

# **Fires Caused by Children Playing with Lighters**

An Evaluation of the CPSC Safety Standard  
for Cigarette Lighters

September 2000  
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## **Executive Summary**

In response to the increasing number of fire deaths caused by young children playing with cigarette lighters, the U.S. Consumer Product Safety Commission (CPSC) promulgated the "Safety Standard for Cigarette Lighters" that required most cigarette lighters to be resistant to operation by children younger than age 5. The Standard became effective on July 12, 1994, for lighters manufactured or imported after that date. It applies to disposable, inexpensive, cigarette lighters and novelty lighters that appeal to young children.

This report was prepared to evaluate the effectiveness of this CPSC Safety Standard and to describe the lighter child play fires that are still occurring. The report is based on the results of two CPSC studies that were conducted to identify the ages of the children involved in starting cigarette lighter child play fires. The first, pre-Standard, study was conducted between 1985 and 1987. The second, post-Standard, study was conducted from October 1997 to February 1999. National estimates of cigarette lighter fires caused by children younger than age 5 were based on the results of these studies as well as data from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA) annual survey of U.S. fire losses.

To estimate the effect of the CPSC Standard, we compared the ratio of cigarette lighter fires caused by children younger than age 5 to those caused by children age 5 and older, before and after the Standard. In the absence of the Standard, it would have been expected that the age ratio would have been the same in both time periods. This approach controls for changes that could have affected both younger and older children, such as changes in the number of smokers or general fire safety improvements. The excess reduction in fire losses seen among the younger age group compared to the older age group is considered a measure of the reduction attributable to the Standard.

Findings were as follows:

- In 1998, the most recent year for which national fire loss data are available, an estimated 2,400 residential structure fires occurred that were caused by children younger than age 5 playing with cigarette lighters. In the absence of the Standard, there would have been an estimated 7,100 fires. The difference of 4,800 represents fires prevented during 1998 that are attributable to the Standard.
- An estimated 70 deaths occurred in residential structure fires caused by children younger than age 5 playing with cigarette lighters in 1998. In the absence of the Standard there would have been an estimated 200 deaths. The difference of 130 deaths represents deaths prevented during 1998 that are attributable to the Standard.

- An estimated 480 injuries occurred in residential structure fires caused by children younger than age 5 playing with cigarette lighters in 1998. In the absence of the Standard there would have been an estimated 1,430 injuries. The difference of 950 represents injuries prevented during 1998 that are attributable to the Standard.
- An estimated \$38.2 million in property loss occurred in residential structure fires caused by children younger than age 5 playing with cigarette lighters in 1998. In the absence of the Standard there would have been an estimated \$114.6 million in property loss. The difference of \$76.4 million represents property loss prevented during 1998 that is attributable to the Standard.
- Total societal costs associated with 1998 fire losses were estimated at \$412.2 million. In the absence of the Standard, estimated societal costs would have been about \$1.2 billion. The difference of \$773.9 million represents the total societal benefits attributable to the Standard.

In spite of the reductions among cigarette lighter fires already seen, some segments of the lighter child play hazard remain:

- Among the children younger than age 5 who ignited cigarette lighters in the CPSC study, about one-third were older than 4 years and 3 months, the oldest age of the children required to be tested by the CPSC Standard testing protocol.
- Children younger than age 5 playing with multi-purpose lighters caused an estimated 800 residential fires that resulted in about 20 deaths, 50 injuries, and \$15.6 million in property loss in 1998.

It is concluded that the Standard has been very effective in reducing fire losses caused by children younger than age 5 playing with cigarette lighters. Based on these measures, it is estimated that the Standard has prevented 4,800 fires, 130 deaths, 950 injuries, and \$76.4 million in property loss in 1998, with total societal savings estimated at \$773.9 million. Additional savings are anticipated in subsequent years.

Nevertheless, fires caused by children playing with lighters remain a concern. It is expected that the recent CPSC Standard requiring child resistant features on multi-purpose lighters, that will become effective on December 22, 2000, will help to further reduce these fire losses. It is noted, however, that both CPSC lighter standards are designed to make lighters child resistant, but not child proof.

## I. Introduction

This report was prepared to evaluate the effectiveness of CPSC's Safety Standard for Cigarette Lighters, 16 C.F.R. Part 1210, which requires that most cigarette lighters be child-resistant. The Standard took effect for products manufactured or imported after July 12, 1994 (16 CFR 1210). At the time the Standard was developed, CPSC estimated that children younger than age 5 playing with cigarette lighters were responsible for an annual average 5,600 residential fires that resulted in 150 deaths and 1,095 injuries annually (based on 1988 - 1990 data, the most recent data available at the time).<sup>1</sup> At that time, it was estimated that children younger than age 5 ignited 73 percent of all residential structure fires started by children playing with cigarette lighters. Those fires accounted for 93 percent of the cigarette lighter child play fire deaths, 83 percent of the cigarette lighter child play fire injuries, and 73 percent of the cigarette lighter child play fire estimated property loss (Harwood, 1987).

The Standard requires disposable and novelty cigarette lighters to have a child-resistant mechanism that makes the lighters difficult for children younger than age 5 to operate. The definition of disposable lighters includes both non-refillable lighters and inexpensive refillable lighters (16 CFR 1210.2). Novelty lighters resemble or depict articles that appeal to children younger than age 5, or have entertaining audio or visual effects. The standard excludes lighters that are primarily intended for igniting materials other than cigarettes, cigars, and pipes.<sup>2</sup>

The child resistance of a cigarette lighter is determined by tests using panels of young children ages 42 to 51 months (16 CFR 1210.4). The lighters used for the tests have no fuel and produce an audible or visual signal instead of a flame when operated. The child-resistant mechanism must automatically reset after each operation of the lighter. The products must be designed so that at least 85 percent of children included in the test panel are not able to operate the lighters under the test conditions. Manufacturers or importers must report the results of the testing to CPSC before first importing or distributing lighters within the U.S. Most reports indicated that the lighters met even higher criteria, with over 90 percent of the children not able to operate the lighters.

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<sup>1</sup> Estimates are based on National Fire Incident Reporting System (NFIRS) data from the U.S. Fire Administration applied to National Fire Protection Association estimates of residential structure fire losses, as well as the CPSC study, "Fire Hazards Involving Children Playing with Cigarette Lighters," Beatrice Harwood, September 1987.

<sup>2</sup> The "Safety Standard for Multi-Purpose Lighters" to require child resistant features (16 CFR Part 1212) will become effective on December 22, 2000.

## II. Methodology

Lighter fires and fire losses caused by children younger than age 5 using cigarette lighters were compared before and after the Standard. The comparison includes:

1. National fire loss trend estimates for lighter child play between 1988 and 1998,
2. A comparison of lighter child play fire incidents in two CPSC studies, one pre-Standard (Harwood, 1987) and one post-Standard, 1997 and 1999, including estimates of fires, deaths, injuries and property damage that were prevented by the Standard, and
3. Descriptions of lighter child play fires that were still occurring after the Standard took effect.

Data and procedures used for estimating national trends are discussed in the first part of this section, followed by a description of the two special studies. Then, procedures for estimating the effectiveness of the Standard in reducing cigarette lighter child play fires are described along with a description of the method for extending the effectiveness estimates to fire losses, i.e., injuries, deaths, and property loss.

### National Fire Loss Estimates

Fires and fire losses caused by children of all ages playing with all types of lighters were identified in the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS).<sup>3</sup> National estimates were derived by applying the percentage of residential structure fires and fire losses in NFIRS that were caused by lighter child play to the National Fire Protection Association's (NFPA) annual estimates of residential structure fires.<sup>4</sup> The results were estimates of U.S. residential structure fires and fire losses caused by children playing with lighters, presented here for 1988 -1998. Estimates for fires were rounded to the nearest hundred, death and injury estimates to the nearest ten, and property loss to the nearest tenth of a million dollars.

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3 NFIRS is a compilation of incident reports completed by U.S. fire departments on fires they attended. Although NFIRS is not a probability sample, it contains nearly 200,000 residential structure fires annually. For 1998, the most recent year for which NFIRS data are available, NFIRS contained reports of 41 percent of estimated U.S. residential structure fires, and 38 percent of estimated civilian deaths, 43 percent of estimated civilian injuries, and 42 percent of estimated property loss in those fires. It is believed that the distribution of participating fire departments is reasonably representative of all fire departments in the U.S.

4 The NFPA provides annual estimated residential structure fire losses in the U.S. (Karter, 1999). The NFPA survey is a stratified random sample of fire departments in the U.S., weighted by size of the community protected. The survey does not include details on fire cause or product involvement.



NFIRS incidents involving children playing with lighters were defined by the following characteristics:

NFIRS Variable	Codes	Description
Type of Situation	11	Structure fire
Fixed Property Use	4	Residential
Form of Heat of Ignition	46	Lighter (flame type)
Ignition Factor	36 or 48	Children playing, misuse of heat or material
Equipment Involved	98 or 99	No equipment or not otherwise specified equipment

Although NFIRS data include the ages of the fire casualties, NFIRS data do not include the ages of the people who ignited the fires. Moreover, there is no maximum age limit that defines when a fire can be considered child play although some in the fire community believe that the upper age limit is usually age 10 or 11. In general, the decision by a fire service to code a fire as involving child play, as opposed to incendiary, is based on fire service evaluation of whether the child understood the possible consequences. The NFIRS code identifying lighters includes both cigarette and multi-purpose lighters. As a result, unless otherwise specified, national estimates include all lighter child play fires, regardless of the type of lighter or age of the child involved in ignition.

For each year, percentages of all NFIRS residential structure fires that involved children playing with lighters were calculated. Unknown values of the variables used in the analysis were allocated among the known values using raking (Little and Rubin, 1987, page 59; Izrael, Hoaglin and Battaglia, 2000). The process was repeated for deaths, injuries, and property loss. These NFIRS percentages were then applied to NFPA annual estimates of U.S. residential structure fire losses (fires, deaths, injuries, and property loss) to provide national estimates of U.S. residential structure fire losses that involved children playing with lighters. Estimates cited in this report may differ from those previously published, which used a different procedure for allocating unknown values (Hall and Harwood, 1989).

### CPSC Special Studies

As noted above, CPSC conducted two special studies to determine the proportion of cigarette lighter fires and fire losses associated with young children.

CPSC's first study of child lighter fires was conducted between 1985 and 1987 (Harwood, 1987). In that study, CPSC's Directorate for Epidemiology contacted about 200 fire departments across the country, requesting notification when they attended a

fire caused by children playing with lighters. This resulted in investigation of 113 fire incidents. Additional fires were identified from newspaper clippings, CPSC's medical examiner reporting program (MECAP) and other sources. The study sample was 277 fire incidents that resulted in 70 deaths and 127 injuries.

CPSC's second study involved collection of data on lighter child play fires between October, 1997 and February, 1999. Staff at CPSC's regional field offices requested notification and documentation from fire jurisdictions in their areas about fires that were started by children playing with lighters. Fire departments were requested to report all fires that involved any type of lighter, including multi-purpose lighters, and any age of child, as long as the fire cause was identified as a lighter child play fire. When a fire was started by a child younger than age 5, the fire service also completed the study questionnaire (Appendix A) and collected the lighter involved. Lighter samples were reviewed by CPSC staff to identify the lighter ignition mechanism and whether it was operable. This study included reports from 108 fire jurisdictions in 31 states. The study sample was 375 fires that resulted in 23 deaths and 95 injuries. One hundred lighters were collected from fires caused by children younger than age 5; 71 cigarette lighters and 29 multi-purpose lighters.

Neither CPSC study was a probability sample. Fires that resulted in death or injury may be over-represented in both CPSC studies. This could occur if fire departments were more likely to investigate, and thus identify, fire cause when death or injury occurred. In addition, the first CPSC study included fires identified in newspaper clippings, which are believed to report fatal fires in a proportion higher than their occurrence, and deaths investigated by local medical examiners. As a result, death rates per fire based on the study data alone may not have been representative of death rates in all lighter child play fires. However, there is no reason to believe that this bias has distorted the distributions of ages of the children who started fires or the types of lighters used.

### Statistical Methods

Odds ratio based methods were used to determine the effectiveness of the cigarette lighter Standard.

In general, odds ratio methods compare changes in the value of a response variable in a comparison group with the changes in a treatment group. It was assumed that the comparison group would change over time in response to general trends. The treatment group would change not only due to the general trends, but also because of the treatment. The method identifies the amount of change in the treatment group that exceeds the general trends.

In this analysis, the Standard represented the treatment. The response variable was the number of fire incidents in the two CPSC studies. This method involved comparison between cigarette lighter child play fire incidents in 1985-87 with those in 1997-99, i.e. before the Standard and after the Standard. The treatment group

consisted of children younger than 5 while the comparison group consisted of children age 5 and older. For the most part, children age 5 and over should not have been affected by the Standard since the child resistant features were designed for children younger than age 5.

The setup for the analysis is shown in the table below.

Number of Fires by Period and Age of the Fire Starter

Age of the Fire Starter	1985-1987 (Before the Standard)	1997-1999 (After the Standard)
Treatment Group: Under 5 years of Age	$n_{yb}$	$n_{ya}$
Comparison Group: 5 years and older	$n_{ob}$	$n_{oa}$

In the table, the symbol  $n$  represents the number of fires. The first subscript identifies the age ( $y$ =young or under age 5,  $o$ =old or age 5 and over), and the second indicates if before or after the Standard.

The odds that an event occurred before (the Standard was imposed), for the comparison group was

$$\text{ODDS}_{\text{comparison}} = n_{ob}/n_{oa} \quad (1)$$

while the odds that an event occurred before the Standard for the treatment group was

$$\text{ODDS}_{\text{treatment}} = n_{yb}/n_{ya}. \quad (2)$$

If the treatment had no effect then the odds should have been the same for both groups, only subject to general trends. This was measured with the odds ratio (OR)

$$\text{OR} = \text{ODDS}_{\text{comparison}} / \text{ODDS}_{\text{treatment}} \quad (3)$$

which compared the changes over time in both groups. Odds ratios smaller than 1 suggested that the Standard has been effective. This would have occurred if there were relatively fewer post Standard incidents in the treatment group than in the comparison group, that is, the treatment group odds was greater than the comparison group odds.

Under the null hypothesis that the odds ratio was 1, the log of the odds ratio divided by its standard deviation follows a standard normal distribution (Agresti, 1996). This was used to determine if the odds ratio was statistically significant and to estimate confidence intervals.

In the absence of the Standard, or if the Standard had no effect, then the treatment group would have changed over time at exactly the same rate as the comparison group. That is, the number of post Standard fire incidents in the treatment group would have been

$$n_{ya}(\text{no effect}) = n_{yb} (n_{oa}/n_{ob}) = n_{ya} /OR. \quad (4)$$

Thus,  $n_{ya}(\text{no effect})$  is a hypothetical estimate of the number of cigarette lighter child play fires that would have been caused by children younger than age 5 if the Standard had no effect. The estimate of the effectiveness of the Standard would then be

$$\text{Effectiveness} = n_{ya}(\text{no effect}) - n_{ya}. \quad (5)$$

which is an estimate for the number of fire incidents prevented by the Standard.

Although the odds ratio was computed with data from the two studies, it is assumed that the same pattern would have occurred with national data.<sup>5</sup> Thus if  $n_{ya}$  represented a national estimate for the actual number of child lighter fires occurring in 1998, then  $n_{ya}(\text{no effect}) = n_{ya} /OR$  represented the number that would have occurred in 1998 if the Standard had not been in effect, where the odds ratio (OR) was computed from the study data.

Hypothetical fire deaths, fire injuries, and fire property loss were estimated by first calculating the 1998 per-fire rates for each loss measure, based on the unrounded 1998 national estimates of fires, deaths, injuries, and property loss caused by children younger than age 5 playing with cigarette lighters. These rates were then multiplied by  $n_{ya}(\text{no effect})$ , the estimate of hypothetical fires, to obtain estimates of the hypothetical number of fire deaths, injuries and amount of property loss that would have occurred in those fires. The difference between the “no effect” hypothetical fire losses and the national estimates of actual fire losses represented the estimated effectiveness, the losses prevented by the Standard.

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<sup>5</sup> It is necessary to use the study estimates to adjust national estimates, because, as noted above, national data (NFIRS) does not contain the age of the fire starter, or distinguish between cigarette and multi-purpose lighters. The standard only requires child resistant cigarette lighters.

### **III. Results**

#### **A. Effectiveness of the Standard**

##### **1. Fire Loss Trends, All Lighters Combined and All Ages of Children Combined**

National fire loss estimates indicated that there were an estimated 6,100 fire service attended residential structure fires caused by children of all ages playing with lighters of all kinds in 1998, the most recent year for which NFIRS data are available.<sup>6</sup> Between 1988 and 1990 lighter child play fires were stable at about 8,000 a year (Figure 1). After 1990, fires increased to a peak of 11,100 in 1994, the year that the CPSC cigarette lighter Standard took effect. After 1994, lighter child play fires decreased 45 percent. All other residential structure fires decreased by 15 percent since 1994, from an estimated 439,900 fires to an estimated 375,400 fires.

Estimated lighter child play fire injuries generally tracked the estimated fires. Following an increase from 1990 to 1993, estimated injuries decreased from 1,600 in 1994 to 810 in 1998, a 49 percent decrease (Figure 2). During this same period, estimated injuries in all other residential structure fires decreased by 11 percent, from 18,430 to 16,370.

Lighter child play fire death estimates, because of their smaller sample sizes, exhibited more year-to-year fluctuations. Lighter child play fire deaths also decreased since 1994, from 230 to 130 (Figure 3). This change represents a 43 percent decrease in lighter child play fire deaths compared to a 4 percent decrease in other residential structure fire deaths during the same period, from an estimated 3,235 deaths to an estimated 3,120 deaths. Among the people who died in lighter child play fires, children younger than age 5 accounted for an estimated 170 fire deaths in 1994 (74 percent) and 40 in 1998 (31 percent).

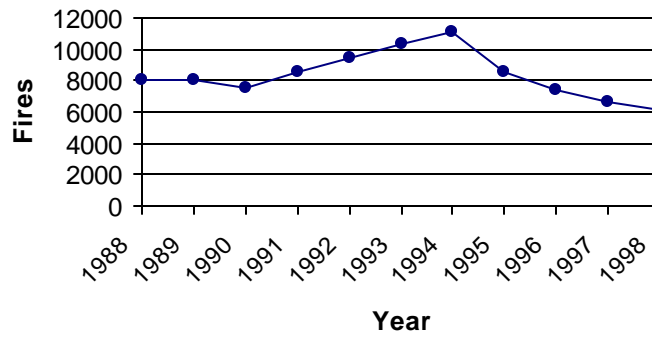
Estimated property loss in lighter child play fires was highest during the years 1993 and 1994. Adjusted for inflation using a base year of 1998, estimated property loss decreased from a high of \$132.3 million in 1994 to \$99 million by 1998, a 25 percent decrease (Figure 4).<sup>7</sup>

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<sup>6</sup> Annual estimates for 1988 - 1998 are presented in Appendix C.

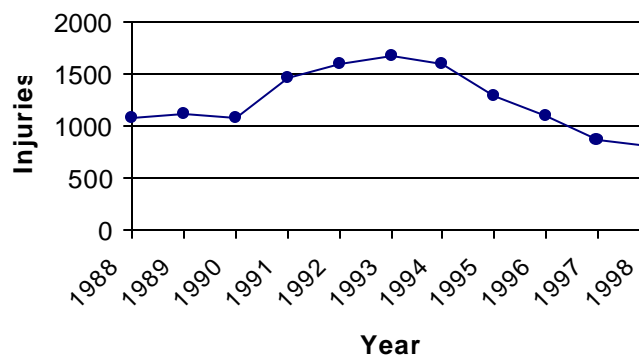
<sup>7</sup> Adjustments for inflation are based on the Consumer Price Index for all Urban Consumers for Housing: Maintenance and Repair using the base year of 1998.

**Figure 1**  
**Estimated Residential Lighter Child Play Fires**  
**1988 - 1998**

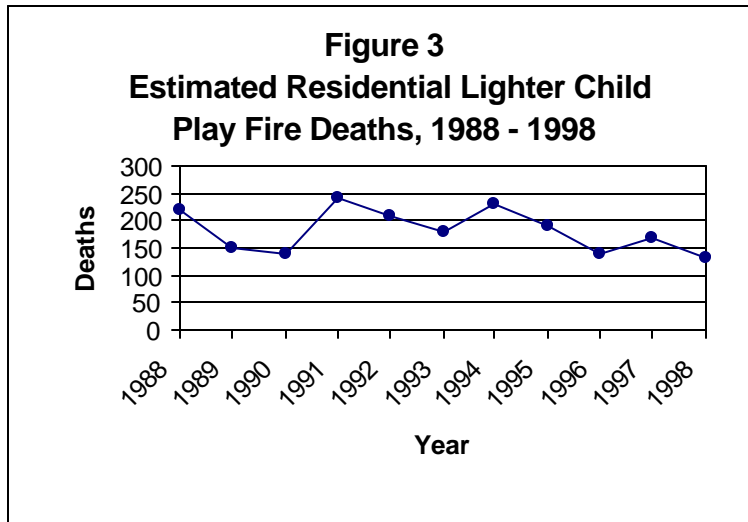


Source: Based on NFIRS/NFPA data.  
 U.S. Consumer Product Safety Commission/EPHA

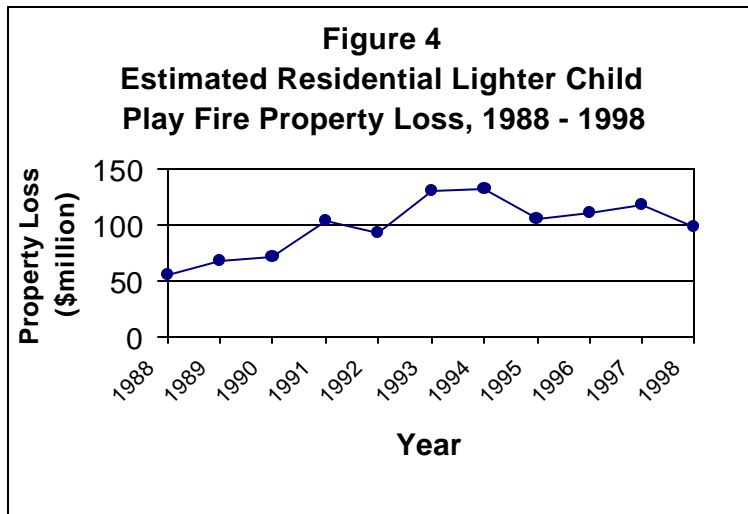
**Figure 2**  
**Estimated Residential Lighter Child Play**  
**Fire Injuries, 1988 - 1998**



Source: Based on NFIRS/NFPA data.  
 U.S. Consumer Product Safety Commission/EPHA



Source: Based on NFIRS/NFPA data.  
U.S. Consumer Product Safety Commission/EPHA



Note: Estimated annual property loss has been adjusted to reflect a base year of 1998.

Source: Based on NFIRS/NFPA data.  
Consumer Product Safety Commission/EPHA

## 2. 1998 Estimated Fire Losses, by Age of Child Who Started the Fire and Lighter Type

Results of the post-Standard study indicated that children younger than age 5 playing with cigarette lighters caused an estimated 2,400 cigarette lighter fires that resulted in 70 deaths, 480 injuries, and \$38.2 million in property loss in 1998 (Table1). Among only cigarette lighter fires, children younger than age 5 ignited an estimated 48 percent of the fires that resulted in 80 percent of the deaths, 71 percent of the injuries, and 48 percent of the property loss. Among all lighter child play fires, children younger than age 5 playing with cigarette lighters were responsible for 39 percent of the fires, 52 percent of the deaths, 59 percent of the injuries and 39 percent of the property loss.

Multi-purpose lighters were involved in an estimated 800 fires that were started by children younger than age 5 in 1998. These fires resulted in an estimated 20 deaths, 50 injuries, and \$15.6 million in property damage.

**Table 1**  
**Estimated 1998 Residential Structure Lighter Child Play**  
**Fires, Deaths, Injuries, and Property Loss,**  
**by Lighter Type and Age of the Fire Starter**

Loss Measure and Lighter Type	Age of Fire Starter					
	Total		< Age 5		Age 5 +	
	Estimate	%	Estimate	%	Estimate	%
<b>Fires</b>						
<b>Total (n=375)</b>	<b>6,100</b>	<b>100</b>	<b>3,100</b>	<b>51</b>	<b>3,000</b>	<b>49</b>
Cigarette	5,000	100	2,400	48	2,600	52
Multi-Purpose	1,100	100	800	73	400	36
<b>Deaths</b>						
<b>Total (n=23)</b>	<b>130</b>	<b>100</b>	<b>90</b>	<b>70</b>	<b>40</b>	<b>30</b>
Cigarette	90	100	70	80	20	20
Multi-Purpose	50	100	20	50	20	50
<b>Injuries</b>						
<b>Total (n=95)</b>	<b>810</b>	<b>100</b>	<b>530</b>	<b>65</b>	<b>280</b>	<b>35</b>
Cigarette	670	100	480	71	200	29
Multi-Purpose	140	100	50	38	90	62
<b>Property Loss (Millions)</b>						
<b>Total (n=\$7.1)</b>	<b>\$99.0</b>	<b>100</b>	<b>\$53.7</b>	<b>54</b>	<b>\$45.3</b>	<b>46</b>
Cigarette	\$79.8	100	\$38.2	48	\$41.7	52
Multi-Purpose	\$19.2	100	\$15.6	81	\$3.6	19

Note: 1998 CPSC Study distributions in Appendix B were applied to the 1998 NFIRS/NFPA estimates of lighter child play fires, deaths, injuries, and property loss. Resulting fire losses were rounded: fires to the nearest 100, deaths and injuries to the nearest ten, and property loss to the nearest tenth of a million. Totals may not add due to rounding.

Source: CPSC investigated incidents, 10/97 - 2/99 and data from NFIRS and NFPA.



### 3. 1998 Estimates of Standard Effectiveness

Estimates of the effectiveness of the Standard were derived by first estimating 1998 hypothetical losses, the number of fires and fire losses caused by children younger than age 5 playing with cigarette lighters that would have occurred in 1998 if the Standard had no effect. Then, the estimated fire losses that did occur (actual) in 1998 (Table 1) were subtracted from the hypothetical losses. The difference represents losses prevented by the Standard.

Table 2 presents the age distribution of the children who started cigarette lighter child play fires in two CPSC studies, one pre-Standard and one post-Standard. The table shows that in the period 1985-1987, about 70 percent of the incidents were started by children younger than age 5 while in 1997-1999, almost 50 percent of the incidents were started by children younger than age 5.

**Table 2**  
**Age Distributions of the Fire Starters in Two CPSC Studies,**  
**Cigarette Lighter Child Play Fires**

Age	1985-1987		1997-1999	
	Number	Percent	Number	Percent
Total	277	100%	299	100%
0-2 years	33	12%	8	3%
3 years	87	31%	53	18%
4 years	74	27%	83	28%
0-4 years	194	70%	144	48%
5 years and older	73	26%	154	52%
Unknown	10	4%	1	0%

Note: Totals may not add due to rounding. This table also does not include the following cases for 1997-1999: one fire where the child was younger than age 5 and the lighter type was not specified, 6 fires where the child was 5 or over and the lighter type was not specified and one cigarette lighter fire where the child's age was unknown.

Source: 1985-1987 data, Harwood (1987, Table 5, page 16), 1997-1999 data -CPSC investigated fires, U. S. Consumer Product Safety Commission/ EPA.

Table 3 presents odds and odds ratios based on data in Table 2. The number of fire incidents in Table 3 is slightly different from the subtotals in Table 2 because the incidents with children of unknown ages and/or lighters of unknown type were distributed among the known incidents in proportion to the distribution of the known incidents. Table 3 shows that in the pre-Standard period, 1985-1987, younger children were responsible for starting 73% of the fires. After the standard, in the 1997-1999 study, young children set slightly less than half, 48%, of the fires.

**Table 3**  
**Adjusted Age Distributions of the Fire Starters in Two CPSC Studies**  
**Cigarette Lighter Child Play Fires**

Age Distribution	1985-1987	1997-1999	Odds
0-4 years	202.66	145.08	1.40
5 years and older	74.34	159.61	0.47
Percent ages 0-4	73%	48%	
Odds Ratio	0.33		
95% Confidence Interval			
Lower	0.24		
Upper	0.47		

Note: Odds ratio was statistically significant,  $t = -6.18$ ,  $p < 0.0001$ .

Fires include distributions of incidents with unknown age or lighter type.

See Appendix B.

U.S. Consumer Product Safety Commission/ EPA

The odds ratio of 0.33 was statistically significant ( $p < 0.0001$ ), with a 95% confidence interval of 0.24 to 0.47. This indicates that the decrease in incidents among children younger than age 5 from 1985-1987 to 1997-1999 could not be attributed to chance.

Table 4 extrapolates the change in fire losses to one-year national estimates using equation (4) from the methodology section. It indicates that if the Standard had no effect, there would have been an estimated 7,100 cigarette lighter fires in 1998 started by children younger than age 5. This is 4,800 more fires than were estimated to have actually occurred. The actual fire estimate of 2,400 represents a 67 percent reduction from the no effect estimate. At 1998 estimated fire loss rates, 1998 fire losses prevented are estimated at 130 deaths, 950 injuries, and \$76.4 million in property loss. Total 1998 societal cost prevented is estimated at \$773.9 million.

**Table 4**  
**Estimated 1998 Cigarette Lighter Child Play Fire Losses**  
**Prevented by the CPSC Standard**  
**Losses Caused by Children Younger than Age 5 Only**

Case	Fires <sup>1</sup>	Deaths <sup>1</sup>	Injuries <sup>1</sup>	Property Loss <sup>1</sup> ( millions)	Total Societal <sup>2</sup> Cost (millions)
<b>1998 Expected Fire Losses if the Standard had No Effect</b>	7,100	200	1,430	\$114.6	\$1,186.1
<b>Actual 1998 Fire Losses</b>	2,400	70	480	\$38.2	\$412.2
<b>Fire Losses Prevented</b>	4,800	130	950	\$76.4	\$773.9

<sup>1</sup> Actual estimates based on 1998 NFIRS and NFPA data adjusted by CPSC study proportions. No Effect fire estimates from equation (4) in Methodology section. No Effect fire loss assumes the same loss rate per fire as actual 1998 fire losses in Table 1. Fires rounded to nearest hundred, deaths and injuries to nearest ten and property loss to nearest tenth of a million dollars. Detail may not add due to rounding.

<sup>2</sup> Societal cost estimate developed by CPSC, Directorate for Economics. A statistical value of \$5 million each was used to estimate the cost of deaths. A value of \$50,000 each was used to estimate the cost of injuries.

Source: U.S. Consumer Product Safety Commission/EPHA

## **B. Fire Characteristics**

Although the Standard has produced significant reductions in fire losses, the characteristics of the remaining fires are useful to direct efforts to further reduce fire losses.

### **1. Fire Ignition (NFIRS and 1997-1999 CPSC Study)**

Data describing the characteristics of lighter child play fires are helpful in understanding where and when fires occurred, what they ignited, etc. (Figures 6-11) This information is available from both the NFIRS and the CPSC Study, and comparison of the two databases indicates that there is very close agreement on most characteristics involved. Unknown values were allocated among reported values in each data source.

Among lighter child play fires, the bedroom was by far the most common location of origin, accounting for 64 percent of the NFIRS fires and 67 percent of CPSC Study fires (Figure 6). Living rooms and closets each accounted for 10 percent or less in both data sources.

The most common items ignited in lighter child play fires were mattresses and bedding, which accounted for 42 percent in NFIRS and 41 percent in the CPSC Study (Figure 7). Clothing, primarily not being worn, was the second most common item ignited, accounting for 11 percent of NFIRS fires and 18 percent of CPSC Study fires. Upholstered furniture was ignited in 7 percent of NFIRS fires and 6 percent of the CPSC Study fires.

Lighter child play fires occurred most often in the afternoon, accounting for about 42 percent of each data source (Figure 8).<sup>8</sup> The second most common time of day was the morning, accounting for 29 percent in each source. Several fires in the CPSC Study indicated that the child awakened and started the fire while the parent was still asleep. Fires in the evening were almost as common as morning fires.

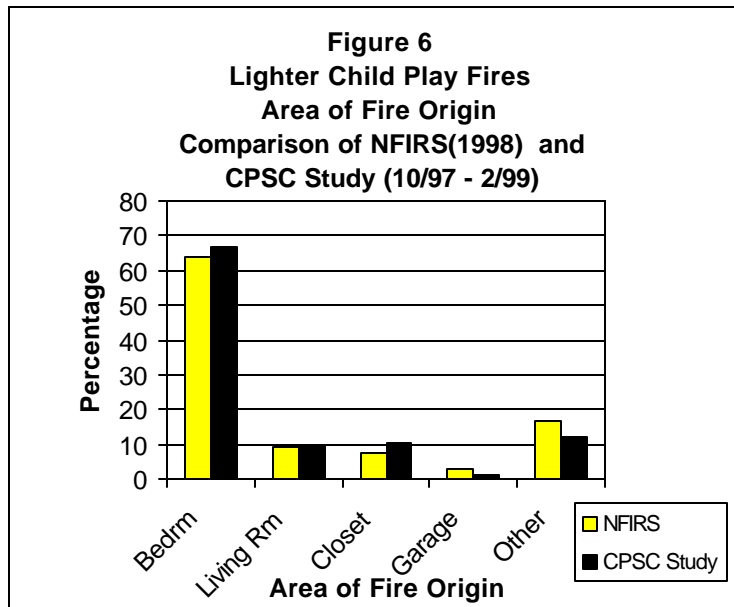
While most lighter child play fires occurred in one or two family dwellings in both data sources, there was some difference in distribution in the two data sources. One or two family dwellings accounted for 74 percent of NFIRS residential fires and 59 percent of CPSC Study fires. (Figure 9).

Flame damage in lighter child play fires was largely confined to the room of origin or the object ignited. Lighter child play fires were confined to these combined areas in 70 percent of NFIRS fires and 65 percent of CPSC Study fires (Figure 10).

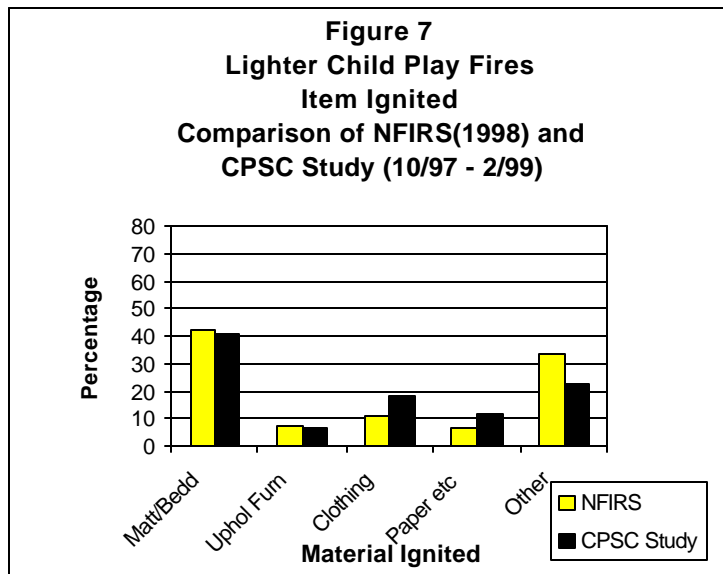
Among fires in which detector presence was cited, a detector was absent in 34 percent of NFIRS fires and 41 percent of CPSC Study fires (Figure 11). Among fires in which a detector was present, alarm performance was reported, and the fire was large enough to expect an alarm, detectors alarmed in 65 percent of NFIRS fires and 72 percent of CPSC Study fires. Conversely, under the same conditions, detectors failed to alarm when they should have in 35 percent of NFIRS fires and 28 percent of CPSC Study fires.

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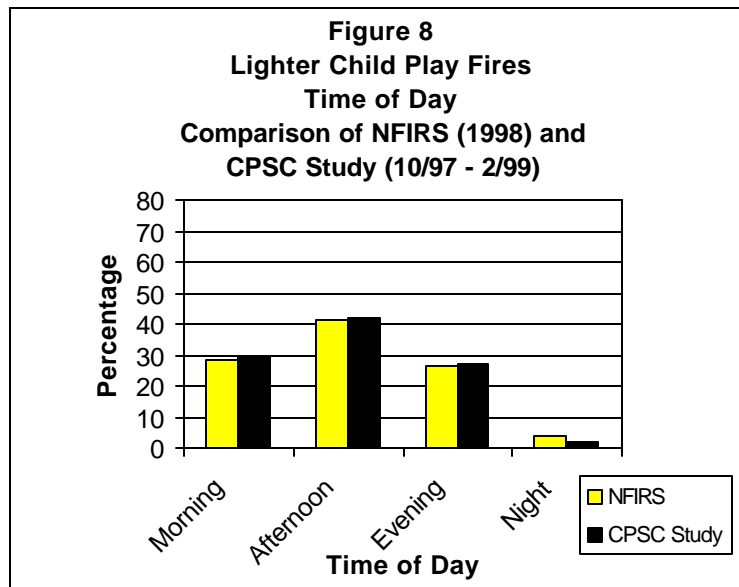
<sup>8</sup> Definition of Time of Day is as follows:  
Morning = 6:00 a.m. to 11:59 a.m.,  
Afternoon = 12:00 noon to 5:59 p.m.,  
Evening = 6:00 p.m. to 11:59 p.m., and  
Night = 12:00 midnight to 5:59 a.m.



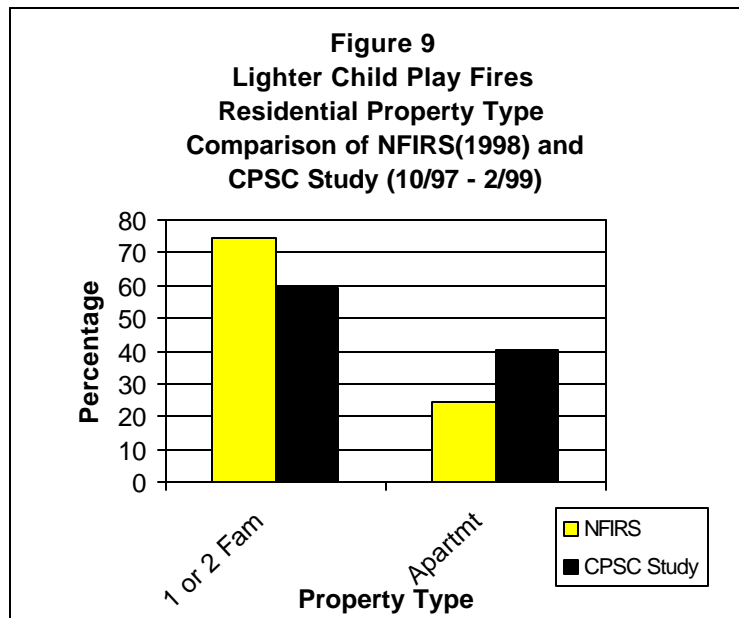
Note: Unreported values were allocated among reported values  
 NFIRS reported n = 1,909, CPSC reported n = 366  
 Source: U.S. Consumer Product Safety Commission/EPHA



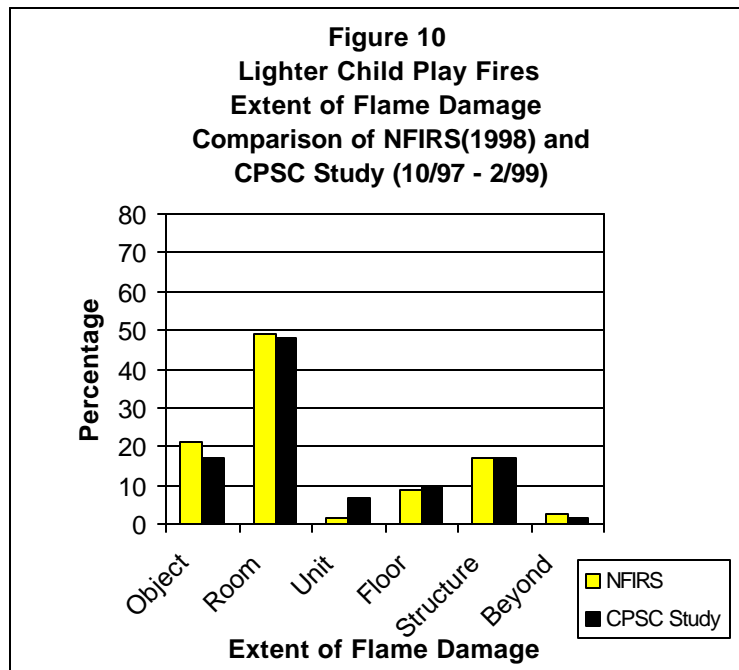
Note: Unreported values were allocated among reported values  
 NFIRS reported n = 1,918, CPSC reported n = 353  
 Source: U.S. Consumer Product Safety Commission/EPHA



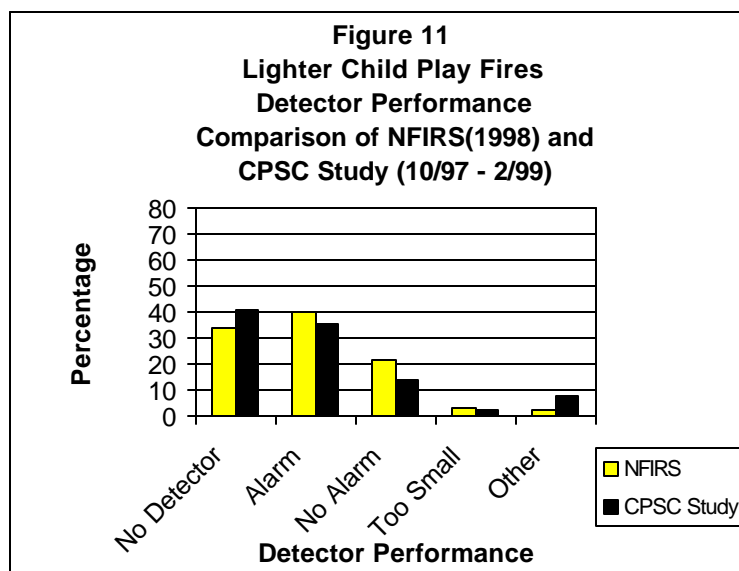
Note: Unreported values were allocated among reported values  
 NFIRS reported n = 1,923, CPSC reported n = 370  
 Source: U.S. Consumer Product Safety Commission/EPHA



Note: Unreported values were allocated among reported values,  
 NFIRS reported n = 1914, CPSC reported n = 357  
 Source: U.S. Consumer Product Safety Commission/EPHA



Note: Unreported values were allocated among reported values, NFIRS reported n =1,888, CPSC reported n=322  
Source: U.S. Consumer Product Safety Commission/EPHA



Note: Unreported values were allocated among reported values, NFIRS reported n=1,493, CPSC reported n=292  
Source: U.S. Consumer Product Safety Commission/EPHA

## **2. Death and Injury Characteristics, 1997 - 1999 CPSC Study**

A total of 23 deaths and 95 injuries were reported among the 375 fires in the CPSC Study. Among these, 16 deaths and 62 injuries occurred in fires started by children younger than age 5.<sup>9</sup> Their characteristics help to understand what happened both before and after the fire (Table 5). Eleven of the 16 fatalities were children younger than age 5; the remaining five were adults. Among injuries there were about equal numbers of young children and adults. Among the 53 injuries for which age was known, 20 were children younger than age 5 while 23 were adults. Many of the adults were injured while trying to rescue the children or extinguish the fire.

Among those injured, more than one-half of the injuries, 36 of 62, resulted from smoke inhalation alone. Less than one-quarter, 14 of 62, resulted from burns alone. Among those with only burn injuries, about half involved burns only to the arms or hands. Five injuries involved the combination of smoke inhalation and burns. The remaining 7 injuries included cuts and bruises of various kinds.

Most of those injured were taken to the hospital, 48 of 54 for which disposition was specified. Among those 48 taken to the hospital, subsequent disposition was reported for 31. Of these, 5 were hospitalized and 26 were treated and released.

The condition of the person before the fire helps to explain how many of these deaths and injuries came about.<sup>10</sup> Among the 12 fatalities for which condition was reported, seven of the victims were reported by the fire service as being too young to be able to respond appropriately. Two deaths occurred when the person was asleep when the fire occurred. Among those injured and for whom condition was reported, nine were too young to respond, seven were asleep and 19 were awake when the fire started.

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<sup>9</sup> Cigarette lighters were involved in 12 fatalities and 56 injuries. Multi-purpose lighters were involved in 4 fatalities and 6 injuries.

<sup>10</sup> The fire service classifies the condition of the person injured to describe the characteristic that was most relevant to the resulting injury. There are no specific guidelines for deciding which conditions take priority in fire service reporting if multiple conditions apply.



**Table 5**  
**Casualty Characteristics in Lighter Child Play Fires**  
**Started by Children Younger than Age 5**  
**CPSC Study (10/97 - 2/99)**

<b>Casualty Characteristic</b>	<b>Deaths</b>	<b>Injuries</b>
<b>Fatality Age Group (Years)</b>		
Total Known	16	53
<5	11	20
5-9	0	5
10-14	0	5
15+	5	23
<b>Nature of Injury</b>		
Total Known	Not Applicable	62
Smoke Inhalation		36
Burn		14
Smoke Inhalation & Burn		5
Other		7
<b>Disposition</b>		
Total Known	Not Applicable	54
Treated at Scene		5
Taken to Hospital		48
Treated/ Released		26
Hospitalized		5
Unknown Disp.		17
Other		1
<b>Condition Before the Fire</b>		
Total Known	12	37
Awake	3	19
Asleep	2	7
Too Young to Respond	7	9
Other Impairment	0	1
Other	0	1
<b>Relationship to Fire Starter</b>		
Total Known	15	42
Self	4	11
Sibling	4	9
Parents	4	10
Other	3	12

Death n=16, injury n=62

Source: CPSC investigated incidents.

U.S. Consumer Product Safety Commission/EPHA

When deaths and injuries occurred to children younger than age 5, 7 of 9 deaths and 9 of 17 injuries for which condition was reported indicated that the child was too young to respond appropriately. Three deaths occurred when the children were awake. However, even for those who were awake it is problematic as to whether they were capable of responding appropriately. One incident occurred when two children, ages 4 and 3, ignited the lighter while the parents were asleep. The older child shouted to alert

the father, but he was unable to rescue the mother and children. The mother and both children died.

When the fire starter was younger than age 5, the relationship of the fatality to the fire starter was obtained. Among the 15 fatalities in those fires for which relationship was known, four were the fire starter, four were siblings of the fire starter and four were the fire starters' parents. Among injuries, 11 of the 42 injured persons for whom the relationship was reported were the fire starters themselves. Ten of those injured were the fire starters' parents and nine were the fire starters' siblings.

### **3. Detector Operation, 1997 - 1999 CPSC Study**

Detector operation is of particular interest whenever deaths occur. Eighteen deaths in the CPSC Study occurred in fires in which detector presence and performance were reported. Seven deaths occurred in residences where no detector was present, six occurred in residences where the detector did not alarm, and five deaths occurred even though the detector alarmed (Table 6). All of those who died in fires where the detector alarmed were young children. Three children, ages 2 months to 4 years old, died in one fire when the adults tried to put out the fires, waited too long to rescue the children, and then could not reach them. In another fire, the 4-year-old fire starter hid under clothes in the closet. In a third fire, the 4-year-old fire starter stayed in the room with the door closed, was overcome by smoke, and received extensive burns from which he died two months later.

**Table 6**  
**Lighter Child Play Fire Deaths and Injuries,**  
**by Detector Performance**  
**CPSC Study (10/97 - 2/99)**

<b>Detector Performance</b>	<b>Deaths</b>	<b>Injuries</b>
<b>Total</b>	23	95
<b>No Detector Present</b>	7	29
<b>Did Not Alarm</b>	6	21
<b>Alarmed</b>	5	20
<b>Fire Too Small</b>	0	1
<b>Other</b>	0	6
<b>Unknown</b>	5	18

Source: CPSC investigated incidents, U.S. Consumer Product Safety Commission/EPHA

In spite of the inability of young children to exit on their own as cited above, detectors that alarmed still were very effective in reducing the overall fire death and injury rates. In fires where no detector alarmed (none present or failed to alarm), the death rate was higher than in fires where the detector alarmed, 8.1 versus 4.9 deaths per 100 fires, a relative rate of 1.7 (Table 7). The injury rate also was higher when no detector alarmed, 31.3 versus 19.4 injuries per 100 fires, a relative rate of 1.6.

**Table 7**  
**Lighter Child Play Death and Injury Rates**  
**Per 100 Fires, by Detector Operation**  
**CPSC Study (10/97 - 2/99)**

Detector Operation	Fires	Deaths		Injuries	
		Number	Rate/100 Fires	Number	Rate/100 Fires
<b>Alarm</b>	103	5	4.9	20	19.4
<b>No Alarm*</b>	160	13	8.1	50	31.3

\*Includes fires where there was no detector and fires where a detector failed to operate. Does not include fires considered too small for the detector to alarm.  
Source: CPSC investigated incidents. U.S. Consumer Product Safety Commission/EPHA

#### **4. Child Behavior and Supervision, 1997 - 1999 CPSC Study**

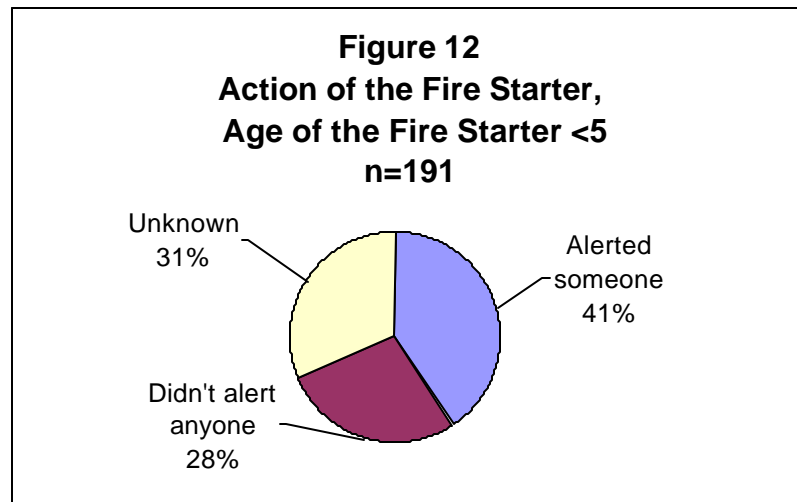
Although not directly related to behavior, it is noteworthy that males were predominantly the fire starters, accounting for 85 percent of lighter child play fires overall (Table 8). The proportions were similar for cigarette lighters (84 percent) and multipurpose lighters (88 percent). In other terms, male fire starters outnumbered females by more than 5 to 1 among all lighter child play fires. This distribution was the same for children younger than age 5 and for older children.

**Table 8**  
**Lighter Child Play Fires**  
**Sex of the Fire Starter, by Lighter Type**  
**CPSC Study (10/97 - 2/99)**

Sex of Child Who Started Fire	Lighter Type							
	Total	%	Cigarette	%	Multi-Purpose	%	Unknown	%
<b>Total</b>	375	100	299	100	69	100	7	100
<b>Male</b>	317	85	252	84	61	88	4	57
<b>Female</b>	55	15	44	15	8	12	3	43
<b>Unknown</b>	3	1	3	1	0	0	0	0

Source: CPSC investigated incidents. U.S. Consumer Product Safety Commission/EPHA

Several questions about behavior and supervision were included in the CPSC Study when the fire starter was younger than age 5 and the fire involved either a cigarette or multi-purpose lighter. Among other items, information was obtained about what the child did after he ignited the fire. The child alerted someone in 78 (41 percent) of 191 fire incidents and did not alert anyone in 53 (28 percent) incidents (Figure 12). It was unreported if the child alerted anyone in 60 (31 percent) incidents. The actions of the children who did not alert anyone included throwing the lighter under the bed, closing the door and going into the next room, or watching the fire from the bedroom.



Source: CPSC investigated incidents.  
U.S. Consumer Product Safety Commission/EPHA

Information about the child's experience in operating lighters was obtained in the CPSC Study when the fire starter was younger than age 5. However, the information was reported in fewer than half the incidents where it was requested (Table 9). Among the 91 incidents reporting experience with the lighter involved in the fire, 39 children had previously operated the lighter used in the fire. In 26 of these 39 incidents, the child had lit other lighters as well. In 25 incidents, the child had not lit previously either the involved lighter or any other lighter. Overall, among those reporting experience, about one-half (51 of 111) of the children had some history of igniting a lighter.

**Table 9**  
**Lighter Child Play Fires**  
**Child's Previous Experience with Operating Lighters**  
**CPSC Study (10/97 - 2/99)**

Previously Lit This Lighter	Total	Previously Lit Other Lighters		
		Yes	No	Unknown
<b>Total</b>	191	48	35	108
<b>Yes</b>	39	26	3	10
<b>No</b>	52	9	25	18
<b>Unknown</b>	100	13	7	80

Note: Includes only fires in which the fire starter was younger than age 5.  
Source: CPSC investigated incidents. U.S. Consumer Product Safety Commission/EPHA

Table 10 presents the caregiver's location at the time of ignition for fires ignited by children younger than age 5. The caregiver was in the building in all but 11 of the 184 incidents where location was specified. Most caregivers, 115, were in the same

building but at an unspecified location. In 12 incidents, the caregiver was in the same room or space as the fire origin. In 46 incidents, the caregiver was on the same floor.

**Table 10**  
**Lighter Child Play Fires**  
**Caregiver's Location at Time of Ignition**  
**CPSC Study (10/97 - 2/99)**

Location of Caregiver	Fires
	# of Incidents
<b>Total</b>	191
<b>Same room or space as fire origin</b>	12
<b>Same floor as fire origin</b>	46
<b>Same building as fire origin</b>	115
<b>Outside building of fire origin but on property</b>	4
<b>Other property</b>	7
<b>Unknown</b>	7

Note: Includes only fires in which the fire starter was younger than age 5.  
Source: CPSC investigated incidents. U.S. Consumer Product Safety Commission/EPHA

Table 11 presents the relationship of the caregiver to the fire starter by age of the caregiver. In 133 (70%) of the 191 incidents, the caregivers were the parents. The caregiver was younger than age 18 in seven incidents. Among these seven incidents, an 8-year-old brother was the caregiver in one incident and a 9-year-old sister was the caregiver in another. Nineteen caregivers were in the relationship category "Other" which included aunts, cousins, uncles, mother's boyfriend, neighbors, and temporary guardians. Sixteen of the 19 were ages 18 or older.

**Table 11**  
**Lighter Child Play Fires**  
**Relationship of Caregiver to the Fire Starter,**  
**by Age of the Caregiver**  
**CPSC Study (10/97 - 2/99)**

Relationship of Caregiver to Fire Starter	Total	Age of the Caregiver (Years)		
		Younger than 18	18 and Older	Unknown
<b>Total</b>	191	7	172	12
<b>Parents</b>	133	0	129	4
<b>Grandparents</b>	18	0	18	0
<b>Brothers/Sisters</b>	9	5	4	0
<b>Babysitter</b>	6	1	4	1
<b>Other</b>	19	1	16	2
<b>Unknown</b>	6	0	1	5

Note: Includes only fires in which the fire starter was younger than age 5.  
Source: CPSC investigated incidents. U.S. Consumer Product Safety Commission/EPHA

## C. Lighter Characteristics, 1997 - 1999 CPSC Study

### 1. Ignition Mechanisms

Both the fire service and the dwelling occupants found it very difficult to identify the cigarette lighter ignition mechanisms. As a result, only the cigarette lighters that were examined by CPSC staff were included in this section. Cigarette lighters were categorized into three general ignition mechanism groups: "spark wheel & push button," "push button only," and "spark wheel only". Among the 71 lighters operated by children younger than age 5, 65 lighters had "spark wheel & push button" mechanisms, four lighters had "push button only" mechanisms and one lighter had a "spark wheel only" mechanism (Table 12).

Samples were examined to determine the specific mechanisms used to achieve child-resistance. Among cigarette lighters with "spark wheel & push button" general mechanisms, 23 used a "metal strip over spark wheel" to achieve child resistance, 15 used a "side wheel spinning freely", and 14 used a "tab/lever under push button". Among the 4 lighters that used "push button only" general mechanisms, one used a "tab or lever under push button" while the other 3 incidents were cited as other or unknown. The incident involving a "spark wheel" type was a refillable lighter that was also a novelty lighter.

**Table 12**  
**Cigarette Lighter Child Play Fires,**  
**Ignition Mechanisms for Lighters**  
**Operated by Children Younger than Age 5**  
**CPSC Study (10/97 - 2/99)**

Specific Mechanism	Total	General Mechanism			
		Spark Wheel & Push Button	Push Button Only	Spark Wheel Only	Unknown
<b>Total</b>	71	65	4	1	1
<b>Tab,lever, or block under push button</b>	15	14	1	0	0
<b>Metal strip over spark wheel</b>	23	23	0	0	0
<b>Side Wheels spin freely</b>	15	15	0	0	0
<b>Smooth side wheels</b>	5	5	0	0	0
<b>Other</b>	6	3	2	0	1
<b>Unknown</b>	7	5	1	1	0

Note: Includes only fires in which cigarette lighter samples were reviewed by CPSC.

Source: CPSC investigated incidents. U.S. Consumer Product Safety Commission/EPHA

Among these 71 cigarette lighter samples, all of which were required to be child-resistant, three were novelty lighters. Novelty lighters are generally defined as lighters with audio or visual effects, or recognized as appealing to children. Novelty lighters in

the study included a lighter with a color picture of a pick-up truck driving into a town, a green and black lighter in the shape of a scuba tank, and a clear plastic lighter that looked like a pager with a spring belt clip on one side.

In addition to the cigarette lighter samples collected, 29 multi-purpose lighter samples also were collected. One of these was a micro-torch that was used by a 3-year-old male to ignite bedding. The lighter was used by the family to light the pilot light on a furnace, and it may have been near the furnace when the child found it.

## **2. Factors Affecting Young Children's Ability to Operate Current Cigarette Lighters**

Even though the CPSC Standard has produced dramatic reductions in cigarette lighter fires started by children younger than age 5, an estimated 2,400 such fires remained in 1998. Some of the reasons may relate to the Standard requirements; others relate to the lighters involved in the fires.

CPSC and others generally refer to children protected by the child-resistance requirements as primarily those younger than age 5. This definition was retained throughout this report to maintain consistency and comparability. However, the CPSC Safety Standard test protocol calls for testing of new lighter models with panels of children that range in age from 42 months (3 years, 6 months) to 51 months (4 years, 3 months). Table 13 presents the age distribution of all children younger than age 5 in the CPSC study who started fires with cigarette lighters, with 4-year-olds shown by 3-month increments. As shown, a minimum of 49 of 144 cigarette lighter fires (34 percent) in the CPSC study were started by children older than 4 years, 3 months, the upper age limit of children included in lighter qualification tests.

The CPSC Standard permits a cigarette lighter to meet the child-resistance requirements if 15 percent or fewer of the children tested were able to operate the lighter. Many manufacturers reported that fewer than 10 percent of the children tested were able to operate the lighters during testing. Nonetheless, some children remain who will be able to operate a child resistant cigarette lighter.

The integrity of the child resistant feature was examined by CPSC staff when cigarette lighter samples were collected during the study. Fifty-nine cigarette lighter samples operated by children younger than age 5 were found to be originally child resistant (Table 14). Among the 59 samples, the child resistant feature had been defeated at some point on 13 lighters (22 percent). Of the 46 lighters that were found to have functional child resistant mechanisms at the time of the fire, 13 (28 percent) were operated by children between the ages of 4 years, 4 months and 4 years, 11 months.

Ten cigarette lighter samples (14 percent of all cigarette lighter samples operated by children younger than age 5) were not manufactured with a child-resistant mechanism, but were of the type that was covered by the Standard. It is estimated that lighters that originally did not have child resistant features were involved in 300 of the

estimated 2,400 cigarette lighter fires started by children younger than age 5 in 1998. Since the manufacturing date of the lighters could not be determined, it was not possible to determine whether the lighters were manufactured before the Standard took effect.

**Table 13**  
**Lighter Child Play Fires**  
**Fire Starters Younger than Age 5,**  
**by Lighter Type**  
**CPSC Study (10/97 - 2/99)**

Age of Fire Starter	Total	Lighter Type			
		Cigarette		Multi-Purpose	
		Number	Percent	Number	Percent
<b>Total</b>	190	144	100	46	100
<b>2 years</b>	14	8	6	6	13
<b>3 years</b>	76	53	37	23	50
<b>4 years, 1-3 months</b>	16	14	10	2	4
<b>4 years, 4-6 months</b>	29	24	17	5	11
<b>4 years, 7-9 months</b>	12	11	8	1	2
<b>4 years, 10-11 months</b>	16	14	10	2	4
<b>4 years, months not spec.</b>	27	20	14	7	15

Note: Table does not include one fire where the child was younger than age 5 and the lighter type was not specified. Totals may not add due to rounding.

Source: CPSC investigated incidents, U.S. Consumer Product Safety Commission/EPHA

**Table 14**  
**Condition of Child Resistant Feature**  
**on Cigarette Lighter Samples Examined**  
**Fire Starters Younger than Age 5**  
**CPSC Study (10/97-2/99)**

Condition of Child Resistant Feature	Number	Percent
<b>Total Originally Child Resistant</b>	<b>59</b>	<b>100</b>
<b>Child Resistance Feature Intact</b>	46	78
<b>Child Resistance Feature Defeated</b>	13	22

Note: Ten lighter samples were not manufactured with a child-resistant feature. The child-resistance of two lighter samples could not be determined.

Source: CPSC investigated incidents, U.S. Consumer Product Safety Commission/EPHA



## IV. Discussion

The primary purpose of this report was to evaluate the effectiveness of the CPSC Safety Standard for Cigarette Lighters. The report was based on national fire loss data from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's annual survey of fires in the U.S. as well as data from two CPSC studies, one pre-Standard and one post-Standard.

Based on an odds ratio procedure applied to CPSC study data, it is estimated that the CPSC Safety Standard for cigarette lighters has reduced cigarette lighter child play fires caused by children younger than age 5 by 67 percent. This estimate of effectiveness is based on the assumption that, without the CPSC Standard, the relationship between the ages of the children igniting cigarette lighter fires (children younger than age 5 versus children age 5 and older) would have remained the same after the Standard as before. Taking into account the estimated fire losses that would have occurred if the Standard had no effect, it is estimated that the CPSC Safety Standard was responsible for reductions of 4,800 fires, 130 deaths, 950 injuries, and \$76.4 million in property loss in 1998. Total societal benefits in 1998 are estimated at \$773.9 million. It is noted, moreover, that these savings apply only to 1998 and that savings will continue to occur in subsequent years.

A second purpose of this report was to evaluate the remaining lighter child play fires. Even with the reductions discussed above, lighter child play fire losses remain a concern.

As noted previously, the current Standard allows a lighter to qualify as child resistant if no more than 15 percent of the children tested are able to operate the lighter under test conditions. Many manufacturers reported that fewer than 10 percent of the children tested were able to operate the lighters tested. Nonetheless, some children remain who will be able to operate a child resistant lighter.

Among the fires in the CPSC 1997 - 1999 study, about one-third of the cigarette lighter fires caused by children younger than age 5 were fires ignited by children older than 4 years, 3 months, the maximum age of children tested under the Standard testing protocol. Additional testing with panels including children between the ages from 4 years, 4 months to 4 years, 11 months would be needed to determine whether inclusion of children in this age group would have prevented some lighters currently on the market from qualifying as child resistant.

It is appropriate to note that the CPSC Standard is intended to make cigarette lighters child resistant, but not child proof. While the Standard can increase the time needed for a child to operate the lighter, it may not prevent some children from operating the lighters given enough time or familiarity.

Among the cigarette lighters involved in fires that were examined by CPSC staff, 59 of 69 were originally child resistant. Of these 59, the child-resistant features had been defeated on 13 (22 percent). Ten lighters were not manufactured with child-resistant features. CPSC was not able to determine whether these ten were illegally sold or whether they were pre-Standard models.

Data evaluated for this report continue to document the increased risk for young children when fires occur, particularly when children are involved at the point of fire origin. A child at the point of origin can be severely injured well before a remote smoke alarm can sound. Moreover, the fire starters' reactions to fire ignition create an additional hazard, not only for them but for their families. In fires started by children younger than age 5, about 40 percent of those for whom subsequent actions were cited did not alert anyone to the fire. As a result, valuable time was lost in evacuating both the fire starter and other occupants. This finding is consistent with the earlier discussion about the prevalence of fire casualties among those who were too young to respond appropriately.

The recent CPSC Standard requiring child-resistant features on multi-purpose lighters, which will take effect in December 2000, represents another important step in addressing child play fires involving lighters.

## References

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## Appendix A Lighter Study Questionnaire

OMB No. 3041-0029, exp 5/31/00

### CHILD PLAY LIGHTER FIRES

Special Study for the U.S. Consumer Product Safety Commission (CPSC)

**Instructions: Complete this form only for a residential structure fire caused by a child under age five (has not reached fifth birthday) playing with a lighter. Attach Fire Incident and Casualty Reports.** (For all other child play lighter fires, complete only a Fire Incident Report with age of the fire starter and type of lighter cited in the margin.)

**Circle appropriate responses or fill in the blanks as appropriate.**

City, State \_\_\_\_\_ Incident Number \_\_\_\_\_ Date of Fire \_\_\_\_\_

Child Who Started Fire: Age \_\_\_\_\_ Birthdate(Mo/Yr) \_\_\_\_\_ Sex \_\_\_\_\_

#### A. Lighter Description (from observation or, if necessary, from occupant):

1. Lighter Availability

- a. Collected for CPSC
- b. Inspected by FD/not providing to CPSC. Current Location \_\_\_\_\_
- c. Not inspected by FD/identification only from occupant

2. Brand name/Manufacturer/Importer/Country of Origin: \_\_\_\_\_

3. Type:

- a. Cigarette
- b. Multi-purpose (grill, BBQ, fireplace) **Skip to Section B.**
- c. Other (specify, e.g., pipe lighter) \_\_\_\_\_
- d. Unknown

4. General physical description/shape (e.g., metal flip top, plastic case with metal top, shape of gun, etc.)

\_\_\_\_\_

5. Describe **any** decorative features (e.g., picture of a cowboy, hologram of a rose)

\_\_\_\_\_

6. Is (was) lighter or packaging labeled as child-resistant? (e.g., pictures or words showing how to operate)

- a. Yes
- b. No
- c. Unknown

7. Do you have any reason to believe the child-resistant feature was disabled before the fire?

- a. Yes, give reason (e.g., tab removed, occupant report) \_\_\_\_\_
- b. No
- c. Unknown

8. Ignition mechanism:



a.

b.

c.

g. Other (Describe) \_\_\_\_\_

h. Unknown

9. Is lighter refillable (has refill port)?

a. Yes

b. No

c. Unknown

10. Approximate Purchase Price:

a. Under \$5

b. \$5 or more

c. Unknown

General: (circle one)

Specific (circle as many as apply)

a. Tab, lever, or block under push button

b. Metal strip over spark wheel

c. Side wheels spin freely

d. Push-down & turn spark wheel

e. Push button moves forward to light

f. Smooth side wheels

**B. Incident Characteristics (from occupant interview):**

1. What did the child do after the fire started (sequence of actions)?

\_\_\_\_\_

2. Has this child lit this lighter in the past?

a. Yes

b. No

c. Unknown

3. Has this child been able to light other lighters or matches?

a. Yes

b. No

c. Unknown

4. Was this child playing with other children at time of the fire? If so, cite their

ages: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

5. Location and activity of caregiver at the time of the fire:

\_\_\_\_\_

6. Relationship of caregiver to child: \_\_\_\_\_

7. Was the caregiver under the age of 18 at time of fire?

a. Yes, specify age \_\_\_\_\_

b. No

c. Unknown

**Fire Department Contact: Name \_\_\_\_\_ Phone No \_\_\_\_\_**

## Appendix B

### Residential Structure Lighter Child Play Fires, Deaths, Injuries, and Property Loss, by Age of the Fire Starter and Lighter Type

**CPSC Study (10/97 - 2/99)**

Loss Measure and Lighter Type	Age of Fire Starter			
	Total	< Age 5	Age 5	Unknown
<b>Fires</b>				
<b>Total</b>	<b>375</b>	<b>191</b>	<b>183</b>	<b>1</b>
Cigarette	299	144	154	1
Multi-Purpose	69	46	23	0
Unknown	7	1	6	0
<b>Deaths</b>				
<b>Total</b>	<b>23</b>	<b>16</b>	<b>7</b>	<b>0</b>
Cigarette	15	12	3	0
Multi-Purpose	8	4	4	0
<b>Injuries</b>				
<b>Total</b>	<b>95</b>	<b>62</b>	<b>33</b>	<b>0</b>
Cigarette	79	56	23	0
Multi-Purpose	16	6	10	0
<b>Property Loss (Thousands)</b>				
<b>Total</b>	<b>\$7,111.3</b>	<b>\$3,799.7</b>	<b>\$3,201.6</b>	<b>\$110.0</b>
Cigarette	\$5,665.5	\$2,678.3	\$2,877.2	\$110.0
Multi-Purpose	\$1,362.7	\$1,109.3	\$253.4	0
Unknown	\$83.0	\$12.0	\$71.0	0

Source: CPSC investigated incidents.

## Appendix C

### Estimated Fires, Deaths, Injuries, and Property Loss Caused by Children Playing with Lighters

Year	Fires	Deaths	Injuries	Estimated Loss (millions)
1988	8,100	220	1,080	\$54.8
1989	8,000	150	1,120	\$67.9
1990	7,500	140	1,070	\$71.9
1991	8,600	240	1,460	\$103.7
1992	9,500	210	1,590	\$ 92.7
1993	10,400	180	1,670	\$130.3
1994	11,100	230	1,600	\$132.3
1995	8,500	190	1,280	\$105.1
1996	7,400	140	1,100	\$110.3
1997	6,700	170	870	\$117.4
1998	6,100	130	810	\$99.0

Note: Estimates include all types of lighters and all ages of children  
Source: Based on NFIRS/NFPA data. Consumer Product Safety  
Commission/ EPHA

## **Acknowledgements**

The authors gratefully acknowledge the participation of the many fire departments around the country that contributed data and lighter samples to this effort for the 17-month data collection period, as well as the efforts of the many CPSC field investigators who worked diligently with the fire departments to make this project productive.