

CHILDREN PLAYING WITH FIRE

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Executive Summary

In 2002, an estimated 13,900 child-playing structure fires were reported in the U.S., with associated losses of 210 civilian deaths, 1,250 civilian injuries, and \$339 million in direct damage. Another 200 confined structure fires starting with trash are estimated as well, but they add no losses at the level of rounding selected.

The figures for 2002 structure fires, deaths, and injuries are the lowest ever recorded. Note that it is much more difficult to select the most appropriate analysis approach (e.g., approach to allocating unknowns) after 1998, due to changes in NFIRS Version 5.0. If a simpler and more traditional analysis approach is used, the numbers are even lower and by quite a lot. However, it is also possible that definitional changes in the code for fires involving playing, as well as changes in the relationship of this cause to other causes, like intentional, are also factors in the apparent decline, which may be less than either the stated results or the simpler approach indicate.

Most child-playing home fires are started with lighters or matches. The decline in child-playing lighter fires and losses, which coincided with the introduction in 1994 of the CPSC child-resistant lighter standard, has coincided in time with an equally large and sustained decline in child-playing home match fires and losses. One reason may be that the trend for child-playing match fires was already declining before 1995, while child-playing lighter fires had been increasing for several years before 1995. Another factor may be a generally heightened awareness of the child-playing fire problem. It may reflect growing success in public fire safety education programs, which provided more attention to child supervision and other steps to reduce the child-playing fire problem, and did so at the same time that the lighter standard was being introduced. It is also possible that there is significant miscoding of fire play with lighters as fire play with matches – or that there used to be. If there has been a shift from matches to lighters, a point on which we have no information, that could have played a role in the opposing trends seen before 1995.

The items ignited by home fire play are principally mattresses, bedding, or clothing, followed by upholstered furniture, trash, and papers. The majority of child-playing home fires begin in the bedroom.

The median age of children who start reported fires by playing is 5 years old, compared to a median age of 4 years old for fatal victims and a median age in the late teens for non-fatal injuries.

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Defining and Measuring Fire Play

In NFIRS Version 5.0, “playing with heat source” is a choice under factor contributing to ignition. Its counterparts under earlier versions of NFIRS were “child playing” or “child with” as choices under misuse of heat of ignition and misuse of material ignited. The elaborated text that helps to define “playing with heat source” includes actions that bring a material to a heat source, which means the change in terminology is not meant to exclude what used to be called child playing with material ignited.

The term “play” has dozens of dictionary definitions and has never been given an official definition in any of the standards for reporting of fire incidents. Moreover, the recent coding changes in NFIRS Version 5.0 have removed two elements that previously served to provide some implicit definition of the term.

The term “child” is no longer an automatic part of fire play. Instead, the age of the firesetter can be specified separately if the age of the firesetter is considered a factor. The possibility of fire play by a reckless adult is no longer precluded.

Also, in previous versions of NFIRS, child playing and incendiary or suspicious were competing choices in a data element, ignition factor, that permitted only one choice. In NFIRS 5.0, intentional – the term that replaced incendiary – is a choice under the data element cause, while playing with heat source is a choice under a separate data element, factor contributing to ignition, for which multiple entries are possible.

Many distinctions which have been identified by researchers, educators, and counselors, cannot be made using either the old or the new coding schemes. Curiosity firesetting, experimentation with fire, cries for help, and acting out of strong emotions, all are known to occur. And there are fires that occur during acts of play but without the child intending to ignite a fire, such as knocking over a candle while running around or tossing a paper airplane that sails into a stovetop burner flame. With each of these, a decision must be made as to whether the fire was intentional or unintentional and separately whether playing was involved. In no case, however, is there an opportunity to specify the kinds of details about motive and circumstances that would distinguish these types of fires from each other. Such details can be captured in the arson module.

Which fires are the subject of this report?

This report estimates the problem of children playing with fire based on all fires coded as playing with heat source plus a proportional share of appropriate unknowns. Fires also coded as intentional are not excluded, nor are fires coded as both intentional and playing excluded from the NFPA report on intentional fires.

Analysis was conducted on 1999-2002 fires coded directly in Version 5.0, with age as a factor and either intentional coded as cause or playing coded as factor contributing to ignition. Of these, 48% were coded as playing but not intentional, 31% were coded as playing and intentional, and 21% were coded as intentional but not playing. For those coded as playing but not intentional, 84% involved firesetters under age 10. For those

coded as playing and intentional, 82% involved firesetters under age 10. For those coded as intentional but not playing, 63% involved firesetters under age 10.

These last two percentages, especially the last one, seem rather high. They may indicate that fire departments are under-coding age as a factor for firesetters between 10 and 18 years of age. As more and more fires are coded directly into Version 5.0, it will be important to reach a strong consensus on when to use which combinations of codes.

Very few playing fires are coded as involving adults, but many playing fires are not coded as to age of the person whose play started the fire. Among the 1999-2002 structure fires coded in Version 5.0 (not converted to Version 5.0 format from Version 4.1) as playing, 70% are coded with a human factor contributing to ignition other than “none”. Of these, 28% were coded as both unattended or unsupervised person (a factor that strongly suggests a child but does not require an estimate of the age of the person involved) and age was a factor. Another 40% were coded as age was a factor but not coded as unsupervised or unattended person. That means 32% were not coded with age as a factor (in addition to those fires not coded with any known factor contributing to ignition). Another 26% were coded as unsupervised or unattended person but not as age was a factor. Of the 6% that were not coded as either unsupervised or unattended person or age was a factor (and recognizing that multiple other factors can be recorded), the primary factors coded were multiple persons involved (2%), possibly mentally disabled (2%), and asleep (1%). For those coded as age was a factor, fewer than 1% showed age higher than age 16, only 4% showed age 2 or lower, and 82% showed age 9 or lower.

No attempt has been made to exclude any playing fires from this report on child playing fires. Another problem for the analysis is that there are several categories of unknowns that could be candidates for proportional allocation.

Fires coded with factor contributing to ignition undetermined or blank are classic unknowns. Our normal analytical procedure is to allocate these fires proportionally over all known values of factor contributing to ignition. An exception is fires with factor not coded because it is not required. This second type of unknown consists almost entirely of confined fires, nearly all of which are fires confined to the insides of cooking equipment, chimneys and furnaces. Some confined trash-receptacle fires involve child playing, and these can be estimated using the 1994-1998 fraction of structure fires starting with trash and confined to object of origin that were attributed to child playing.

In addition to these two types of unknowns, for which the best analysis approach seems fairly clear, there are others for which the proper approach is not so clear. Factor contributing to ignition need not be coded if the fire is intentional, but as already noted, intentional fires can also be child-playing fires in the new coding. Factor contributing to ignition also is not coded for fires reported in NFIRS Version 4.1 if their coded ignition factor converts to a Version 5.0 human factor contributing to ignition, which is a different data element from factor contributing to ignition. These are converted to blanks under the Version 5.0 factor contributing to ignition, but it is arguable that something is known about those fires and they should not be treated as unknowns. In this report, the primary analysis treats these fires as unknowns and proportionally allocates them, but a second analysis is also shown without this allocation.

Finally, there are fires coded as “none” under factor contributing to ignition. In a data element like this, which allows multiple entries, an entry of none could be entered after the fire officer’s report is completed, to indicate a blank in both factor-contributing fields. More basically, however, it is not clear how a fire can occur if there literally is no factor to bring heat source and first ignited item together. Therefore, in this report, the primary analysis treats these fires as unknowns and proportionally allocates them, but a second analysis is also shown without this allocation.

Patterns of Child-Playing Fires

In 2002, an estimated 13,900 child-playing structure fires were reported in the U.S., with associated losses of 210 civilian deaths, 1,250 civilian injuries, and \$339 million in direct damage.

Another 200 structure fires confined to trash receptacles, with no casualties (to the nearest ten) and no property damage (to the nearest million dollars) are estimated to be due to child playing as well. The figures for 2002 structure fires, deaths, and injuries are the lowest ever recorded. In 1995, the first full year for the child-resistant lighter standard of the U.S. Consumer Product Safety Commission (CPSC), child-playing fire deaths began declining sharply after a decade with no sustained change up or down. (See Table 1 and Figures 1-3.) Since 1999, coding of outdoor trash fires typically lack cause detail, which is why outdoor fires are not addressed for this report.

For the reasons given in the previous section, it is much more difficult to select the most appropriate analysis approach (e.g., approach to allocating unknowns) after 1998, due to changes in coding in NFIRS Version 5.0. If instead we use a simpler analysis approach, more like our traditional approach, in which only fires reported as factor contributing to ignition undetermined (or field left blank) are proportionally allocated, then the estimates decline much faster. Table 1 shows these lower estimates under the heading “Not Adjusted.” These sharper declines are driven by the speed of conversion of fire department reporting to NFIRS Version 5.0.

Because the period of 1995-1998 showed a large impact from the child-resistant lighter standard, it is certainly possible that that decline has continued. The sharp declines through 2002 implied by the lower estimates may actually be the more accurate estimate of what has been happening. We recommend using both sets of estimates as a range. Also, note that both sets of estimates show a fire problem in decline; only the rate of decline is in question. However, it is also possible that definitional changes in the code for fires involving playing, as well as changes in the relationship of this cause to other causes, like intentional, are also factors in the apparent decline, which may be less than either the stated results or the simpler approach indicate. For example, in 1999-2002 data coded directly into Version 5.0, only 2.3% of structure fires were playing, even if undetermined, none, and not reported are all allocated as unknowns. By contrast, in 1999-2002 data coded initially into Version 4.1, at least 3.6% of structure fires were playing, even if not reported is not allocated (which is a defensible difference in analysis) and undetermined is allocated. While not conclusive, this at least suggests that something about the changes in terminology and positioning of playing is resulting in many fires not being coded as such that would have been coded as playing under NFIRS Version 4.1

Table 2 provides comparable figures for Canada, Japan, and the United Kingdom. Canada’s child-playing fires (546 in 1999) are much lower, relative to population, than the U.S. total. Canada also experienced a sharp decline in child-playing fire deaths in 1995 (50% when calculated on deaths estimated to the nearest one), coinciding with the U.S. change in lighter requirements, which probably affected the Canadian market as well. Japan’s child-playing fire problem is much lower than its U.S. counterpart, whether

measured relative to population or measured as a share of its fire problem. Statistics in the United Kingdom are difficult to evaluate, because coding rule changes in 1994 resulted in a sharp increase in fire injuries generally but also a shift of most child-playing fires to malicious, the U.K. designation for intentional, incendiary, or arson fires.

The leading nonresidential structures for child-playing fires are properties associated with homes.

See Table 3. Buildings associated with homes include dwelling garages and sheds.

Most child-playing home fires are started with lighters or matches.

Table 4 shows that, in 1999-2002, lighters and matches accounted for 67% of child-playing home structure fires, 73% of associated civilian deaths, and 75% of associated civilian injuries. Child-playing candle fires have been increasing in numbers and as a share of the total child-playing fire problem, reflecting the substantial increases in candle usage and candle fires generally.*

Table 5 shows that the decline in child-playing lighter fires and losses, which coincided with the introduction in 1994 of the CPSC child-resistant lighter standard, has coincided in time with an equally large and sustained decline in child-playing home match fires and losses. One reason may be that the trend for child-playing match fires was already declining before 1995, while child-playing lighter fires had been increasing for several years before 1995. Another factor may be a generally heightened awareness of the child-playing fire problem. It may reflect growing success in public fire safety education programs, which provided more attention to child supervision and other steps to reduce the child-playing fire problem, and did so at the same time that the lighter standard was being introduced. It is also possible that there is significant miscoding of fire play with lighters as fire play with matches – or that there used to be. If there has been a shift from matches to lighters, a point on which we have no information, that could have played a role in the opposing trends seen before 1995.

Under most circumstances, matches, lighters, and candles – which account for 78% of child-playing fires – are not considered equipment types in NFIRS. Table 6 shows the leading type of equipment, from among heat sources recognized as equipment, was the range or stove, which accounted for only 2% of child-playing home fires.

Mattresses and bedding were the first item ignited in 33% of child-playing home fires.

Upholstered furniture was the first item ignited in only 6% of child-playing home fires but for 33% of associated civilian deaths, compared to 28% of deaths associated with child-playing home mattress and bedding fires.

Tables 7-9 show that mattresses and bedding dominate more in lighter play fires, while trash is more a factor in match play fires. However, fire play affects a wide diversity of items, which means that restrictions on burnable items are a much less effective way to attempt to reduce the fire play problem.

*For more on candle fire trends, see Marty Ahrens, *Home Candle Fires*, NFPA Fire Analysis and Research Division, Quincy, MA, September 2004.

The majority of child-playing home fires begin in the bedroom.

Tables 10-12 show that other leading areas of origin are living rooms, family rooms, and dens; closets; and kitchens. Garages are coded both as areas of origin and as separate properties (in Table 3). If all such fires were combined, garage would still rank behind kitchen for 1999-2002 child-playing fires.

The median age of children who start reported fires by playing is 5 years old, compared to a median age of 4 years old for fatal victims and a median age in the late teens for non-fatal injuries.

Table 13 shows the age distribution for fatal and non-fatal victims of child-playing fires – overall and for lighter and match fires, specifically, as well as death and injury rates for child-playing fires, by age group. It seems clear that non-fatal injuries often involve parents or other caregivers, but fatal injuries rarely do. Less than one-fifth of fatal injuries involve adults. The highest death rate among adults is for older adults (age 65 or older), who may be less likely to be primary caregivers but, not unexpectedly, face greater risks and greater difficulty in responding to fire if it occurs.

The U.S. Consumer Product Safety Commission (CPSC) conducted special studies of samples of 1986-88 child-playing residential fires involving lighters.* CPSC found that two-thirds of the victims of the lighter fires were not the children who were playing with the lighters. While both fire-starters and victims tended to be preschoolers – 90% of the children whose lighter play started the fires were under age six – the victims often were younger than those who started the fires. The CPSC special study found that the children playing with lighters were most likely to be three or four years old, slightly older than the typical ages of fatal victims of lighter play fires, as shown in Table 13.

Further data is provided by a study by Ditsa Kafry.** Kafry studied 99 randomly selected boys from grades K-4 in the Berkeley, California school district in the late 1970s and found that 45% had engaged in fireplay and 21% caused fires through their fireplay. Of the fires set, 18% were set by children who were aged two or younger when they set the fires. This supports the view that very young children can and do set fires (and unlike the CPSC study, this study dealt almost entirely in fireplay with matches). However, as noted earlier, the 1999-2002 Version 5.0 NFIRS data, which provides our first national data on ages of children who play with fire, show only 4% of child-playing home structure fires set by children aged two or younger.

All of this suggests that any educational or product redesign strategies must target preschoolers and probably need to be effective with children at least as young as three-year-olds. Targeting may be direct to the children or indirect to the parents or caregivers, but this is the age group of concern.

*Beatrice Harwood, "Letter to the Editor," *Fire Journal*, July/August 1989, p. 86, and Beatrice Harwood and James F. Hoebel, "Notice of Proposed Rulemaking for Cigarette Lighters," Report to the U.S. Consumer Product Safety Commission, December 19, 1990.

**Ditsa Kafry, "Playing with Matches: Children and Fire," *Fires and Human Behavior*, 2nd edition, London: David Fulton Publishers, 1990, Chapter 4.

The CPSC special study found boys playing with lighters outnumbered girls by more than four to one. Among *fatal victims* of those fires, however, boys typically outnumber girls by less than two to one. The implication is that girls are often killed by fires started by their male siblings or playmates. A large sex differential is a major factor in the overall gender-related difference in fire death rates for preschoolers. This is consistent with other statistics, such as the male dominance of arrests for every type of crime.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class**

A. Fires

Year	Home		Other Residential Structure		Non-Residential Structure		Total Structure		Vehicle
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	
1980	43,800	(73%)	700	(1%)	15,900	(26%)	60,400	(100%)	4,700
1981	37,900	(68%)	500	(1%)	17,200	(31%)	55,600	(100%)	3,800
1982	30,400	(68%)	500	(1%)	13,600	(31%)	44,500	(100%)	3,600
1983	29,000	(71%)	400	(1%)	11,300	(28%)	40,800	(100%)	3,000
1984	29,000	(72%)	400	(1%)	10,700	(27%)	40,000	(100%)	2,900
1985	27,700	(75%)	500	(1%)	8,800	(24%)	36,900	(100%)	2,100
1986	27,000	(76%)	400	(1%)	8,100	(23%)	35,500	(100%)	2,100
1987	26,300	(77%)	400	(1%)	7,700	(22%)	34,300	(100%)	2,100
1988	26,300	(78%)	400	(1%)	6,900	(21%)	33,500	(100%)	1,900
1989	24,200	(81%)	400	(1%)	5,400	(18%)	29,900	(100%)	1,500
1990	21,700	(82%)	300	(1%)	4,400	(17%)	26,400	(100%)	1,400
1991	22,400	(82%)	300	(1%)	4,700	(17%)	27,500	(100%)	1,400
1992	23,800	(81%)	300	(1%)	5,200	(18%)	29,300	(100%)	1,200
1993	23,500	(83%)	300	(1%)	4,500	(16%)	28,300	(100%)	1,300
1994	24,000	(81%)	300	(1%)	5,200	(18%)	29,500	(100%)	1,500

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported treated separately in , except for confined fires, which are treated separately in the calculation. The “not adjusted” figures do not allocate the fires with factor not reported.

Source: NFIRS and NFPA survey.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class (Continued)**

A. Fires

Year	Home		Other Residential Structure		Non-Residential Structure		Total Structure		Confined Structure Fires in Trash Receptacles	Vehicle
1995	19,800	(79%)	300	(1%)	4,800	(19%)	24,900	(100%)		1,300
1996	18,700	(81%)	300	(1%)	4,000	(18%)	23,000	(100%)		1,200
1997	17,000	(83%)	300	(1%)	3,100	(15%)	20,300	(100%)		800
1998	15,100	(81%)	300	(1%)	3,300	(18%)	18,700	(100%)		900
1999	18,100	(82%)	300	(1%)	3,700	(17%)	22,100	(100%)	100	900
2000	16,100	(83%)	400	(2%)	2,800	(15%)	19,300	(100%)	200	1,000
2001	13,200	(80%)	300	(2%)	3,100	(19%)	16,600	(100%)	400	1,100
2002	11,000	(79%)	400	(3%)	2,500	(18%)	13,900	(100%)	500	800

Not Adjusted

1999	14,600		200		2,600		17,500			700
2000	12,600		300		2,000		14,800			700
2001	8,400		200		1,700		10,300			600
2002	7,100		200		1,400		8,700			400

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported because not required, except for confined fires, which are treated separately in the calculation. The “not adjusted” figures do not allocate the fires with factor not reported.

Source: NFIRS and NFPA survey.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class (Continued)**

B. Civilian Deaths

Year	Home		Child-Playing as % of Home Fire Deaths	Other Residential Structure		Non- Residential Structure		Total Structure		Vehicle
1980	430	(99%)	8%	0	(0%)	10	(1%)	440	(100%)	10
1981	300	(93%)	6%	0	(0%)	20	(7%)	320	(100%)	0
1982	280	(95%)	6%	0	(0%)	10	(5%)	290	(100%)	0
1983	310	(94%)	7%	0	(0%)	20	(6%)	330	(100%)	10
1984	300	(97%)	7%	10	(3%)	0	(0%)	310	(100%)	0
1985	390	(93%)	8%	20	(4%)	10	(3%)	420	(100%)	0
1986	380	(98%)	8%	0	(0%)	10	(2%)	390	(100%)	0
1987	490	(98%)	11%	0	(1%)	10	(2%)	500	(100%)	0
1988	510	(99%)	10%	0	(1%)	0	(1%)	510	(100%)	10
1989	460	(98%)	11%	0	(1%)	0	(1%)	460	(100%)	0
1990	330	(97%)	8%	10	(2%)	10	(1%)	350	(100%)	10
1991	430	(94%)	12%	0	(1%)	30	(6%)	460	(100%)	0
1992	370	(99%)	10%	0	(0%)	0	(1%)	370	(100%)	10
1993	400	(98%)	11%	0	(1%)	10	(1%)	410	(100%)	0
1994	410	(100%)	12%	0	(0%)	0	(0%)	410	(100%)	0

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported because not required, except for confined fires, which are excluded from the calculation entirely. The “not adjusted” figures do not allocate the fires with factor not reported.

Source: NFIRS and NFPA survey.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class (Continued)**

B. Civilian Deaths

Year	Home		Child-Playing as % of Home Fire Deaths	Other Residential Structure		Non- Residential Structure		Total Structure		Confined Structure Fires in Trash Receptacles	Vehicle
1995	300	(100%)	8%	0	(0%)	0	(0%)	300	(100%)	0	10
1996	280	(100%)	7%	0	(0%)	0	(0%)	280	(100%)	0	0
1997	270	(98%)	8%	0	(0%)	10	(2%)	280	(100%)	0	0
1998	220	(96%)	7%	0	(2%)	0	(2%)	220	(100%)	0	10
1999	240	(93%)	8%	20	(7%)	0	(0%)	260	(100%)	0	0
2000	370	(99%)	11%	0	(0%)	10	(1%)	380	(100%)	0	0
2001	220	(93%)	7%	0	(0%)	20	(7%)	240	(100%)	0	0
2002	210	(100%)	8%	0	(0%)	0	(0%)	210	(100%)	0	10

Not adjusted

1999	150			10		0		160			0
2000	230			0		0		230			0
2001	120			0		10		130			0
2002	100			0		0		100			0

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported because not required, except for confined fires, which are excluded from the calculation entirely. The “not adjusted” figures do not allocate the fires with factor not reported.

Source: NFIRS and NFPA survey.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class (Continued)**

C. Civilian Injuries

Year	Home		Other Residential Structure		Non-Residential Structure		Total Structure		Vehicle
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	
1980	2,060	(96%)	0	(0%)	90	(4%)	2,150	(100%)	60
1981	1,770	(92%)	10	(1%)	150	(8%)	1,930	(100%)	20
1982	1,870	(94%)	10	(1%)	100	(5%)	1,990	(100%)	20
1983	2,010	(93%)	20	(1%)	130	(6%)	2,160	(100%)	70
1984	2,020	(96%)	10	(0%)	80	(4%)	2,110	(100%)	30
1985	2,040	(95%)	20	(1%)	100	(5%)	2,150	(100%)	40
1986	2,020	(95%)	10	(0%)	100	(5%)	2,120	(100%)	40
1987	2,330	(96%)	20	(1%)	80	(3%)	2,430	(100%)	20
1988	2,420	(95%)	20	(1%)	100	(4%)	2,540	(100%)	40
1989	2,360	(94%)	20	(1%)	140	(5%)	2,520	(100%)	40
1990	2,250	(95%)	10	(0%)	120	(5%)	2,380	(100%)	20
1991	2,610	(97%)	20	(1%)	70	(3%)	2,690	(100%)	20
1992	2,810	(97%)	30	(1%)	70	(2%)	2,910	(100%)	30
1993	2,840	(96%)	20	(1%)	100	(3%)	2,970	(100%)	10
1994	2,620	(96%)	50	(2%)	70	(3%)	2,740	(100%)	40

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on).. Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported because not required, except for confined fires, which are excluded from the calculation entirely. The “not adjusted” figures do not allocate the fires with factor not reported.

Source: NFIRS and NFPA survey.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class (Continued)**

C. Civilian Injuries

Year	Home		Other Residential Structure		Non-Residential Structure		Total Structure		Confined Structure Fires in Trash Receptacles	Vehicle
1995	2,310	(97%)	20	(1%)	50	(2%)	2,370	(100%)		30
1996	2,020	(96%)	20	(1%)	60	(3%)	2,100	(100%)		40
1997	1,940	(97%)	20	(1%)	40	(2%)	2,000	(100%)		20
1998	1,650	(99%)	0	(0%)	30	(1%)	1,670	(100%)		30
1999	2,140	(95%)	40	(2%)	60	(3%)	2,240	(100%)	0	30
2000	1,990	(97%)	10	(1%)	50	(3%)	2,060	(100%)	0	30
2001	1,460	(94%)	20	(1%)	70	(5%)	1,550	(100%)	0	30
2002	1,170	(94%)	50	(4%)	30	(2%)	1,250	(100%)	0	30
Not adjusted										
1999	1,680		30		40		1,750			30
2000	1,530		10		50		1,580			20
2001	1,070		10		50		1,140			20
2002	820		30		20		870			20

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported because not required, except for confined fires, which are excluded from the calculation entirely. The “not adjusted” figures do not allocate the fires with factor not reported.

Source: NFIRS and NFPA survey.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class (Continued)**

D. Direct Property Damage (in Millions)

Year	Home		Other Residential Structure		Non-Residential Structure		Structure Total		Structure Total (Adjusted to 2002 Dollars)	Vehicle
	\$	(%)	\$	(%)	\$	(%)	\$	(%)		
1980	\$140	(84%)	\$1	(0%)	\$26	(15%)	\$167	(100%)	\$364	\$3
1981	\$145	(80%)	\$2	(1%)	\$35	(19%)	\$182	(100%)	\$360	\$3
1982	\$131	(86%)	\$1	(1%)	\$21	(14%)	\$153	(100%)	\$285	\$2
1983	\$154	(84%)	\$1	(1%)	\$29	(16%)	\$184	(100%)	\$332	\$3
1984	\$162	(90%)	\$1	(1%)	\$17	(10%)	\$181	(100%)	\$312	\$3
1985	\$189	(88%)	\$1	(1%)	\$26	(12%)	\$215	(100%)	\$359	\$1
1986	\$186	(91%)	\$2	(1%)	\$16	(8%)	\$204	(100%)	\$335	\$1
1987	\$203	(91%)	\$1	(0%)	\$19	(9%)	\$223	(100%)	\$354	\$2
1988	\$208	(88%)	\$2	(1%)	\$26	(11%)	\$236	(100%)	\$359	\$2
1989	\$229	(94%)	\$3	(1%)	\$12	(5%)	\$244	(100%)	\$354	\$1
1990	\$206	(92%)	\$1	(1%)	\$16	(7%)	\$223	(100%)	\$307	\$2
1991	\$285	(94%)	\$3	(1%)	\$16	(5%)	\$304	(100%)	\$401	\$14
1992	\$206	(91%)	\$3	(1%)	\$18	(8%)	\$226	(100%)	\$290	\$1
1993	\$269	(90%)	\$3	(1%)	\$26	(9%)	\$297	(100%)	\$370	\$1
1994	\$269	(92%)	\$2	(1%)	\$21	(7%)	\$292	(100%)	\$355	\$2

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to "playing" are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported because not required, except for confined fires, which are excluded from the calculation entirely. The "not adjusted" figures do not allocate the fires with factor not reported.

Source: NFIRS and NFPA survey.

**Table 1. Child-Playing Structure and Vehicle Fires Reported to U.S. Fire Departments, 1980-2002
Trends by Major Property Class (Continued)**

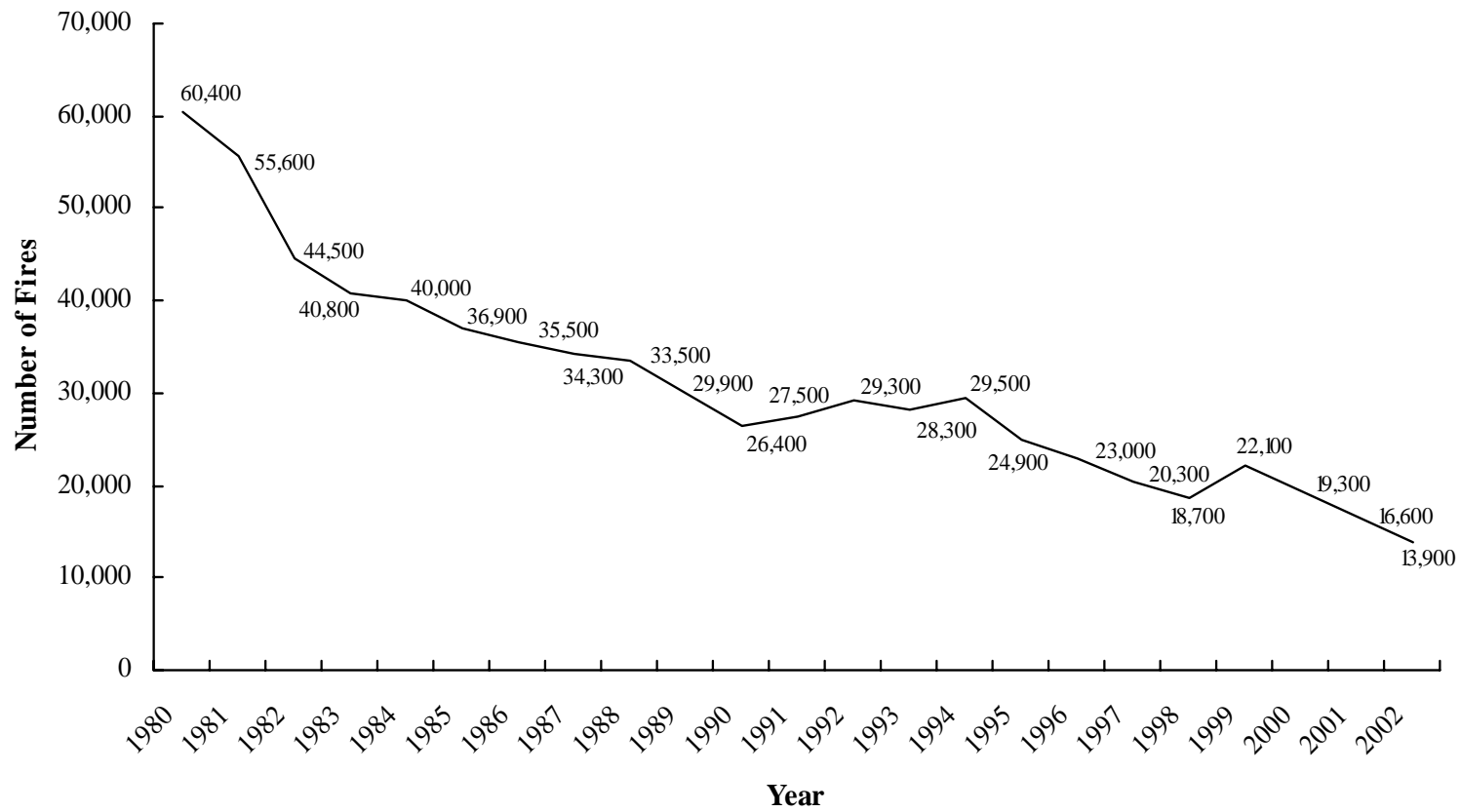
D. Direct Property Damage (in Millions)

Year	Home		Other Residential Structure		Non-Residential Structure		Structure Total		Structure Total (Adjusted to 2002 Dollars)	Confined Structure Fires in Trash Receptacles	Vehicle
1995	\$255	(90%)	\$2	(1%)	\$24	(9%)	\$282	(100%)	\$333		\$3
1996	\$255	(93%)	\$5	(2%)	\$16	(6%)	\$275	(100%)	\$316		\$2
1997	\$262	(93%)	\$2	(1%)	\$17	(6%)	\$281	(100%)	\$315		\$1
1998	\$210	(92%)	\$2	(1%)	\$16	(7%)	\$229	(100%)	\$253		\$2
1999	\$320	(92%)	\$7	(2%)	\$20	(6%)	\$347	(100%)	\$375	\$0	\$2
2000	\$350	(91%)	\$7	(2%)	\$30	(8%)	\$386	(100%)	\$404	\$0	\$2
2001	\$260	(87%)	\$6	(2%)	\$32	(11%)	\$298	(100%)	\$303	\$0	\$4
2002	\$266	(79%)	\$16	(5%)	\$56	(16%)	\$339	(100%)	\$339	\$0	\$1
Not adjusted											
1999	\$248		\$4		\$16		\$267				\$2
2000	\$251		\$4		\$20		\$275				\$1
2001	\$184		\$3		\$20		\$208				\$2
2002	\$170		\$8		\$29		\$207				\$1

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to "playing" are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported because not required, except for confined fires, which are excluded from the calculation entirely. The "not adjusted" figures do not allocate the fires with factor not reported.

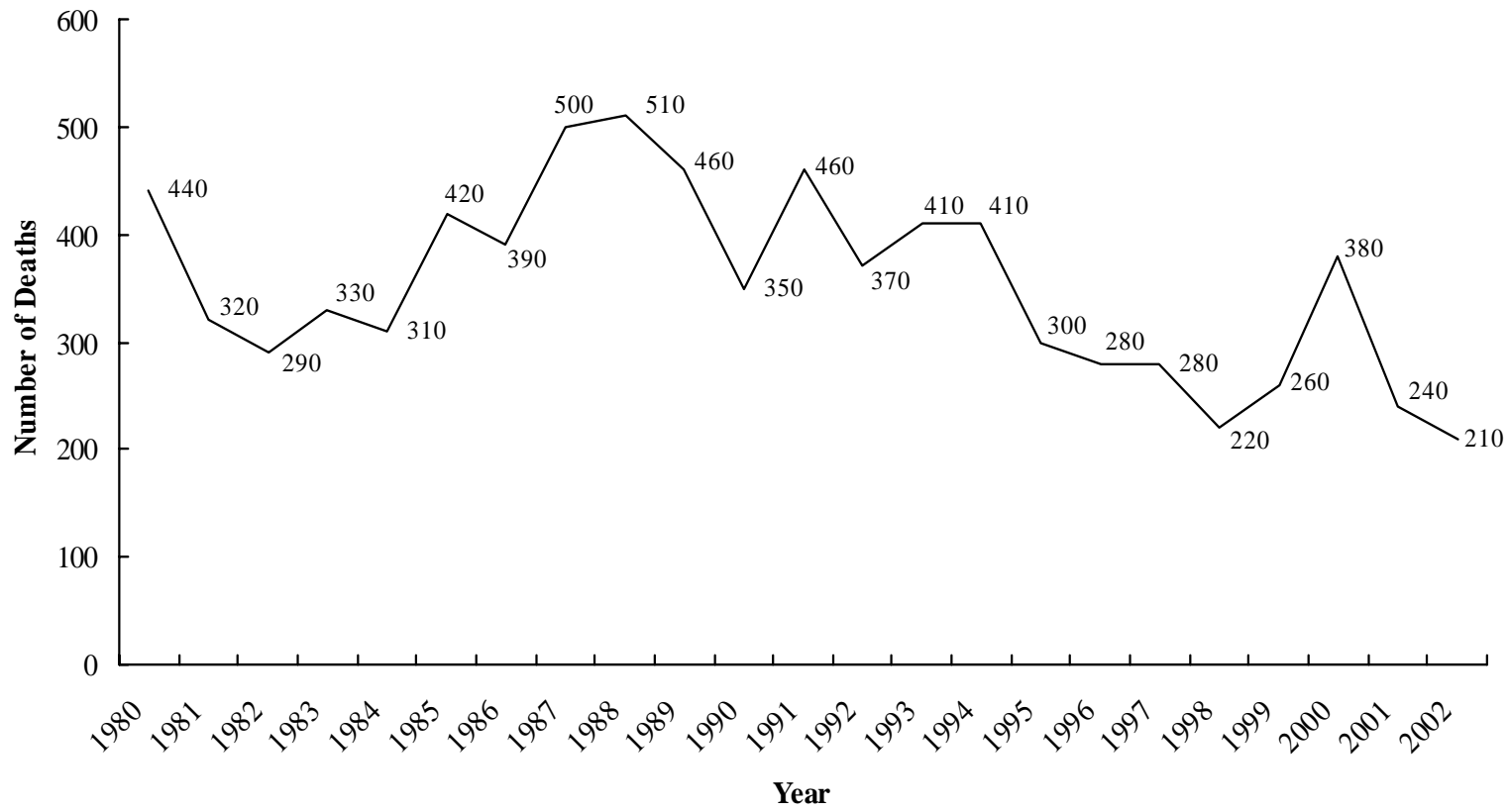
Source: NFIRS and NFPA survey.

Figure 1.
Child-Playing Structure Fires, 1980-2002



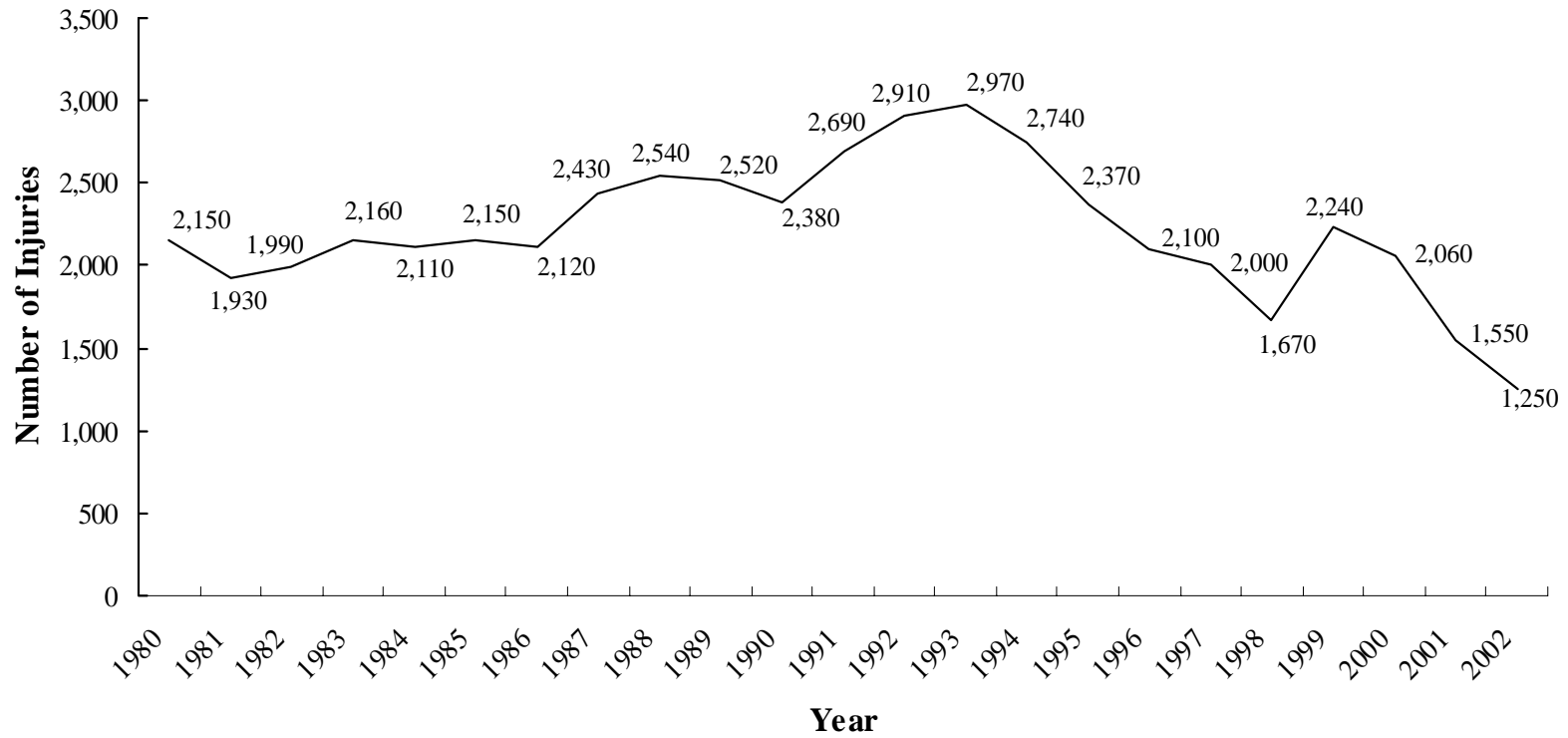
Source: NFIRS and NFPA survey.

Figure 2.
Civilian Deaths in Child-Playing Structure Fires,
1980-2002



Source: NFIRS and NFPA survey.

Figure 3.
Civilian Injuries in Child-Playing Structure Fires,
1980-2002



Source: NFIRS and NFPA survey.

Table 2. Child-Playing Fires in Other Countries, 1990-1999

A. Canada

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)		
				<u>In Canadian Dollars</u>	<u>In U.S. Dollars</u>	<u>In 2002 U.S. Dollars</u>
1990	1,230	20	120	\$15	\$13	\$18
1991	1,210	10	100	\$15	\$13	\$17
1992	1,290	30	130	\$15	\$12	\$16
1993	830	20	130	\$13	\$10	\$12
1994	900	20	110	\$14	\$10	\$13
1995	920	10	120	\$14	\$11	\$12
1996	610	10	70	\$10	\$7	\$8
1997	680	10	90	\$12	\$8	\$9
1998*	3,750	50	370	\$55	\$37	\$41
1999	550	20	100	\$12	\$8	\$9

*All child-playing fire statistics for 1998 are far off the trendline and are probably incorrect. The reason is unknown.

Note: Fires, deaths and injuries are shown to the nearest ten, and damages are shown to the nearest million dollars. Adjustment of damage to 2002 U.S. dollars is done using the consumer price index. Figures include a proportional allocation of fires with unknown or undetermined cause. As of 2000, Canada stopped listing child-playing fires separately from other types of misuse of heat source.

Source: Annual reports of the Canadian Fire Commissioner.

Table 2. Child-Playing Fires in Other Countries, 1990-2001 (Continued)

B. Japan Structure Fires

Year	Fires	Civilian Deaths	Direct Property Damage		
			<u>In Billions of Yen</u>	<u>In Millions of U.S. Dollars</u>	<u>In Millions of 2002 U.S. Dollars</u>
1990	1,500	50	¥3.9	\$27	\$37
1991	1,500	20	¥3.8	\$28	\$37
1992	1,500	40	¥3.9	\$31	\$40
1993	1,500	30	¥3.6	\$33	\$41
1994	1,400	50	¥4.1	\$40	\$49
1995	1,200	20	¥3.2	\$34	\$40
1996	1,200	30	¥3.3	\$30	\$35
1997	1,300	40	¥2.9	\$24	\$27
1998	1,100	30	¥2.5	\$19	\$21
1999	1,100	20	¥2.7	\$24	\$26
2000	1,000	20	¥2.4	\$22	\$23
2001	900	20	¥1.9	\$16	\$16

Note: Fires are shown to the nearest hundred, deaths to the nearest ten, and damages to the nearest hundred million yen or million dollars. Figure on injuries are unavailable. Figures include a proportional allocation of fires with unknown or undetermined cause.

Source: Japan's White Book and special analyses by Dr. Ai Sekizawa, National Research Institute for Fire and Disaster.

Table 2. Child-Playing Fires in Other Countries, 1990-2002 (Continued)

C. United Kingdom Structure Fires

Year	Fires			Civilian Deaths in Homes	Civilian Injuries in Homes
	Home	Other	All		
1990	3,300	2,100	5,400	40	780
1991	2,900	1,800	4,700	40	750
1992	3,300	2,100	5,400	40	920
1993	3,200	2,000	5,200	40	870
.....					
1994*	1,200	300	1,500	20	590
1995	1,100	300	1,400	30	510
1996	1,100	300	1,400	20	490
1997	1,100	200	1,300	20	480
1998	1,100	200	1,300	10	430
1999	900	200	1,100	0	350
2000	800	200	1,000	10	350
2001	800	100	900	10	360
2002	700	100	800	0	360

*Coding changes in 1994 switched most child-playing fires to malicious, so it is not possible to compare numbers from 1994 or to numbers prior to 1994.

Note: Fires are shown to the nearest hundred and deaths and injuries to the nearest ten. Figures on property damage are unavailable. Figures include a proportional allocation of fires with unknown or undetermined cause.

Source: *Fire Statistics – United Kingdom* series from the U.K. Home Office.

Table 3. Child-Playing Structure Fires, by Property Use
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002

Property Use	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
One- or two-family dwelling	63%	80%	69%	64%
Apartment	21%	17%	27%	26%
Dwelling garage	3%	0%	0%	1%
Outbuilding or sheds	2%	0%	0%	1%
Unclassified residential property	1%	0%	1%	1%
Livestock or poultry storage	1%	0%	0%	1%
Outbuilding used as a protective shelter	1%	0%	0%	0%
Unclassified storage property	1%	1%	0%	0%
High school, junior high school, or middle school	1%	0%	0%	0%
Warehouse	1%	0%	0%	2%
Other known property use	5%	1%	1%	4%
Unknown property use	1%	1%	1%	1%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children.

Source: NFIRS and NFPA survey.

**Table 4. Child-Playing Home Structure Fires, by Heat Source
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002**

Heat Source	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Lighter	42%	60%	59%	44%
Match	29%	19%	20%	27%
Candle	7%	5%	8%	8%
Radiated or conducted heat from operating equipment	5%	3%	2%	2%
Unclassified open flame or smoking material	4%	6%	4%	5%
Fireworks	3%	1%	1%	2%
Spark, ember or flame from operating equipment	1%	1%	2%	1%
Cigarette	1%	0%	0%	1%
Unclassified hot or smoldering object	1%	1%	0%	1%
Unclassified heat source	1%	1%	0%	1%
Unclassified heat from powered equipment	1%	0%	1%	0%
Unclassified heat spread from another fire	1%	4%	1%	1%
Unclassified smoking material	1%	0%	0%	1%
Flame or torch used for lighting	1%	0%	0%	1%
Other known heat source	2%	0%	1%	5%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with heat source unknown.

Source: NFIRS and NFPA survey.

Table 5. Child-Playing Home Structure Fires Involving Matches or Lighters, 1980-2002

A. Fires

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Lighter	8,900	8,200	7,600	7,300	7,600	7,500	7,900	8,000	7,700
Match	25,300	21,200	16,100	15,300	14,800	13,700	13,200	12,800	12,700
	1989	1990	1991	1992	1993	1994	1995	1996	1997
Lighter	7,700	7,200	8,200	9,100	9,800	10,400	7,900	7,000	6,300
Match	11,500	9,900	9,500	9,900	9,000	8,900	7,400	7,100	5,900
	1998	1999	2000		2001		2002		
Lighter	5,700	7,400	(6,000)	7,000	(5,500)	5,300	(3,400)	4,800	(3,100)
Match	5,500	5,700	(4,600)	4,500	(3,500)	3,800	(2,400)	2,900	(1,900)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with heat source unknown and of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported, except for confined fires, which are excluded from the calculation entirely. The numbers in parentheses do not include allocations of the not-reported fires.

Source: NFIRS and NFPA survey.

Table 5. Child-Playing Home Structure Fires Involving Matches or Lighters, 1980-2002 (Continued)

B. Civilian Deaths

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Lighter	220	100	100	120	60	120	170	170	200
Match	170	180	120	140	160	190	160	210	230
	1989	1990	1991	1992	1993	1994	1995	1996	1997
Lighter	160	130	230	190	150	230	180	120	120
Match	170	120	140	120	150	140	100	80	70
	1998	1999		2000		2001		2002	
Lighter	120	130	(80)	280	(170)	80	(40)	130	(70)
Match	70	80	(50)	30	(20)	60	(30)	30	(20)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with heat source unknown and of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported, except for confined fires, which are excluded from the calculation entirely. The numbers in parentheses do not include allocations of the not-reported fires.

Source: NFIRS and NFPA survey.

Table 5. Child-Playing Home Structure Fires Involving Matches or Lighters, 1980-2002 (Continued)

C. Civilian Injuries

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Lighter	780	550	700	760	730	850	920	970	1,020
Match	910	940	840	820	920	780	740	940	940
	1989	1990	1991	1992	1993	1994	1995	1996	1997
Lighter	1,060	1,060	1,400	1,490	1,570	1,520	1,190	1,070	810
Match	940	850	790	840	800	740	680	620	700
	1998	1999	2000		2001		2002		
Lighter	770	1,220	(960)	1,160	(890)	840	(610)	760	(530)
Match	540	480	(380)	420	(320)	260	(190)	200	(140)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with heat source unknown and of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported, except for confined fires, which are excluded from the calculation entirely. The numbers in parentheses do not include allocations of the not-reported fires.

Source: NFIRS and NFPA survey.

Table 5. Child-Playing Home Structure Fires Involving Matches or Lighters, 1980-2002 (Continued)

D. Direct Property Damage (in Millions)

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Lighter	\$36	\$36	\$38	\$45	\$45	\$58	\$64	\$66	\$68
Match	\$75	\$78	\$69	\$76	\$80	\$93	\$87	\$92	\$99
	1989	1990	1991	1992	1993	1994	1995	1996	1997
Lighter	\$81	\$83	\$119	\$99	\$136	\$135	\$107	\$110	\$107
Match	\$92	\$83	\$114	\$73	\$92	\$93	\$95	\$92	\$96
	1998	1999	2000		2001		2002		
Lighter	\$89	\$146	(\$113)	\$153	(\$110)	\$101	(\$72)	\$133	(\$85)
Match	\$70	\$97	(\$75)	\$97	(\$70)	\$60	(\$43)	\$73	(\$47)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are estimated to the nearest hundred, civilian deaths and injuries to the nearest ten, and direct property damage to the nearest million dollars. Adjustment of damage to 2002 dollars is done using the consumer price index. Totals may not equal sums because of rounding. For 1999 and later, all fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with heat source unknown and of fires with ignition factor (up to 1998) or appropriate unknowns (from 1999 on). Appropriate unknowns include factor contributing to ignition undetermined, blank, none, or not reported, except for confined fires, which are excluded from the calculation entirely. The numbers in parentheses do not include allocations of the not-reported fires.

Source: NFIRS and NFPA survey.

**Table 6. Child-Playing Home Fires, by Equipment Involved in Ignition
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002**

Equipment Involved in Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
No equipment involved	87%	86%	89%	87%
Unclassified equipment	3%	2%	2%	3%
Range or stove	2%	1%	1%	1%
Lighter*	2%	9%	4%	3%
Lamp or lighting fixture	1%	1%	0%	1%
Oven or rotisserie	1%	0%	0%	0%
Unclassified cooking or other kitchen equipment	1%	0%	0%	0%
Other known equipment	3%	2%	3%	6%
Total	100%	100%	100%	100%

*Most fires due to playing with a lighter are listed as involving no equipment.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with equipment involved unknown.

Source: NFIRS and NFPA survey.

Table 7. Child-Playing Home Fires, by Item First Ignited
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Mattress and bedding	33%	28%	41%	36%
Clothing	11%	10%	11%	9%
Upholstered furniture	6%	33%	9%	11%
Trash or waste	5%	3%	3%	3%
Papers	5%	1%	4%	6%
Unclassified furniture	4%	5%	5%	5%
Curtains or drapery	3%	1%	2%	2%
Unclassified item first ignited	3%	5%	3%	3%
Floor covering	2%	0%	2%	1%
Multiple items first ignited	2%	5%	2%	3%
Box or bag	2%	3%	1%	2%
Unclassified clothing or soft goods	2%	1%	2%	2%
Toy or game	2%	2%	3%	2%
Structural member or framing	2%	2%	2%	2%
Exterior wall covering	2%	0%	0%	2%
Linen other than bedding	2%	0%	2%	1%
Interior wall covering	1%	1%	1%	1%
Accelerant or other combustible or flammable liquid or gas	1%	0%	2%	1%
Cooking materials	1%	1%	0%	0%
Other known item	10%	2%	6%	8%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with item first ignited unknown.

Source: NFIRS and NFPA survey.

**Table 8. Child-Playing Home Fires Involving Lighters, by Item First Ignited
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002**

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Mattress or bedding	41%	30%	44%	43%
Clothing	11%	12%	12%	10%
Upholstered furniture	7%	36%	11%	11%
Papers	5%	0%	4%	5%
Unclassified furniture	5%	4%	6%	5%
Curtains or drapery	4%	1%	3%	2%
Trash or waste	3%	0%	1%	2%
Box or bag	2%	5%	1%	3%
Unclassified clothing or soft goods	2%	0%	2%	2%
Unclassified item first ignited	2%	5%	2%	3%
Toy or game	2%	2%	3%	1%
Linen other than bedding	2%	0%	2%	1%
Floor covering	2%	0%	1%	1%
Multiple items first ignited	2%	4%	3%	3%
Other known item	10%	1%	6%	9%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with item first ignited unknown.

Source: NFIRS and NFPA survey.

**Table 9. Child-Playing Home Fires Involving Matches, by Item First Ignited
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002**

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Mattress or bedding	35%	28%	40%	35%
Clothing	12%	14%	12%	9%
Trash or waste	8%	0%	6%	5%
Upholstered furniture	6%	14%	7%	15%
Papers	5%	0%	4%	7%
Unclassified furniture	3%	11%	4%	3%
Multiple items first ignited	3%	10%	4%	4%
Unclassified item first ignited	2%	10%	4%	3%
Floor covering	2%	0%	0%	1%
Structural member or framing	2%	5%	3%	2%
Box or bag	2%	0%	4%	1%
Unclassified clothing or soft goods	2%	5%	2%	2%
Curtains or drapery	2%	0%	0%	1%
Exterior wall covering	2%	0%	0%	0%
Accelerant or other flammable or combustible liquid or gas	2%	0%	3%	1%
Interior wall covering	1%	0%	0%	1%
Plants including grass	1%	0%	1%	0%
Toy or game	1%	0%	3%	1%
Linen other than bedding	1%	0%	2%	2%
Other known item	7%	5%	2%	5%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with item first ignited unknown.

Source: NFIRS and NFPA survey.

Table 10. Child-Playing Home Fires, by Area of Origin
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002

Area of Origin Millions)	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in
Bedroom	53%	48%	63%	57%
Living room, den, or family room	7%	29%	11%	10%
Kitchen	7%	2%	4%	3%
Closet	5%	2%	5%	5%
Bathroom	4%	0%	2%	1%
Garage	3%	0%	2%	3%
Exterior wall surface	2%	0%	0%	2%
Exterior balcony or unenclosed porch	2%	3%	0%	2%
Substructure area or crawl space	2%	0%	1%	1%
Laundry area	1%	1%	1%	1%
Unclassified storage area	1%	0%	0%	1%
Tool or supply storage area	1%	0%	1%	1%
Unclassified area of origin	1%	1%	0%	1%
Unclassified function area	1%	6%	2%	1%
Unclassified structural area	1%	1%	1%	1%
Corridor, hallway, or mall	1%	0%	0%	1%
Other known area	8%	8%	6%	10%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with area of fire origin unknown.

Source: NFIRS and NFPA survey.

**Table 11. Child-Playing Home Fires Involving Lighters, by Area of Origin
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002**

Area of Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Bedroom	64%	53%	66%	65%
Living room, den, or family room	8%	32%	10%	10%
Closet	7%	3%	7%	7%
Bathroom	4%	0%	2%	1%
Kitchen	2%	0%	1%	1%
Garage	2%	0%	1%	1%
Exterior wall surface	1%	0%	0%	2%
Substructure area or crawl space	1%	0%	1%	1%
Laundry area	1%	1%	0%	1%
Unclassified function area	1%	4%	2%	2%
Exterior balcony or unenclosed porch	1%	0%	0%	2%
Dining room	1%	0%	2%	1%
Unclassified structural area	1%	0%	0%	1%
Other known area of origin	7%	7%	7%	7%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with area of fire origin unknown.

Source: NFIRS and NFPA survey.

**Table 12. Child-Playing Home Fires Involving Matches, by Area of Origin
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002**

Area of Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Bedroom	54%	56%	65%	62%
Living room, den, or family room	6%	13%	10%	9%
Closet	6%	4%	2%	4%
Garage	4%	0%	5%	4%
Bathroom	4%	0%	3%	1%
Kitchen	3%	5%	4%	3%
Exterior balcony or unenclosed porch	3%	0%	2%	4%
Exterior wall surface	2%	0%	0%	1%
Substructure area or crawl space	2%	0%	2%	1%
Tool or supply storage area	1%	0%	1%	0%
Outside open area	1%	0%	0%	2%
Unclassified storage area	1%	0%	0%	1%
Corridor, hallway, or mall	1%	0%	0%	0%
Laundry area	1%	0%	1%	0%
Other known area	10%	22%	7%	7%
Total	100%	100%	100%	100%

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with area of fire origin unknown.

Source: NFIRS and NFPA survey.

**Table 13. Victims of Child-Playing Home Fires
by Age of Victim and Heat Source
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002**

A. All Heat Sources, Including Matches and Lighters

Age of Victim	Annual Average		Rate per Million Population	
	Civilian Deaths	Civilian Injuries	Civilian Deaths	Civilian Injuries
Under 2 years old	15%	5%	3.0	8.9
2 years old	15%	4%	5.9	13.1
3 years old	16%	5%	6.4	16.7
4 years old	8%	6%	3.2	19.0
5 years old	7%	4%	2.6	14.1
6 years old	5%	4%	1.8	12.9
7 years old	5%	2%	1.8	7.6
8 years old	4%	2%	1.5	5.8
9 years old	2%	2%	0.7	4.7
10 years old	1%	2%	0.5	5.6
11-14 years old	5%	8%	0.5	6.6
15-17 years old	0%	3%	0.0	3.3
18-20 years old	0%	3%	0.0	3.6
21-29 years old	7%	16%	0.3	6.1
30-39 years old	2%	16%	0.1	4.6
40-49 years old	2%	9%	0.1	2.6
50-64 years old	1%	4%	0.0	1.3
65 years old or more	5%	4%	0.2	1.3
0-4 years old	55%	20%	4.3	13.3
0-14 years old	83%	45%	2.1	9.5
0-17 years old	83%	48%	1.7	8.4
0-20 years old	83%	51%	1.5	7.7
Total	100%	100%	0.5	4.5

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with victim age unknown.

Source: NFIRS and NFPA survey.

**Table 13. Victims of Child-Playing Home Fires
by Heat Source and Age of Victim
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002 (Continued)**

B. Lighter

Age of Victim	Annual Average		Rate per Million Population	
	Civilian Deaths	Civilian Injuries	Civilian Deaths	Civilian Injuries
Under 2 years old	15%	5%	1.6	4.5
2 years old	13%	3%	2.9	5.3
3 years old	15%	6%	3.4	11.0
4 years old	12%	8%	2.6	13.9
5 years old	7%	5%	1.7	9.6
6 years old	6%	3%	1.2	6.3
7 years old	6%	3%	1.2	4.5
8 years old	6%	2%	1.2	3.6
9 years old	2%	1%	0.3	2.2
10 years old	1%	2%	0.2	3.4
11-14 years old	3%	6%	0.2	2.7
15-17 years old	0%	3%	0.0	1.6
18-20 years old	0%	4%	0.0	2.1
21-29 years old	6%	18%	0.1	3.7
30-39 years old	3%	16%	0.1	2.6
40-49 years old	1%	9%	0.0	1.4
50-64 years old	0%	4%	0.0	0.7
65 years old or more	6%	3%	0.1	0.6
0-4 years old	54%	21%	2.4	7.8
0-14 years old	84%	44%	1.2	5.2
0-17 years old	84%	47%	1.0	4.6
0-20 years old	84%	50%	0.9	4.3
Total	100%	100%	0.3	2.5

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with victim age unknown.

Source: NFIRS and NFPA survey.

**Table 13. Victims of Child-Playing Home Fires
by Heat Source and Age of Victims
Annual Average of Structure Fires Reported to U.S. Fire Departments, 1999-2002 (Continued)**

C. Matches

Age of Victim	Annual Average		Rate per Million Population	
	Civilian Deaths	Civilian Injuries	Civilian Deaths	Civilian Injuries
Under 2 years old	27%	8%	0.9	2.4
2 years old	10%	7%	0.7	4.3
3 years old	22%	3%	1.5	1.8
4 years old	5%	2%	0.4	1.4
5 years old	4%	5%	0.3	3.4
6 years old	0%	6%	0.0	3.6
7 years old	9%	3%	0.6	1.7
8 years old	4%	2%	0.3	1.0
9 years old	0%	2%	0.0	1.2
10 years old	4%	2%	0.3	0.9
11-14 years old	4%	12%	0.1	1.7
15-17 years old	0%	4%	0.0	0.9
18-20 years old	0%	3%	0.0	0.6
21-29 years old	4%	12%	0.0	0.9
30-39 years old	0%	14%	0.0	0.8
40-49 years old	0%	9%	0.0	0.5
50-64 years old	0%	3%	0.0	0.2
65 years old or more	4%	5%	0.0	0.4
0-4 years old	65%	19%	0.9	2.4
0-14 years old	92%	50%	0.4	2.0
0-17 years old	92%	54%	0.3	1.8
0-20 years old	92%	57%	0.3	1.7
Total	100%	100%	0.1	0.9

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Percents are shown because of the uncertainties regarding the totals (see Table 1). Totals may not equal sums because of rounding. All fires attributed to “playing” are included, and so statistics may not be limited to fireplay by children. Statistics include a proportional share of child-playing fires with victim age unknown.

Source: NFIRS and NFPA survey.

What Can Be Done About Child-Playing Fires?

Educational programs that teach children about the dangers of matches and lighters are part of *Risk Watch*, a program that reaches from grade 8 down to pre-school. However, *Risk Watch* is in use in only about five percent of the nation's classrooms, so its impact is reduced by its limited market penetration.

There is urgent need for wider use of effective fire safety educational programs, supplemented by other initiatives such as the use of product labeling and mass media public awareness. Labels are needed on matches and lighters themselves, not just on wrappers or packages that are discarded after purchase. These labels should remind adults of the dangers of small children playing with the products and, if possible, discourage the children themselves. Mass media programs on matches and lighters can target parents, guardians and other caregivers of preschoolers. These family members must be encouraged to supervise children and to keep dangerous fireplay articles out of their reach and sight. Smokers must remain conscious of children in the home.

NFPA's Center for High Risk Outreach tested a television public service announcement (PSA) designed to teach preschoolers to tell grown-ups if they see matches or lighters. The test, conducted with children age 3 to 6 in several day-care centers in low-income communities in Boston and in schools in several towns near Boston, found that children age 3 to 4 – the primary target group – did not sufficiently comprehend the message without interaction with an adult. As a result, the Center concluded that effective strategies needed to focus on the preschool curriculum, where children interact with adults when learning a match or lighter lesson, and on other messages targeted on caregivers.

Studies of firesetting behavior have demonstrated that many young children who start fires are in crisis. They may be crying for help or reacting to other stressful life experiences. It is important that any child suspected of starting fires be assessed by knowledgeable parties so that he or she may be treated in a manner appropriate to the circumstance.

Because preschool children are the ones principally at risk, because many preschoolers are not in preschools where they can be reached by preschool programs, and because preschoolers may not be reached by labels, public fire safety education via mass media messages targeted to parents and other caregivers must be more widely distributed and must be aired or published in prime locations. Toward that end, NFPA's Center for High Risk Outreach offers parents and caregivers of preschool children, particularly in selected high-risk communities, "A Lighter is Not a Toy," an 8 minute video. It emphasizes the importance of keeping all lighters and matches away from children and never leaving children unattended.

NFPA's *Risk Watch* website (www.riskwatch.org) includes match and lighter safety material especially for parents.

The U.S. Consumer Product Safety Commission, whose 1994 child-resistant lighter requirement is associated with large declines in child-playing fires and losses, is considering requirements to increase small open-flame resistance for upholstered furniture and mattresses. Because child-playing fires are nearly all small open-flame ignitions, these product requirements could make a significant difference in the remaining child-playing fire problem.

Appendix A: How National Estimates Statistics Are Calculated

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

Data Bases Used

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

The strength of NFIRS is that it provides the most detailed incident information of any national data base not limited to large fires. NFIRS is the only data base capable of addressing national patterns for fires of all sizes by specific property use and specific fire cause. (The NFPA survey separates fewer than 20 of the hundreds of property use categories defined by NFPA 901 and solicits no cause-related information except for incendiary and suspicious fires.) NFIRS also captures information on the avenues and extent of flame spread and smoke spread and on the performance of detectors and sprinklers. For more information about NFIRS visit <http://www.usfa.fema.gov/nfirs>.

The NFPA survey is based on a stratified random sample of roughly 3,000 U.S. fire departments (or just over one of every ten fire departments in the country). The survey includes the following information: (1) the total number of fire incidents, civilian deaths, and civilian injuries, and the total estimated property damage (in dollars), for each of the major property use classes defined by the NFPA 901 Standard; (2) the number of on-duty firefighter injuries, by type of duty and nature of illness; and (3) information on the type of community protected (e.g., county versus township versus city) and the size of the population protected, which is used in the statistical formula for projecting national totals from sample results.

The NFPA survey begins with the NFPA Fire Service Inventory, a computerized file of about 30,000 U.S. fire departments, which is the most complete and thoroughly validated such listing in existence. The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities protect fewer people per department and are less likely to respond to the survey, so a large number must be surveyed to obtain an adequate sample of those departments. (NFPA also makes follow-up calls to a sample of the smaller fire departments that do not respond, to confirm that those that did respond are truly representative of fire departments their size.) On the other hand, large city departments are so few in number and protect such a large proportion of the total U.S. population that it makes sense to

survey all of them. Most respond, resulting in excellent precision for their part of the final estimate. The results of the survey are published in the annual report Fire Loss in the United States. To download a free copy of the report visit <http://www.nfpa.org/assets/files/PDF/OS.fireloss.pdf>

Projecting NFIRS to National Estimates

To project NFIRS results to national estimates, one needs at least an estimate of the NFIRS fires as a fraction of the total so that the fraction can be inverted and used as a multiplier or scaling ratio to generate national estimates from NFIRS data. But NFIRS is a sample from a universe whose size cannot be inferred from NFIRS alone. Also, participation rates in NFIRS are not necessarily uniform across regions and sizes of community, both of which are factors correlated with frequency and severity of fires. This means NFIRS may be susceptible to systematic biases. No one at present can quantify the size of these deviations from the ideal, representative sample, so no one can say with confidence that they are or are not serious problems. But there is enough reason for concern so that a second data base - the NFPA survey - is needed to project NFIRS to national estimates and to project different parts of NFIRS separately. This multiple calibration approach makes use of the annual NFPA survey where its statistical design advantages are strongest.

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

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

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

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

Calculating National Estimates of Particular Types of Fires

Most analyses of interest involve the calculation of the estimated number of fires not only within a particular occupancy but also of a particular type. The types that are mostly frequently of interest are those defined by some ignition-cause characteristic. The

six cause-related characteristics most commonly used to describe fires are: form of the heat that caused the ignition, equipment involved in ignition, form or type of material first ignited, the ignition factor that brought heat source and ignited material together, and area of origin. Other characteristics of interest are victim characteristics, such as ages of persons killed or injured in fire.

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

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

Rounding Errors

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

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

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

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

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

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

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

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

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