Ohio Board of Building Standards

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Report on Building Codes and Fire Safety

The Building Code—Our first and best line of defense.

1995-2004

TABLE OF CONTENTS

Introduction	Pg. 4
What is the Ohio Building Code	Pg. 4
Ohio and the National Fire Data Center	Pg. 5
What Do the Fire Dada Indicate	Pg. 6
Where Do Fire Losses Occur	Pg. 7
One- and Two-Family Dwellings	Pg. 9
Apartments	Pg. 10
Trends in Apartments	Pg. 11
Other Residential Structures	Pg. 11
Trends	Pg. 11
Non-Residential	Pg. 12
Causes of Fires and Fire Losses	Pg. 12
Who Gets Injured or Dies in Fires	Pg. 15
Age	Pg. 16
How Do Ohio's Fire Statistics Compare to Other States?	Pg. 18
Fire Service Fatalities and Injuries	Pg. 21
Conclusion	Pg. 21
Appendix	Pg. 23

BUILDINGS AND FIRE 1992-2001

Model Building Codes and Fire Data

Introduction

The current dialogue about building codes, fire, and the desire to modify building codes in Ohio has generally been conducted without the necessary background information. This has put the public and legislators at a loss when trying to follow the debate and trying to sort out real needs from personal opinion. We have attempted herein to summarize one of the most authoritative sources for examining fire safety in the built environment. This report summary is based upon the text and data of the Federal Emergency Management Agency's United States Fire Administration report *Fire in the United States 1992-2001*.* The report is based upon data maintained by the National Fire Data Center and these data are drawn from the National Fire Incident Reporting System (NFIRS) in which Ohio participates.

What is the Ohio Building Code?

Providing a built environment that is safe and sanitary drives the extensive research and development upon which national model building codes are based. Risk management is at the heart of the development, adoption, and use of building codes. These risks include earthquakes, fires, hurricanes, tornadoes, floods, landslides, naturally imposed loads such as snow and rain, man-made imposed risks such as furniture and equipment, and people. The management of these risks using a building's structural, electrical, mechanical, plumbing, egress, fire protection, and other systems designed with the help of state-of-the-art building codes provide Ohio's citizens with a safe and sanitary living and working environment.

One of the primary risks is that of fire and how the building equipment and systems are designed to manage the risk of fire is at the heart of building codes. Failures in any of the equipment or systems could be detrimental to the building occupants in case of fire.

With special interest groups suggesting that the built environment needs more restrictive code requirements, that local modifications to the nationally developed model codes are needed, or that current schemes of code enforcement are deficient, an examination of national fire data is essential. Perhaps these arguments have some basis from the advocate's view but that is why the national model code development process relies on a more objective participant in the process to establish the code content - our code enforcement official. The building code is in place to assure that buildings are safe to the extent that technology permits but it is neither promulgated to establish a level of gentrification in property values, nor is it promulgated to price the public out of the market by favoring one product, system, or process over another.

The Ohio Building Code, as mandated in the Ohio Revised Code, is promulgated:

> "To formulate such standards and requirements, so far as may be practicable, in terms of performance objectives, so as to make adequate performance for the use intended the test of acceptability; Permit to the fullest extent feasible, the use of materials and technical methods, devices, and improvements ... which tend to reduce the cost of construction and erection without affecting minimum requirements for the health, safety, and security *of the occupants or users of buildings or industrialized units and without preferen-*

* The entire report is available at: U.S. Fire Admin., FEMA, Publications Center, Rm. N310, 16825 S. Seaton Ave., Emmitsburg, MD 21727

tial treatment of types or classes of materials or products or methods of construction … and to encourage, so far as may be practicable, the standardization of construction practices, methods, equipment, material and techniques, including methods employed to produce industrialized units."

Given this charge to the Board of Building Standards, the question periodically arises as to what "minimum" means in this context. An editorial in the November/December 1995 issue of the *Building Official and Code Administrator** magazine answered this point specifically.

> *"Does the term imply shoddy or cheap construction that makes buildings unsafe? Does it suggest that governmental entities adopting the code need to amend the document to impose stricter construction requirements (i.e., "minimum is not quite good enough for us")? The answer to such questions is no. "Minimum standards" mean construction regulations which are both practical and provide a reasonable level of performance to protect the public health and safety. The term denotes a level of soundness and safety below which buildings should not be constructed."*
>
> *"Those who debate the use of the term 'minimum' miss the point and are quite possibly tangled up in semantics. Rationally, any code is a 'minimum' code. A code requiring every single-family house to be built to the same standards as a nuclear power plant would be preposterous but would still be a 'minimum' code. Any code is by its nature a minimum. Local amendments to a national model code do not at all change the application of 'minimum' as an adjective. The amended model document would still reflect 'minimum requirements' of the governmental jurisdiction doing the amending."*
>
> The Ohio Building Code *"reflects the best efforts of the code enforcement community to maintain a reasonable balance between safety and affordability based on current technology. This balance is reached after extensive analysis and research, and after code change proposals have been thoroughly debated on their merits by all interested parties."* Ohio also provides a state code change process whereby anyone can submit a code change and supporting justification for public hearing. Any adopted change then benefits the entire state and its citizens.
>
> As a performance-oriented document, rather than specification-based, the Ohio Building Code *"establishes performance levels required of buildings and their component systems and assemblies. Obvious examples would be the fireresistance rating in hours for a particular structural element, or the live load required for floors in a particular type of occupancy."* The performance levels contained in the Ohio Building Code reflect the "*reasoned determination by the collective national model building code development voting membership*" (including many of Ohio's building officials, architects, and engineers) "*as to what constitutes reasonable requirements to protect the health and safety of occupants over the life of a structure. As performance-oriented requirements, they do not so much tell an owner how to build a structure as they tell the owner what performance levels the completed structure must be capable of providing. The code fulfills its purpose by establishing the minimum level of building safety necessary to protect the public. Unequivocally, it is possible to exceed code requirements. For those with the financial means, it is possible to far exceed code requirements. The code does nothing to deter this.*"

Ohio and the National Fire Data Center

In all of the 10 years of data reported by the National Fire Data Center, Ohio's record is at or below the national trend line. **Most importantly Ohio is one of twenty-seven states that are consistently below**

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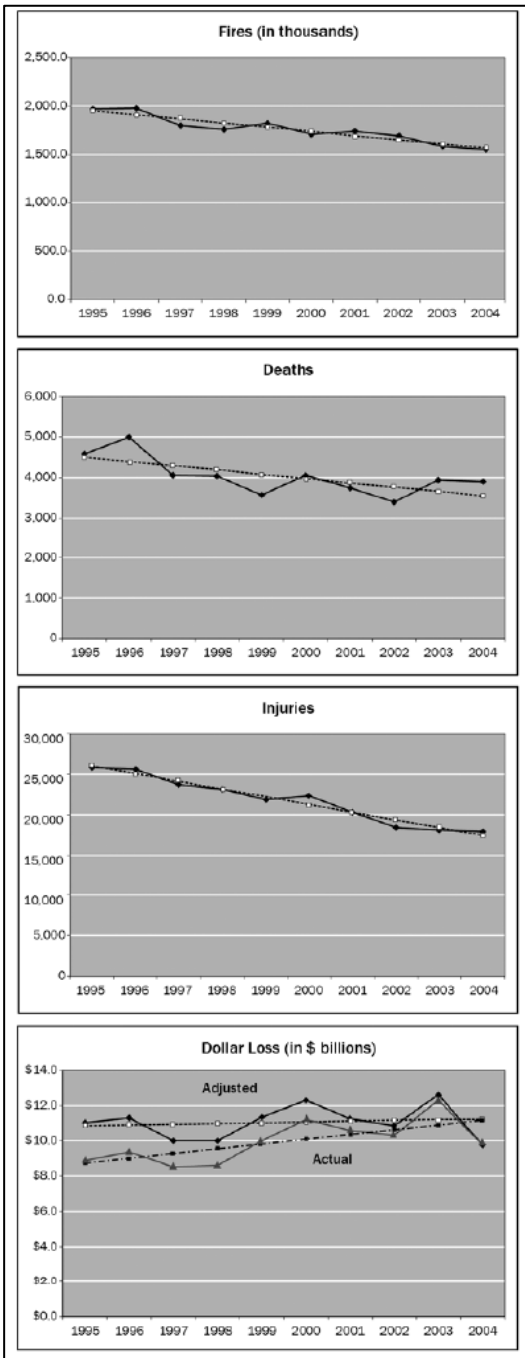
the national average for fire deaths. Figure 8 shows that many states' records fall above and below the national average during the five-year report period, and twenty-three states are consistently above the national average.

States with higher fire death rates appear to fall primarily in the southern half of the U.S (Figure 1C). The states that appear to be anomalies may have explanations. Illinois' fire statistics, for instance, would include Chicago and surrounding metropolitan areas. While Alaska, and Kansas may have higher risks from heating during extended or more severe winter weather and have smaller populations that are much more widely dispersed, other similar states do not have these same losses.

What Do the Fire Data Indicate?

An excellent indicator of the benefit of building codes in helping provide a safe and sanitary built environment is seen in the fire statistics of the past ten years.



FIRES (K)

Year	Value
1995	1,965.5
1996	1,975.0
1997	1,795.0
1998	1,755.5
1999	1,823.0
2000	1,708.0
2001	1,734.5
2002	1,687.5
2003	1,584.5
2004	1,550.5
10-Year Trend (%)	-20.1%

DEATHS

Year	Value
1995	4,585
1996	4,990
1997	4,050
1998	4,035
1999	3,570
2000	4,045
2001	3,745
2002	3,380
2003	3,925
2004	3,900
10-Year Trend (%)	-21.1%

INJURIES

Year	Value
1995	25,775
1996	25,550
1997	23,750
1998	23,100
1999	21,875
2000	22,350
2001	20,300
2002	18,425
2003	18,125
2004	17,875
10-Year Trend (%)	-33.1%

DOLLAR LOSS ($B)

Year	Actual Value	Value Adjusted to 2004 Dollars
1995	$8.9	$11.1
1996	$9.4	$11.3
1997	$8.5	$10.0
1998	$8.6	$10.0
1999	$10.0	$11.4
2000	$11.2	$12.3
2001	$10.6	$11.3
2002	$10.3	$10.9
2003	$12.3	$12.6
2004	$9.8	$9.8
10-Year Trend (%)	27.6%	3.4%

FIGURE 1A

Figure 1A summarizes the fire trends in the U.S. and they translate into significant improvements during the ten years from 1995 – 2004, continuing a more than eighty-year trend. These figures show that the numbers of civilian deaths and civilian injuries have dropped 21% and 33% respectively, the number of fires was down 20% (despite an 10% population increase), and the amount of dollar loss (in constant 2004 dollars) is up slightly (3.4%).

Figure 1B shows these same statistics on a per capita basis and again indicates the improvement over the last ten years – civilian deaths down almost 30%, injuries down almost 40%, fires down 28%, and dollar loss down over 6% per capita. The 13 deaths per million population is one of the lowest rates in NFPA survey history.

For 2004, there were 1,550,500 fires in the United States, the lowest since fire data have been recorded.

Of these:

44% were outside and other fires
37.5% were structure fires
18.5% were vehicle fires

Residential fires represented 29.1% of all fires and 79.5% of structure fires. The South had the highest fire death rate per capita with 20 or more civilian deaths per million population, 76% of all civilian fire fatalities occurred in the home. Of those civilian fire fatalities 74% occurred in single-family homes or duplexes.

The following latest fire history table shows the number of actual fires, deaths, injuries, and dollar loss in the US for the ten year period from 1994 to 2004. Over that time period fire, fire deaths, and injuries have continued to decline.

What then emerges from the US Fire Administration fire statistics over the last ten years is that the numbers of fires have decreased by 20%, civilian fire deaths have decreased by 21%, and civilian fire injuries have decreased by 33%.

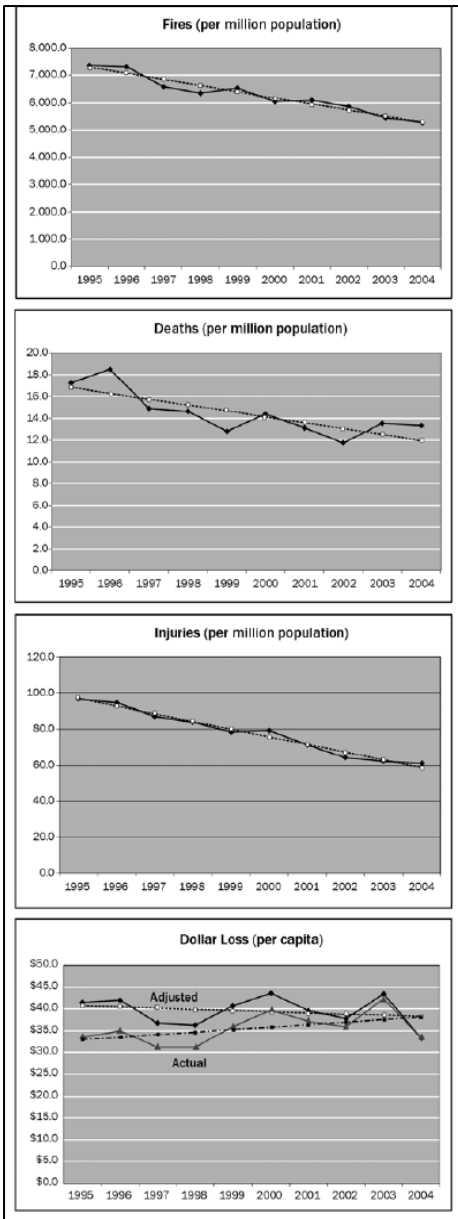
Year	Fires in Millions	Deaths	Injuries	Direct Dollar Loss in Billions
1994	2.05	4,275	27,250	$8.63
1995	1.97	4,585	25,775	$9.18
1996	1.98	4,990	25,550	$9.41
1997	1.80	4,050	23,750	$8.53
1998	1.76	4,035	23,100	$8.63
1999	1.82	3,570	21,875	$10.02
2000	1.71	4,045	22,350	$11.21
2001	1.73	3,745	20,300	$10.58
2002	1.69	3,380	18,425	$10.34
2003	1.58	3,925	18,125	$12.31
2004	1.55	3,900	17.875	$9.8

1994-2004 US FIRE HISTORY

Where Do Fire Losses Occur?

Figure 1C shows graphically the numbers of fire deaths per capita in the United States. As is seen, the lowest rates are in the southwest – primarily states with both smaller populations and greater geographic areas; the exceptions being the populous but still geographically large states of California and Texas.

The upper Midwest and Northwest are also areas of low per capita fire death rates. This is true even in large population states like New York, Ohio, Wisconsin, and Illinois with older infrastructure and built environ-



Sources: NFPA, Consumer Price Index, and U.S. Census Bureau

FIRES PER MILLION POPULATION

YEAR	VALUE
1995	7,381.4
1996	7,331.3
1997	6,583.6
1998	6,363.9
1999	6,533.1
2000	6,052.1
2001	6,081.1
2002	5,856.8
2003	5,448.8
2004	5,280.3
10-Year Trend (%)	-27.7%

DEATHS PER MILLION POPULATION

Year	Value
1995	17.2
1996	18.5
1997	14.9
1998	14.6
1999	12.8
2000	14.3
2001	13.1
2002	11.7
2003	13.5
2004	13.3
10-Year Trend (%)	-28.9%

INJURIES PER MILLION POPULATION

Year	Value
1995	96.8
1996	94.8
1997	87.1
1998	83.7
1999	78.4
2000	79.2
2001	71.2
2002	63.9
2003	62.3
2004	60.9
10-Year Trend (%)	-39.6%

DOLLAR LOSS PER CAPITA

Year	Actual Value	Value Adjusted to 2004 Dollars
1995	$33.5	$41.5
1996	$34.9	$42.0
1997	$31.3	$36.8
1998	$31.3	$36.3
1999	$35.9	$40.7
2000	$39.7	$43.6
2001	$37.1	$39.6
2002	$35.9	$37.7
2003	$42.3	$43.4
2004	$33.4	$33.4
10-Year Trend (%)	15.7%	-6.2%

FIGURE 1B

ment.

The highest rates of fire death per capita are in the central southern states grouped around the Mississippi River and states south of the Ohio River, although Florida is an exception. These tend to be poorer states with milder climates.

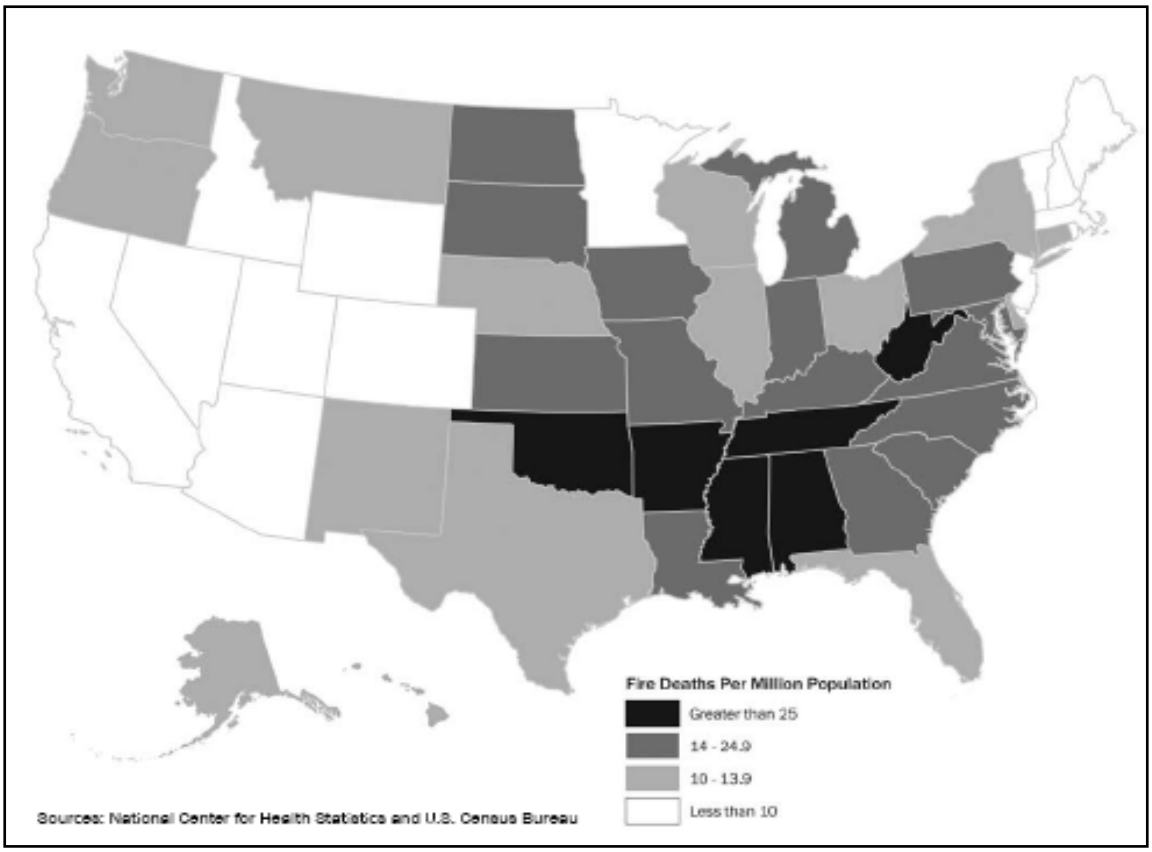


FIGURE 1C

A few individuals have recently suggested that multi-family residential occupancies need further and additional requirements placed upon them to reduce a perceived risk of living in these occupancies. *These claims are not supported by the fire data.* The National Fire Data Center reports (Figure 2) that in 2004 the vast majority of civilian fire deaths (76%) and injuries (74%) continue to occur in residential occupancies, although residences have only 29% of the total fires. Of those residential fires (where 76% of all fire deaths occur) over 84% of those deaths that occur in residences are in <u>one- and two-family dwellings</u>, <u>not apartments</u>. More than 78% of injuries incurred by firefighters are in residences (56% of which happen in one- and two-family dwellings) and residences account for a substantial portion of the dollar loss (57%).

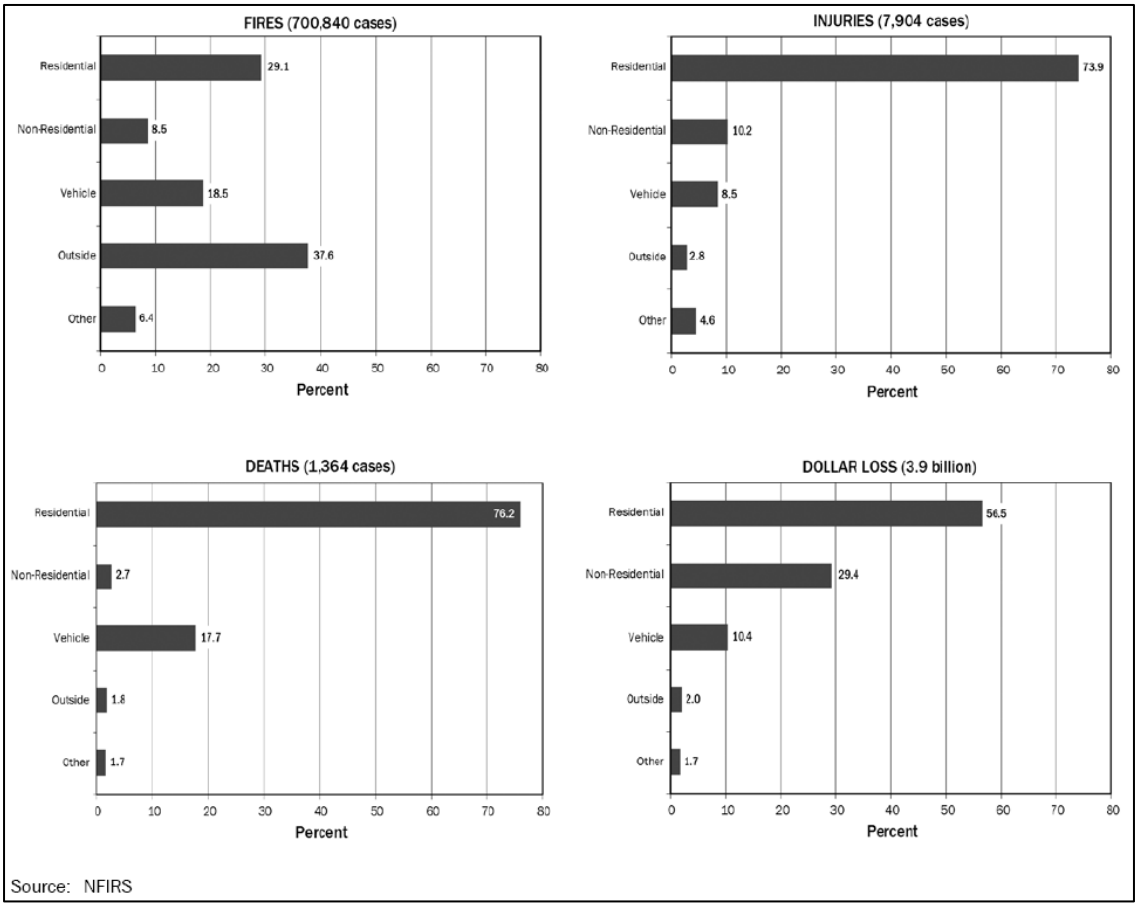


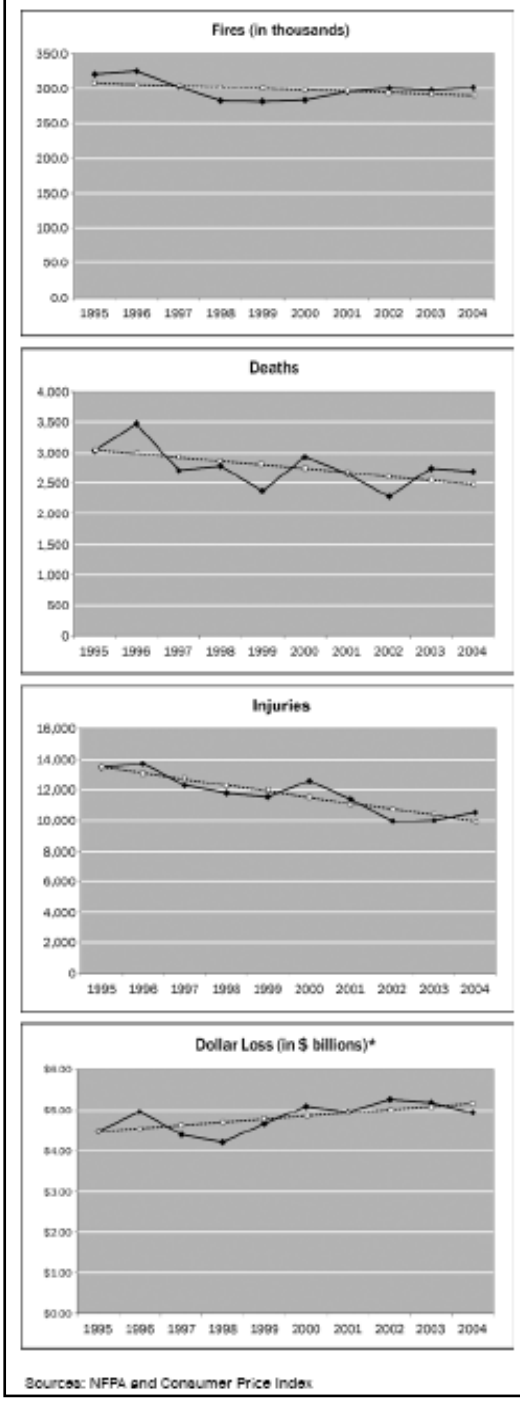
FIGURE 2

The public may underestimate the fire problem potential in their homes because large fires in hotels, apartments, high- rise office buildings, and other public buildings receive greater media attention than fires in single-family homes. In spite of these facts, Ohio has only recently developed a statewide uniform residential building code which includes requirements for the certification of residential building departments, provisions requiring review of residential plans, and certification/qualification requirements for plans reviewers and inspectors. Unlike the commercial building departments, which are certified and have certified personnel, prior to May 2007, residential construction may or may not have been regulated and plan review and inspections may or may not have been done.

Often overlooked or ignored in the discussion of residential fires are outside fires (fields, vacant lots, and wild areas) and vehicle fires; categories with the greatest number of fires (63% of fires). They produce 18% of the deaths, 13% of injuries, *but only 16% of the dollar losses.*

One- and two-family dwellings

When residential fire data are broken down (Figure 3), specifically when dealing with statements about apartment occupancies, a much better picture emerges. The ten-year trends show a 6% drop in the number of fires, a 18% drop in fire deaths, and a 26% decrease in number of injuries in one- and two-family dwellings. These improvements can probably be attributed to the fact over the past ten years, at 3% to 5% per year, newer housing makes up from 30% to 50% of the total housing stock. Many of these homes were constructed under various model-code-based residential codes. Unfortunately, fire data reporting makes no designation concerning the age of the structure or whether it was built to comply with a building code. As older, less code compliant housing is removed from the housing stock, these downward trends should continue. Still, it is apparent that one- and two-family dwellings are a primary



FIRES (THOUSANDS)

Year	Value
1995	320.0
1996	324.0
1997	302.5
1998	283.0
1999	282.5
2000	283.5
2001	285.5
2002	300.5
2003	287.0
2004	301.5
10-Year Trend (%)	-5.8%

DEATHS

Year	Value
1995	3,035
1996	3,470
1997	2,700
1998	2,778
1999	2,375
2000	2,820
2001	2,650
2002	2,280
2003	2,735
2004	2,680
10-Year Trend (%)	-18.4%

INJURIES

Year	Value
1995	13,450
1996	13,700
1997	12,300
1998	11,800
1999	11,550
2000	12,575
2001	11,400
2002	9,850
2003	10,000
2004	10,500
10-Year Trend (%)	-26.1%

DOLLAR LOSS ($B)*
*ADJUSTED TO 2004 DOLLARS

Year	Value
1995	$4.5
1996	$5.0
1997	$4.4
1998	$4.2
1999	$4.7
2000	$5.1
2001	$5.0
2002	$5.3
2003	$5.2
2004	$4.8
10-Year Trend (%)	15.5%

FIGURE 3

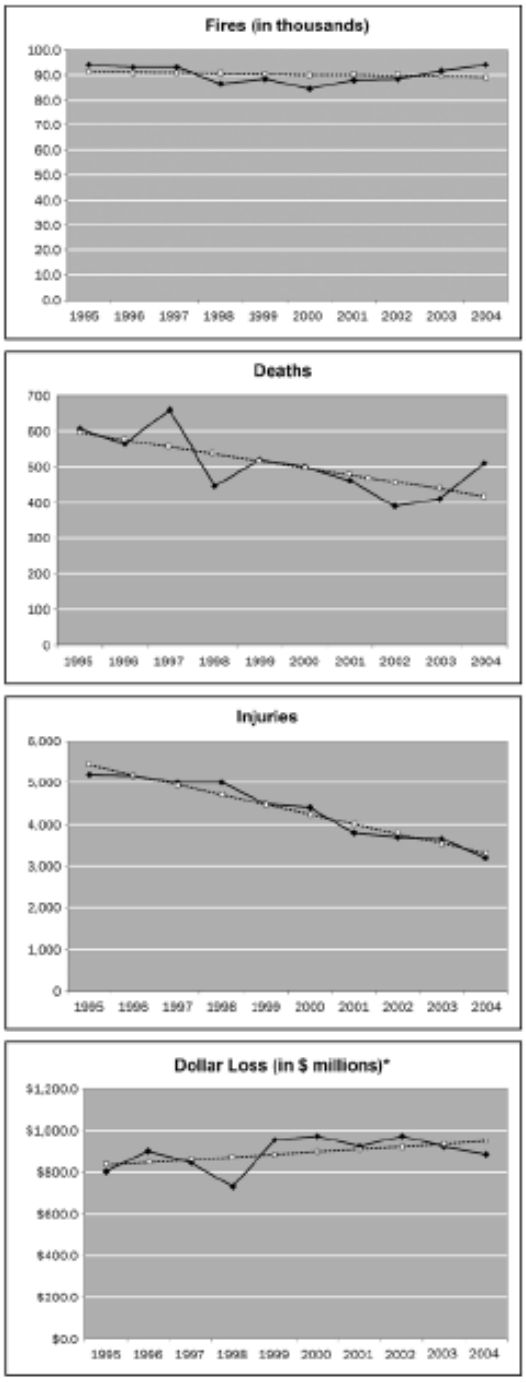
factor in fire loss statistics.

Appendix Figure A-7 shows that almost 12% of residential life-loss fires reported in Ohio are of an unknown origin and 11% are arson or suspicious in nature. Nationally (appendix Figure A-6), of the fires of know origin, the leading causes of death in one– and two-family dwellings are arson, smoking, and open flames. When cooking and children playing with matches is included, these factors account for almost 34% of fatal residential fires. When examining the causes of residential fires nationally, these factors add up to over 40% of all residential fires. These causes are, consequently, issues of education and not primarily issues in which the building code is deficient. Still, the codes have both contributed to the declines in fires (and fire related deaths and injuries) as well as attempted to address them through technology that detects and notifies residential occupants in case of danger.

Apartments

Apartment occupancies make up 23% of all residential fires. Over the past ten years apartment fire incidence dropped 2% and fire deaths decreased 30%. Injuries trended downwards over 39% and property losses in adjusted 2001 dollars rose about 14% (Figure 4).

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



Sources: NFPA and Consumer Price Index

FIRES (THOUSANDS)

Year	Value
1995	94.0
1996	93.0
1997	93.0
1998	86.5
1999	88.5
2000	84.5
2001	88.0
2002	88.5
2003	91.5
2004	94.0
10-Year Trend (%)	-1.9%

DEATHS

Year	Value
1995	605
1996	585
1997	660
1998	445
1999	520
2000	500
2001	460
2002	390
2003	410
2004	510
10-Year Trend (%)	-29.9%

INJURIES

Year	Value
1995	5,200
1996	5,175
1997	5,000
1998	5,000
1999	4,500
2000	4,400
2001	3,800
2002	3,700
2003	3,650
2004	3,200
10-Year Trend (%)	-39.1%

DOLLAR LOSS ($M)*
*ADJUSTED TO 2004 DOLLARS

Year	Value
1995	$804.4
1996	$900.6
1997	$845.0
1998	$731.3
1999	$954.7
2000	$971.9
2001	$921.6
2002	$972.3
2003	$920.9
2004	$885.0
10-Year Trend (%)	13.7%

FIGURE 4

sented in apartments.

Trends in Apartments

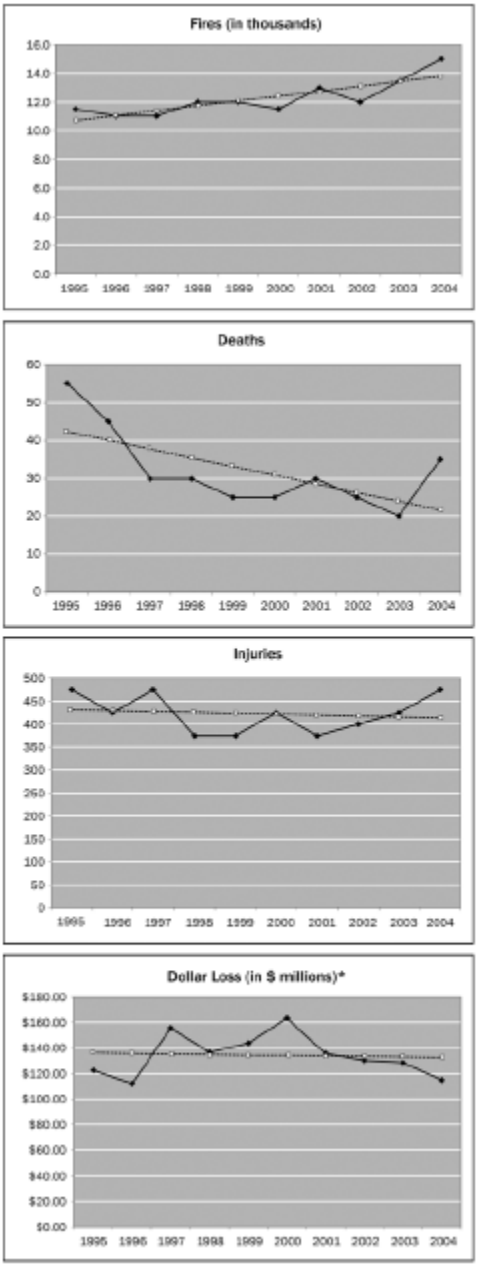
These downward trends in casualties were much larger than those in one- and two-family dwellings, even though the decline in fires in one- and two-family dwellings was larger. Apartment fire injuries reached their lowest level in 2004 with 3,200 injuries. Dollar losses in both types of structures continued the upward trends shown in the previous 10-year period (1992 to 2001): adjusted dollar losses were up 14 percent in apartments, similar to the 16 percent increase in one- and two-family structures. The declines in apartment deaths and injuries may be due to compliance with stricter building codes, the required presence of smoke alarms, and the increase in the number of sprinkler systems. More detailed study of socioeconomic and demographic changes over time might reveal some of the other factors involved in fire incidence.

Past years' data suggest that fire prevention programs aimed at apartment dwellers should emphasize the risk of careless smoking, the importance of controlling arson, and the danger in leaving cooking unattended. There is a potential for up to a one third reduction in fires, death, and injury from education in just these three areas.

The data do not support the claims that the construction materials, methods, or the building codes are deficient for this occupancy. The codes cannot regulate cooking, smoking, or arson but have, during the past decade, put detection, notification, and protection provisions into the codes for this occupancy. The trends reflect the benefits of these added safety features.

Other Residential Structures

Other residential structures include rooming houses, dormitories, residential hotels, halfway houses, hotels and motels, and miscellaneous and unclassified structures reported as residences. This category does not include homes for the elderly, prisons, orphanages, or other institutions. These categories are addressed as part of non-



Sources: NFPA and Consumer Price Index

FIRES (THOUSANDS)

Year	Value
1995	11.5
1996	11.0
1997	11.0
1998	12.0
1999	12.0
2000	11.5
2001	13.0
2002	12.0
2003	13.5
2004	15.0
10-Year Trend (%)	28.8%

DEATHS

Year	Value
1995	55
1996	45
1997	30
1998	30
1999	25
2000	25
2001	30
2002	25
2003	20
2004	35
10-Year Trend (%)	-48.9%

INJURIES

Year	Value
1995	475
1996	425
1997	475
1998	375
1999	375
2000	425
2001	375
2002	400
2003	425
2004	475
10-Year Trend (%)	-4.1%

DOLLAR LOSS ($M)*
*ADJUSTED TO 2004 DOLLARS

Year	Value
1995	$122.7
1996	$112.0
1997	$155.4
1998	$136.7
1999	$144.0
2000	$183.5
2001	$135.5
2002	$130.2
2003	$128.3
2004	$115.0
10-Year Trend (%)	-2.6%

FIGURE 5

residential structures in the next section.

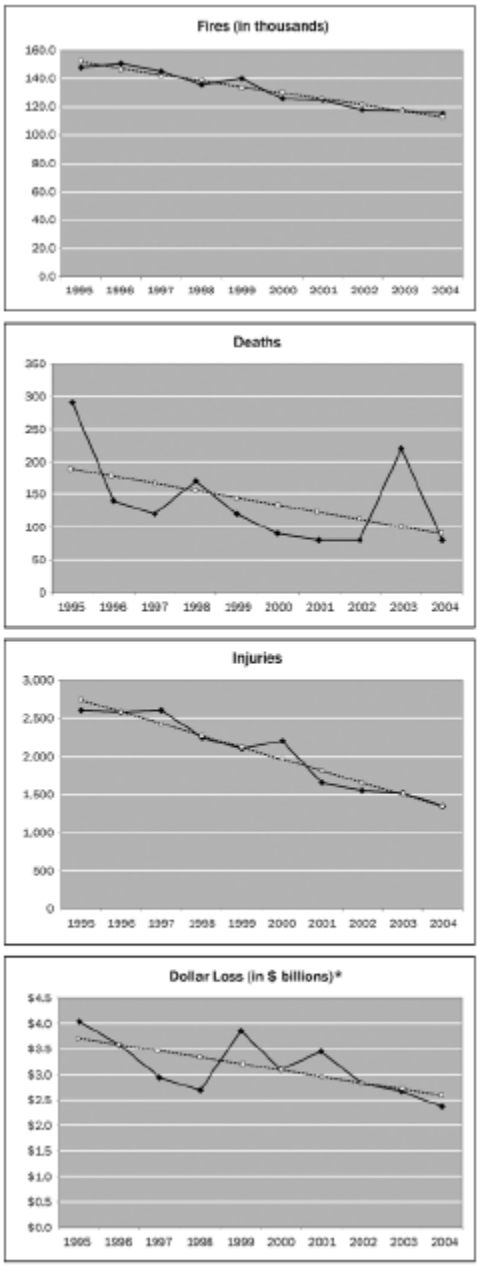
Trends

Figure 5 shows a large 10-year increase (29 percent) in the number of other residential fires, while showing a substantial decrease in the number of fire deaths (49 percent). Injuries decreased slightly, down 4 percent. Fire deaths ranged from 20 to 55 per year; injuries ranged from 375 to 475. Adjusted dollar loss has decreased 3 percent over 10 years, with a low of $112 million in 1996 and a high of $163 million in 2000.

Non-residential

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.

It is especially important to note that over the 10-year period, non-residential structures accounted for *less than 3% of fire deaths annually*, 10% of all fire injuries, 29% of total fire dollar loss, and only 8.5% of all fires (Figure 2). In absolute numbers, non-residential fires, injuries, and property loss were at all-time lows. In 2004, total deaths were down almost 53%, non-residential dollar loss, adjusted to 2004 dollars, was down over 30%, total fires were down almost 26%, and injuries were down almost 51%. (Figure 6) Yet, given this commendable record, advocates apply most pressure to code officials and legislators in the attempt to add further fire protection requirements to the building code for non-residential building types. *The data do not support the claims that the construction materials, methods, or the building codes are deficient for these occupancies.*



FIRES (THOUSANDS)

Year	Value
1995	148.0
1996	150.5
1997	145.5
1998	138.0
1999	140.0
2000	126.0
2001	125.0
2002	118.0
2003	117.5
2004	115.5
10-Year Trend (%)	-25.5%

DEATHS

Year	Value
1995	280
1996	140
1997	120
1998	170
1999	120
2000	90
2001	80
2002	80
2003	220
2004	80
10-Year Trend (%)	-52.8%

INJURIES

Year	Value
1995	2,800
1996	2,575
1997	2,800
1998	2,250
1999	2,100
2000	2,200
2001	1,850
2002	1,550
2003	1,525
2004	1,350
10-Year Trend (%)	-50.9%

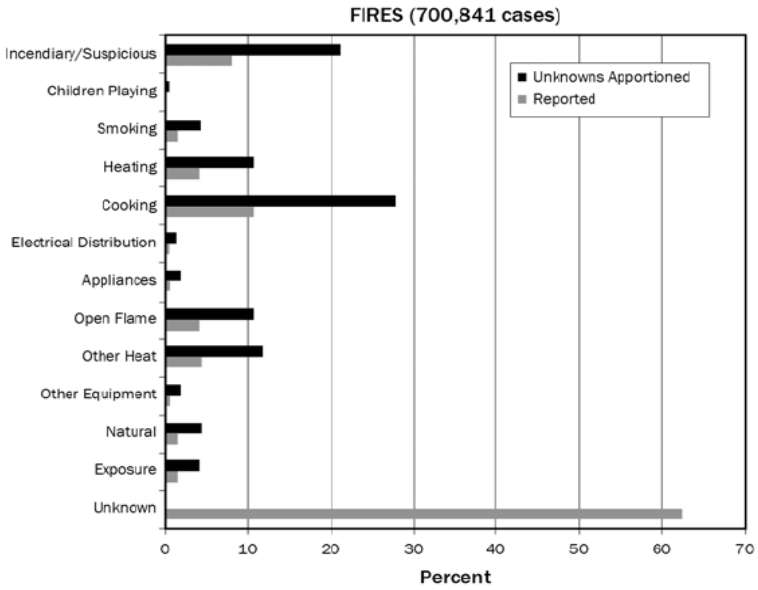
DOLLAR LOSS ($B)*
*ADJUSTED TO 2004 DOLLARS

Year	Value
1995	$4.0
1996	$3.6
1997	$2.9
1998	$2.7
1999	$3.9
2000	$3.1
2001	$3.4
2002	$2.8
2003	$2.7
2004	$2.4
10-Year Trend (%)	-30.1%

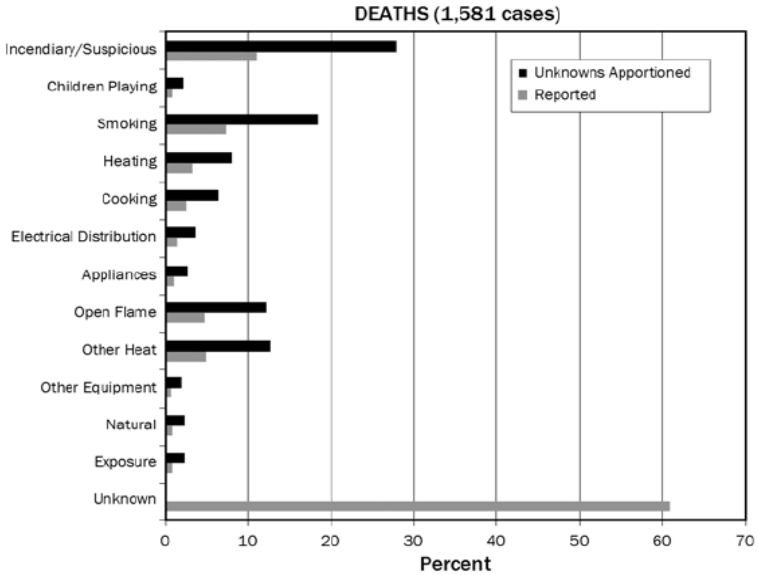
FIGURE 6

CAUSES OF FIRES AND FIRE LOSSES

Figures 7A and 7B show the profile of the major causes of fires, fire deaths and injuries, and direct dollar loss in 2004 for all property types grouped together. At 28 percent, cooking is the leading cause of fires. Incendi-



Cause	Reported	Unknowns Apportioned
Incendiary/Suspicious	8.0	21.0
Children Playing	0.2	0.6
Smoking	1.6	4.3
Heating	4.0	10.6
Cooking	10.5	27.6
Electrical Distribution	0.6	1.5
Appliances	0.8	2.0
Open Flame	4.0	10.6
Other Heat	4.4	11.6
Other Equipment	0.7	1.9
Natural	1.7	4.4
Exposure	1.6	4.1
Unknown	61.8	0.0

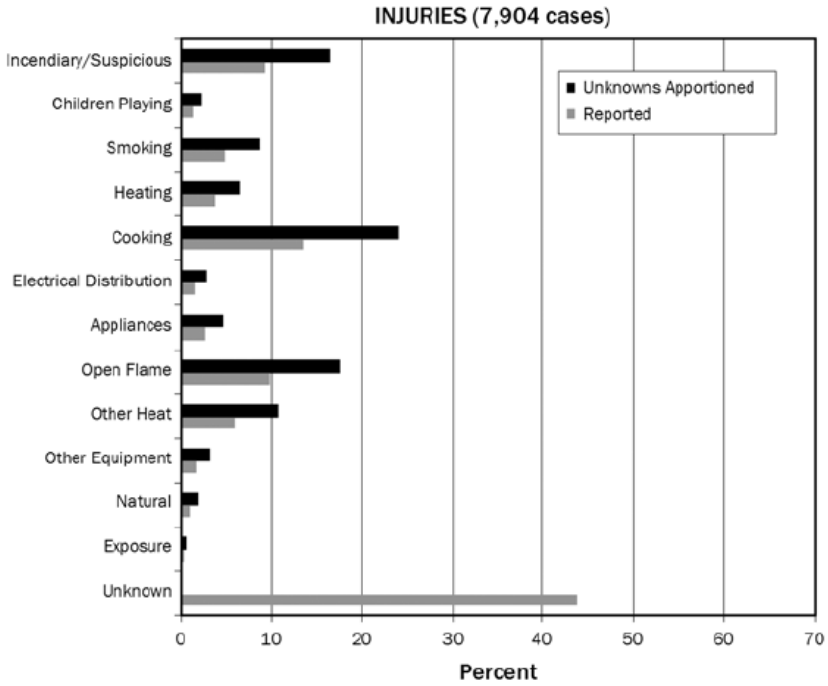


Cause	Reported	Unknowns Apportioned
Incendiary/Suspicious	10.9	27.9
Children Playing	0.8	2.1
Smoking	7.2	18.4
Heating	3.1	7.9
Cooking	2.5	6.3
Electrical Distribution	1.4	3.5
Appliances	1.0	2.6
Open Flame	4.7	12.1
Other Heat	5.0	12.7
Other Equipment	0.8	1.9
Natural	0.9	2.3
Exposure	0.9	2.3
Unknown	60.8	0.0

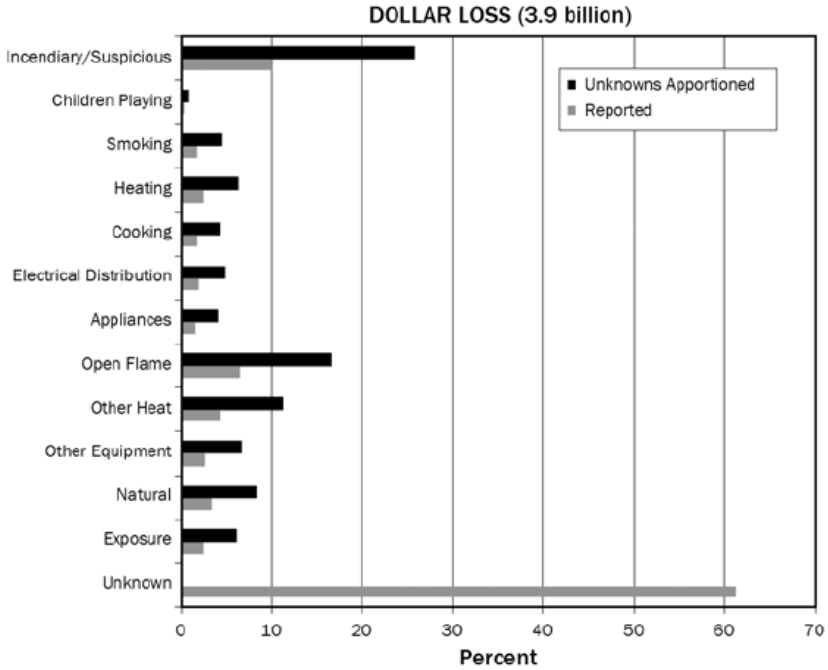
FIGURE 7A

ary or suspicious fires (arson) cause another 21 percent. These percentages (and those that follow) are adjusted, which proportionally spreads the unknowns over the other 12 causes. The two leading causes of civilian deaths are arson at 28 percent and smoking at 18 percent. The leading cause of injuries is cooking (24 percent), followed by open flame (18 percent) and arson (17 percent). Arson is by far the leading cause of property loss at 26 percent.

The causes of fire deaths and injuries are similar for both males and females (Figure 7C). For deaths, the most notable differences are (1) in other heat and other equipment fires, where the proportion of male deaths is 15 to 20 percent greater than the proportion of female deaths and natural fires, where the proportion of male deaths is 45 percent greater than the proportion of female deaths; and (2) in cooking, electrical, and appliance fires, where the proportion of female deaths is 33 to 47 percent higher than the proportion of male deaths. A much higher proportion of men are injured in natural, other equipment, and exposure fires,



Cause	Reported	Unknowns Apportioned
Incendiary/Suspicious	9.3	16.5
Children Playing	1.3	2.4
Smoking	4.9	8.8
Heating	3.6	6.4
Cooking	13.6	24.1
Electrical Distribution	1.6	2.8
Appliances	2.7	4.8
Open Flame	9.9	17.6
Other Heat	6.0	10.7
Other Equipment	1.8	3.2
Natural	1.1	1.9
Exposure	0.4	0.7
Unknown	43.8	0.0



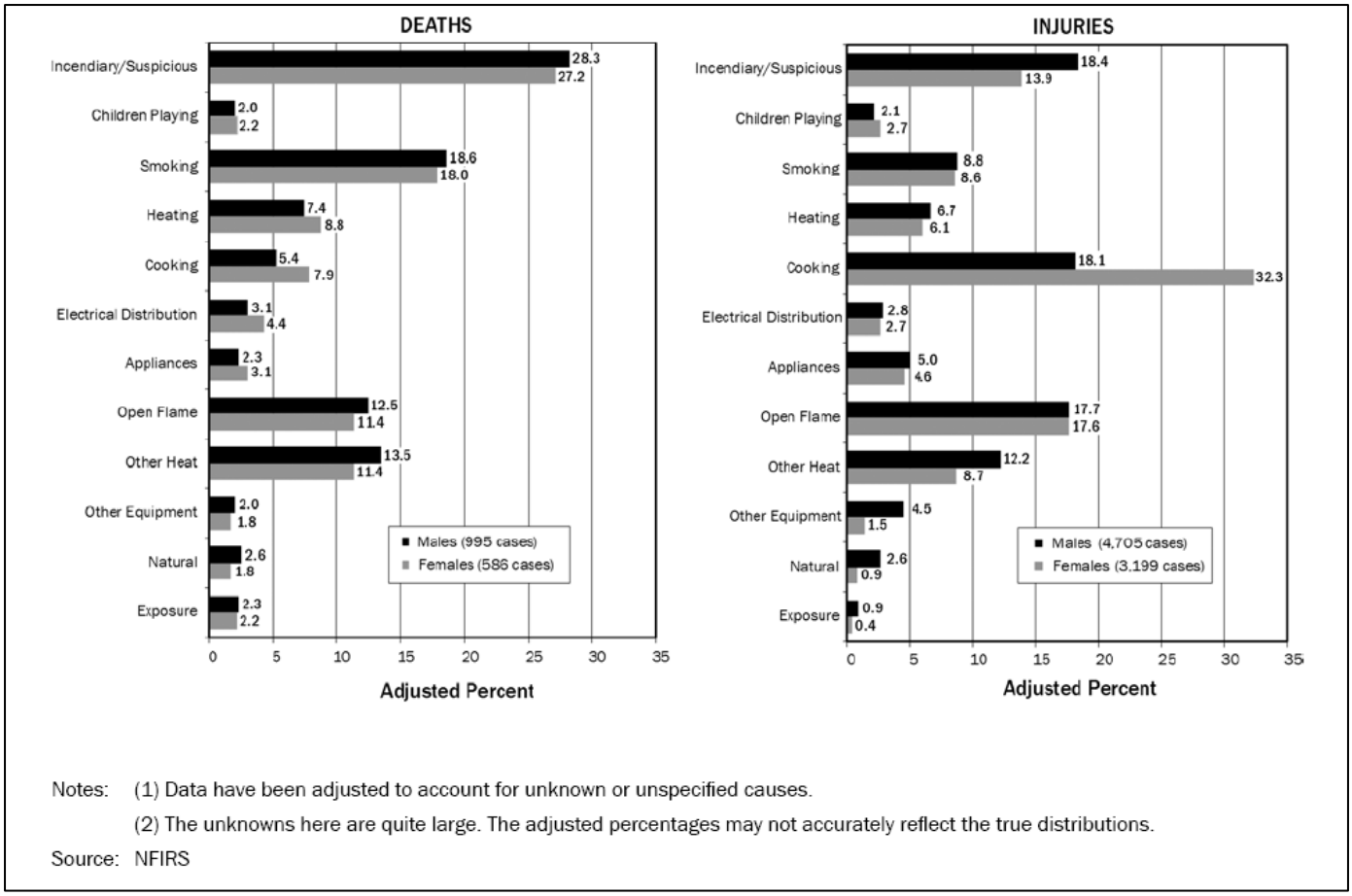
Cause	Reported	Unknowns Apportioned
Incendiary/Suspicious	10.0	25.9
Children Playing	0.3	0.8
Smoking	1.8	4.6
Heating	2.5	6.3
Cooking	1.7	4.3
Electrical Distribution	1.9	4.9
Appliances	1.5	4.0
Open Flame	6.5	16.7
Other Heat	4.4	11.3
Other Equipment	2.6	6.6
Natural	3.3	8.4
Exposure	2.4	6.2
Unknown	61.2	0.0

Source: NFIRS

FIGURE 7B

and a substantially higher proportion of women are injured in cooking fires.

For both men and women, the two leading causes—arson and smoking—account for approximately 45 percent of fire deaths. The two leading causes of injuries to women—cooking and open flame—account for 50 percent of injuries, whereas the two leading causes of male injuries—cooking and arson—account for only 37 percent of injuries.



Notes: (1) Data have been adjusted to account for unknown or unspecified causes.

(2) The unknowns here are quite large. The adjusted percentages may not accurately reflect the true distributions.

Source: NFIRS

FIGURE 7C

WHO GETS INJURED OR DIES IN FIRES

More men die in fires than women (Table 7 below). The high proportion of male-to-female fire deaths has remained remarkably steady throughout previous editions of *Fire in the United States*. Males have a higher fire death rate per million population than females for all age groups save one—the 10 to 14 age group. Females have a slightly elevated rate for this age group in 2004. Males aged 25 to 69 had twice the fire death rate as women in 2004. Males in general have fire death rates 1.5 to 2 times that of females.

The male-to-female ratio for fire injuries is similar to that for fire deaths, except that the gender gap is slightly smaller (Table 7). Injuries per million population for males are generally one and one-half times the female rate, but this ratio lessens as age increases (Figure 7A).

Table 7. Distribution of Fire Casualties by Gender

Casualty Type	Males (percent)	Females (percent)
Deaths	60.3	39.7
Injuries	59.5	40.5

Sources: National Center for Health Statistics and NFIRS

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 and the more dangerous occupations of men

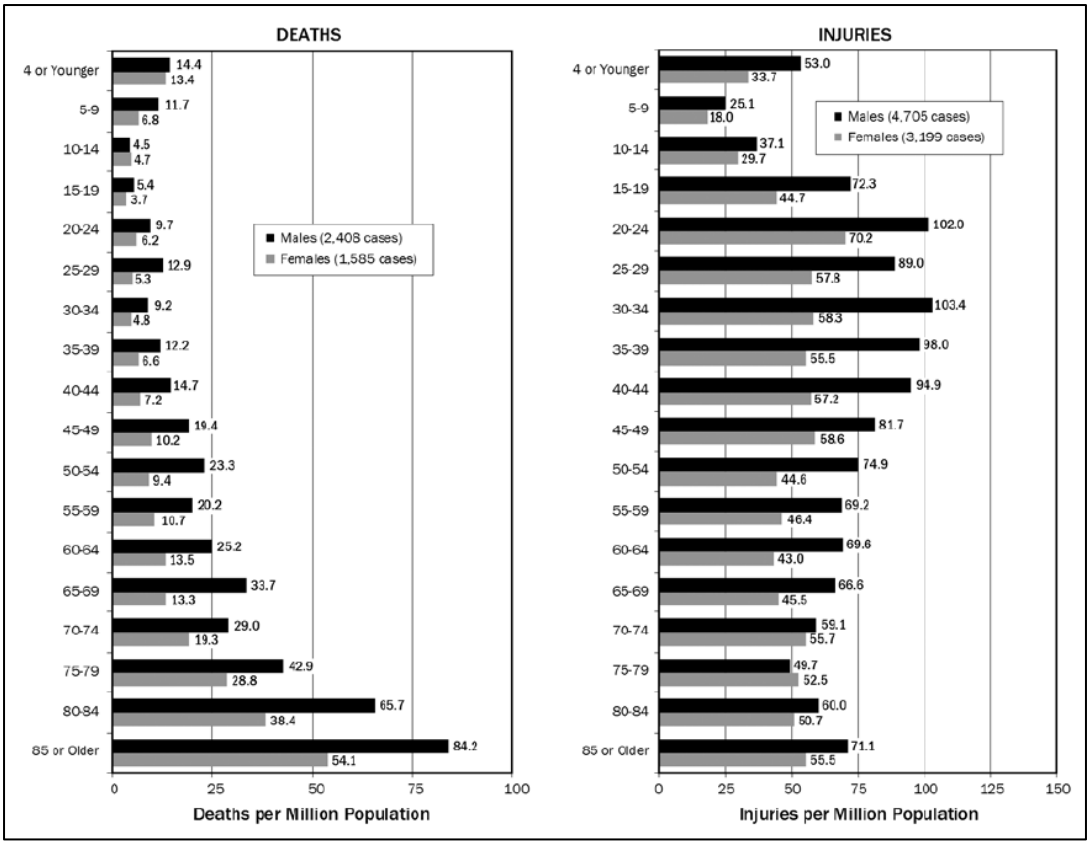


FIGURE 8A

(most industrial fire fatalities are males). It is also know that men have more injuries trying to extinguish the fire and rescue people than do women.

Age

People over 60 have a much higher fire death rate than the average population (13.6 deaths per million population), as shown in Figure 8B. The relative risk of dying and being injured in a fire for various age groups is shown in Figure 8D In 2004, the risk of fire death rose substantially above the national aver-age at age 60 and continued increasing for the older population groups These profiles have remained relatively constant from year to year Contrary to what might be expected, the age profile for injuries is very different from that for deaths (Figure 8A, Figure 8B, and Figure 8C). Adults aged 20 to 49 experienced the highest fire injury rates yet have some of the lowest fire death rates Fire injury rates are below average for children aged 19 or younger and for people aged 50 and over Correspondingly, the relative risk of fire injury was lowest for the younger and older age groups and highest for the mid-aged groups

Figure 8D shows the percent of 2004 fire deaths and injuries falling into each age group (This is not the same as risk.) Fire deaths peak at ages 45 to 54 and account for a combined 16 percent of the deaths Those under 4 years of age account for 7 percent of fire deaths, and those 65 and over comprise 32 percent of the fire deaths These two

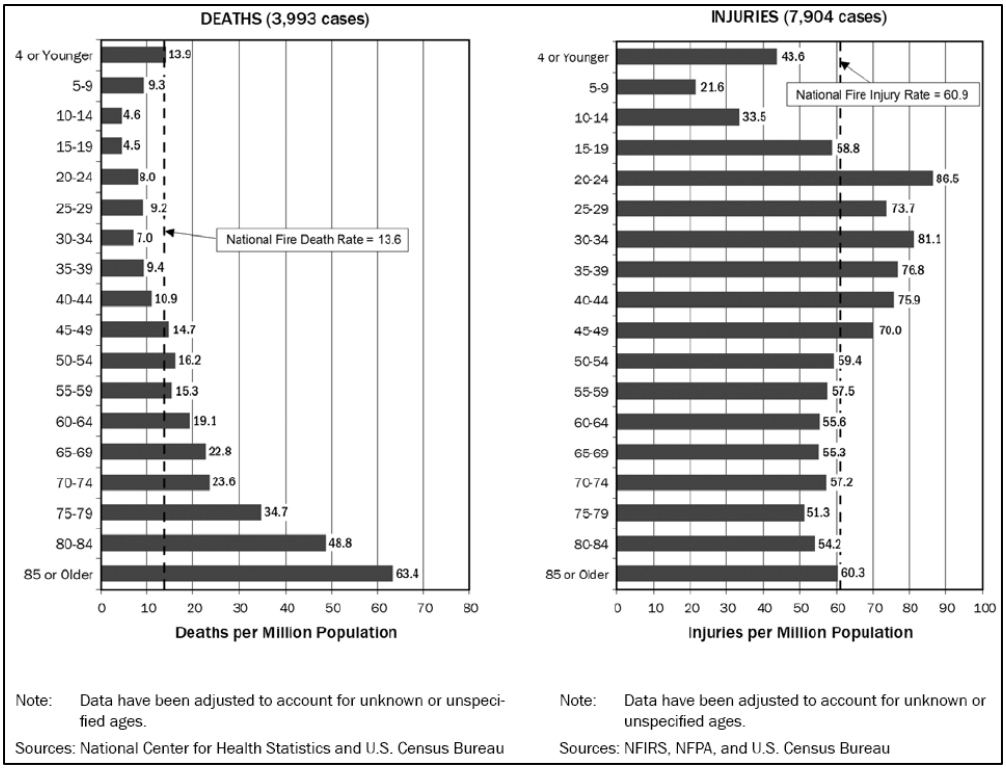


FIGURE 7B

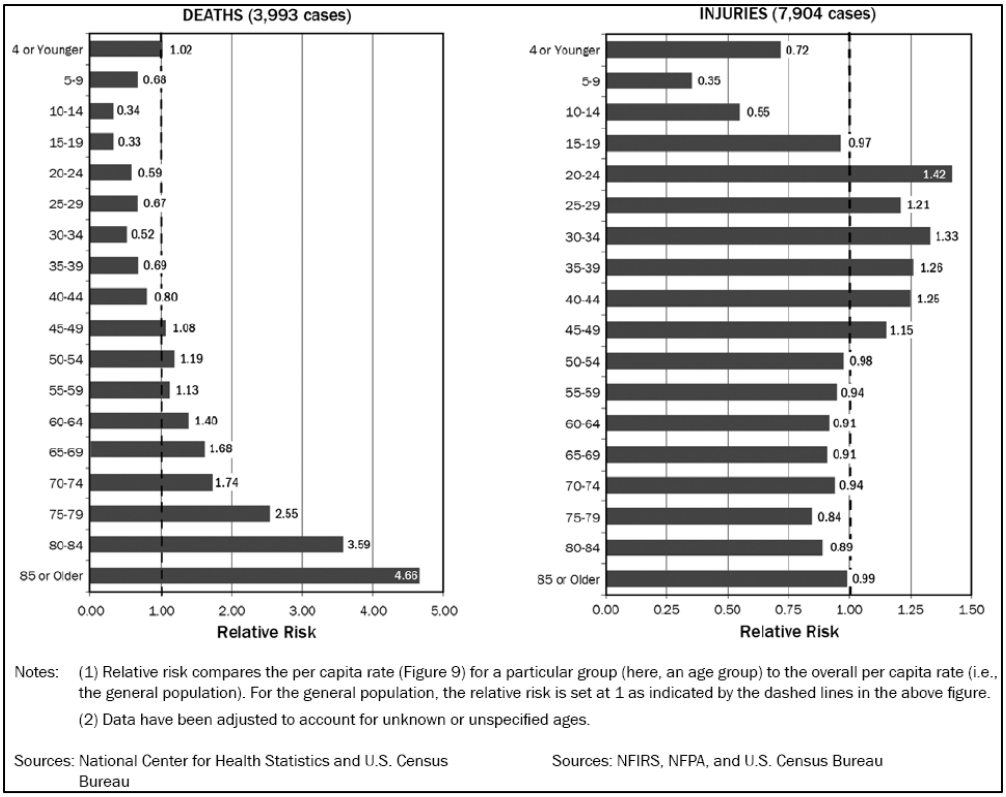


FIGURE 8C

high risk groups (the very young and older adults) represent over one-third of all fire deaths On the other hand, nearly 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 Unlike the age distribution of deaths, the injury age distribution tracks closely to the relative risk profile by age The exception to this, however, is the elderly (Figure 8D) Ages 20 to 49 account for over half of the 2004 fire injuries The young, under age 10, account for 7 percent; older adults over age 70 account for 8 percent Although the elderly have an average level of fire injury 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 to 49 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 and injuries by age is somewhat different for males versus females (Figure 8E). Males tend to have a slightly higher proportion of deaths until age 70 and injuries until age 55. As age increases, the male/female proportions are reversed. The proportion of male fire deaths is higher for people ages 20 to 69. By contrast, elderly females have twice the proportion of both deaths and injuries than elderly males.

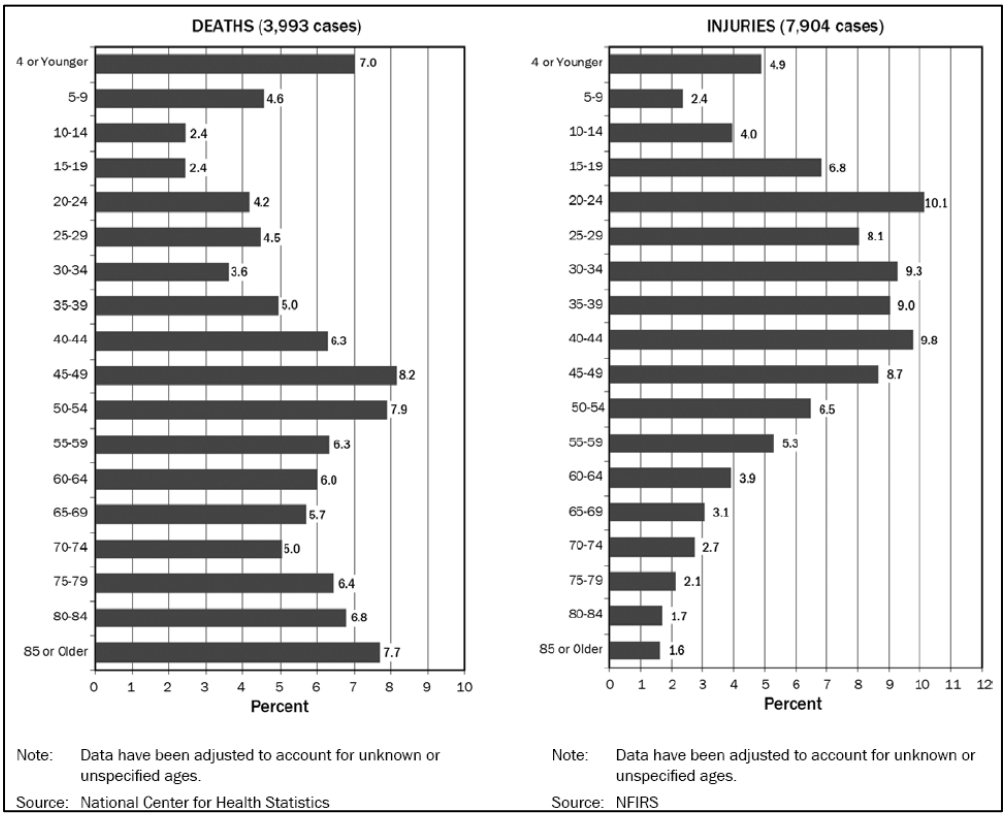
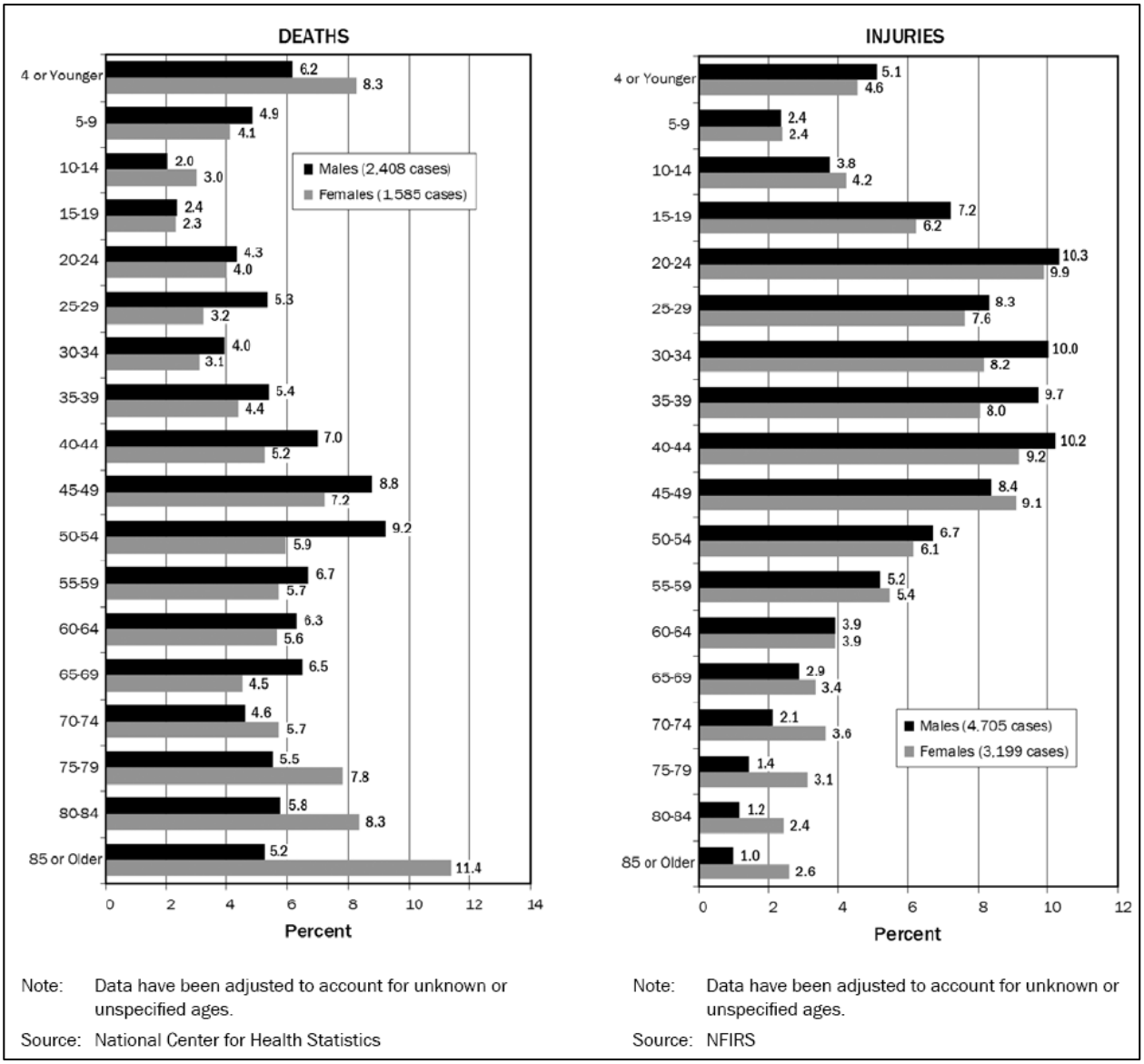


FIGURE 8D



Note: Data have been adjusted to account for unknown or unspecified ages.

Source: National Center for Health Statistics

Note: Data have been adjusted to account for unknown or unspecified ages.

Source: NFIRS

FIGURE 8E

How Do Ohio's Fire Statistics Compare to Other States?

In the 10 year timeframe of data reported to the National Fire Data Center, Ohio's record has historically been at or below the national trend line. Figure 9 shows that many states' records fall above and below the national average during the 5-year report period, and seventeen states are consistently above the average.

Under proposals made in hearings on a bill before the Senate (S.B. 72 before the Ohio Senate's Insurance, Commerce, and Labor Committee) these very issues were debated. In fact, a compromise was proposed that would allow local changes that differ with the state building code after an open public hearing on the justification before the Board of Building Standards. Advocates of local changes to model building codes would not accept this option stating rather that, to address the perceived inadequacy of the model-code-based state code, local decisions should be adequate justification for making changes and need no further open public hearing for approval. *It appears, however, that after even a preliminary examination of the data, the claim of improved safety cannot be substantiated.*

A rather extensive study of Ohio's building code laws and practices was made in 1998 by the National Institute of Building Sciences (NIBS), and subcontractor Cleveland State University's Urban Center at the Maxine

Goodman Levin College of Urban Affairs, and issued its report on 11 December 1998. A copy of the study was distributed to each member of the legislature in January 1999. The study was commissioned by the Department of Commerce (Board of Building Standards Building Standards funds) after recommendations from the Ohio Manufacturers Association during testimony before the Senate Committee hearing SB 72 and was subsequently mandated in HB 215. The study dealt with Ohio law, local amendments, the residential exemption, multiple codes, verifiable professional competency, administrative inefficiencies, and historic preservation. This comprehensive study provided much needed clarity and included recommendations on courses of action open to the legislature. In 2004, the Legislature passed and the Governor, in February of 2005, signed H.B. 175 which puts in place the mechanism and organization to permit Ohio to adopt a statewide residential building code—a first in Ohio's history.

Because Ohio is one of the twenty-seven states that are consistently below the national average for fire deaths, and given the historical downward trend of Ohio's loss of life, injury, and property loss statistics, action should be taken in response to the data in those areas that are shown to have the greatest need. This approach to risk management and code development will continue to yield savings in all report categories while being responsive to the real need for safety and soundness.

Fire Service Fatalities and Injuries

In the US in 2007, 118 firefighters died in operations throughout the year (appendix Figure A-10). The total deaths are small enough that a change of even a few deaths in a year may dramatically impact the 10-year trend line. Over this 10-year period, an average of 109 firefighters died in the line of duty each year. In every year until 1992, more than 100 firefighters were fatally injured. The peak was in 1978 when 171 firefighters died. The fewest deaths (77) were recorded in 1992.

Despite wide fluctuations, fire-incident-related firefighter fatalities per 100,000 reported incidents have risen approximately 27%, with 1999 having the highest rate. In contrast, the trend in fire incidence declined 20% and fire deaths declined 21% (Figure 1A). It is not clear why there has been a reduction in the number of fires and civilian deaths but not a reduction in the number of fire-incident-related fire service fatalities. Perhaps, the number of small fires has been reduced, but the more serious fires where firefighters are killed has not decreased as much, or perhaps firefighter equipment has become so effective that firefighters are inadvertently pushing the limits of the equipment and consequently putting themselves in harm's way.

Firefighter fatalities in 2005 include 81 volunteer firefighters and 34 career firefighters (Figure 7-F). Among the volunteer firefighter fatalities, 71 were from local or municipal volunteer fire departments, and 10 were members of wildland fire agencies. All of the career firefighters who died were members of local or municipal fire departments. Three of the firefighters who died in 2005 were female and 112 were male.

Appendix Figure A-12 reports the Bureau of Labor Statistics' Ohio figures for fatalities by industry. This will place the national statistics in perspective and show how Ohio's firefighters fared

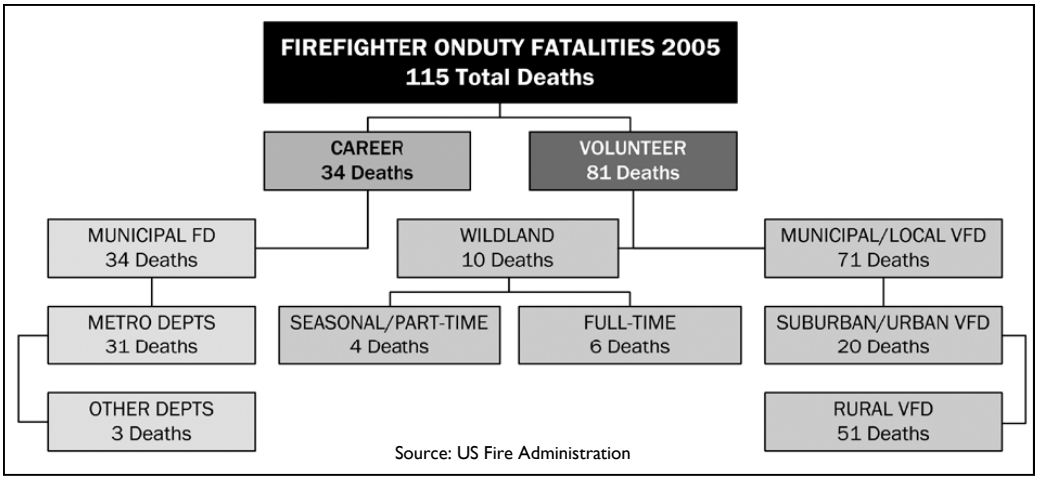


FIGURE 7F

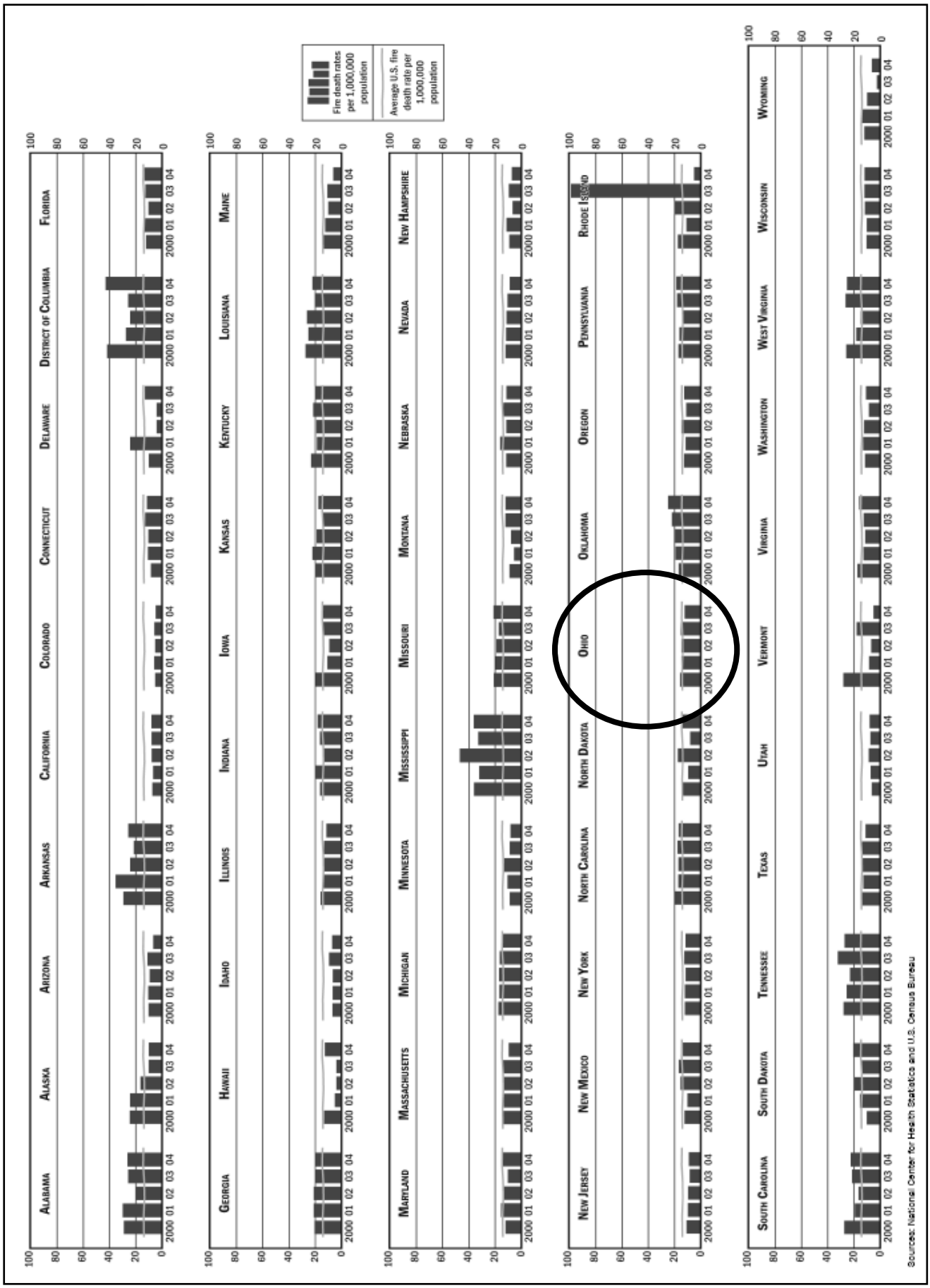

Fire death rates per 1,000,000 population
Average U.S. fire death rate per 1,000,000 population
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
District of Columbia
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming
100
80
60
40
20
0
2000 01 02 03 04
Sources: National Center for Health Statistics and U.S. Census Bureau

FIGURE 9

over the five year period ending in 2007. Over the period from 1987-2007 Ohio's firefighter fatalities average about 1.5 per year versus the national average of 102 per year. One quarter of fire service fatalities (25%) are transportation related, making it the first cause of firefighter fatalities (Figure 10). Nationally, transportation related fatalities (responding to or returning from an emergency) are the second leading category or activity resulting in firefighter deaths, as in all reporting years.

In U.S. Bureau of Labor Statistics data (appendix Figure A-9), Ohio firefighter fatalities are shown ranked among the industries reported and it indicates that occupations in the construction, agriculture, transportation and warehousing, and manufacturing industry segments fare much worse. The top three Ohio industry categories averaging more than 25 and 30 fatalities per year are Construction, Transportation, and Warehousing and Manufacturing, .

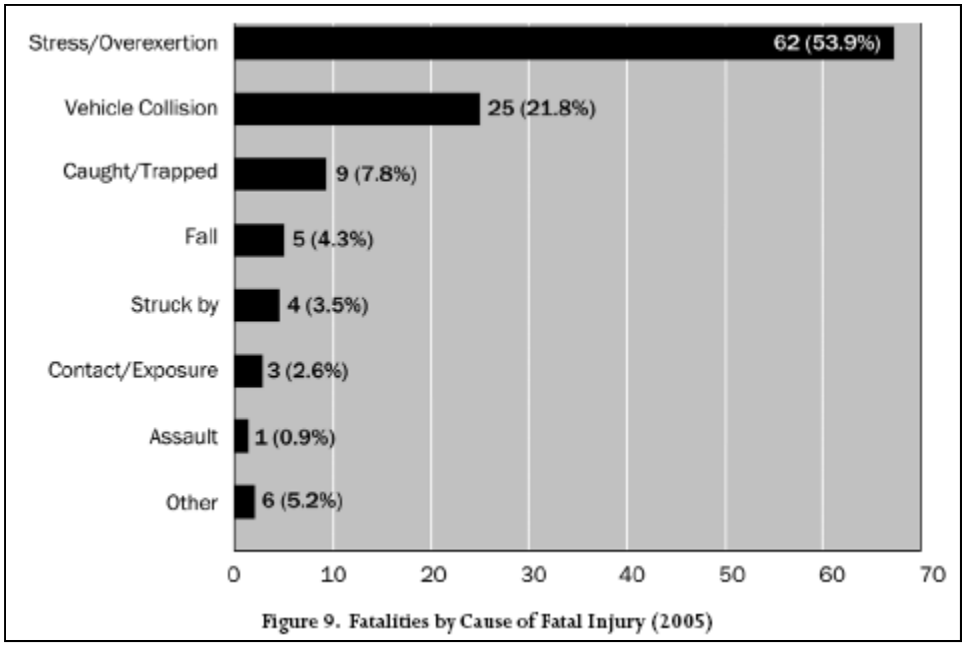


FIGURE 10

Conclusions

Safety in the built environment in Ohio should be an area of pride for the owners, designers, contractors, and enforcement personnel—both building service and fire service—because of the history, current national standing, and potential for improvement the data provide. As is shown in Figures A-1 and A-2, the trends are in the correct direction. Figure A-8 puts things further into focus. Of the 74,276 accidental and disease deaths in Ohio in 2006, only 0.13% (thirteen one hundredths of one percent) of the fatalities were in residential fires (including HUD manufactured units). That is 0.13% of total deaths in the type of structures (residential) in which over 78% of fatalities occur as a percentage of all of Ohio's structure fires. Ohio's structures appear to provide a high level of safety and a relatively low risk to occupants—even one and two-family residential structures.

The hazards associated with the built environment are identifiable, understandable, and addressable through rational, performance-based requirements. Reactionary and provincial regulations will almost always tend to inflate the costs of construction, seek to protect entities and practices that otherwise would be forced to compete or innovate, and usually do not add to the protection of the public's health and safety. Report data bear out that with the continued efforts of the building and fire services, if we prioritize the use of scarce resources where they will be most effective, and make our regulatory process responsive to real hazards, we can realize continued reductions in life and property loss.

The International Code Council's International Building, Mechanical, Plumbing, Energy, Residential, Fuel Gas, Fire, and Property Maintenance Codes are now completed through the work of this model code group and its membership. These documents provide the country with a family of building construction codes for use throughout the U.S. Ultimately, this process will bring the U.S. closer to the performance–based type of building codes used in other parts of the world and will assist those adopting jurisdictions in continuing the decline in fires and fire related life losses.

The use of model code-based building codes in most states has significantly contributed to the ongoing reduction in loss of life, loss of property, and in injuries caused when the built environment is subject to either man-made or natural hazards. The public is safer today because buildings and their systems and equipment are designed and built as code compliant structures. These codes are the first and best line of defense in the ongoing efforts to protect the people who live and work in our built environment.

APPENDIX

Ohio Fire Statistics (As reported – NFIRS and OFIRS) **Pg. 24-27**
Fig A-1: Civilian Fire Deaths in Ohio 1979- 2007
Fig A-2: Twenty-one Year Fire Life Loss by Category 1987 - 2007
Fig A-3: US—Causes of Residential Fires 2006
Fig A-4: Ohio—Causes of Residential Fire Deaths 1999-2003
Fig A-5: Causes of Residential Fire Deaths 2003-2007
Fig A-6: Ohio—Causes of Residential Fires 2003-2007
Fig A-7: Ohio—Residential Fires—Places of Origin 2003-2007

Fig A-8: The Size of the Problem: Ohio Accident & Disease Death Statistics. **Pg. 28**

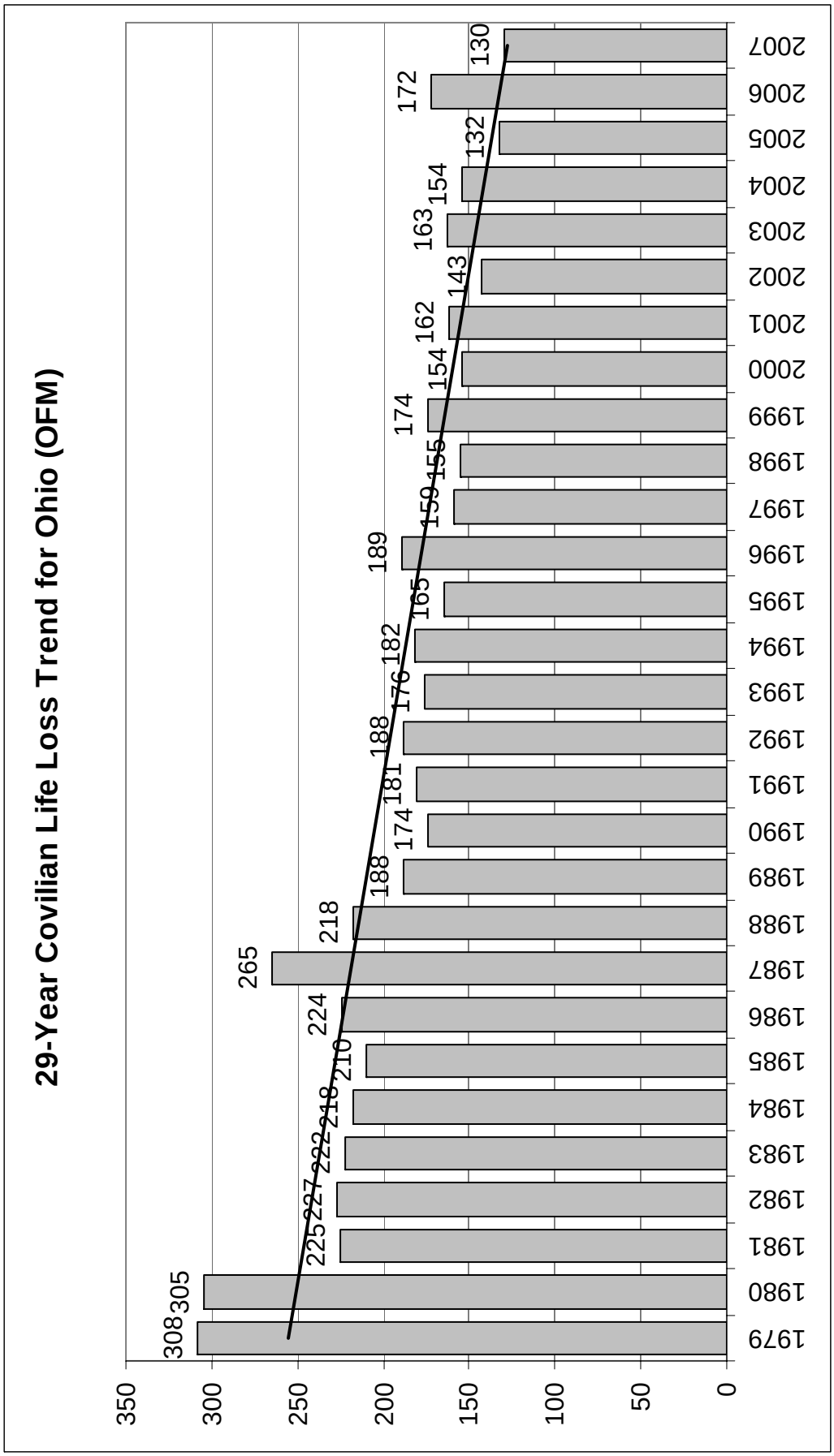
Fig A-9: Fatal Occupational Injuries by Industry & Event of Exposure, Ohio, 2003 to 2007 **Pg. 29**

Fig A-10: Firefighter Casualties—1998-2007 **Pg. 30**

Fig A-11: Firefighter Deaths by Type of Duty 2007 **Pg. 30**

Fig A-12: Onduty Firefighter Fatalities 1977-2005 **Pg. 31**

Fig A-13: Firefighter Fatalities by Region 2005 **Pg. 31**


29-Year Covilian Life Loss Trend for Ohio (OFM)
350
300
250
200
150
100
50
0
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
308
305
225
227
222
218
210
224
265
218
188
174
181
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176
182
165
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174
154
162
143
163
154
132
172
130

Fig A-1

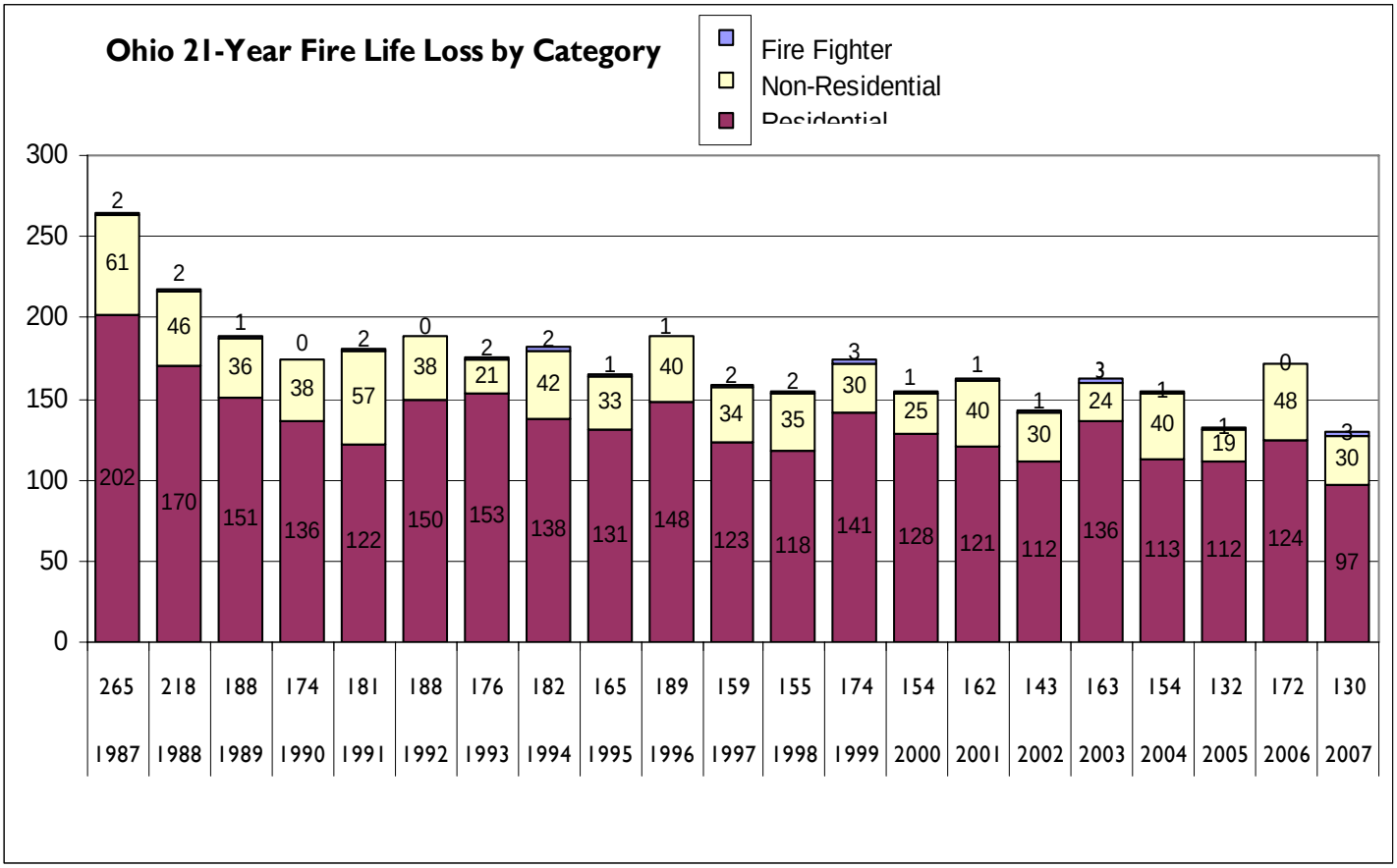
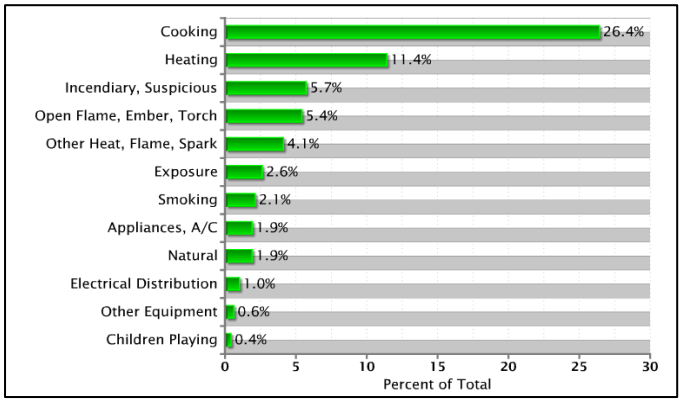
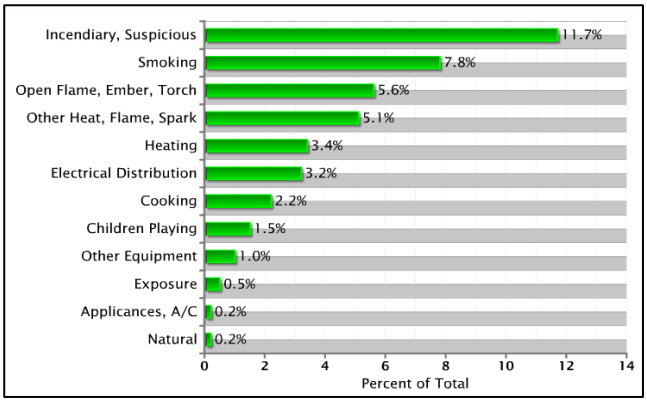


Fig A-2

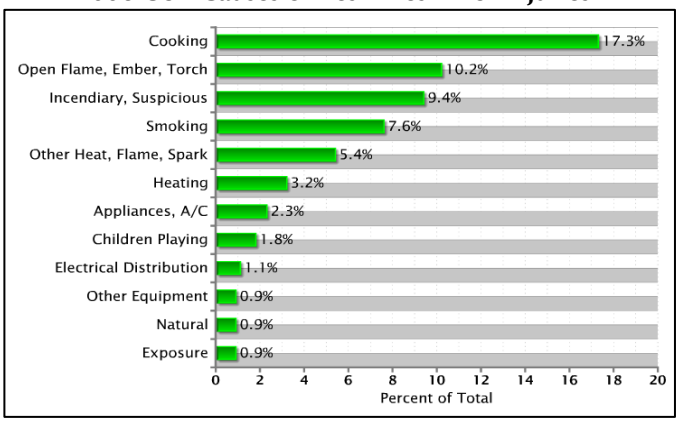
2006 US—Causes of Res. Fires: % of Fires



2006 US—Causes of Res. Fires: % of Fatalities



2006 US—Causes of Res. Fires: % of Injuries



2006 US—Causes of Res. Fires: % of Dollar Loss

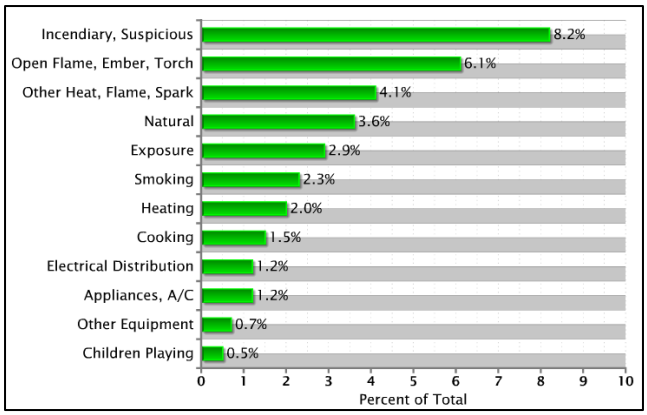


Fig A-3

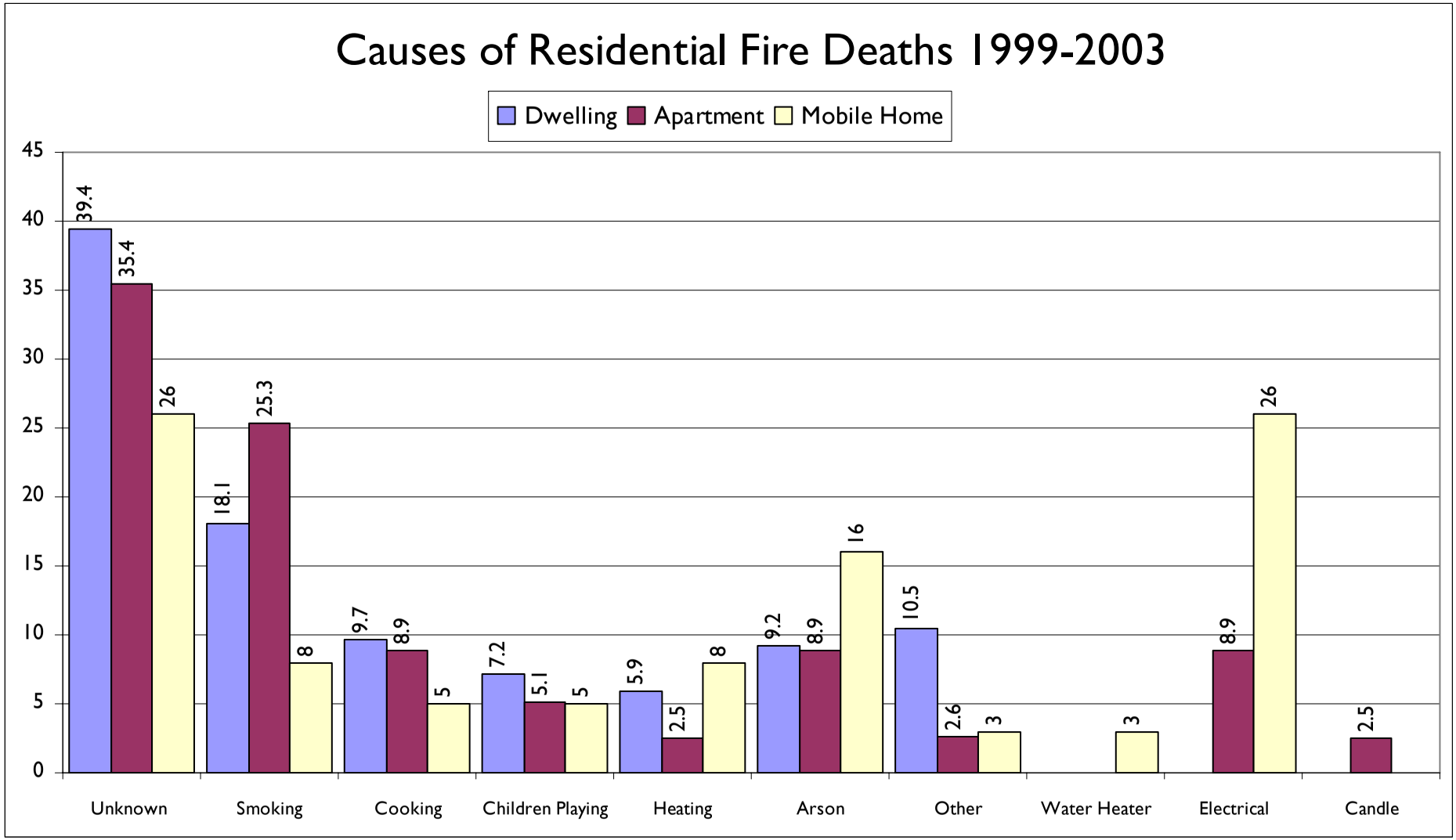

Causes of Residential Fire Deaths 1999-2003
Dwelling
Apartment
Mobile Home
45
40
35
30
25
20
15
10
5
0
39.4
35.4
26
18.1
25.3
8
9.7
8.9
5
7.2
5.1
5
5.9
2.5
8
9.2
8.9
16
10.5
2.6
3
3
8.9
26
2.5
Unknown
Smoking
Cooking
Children Playing
Heating
Arson
Other
Water Heater
Electrical
Candle

Fig A-4

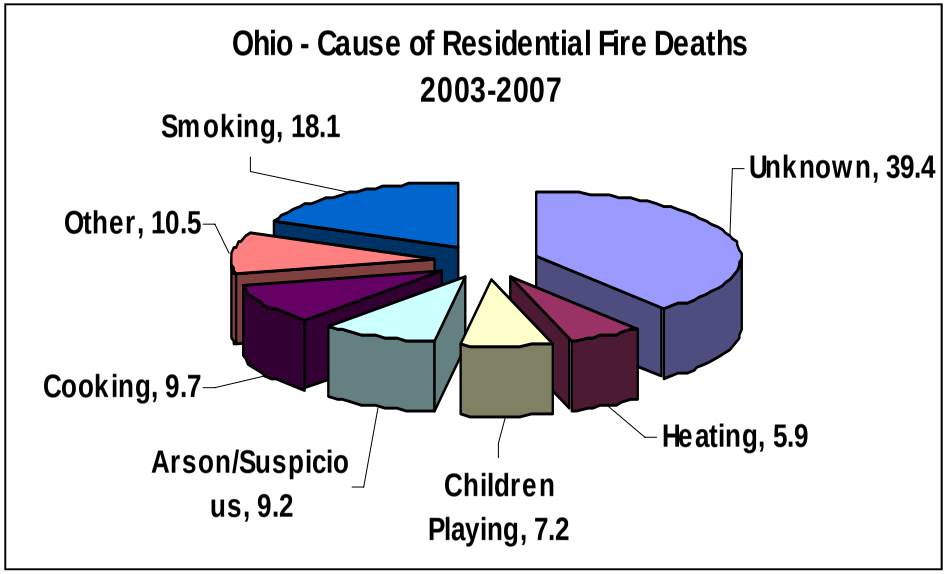


Fig A-5

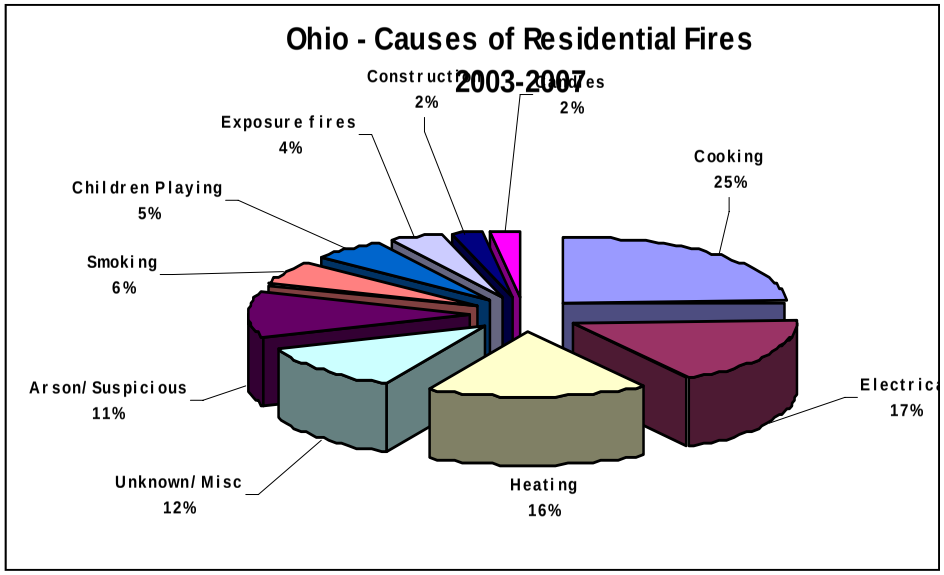


Fig A-6

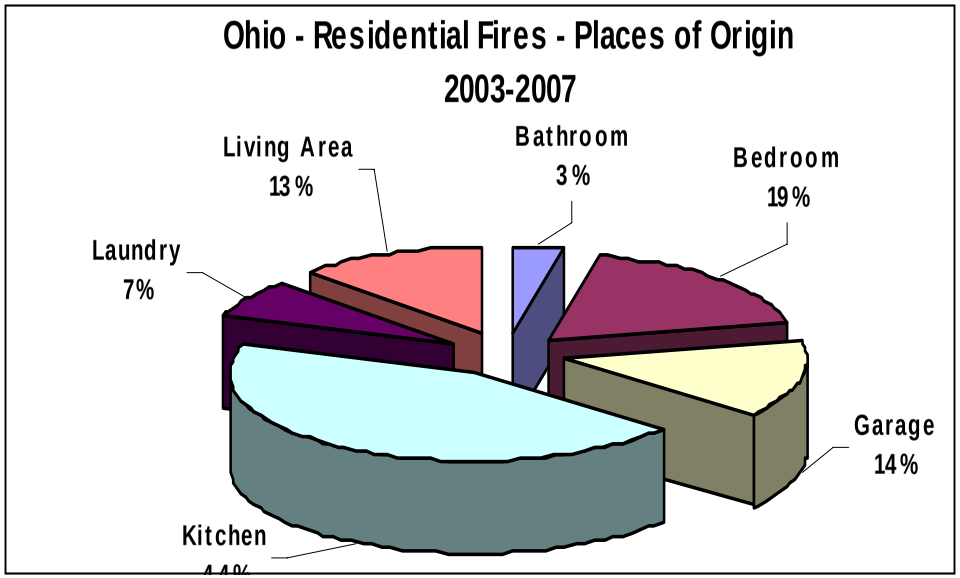


Fig A-7

The Size of the Problem:

Ohio Accident & Disease Death Statistics:

2006

11,478,000	Population of Ohio (Est.)
5,038,654	Residential Units Including Mobile Homes (2005-2007)

Source: U.S. Census Bureau

Accidental & disease deaths

2006

27,764	Heart	37.4%
24,865	Cancer	33.5%
6,041	Chron. Lower Resp. Dis.	8.1%
5,778	Stroke	7.8%
4,737	Unintentional	6.4%
3,740	Diabetes	5.0%
1,257	Traffic	1.7%
94	*Residential Fires*	*0.13%*
74,276	Total	

Deaths per million homes

2006

2,419	Heart Disease
2,166	Cancer
526	Chron. Lower Resp. Dis.
503	Stroke
413	Unintentional
326	Diabetes
110	Traffic
8.2	*Residential Fires*

Fig A-8

Ohio Fatal Occupational Injuries by Industry and Event or Exposure — 2003 to 2007

Rank	Industry	Total Fatalities (Number)	Event of Exposure (Percent)					
			Transporta-tion [1]	Assaults/ Violent Acts [2]	Contact w/ Objects & Equipment	Falls	Exposure to Harmful Sub-stances/ Environments	Fires & Explosions
3	**Agriculture, Forestry, Fishing**	124	62	10	34	7	9	0
	Mining	14	3	0	5	0	0	0
1	**Construction**	164	36	4	41	46	36	0
4	**Manufacturing**	122	28	14	40	14	15	11
2	**Transportation and Warehousing**	127	83	9	21	7	3	3
	Utilities	10	4	0	0	0	3	0
	Wholesale Trade	42	26	8	0	10	0	0
	Retail Trade	62	9	38	6	7	0	0
	Information	7	5	0	0	0	0	0
	Financial Activities	16	5	5	0	3	0	0
5	**Professional, Business Services**	80	31	6	18	14	11	0
	Education , Health Services	23	17	0	0	0	0	0
	Leisure and Hospitality	50	18	24	3	0	0	0
	Other Services	31	8	5	8	4	3	3
	Government	76	39	15	0	4	13	4
	Federal	7	4	0	0	0	0	0
	State	14	11	0	0	0	3	0
	Educational Services	3	0	0	0	0	0	0
	Public Admin.	9	8	0	0	0	0	0
	Local	55	24	13	0	3	10	4
	Construction	4	5	4	0	0	0	0
	Trade, Transp & Public Utilities	4	0	0	0	0	0	0
	Education , Health Services	9	6	0	0	0	0	0
	Public Administration	33	12	9	0	3	6	0
	-Justice, Public Order, Safety	29	12	8	0	3	3	0
	Police Protection	15	3	8	0	0	0	0
	Fire Protection	12	5	0	0	0	0	0

Notes: 1. Includes highway, nonhighway, air, water, rail fatalities, and being struck by a vehicle

2. Includes violence by persons, self-inflicted injury, and assaults by animals.

Source: U.S. Departmetn of Labor, Bureau of Labor Statistics, in cooperation with State and Federal agencies, Census of Fatal Occupational Injuries.

Fig A-9

Firefighter Casualties 1998-2007

Year	Deaths[1]	Fireground Injuries[2]	Total Injuries[2]
1998	93	43,080	87,500
1999	114	45,550	88,500
2000	105	43,065	84,550
2001	105	41,395	82,250
2002	100	37,860	80,800
2003	113	38,045	78,750
2004	119	36,880	75,840
2005	115	41,950	80,100
2006	106	44,210	83,400
2007	118	38,340	80,100

[1] This figure reflects the number of deaths as published in USFA's annual report on firefighter fatalities. All totals are provisional and subject to change as further information about individual fatality incidents is presented to USFA.
[2] This figure reflects the number of injuries as published in NFPA's annual report on firefighter injuries.

Fig A-10

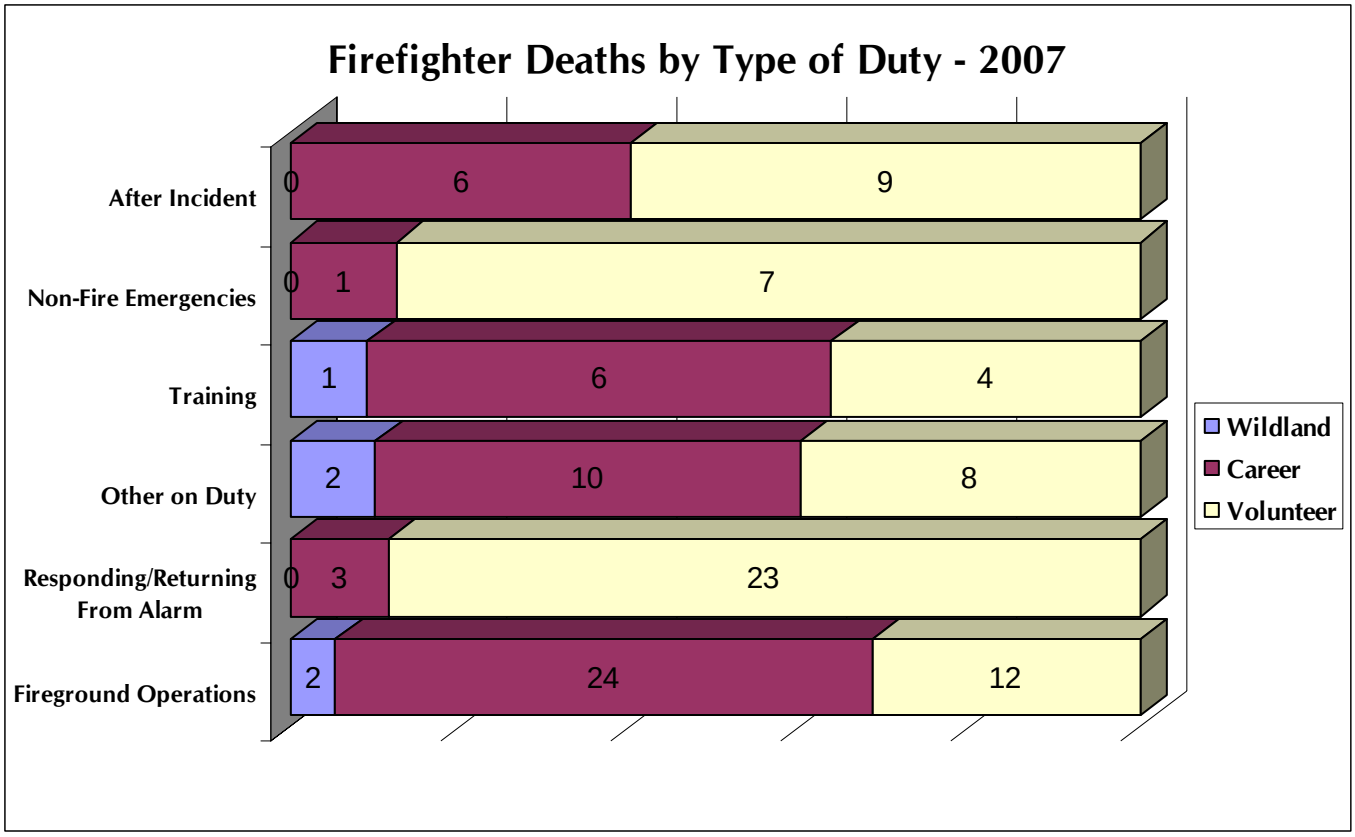


Fig A-11

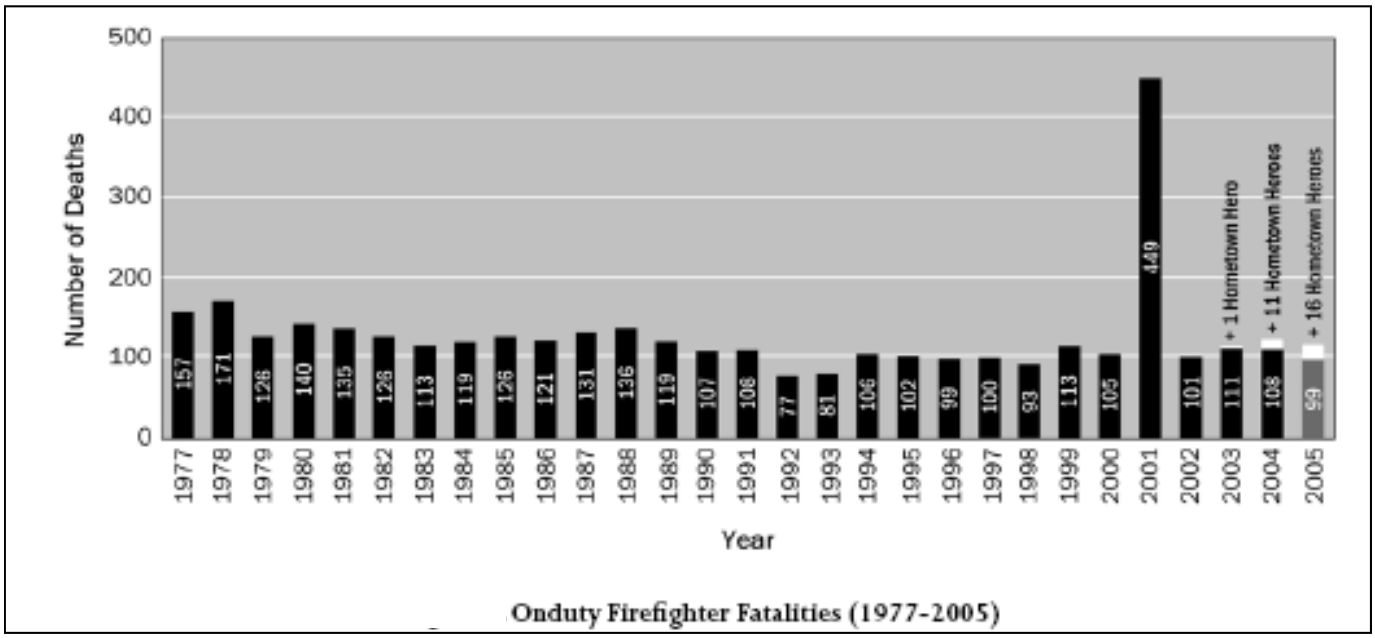


Fig A-12

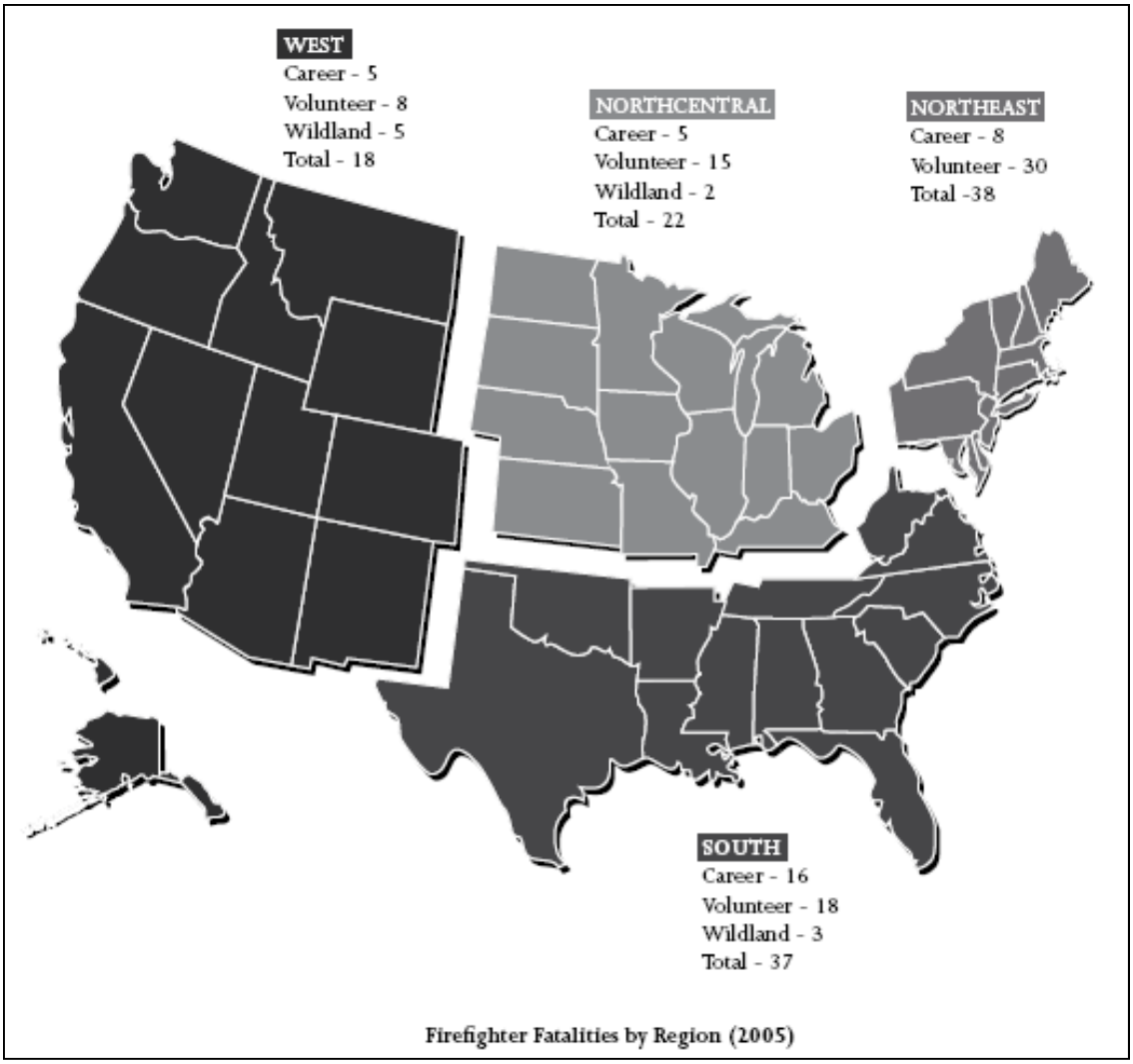


Fig A-13