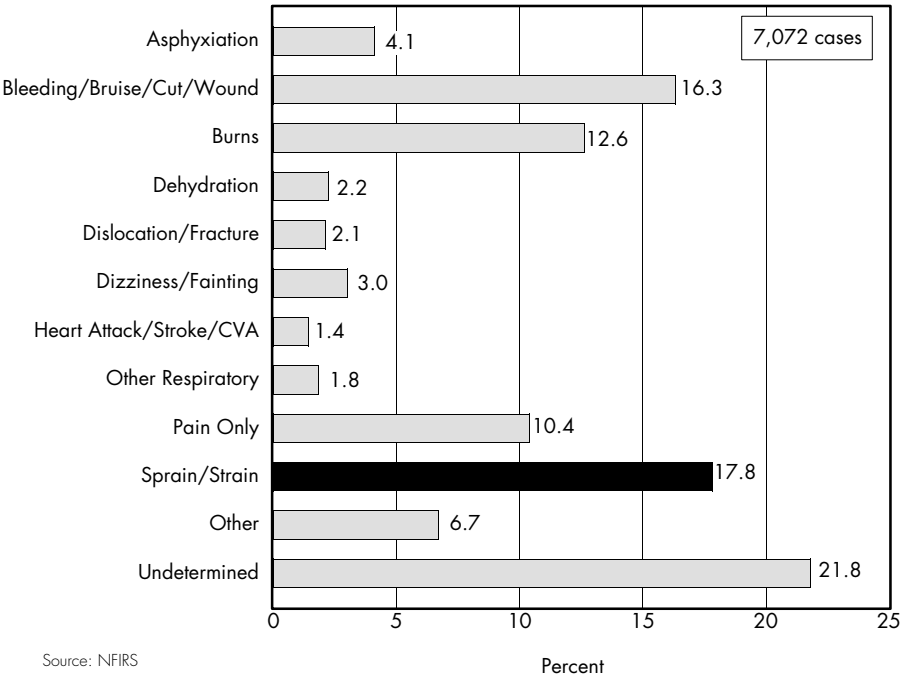


FIGURE 127. FIREFIGHTER INJURIES BY NATURE OF INJURY (1998)

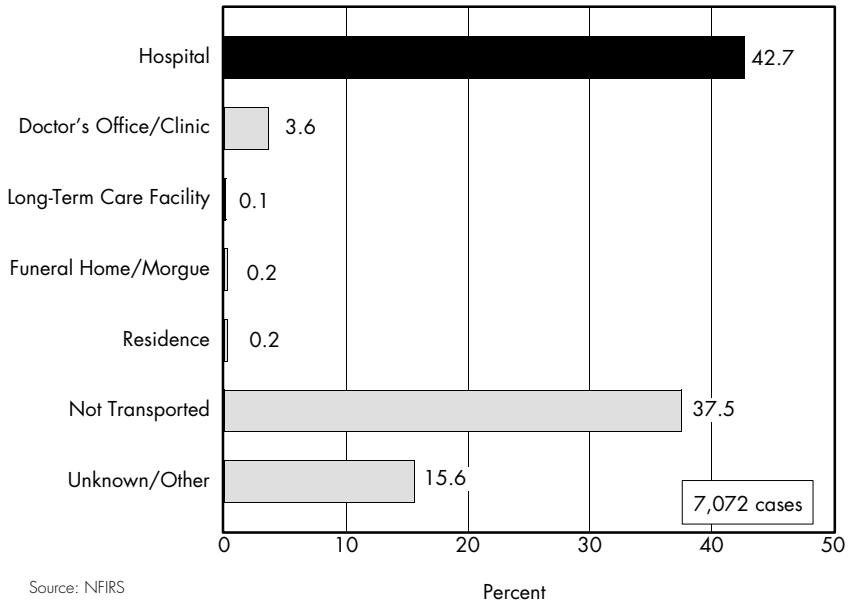


FIGURE 128. FIREFIGHTER INJURIES BY WHERE TREATED (1998)

USFA RESOURCES ON FIREFIGHTER CASUALTIES

Publications

The USFA recently revised its NFIRS Firefighter Casualty Report to improve the quality of available data in its annual review of firefighter line-of-duty deaths. The 1999 report of the Firefighter Fatality Project, *Firefighter Fatalities in the United States in 1999* (#FA–211), describes the data collected on line-of-duty firefighter deaths. This and other USFA-supported research and development are intended to increase the safety and well-being of emergency response personnel. USFA encourages the sharing of research findings and incorporation of innovations in equipment available to firefighters and other responders through programs that focus on health and safety studies; research, training, and awareness; emergency medical services; search and rescue; and equipment and technology development.

Because accidents involving emergency vehicles are one of the leading causes of firefighter death and injury, USFA has several resources on the subject for fire departments and emergency medical services departments. *Emergency Vehicle Driver Training* (#FA–110) is a 220-page training package that includes both an instructor manual and a student workbook designed to assist fire and EMS departments with training in emergency vehicle operations. *Alive on Arrival—Tips for Safe Emergency Vehicle Operations* (#L–195) is a pamphlet detailing actions that emergency vehicle operators, passengers, and officers-in-charge can take to improve safe operation of emergency vehicles. Also available is a 48-page special report titled *Fire Apparatus/Train Collision* (#TR048), which presents the investigation of the collision near Catlett, Virginia, on September 28, 1989.

Publications addressing incident response issues have been developed for fire and EMS departments. Among these are *Emergency Incident Rehabilitation* (#FA–114), a short booklet that includes a sample standard operating procedure and guidelines for establishing a rehab area to reduce heat- or cold-related injuries to emergency response personnel operating in labor-intensive or extreme climate conditions.

Guides are also available on recommended safe practices, including response to crashes involving cars equipped with airbags and on a comprehensive safety program designed for fire department safety officers.

The USFA also emphasizes research and development of protective clothing for chemical, emergency medical, and search-and-rescue emergencies as well as structural firefighting protective clothing and self-contained breathing apparatus (SCBA). For example, USFA has been involved in the development of a new test method for evaluating the performance of complete firefighter protective clothing ensembles. A suit integrity field test was conducted during hazardous materials training for USFA's study, *Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles* (#FA–107). Three protective clothing ensembles were evaluated in *Physiological Field Evaluation of Hazardous Materials Protective Ensembles* (#FA–109). Another study, the *Non-Destructive Testing and Field Evaluation of Chemical Protective Clothing* (#FA–106), details a procedure, field tested by the Cambridge, MA, Fire Department, developed for assessing the presence of contamination before or after decontamination of chemical protective clothing.

The USFA has supported research into health hazards faced by firefighters, including the *Northwest Firefighters Mortality Study* (#FA–105). USFA also supports symposia on the occupational health and hazards of the fire service focusing on emerging firefighter safety and health issues.

A manual has been prepared for emergency response managers on infection control programs based on federal laws, regulations, and standards. The *Guide to Developing and Managing an Emergency Service Infection Control Program* (#FA–112) addresses modes of disease transmission, measures for prevention, incident response and recovery, station issues, and training/role modeling. The 200-page manual provides a step-by-step approach to designing, implementing, managing, and evaluating a fire or emergency medical services department infection control program. The guide is also a key resource in a National Fire Academy course on infection control.

A series of comprehensive manuals has been developed for fire service and EMS managers interested in instituting programs for firefighter health promotion and injury prevention. The 80-page *Fire and Emergency Service Hearing Conservation Program* (#FA–118) outlines measures to reduce the risk of occupationally induced hearing loss. USFA also is conducting research to identify causes and to develop solutions for reducing stress levels in EMS providers.

The *Topical Fire Research* series for firefighter casualties can be downloaded from http://www.usfa.fema.gov/nfdc/reports.htm:

Firefighter Deaths

Firefighter Injuries series

Reports produced under the USFA's Major Fires Investigation series are directed primarily to chief fire officers, training officers, fire marshals, and investigators as a resource for training and prevention. Recent reports on incidents with firefighter deaths and injuries include:

Aerial Ladder Collapse Incidents, 1993–1994 (#TR081)
Confined Space Rescue on SS Gem State, Tacoma, WA (#FA–163A)
Detroit Warehouse Fire Claims Three Firefighters, March 1987 (#TR003)
Entrapment in Garage Kills One Firefighter, San Francisco, CA, March 1995 (#TR084)
Floor Collapse Claims Two Firefighters, Pittston, PA, March 1993 (#TR073)
Four Firefighters Die in Seattle Warehouse Fire, Seattle, WA (#TR077)
Four Firefighters Killed, Trapped by Floor Collapse, Brackenridge, PA, December 1991 (#TR061)
Indianapolis Athletic Club Fire, Indianapolis, IN, February 1992 (#TR063)
Six Firefighter Fatalities in Construction Site Explosion, Kansas City, MO, November 1988 (#TR024)
Sodium Explosion Critically Burns Firefighters, Newton, MA, October 1993 (#TR075)
Three Firefighter Fatalities in Training Exercise, Milford, MI, October 1987 (#TR015)
Three Firefighters Die in Pittsburgh House Fire, February 1995 (#TR078)
Wood Truss Roof Collapse Claims Two Firefighters, Memphis, TN, December 1992 (#TR069)

Other USFA works of interest while analyzing firefighter casualties include:

1998 Death and Injury Survey [International Association of Fire Fighters]
Aftermath of Firefighter Fatality Incidents: Preparing for the Worst (#TR089)
EMS Safety Techniques and Applications (#FA–144)
Fire and Emergency Medical Services Ergonomics (#FA–161)
Fire Department Communications Manual: A Basic Guide to System Concepts and Equipment (#FA–160)
Firefighter Autopsy Protocol (#FA–156)
Firefighter Fatality Investigation and Prevention Program [National Institute for Occupational Safety and Health]
Firefighter Fatalities in the Unites States series [for years 1986–1999]
Health and Safety Issues of the Female Emergency Responder (#FA–162)
Improving Firefighter Communications (TR099)
Northwest Firefighters Mortality Study series [for years 1945–1989]
Personnel Accountability System Technology Assessment (#FA–198)
Prevention of Self-Contained Breathing Apparatus Failures (TR088)
Risk Management Practices in the Fire Service (#FA–166)
Safety and Health Considerations for the Design of Fire and Emergency Medical Services Stations (#FA–168)
Strategies for Marketing Your Fire Department Today and Beyond (#FA–182)
Wildland Fire Fatalities in the United States: 1990–1998

The USFA publications are free of charge by writing or calling:

United States Fire Administration
Publications Center
16825 S. Seton Avenue
Emmitsburg, MD 21727
(800) 561–3356

Please include the parenthetical publication number, if given, in your request. Documents may also be ordered on line at http://www.usfa.fema.gov/usfapubs.

National Fire Academy Courses

The National Fire Academy (NFA) of the U.S. Fire Administration has educated more than 1,300,000 people in fire-related courses. The NFA works to enhance the ability of the fire service and allied professions to deal more effectively with fire and related emergencies. Courses are delivered on campus at the resident facility in Emmitsburg, Maryland, and off campus throughout the nation in cooperation with state and local fire training officials and local colleges and universities. An initiative begun in 1992 offers NFA resident courses on a regional basis.

Issues relating to firefighter safety are indirectly covered in several on-campus courses, but are more directly offered through "Distance Delivery Courses and Programs." These courses were established for the student's convenience being taught either at a local department or at a number of local colleges or public service training facilities. NFA offers several courses relevant to firefighter safety on incident scenes. Fireground safety is key in any operating incident. NFA offers two off-campus courses on managing scene safety. *Incident Safety Officer* (#F719) examines the safety officer's role at emergency responses. A specific focus of this course is operations within an Incident Command System as the safety officer. *Health and Safety Officer* (#F720) is a 2-day course that examines the health and safety officer's role in identifying, evaluating, and implementing policy and procedures that affect health and safety aspects for emergency responders. The course emphasizes risk analysis, wellness, and other occupational safety issues.

NFA also offers several courses in emergency response to terrorism. *Emergency Response to Terrorism: Incident Management* (#R817), the only resident course on this topic offered by the NFA, is a 6-day course focusing on incident management on suspected terrorist incidents involving biological, nuclear, incendiary, chemical, and explosive (B–NICE) attacks. *Emergency Response to Terrorism: Basic Concepts* (#F531) is a 2-day course designed to prepare first-responder personnel to take the appropriate course of action at the scene of a potential terrorist incident. The *Emergency Response to Terrorism: Tactical Considerations* (#F552) is a 2-day course designed to build upon the existing skills of the initial first-responding supervisor. *Emergency Response to Terrorism: Self Study* is a self-paced, paper-based course that provides basic awareness training to prepare first responders to respond to incidents of terrorism safely and effectively.

Selected NFA course materials are available for purchase for locally sponsored delivery from the National Technical Information Service. One relevant course is titled *The Firefighter Safety and Survival*. Contact NFA for course materials on this topic.

Information on NFA course offerings can be obtained at http://www.usfa.fema.gov/nfa. Or for additional descriptions of course offerings, materials, eligibility, and application procedures, write to:

U.S. Fire Administration
The National Fire Academy
16825 South Seton Avenue
Emmitsburg, Maryland 21727

6 Special Topics

Each edition of *Fire in the United States* considers several topics of special interest related to the severity of the fire problem. This edition examines in detail two somewhat similar topics that are receiving close attention by the U.S. Fire Administration (USFA):

- Characteristics of child casualties in residential fires for children ages 1 to14, and specific consumer products that pose fire risk to this segment of the population.
- Characteristics of older adult casualties in residential fires for adults over age 64, and specific consumer products that pose fire risk to this segment of the population.

The relative risk of fire death to children is roughly the same as that for the general population, but it is substantially higher for the very young (age 4 and under). The relative risk to older adults is more than twice that of the general population. The USFA has set a goal to reduce fire deaths and injuries to children and adults by 25 percent by the year 2005.

In this analysis, children are defined as individuals through age 14; older adults are defined as individuals age 65 and older. Residential structure fires are the focal point of discussion as they account for the vast majority of both numbers of fires and casualties. In analyzing the fire data for these two groups, they have been divided into subgroups to gain a better perspective on the differences as they age:

- Children: 4 and under, 5–9, and 10–14
- Older adults: 65–74, 75–84, 85 and over

In addition to NFIRS, mortality data are used from the National Center for Health Statistics (NCHS). These two sets answer different questions about the relationship of casualties to fire in the United States. NFIRS data answer questions about the incident and the victim's relationship to the fire. NCHS data yield specific numbers of deaths by age group and the ethnicity of the victims.

CHILDREN AND FIRE

In 1998 alone, approximately 3,100 children under the age of 15 were injured and 750 were killed as a result of fires. More than 90 percent of child fatalities and 80 percent of injuries to children occurred in the home in the 1996 to 1998 period. Children accounted for 20 percent of all fire deaths and 14 percent of all fire injuries.[1]

[1] These percentages were computed based on casualties where the age of the victim was reported to NFIRS.

Risk

The overall risk of dying in a fire has decreased since the early 1990s and now is slightly lower for children than it is for the general population. However, this risk varies depending on age, sex, and race. Table 20 shows the number of 1997 fire deaths relative to population size for children under age 15 and for the three subgroups of this population. The last column of the table, relative risk, calculates the risk of each category for children relative to the general population, whose relative risk is set at 1. Children age 4 and under are 40 percent more likely to die in a fire than the general population. Children 5–14, on the other hand, have a substantially lower risk of dying in a fire than the general population. As the age of the child increases, the likelihood of dying in a fire decreases. For all age categories, boys are at higher risk than girls.

TABLE 20. CHILD FIRE DEATHS BY AGE, GENDER, AND ETHNICITY

Gender/Ethnicity	1997 Population	1997 Fire Deaths	Death Rate (per million population)	Relative Risk
ALL CHILDREN (AGE 0–14)				
Total	58,014,378	830	14.3	0.8
Male	29,690,906	466	15.7	0.9
Female	28,323,472	364	12.9	0.7
White	45,881,923	466	10.2	0.6
African American	8,972,118	325	36.2	2.0
American Indian	668,174	18	26.9	1.5
Asian	2,492,163	21	8.4	0.5
White Male	23,522,573	273	11.6	0.6
African American Male	4,553,358	169	37.1	2.1
American Indian Male	338,897	9	26.6	1.5
Asian Male	1,276,078	15	11.8	0.7
White Female	22,359,350	193	8.6	0.5
African American Female	4,418,760	156	35.3	2.0
American Indian Female	329,277	9	27.3	1.5
Asian Female	1,216,085	6	4.9	0.3
AGE 0–4				
Total	19,041,871	475	24.9	1.4
Male	9,739,537	268	27.5	1.5
Female	9,302,334	207	22.3	1.2
White	15,107,054	270	17.9	1.0
African American	2,857,636	186	65.1	3.6
American Indian	200,346	7	34.9	1.9
Asian	876,835	12	13.7	0.8
White Male	7,743,548	160	20.7	1.1
African American Male	1,448,576	99	68.3	3.8
American Indian Male	101,318	2	19.7	1.1
Asian Male	446,095	7	15.7	0.9
White Female	7,363,506	110	14.9	0.8
African American Female	1,409,060	87	61.7	3.4
American Indian Female	99,028	5	50.5	2.8
Asian Female	430,740	5	11.6	0.6

Continued

TABLE 20. CHILD FIRE DEATHS BY AGE, GENDER, AND ETHNICITY

Gender/Ethnicity	1997 Population	1997 Fire Deaths	Death Rate (per million population)	Relative Risk
AGE 5–9				
Total	19,840,396	228	11.5	0.6
Male	10,151,998	126	12.4	0.7
Female	9,688,398	102	10.5	0.6
White	15,632,311	118	7.5	0.4
African American	3,158,763	96	30.4	1.7
American Indian	226,627	10	44.1	2.5
Asian	822,695	4	4.9	0.3
White Male	8,008,677	68	8.5	0.5
African American Male	1,603,412	49	30.6	1.7
American Indian Male	115,069	6	52.1	2.9
Asian Male	424,840	3	7.1	0.4
White Female	7,623,634	50	6.6	0.4
African American Female	1,555,351	47	30.2	1.7
American Indian Female	111,558	45	35.9	2.0
Asian Male	397,855	1	2.5	0.1
AGE 10–14				
Total	19,132,111	127	6.6	0.4
Male	9,799,371	72	7.3	0.4
Female	9,332,740	55	5.9	0.3
White	15,142,558	78	5.2	0.3
African American	2,955,719	43	14.5	0.8
American Indian	241,201	1	4.1	0.2
Asian	792,633	5	6.3	0.4
White Male	7,770,348	45	5.8	0.3
African American Male	1,501,370	21	14.0	0.8
American Indian Male	122,510	1	8.2	0.5
Asian Male	405,143	5	12.3	0.7
White Female	7,372,210	33	4.5	0.2
African American Female	1,454,349	22	15.1	0.8
American Indian Female	118,691	0	0	0
Asian Female	387,490	0	0	0

Sources: National Center for Health Statistics and Bureau of the Census.

Of particular concern is the variation in fire death risk based on ethnicity. African American and American Indian children are at a higher risk of fire death, particularly relative to their white or Asian counterparts. Overall, African American and American Indian children are more likely to die in a fire than white or Asian children. Table 20 shows that African American children have the highest fire risk (2.0); Asian American children have the lowest (0.5). African American males age 4 and under have the highest risk of all children with a relative risk of 3.8—or nearly four times that of the general population. Deaths in this group totaled 99 in 1997, or 12 percent of all children who died as a result of fires that year. African American females age 4 and under have a relative risk that is close to African American males: 3.4 and 87 deaths.

Children are at risk for several reasons. They may be too young to escape from a fire or may not have the reasoning ability to safely exit a burning structure. Young children are particularly adventurous and experimental and will play with items that are left within their reach such as matches, cigarette lighters, candles, and fireworks. These fire-starting products have been shown to play a role in numerous child playing fires, often with fatal results. The youngest children account for nearly 60 percent of child fire deaths, as shown in Table 21. As the age of the child increases, both the number and the proportion of fire deaths decrease. The older child can function independently and is more aware of the risks associated with fire. Fire injuries, on the other hand, are more evenly distributed across the age groups.

TABLE 21. CHILD FIRE CASUALTIES BY AGE GROUP (1996–98)[2]

Age	Percent of Fire Deaths	Percent of Fire Injuries
4 and under	59	39
5–9	27	27
10–14	14	34
All Children	100	100

Source: NFIRS

Cause of Fire

NFIRS data do not show whether a casualty of fire was its instigator. For example, it is clear that children 4 and under do not commit arson, yet this cause is responsible for about 12 percent of deaths and injuries to this age group.

By far, the leading cause of residential fires that result in child fatalities is children playing (Table 22). For the youngest child, one-third of fatalities results from fires caused by children playing. Although residential heating fires are the second leading cause of child fatalities, at 16 percent, they result in half the number of fatalities as children playing fires. Arson is third at 14 percent. As a child matures, children playing fires become far less injurious; heating fires are the leading cause of fatalities for children age 10–14, while fatalities due to children playing fires for this age group drop to 11 percent. Arson, the third leading cause of residential child fire fatalities, is fairly consistent at about 13 percent regardless of age group.

Fires caused by children playing are also the leading cause of injuries to children 14 and under (Table 22). Although children age 5 to 9 have the largest proportion of fire-related injuries, the oldest children (10 –14) are not immune to the fascination of fire play—one in five fire-related injuries to this group is the result of fire started by children playing. Cooking is the second leading cause of

[2] These proportions from the NFIRS data are validated by the data from NCHS shown in Table 20. The NCHS data show fire deaths for children age 4 and under to be 57 percent of fire deaths to children under 15; children age 5 to 9 are 27 percent; children age 10 to 14 are 15 percent.

TABLE 22. LEADING CAUSES OF FIRE IN CHILD CASUALTIES (1996–98)

Age	Deaths (percent of fires)			Injuries (percent of fires)		
	Children Playing	Heating	Arson	Children Playing	Heating	Arson
4 and under	32.7	16.2	12.5	34.1	19.5	11.9
5–9	25.2	16.5	12.2	36.8	14.9	12.2
10–14	11.0	21.9	13.7	21.6	26.8	9.3
All Children	27.6	17.1	12.6	30.6	20.7	11.6

Source: NFIRS

fire injuries overall. For the oldest children at 27 percent of injuries, however, cooking is the leading cause. Arson, as in child fatalities, is the third leading cause.

Activity When Killed or Injured

More than half of children fatalities occur when the victim is asleep. This statistic is largely a result of the fact that most fatal residential fires occur in the late evening and early morning hours when most people are sleeping (Chapter 3). For the youngest age group (age 4 and under), 22 percent were unable to react because of their young age. Young children that are awake during a fire do not have the rational ability to safely escape from a fire. About 25 percent of children are injured while trying to escape.

Trying to escape the fire is the leading cause of fire-related injuries. Thirty-seven percent of children are injured when they try to escape from fire—even the very youngest try to escape when they can (34 percent). A large portion of children are still sleeping when they are injured (30 percent), with the youngest of the age groups most likely to be sleeping (36 percent). The oldest children are as likely to be injured trying to control the fire (33 percent) as they are to be escaping (34 percent), and they are the least likely to be sleeping (21 percent).

Where Fires Start

Contrary to what might be perceived, the lounge area of the home, be it the family room or the living room, is where most fires start that result in child fatalities (31 percent). The bedroom is close behind (27 percent) and the kitchen is a distant third (12 percent). These locations, however, differ based on the age of the victim. For children age 4 and under, the bedroom is the leading area of fire origin for fatalities in this age group (32 percent), followed closely by the lounge area.

Fires that originate in the bedroom injure most children (32 percent). Kitchen fires are the second leading area of fire origin for child fire injuries (25 percent). Lounge area fires result in 16 percent of injuries. Again, the room where the fire originates is related to the age of the injured child. For injuries, however, it is the older child that is the exception. Children age 10 to 14 are injured most often with fires that originate in the kitchen. This location coincides with the cause of most older children's fire injuries, cooking fires.

What Catches Fire

Soft goods, furniture, and structural components are the major categories of items that are first ignited in fires that result in child fatalities (Table 23). Each of these categories accounts for approximately 25 percent of these fires. The single largest subgroup is upholstered furniture. The older the child, the larger role upholstered furniture plays. The next largest subgroup is actually a combination of two: mattresses and bedding. For mattresses and bedding, the younger the child, the larger the role mattresses and bedding plays in fire ignition.

TABLE 23. ITEM FIRST IGNITED IN CHILD FATALITIES (1996–98)

Age	Item First Ignited (percent)		
	Upholstered Furniture	Mattresses and Bedding	Interior Wall Covering
4 and under	17.1	21.3	5.2
5–9	19.4	12.1	10.5
10–14	21.5	8.9	13.9
All Children	18.4	17.0	8.0

Source: NFIRS

The form of material ignited in fires in homes that cause injury to children is similar for both the 0–4 and the 5–9 age groups. The leading form of material ignited in these two groups that causes injury and deaths is soft goods (e.g., clothing on and off a person, bedding, pillows, curtains and drapes). The second leading form of material ignited is furniture, such as sofas, chairs, and other items typically found in lounge areas. For injuries to children 10 to 14, the leading forms of material ignited is also soft goods and furniture. For deaths in this age group, however, furniture is the leading material ignited and soft goods are not even in the top three. This is due to the higher number of cooking fires in this age group compared to the younger age groups. The form of material ignited from cooking fires is a wall (12 percent of fires resulting in death) or framing (11 percent).

Fire-Starting Consumer Products

Several common household consumer products pose fire risks to children: children's nightlights, lamps, electrical outlets, faulty electrical toys and products, and portable space heaters. Some of these consumer products have been recalled or documented as having caused fire injuries and deaths in children.

The most common type of consumer product involved in child fires is the cigarette lighter. Approximately 30 million households own one or more working lighters.[3] The U.S. Consumer Product Safety Commission (CPSC) estimated that 2,400 residential structure fires occurred in 1998 that were caused by children age 4 and under playing with cigarette lighters.[4]

[3] *Child-Resistant Lighters Protect Young Children,* Consumer Product Safety Commission, CPSC Document #5021.

[4] *Fires Caused by Children Playing with Lighters,* Consumer Product Safety Commission, September 2000.

Incidents where matches are an ignition source for residential child playing fires have slowly declined.[5] One factor in this decrease is product improvements in matches making them more difficult to ignite. Many years ago matches could be ignited anywhere friction could be made (the bottom of a shoe, a sidewalk, a wall). Currently, the friction plate of a matchbook is needed to ignite a match, making it slightly more difficult, especially for the younger children age 4 and under. And this friction plate is now on the back of the match package, which has greatly improved safety.

Candles and fireworks are fire-starting consumer products that pose specific fire risks for children, each posing unique risks at different times of the year. Nearly 50 percent of residential candle fires injuring and killing children occur in the winter months, when candles are most used for holiday and religious purposes.[6] Child injuries and deaths from fires involving fireworks occur most often in the summer months, especially the period around the Fourth of July holiday when fireworks are most accessible.

Common Household Consumer Products

Space heaters, stoves, cords, plugs, and fixed wiring are the leading items of equipment involved in fires that result in child casualties, although very few of these fires can be traced to the child or child play. However, as noted by the CPSC, several common household consumer products pose specific fire risk to children. The fires ignited by these products are not always a result of children playing. Children's nightlights have been documented by the CPSC as being responsible for an average of 10 fire injuries and deaths annually.[7] The bulb of the nightlight or exposed electrical prongs can ignite toilet paper or a child's bedding or pillow if these items come in contact.

Each year, the CPSC recalls or warns consumers against numerous faulty electrical products and toys that children have in their possession. Several brands of children's lamps were recalled; their faulty wiring was short circuiting and causing fires.[8] The CPSC has also warned consumers that electrical toys, especially those with heating elements, can be particularly dangerous without proper supervision and when improperly wired or constructed.[9] Short circuiting products cause many fires annually. Between 1996 and 1998, fires from short circuits were the cause of 4 percent of children fatalities and 3 percent of injuries.[10]

Consumer Product Improvements and Their Effect on Fires

In response to the increasing number of fire deaths and injuries caused by young children playing with cigarette lighters, the CPSC adopted a standard that required most cigarette lighters be re-

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[5] National estimates analysis are based on NFIRS data and on the National Fire Protection Association annual survey, *Fire Loss in the United States.*

[6] NFIRS casualty data 1996–1998.

[7] *Fire Hazard with Nightlights,* Consumer Product Safety Commission, CPSC Document #5063, 1996.

[8] Consumer Product Safety Commission, Release #00-093.

[9] *The Dangers of Electrical Toys,* Consumer Product Safety Commission, CPSC Document #287.

[10] 1998 NFIRS data.

sistant to operation by children age 4 and under. The standard became effective on July 12, 1994, for lighters manufactured or imported after that date. The CPSC has been diligent in recalling lighters that do not meet this standard. The CPSC conducted two studies to measure the effectiveness of this standard. They concluded that 4,800 fires were prevented during 1998 alone as a result of the implementation of this standard.[11]

OLDER ADULTS AND FIRE

In 1998, approximately 2,550 older adults (age 65 and older) were injured and 1,035 killed as a result of fires.[12] The older adult population represents the highest fire risk group in the United States with a risk of more than twice the national average. Eighty-five percent of fire-related fatalities and 80 percent of fire-related injuries in older adults occur in the home. Older adults comprise over 25 percent of fire deaths of all ages and 30 percent of all fire deaths that occur in the home. Fires and burns are leading causes of all older adult deaths.[13]

As baby boomers enter retirement age, the U.S. demographic profile is expected to change dramatically. Over the coming decades, the older population will increase from its current 12.5 percent of the total U.S. population to nearly 20 percent. As the older population swells, a corresponding increase in fire deaths and injuries among older adults is likely. For a group with the highest fire risk already, this increase yields substantial challenges to the U.S. fire service.

Risk

The risk of dying in fire varies depending on age, gender, and race. Table 24 shows the number of 1997 fire deaths relative to population size for adults ages 65 and over along with various subgroups of this population. The last column, relative risk, calculates the risk of each category for older adults relative to the general population, whose relative risk is set at 1. The "youngest" older adults (those between the ages of 65 and 74) are 1.6 times more likely to die in a fire than the general population. The oldest adults (85 and over) have a relative risk of fire death of 4.6—nearly three times the risk as the youngest older adults and nearly five times that of the general population. As the age of the older adult increases, the likelihood of dying in a fire increases substantially. Males have a higher risk of fire deaths than females for all age categories.

Of particular concern is risk of fire death based on ethnicity. Older African Americans and American Indians are at a higher risk of fire death, particularly relative to their white or Asian counterparts. Table 24 shows that overall older African Americans have by far the highest risk of dying in a fire (6.7). Older American Indians have half the fire risk as their African American counterparts, but still have a fire risk of over three times that of the general population. Older white Americans

[11] *Fires Caused by Children Playing with Lighters*, loc. cit.

[12] National estimates are based on NFIRS data and on the NFPA annual survey.

[13] *Ten Leading Causes of Deaths by Age Groups,* Centers for Disease Control and Prevention,1996.

TABLE 24. OLDER ADULT FIRE DEATHS BY AGE, GENDER, AND ETHNICITY

Gender/Ethnicity	1997 Population	1997 Fire Deaths	Death Rate (per million population)	Relative Risk
ALL OLDER ADULTS (65+)				
Total	34,316,365	1,407	41.0	2.3
Male	14,135,274	747	52.8	2.9
Female	20,181,091	660	32.7	1.8
White	30,593,627	1,042	34.1	1.9
African American	2,828,627	341	120.6	6.7
American Indian	153,799	9	58.5	3.3
Asian	740,312	15	20.3	1.1
White Male	12,651,296	561	44.3	2.5
African American Male	1,106,102	170	153.7	8.5
American Indian Male	65,192	7	107.4	6.0
Asian Male	312,684	9	28.8	1.6
White Female	17,942,331	481	26.8	1.5
African American Female	1,722,525	171	99.3	5.5
American Indian Female	88,607	2	22.6	1.3
Asian Female	427,628	6	14.0	0.8
AGE 65–74				
Total	18,489,435	515	27.9	1.6
Male	8,277,833	314	37.9	2.1
Female	10,211,602	202	19.8	1.1
White	16,278,774	377	23.2	1.3
African American	1,658,104	130	78.4	4.4
American Indian	88,370	5	56.6	3.1
Asian	464,187	4	8.6	0.5
White Male	7,347,843	234	31.8	1.8
African American Male	694,980	75	107.9	6.0
American Indian Male	39,813	4	100.5	5.6
Asian Male	195,197	1	5.1	0.3
White Female	8,930,931	143	16.0	0.9
African American Female	963,124	55	57.1	3.2
American Indian Female	48,557	1	20.6	1.1
Asian Female	268,990	3	11.2	0.6
AGE 75–84				
Total	11,842,596	563	47.5	2.6
Male	4,698,859	273	58.1	3.2
Female	7,143,737	290	40.6	2.3
White	10,706,747	432	40.3	2.2
African American	871,785	122	139.9	7.8
American Indian	47,380	4	84.4	4.7
Asian	216,684	5	23.1	1.3
White Male	4,262,738	211	49.5	2.8
African American Male	323,587	57	176.2	9.8
American Indian Male	19,653	3	152.6	8.5
Asian Male	92,881	2	21.5	1.2
White Female	6,444,009	221	34.3	1.9
African American Female	548,198	65	118.6	6.6
American Indian Female	27,727	1	36.1	2.0
Asian Male	123,803	3	24.2	1.3

Continued

TABLE 24. OLDER ADULT FIRE DEATHS BY AGE, GENDER, AND ETHNICITY

Gender/Ethnicity	1997 Population	1997 Fire Deaths	Death Rate (per million population)	Relative Risk
AGE 85+				
Total	3,984,334	328	82.3	4.6
Male	1,158,582	160	138.1	7.7
Female	2,825,752	168	59.8	3.3
White	3,608,106	233	64.6	3.6
African American	298,738	89	297.9	16.6
American Indian	18,049	0	0	0
Asian	59,441	6	100.9	5.6
White Male	1,040,715	116	111.5	6.2
African American Male	87,535	38	434.1	24.1
American Indian Male	5,726	0	0	0
Asian Male	24,606	6	243.8	13.6
White Female	2,567,391	117	45.6	2.5
African American Female	211,203	51	241.5	13.4
American Indian Female	12,323	0	0	0
Asian Female	34,835	0	0	0

Sources: National Center for Health Statistics and Bureau of the Census.

are twice as likely to die in a fire as the general population, while older Asians have nearly the same fire risk. African American males over the age of 85 have the highest risk of all: a startling 434 deaths per million population, or 24 times that of the general population. Deaths in this group totaled 38 in 1997, or 12 percent of all the oldest adults who died as a result of fires that year. Although the absolute number of fire deaths in these categories is small, it must be stressed that relative to the size of the population of each category (e.g., adults over the age of 84), these deaths represent a significant portion. As the older adult population grows, these numbers will likely increase.

Factors such as the physical and cognitive changes associated with aging and the higher poverty levels in the elderly population increase the likelihood that an older adult will be involved in a fire and not be able to escape before injury or death. The younger age groups have a higher percentage of both fire deaths and fire injuries. Fire deaths are more evenly distributed than fire injuries, but fire injuries clearly decrease with increasing age. This circumstance is a reflection of the population size of the oldest old: there far fewer 85-year olds than there are of the "younger" age groups. Overall, one-quarter of fire casualties are deaths and the remaining three-quarters are injuries. The relative percent of deaths within each age group increases with age; that is, the older the adult, the more likely the casualty will result in a fire death (Table 25).

Cause of Fire

By far, the leading cause of residential fires that result in fatalities to older adults is smoking (Table 26). For the youngest older adult, one-third of fatalities result from fires caused by careless use of smoking materials. Although residential heating fires are the second leading cause of all older adult fatalities (18 percent), these fires are the leading cause of fatalities among the oldest old. As

TABLE 25. OLDER ADULT FIRE CASUALTIES WITHIN AGE GROUPS (1996–98)

Age	Percent of Fire Deaths	Percent of Fire Injuries
65–74	24	76
75–84	29	71
>84	30	70
All Older Adults	27	73

Source: NFIRS

TABLE 26. LEADING CAUSES OF FIRE IN OLDER ADULT CASUALTIES (1996–98)

Age	Deaths (percent of fires)			Injuries (percent of fires)		
	Smoking	Heating	Cooking	Cooking	Smoking	Electrical Distribution
65–74	35.0	13.2	11.1	27.0	19.8	10.4
75–84	29.7	19.4	11.8	32.7	18.5	10.4
>84	19.6	22.1	16.0	34.6	17.4	9.9
All Older Adults	29.1	17.8	12.6	30.6	18.9	10.3

Source: NFIRS

adults age, heating and cooking fires become much more important factors in fire casualties. Smoking becomes less so, but at 20 percent still affects one in five of the oldest old. Cooking is third for all age groups at an overall average of 13 percent.

Cooking fires are the leading cause of fire injuries to older adults. Moreover, as age increases, cooking fires play a larger and larger role in fire injuries. For the youngest old, cooking fires cause 27 percent of fire injuries; for the oldest old, these fires are the cause of 35 percent of fire injuries. Smoking is the second leading cause of fire injuries overall. Unlike cooking fires, injuries resulting from smoking decrease (slightly) with age. Electrical distribution fires are the third leading cause of older adult injuries and reflect, perhaps, the age of the housing in which older adults live.

Activity When Killed or Injured

Forty percent of older adults who die in fires are asleep. This statistic is largely a result of the fact that most fatal residential fires occur in the late evening and early morning hours when most people are sleeping (Chapter 3). Twenty-four percent of the oldest old fatalities were unable to act, due in large part to advanced age. The oldest adults who are awake during a fire appear to have neither the cognitive nor the physical ability to safely escape from a fire. One-third of older adults are injured while trying to escape.

Trying to control the fire is the leading cause of fire-related injuries in older adults. Forty-two percent of older adults are injured when they try to control the fire; even the oldest old try to extinguish the fire (22 percent). Escaping the fire is the second leading cause of fire injuries (22 percent).

A large portion of adults are sleeping when they are injured (18 percent), with the oldest old most likely to be asleep (22 percent).

Where Fires Start

The lounge area of the home is where most fires start that result in older adult fatalities (30 percent). The bedroom is close behind (27 percent), and the kitchen is third (20 percent). The oldest old are equally likely to die in any one of these rooms.

Older adults are most often injured by fires that start in the kitchen (38 percent). The kitchen coincides with cause of most older adult's fire injuries, cooking fires. Twenty-two percent of injuries are from fires that originate in the bedroom, and 16 percent of injuries are from those that start in the lounge area. Both of these locations mirror the incidence of smoking fires. These locations are true across all older adult age groups.

What Catches Fire

Cooking materials are the leading form of material ignited in fires that cause injuries in all age groups of older adults (Table 27). The leading form of material ignited in fires that cause death is furniture, specifically upholstered furniture; smoking is the likely cause in the majority of these fires. Clothing, although not the third leading cause of items first ignited for all older adults, is a leading factor for the oldest old. Both cooking and smoking are leading causes of the ignition of clothing.

TABLE 27. ITEM FIRST IGNITED IN OLDER ADULT FATALITIES (1996–98)

Age	Item First Ignited (percent)		
	Upholstered Furniture	Mattresses and Bedding	Wearing Apparel on a Person
65–74	19.6	19.1	5.1
75–-84	17.5	17.5	9.8
>84	14.2	12.4	12.4
All Older Adults	17.4	16.8	8.8

Source: NFIRS

Fire-Starting Consumer Products

Several common household consumer products pose a high fire risk to older adults. Combined with the physical and cognitive factors that put the older adult population at a higher fire risk, these products can increase risk even further.

Smoking Materials. Cigarettes (and other smoking material) are dangerous products for the older adult population. The increased danger is attributed not to the cigarette alone, but rather in combination with other factors such as the interaction of prescription drugs or alcohol. These can increase drowsiness and decrease judgment or reaction time, especially in an older adult, subsequently igniting a fire.

Cooking-Related Products. Stoves and ovens pose an additional fire risk to older adults. The stove can ignite any material within proximity such as clothing, potholders, cookbooks, and food. Older adults have an increased chance of igniting loose clothing while cooking and of forgetting to turn the burner or oven off when finished cooking. Stoves and ovens are involved in 20 percent of fire deaths and 39 percent of fire injuries for older adults when equipment is involved in the fire. Stoves are the leading products involved in deaths and injuries to older adults.

Kitchens of older adults may contain old, and dangerous, kitchen appliances. Fires caused by faulty appliances are responsible for 5 percent of injuries and 4 percent of deaths in older adults. Older adults are less likely to replace aging kitchen appliances, giving rise to the increased probability of frayed wires and cords.

Alternative Heating Products. Older adults tend to use more alternative heating sources than the general population for a variety of reasons. In many cases, this is due to deteriorating internal thermoregulatory mechanisms associated with aging. Space heaters (both portable and fixed) and electric blankets are two of the most dangerous consumer products posing risk of fire to older adults. Space heaters can ignite any nearby flammable material. Space heaters are involved in 21 percent of fire deaths and 9 percent of fire injuries for older adults where equipment is involved in the fire. Just as older adults are less likely to replace old kitchen appliances, electric blankets pose a fire risk for the same reason. Rewashing an electric blanket damages its electrical circuitry, making it prone to igniting a fire while the older adult is asleep. Old electric blankets may not conform to the appropriate or current fire standards or include the overheating protection that is now mandatory. Appliances that produce controlled heat (among which are electric blankets) are involved in fires that kill 5 percent of older adults and injure another 2 percent where equipment is involved in the fire.

Electrical Problems and Products. An often hidden and overlooked dangerous product is electrical cords, plugs, and, in older homes, electrical wiring. Many elderly adults live in older homes, and a large portion of them live alone. Old homes do not always have electrical wiring that meets current fire code standards. The increase of older adults living alone at home or in home health care situations makes the risk greater. The proliferation of electrical appliances as well as the use of various types of medical electronic monitoring equipment could potentially overload the electrical wiring in a home. The lack of sufficient outlets may increase the use of extension cords. Cords and plugs and fixed wiring are among the leading equipment involved in fires involving the elderly. They account for 14 percent of fire deaths and 9 percent of fire injuries to older adults where equipment is involved in the fire.

7 State Profiles

There is considerable variation in the fire problem from state to state, from one area of the country to another, and from year to year. The state rankings, in terms of death per million population, in Chapter 2 showed that the death rates per capita ranged from 39 to 1, a wide range from the highest state to the lowest. The variations in the data from state to state and from year to year result from a combination of real-world fire experience, completeness of the data, and accuracy of reporting.

This chapter presents the numbers of deaths, death rates, causes of fires and fire deaths in residences, 1998 comparisons with 1996, and other available fire-related data on a state-by-state basis. Fire death data and other fire-related information were obtained from the state agency that oversees the fire and public safety arena, usually a State Fire Marshal Office. Where possible, the information is directly from this agency or from its annual report. Presenting deaths per capita in each state is a useful, and consistent, measure for assessing the fire situation in that state and between states.

Where data from the National Fire Incident Reporting System are also available, the causes of fires and fire deaths in residential structures—where the preponderance of deaths occur—are presented as the total over a 3-year period from 1996 to 1998. For states that did not report to NFIRS for all of these 3 years, 1- or 2-year data are used. Three-year totals are used because one year's data in isolation can present a skewed picture of the overall problem. A single large fire, a particularly cold winter, or a very hot, dry year for example can affect the data one way this year and another way the next. Taken out of context of the overall fire picture, one year's data can sometimes present a profile very different from the norm or "average" profile.

The data regarding the number of deaths each year that were supplied by the state are plotted in terms of deaths per million population and the 10-year trend. For comparison, the 10-year national average is also juxtaposed on this chart.

WHAT CAUSES VARIATIONS

A significant part of the real-world variations is associated with socioeconomic characteristics of the states' populations and their climates. Alaska has a severe heating problem and extreme rural conditions in much of the state. Rural areas of parts of the Southeast are in a lower economic strata than other parts of the country. The older cities of the Northeast have different fire experiences than the younger cities of the Southeast. Hawaii obviously does not have much of a heating problem, which is a leading cause of fires and fire deaths in many states. The El Nino weather pattern had an effect on the 1997 and 1998 fire data. Large cities often have a higher incidence of arson than rural areas. These factors and many others influence the magnitude and the characteristics of each state's fire problem.

A second factor in variations is the completeness and representativeness of the departments that report data, whether it be to NFIRS or to the local or state reporting agency. Completeness means that the information reported is complete and that the data reported represent the full range of the state's fire experience. In some states, a major city may not report; in others, large cities report but the rural areas do not. Representativeness can be achieved either by reporting all fires or by having a judicious sample of fires to paint a reasonably accurate picture of the fire problem. The number of departments that reported to each NFIRS state was shown in Table 7, Chapter 1, and is repeated on each of the following state profiles. The table gives some feel for the completeness of department reporting, although it is not as accurate as the percent of population represented by the reporting departments.

Though the lack of data can, and does, skew the profile of some states, the states that participate in NFIRS collect data from approximately half of the nation's fire departments. A large proportion of fires are reported to NFIRS, and the stability and completeness of the data are considered generally good; so good, in fact, that the NFIRS data are routinely used by other nations because it is the largest, most comprehensive fire incident data set available in the world.

A third major factor in the variations from state to state and locale to locale is the accuracy of reporting. Along with completeness, the accuracy of the data affects the manner in which the cause of the fire is determined for statistical purposes. If fire data are not coded according to the NFPA 901 code and the NFIRS handbook, the cause of the fire may be categorized incorrectly or, potentially, cannot be categorized at all, which can seriously affect the overall statistical analysis. Nearly 20 percent of residential fires in 1998 do not have sufficient information to determine cause. It is generally assumed that the "unknown" cause fires are distributed among the causes somewhat like the fires with known cause. If this is not the case, the NFIRS cause profiles could vary from those shown in the following state graphs. Data from states with large percentages of fires of unknown cause should be considered with caution.

NFIRS PARTICIPATION

Participation in the National Fire Incident Reporting System changed slightly in 1998. In 1998, two states—Colorado and Delaware—dropped their participation in NFIRS, but California rejoined and Nevada participated for the first time. The number of fire departments in the United States that participated remained relatively constant from 1996 to 1998. Of the 39 states plus the District of Columbia that did participate, 21 had greater than 50 percent of their departments reporting. Two states had less than 10 percent reporting—Alabama and Maine—while three had 90 percent or better—District of Columbia, Maryland, and West Virginia.

10-YEAR TRENDS

It is encouraging that the trends in both the number of deaths and the deaths per million population have declined over 10 years in the United States. The decline is broad across nearly every

state. In 30 states the decline is substantial (>25 percent). Eleven states had declines of more than 50 percent. In fact, only four states have shown any meaningful increase in the death rate trend: Vermont (202 percent), Connecticut (37 percent), Hawaii (26 percent), and Nevada (20 percent). For the most part, these are very low population states with relatively few deaths per year and considerable year-to-year variation. An increase of even one or two deaths a year significantly affects their death rate.

CAUSES

Over the 3-year period 1996–1998, 43 states provided data to NFIRS on the causes of residential fires and deaths (Table 28). Cooking was the leading cause of fire in 30 states. Thirteen had heating or arson as their leading cause. Though cooking was the leading cause of fires in most states, it was almost never the leading cause of deaths. Instead, smoking was the leading cause of deaths in 23 states. Heating or arson was the leading cause of fire deaths in another 13 states.

TABLE 28. LEADING CAUSE OF RESIDENTIAL FIRES AND DEATHS (1996–98) BY NUMBER/PERCENTAGE OF STATES

Fires			Deaths*		
Leading Cause	No. of States	Percent	Leading Cause	No. of States	Percent
Cooking	30	69.8	Smoking	23	52.3
Heating	9	20.9	Heating	7	15.9
Arson	4	9.3	Arson	6	13.6
			Electrical Distribution	4	9.1
			Children Playing	1	2.3
			Cooking	1	2.3
			Other Heat	1	2.3
			Other Equipment	1	2.3

* Alabama and Alaska had a two-way tie for the leading cause of fire deaths, and Utah had a three-way tie. Delaware and New Mexico reported no deaths. Washington had one death with an unknown cause.

Source: NFIRS

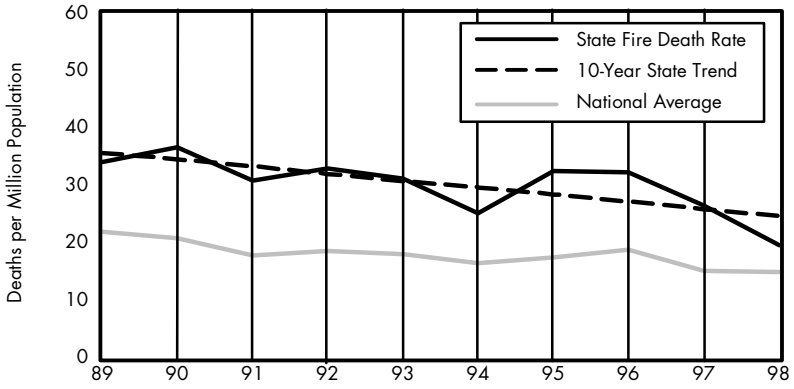
PROFILES

Each state is represented in the following one-page summaries, with graphs showing fire deaths, deaths per million population, and 10-year trends as reported by State Fire Marshals Offices or other sources. The death rate graphs show the national trend line from 1989 to 1998 as a visual comparison against the state's experience. Additionally, the 1998 ranking of each state vis à vis all states is provided for both number of deaths and death rate. For comparison, the 1996 rankings are also provided. However, state rankings for 1996 may reflect death information that has been updated from the numbers previously published. For those states that reported to NFIRS in any of a 3-year period 1996–1998, the causes of both total number of fires and deaths are plotted.

State Fire Marshals Offices initiate, coordinate, or contribute to fire prevention programs. Each office was contacted to determine current initiatives. Some of these programs are summarized following the state profiles. The chapter concludes with a table of web site addresses of each State Fire Marshal Office.

ALABAMA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	137	34.0
1990	148	36.6
1991	126	30.8
1992	136	32.9
1993	130	31.1
1994	106	25.1
1995	138	32.5
1996	138	32.2
1997	114	26.4
1998	85	19.5
10-Year Trend	**-25.2%**	**-30.9%**

Sources: Alabama State Fire Marshal Office; Alabama Center for Health Statistics, Department of Public Health; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

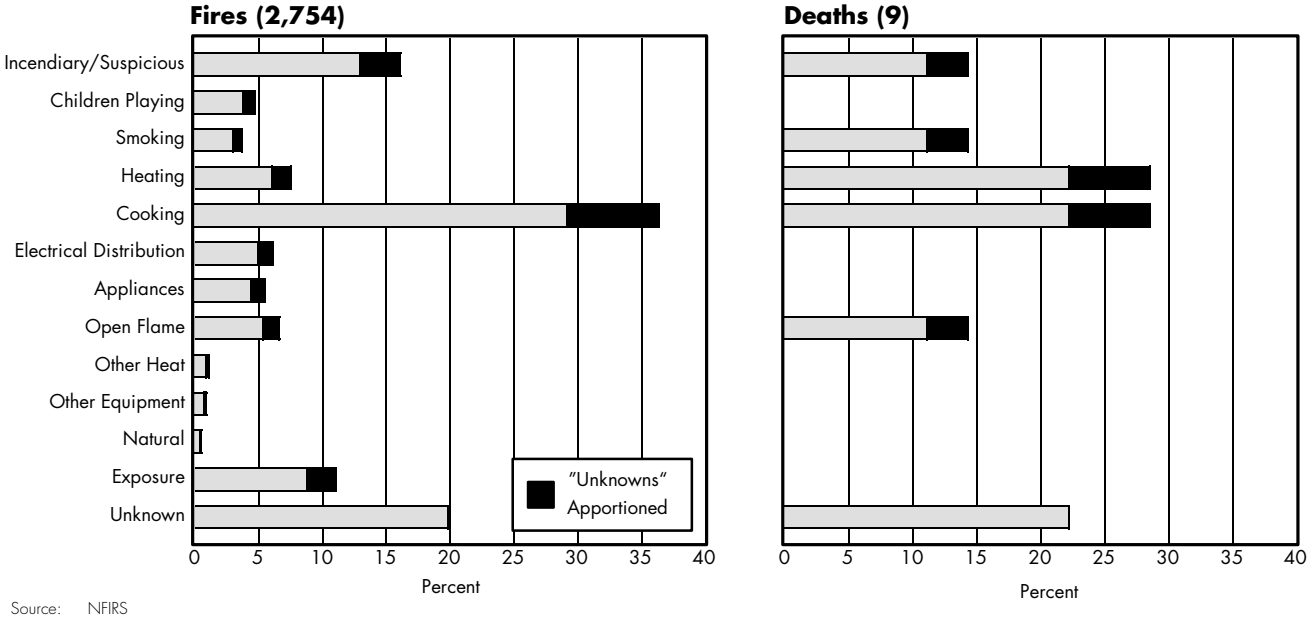
1998 deaths: 16th; 1996 deaths: 12th
1998 death rate: 13th; 1996 death rate: 6th

Note: See page 236 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 1,100
No. Fire Departments Reporting to NFIRS: 1
Percent of Fire Departments Reporting to NFIRS: <0.1%
No. Fires Reported to NFIRS in 1998: 868
Deaths/1,000 Fires in 1998: 2.3

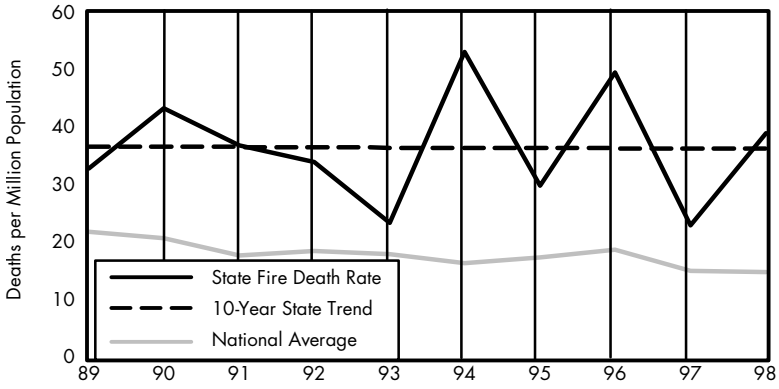
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

ALASKA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	18	32.9
1990	24	43.4
1991	21	36.9
1992	20	34.0
1993	14	23.4
1994	32	53.1
1995	18	29.9
1996	30	49.6
1997	14	23.0
1998	24	39.0
10-Year Trend	**+11.0%**	**-1.0%**

Sources: Alaska State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

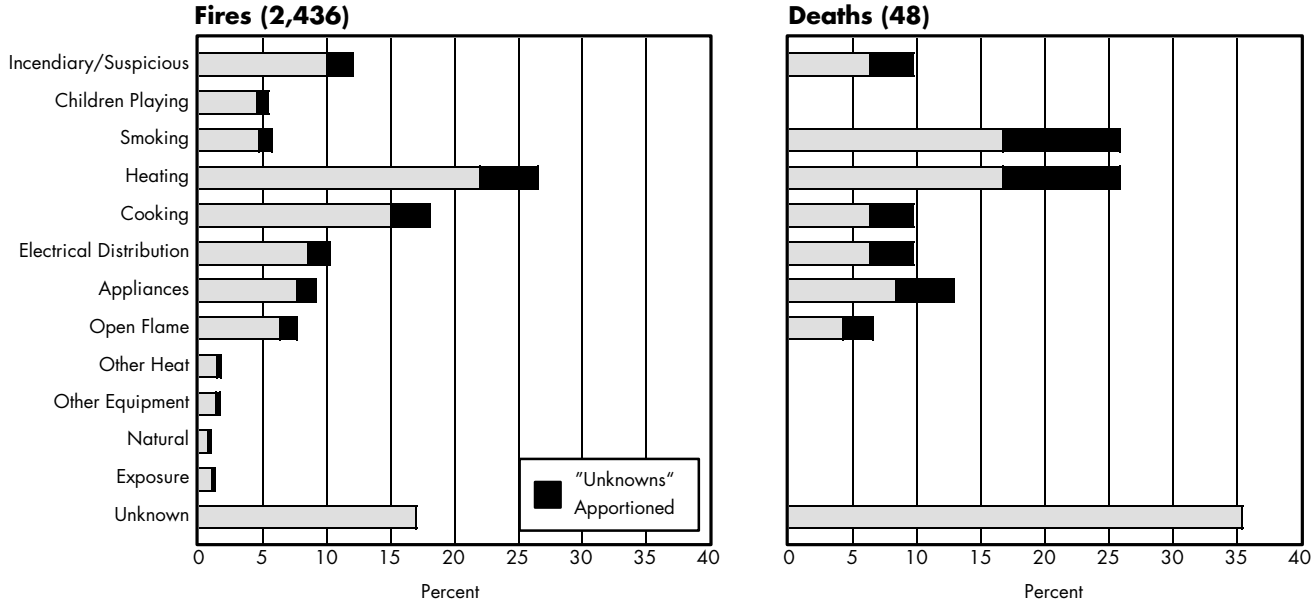
1998 deaths: 36th (tied); 1996 deaths: 34th (tied)
1998 death rate: 1st; 1996 death rate: 1st

Note: See page 236 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 320
No. Fire Departments Reporting to NFIRS: 93
Percent of Fire Departments Reporting to NFIRS: 29%
No. Fires Reported to NFIRS in 1998: 742
Deaths/1,000 Fires in 1998: 25.6

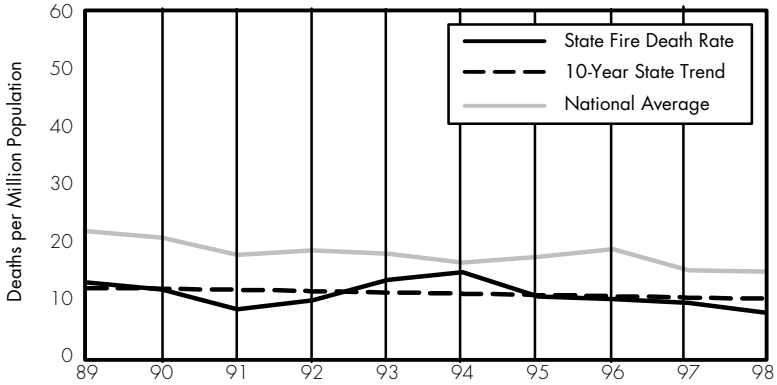
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

ARIZONA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	47	13.0
1990	43	11.7
1991	31	8.3
1992	38	9.9
1993	53	13.4
1994	60	14.7
1995	45	10.5
1996	45	10.1
1997	43	9.4
1998	36	7.7
10-Year Trend	**-0.1%**	**-22.6%**

Sources: Arizona State Fire Marshal Office; Arizona Vital Records Section, Department of Health Services; and the Bureau of the Census

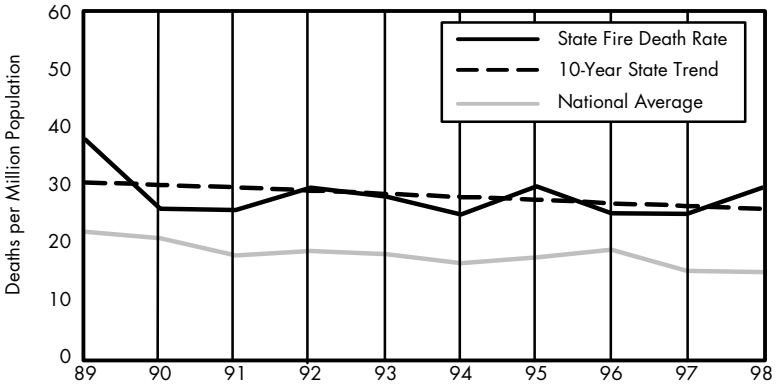
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 32nd; 1996 deaths: 29th (tied)
1998 death rate: 46th; 1996 death rate: 41st

NFIRS PARTICIPATION (None)

ARKANSAS

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	89	37.9
1990	61	25.9
1991	61	25.7
1992	71	29.6
1993	68	28.0
1994	61	24.9
1995	74	29.8
1996	63	25.1
1997	63	25.0
1998	75	29.5
10-Year Trend	**-7.6%**	**-15.7%**

Sources: Arkansas State Fire Marshal Office; Arkansas Division of Vital Records, Department of Health; and the Bureau of the Census

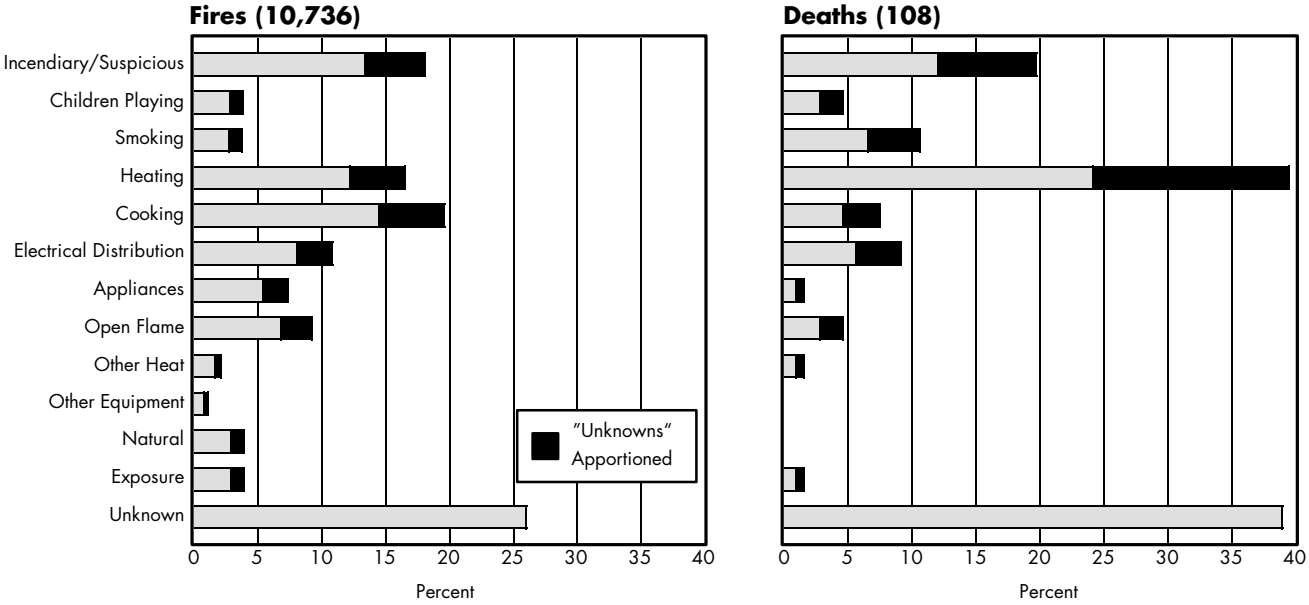
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 18th; 1996 deaths: 23rd
1998 death rate: 3rd; 1996 death rate: 12th

NFIRS PARTICIPATION

No. Fire Departments in State: 985
No. Fire Departments Reporting to NFIRS: 439
Percent of Fire Departments Reporting to NFIRS: 45%
No. Fires Reported to NFIRS in 1998: 3,549
Deaths/1,000 Fires in 1998: 7.6

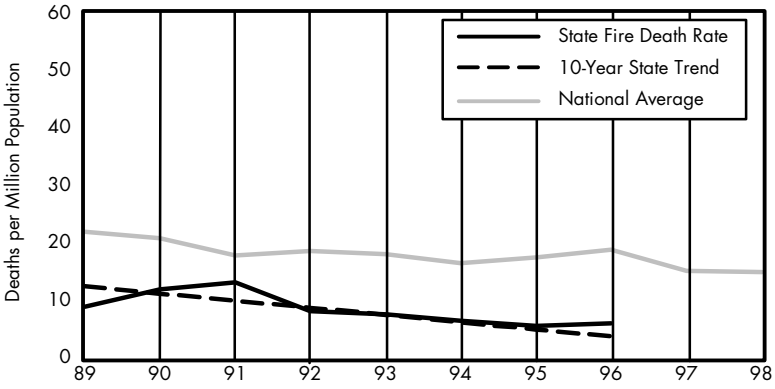
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

CALIFORNIA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	259	8.9
1990	357	11.9
1991	398	13.1
1992	250	8.1
1993	234	7.5
1994	200	6.4
1995	173	5.5
1996	191	6.0
1997	[No Data]	[No Data]
1998	[No Data]	[No Data]
8-Year Trend	**-49.0%**	**-53.2%**

Sources: California State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

1998 deaths: 3rd*; 1996 deaths: 6th (tied)
1998 death rate: 50th*; 1996 death rate: 48th

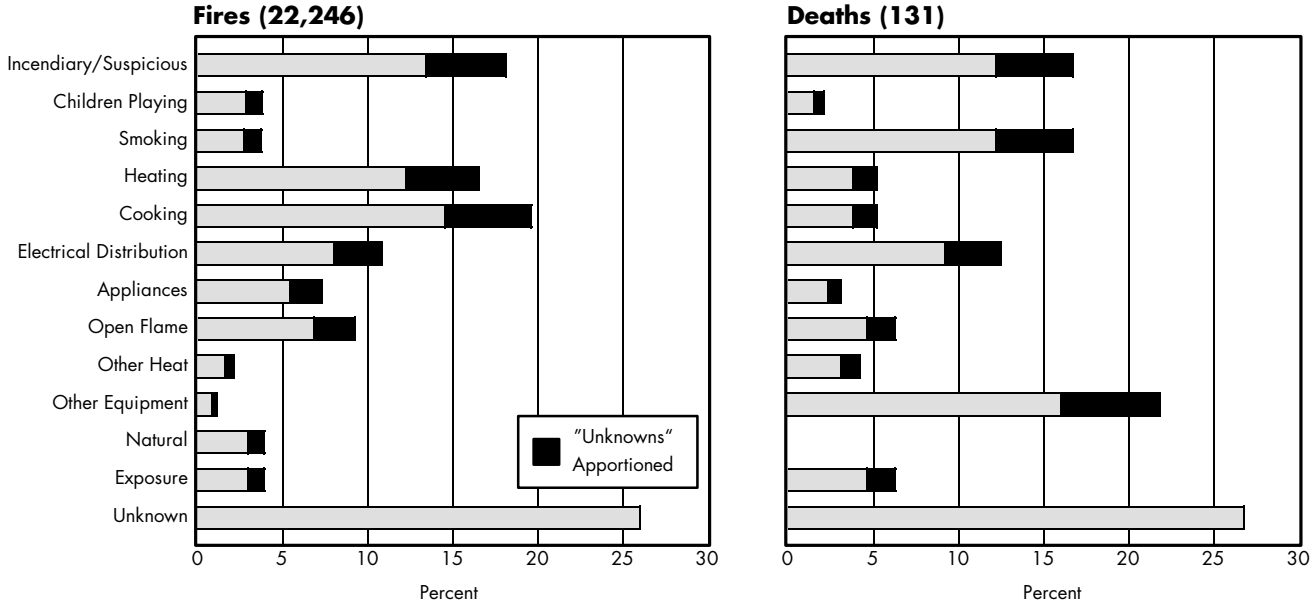
* 1998 ranking based on 1996 state data

Note: See page 236 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 1,186
No. Fire Departments Reporting to NFIRS: 249
Percent of Fire Departments Reporting to NFIRS: 21%
No. Fires Reported to NFIRS in 1998: 7,133
Deaths/1,000 Fires in 1998: 5.9

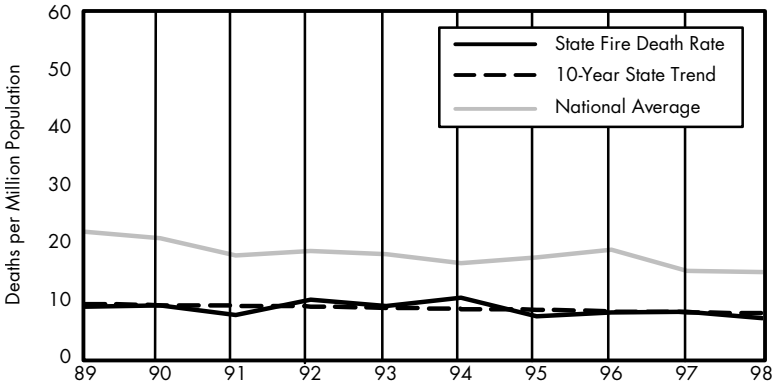
CAUSES OF RESIDENTIAL FIRES AND DEATHS (1996 AND 1998 TOTALS)



Source: NFIRS

COLORADO

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	29	8.9
1990	30	9.1
1991	25	7.4
1992	35	10.1
1993	32	9.0
1994	38	10.4
1995	27	7.2
1996	30	7.9
1997	31	8.0
1998	27	6.8
10-Year Trend	**-0.7%**	**-18.3%**

Sources: Colorado Division of Fire Safety, Department of Public Safety; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

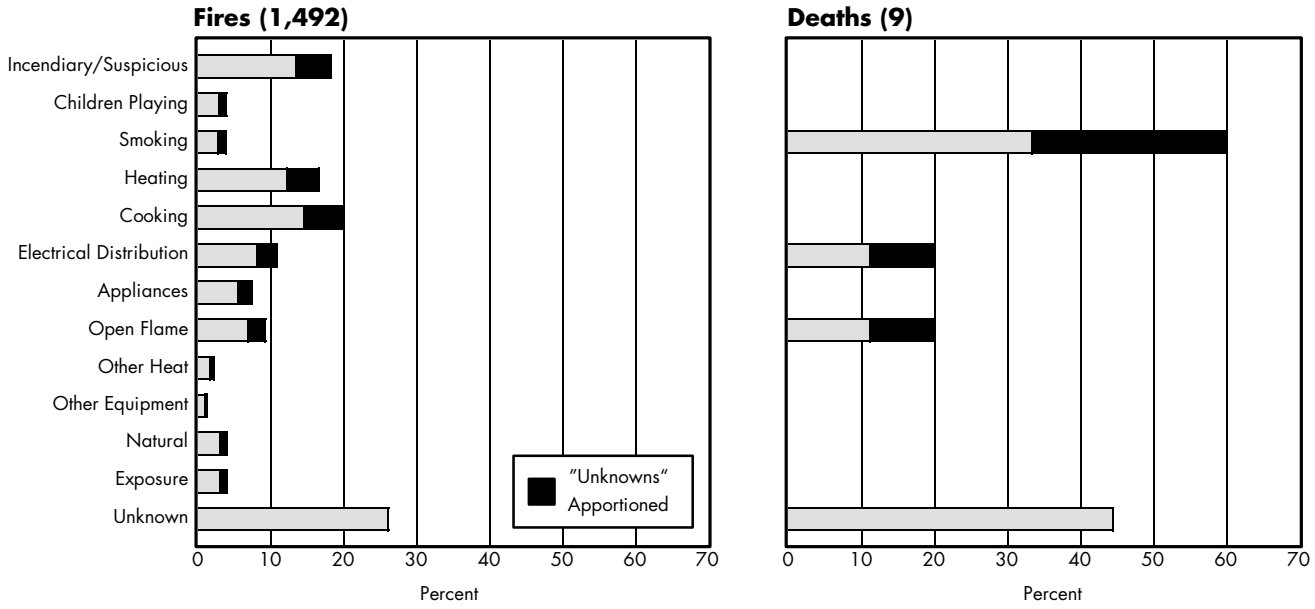
1998 deaths: 34th; 1996 deaths: 34th (tied)
1998 death rate: 49th; 1996 death rate: 46th

Note: See page 236 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 380
No. Fire Departments Reporting to NFIRS in 1997: 29
Percent of Fire Departments Reporting to NFIRS in 1997: 8%
No. Fires Reported to NFIRS in 1997: 601
Deaths/1,000 Fires in 1997: 11.6

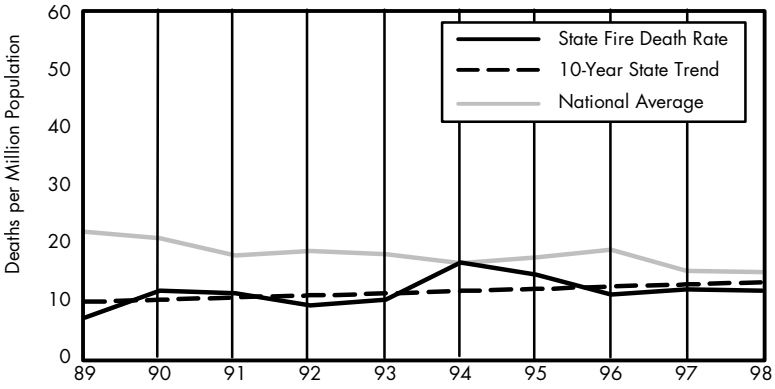
CAUSES OF RESIDENTIAL FIRES AND DEATHS (1996 AND 1997 TOTALS)



Source: NFIRS

CONNECTICUT

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	23	7.0
1990	38	11.6
1991	37	11.2
1992	30	9.1
1993	33	10.1
1994	54	16.5
1995	47	14.4
1996	36	11.0
1997	39	11.9
1998	38	11.6
10-Year Trend	**+35.8%**	**+36.7%**

Sources: Connecticut Office of the State Fire Marshal and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

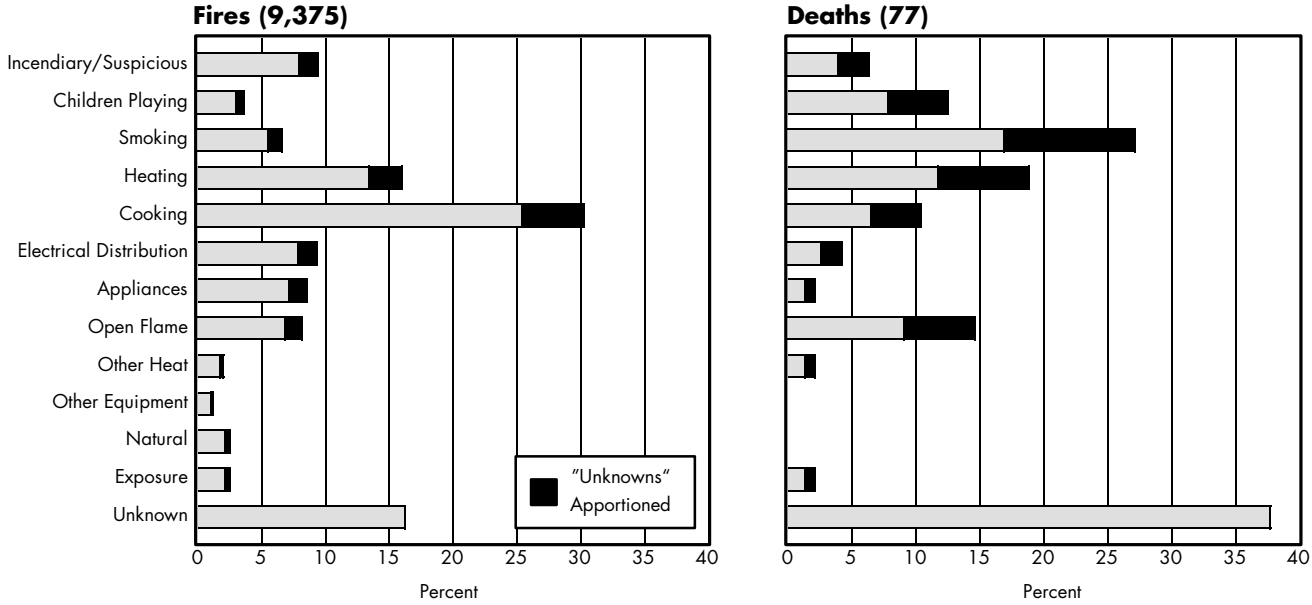
1998 deaths: 31st; 1996 deaths: 32nd
1998 death rate: 34th; 1996 death rate: 36th

Note: See page 236 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 330
No. Fire Departments Reporting to NFIRS: 179
Percent of Fire Departments Reporting to NFIRS: 54%
No. Fires Reported to NFIRS in 1998: 9,375
Deaths/1,000 Fires in 1998: 8.2

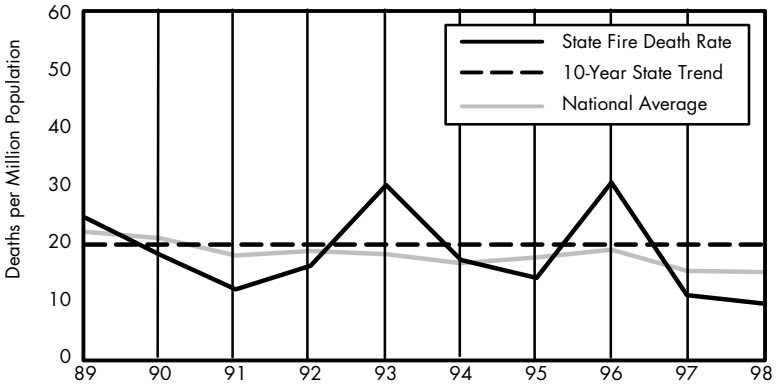
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

DELAWARE

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	16	24.3
1990	12	17.9
1991	8	11.8
1992	11	16.0
1993	21	30.0
1994	12	17.0
1995	10	13.9
1996	22	30.4
1997	8	10.9
1998	7	9.4
10-Year Trend	**-19.7%**	**-28.2%**

Sources: Delaware State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

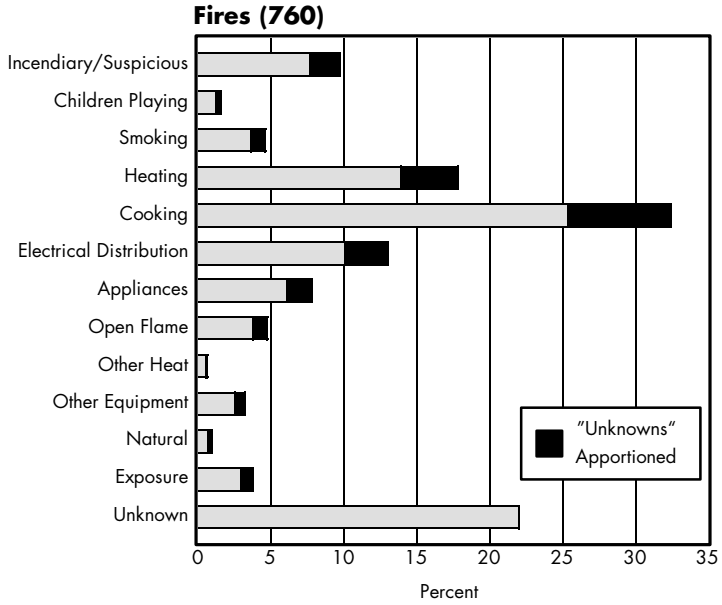
1998 deaths: 48th (tied); 1996 deaths: 36th (tied)
1998 death rate: 39th; 1996 death rate: 7th

Note: See page 237 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 64
No. Fire Departments Reporting to NFIRS in 1997: 25
Percent of Fire Departments Reporting to NFIRS in 1997: 39%
No. Fires Reported to NFIRS in 1997: 760
Deaths/1,000 Fires in 1997: 0

CAUSES OF RESIDENTIAL FIRES AND DEATHS (1996 AND 1997 TOTALS)

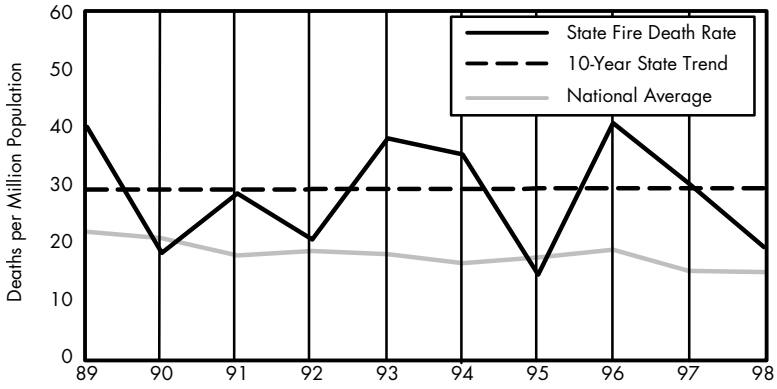


No deaths were reported to NFIRS in 1996 and 1997.

Source: NFIRS

DISTRICT OF COLUMBIA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	25	40.1
1990	11	18.2
1991	17	28.6
1992	12	20.5
1993	22	38.1
1994	20	35.3
1995	8	14.4
1996	22	40.8
1997	16	30.3
1998	10	19.2
10-Year Trend	**-25.9%**	**-11.5%**

Sources: District of Columbia Fire Marshal Office and the Bureau of the Census

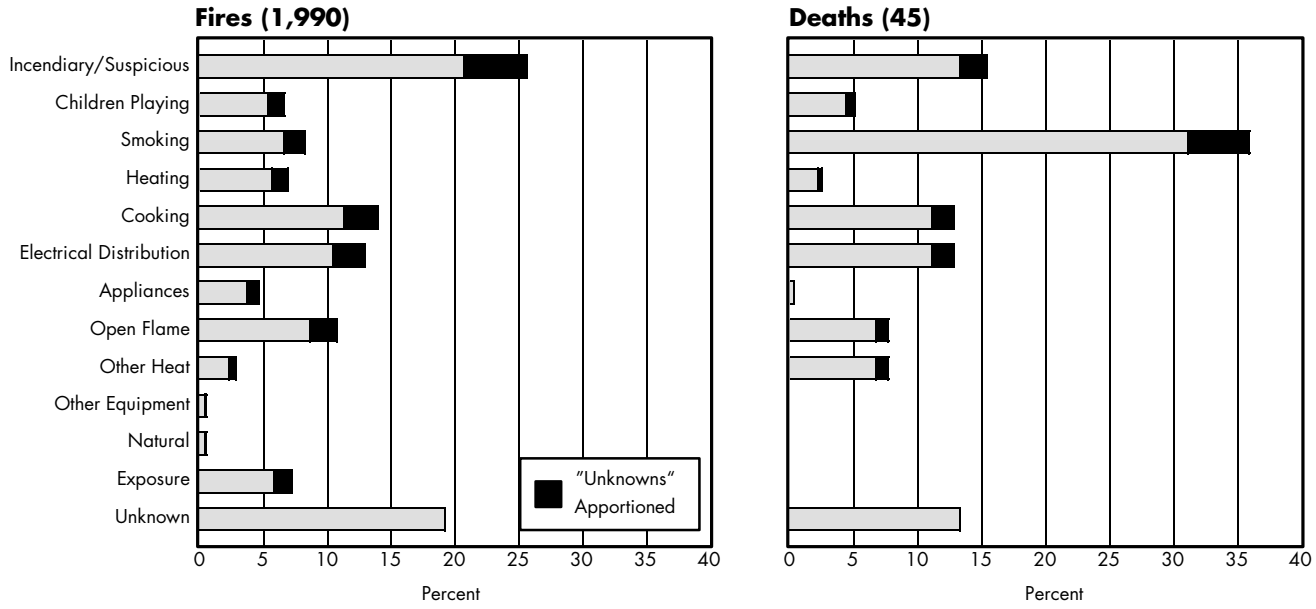
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 47th; 1996 deaths: 36th (tied)
1998 death rate: 14th; 1996 death rate: 2nd

NFIRS PARTICIPATION

No. Fire Departments in State: 1
No. Fire Departments Reporting to NFIRS: 1
Percent of Fire Departments Reporting to NFIRS: 100%
No. Fires Reported to NFIRS in 1998: 145
Deaths/1,000 Fires in 1998: 22.8

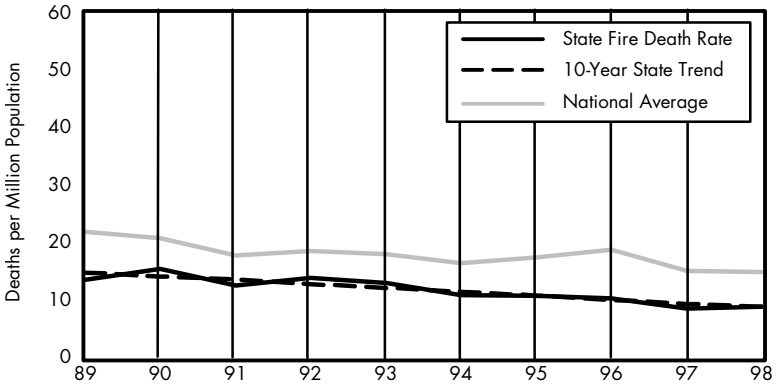
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

FLORIDA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	171	13.5
1990	200	15.4
1991	166	12.5
1992	188	13.9
1993	178	13.0
1994	151	10.8
1995	152	10.7
1996	148	10.3
1997	125	8.5
1998	132	8.9
10-Year Trend	**-31.4%**	**-41.5%**

Sources: Florida State Fire Marshal Office and the Bureau of the Census

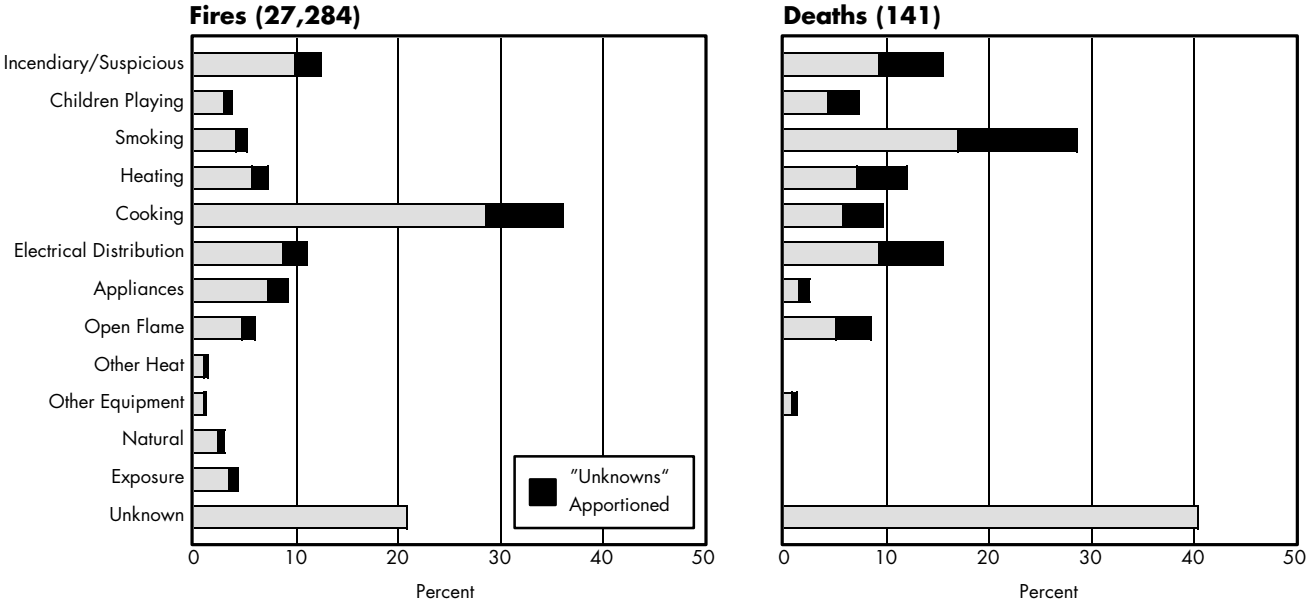
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 10th; 1996 deaths: 11th
1998 death rate: 40th; 1996 death rate: 40th

NFIRS PARTICIPATION

No. Fire Departments in State: 672
No. Fire Departments Reporting to NFIRS: 305
Percent of Fire Departments Reporting to NFIRS: 45%
No. Fires Reported to NFIRS in 1998: 8,138
Deaths/1,000 Fires in 1998: 4.8

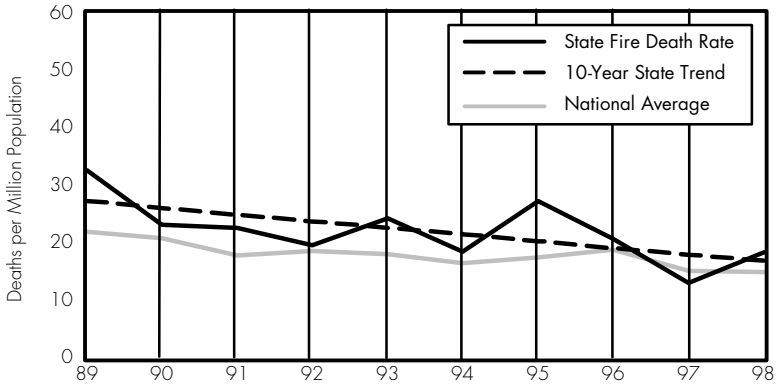
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

GEORGIA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	209	32.6
1990	150	23.1
1991	149	22.5
1992	132	19.5
1993	167	24.2
1994	130	18.4
1995	196	27.2
1996	151	20.6
1997	97	13.0
1998	140	18.3
10-Year Trend	**-25.8%**	**-38.4%**

Sources: Georgia State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

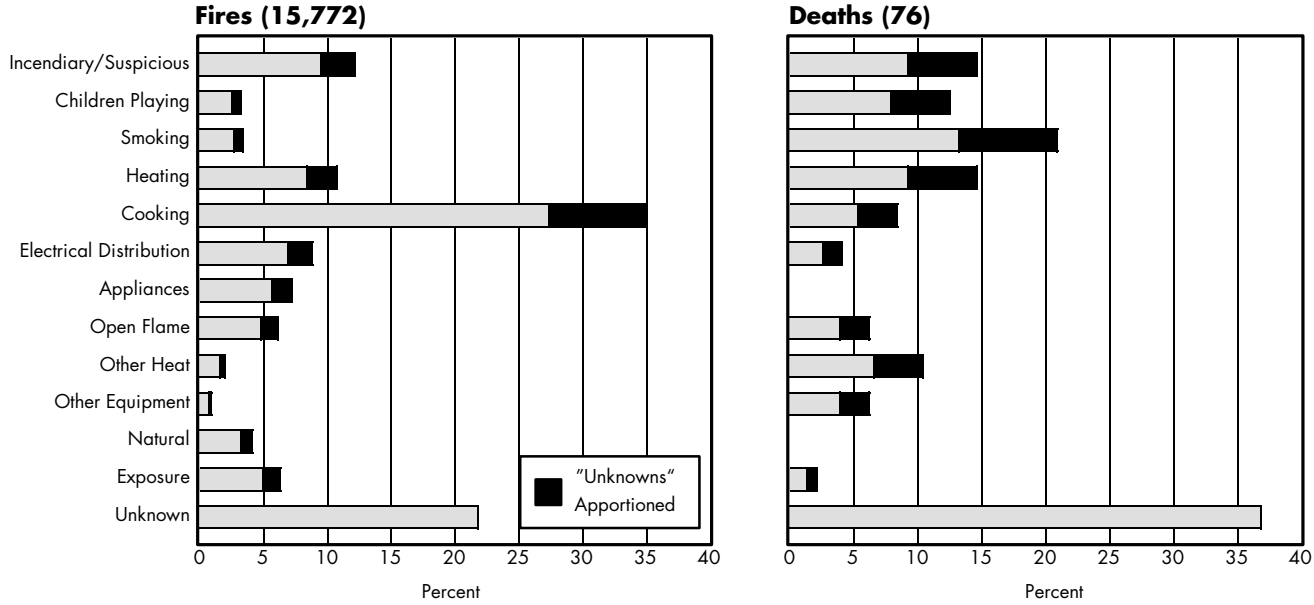
1998 deaths: 8th; 1996 deaths: 10th
1998 death rate: 15th; 1996 death rate: 17th

Note: See page 237 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 750
No. Fire Departments Reporting to NFIRS: 127
Percent of Fire Departments Reporting to NFIRS: 17%
No. Fires Reported to NFIRS in 1998: 5,152
Deaths/1,000 Fires in 1998: 3.9

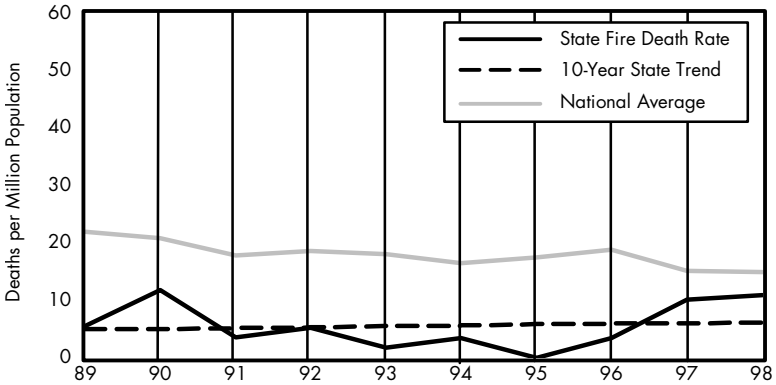
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

HAWAII

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	6	5.5
1990	13	11.7
1991	4	3.5
1992	6	5.2
1993	2	1.7
1994	4	3.4
1995	0	0.0
1996	4	3.4
1997	12	10.1
1998	13	10.9
10-Year Trend	**+41.1%**	**+25.7%**

Sources: Hawaii State Fire Council and the Bureau of the Census

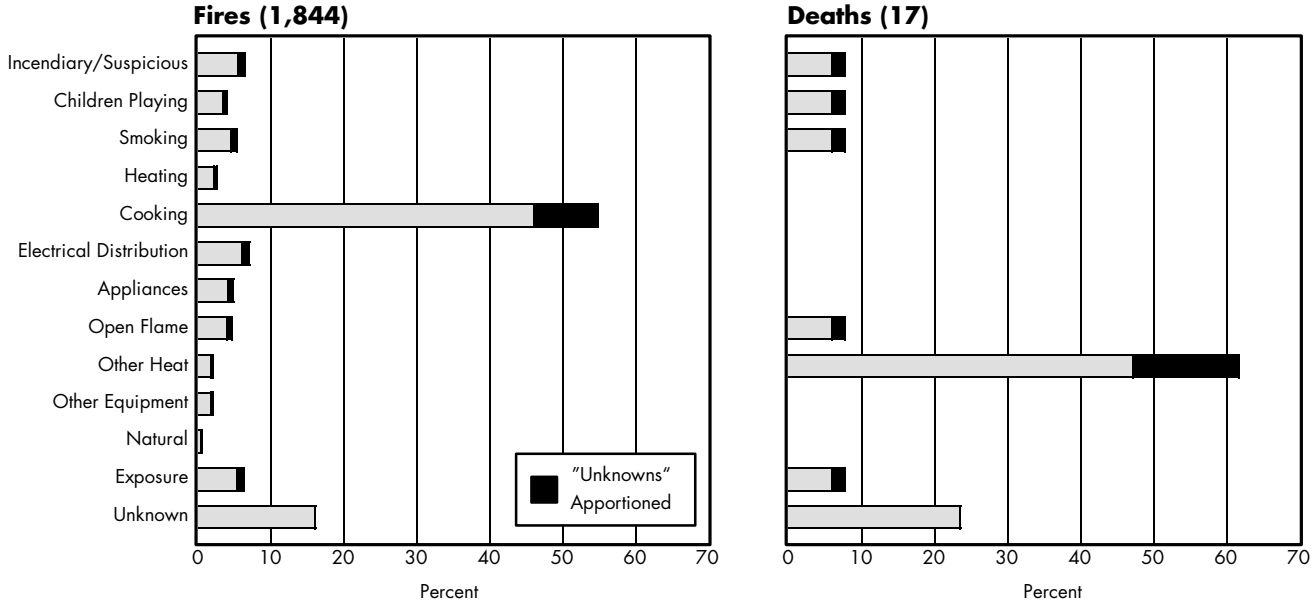
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 45th; 1996 deaths: 50th (tied)
1998 death rate: 37th; 1996 death rate: 51st

NFIRS PARTICIPATION

No. Fire Departments in State: 4
No. Fire Departments Reporting to NFIRS: 3
Percent of Fire Departments Reporting to NFIRS: 75%
No. Fires Reported to NFIRS in 1998: 597
Deaths/1,000 Fires in 1998: 5.0

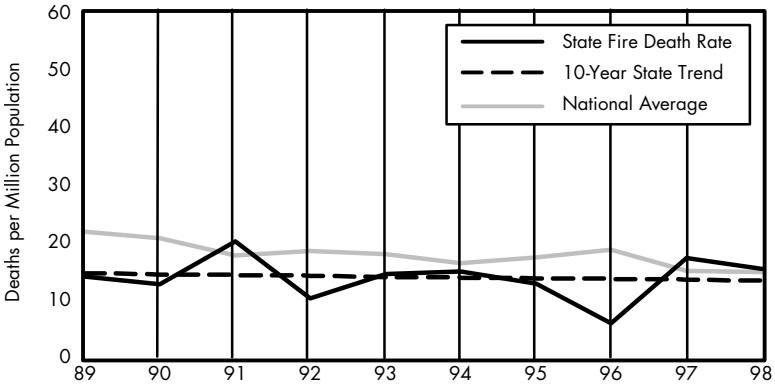
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

IDAHO

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	14	14.1
1990	13	12.8
1991	21	20.2
1992	12	11.3
1993	16	14.5
1994	17	15.0
1995	15	12.9
1996	7	5.9
1997	21	17.3
1998	19	15.4
10-Year Trend	**+15.5%**	**-8.5%**

Sources: Idaho State Fire Marshal Office and the Bureau of the Census

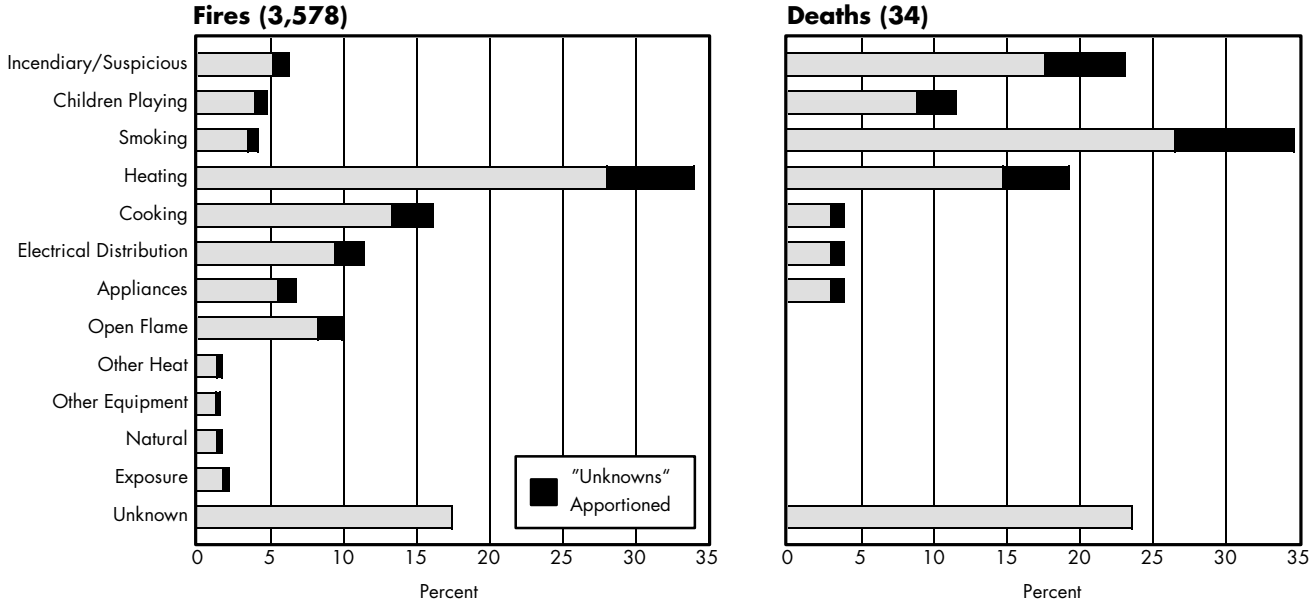
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 39th; 1996 deaths: 49th
1998 death rate: 23rd; 1996 death rate: 49th

NFIRS PARTICIPATION

No. Fire Departments in State: 250
No. Fire Departments Reporting to NFIRS: 157
Percent of Fire Departments Reporting to NFIRS: 63%
No. Fires Reported to NFIRS in 1998: 1,122
Deaths/1,000 Fires in 1998: 10.7

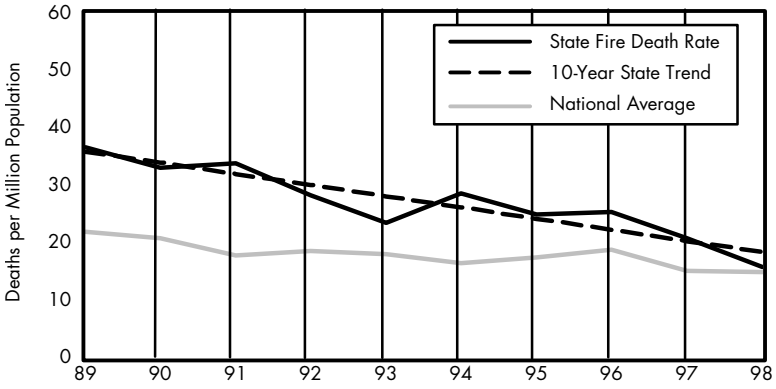
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

ILLINOIS

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	418	36.6
1990	378	33.0
1991	390	33.8
1992	328	28.2
1993	273	23.4
1994	335	28.5
1995	294	24.9
1996	300	25.3
1997	250	20.8
1998	189	15.7
10-Year Trend	**-45.9%**	**-49.0%**

Sources: Illinois State Fire Marshal Office and the Bureau of the Census

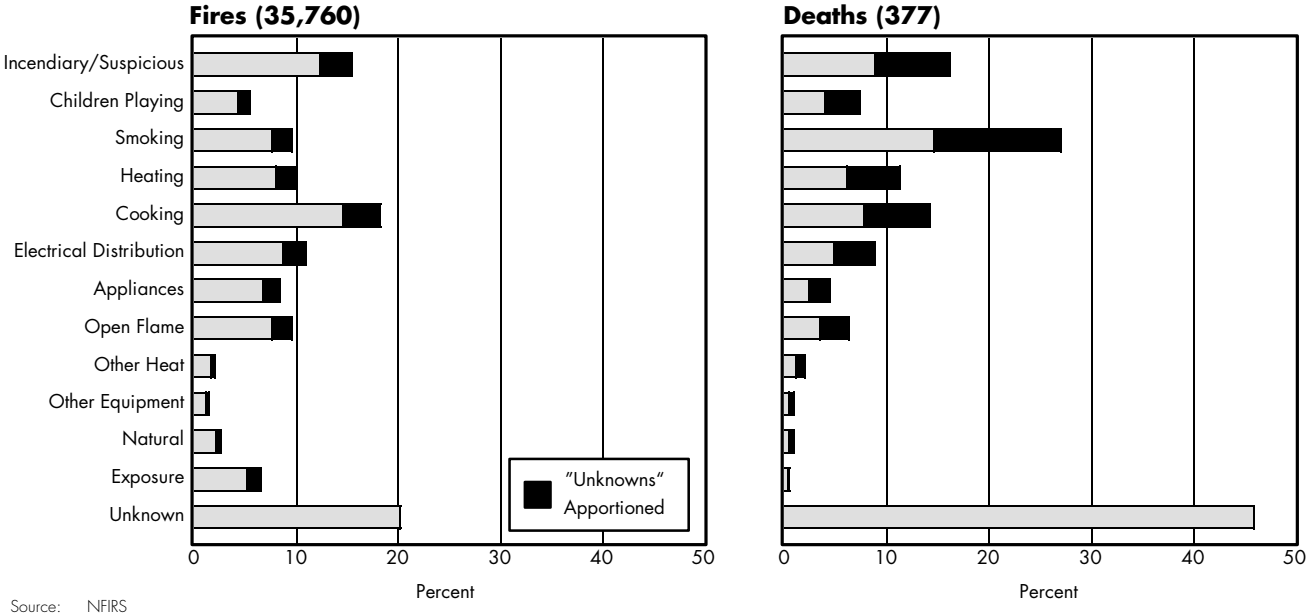
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 4th; 1996 deaths: 1st
1998 death rate: 22nd; 1996 death rate: 11th

NFIRS PARTICIPATION

No. Fire Departments in State: 1,330
No. Fire Departments Reporting to NFIRS: 823
Percent of Fire Departments Reporting to NFIRS: 62%
No. Fires Reported to NFIRS in 1998: 11,215
Deaths/1,000 Fires in 1998: 9.6

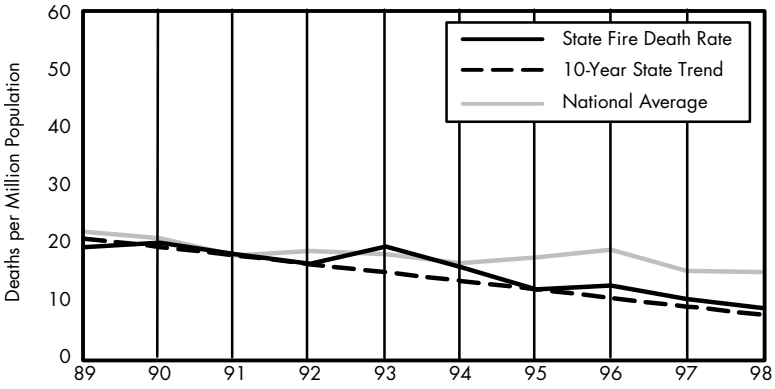
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

INDIANA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	106	19.2
1990	111	20.0
1991	101	18.0
1992	92	16.3
1993	110	19.3
1994	91	15.8
1995	69	11.9
1996	73	12.5
1997	60	10.2
1998	51	8.6
10-Year Trend	**-50.8%**	**-54.3%**

Sources: Indiana State Fire Marshal Office; Indiana Vital Records, State Board of Health; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

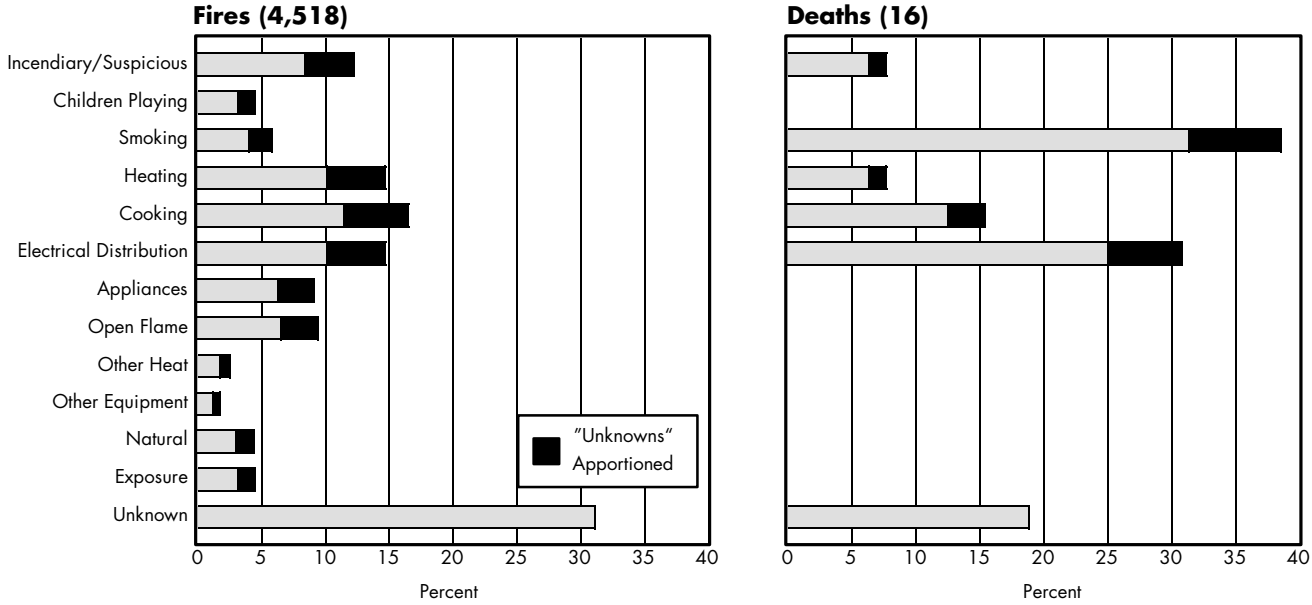
1998 deaths: 29th; 1996 deaths: 22nd
1998 death rate: 42nd; 1996 death rate: 32nd

Note: See page 237 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 952
No. Fire Departments Reporting to NFIRS: 451
Percent of Fire Departments Reporting to NFIRS: 47%
No. Fires Reported to NFIRS in 1998: 2,073
Deaths/1,000 Fires in 1998: 2.9

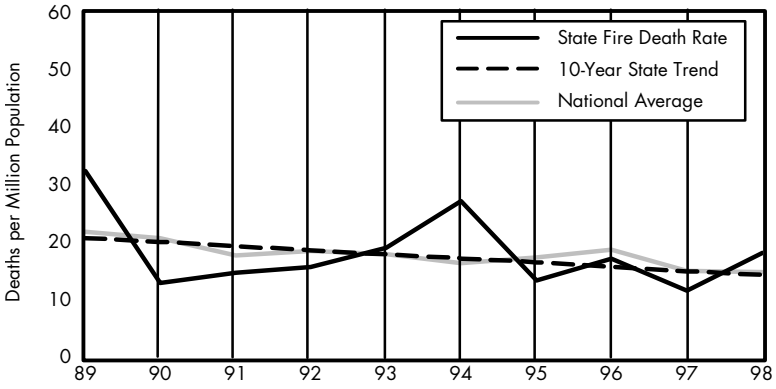
CAUSES OF RESIDENTIAL FIRES AND DEATHS (1997 AND 1998 TOTALS)



Source: NFIRS

IOWA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	90	32.5
1990	36	13.0
1991	41	14.7
1992	44	15.7
1993	54	19.1
1994	77	27.2
1995	38	13.4
1996	49	17.2
1998	33	11.6
1998	52	18.2
10-Year Trend	**-28.9%**	**-31.4%**

Sources: Iowa State Fire Marshal Office and the Bureau of the Census

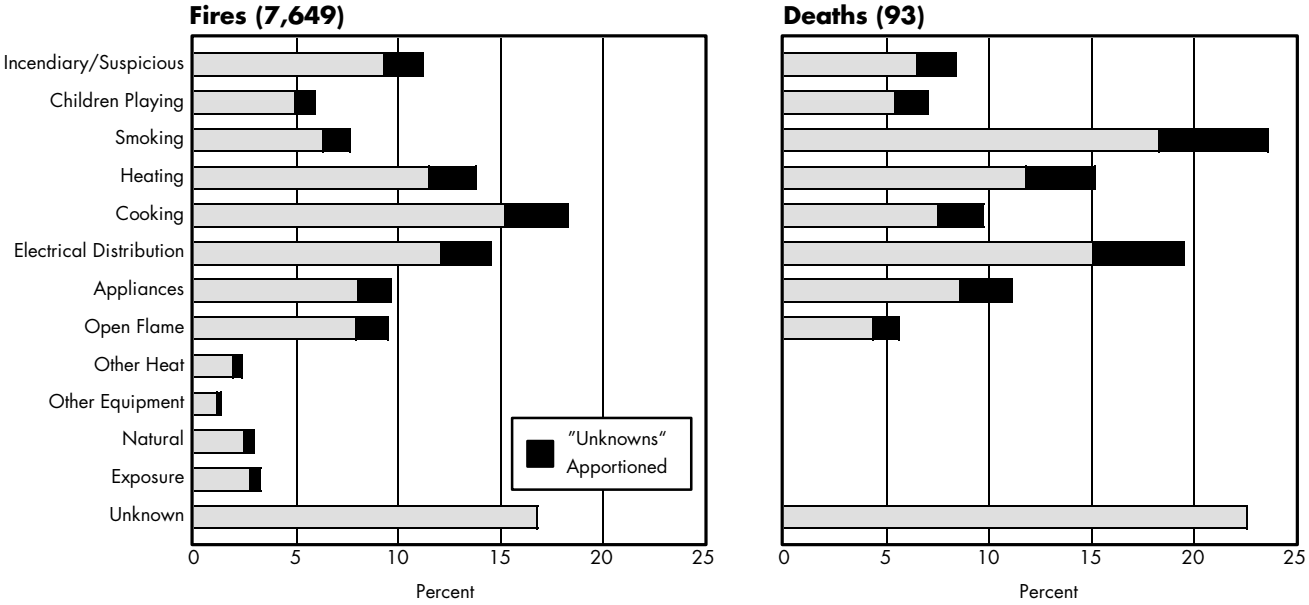
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 27th (tied); 1996 deaths: 28th
1998 death rate: 16th; 1996 death rate: 22nd

NFIRS PARTICIPATION

No. Fire Departments in State: 870
No. Fire Departments Reporting to NFIRS: 557
Percent of Fire Departments Reporting to NFIRS: 64%
No. Fires Reported to NFIRS in 1998: 2,332
Deaths/1,000 Fires in 1998: 17.6

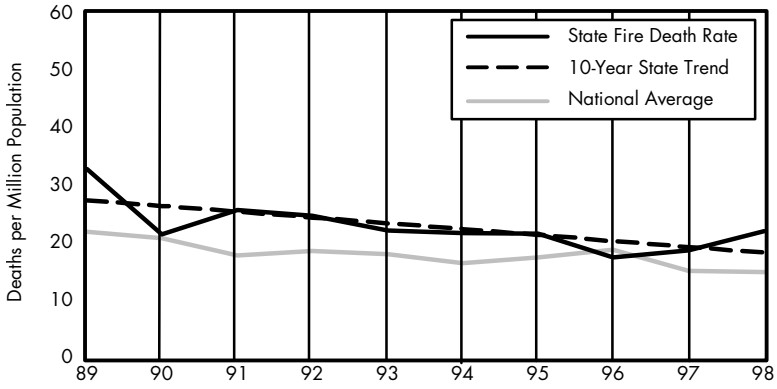
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

KANSAS

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	81	32.8
1990	53	21.4
1991	64	25.7
1992	62	24.7
1993	56	22.1
1994	55	21.6
1995	55	21.5
1996	45	17.4
1997	49	18.7
1998	58	22.0
10-Year Trend	**-28.5%**	**-33.3%**

Sources: Kansas State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

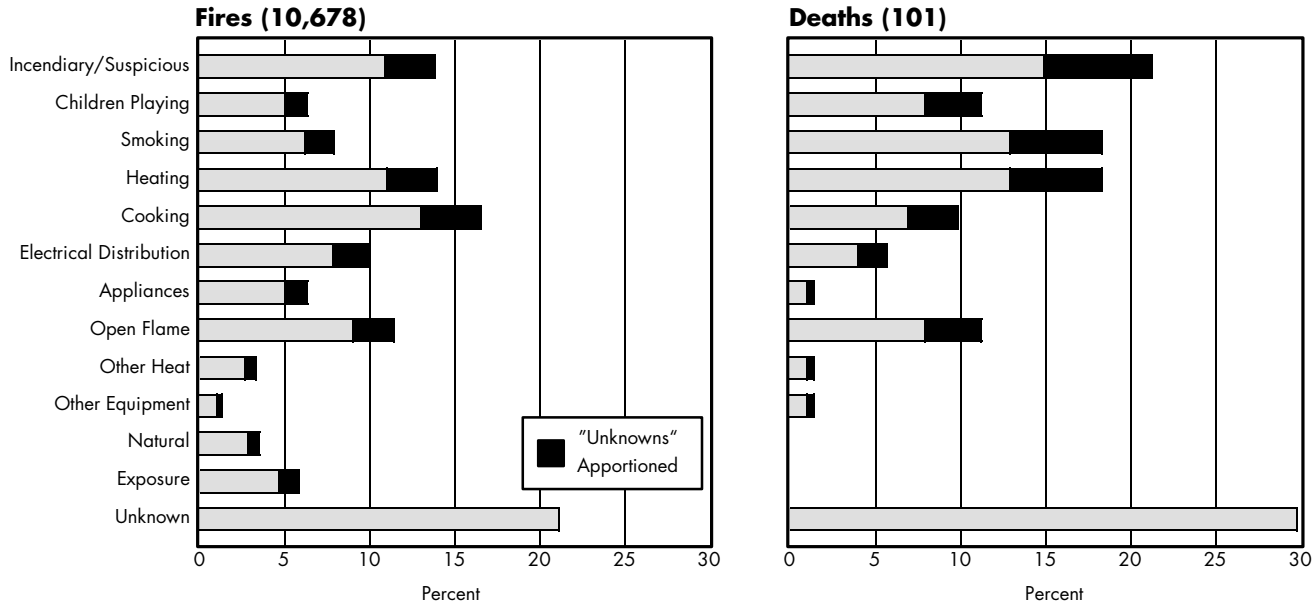
1998 deaths: 26th; 1996 deaths: 29th (tied)
1998 death rate: 10th; 1996 death rate: 21st

Note: See page 237 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 666
No. Fire Departments Reporting to NFIRS: 501
Percent of Fire Departments Reporting to NFIRS: 75%
No. Fires Reported to NFIRS in 1998: 3,093
Deaths/1,000 Fires in 1998: 12.9

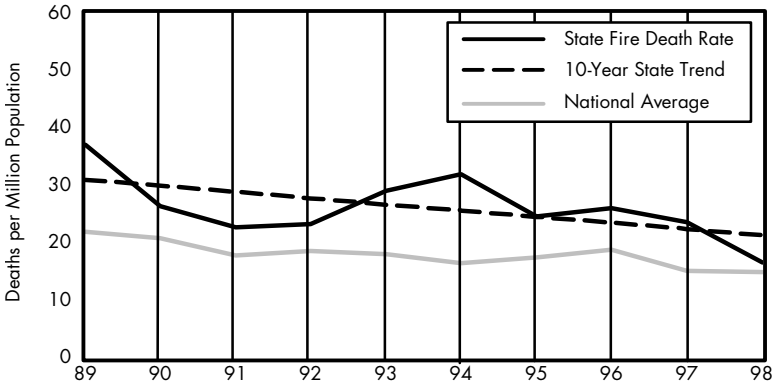
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

KENTUCKY

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	136	37.0
1990	97	26.3
1991	84	22.6
1992	87	23.2
1993	110	29.0
1994	122	31.9
1995	95	24.6
1996	101	26.0
1997	92	23.5
1998	65	16.5
10-Year Trend	**-26.5%**	**-31.6%**

Sources: Kentucky State Fire Marshal Office and the Bureau of the Census

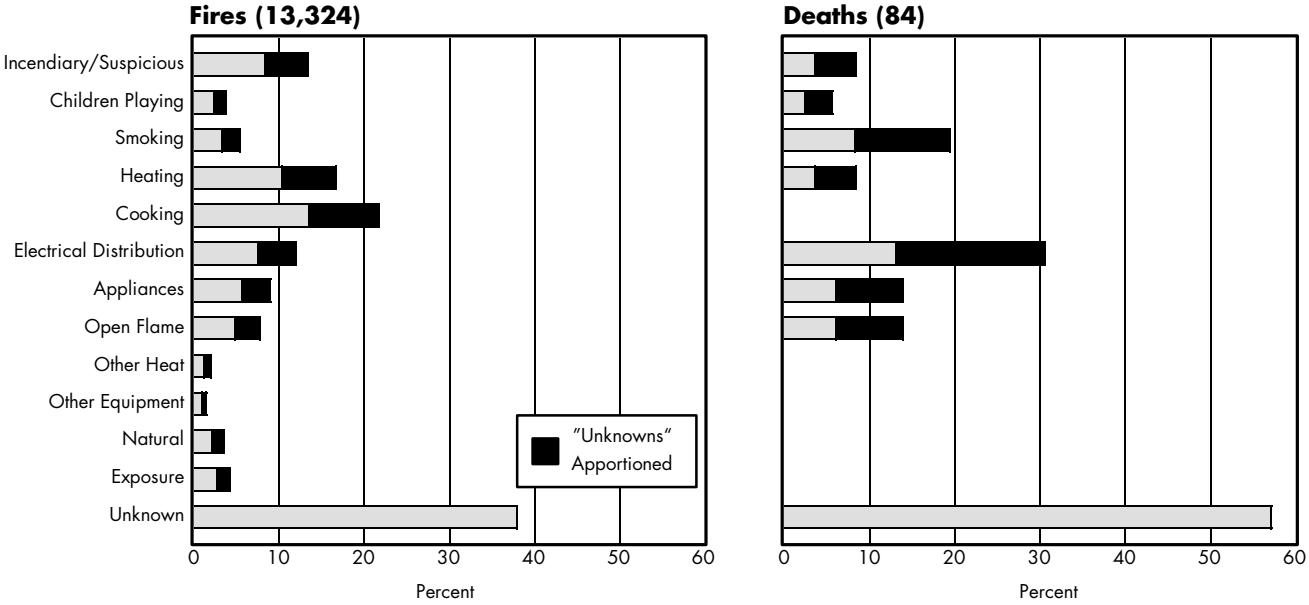
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 21st (tied) ; 1996 deaths: 16th
1998 death rate: 20th; 1996 death rate: 9th

NFIRS PARTICIPATION

No. Fire Departments in State: 813
No. Fire Departments Reporting to NFIRS: 552
Percent of Fire Departments Reporting to NFIRS: 68%
No. Fires Reported to NFIRS in 1998: 4,167
Deaths/1,000 Fires in 1998: 5.8

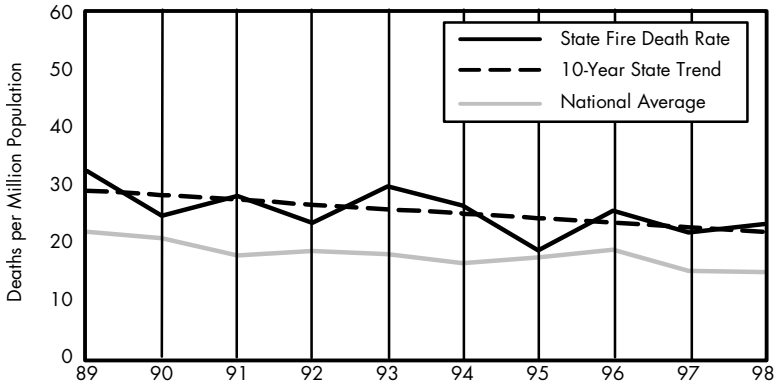
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

LOUISIANA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	138	32.4
1990	104	24.7
1991	119	28.1
1992	100	23.4
1993	128	29.8
1994	114	26.4
1995	81	18.7
1996	111	25.6
1997	95	21.8
1998	101	23.2
10-Year Trend	**-22.5%**	**-25.1%**

Sources: Louisiana State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

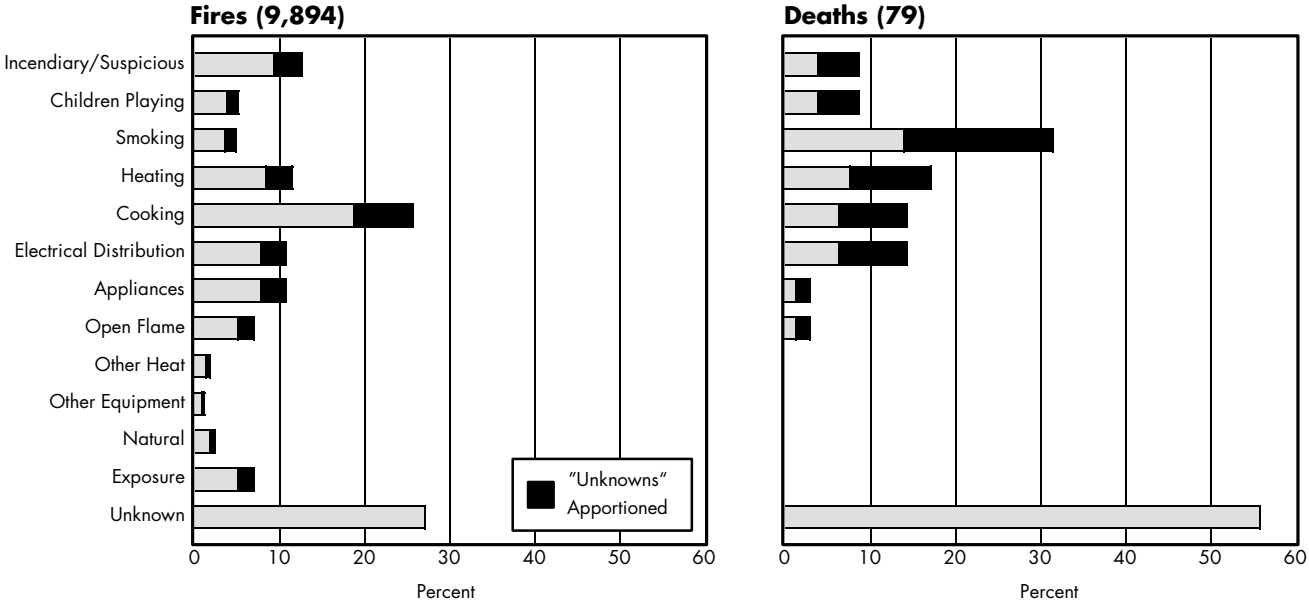
1998 deaths: 14th; 1996 deaths: 14th
1998 death rate: 9th; 1996 death rate: 10th

Note: See page 237 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 604
No. Fire Departments Reporting to NFIRS: 266
Percent of Fire Departments Reporting to NFIRS: 44%
No. Fires Reported to NFIRS in 1998: 3,475
Deaths/1,000 Fires in 1998: 7.2

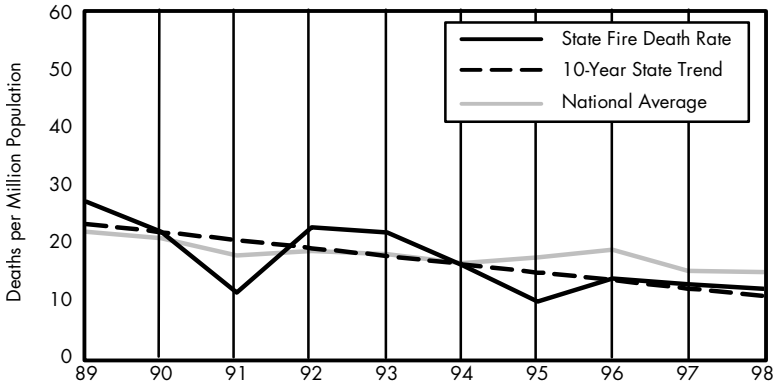
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

MAINE

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	33	27.1
1990	27	21.9
1991	14	11.3
1992	28	22.6
1993	27	21.8
1994	20	16.1
1995	12	9.7
1996	17	13.7
1997	16	12.8
1998	15	12.0
10-Year Trend	**-53.4%**	**-54.3%**

Sources: Maine State Fire Marshal Office and the Bureau of the Census

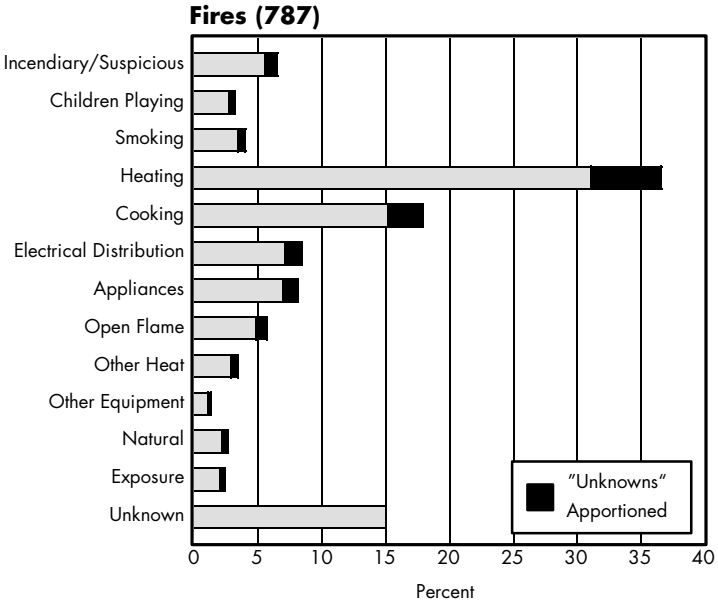
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 41st (tied); 1996 deaths: 42nd (tied)
1998 death rate: 32nd; 1996 death rate: 30th

NFIRS PARTICIPATION

No. Fire Departments in State: 463
No. Fire Departments Reporting to NFIRS: 39
Percent of Fire Departments Reporting to NFIRS: 8%
No. Fires Reported to NFIRS in 1998: 419
Deaths/1,000 Fires in 1998: 0

CAUSES OF RESIDENTIAL FIRES AND DEATHS (1997 AND 1998 TOTALS)

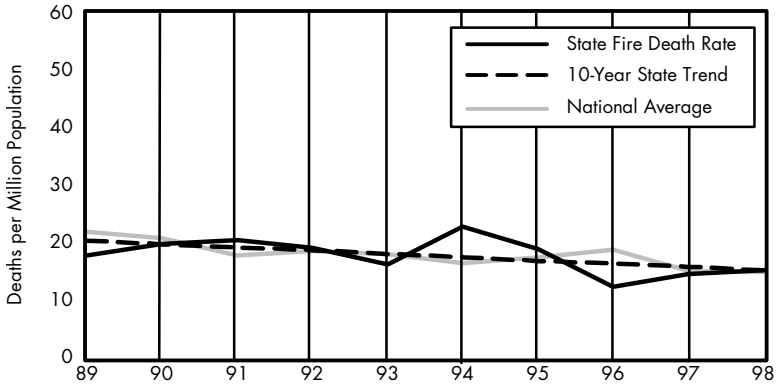


The cause of the one reported death is incendiary/suspicious.

Source: NFIRS

MARYLAND

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	84	17.8
1990	95	19.8
1991	99	20.4
1992	94	19.1
1993	80	16.2
1994	114	22.8
1995	95	18.9
1996	62	12.3
1997	74	14.5
1998	78	15.2
10-Year Trend	**-19.6%**	**-25.5%**

Sources: Maryland State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

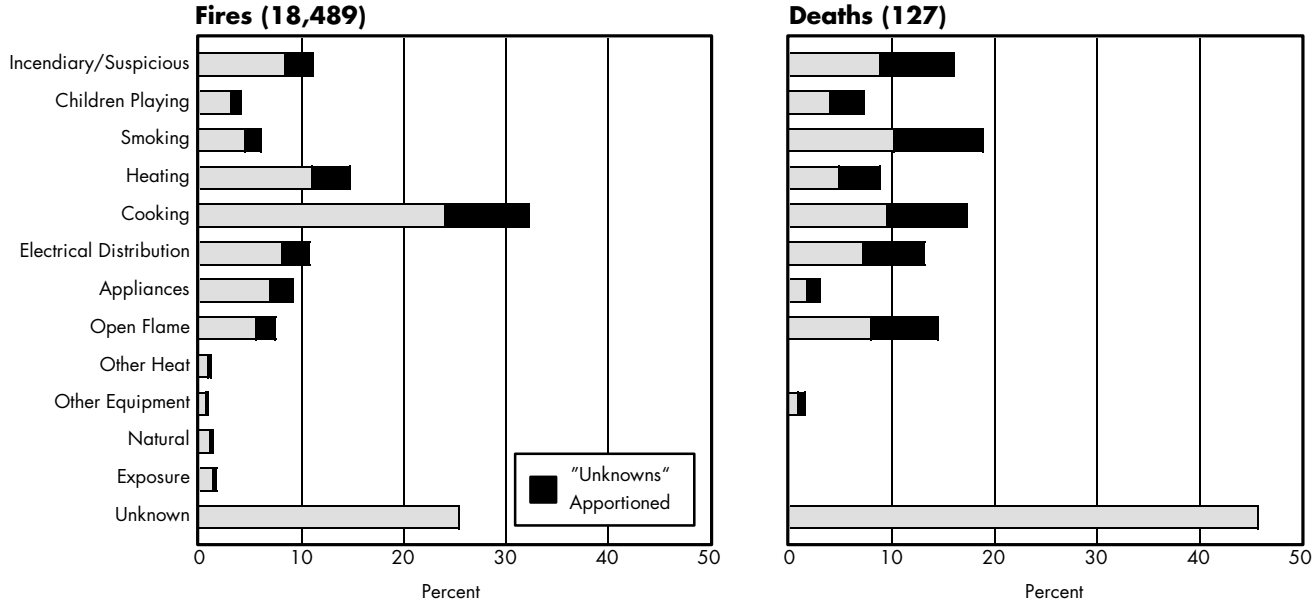
1998 deaths: 17th; 1996 deaths: 24th
1998 death rate: 24th; 1996 death rate: 33rd

Note: See page 237 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 365
No. Fire Departments Reporting to NFIRS: 331
Percent of Fire Departments Reporting to NFIRS: 91%
No. Fires Reported to NFIRS in 1998: 5,691
Deaths/1,000 Fires in 1998: 9.7

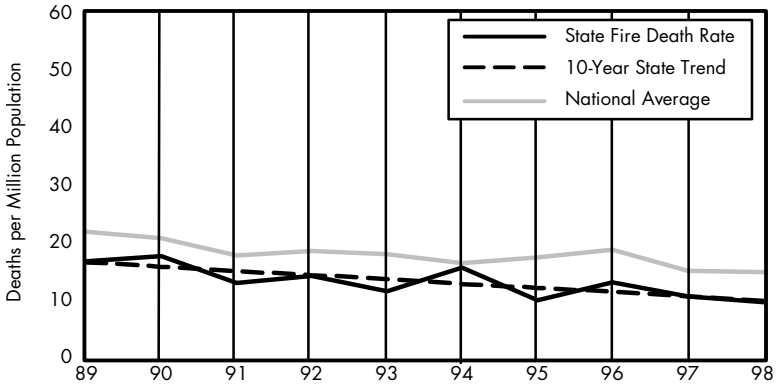
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

MASSACHUSETTS

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	101	16.8
1990	106	17.6
1991	78	13.0
1992	85	14.2
1993	69	11.5
1994	94	15.6
1995	61	10.0
1996	80	13.1
1997	65	10.6
1998	59	9.6
10-Year Trend	**-38.7%**	**-40.0%**

Sources: Massachusetts State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

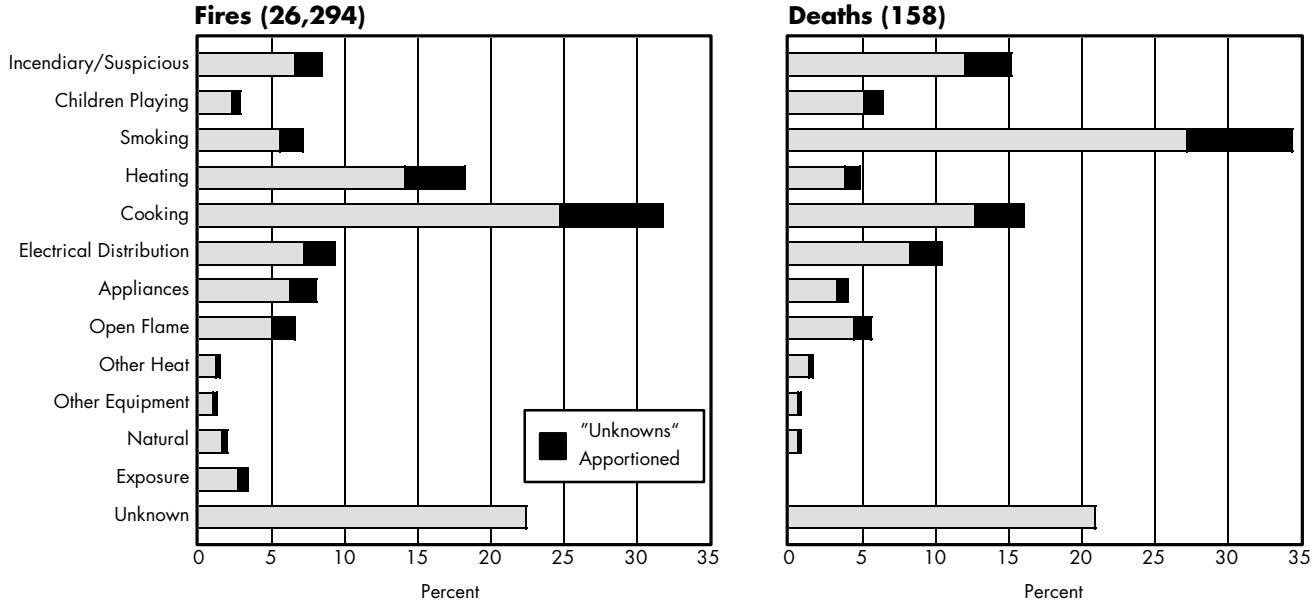
1998 deaths: 24th (tied); 1996 deaths: 18th
1998 death rate: 38th; 1996 death rate: 31st

Note: See page 237 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 367
No. Fire Departments Reporting to NFIRS: 328
Percent of Fire Departments Reporting to NFIRS: 89%
No. Fires Reported to NFIRS in 1998: 8,316
Deaths/1,000 Fires in 1998: 5.8

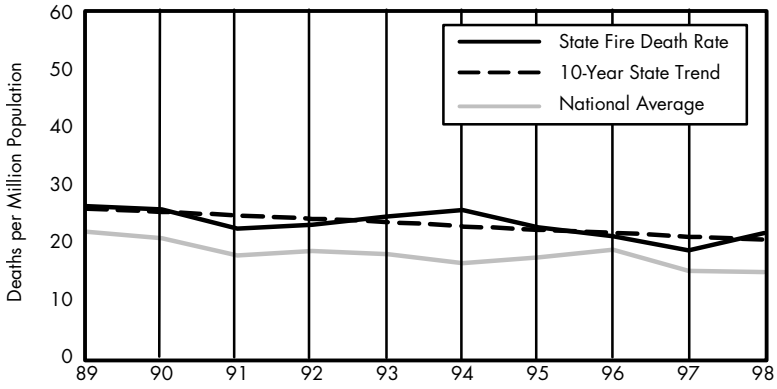
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

MICHIGAN

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	243	26.3
1990	240	25.8
1991	210	22.4
1992	218	23.1
1993	233	24.6
1994	244	25.7
1995	212	22.2
1996	205	21.1
1997	182	18.6
1998	213	21.7
10-Year Trend	**-16.1%**	**-21.0%**

Sources: Michigan State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

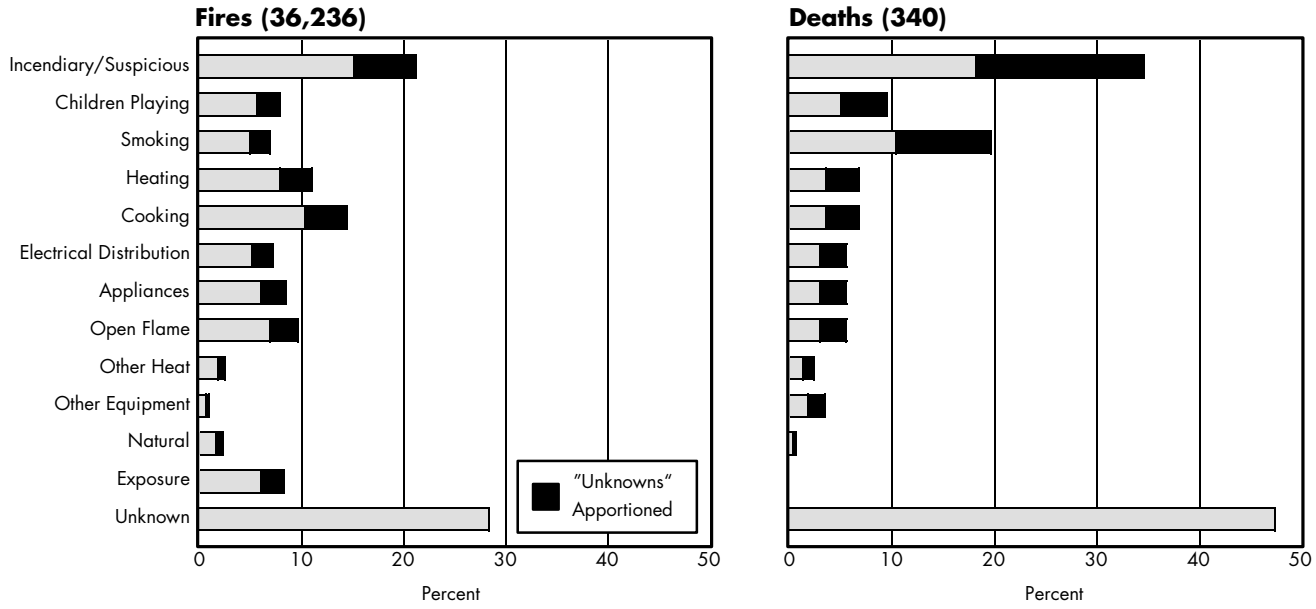
1998 deaths: 2nd; 1996 deaths: 5th
1998 death rate: 11th; 1996 death rate: 16th

Note: See page 238 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 1,079
No. Fire Departments Reporting to NFIRS: 907
Percent of Fire Departments Reporting to NFIRS: 84%
No. Fires Reported to NFIRS in 1998: 13,095
Deaths/1,000 Fires in 1998: 12.4

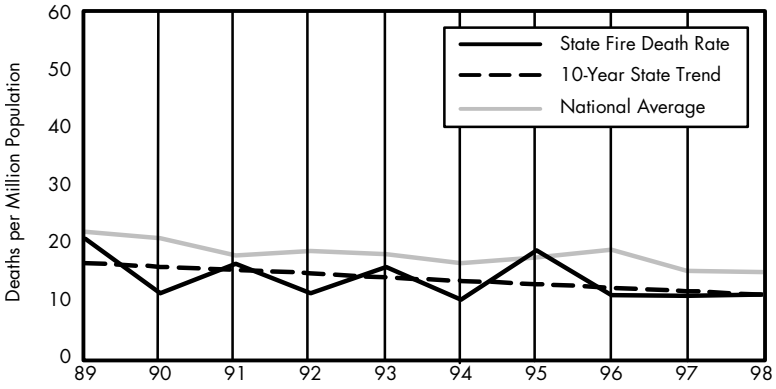
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

MINNESOTA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	90	20.7
1990	49	11.2
1991	72	16.3
1992	50	11.2
1993	71	15.7
1994	46	10.1
1995	86	18.6
1996	50	10.8
1997	50	10.7
1998	52	11.0
10-Year Trend	**-27.6%**	**-33.9%**

Sources: Minnesota State Fire Marshal Office; Minnesota Section of Vital Statistics, Department of Health; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

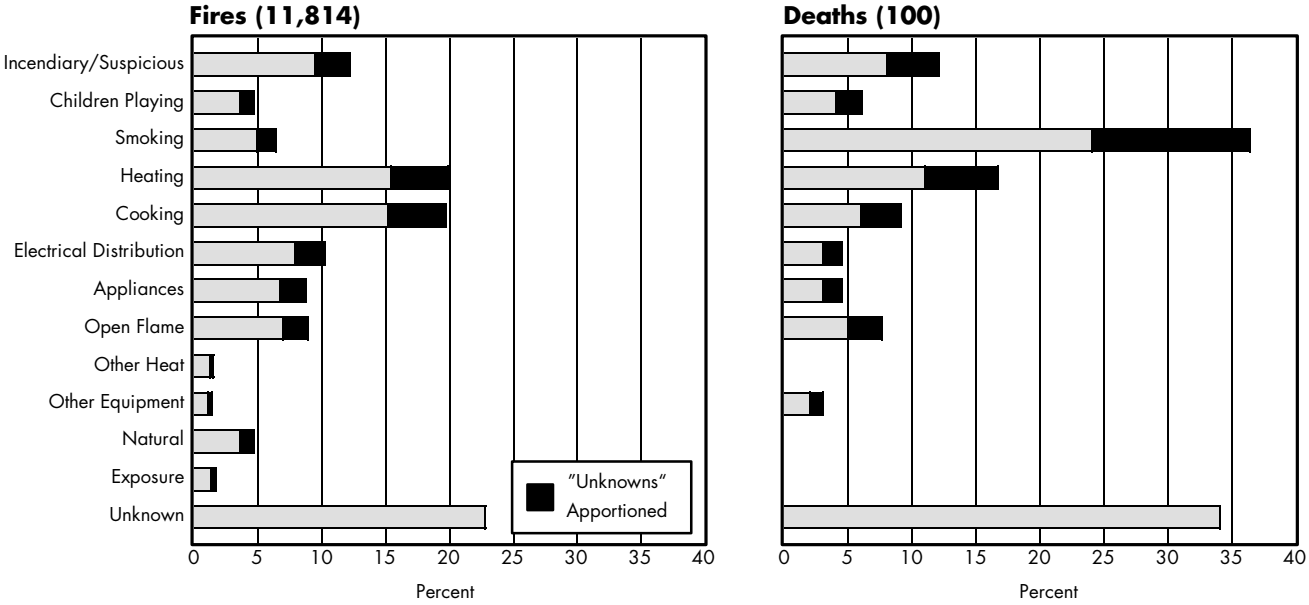
1998 deaths: 27th (tied); 1996 deaths: 27th
1998 death rate: 35th; 1996 death rate: 38th

Note: See page 238 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 793
No. Fire Departments Reporting to NFIRS: 641
Percent of Fire Departments Reporting to NFIRS: 81%
No. Fires Reported to NFIRS in 1998: 3,564
Deaths/1,000 Fires in 1998: 7.9

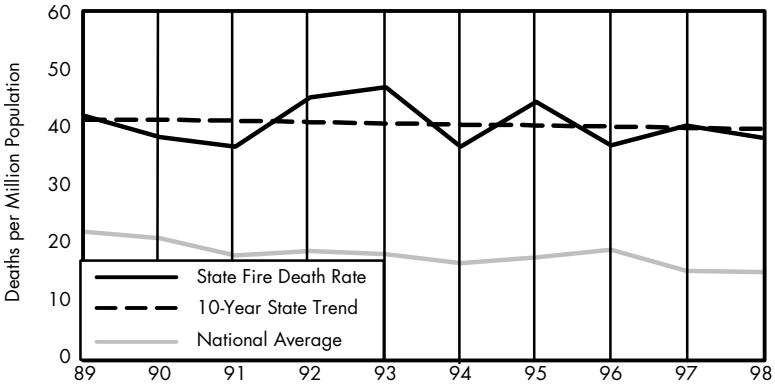
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

MISSISSIPPI

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	108	42.0
1990	99	38.4
1991	95	36.7
1992	118	45.2
1993	124	47.0
1994	98	36.7
1995	120	44.5
1996	100	36.9
1997	110	40.3
1998	105	38.2
10-Year Trend	**+2.8%**	**-4.2%**

Sources: Mississippi Fire Services Development, Department of Insurance; Vital Records, State Department of Health; and Bureau of the Census

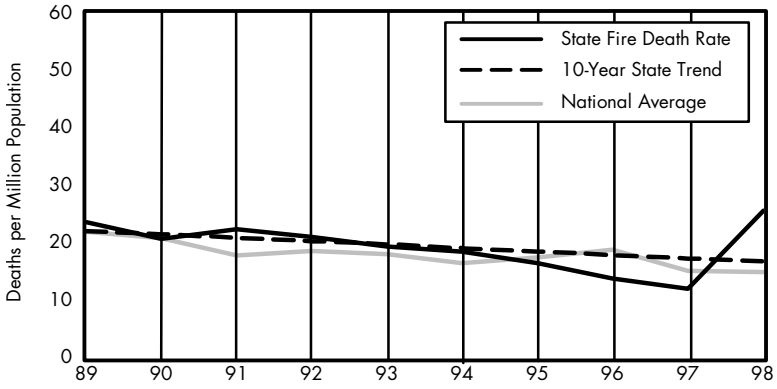
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 13th; 1996 deaths: 17th
1998 death rate: 2nd; 1996 death rate: 3rd

NFIRS PARTICIPATION (None)

MISSOURI

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	120	23.5
1990	106	20.7
1991	115	22.3
1992	109	21.0
1993	101	19.3
1994	97	18.4
1995	87	16.4
1996	74	13.8
1997	65	12.0
1998	139	25.6
10-Year Trend	**-19.0%**	**-24.7%**

Sources: Missouri State Fire Marshal Office; Missouri Vital Records, State Department of Health; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

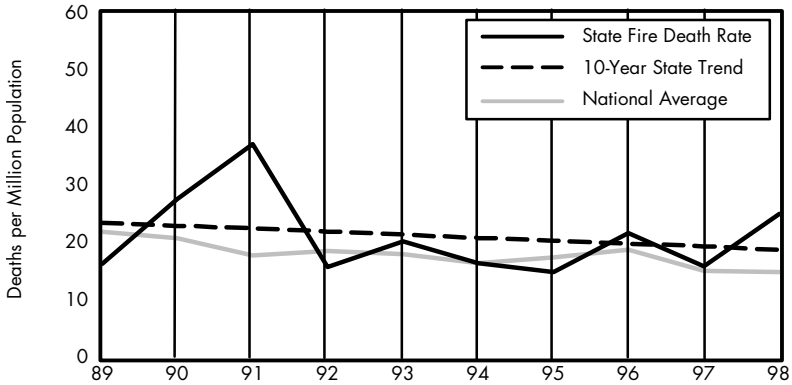
1998 deaths: 9th; 1996 deaths: 20th (tied)
1998 death rate: 4th; 1996 death rate: 29th

Note: See page 238 for current state initiatives.

NFIRS PARTICIPATION (None)

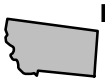
MONTANA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	13	16.3
1990	22	27.5
1991	30	37.1
1992	13	15.8
1993	17	20.2
1994	14	16.4
1995	13	14.9
1996	19	21.7
1997	14	15.9
1998	22	25.0
10-Year Trend	**-9.7%**	**-20.0%**

Sources: Montana State Fire Marshal Office and the Bureau of the Census



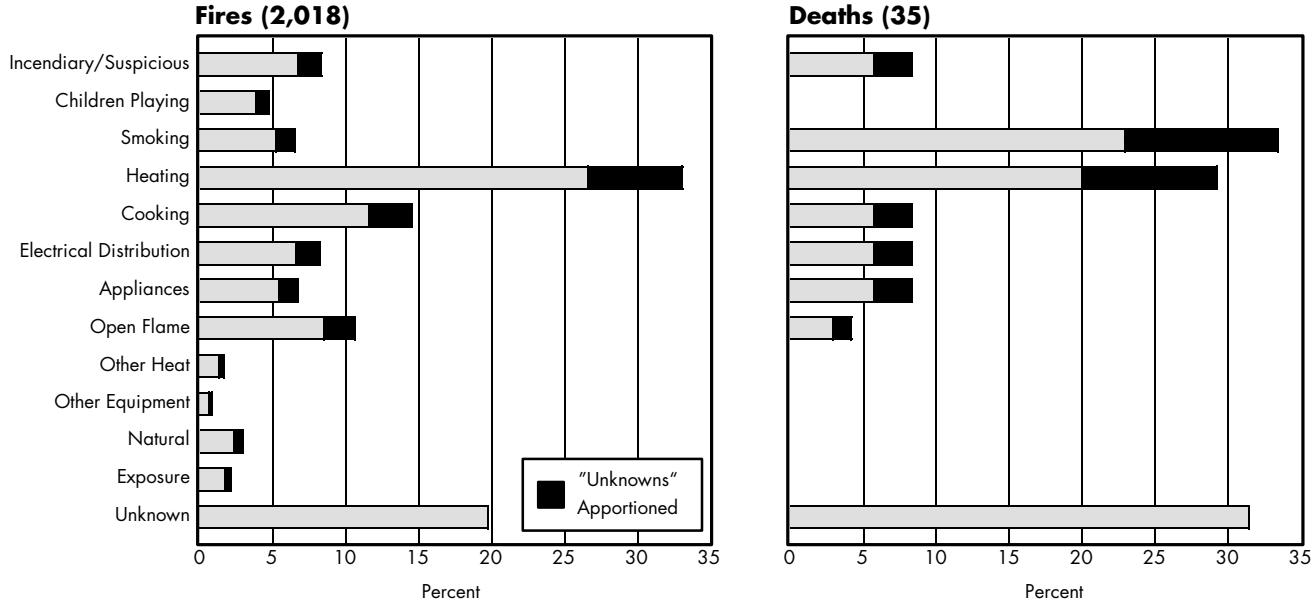
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 38th; 1996 deaths: 39th
1998 death rate: 6th; 1996 death rate: 15th

NFIRS PARTICIPATION

No. Fire Departments in State: 400
No. Fire Departments Reporting to NFIRS: 243
Percent of Fire Departments Reporting to NFIRS: 61%
No. Fires Reported to NFIRS in 1998: 774
Deaths/1,000 Fires in 1998: 24.5

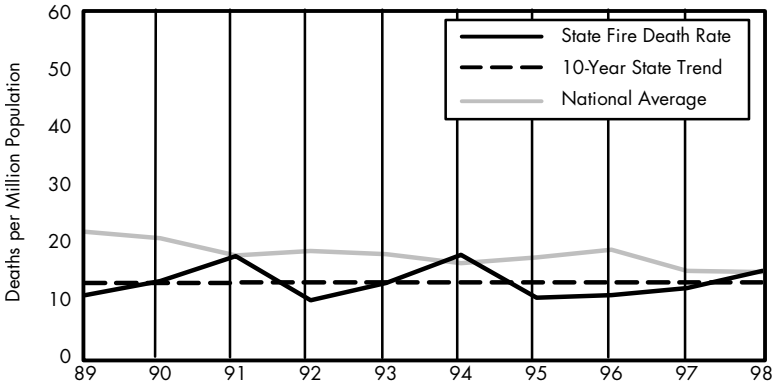
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

NEBRASKA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	17	10.8
1990	21	13.3
1991	28	17.6
1992	16	10.0
1993	21	13.0
1994	29	17.9
1995	17	10.4
1996	18	10.9
1997	20	12.1
1998	25	15.1
10-Year Trend	**+6.9%**	**+1.1%**

Sources: Nebraska State Fire Marshal Office; Nebraska Bureau of Vital Statistics, Department of Health; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

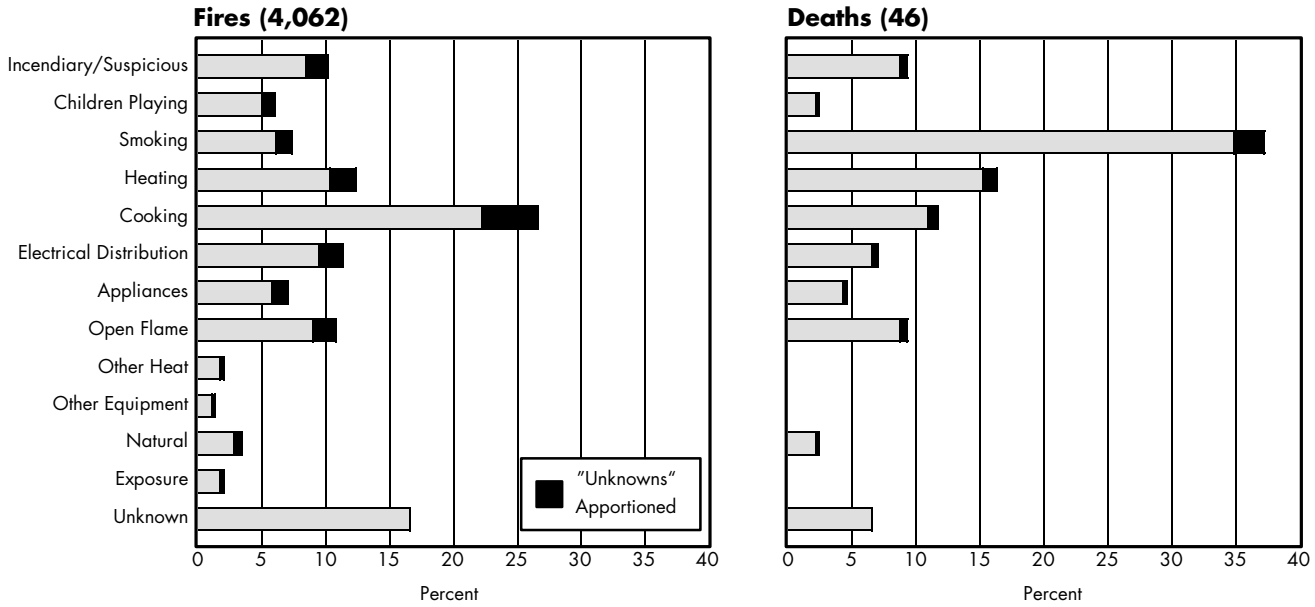
1998 deaths: 35th; 1996 deaths: 40th
1998 death rate: 25th; 1996 death rate: 37th

Note: See page 238 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 480
No. Fire Departments Reporting to NFIRS: 226
Percent of Fire Departments Reporting to NFIRS: 47%
No. Fires Reported to NFIRS in 1998: 1,184
Deaths/1,000 Fires in 1998: 16.9

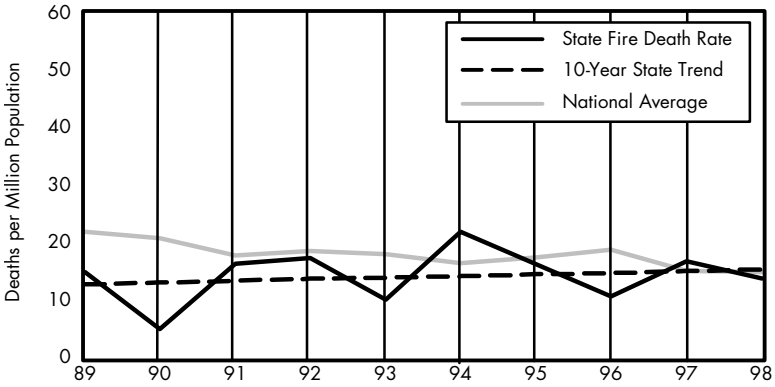
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

NEVADA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	17	14.9
1990	6	4.9
1991	21	16.3
1992	23	17.3
1993	14	10.1
1994	32	21.9
1995	-	-
1996	17	10.6
1997	28	16.7
1998	24	13.8
9-Year Trend	**+79.5%**	**+19.9%**

Sources: Nevada State Fire Marshal Office; Nevada Division of Health, Vital Statistics; and the Bureau of the Census

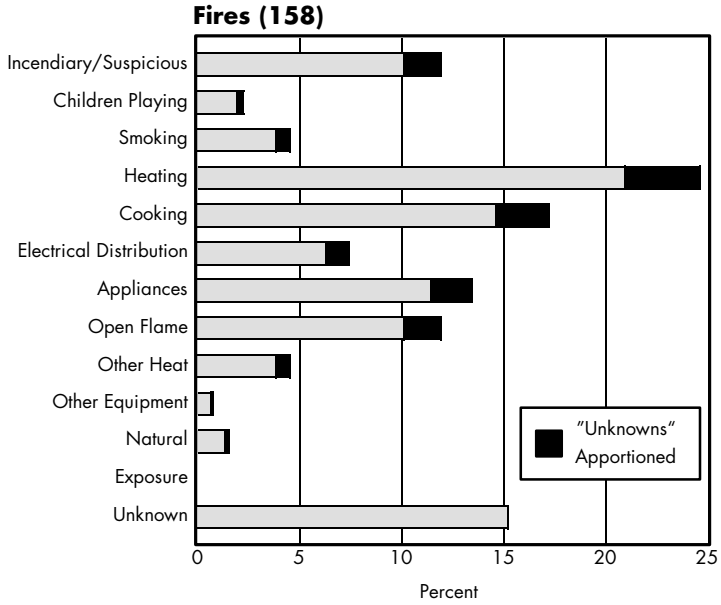
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 36th (tied); 1996 deaths: 42nd
1998 death rate: 27th; 1996 death rate: 39th

NFIRS PARTICIPATION

No. Fire Departments in State: 210
No. Fire Departments Reporting to NFIRS: 13
Percent of Fire Departments Reporting to NFIRS: 6%
No. Fires Reported to NFIRS in 1998: 158
Deaths/1,000 Fires in 1998: 6.3

CAUSES OF RESIDENTIAL FIRES AND DEATHS (1998 TOTALS)

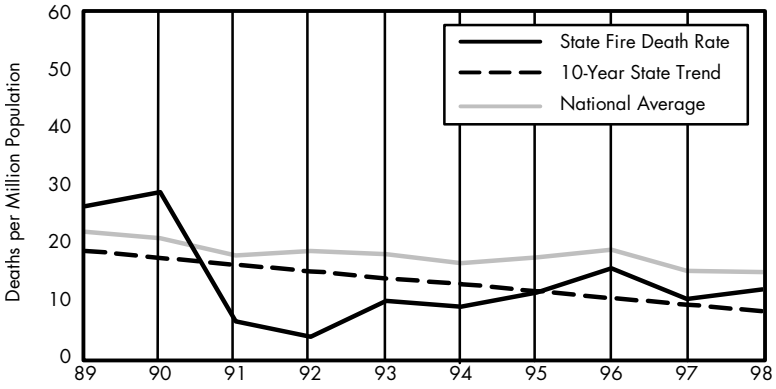


The cause of the one reported death is electrical distribution.

Source: NFIRS

NEW HAMPSHIRE

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	29	26.3
1990	32	28.8
1991	7	6.3
1992	4	3.6
1993	11	9.8
1994	10	8.8
1995	13	11.3
1996	18	15.5
1997	12	10.2
1998	14	11.8
10-Year Trend	**-52.2%**	**-56.6%**

Sources: New Hampshire State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

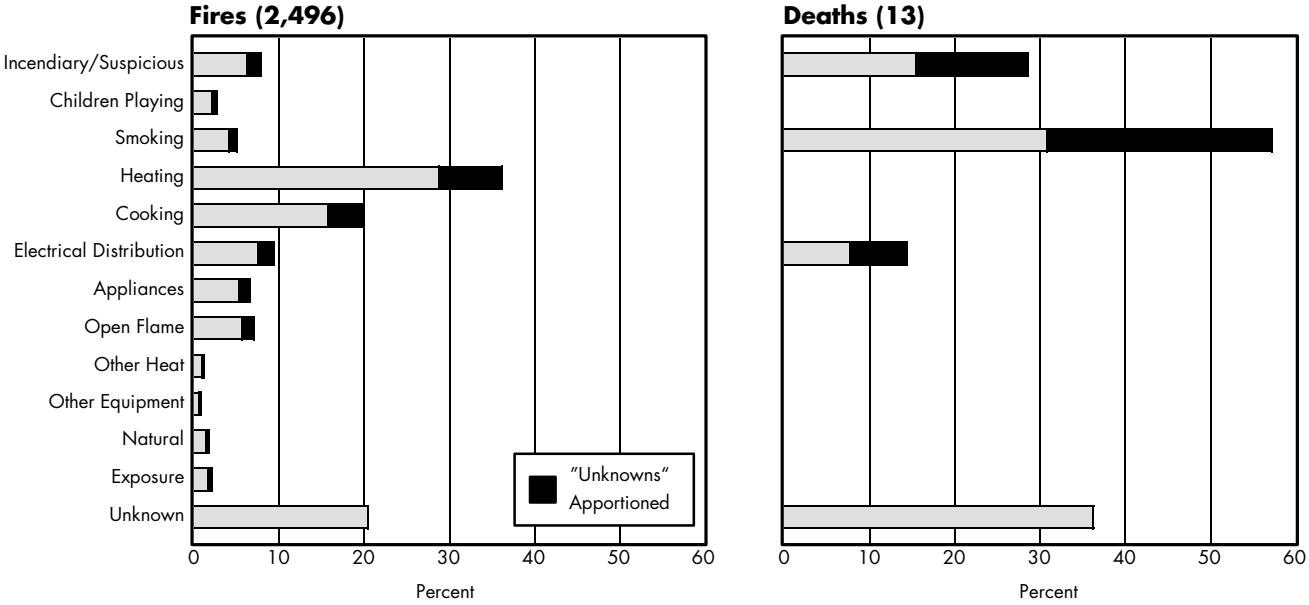
1998 deaths: 43rd (tied); 1996 deaths: 40th (tied)
1998 death rate: 33rd; 1996 death rate: 26th

Note: See page 238 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 242
No. Fire Departments Reporting to NFIRS: 93
Percent of Fire Departments Reporting to NFIRS: 38%
No. Fires Reported to NFIRS in 1998: 911
Deaths/1,000 Fires in 1998: 3.3

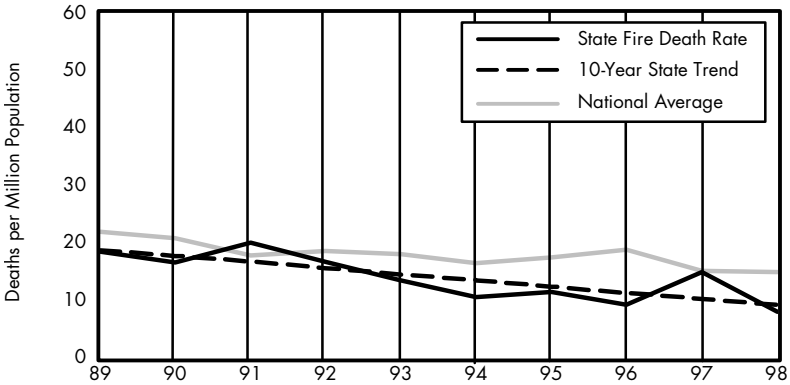
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

NEW JERSEY

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	142	18.4
1990	128	16.5
1991	155	20.0
1992	130	16.6
1993	105	13.4
1994	83	10.5
1995	91	11.4
1996	74	9.2
1997	120	14.9
1998	65	8.0
10-Year Trend	**-48.8%**	**-51.5%**

Sources: New Jersey Division of Fire Safety and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

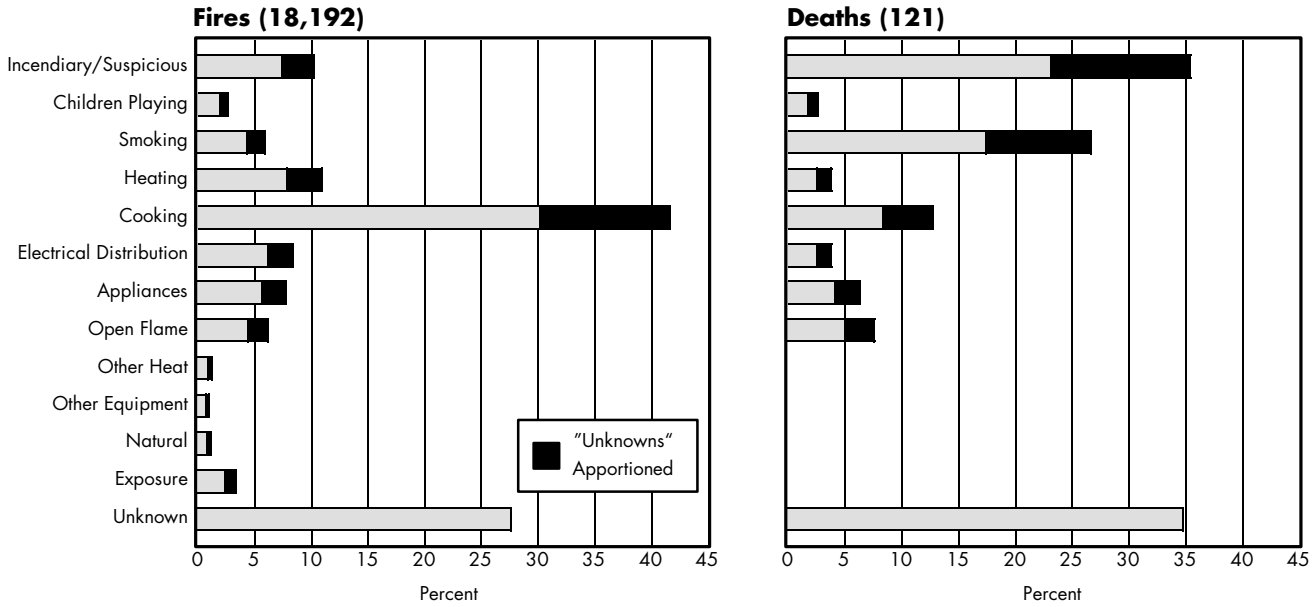
1998 deaths: 21st (tied); 1996 deaths: 20th (tied)
1998 death rate: 45th; 1996 death rate: 42nd

Note: See page 238 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 810
No. Fire Departments Reporting to NFIRS: 305
Percent of Fire Departments Reporting to NFIRS: 38%
No. Fires Reported to NFIRS in 1998: 5,157
Deaths/1,000 Fires in 1998: 2.1

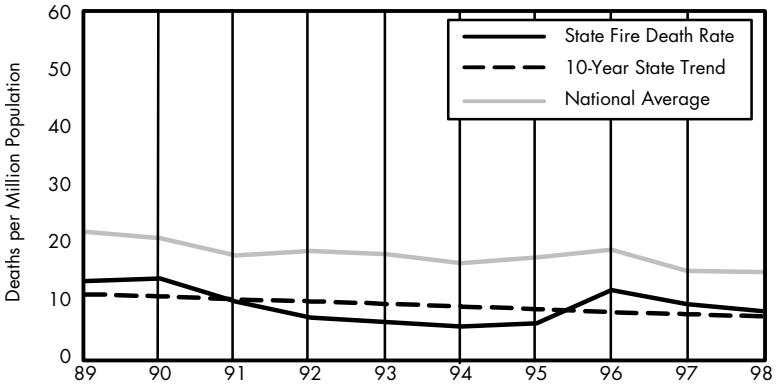
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

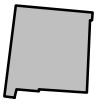
NEW MEXICO

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	20	13.3
1990	21	13.8
1991	15	9.7
1992	11	7.0
1993	10	6.2
1994	9	5.4
1995	10	5.9
1996	20	11.7
1997	16	9.3
1998	14	8.1
10-Year Trend	**-22.5%**	**-36.0%**

Sources: New Mexico State Fire Marshal Office and the Bureau of the Census



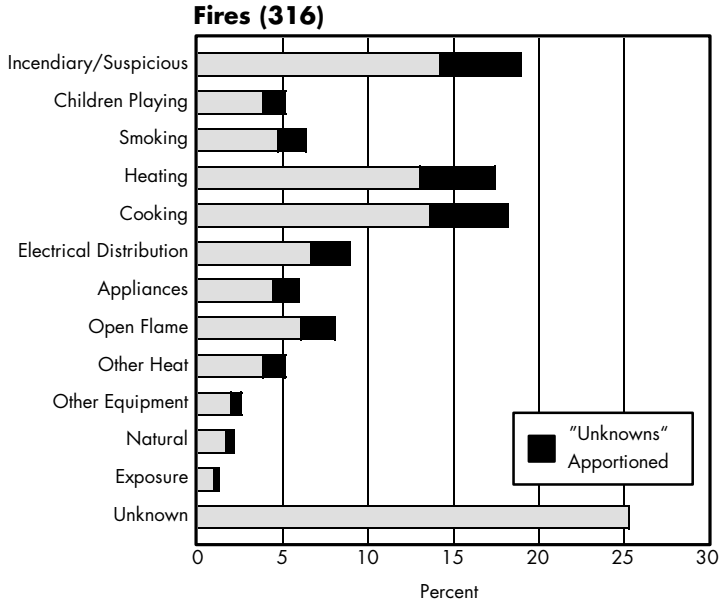
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 43rd (tied); 1996 deaths: 38th
1998 death rate: 44th; 1996 death rate: 35th

NFIRS PARTICIPATION

No. Fire Departments in State in 1996: 356
No. Fire Departments Reporting to NFIRS in 1996: 9
Percent of Fire Departments Reporting to NFIRS in 1996: 3%
No. Fires Reported to NFIRS in 1996: 316
Deaths/1,000 Fires in 1996: 0

CAUSES OF RESIDENTIAL FIRES AND DEATHS (1996 TOTALS)

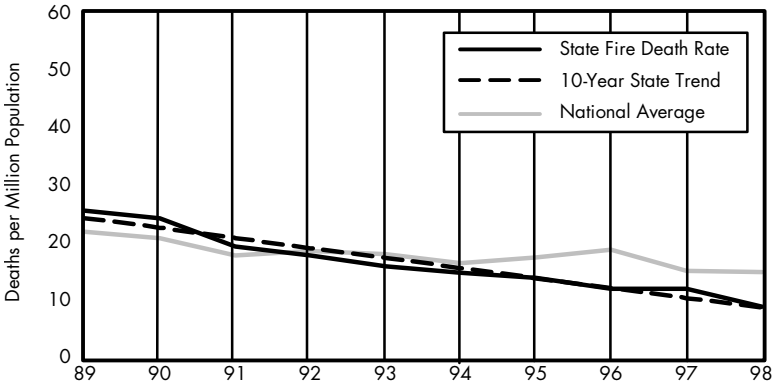


No deaths were reported to NFIRS in 1996.

Source: NFIRS

NEW YORK

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	461	25.6
1990	435	24.2
1991	348	19.3
1992	322	17.8
1993	288	15.9
1994	268	14.8
1995	253	13.9
1996	218	12.0
1997	217	12.0
1998	159	8.8
10-Year Trend	**-64.0%**	**-64.5%**

Sources: New York State Fire Administrator, Office of Fire Prevention and Control; and the Bureau of the Census

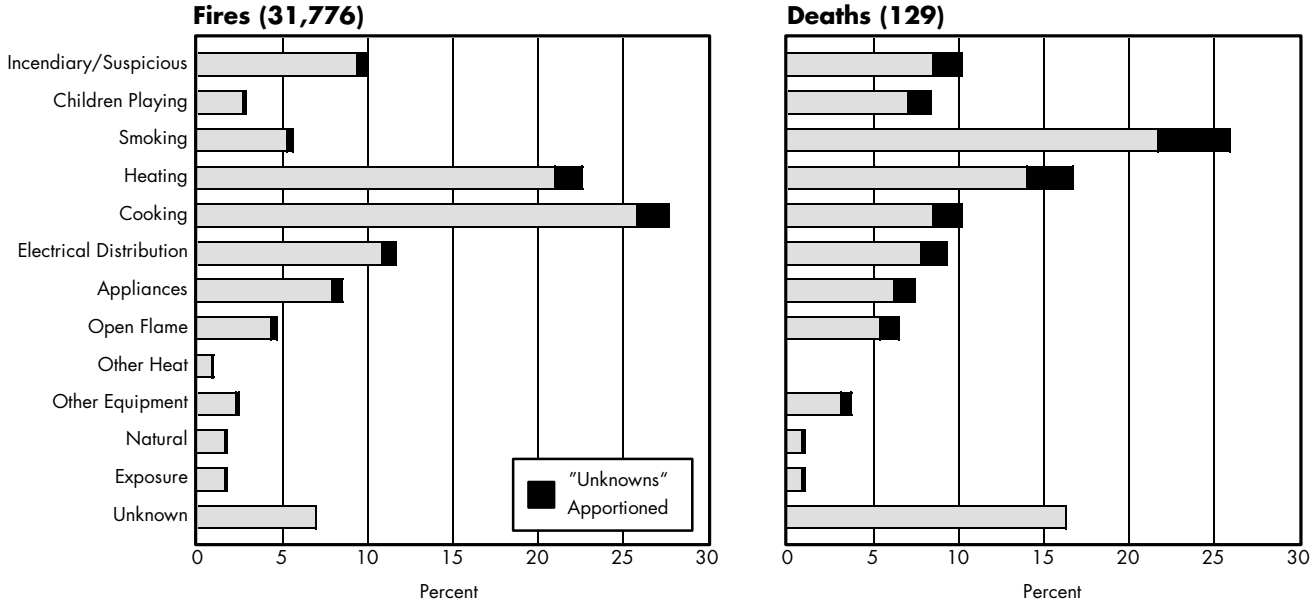
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 5th; 1996 deaths: 4th
1998 death rate: 41st; 1996 death rate: 34th

NFIRS PARTICIPATION

No. Fire Departments in State: 1,800
No. Fire Departments Reporting to NFIRS: 1,495
Percent of Fire Departments Reporting to NFIRS: 83%
No. Fires Reported to NFIRS in 1998: 7,985
Deaths/1,000 Fires in 1998: 4.6

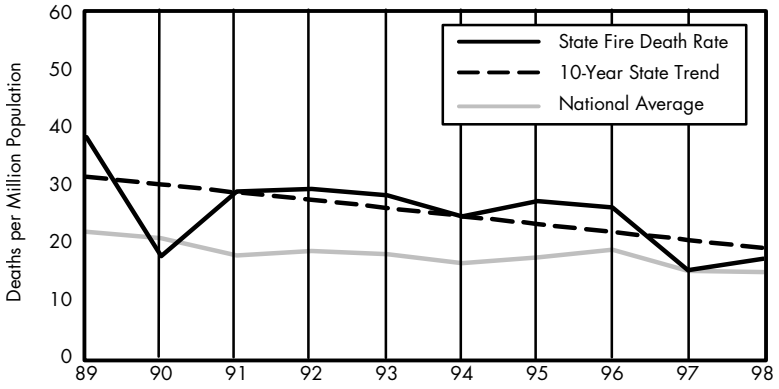
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

NORTH CAROLINA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	252	38.4
1990	117	17.6
1991	195	28.9
1992	200	29.3
1993	196	28.2
1994	173	24.5
1995	196	27.2
1996	191	26.1
1997	113	15.2
1998	130	17.2
10-Year Trend	**-30.9%**	**-39.9%**

Sources: Commissioner, North Carolina Department of Insurance; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

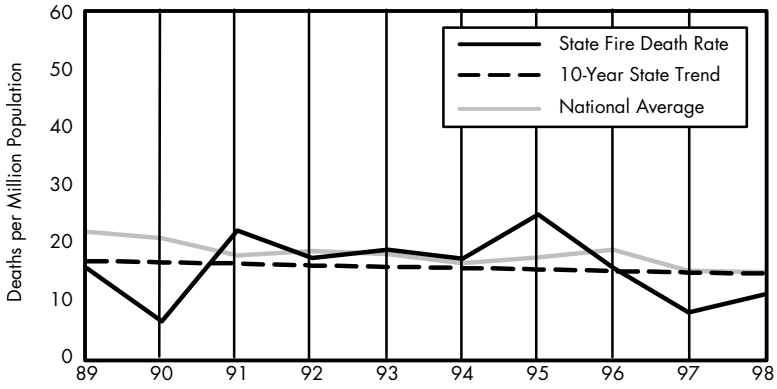
1998 deaths: 11th; 1996 deaths: 6th (tied)
1998 death rate: 19th; 1996 death rate: 8th

Note: See page 239 for current state initiatives.

NFIRS PARTICIPATION (None)

NORTH DAKOTA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	10	15.5
1990	4	6.3
1991	14	22.1
1992	11	17.3
1993	12	18.8
1994	11	17.2
1995	16	24.9
1996	10	15.6
1997	5	7.8
1998	7	11.0
10-Year Trend	**-13.2%**	**-13.4%**

Sources: North Dakota State Fire Marshal Office and the Bureau of the Census

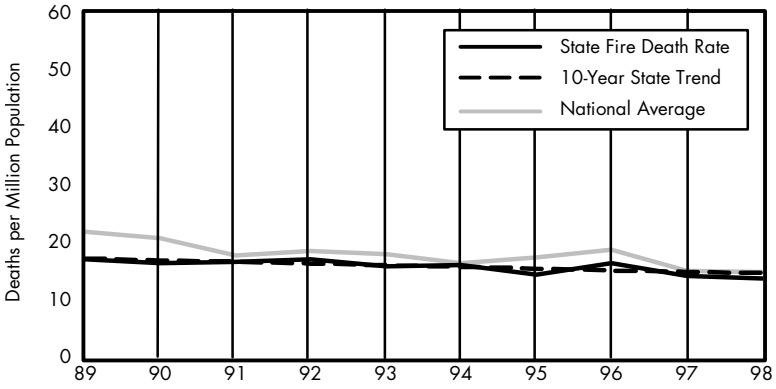
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 48th; 1996 deaths: 48th
1998 death rate: 36th; 1996 death rate: 25th

NFIRS PARTICIPATION (None)

OHIO

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	185	17.1
1990	178	16.4
1991	181	16.6
1992	188	17.1
1993	176	15.9
1994	179	16.1
1995	160	14.4
1996	183	16.4
1997	159	14.2
1998	154	13.7
10-Year Trend	**-14.1%**	**-17.3%**

Sources: Ohio State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

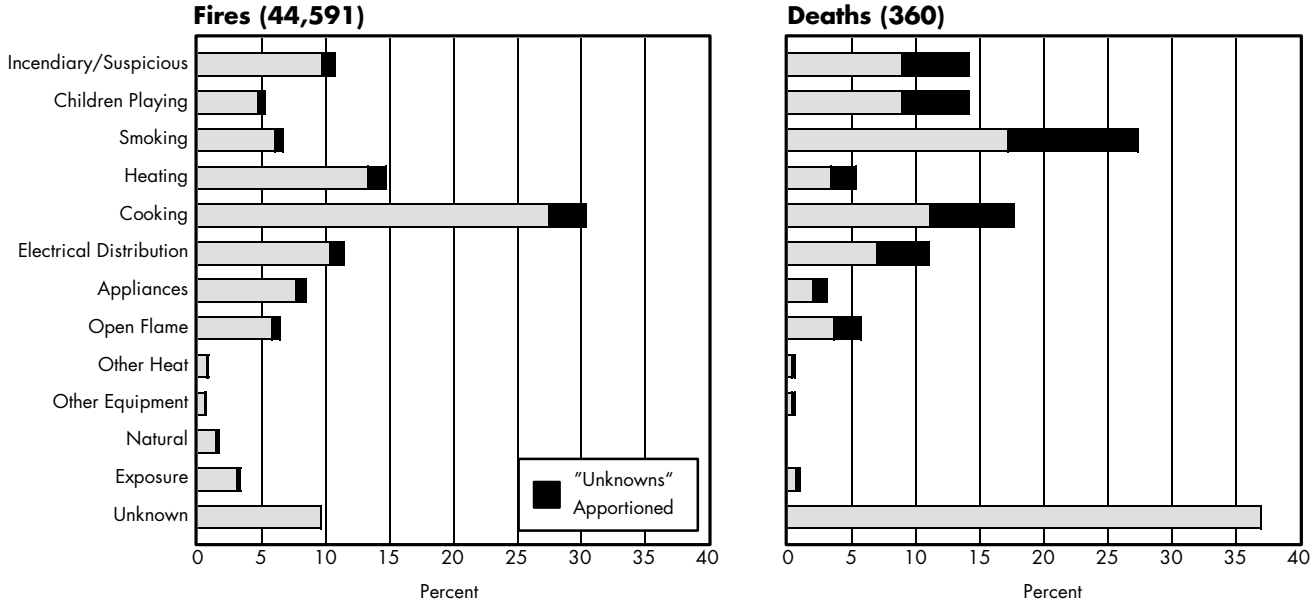
1998 deaths: 6th; 1996 deaths: 8th
1998 death rate: 28th; 1996 death rate: 23rd

Note: See page 239 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 1,240
No. Fire Departments Reporting to NFIRS: 1,064
Percent of Fire Departments Reporting to NFIRS: 86%
No. Fires Reported to NFIRS in 1998: 14,548
Deaths/1,000 Fires in 1998: 8.0

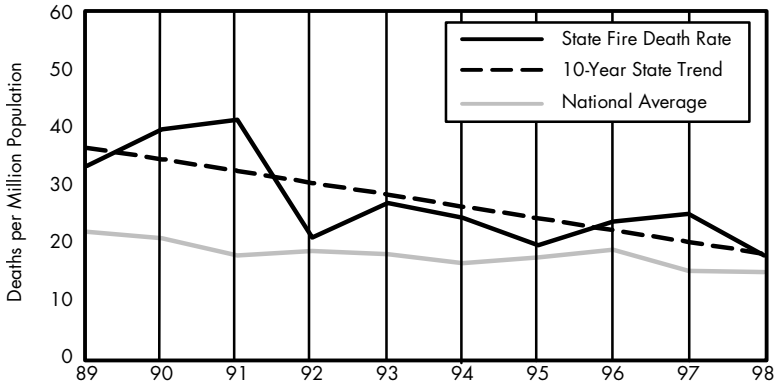
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

OKLAHOMA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	105	33.3
1990	125	39.7
1991	131	41.4
1992	67	20.9
1993	87	26.9
1994	79	24.3
1995	64	19.5
1996	78	23.7
1997	83	25.0
1998	59	17.7
10-Year Trend	**-47.0%**	**-50.7%**

Sources: Oklahoma State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

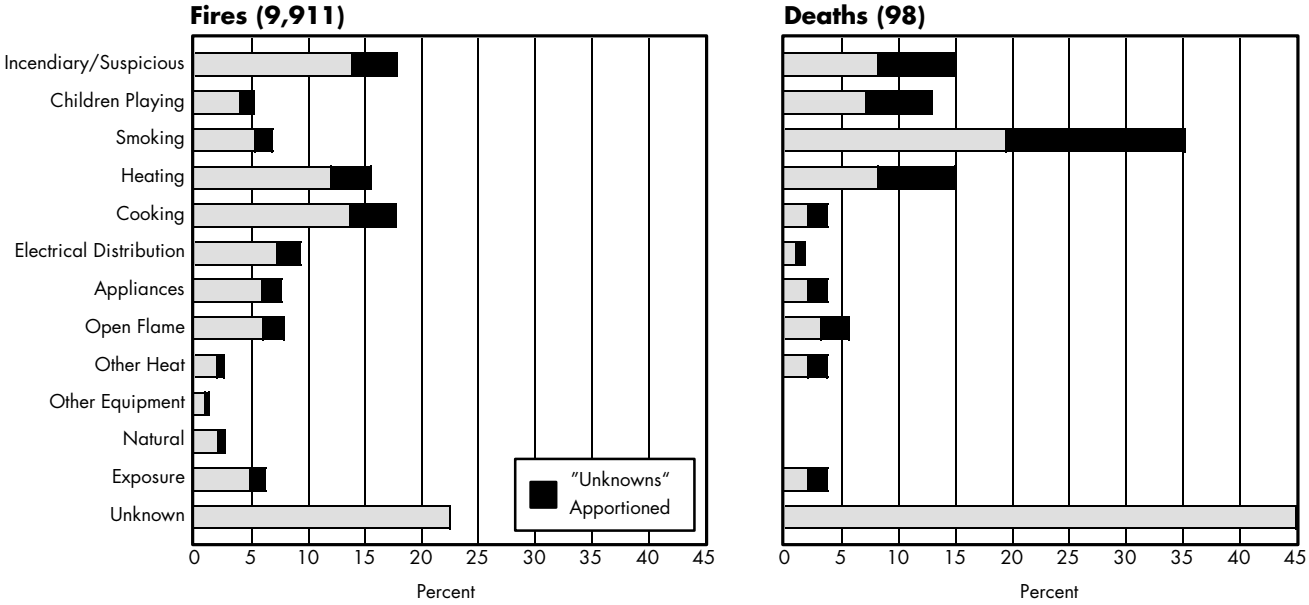
1998 deaths: 24th (tied); 1996 deaths: 19th
1998 death rate: 18th; 1996 death rate: 14th

Note: See page 239 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 883
No. Fire Departments Reporting to NFIRS: 87
Percent of Fire Departments Reporting to NFIRS: 10%
No. Fires Reported to NFIRS in 1998: 3,106
Deaths/1,000 Fires in 1998: 9.0

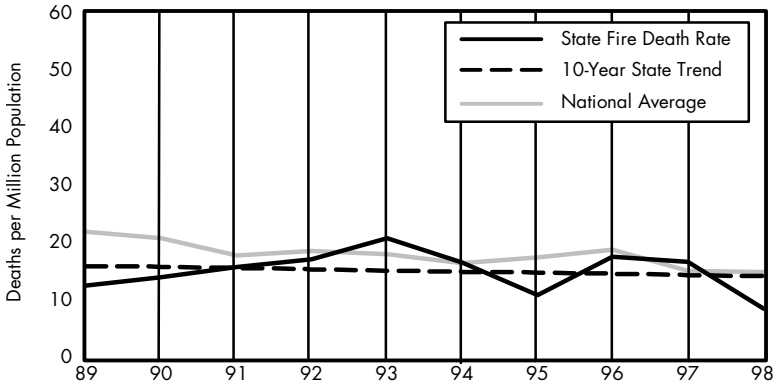
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

OREGON

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	35	12.5
1990	40	14.0
1991	46	15.8
1992	51	17.1
1993	63	20.8
1994	51	16.5
1995	34	10.8
1996	56	17.5
1997	54	16.6
1998	28	8.5
10-Year Trend	**+2.7%**	**-11.0%**

Sources: Oregon State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

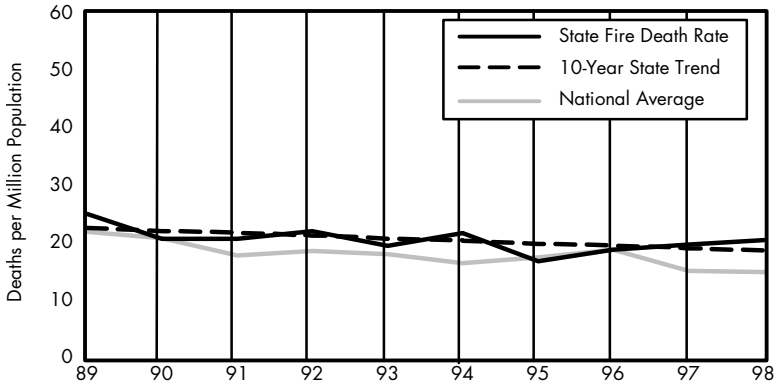
1998 deaths: 33rd; 1996 deaths: 25th
1998 death rate: 43rd; 1996 death rate: 20th

Note: See page 239 for current state initiatives.

NFIRS PARTICIPATION (None)

PENNSYLVANIA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	297	25.0
1990	246	20.7
1991	247	20.7
1992	264	22.0
1993	234	19.4
1994	261	21.6
1995	201	16.7
1996	226	18.8
1997	236	19.6
1998	245	20.4
10-Year Trend	**-16.4%**	**-17.5%**

Sources: Fire Marshal Division, Pennsylvania State Police; Pennsylvania Division of Vital Statistics; and the Bureau of the Census

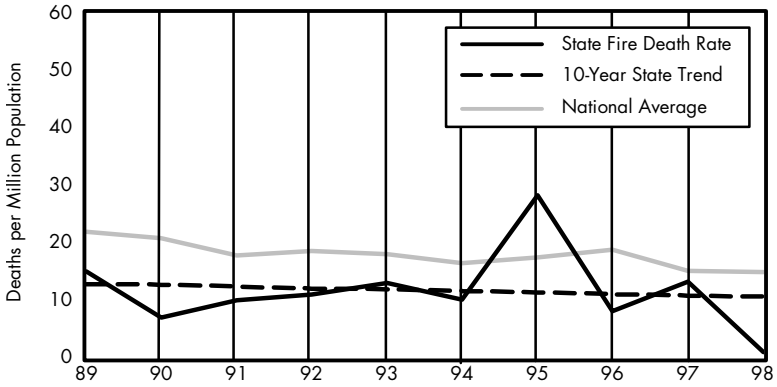
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 1st ; 1996 deaths: 3rd
1998 death rate: 12th; 1996 death rate: 19th

NFIRS PARTICIPATION (None)

RHODE ISLAND

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	15	15.0
1990	7	7.0
1991	10	10.0
1992	11	11.0
1993	13	13.0
1994	10	10.1
1995	28	28.2
1996	8	8.1
1997	13	13.2
1998	1	1.0
10-Year Trend	**-19.5%**	**-18.2%**

Sources: Rhode Island State Fire Marshal Office and the Bureau of the Census

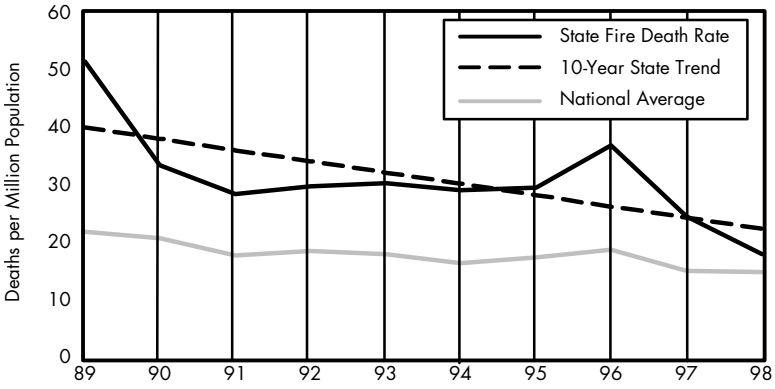
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 51st; 1996 deaths: 48th
1998 death rate: 51st; 1996 death rate: 45th

NFIRS PARTICIPATION (None)

SOUTH CAROLINA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	178	51.5
1990	117	33.4
1991	101	28.4
1992	107	29.8
1993	110	30.3
1994	106	29.1
1995	108	29.5
1996	137	36.9
1997	93	24.5
1998	69	18.0
10-Year Trend	**-38.0%**	**-44.2%**

Sources: South Carolina State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

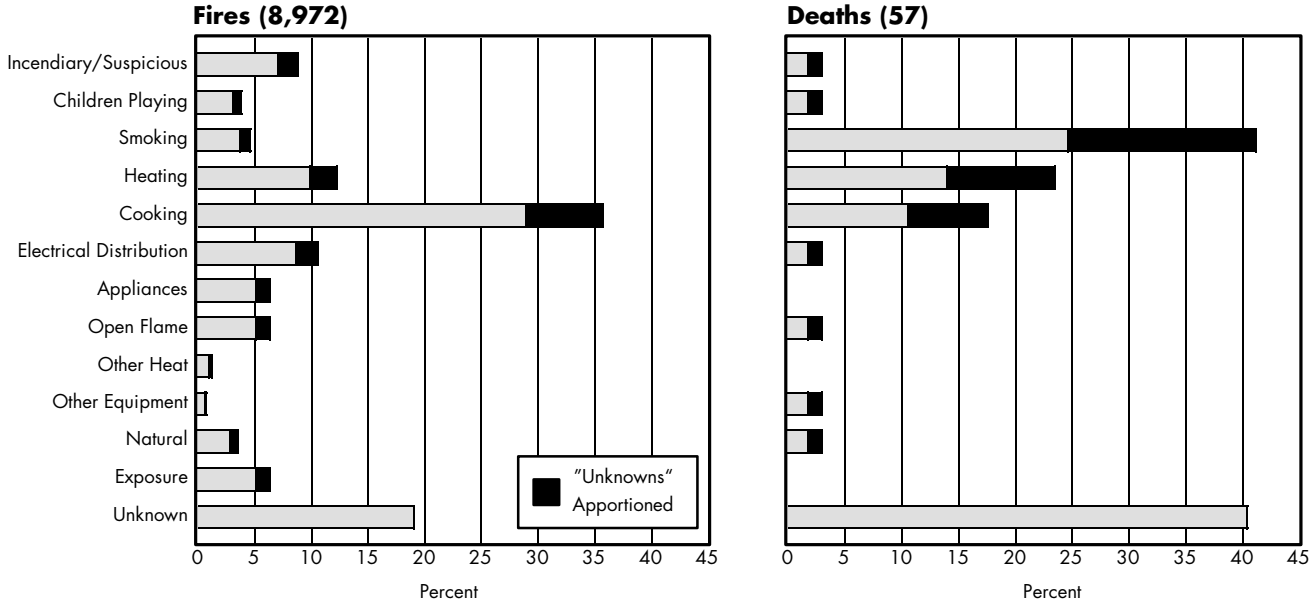
1998 deaths: 20th; 1996 deaths: 13th
1998 death rate: 17th; 1996 death rate: 4th

Note: See page 239 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 640
No. Fire Departments Reporting to NFIRS: 141
Percent of Fire Departments Reporting to NFIRS: 22%
No. Fires Reported to NFIRS in 1998: 2,703
Deaths/1,000 Fires in 1998: 3.7

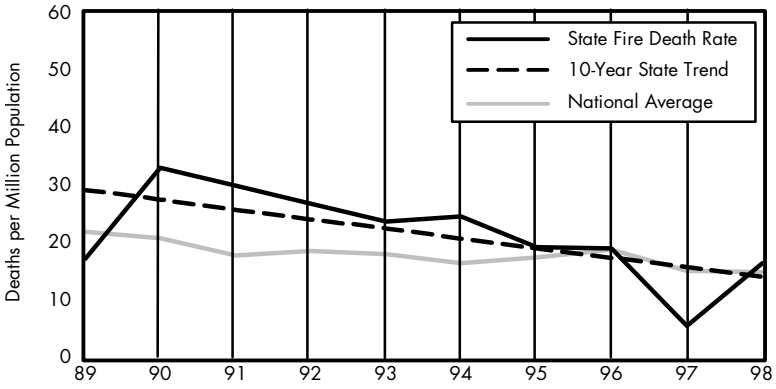
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

SOUTH DAKOTA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	12	17.2
1990	23	33.0
1991	21	29.9
1992	19	26.8
1993	17	23.7
1994	18	24.6
1995	14	19.2
1996	14	19.0
1997	4	5.5
1998	12	16.4
10-Year Trend	**-48.8%**	**-51.9%**

Sources: South Dakota State Fire Marshal Office and the Bureau of the Census

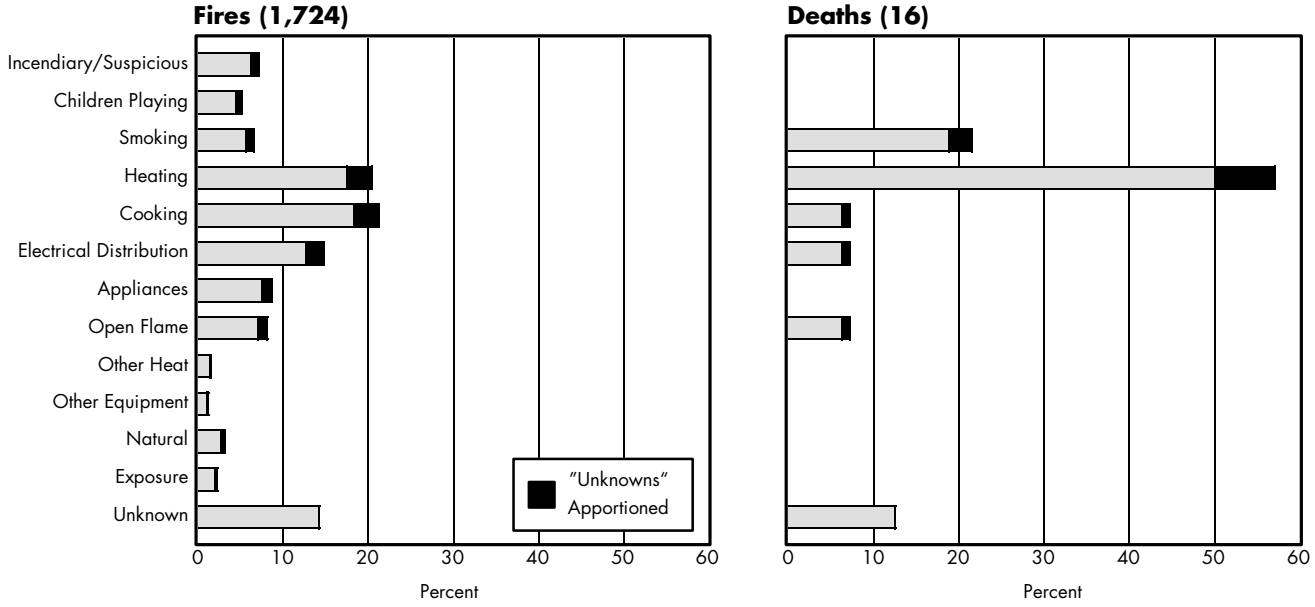
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 46th; 1996 deaths: 44th
1998 death rate: 21st; 1996 death rate: 18th

NFIRS PARTICIPATION

No. Fire Departments in State: 359
No. Fire Departments Reporting to NFIRS: 230
Percent of Fire Departments Reporting to NFIRS: 64%
No. Fires Reported to NFIRS in 1998: 500
Deaths/1,000 Fires in 1998: 14.0

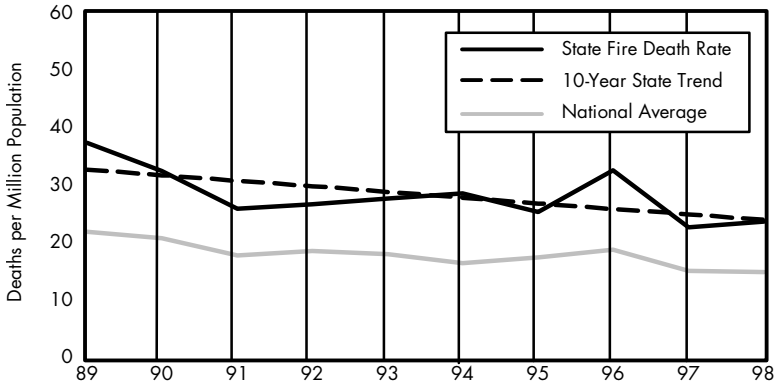
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

TENNESSEE

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	181	37.3
1990	159	32.5
1991	128	25.9
1992	134	26.7
1993	141	27.7
1994	148	28.6
1995	133	25.3
1996	173	32.6
1997	122	22.7
1998	128	23.6
10-Year Trend	**-17.4%**	**-27.0%**

Sources: Tennessee State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

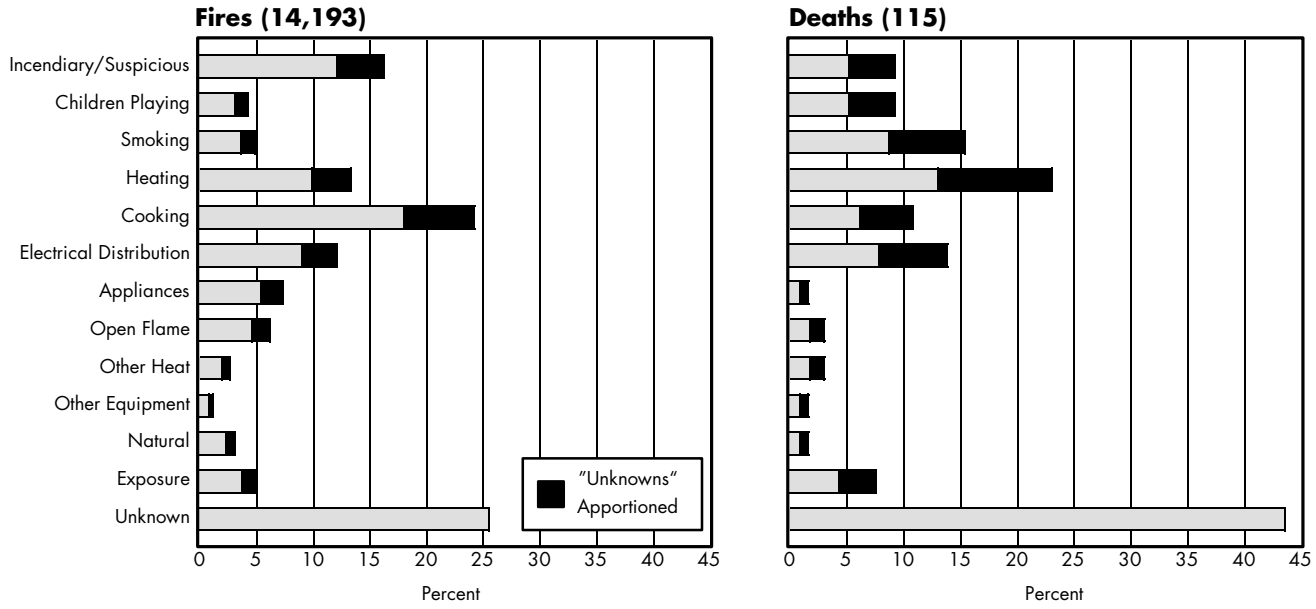
1998 deaths: 12th; 1996 deaths: 9th
1998 death rate: 8th; 1996 death rate: 5th

Note: See page 239 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 662
No. Fire Departments Reporting to NFIRS: 196
Percent of Fire Departments Reporting to NFIRS: 30%
No. Fires Reported to NFIRS in 1998: 4,031
Deaths/1,000 Fires in 1998: 8.4

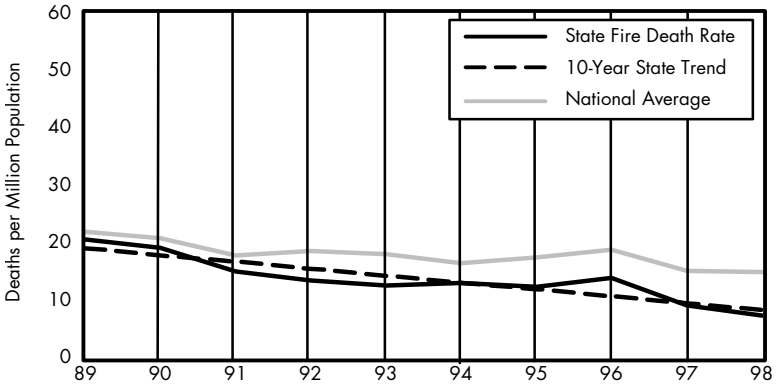
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

TEXAS

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	345	20.5
1990	326	19.1
1991	261	15.0
1992	237	13.4
1993	225	12.5
1994	239	13.0
1995	232	12.3
1996	266	13.9
1997	176	9.1
1998	143	7.3
10-Year Trend	**-48.1%**	**-56.8%**

Sources: Texas State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

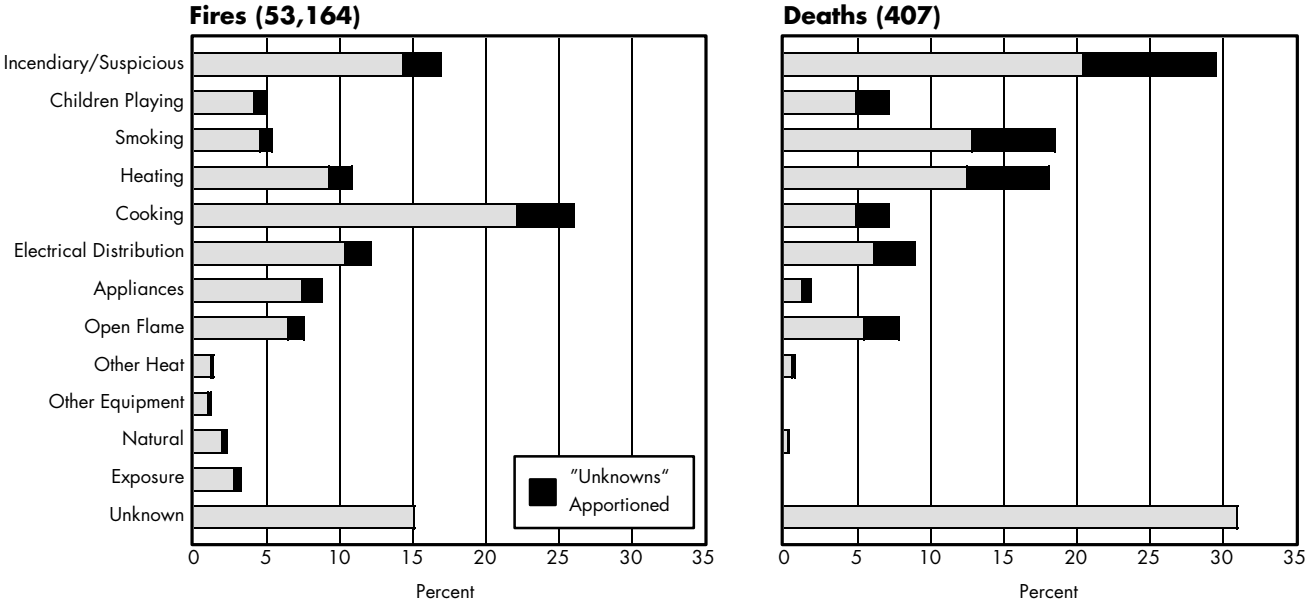
1998 deaths: 7th; 1996 deaths: 2nd
1998 death rate: 48th; 1996 death rate: 28th

Note: See page 239 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 2,300
No. Fire Departments Reporting to NFIRS: 509
Percent of Fire Departments Reporting to NFIRS: 22%
No. Fires Reported to NFIRS in 1998: 15,717
Deaths/1,000 Fires in 1998: 6.6

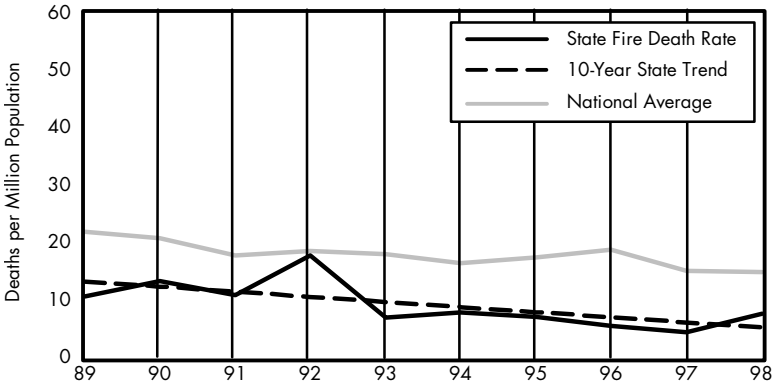
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

UTAH

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	18	10.6
1990	23	13.3
1991	19	10.8
1992	32	17.7
1993	13	7.0
1994	15	7.9
1995	14	7.1
1996	11	5.5
1997	9	4.4
1998	16	7.6
10-Year Trend	**-50.0%**	**-60.6%**

Sources: Utah State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

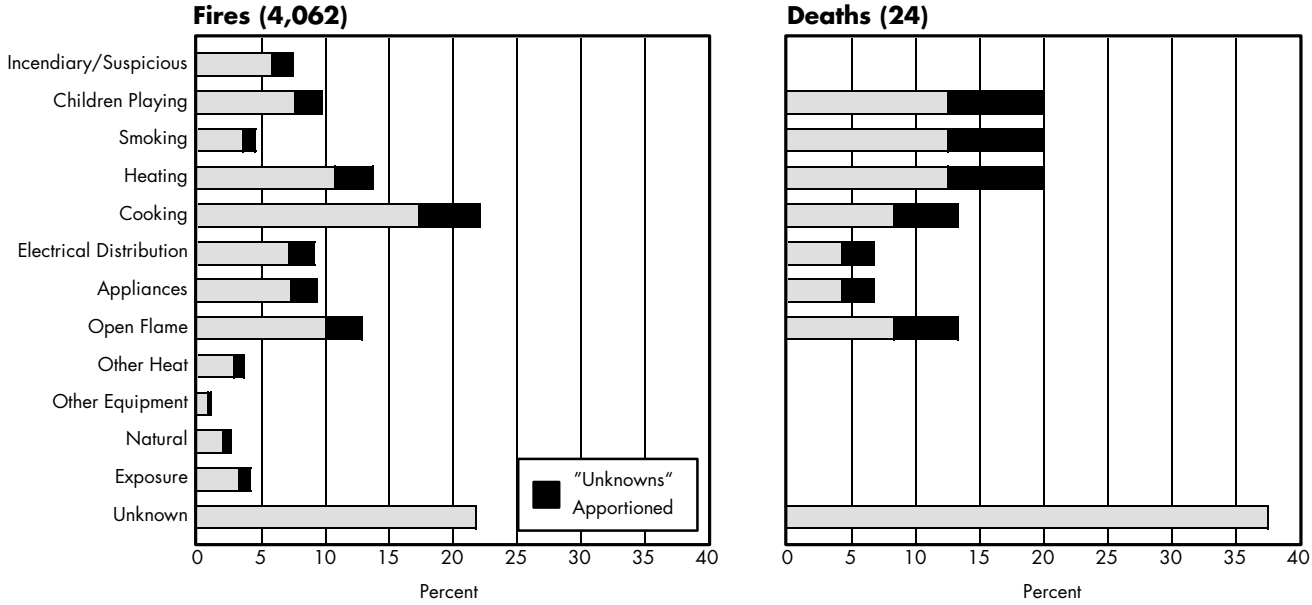
1998 deaths: 40th; 1996 deaths: 45th
1998 death rate: 47th; 1996 death rate: 50th

Note: See page 240 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 250
No. Fire Departments Reporting to NFIRS: 169
Percent of Fire Departments Reporting to NFIRS: 68%
No. Fires Reported to NFIRS in 1998: 1,295
Deaths/1,000 Fires in 1998: 5.4

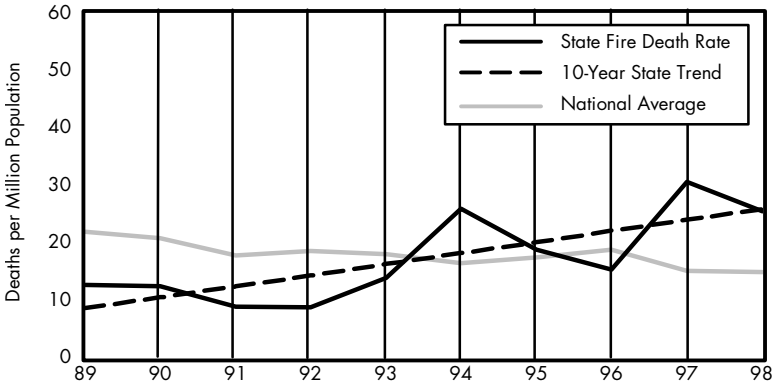
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

VERMONT

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	7	12.6
1990	7	12.4
1991	5	8.8
1992	5	8.7
1993	8	13.9
1994	15	25.9
1995	11	18.8
1996	9	15.3
1997	18	30.6
1998	15	25.4
10-Year Trend	**+224.7%**	**+202.3%**

Sources: Vermont Fire Prevention Division (Inspection), Department of Labor and Industry; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

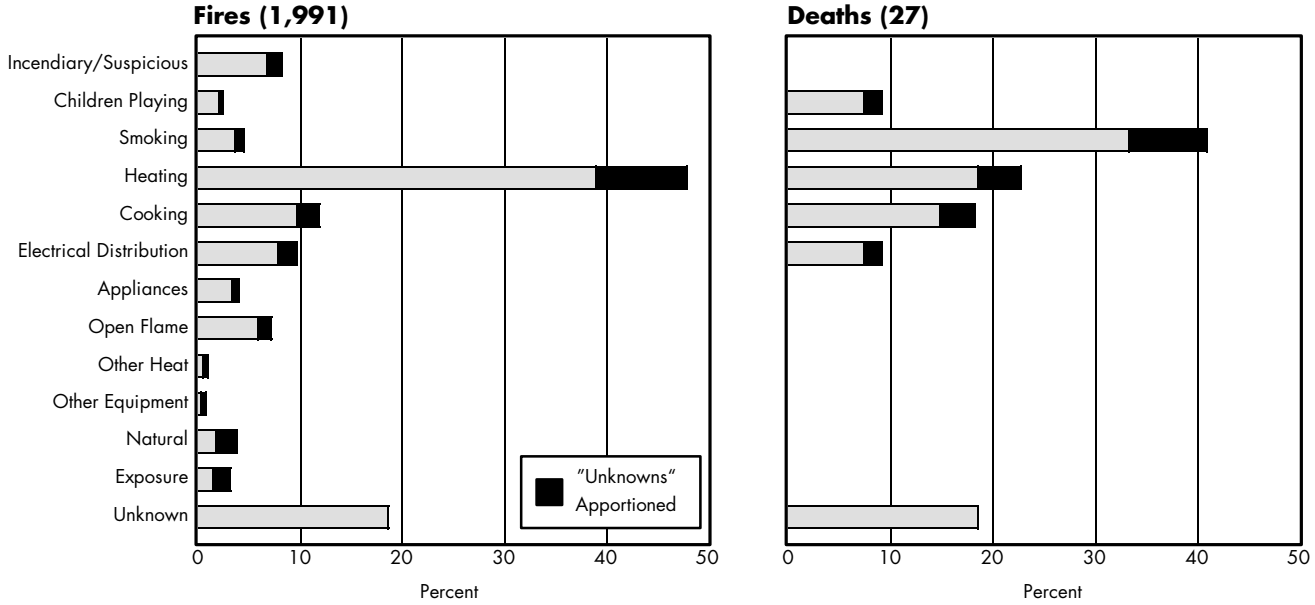
1998 deaths: 41st; 1996 deaths: 47th
1998 death rate: 5th; 1996 death rate: 27th

Note: See page 240 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 243
No. Fire Departments Reporting to NFIRS: 136
Percent of Fire Departments Reporting to NFIRS: 56%
No. Fires Reported to NFIRS in 1998: 663
Deaths/1,000 Fires in 1998: 13.6

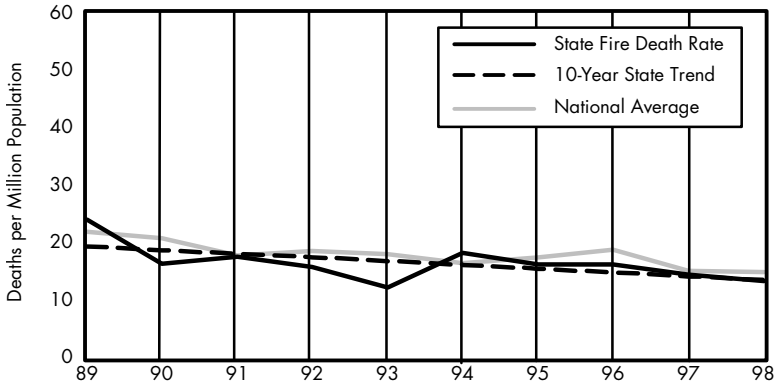
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

VIRGINIA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	147	24.0
1990	101	16.3
1991	110	17.5
1992	100	15.7
1993	79	12.2
1994	119	18.2
1995	107	16.2
1996	108	16.2
1997	97	14.4
1998	90	13.3
10-Year Trend	**-22.4%**	**-30.7%**

Sources: Virginia State Fire Marshal Office and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

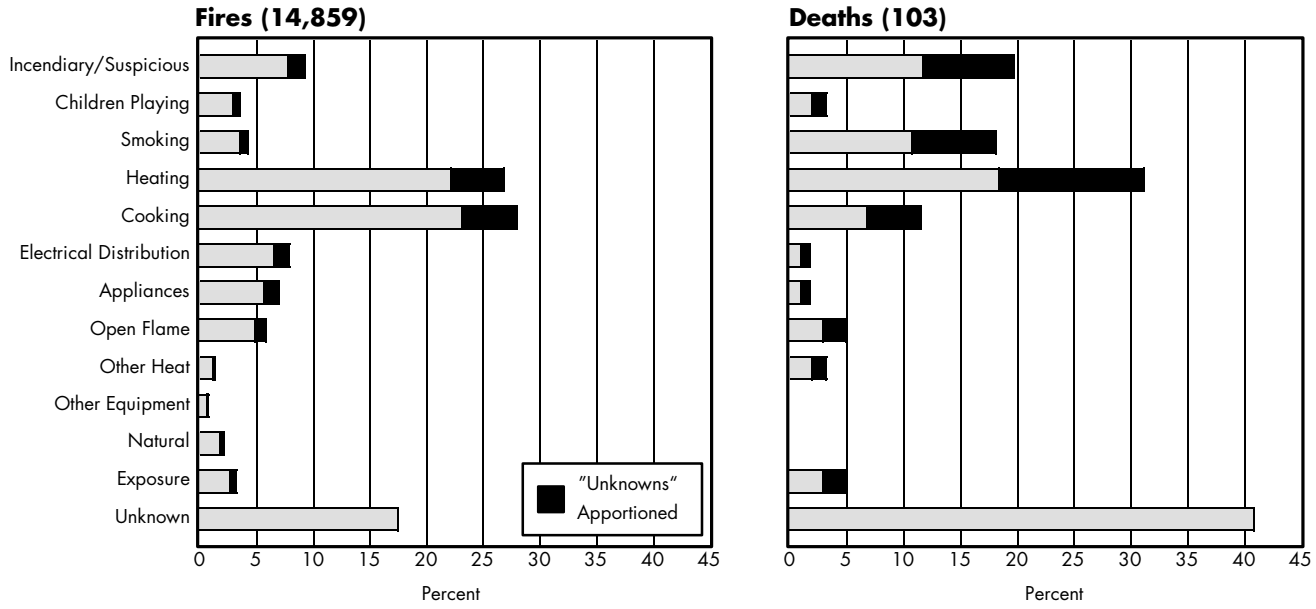
1998 deaths: 15th; 1996 deaths: 15th
1998 death rate: 29th; 1996 death rate: 24th

Note: See page 240 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 596
No. Fire Departments Reporting to NFIRS: 263
Percent of Fire Departments Reporting to NFIRS: 44%
No. Fires Reported to NFIRS in 1998: 4,396
Deaths/1,000 Fires in 1998: 6.4

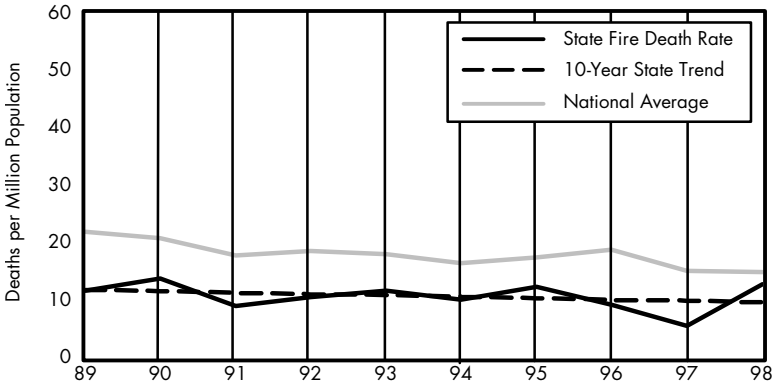
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

WASHINGTON

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	55	11.6
1990	67	13.7
1991	45	9.0
1992	54	10.5
1993	61	11.6
1994	54	10.1
1995	67	12.3
1996	51	9.2
1997	31	5.5
1998	73	12.8
10-Year Trend	**-2.7%**	**-18.8%**

Sources: Washington State Fire Marshal Office; Washington Vital Records; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

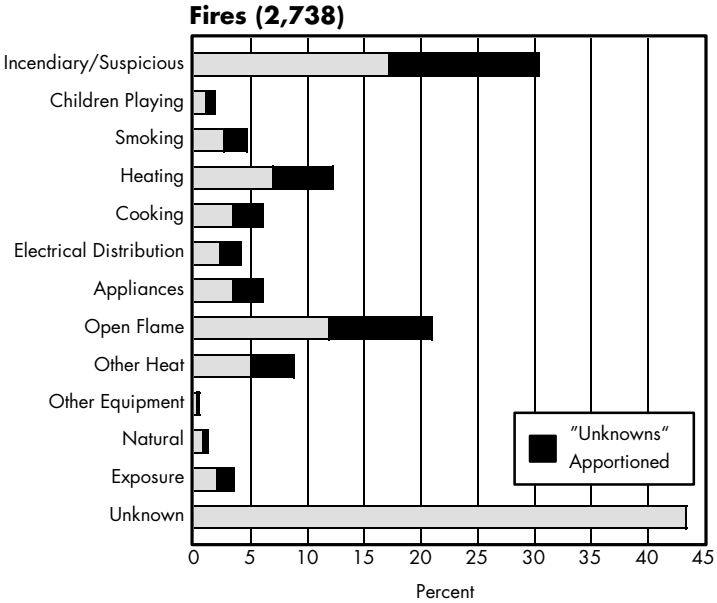
1998 deaths: 19th; 1996 deaths: 26th
1998 death rate: 30th; 1996 death rate: 43rd

Note: See page 240 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 650
No. Fire Departments Reporting to NFIRS: 58
Percent of Fire Departments Reporting to NFIRS: 10%
No. Fires Reported to NFIRS in 1998: 1,031
Deaths/1,000 Fires in 1998: 1.0

CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)

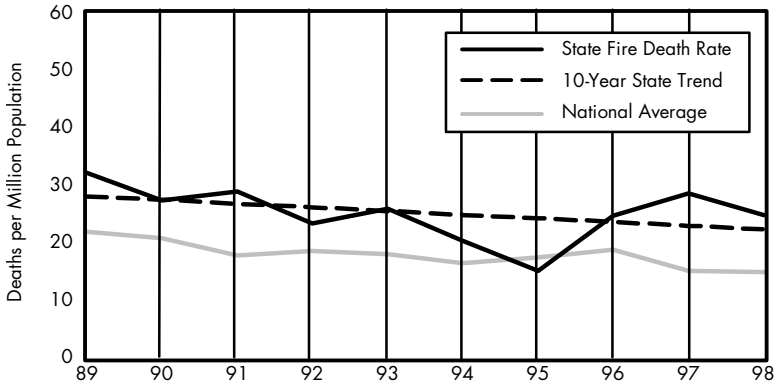


The cause of the one reported death is unknown.

Source: NFIRS

WEST VIRGINIA

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	58	32.1
1990	49	27.3
1991	52	28.9
1992	42	23.2
1993	47	25.8
1994	37	20.3
1995	28	15.3
1996	45	24.7
1997	52	28.6
1998	45	24.8
10-Year Trend	**-19.8%**	**-20.7%**

Sources: West Virginia State Fire Marshal Office and the Bureau of the Census

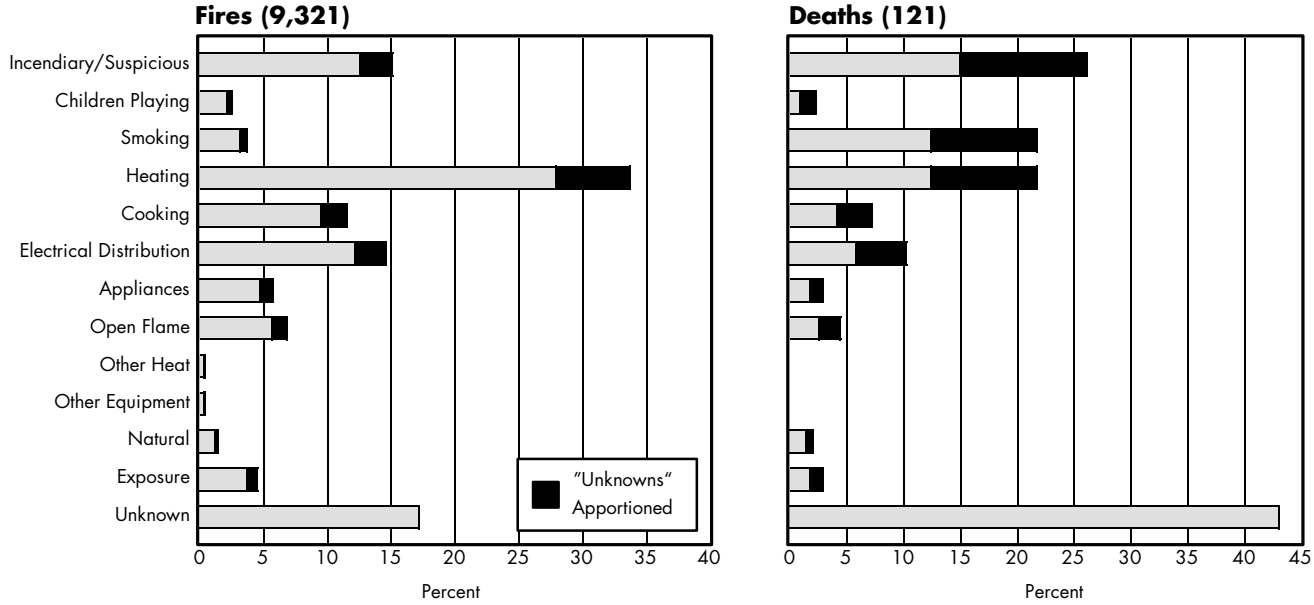
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 30th; 1996 deaths: 29th (tied)
1998 death rate: 7th; 1996 death rate: 13th

NFIRS PARTICIPATION

No. Fire Departments in State: 446
No. Fire Departments Reporting to NFIRS: 433
Percent of Fire Departments Reporting to NFIRS: 97%
No. Fires Reported to NFIRS in 1998: 2,807
Deaths/1,000 Fires in 1998: 14.6

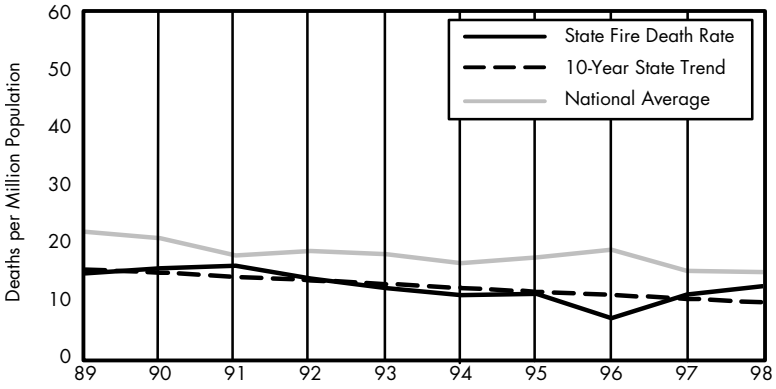
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

WISCONSIN

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	71	14.6
1990	76	15.5
1991	79	16.0
1992	69	13.8
1993	61	12.1
1994	55	10.8
1995	57	11.1
1996	35	6.8
1997	57	11.0
1998	65	12.4
10-Year Trend	**-32.8%**	**-37.9%**

Sources: Wisconsin State Fire Marshal Office; Wisconsin Vital Records; and the Bureau of the Census

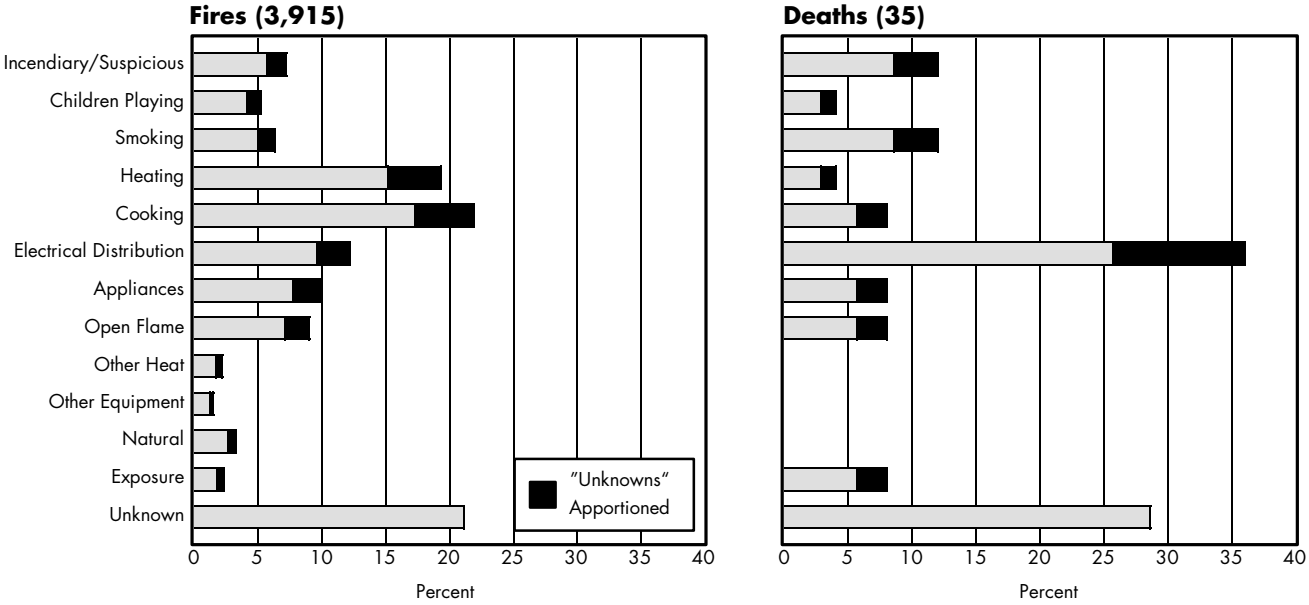
Rank Order (1st = highest; 51st = lowest)

1998 deaths: 21st (tied); 1996 deaths: 33rd
1998 death rate: 31st; 1996 death rate: 47th

NFIRS PARTICIPATION

No. Fire Departments in State: 880
No. Fire Departments Reporting to NFIRS: 176
Percent of Fire Departments Reporting to NFIRS: 20%
No. Fires Reported to NFIRS in 1998: 1,083
Deaths/1,000 Fires in 1998: 12.0

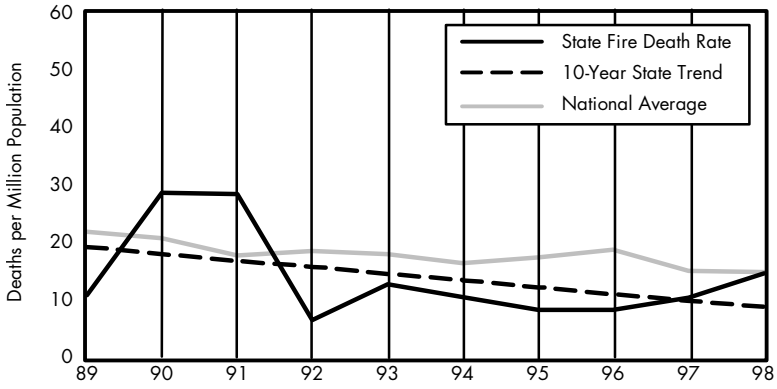
CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

WYOMING

FIRE DEATHS AND DEATH RATE



Year	Fire Deaths	Deaths/ Million
1989	5	10.9
1990	13	28.7
1991	13	28.4
1992	3	6.5
1993	6	12.8
1994	5	10.5
1995	4	8.3
1996	4	8.3
1997	5	10.4
1998	7	14.6
10-Year Trend	**-50.7%**	**-54.5%**

Sources: Wyoming State Fire Marshal Office; Wyoming Vital Records; and the Bureau of the Census

Rank Order (1st = highest; 51st = lowest)

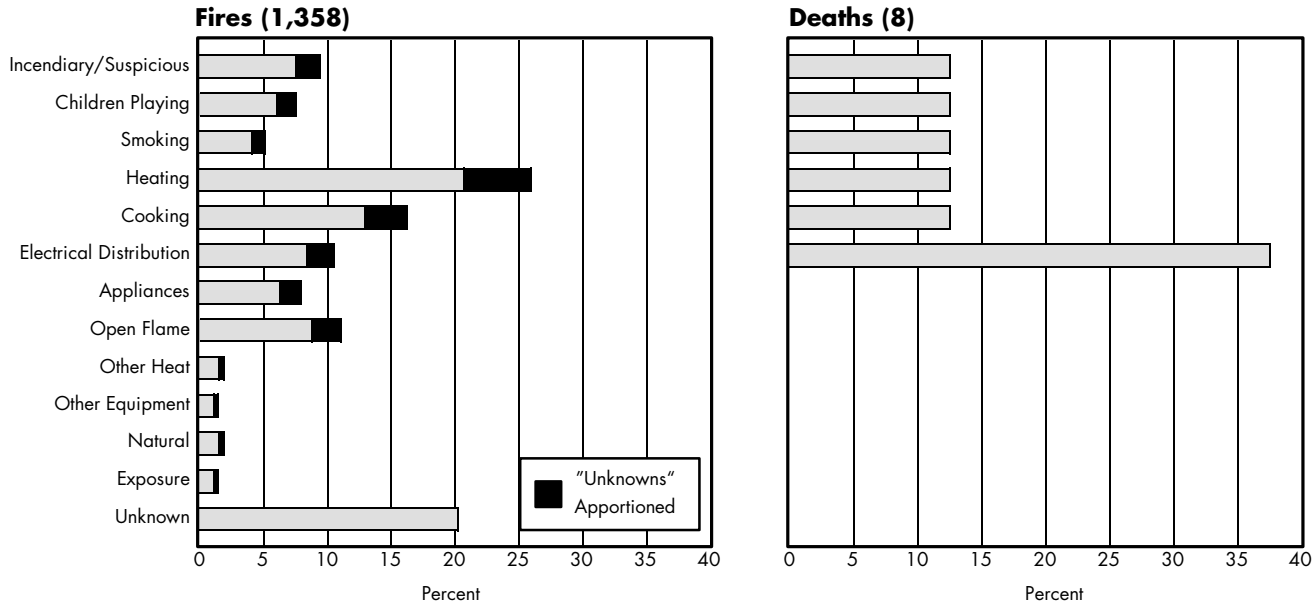
1998 deaths: 50th; 1996 deaths: 50th (tied)
1998 death rate: 26th; 1996 death rate: 44th

Note: See page 240 for current state initiatives.

NFIRS PARTICIPATION

No. Fire Departments in State: 165
No. Fire Departments Reporting to NFIRS: 92
Percent of Fire Departments Reporting to NFIRS: 56%
No. Fires Reported to NFIRS in 1998: 411
Deaths/1,000 Fires in 1998: 4.9

CAUSES OF RESIDENTIAL FIRES AND DEATHS (3-YEAR TOTALS)



Source: NFIRS

STATE-LEVEL INITIATIVES AND PROGRAMS

The following are fire prevention/awareness initiatives from State Fire Marshal (FM) Offices or their equilavents. A wide variety of other programs are provided by local governments.

ALABAMA

In conjunction with the University of Alabama at Birmingham Injury Control Research Center, the Alabama State Fire Marshal's Office is involved in an effort to obtain and install free smoke alarms in every residence in the state by October 9, 2002.

ALASKA

The FM's Office coordinates several programs. The FireStoppers Program is designed to supply parents and various social service professionals with the tools and education required to positively intervene and mitigate the actions of juvenile firesetters. Along with participating agencies throughout the state, the FM's Office has embarked on a 5-year plan to expand the Learn Not To Burn Program to include all preschools, Headstart programs, and elementary classrooms (K–3). Also, the Sprinklers, Smoke Detectors, and Defensible Spaces Project provides the structure for statewide emergency service communications. It tracks the installation of sprinklers and smoke detectors as well as the establishment of spaces defensible from wildland fires on a geographic basis.

CALIFORNIA

The Fire Safe In and Out program focuses on mitigating the wildfire risk in the urban/wildland interfaces throughout the state. Steps in the program include establishing a defensible area around one's home and ensuring accessibility to an emergency water supply.

COLORADO

The Colorado Division of Fire Safety, Department of Public Safety, coordinates several federally funded programs, which focus on Juvenile Firesetting Prevention and Hazardous Material First Responder Training. In addition, the office administers a program for Fire Safety in Limited Gaming Establishments.

CONNECTICUT

The Public Fire and Life Safety Educators Coalition serves as a clearinghouse of information resources and a forum for discussion of methods on prevention and control for public educators throughout the state.

DELAWARE

The FM enforces the state's mandatory smoke alarm installation statute, which requires all residential occupancies have smoke alarms installed.

GEORGIA

The FM's Office operates a simulated fire safety house for children. The mobile unit has a living room, kitchen, and a bedroom. Simulated smoke is used to imitate a fire situation. Through the program, children are taught fire safety and how to make emergency telephone calls.

INDIANA

The Juvenile Firesetter Task Force is comprised of professionals from a variety of specialties. Among their programs are the Hoosier Burn Camp and the Juvenile Firesetter Resource Directory.

KANSAS

The Juvenile Firesetter Intervention Project is the combined effort of the FM's Office, law enforcement, and local fire departments. Its goal is to identify, alert, mobilize, and integrate the forces necessary to prevent juvenile firesetting.

LOUISIANA

The FM's Office coordinates a smoke alarm distribution program aimed at communities with higher than average fire death rates. Another program, Risk Watch, is a general injury prevention program that includes a fire/burn safety component.

MARYLAND

The Baltimore Urban Residential Smoke Detector (BURNS) Project seeks to reduce the fire and burn-related injuries and deaths in the City of Baltimore by facilitating the installation of smoke alarms into homes that need them. This program is actually administered by the State Office of Injury and Disability Prevention, through the Community and Public Health Administration.

MASSACHUSETTS

The Student Awareness of Fire Education (SAFE) program is a state initiative to provide resources to local fire departments to conduct fire and life safety educational programs for students in grades K–12. The program enables students to recognize the dangers of fire, specifically the hazards posed by tobacco products.

MICHIGAN

The Fire TIES publication is a collaborative effort between the FM's Office and the Michigan Firefighters Training Council. This document provides a direct avenue of communication to fire service and law enforcement agencies in the areas of firefighter training and certification, fire investigation, public education and arson awareness, and fire incident statistics and analysis. The FM's Office continues to coordinate the Residential Sprinkler Trailer Program. The sprinkler trailer is used to demonstrate the effectiveness of residential sprinkler systems

MINNESOTA

The Minnesota Juvenile Firesetter Intervention Project consists of a definitive sequence of intervention techniques to deal with juvenile firesetters. A Juvenile Firesetter Interventionist, based in the FM's Office, coordinates the project.

MISSOURI

Along with the State Department of Health, the Division of Fire Safety has implemented the Learn Not To Burn program aimed toward preschool and elementary-age children.

NEBRASKA

The FM's Office operates a simulator trailer that is used statewide, primarily with elementary aged children. Half of the program involves a simulation of an actual fire; the other half is spent in the classroom reviewing fire safety.

NEW HAMPSHIRE

The Division of Fire Safety is a charter member of the New Hampshire SAFE Kids Campaign, which is dedicated to reducing unintentional injuries to children. The Division is also in the process of establishing a statewide, multidisciplinary juvenile firesetting program.

NEW JERSEY

The Division of Fire Safety, Bureau of Fire Department Services coordinates a technical assistance program to increase public awareness of fire safety by developing educational fire safety materials such as brochures, flyers, posters, and booklets for distribution to schools, fire departments, and the general public. Also, the Public Education program develops specific fire safety programs for schools, preschools, and senior citizens; publishes a newsletter for members of the fire service and other individuals and organizations interested in fire safety; and helps coordinate an annual fire safety poster contest for school children throughout the state.

NORTH CAROLINA

In conjunction with the Seniors' Health Insurance Information Program (SHIIP), the FM's Office coordinate the Remembering When Program, which is aimed at promoting fire safety among senior citizens. The office also coordinates the Learn Not To Burn program for school-age children.

OHIO

The Fire Prevention Bureau coordinates fire safety programs with emphasis on those targeted at children and the elderly. In addition, they develop and distribute fire safety brochures and posters throughout the state.

OKLAHOMA

The FM's Office participates in the Oklahoma SAFE KIDS Coalition, which uses the Risk Watch Curriculum. In 2000, Oklahoma was one of 12 states to receive a grant from the NFPA to expand the use of the Risk Watch Curriculum.

OREGON

The FM's office developed the *Oregon Fire Safety Skills Curriculum* for classroom teachers throughout the state; teachers spend at least 30 minutes each month discussing fire and earthquake safety. The office also maintains a resource library for public educators. The library includes more than 200 videos, books, curricula, and kits.

SOUTH CAROLINA

The "Get Alarmed, South Carolina" program educates citizens as to the importance of smoke alarms and provides alarms to those at high risk. Since the program's inception, more than 400,000 alarms have been distributed. The FM's Office is also a partner in a fire safety program for elementary students in kindergarten through the fifth grade; "Freddie," the program's mascot reaches nearly 140,000 students annually.

TENNESSEE

The FM's Office maintains a video library for local fire departments and stocks brochures and other printed materials for distribution.

TEXAS

The FM's Office operates a fire safety house (trailer)—a gift from the Texas Fire Chiefs' Foundation—that travels throughout the state. The office also developed Fire Safety for Texans, which is

a series of fire-and-burn prevention curriculum guides developed for school-age children from kindergarten through high school.

UTAH

A deputy fire marshal works with local fire departments to develop juvenile firesetter programs that identify juvenile firesetters.

VERMONT

The FM's Office coordinates a smoke alarm program for needy citizens.

VIRGINIA

The FM's Office coordinates the "Get Alarmed, Virginia" program, which distributes smoke alarms to citizens throughout the state.

WASHINGTON

The FM's Office coordinates the Risk Watch injury prevention program used by fire departments throughout the state.

WYOMING

The FM's Office coordinates Operation Fire Safe, which is a joint effort with the Tandy Corporation to provide smoke alarms to needy citizens. The office also operates a fire safety house for school children.

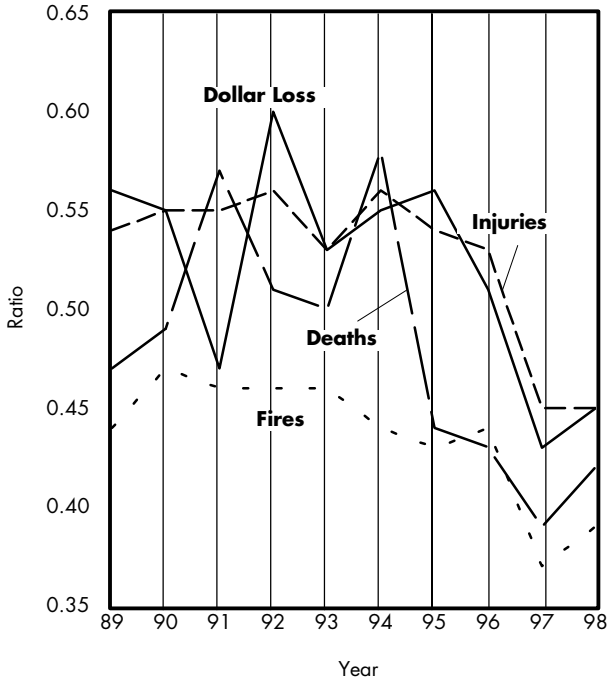
WEB SITES OF STATE FIRE MARSHAL OFFICES OR EQUIVALENTS

Alaska	http://www.dps.state.ak.us/fire/asp
Arkansas	http://www.asp.state.ar.us/fm/fm.html
California	http://www.fire.ca.gov/FireMarshal/FireMarshal.asp
Colorado	http://www.state.co.us/gov_dir/cdps/dfs.htm
Connecticut	http://www.state.ct.us/dps/dfebs/OSFM.htm
Delaware	http://www.state.de.us/sfmo/
District of Columbia	http://fems.washingtondc.gov/index.html
Florida	http://www.doi.state.fl.us/SFM/sfm.htm
Georgia	http://www.inscomm.state.ga.us/
Idaho	http://www.doi.state.id.us/firemars/firemars.htm
Illinois	http://www.state.il.us/osfm/
Indiana	http://www.state.in.us/sema/osfm.html
Iowa	http://www.state.ia.us/government/dps/fm/index.htm
Kansas	http://www.ink.org/public/ksfm
Kentucky	http://www.state.ky.us/agencies/housing/divfire.htm
Louisiana	http://www.dps.state.la.us/sfm/sfm0.htm
Maine	http://www.state.me.us/dps/fmo/
Maryland	http://www.dpscs.state.md.us/fmo
Massachusetts	http://www.magnet.state.ma.us/dfs/sfmo/sfmohome.htm
Michigan	http://www.mspfmd.org/
Minnesota	http://www.dps.state.mn.us/fmarshal/fmarshal.html
Mississippi	http://www.doi.state.ms.us/marsha.html
Missouri	http://www.mdfs.state.mo.us
Montana	http://www.doj.state.mt.us/les/fpib.htm
Nebraska	http://vmhost.cdp.state.ne.us:97/~sfmweb/sfmhome.html
Nevada	http://ps.state.nv.us/firemar.htm
New Hampshire	http://webster.state.nh.us/safety/
New Jersey	http://www.state.nj.us/dca/dfs
New York	http://www.dos.state.ny.us/fire/firewww.html
North Carolina	http://www.ncdoi.com/OSFM/default.asp
North Dakota	http://expedition.bismarck.ag.state.nd.us/ndag/firemarshal/FM.html
Ohio	http://www.com.state.oh.us/sfm
Oklahoma	http://www.oklaosf.state.ok.us/~firemar/
Oregon	http://www.sfm.state.or.us/
Pennsylvania	http://sites.state.pa.us/PA_Exec/OFSC/
Rhode Island	http://www.state.ri.us/manual/data/queries/stdept_.idc?id=5
South Carolina	http://www.llr.state.sc.us/fmarshal
South Dakota	http://www.state.sd.us/dcr/fire/FIRE_hom.htm
Tennessee	http://www.state.tn.us/commerce/fpdiv.html
Texas	http://www.tdi.state.tx.us/fire/indexfm.html
Utah	http://www.fm.state.ut.us
Vermont	http://www.state.vt.us/labind/fpindex.htm
Virginia	http://www.vdfp.state.va.us/
Washington	http://www.wa.gov/wsp/fire/firemars.htm
West Virginia	http://www.wvfiremarshal.org
Wisconsin	http://www.doj.state.wi.us/
Wyoming	http://wyofire.state.wy.us/

A Differences Between NFPA and NFIRS Estimates

The National Fire Incident Reporting System collects data from an average of 13,000 fire departments each year. The National Fire Protection Association's annual survey of fire departments[1] collects data from more than 3,000 fire departments. Neither is a perfect random sample; not all fire departments asked to participate do so. The distribution of fire departments is not the same in the two samples. And the NFPA survey collects tallied totals whereas NFIRS collects individual incident reports. Not surprisingly, therefore, there are differences between the NFPA annual survey results and the NFIRS results. In 9 of the 10 years examined (1989–98), the deaths reported to NFIRS represent a larger fraction of the NFPA national estimate of deaths than the NFIRS number of fires is of the NFPA estimate of fires. NFIRS injuries and dollar loss are even larger fractions of the NFPA totals than are deaths or fires (Figure A-1).

Looking at the problem another way, Figure A-2 shows the number of deaths per fire, injuries per fire, and dollar loss per fire from NFIRS and NFPA from 1989 to 1998. Deaths per fire are similar



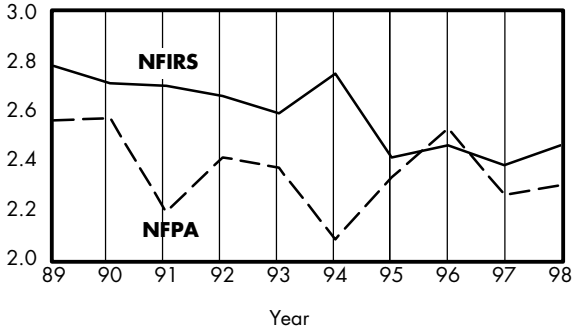
	Fires	Deaths	Injuries	Dollar Loss
1989	0.44	0.47	0.54	0.56
1990	0.47	0.49	0.55	0.55
1991	0.46	0.57	0.55	0.47
1992	0.46	0.51	0.56	0.60
1993	0.46	0.50	0.53	0.53
1994	0.44	0.58	0.56	0.55
1995	0.43	0.44	0.54	0.56
1996	0.44	0.43	0.53	0.51
1997	0.37	0.39	0.45	0.43
1998	0.39	0.42	0.45	0.45

Sources: NFPA and NFIRS

FIGURE A-1. RATIO OF RAW NFIRS SAMPLE TO NFPA NATIONAL ESTIMATES

[1] "Fire Loss in the United States," *NFPA Journal,* September/October issue each year.

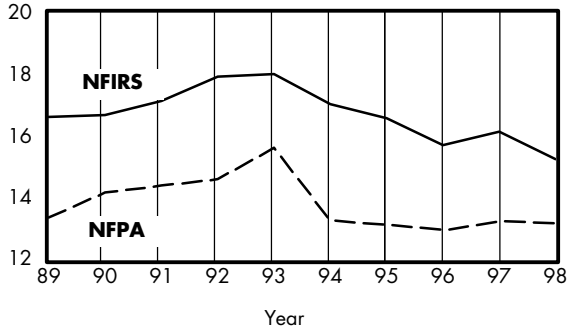
DEATHS (per 1,000 fires)



	NFIRS	NFPA
1989	2.78	2.56
1990	2.71	2.57
1991	2.70	2.19
1992	2.66	2.41
1993	2.59	2.37
1994	2.75	2.08
1995	2.41	2.33
1996	2.46	2.53
1997	2.38	2.26
1998	2.46	2.30

10-Year NFIRS Trend = -13.5%
10-Year NFPA Trend = -7.5%

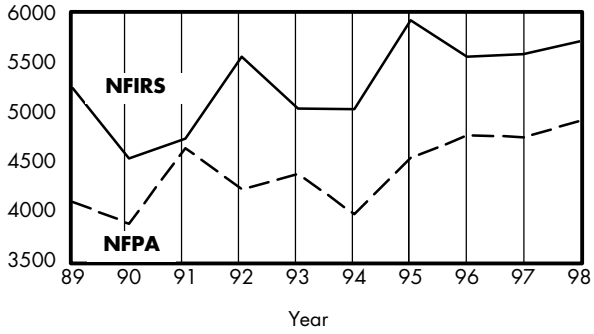
INJURIES (per 1,000 fires)



	NFIRS	NFPA
1989	16.62	13.36
1990	16.68	14.17
1991	17.12	14.39
1992	17.92	14.61
1993	18.01	15.61
1994	17.02	13.26
1995	16.57	13.11
1996	15.69	12.94
1997	16.14	13.23
1998	15.25	13.16

10-Year NFIRS Trend = -8.9%
10-Year NFPA Trend = -8.5%

DOLLAR LOSS (per fire)



	NFIRS	NFPA
1989	5,247	4,092
1990	4,532	3,872
1991	4,734	4,637
1992	5,560	4,222
1993	5,035	4,377
1994	5,031	3,967
1995	5,931	4,538
1996	5,564	4,763
1997	5,586	4,749
1998	5,720	4,915

10-Year NFIRS Trend = +19.1%
10-Year NFPA Trend = +20.0%

Sources: NFPA and NFIRS

FIGURE A-2. NFIRS VS. NFPA SURVEY: LOSSES PER FIRE

for NFIRS and NFPA, with an average difference of 10 percent and a maximum difference of 32 percent in 1994. Injuries and dollar loss per fire are lower in the NFPA sample than in the NFIRS sample by an average of 21 percent for injuries and 20 perecent for dollar loss.

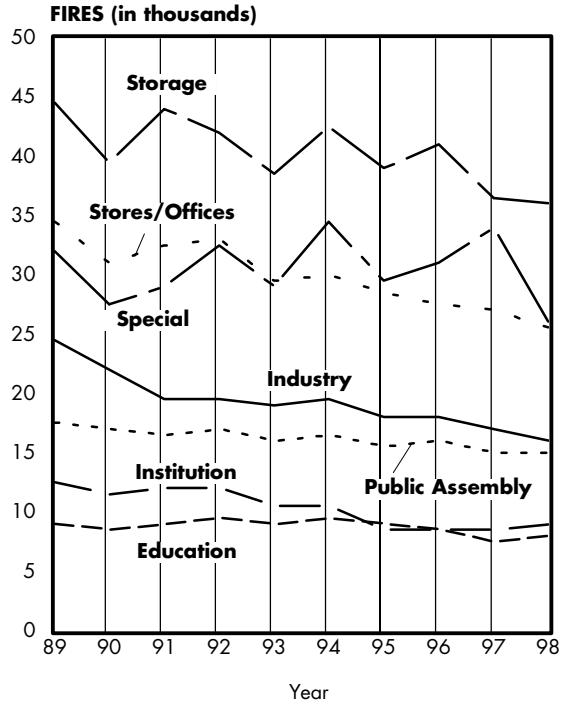
The reasons for these differences are not known. One possibility is that some departments that report summary data to NFPA may undercount their casualties and losses when reporting on the NFPA survey forms. Another possibility is that there are data entry errors in NFIRS, with larger numbers of deaths, injuries, and dollar loss creeping into the database despite edit checks at state and federal levels. (It appears that at least some of the dollar loss difference is due to this.)

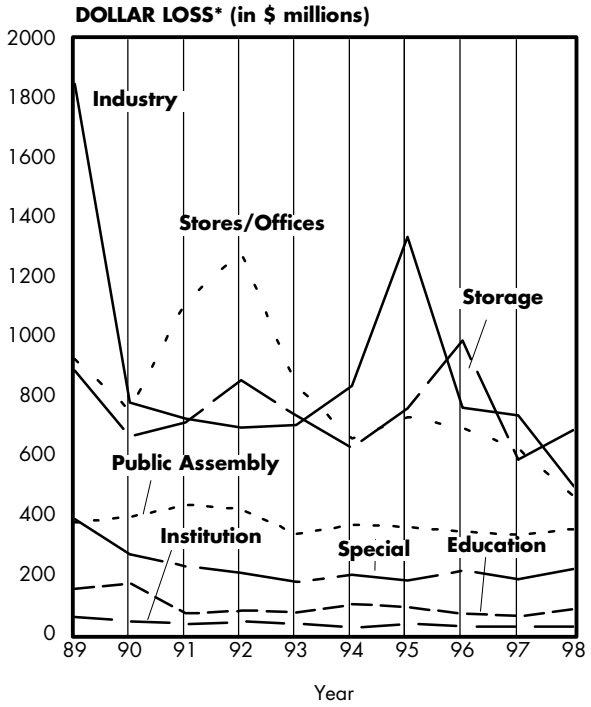
A third possibility for the differences is that fire departments might not report some minor fires to NFIRS that they include in their own totals that are reported to NFPA. We know that some departments do not fill out NFIRS forms for minor fires such as food on stove or chimney fires, but we are unsure whether these fires are or are not included in the department's report to NFPA nor the extent of the problem.

A fourth possibility is that some jurisdictions use NFIRS as a tracking system for fire casualty information without providing the related incident data. We know that this possibility does indeed occur from time to time in NFIRS. Again, we are unsure of how these deaths and their corresponding incidents are reported to NFPA.

Resolving the differences between the two major sources of fire statistics in the United States is important to prevent confusion among the users of the data. With the new NFIRS, more complete data on the population protected by participating departments is possible, and the NFIRS estimates will be able to be made independent of other sources. This should improve consistency.

Figure A-3 represents the NFPA survey trends for non-residential property fires and dollar loss.





Year	Public Assembly	Education	Institution	Stores/Offices	Industry	Storage	Special
Fires							
1989	17,500	9,000	12,500	34,500	24,500	44,500	32,000
1990	17,000	8,500	11,500	31,000	22,000	39,500	27,500
1991	16,500	9,000	12,000	32,500	19,500	44,000	29,000
1992	17,000	9,500	12,000	33,000	19,500	42,000	32,500
1993	16,000	9,000	10,500	29,500	19,000	38,500	29,000
1994	16,500	9,500	10,500	30,000	19,500	42,500	34,500
1995	15,500	9,000	8,500	28,500	18,000	39,000	29,500
1996	16,000	8,500	8,500	27,500	18,000	41,000	31,000
1997	15,000	7,500	8,500	27,000	17,000	36,500	34,000
1998	15,000	8,000	9,000	25,500	16,000	36,000	26,000
Dollar Loss* ($ millions)							
1989	$376	$152	$57	$ 924	$1,848	$885	$385
1990	395	170	41	752	777	666	267
1991	433	69	34	1,114	724	711	227
1992	419	79	41	1,284	694	853	206
1993	336	72	34	836	703	734	176
1994	367	100	22	658	834	625	199
1995	359	90	33	728	1,335	759	179
1996	343	68	25	691	761	986	213
1997	332	59	25	622	734	586	183
1998	354	84	23	462	496	687	220

* Adjusted to 1998 dollars.

Source: NFPA

FIGURE A-3. TRENDS IN NFPA NON-RESIDENTIAL STRUCTURE FIRES AND DOLLAR LOSS BY PROPERTY TYPE

B Data Supporting Causes of Fires and Losses

The four tables in this appendix provide the actual cause data used in developing the 10-year trend charts in Chapters 3 and 4 where there was no room to present the numbers.

TABLE B-1. CAUSES OF RESIDENTIAL FIRES AND FIRE LOSSES

Cause	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fires										
Incendiary/Suspicious	68,847	67,467	67,738	66,589	61,888	61,966	56,761	59,607	51,091	51,894
Children Playing	25,952	23,207	24,102	25,463	25,215	25,876	21,545	20,081	18,060	16,402
Smoking	35,533	31,707	30,559	28,814	27,931	26,498	26,056	25,714	23,494	23,121
Heating	116,939	88,339	89,163	87,728	88,695	77,439	73,352	66,228	63,292	50,998
Cooking	109,183	109,741	111,140	118,605	116,919	107,408	101,988	104,024	108,093	97,797
Electrical	44,197	43,662	45,091	43,084	45,089	44,552	44,117	43,586	43,453	40,459
Appliances	35,777	35,395	35,401	34,748	35,322	35,094	34,532	33,278	33,520	31,715
Open Flame	34,253	28,590	27,386	27,797	28,232	30,050	28,468	31,495	30,483	29,544
Other Heat	7,670	6,263	6,318	6,417	6,641	6,927	6,293	6,904	6,348	6,881
Other Equipment	5,547	5,584	5,885	6,564	6,020	7,017	4,983	8,820	4,627	6,245
Natural	10,413	8,820	9,985	8,951	10,164	10,197	9,359	9,485	8,835	9,557
Exposure	19,187	18,226	25,232	17,241	17,885	17,975	18,046	18,779	15,203	16,885
Total	513,500	467,000	478,000	472,000	470,000	451,000	425,500	428,000	406,500	381,500
Deaths										
Incendiary/Suspicious	809	770	663	698	756	505	737	662	675	592
Children Playing	474	353	450	398	423	426	333	288	294	224
Smoking	1,103	1,062	823	994	913	817	971	1,052	797	782
Heating	636	635	542	516	570	503	496	670	455	373
Cooking	382	382	299	280	371	314	283	399	313	422
Electrical	538	382	329	354	353	409	437	415	308	319
Appliances	129	122	121	99	112	147	167	164	113	128
Open Flame	186	218	169	245	168	179	187	218	269	244
Other Heat	88	93	80	80	35	62	29	66	78	41
Other Equipment	20	42	36	29	70	73	25	103	20	66
Natural	37	10	18	13	14	15	8	8	15	21
Exposure	34	48	44	61	38	15	21	37	54	37
Total	4,435	4,115	3,575	3,765	3,825	3,465	3,695	4,080	3,390	3,250
Injuries										
Incendiary/Suspicious	2,460	2,595	2,836	2,772	2,521	2,593	2,126	2,366	1,782	2,010
Children Playing	2,513	2,391	2,786	3,019	2,997	2,784	2,514	2,133	2,070	1,726
Smoking	3,095	3,000	2,793	2,767	2,907	2,436	2,388	2,523	2,755	1,984
Heating	2,627	2,211	2,287	2,278	2,595	2,003	1,970	1,858	1,456	1,514
Cooking	4,975	5,573	5,564	5,499	6,143	5,022	4,982	5,001	5,317	4,942
Electrical	1,444	1,477	1,836	1,730	1,854	1,546	1,680	1,544	1,477	1,297
Appliances	1,191	1,186	1,286	1,180	1,300	1,518	972	1,048	1,133	1,156
Open Flame	1,471	1,190	1,375	1,352	1,377	1,514	1,629	1,772	1,696	1,620
Other Heat	330	381	381	343	332	285	374	311	317	314
Other Equipment	265	245	304	277	245	359	170	413	166	288
Natural	193	189	212	153	154	148	116	116	160	153
Exposure	186	211	189	228	175	148	205	215	145	170
Total	20,750	20,650	21,850	21,600	22,600	20,025	19,125	19,300	17,775	17,175
Adjusted (1998) Dollar Loss ($ millions)*										
Incendiary/Suspicious	$1,135.2	$1,220.4	$1,468.1	$ 992.1	$1.005.0	$ 997.1	$ 980.4	$1,047.9	$ 892.5	$ 867.0
Children Playing	306.3	267.3	351.1	256.0	317.9	308.9	290.7	280.2	278.7	224.5
Smoking	356.4	371.7	444.8	255.0	325.5	298.3	312.6	294.8	312.4	281.4
Heating	920.5	795.3	993.1	680.4	722.4	694.8	711.4	792.6	648.6	531.0
Cooking	529.9	528.2	603.6	432.3	554.1	584.9	431.8	478.8	499.7	424.3
Electrical	696.3	720.9	894.1	595.3	807.7	674.0	739.8	734.3	752.9	711.4
Appliances	310.2	310.6	386.6	246.3	317.0	289.8	276.9	328.6	318.6	273.3
Open Flame	327.3	371.9	405.6	238.4	329.4	312.1	338.9	439.6	372.3	360.9
Other Heat	133.1	71.8	73.3	58.7	65.9	68.1	80.3	78.7	87.3	87.6
Other Equipment	82.9	113.5	106.7	162.7	113.7	128.2	77.7	181.1	83.8	145.5
Natural	147.3	153.5	235.8	144.9	202.8	186.4	210.1	174.8	168.4	213.6
Exposure	310.0	379.0	681.7	445.6	701.7	205.4	216.0	323.6	241.1	270.6
Total	$5,255.4	$5,304.0	$6,664.5	$4,507.8	$5,463.0	$4,748.1	$4,666.5	$5,154.9	$4,656.4	$4,391,0

Note: These data support Figure 35, Chapter 3. Columns may not add exactly to the totals due to rounding.

Sources: NFIRS and NFPA

TABLE B-2. CAUSES OF ONE- AND TWO-FAMILY DWELLING FIRES AND FIRE CASUALTIES

Cause	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fires										
Incendiary/Suspicious	47,660	47,762	46,686	46,977	43,838	43,811	39,721	42,841	36,517	37,373
Children Playing	19,276	17,004	17,567	18,722	18,519	18,981	16,228	15,554	13,726	12,461
Smoking	20,194	18,055	17,564	16,761	16,339	16,057	16,079	15,804	14,253	14,032
Heating	115,185	85,443	84,208	84,132	84,730	72,554	67,831	61,090	57,474	45,811
Cooking	69,445	70,160	69,447	73,887	72,053	66,283	62,723	64,037	64,820	58,510
Electrical	37,319	36,530	37,094	35,855	37,539	36,904	36,082	36,376	36,891	34,308
Appliances	28,929	28,592	28,216	27,746	28,284	27,824	27,212	26,959	26,924	25,484
Open Flame	28,315	23,257	21,834	22,562	23,264	24,332	23,054	25,383	24,357	23,063
Other Heat	6,251	5,070	5,102	5,122	5,419	5,484	4,888	5,591	4,850	5,310
Other Equipment	4,262	4,208	4,304	4,682	4,478	5,403	3,774	6,540	3,599	4,924
Natural	9,972	8,375	9,309	8,498	9,669	9,659	8,695	8,971	7,981	8,636
Exposure	15,693	14,543	21,670	13,055	13,868	13,708	13,713	14,855	11,106	13,088
Total	402,500	359,000	363,000	358,000	358,000	341,000	320,000	324,000	302,500	283,000
Deaths										
Incendiary/Suspicious	548	583	541	554	653	400	580	515	482	533
Children Playing	335	230	376	338	310	270	247	248	236	218
Smoking	703	814	592	745	653	608	711	797	533	573
Heating	661	631	524	485	514	444	434	673	461	373
Cooking	314	314	205	248	269	236	202	351	261	324
Electrical	557	306	311	338	318	383	429	371	261	315
Appliances	126	119	96	86	65	120	161	178	113	111
Open Flame	151	206	133	212	147	174	192	158	205	173
Other Heat	67	87	65	61	24	48	35	50	67	36
Other Equipment	17	36	24	29	53	68	25	84	15	62
Natural	46	12	17	16	16	17	5	10	15	18
Exposure	21	32	21	49	12	17	15	35	51	40
Total	3,545	3,370	2,905	3,160	3,035	2,785	3,035	3,470	2,700	2,775
Injuries										
Incendiary/Suspicious	1,477	1,529	1,643	1,375	1,498	1,441	1,326	1,360	942	1,174
Children Playing	1,969	1,772	1,864	2,229	2,009	1,976	1,792	1,571	1,416	1,346
Smoking	1,797	1,837	1,687	1,581	1,569	1,370	1,351	1,451	1,216	1,088
Heating	2,493	2,141	2,120	2,093	2,327	1,783	1,758	1,642	1,330	1,300
Cooking	3,535	3,928	3,819	3,693	4,083	3,340	3,364	3,307	3,380	2,995
Electrical	1,158	1,245	1,557	1,450	1,480	1,320	1,224	1,281	1,197	995
Appliances	945	1,012	950	960	1,055	874	707	844	885	912
Open Flame	1,039	941	1,085	1,057	1,055	1,146	1,216	1,410	1,298	1,235
Other Heat	275	275	286	287	235	231	291	246	242	227
Other Equipment	243	234	242	234	169	311	198	290	143	249
Natural	160	172	195	161	128	124	85	117	134	135
Exposure	133	166	153	156	92	83	139	179	118	144
Total	15,225	15,250	15,600	15,275	15,700	14,000	13,450	13,700	12,300	11,800

Note: These data support the Figure 47 chart. Columns may not add exactly to the totals due to rounding.

Sources: NFIRS and NFPA

TABLE B-3. CAUSES OF APARTMENT FIRES AND FIRE CASUALTIES

Cause	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fires										
Incendiary/Suspicious	16,494	15,913	16,943	16,014	14,571	14,693	13,736	13,750	12,162	11,948
Children Playing	6,066	5,786	6,134	6,263	6,230	6,400	5,105	4,362	4,108	3,641
Smoking	11,345	10,526	10,475	9,306	9,228	8,573	8,366	8,155	7,687	7,624
Heating	5,847	5,647	5,999	5,647	5,940	5,362	5,528	5,441	5,167	4,480
Cooking	34,798	36,070	38,750	41,060	41,376	38,306	37,553	37,426	40,324	36,372
Electrical	4,980	5,250	5,678	5,406	5,775	5,700	6,017	5,590	5,887	5,290
Appliances	5,125	5,391	5,715	5,587	5,581	5,681	5,895	5,316	5,515	5,107
Open Flame	5,241	4,828	4,863	4,794	4,643	5,274	4,945	5,495	5,481	5,487
Other Heat	1,276	1,133	1,153	1,225	1,198	1,347	1,279	1,338	1,293	1,339
Other Equipment	1,024	1,066	1,288	1,539	1,211	1,321	953	1,990	797	1,027
Natural	694	646	775	631	719	641	720	696	705	715
Exposure	3,109	3,243	3,725	3,528	3,526	3,701	3,905	3,441	3,874	3,468
Total	96,000	95,500	101,500	101,000	100,000	97,000	94,000	93,000	93,000	86,500
Deaths										
Incendiary/Suspicious	233	175	128	110	122	133	138	112	173	64
Children Playing	95	88	58	80	119	130	89	49	60	12
Smoking	300	217	193	187	235	193	241	214	242	175
Heating	31	41	31	30	29	40	31	23	4	15
Cooking	49	41	70	37	58	59	45	59	47	89
Electrical	33	41	19	24	42	40	28	26	47	9
Appliances	8	12	27	11	16	6	21	10	4	15
Open Flame	26	32	24	32	23	25	10	36	60	52
Other Heat	3	15	19	19	10	14	0	16	13	3
Other Equipment	3	0	10	4	6	0	0	13	4	6
Natural	0	0	0	0	0	0	0	0	0	3
Exposure	10	17	15	11	26	0	3	7	4	0
Total	790	680	595	545	685	640	605	565	658	443
Injuries										
Incendiary/Suspicious	835	791	960	1,080	892	952	819	808	680	741
Children Playing	573	628	835	823	941	704	702	565	634	416
Smoking	1,011	929	916	1,017	1,128	872	811	931	680	788
Heating	289	212	242	255	266	223	190	188	149	222
Cooking	1,384	1,557	1,638	1,685	1,965	1,616	1,504	1,635	1,830	1,902
Electrical	242	226	302	267	357	277	314	247	284	280
Appliances	186	201	270	200	224	255	205	190	222	158
Open Flame	343	232	309	291	293	385	403	403	376	333
Other Heat	60	93	89	74	91	52	92	70	75	81
Other Equipment	45	29	61	51	58	56	51	85	18	28
Natural	35	27	20	10	20	22	28	9	23	22
Exposure	58	49	32	72	64	62	81	45	28	28
Total	5,050	4,975	5,675	5,825	6,300	5,475	5,200	5,175	5,000	5,000

Note: These data support the Figure 59 chart. Columns may not add exactly to the totals due to rounding.

Sources: NFIRS and NFPA

TABLE B-4. CAUSES OF NON-RESIDENTIAL FIRE AND FIRE LOSSES

Cause	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fires										
Incendiary/Suspicious	52,390	48,222	50,871	53,794	45,888	46,472	43,859	42,404	36,089	34,651
Children Playing	5,553	4,522	4,887	5,235	4,550	4,934	5,085	4,114	2,648	2,964
Smoking	9,673	8,713	8,658	7,933	7,410	6,794	6,520	6,792	6,528	6,110
Heating	12,688	10,113	10,350	11,024	10,798	9,927	10,676	10,874	10,997	10,315
Cooking	12,285	11,927	12,277	13,239	12,617	11,959	12,298	13,016	15,753	13,481
Electrical	18,159	17,674	17,618	17,198	16,765	15,871	15,656	17,053	18,419	16,596
Appliances	9,724	9,265	9,344	9,613	9,442	8,849	8,801	8,854	10,340	8,968
Open Flame	19,1813,	15,805	16,053	16,435	14,447	15,934	15,739	15,279	15,867	14,640
Other Heat	235	2,908	3,017	2,956	2,769	2,999	2,838	2,938	2,989	2,898
Other Equipment	13,163	11,404	11,734	11,782	11,650	11,879	10,850	12,627	13,446	11,972
Natural	6,308	5,722	5,900	5,133	5,277	5,417	5,082	4,834	5,502	5,041
Exposure	12,140	10,725	11,791	11,158	9,888	10,463	10,595	11,716	6,922	8,365
Total	174,500	157,000	162,500	165,500	151,500	151,500	148,000	150,500	145,500	136,000
Deaths										
Incendiary/Suspicious	46	73	63	63	57	21	51	47	30	55
Children Playing	4	6	26	4	4	0	0	2	5	4
Smoking	26	34	24	20	15	24	34	13	18	8
Heating	17	17	15	6	21	15	23	18	15	8
Cooking	7	17	4	4	6	10	6	4	0	16
Electrical	4	14	15	20	15	12	40	9	20	12
Appliances	9	17	4	6	6	0	6	0	0	0
Open Flame	24	28	17	26	9	21	57	22	25	36
Other Heat	9	8	4	9	3	5	0	9	0	4
Other Equipment	61	17	13	15	9	17	45	13	5	24
Natural	4	56	4	0	7	0	28	2	0	0
Exposure	9	0	0	4	3	0	2	2	3	4
Total	220	285	190	175	155	125	290	140	121	171
Injuries										
Incendiary/Suspicious	643	735	740	556	811	577	441	404	404	413
Children Playing	140	122	70	65	102	76	55	63	44	26
Smoking	268	231	286	214	285	182	132	170	188	147
Heating	214	263	211	255	326	227	259	204	250	168
Cooking	254	282	324	264	413	298	296	258	296	256
Electrical	344	393	305	340	478	353	241	309	292	263
Appliances	223	198	160	166	196	284	200	189	283	140
Open Flame	404	414	435	290	357	366	348	345	299	197
Other Heat	69	71	81	74	78	60	73	72	64	55
Other Equipment	457	506	351	378	746	498	417	441	319	450
Natural	198	168	144	90	122	156	107	76	136	123
Exposure	62	42	19	32	37	22	32	44	25	12
Total	3,275	3,425	3,125	2,725	3,950	3,100	2,600	2,575	2,600	2,250
Dollar Loss ($ millions)*										
Incendiary/Suspicious	$969.6	$1,121.7	$1,253.7	$2,093.8	$929.2	$995.6	$1,243.8	$867.0	$660.0	$671.5
Children Playing	18.1	25.0	23.2	21.5	31.5	25.2	26.6	17.9	18.8	17.3
Smoking	182.9	70.5	104.1	59.0	57.2	77.6	172.5	86.3	70.0	46.3
Heating	222.8	223.5	216.5	194.4	176.3	214.4	191.8	215.1	193.6	133,7
Cooking	105.3	96.2	122.4	99.2	77.7	106.1	123.2	146.7	76.4	100.0
Electrical	376.1	487.8	392.2	337.1	453.9	375.9	389.7	384.8	374.8	383.3
Appliances	95.8	104.4	121.3	89.3	97.0	83.7	91.4	79.3	113.9	131.3
Open Flame	267.6	221.0	203.6	166.3	290.5	239.7	272.8	278.5	439.3	167.0
Other Heat	37.0	74.2	66.2	45.7	48.4	47.6	370.9	44.1	51.3	57.9
Other Equipment	2,072.8	292.3	360.1	212.8	313.4	380.3	271.6	620.5	307.2	347.0
Natural	119.5	189.3	278.7	105.9	142.2	157.7	140.3	143.4	144.3	132.6
Exposure	159.5	162.3	170.8	149.7	273.9	115.1	189.0	202.9	91.4	138.2
Total	$4,627.1	$3,067.9	$3,312.7	$3,574.9	$2,891.1	$2,819.0	$3,483.5	$3,086.5	$2,541.0	$2,326.0

Note: These data support the Figure 75 chart. Columns may not add exactly to the totals due to rounding.
* Adjusted to 1996 dollars

Sources: NFIRS and NFPA

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