1999 Residential Fire Loss Estimates

U.S. National Estimates of Fires, Deaths, Injuries, and Property Losses from Unintentional Fires

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Summary

This report presents estimates of product-related fire losses that occurred in U.S. residential structure fires attended by the fire service in 1999. The estimates were derived from data provided by the U.S. Fire Administration's (USFA) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association (NFPA). Intentional fires, and their associated losses, are excluded from the estimates. All the product categories in the tables, with the exception of smoking materials, are products within the jurisdiction of the U.S. Consumer Product Safety Commission (CPSC).

A major revision to the NFIRS data coding system took effect with 1999 data. For that reason, this document contains estimates for 1999 only and CPSC staff discourages comparisons of 1999 estimates with estimates from earlier years.

Overview of the estimates:

- An estimated 337,300 unintentional, residential structure fires occurred in 1999. These fires resulted in an estimated 2,390 civilian deaths, 14,550 civilian injuries and $4.24 billion in property losses.

- Cooking equipment (Table 1) accounted for the largest percentage of fires (29%), 13% of the deaths, and 28% of the injuries. Most of these losses were associated with range and oven fires.

- Heating and cooling equipment fires accounted for 14% of the fires, 13% of the deaths, and 9% of the injuries.

- Twelve percent of the fires were attributable to electrical distribution system components (e.g. wiring, lighting, etc.). These fires led to 8% of the total deaths and 7% of the total injuries.

- By item first ignited (Table 2), upholstered furniture ignition was involved in the greatest number of deaths, accounting for 440 residential fire deaths, 18% of the total deaths. Mattress or bedding ignitions accounted for 330 residential fire deaths, 14% of total deaths.

- By heat source, smoking materials were the largest contributor to deaths, accounting for 33% of fire deaths. Lighters, candles, and matches accounted for 5%, 4%, and 3% of fire deaths respectively.

As in previous years, only selected product-specific estimates are included in the tables. Therefore, the detail may not add to the totals that appear in the headings. Also, it should be noted that some estimates provided in the different sections of the tables overlap. For example, estimates of match and lighter child play losses overlap with the estimates of losses for mattress/bedding and upholstered furniture with open flame ignition. Additional details about the estimates and the data system are included in the Methodology section.

TABLE 1
ESTIMATED RESIDENTIAL STRUCTURE FIRES
SELECTED EQUIPMENT, 1999

Equipment	Fires	Civilian Deaths	Civilian Injuries	Property Loss (In Millions)
Total Residential	**337,300**	**2,390**	**14,550**	**$4,237.7**
Total Heating and Cooling Equipment	**46,500**	**300**	**1,280**	**$563.2**
Local Fixed Heater	7,100	90	240	$98.6
Portable Heater	3,800	100	280	$90.4
Central Heating	7,600	20	150	$73.4
Fireplace, Chimney, Chimney Connector	15,500	40	130	$152.2
Water Heater	6,300	10	310	$61.9
Air Conditioning	2,200	30	70	$27.0
Other	4,000	20	110	$59.8
Total Cooking Equipment[1]	**97,900**	**310**	**4,060**	**$512.6**
Range/Oven	81,000	260	3,450	$355.2
Gas	23,800	110	780	$52.3
Electric	54,700	130	2,610	$279.3
Other	2,400	20	70	$23.6
All Other Cooking	16,900	50	610	$157.5
Gas	3,000	20	80	$36.8
Electric	12,600	20	480	$99.2
Other	1,300	*	50	$21.4
Total Electric Distribution	**39,800**	**180**	**1,090**	**$733.9**
Installed Wiring[2]	14,100	30	210	$260.1
Cord, Plug	6,700	80	350	$140.7
Receptacle, Switch	3,300	10	50	$60.6
Lighting	8,500	20	300	$127.0
Other	7,100	30	180	$145.5
Total Appliances (Except Above)	**28,100**	**100**	**910**	**$315.4**
TV, Radio	1,600	40	140	$29.2
Clothes Dryer	14,600	*	300	$86.8
Washing Machine	1,400	*	*	$4.4
Torch	3,600	10	180	$94.3
Other	6,900	50	290	$100.7

Source: U. S. Consumer Product Safety Commission/EPHA, from data obtained from the U. S. Fire Administration and NFPA. Note: Estimates exclude losses from intentionally set fires. Fire estimates are rounded to the nearest 100. Death and injury estimates are rounded to the nearest 10. Property loss is rounded to the nearest tenth of a million. Estimates less than 10 are denoted by an asterisk (*). Selected product categories presented; subtotals do not necessarily add to heading totals.

TABLE 2
ESTIMATED RESIDENTIAL STRUCTURE FIRES
SELECTED PRODUCTS, 1999

Product	Fires	Civilian Deaths	Civilian Injuries	Property Loss (In Millions)
Total Residential	**337,300**	**2,390**	**14,550**	**$4,237.7**
By Heat Source				
Cigarette, Other Tobacco Prod.	**25,300**	**780**	**1,890**	**$373.5**
Match	**7,000**	**70**	**600**	**$103.1**
Child Play	5,000	60	450	$82.4
Other	2,000	10	150	$20.7
Lighter	**4,600**	**130**	**640**	**$96.5**
Child Play	4,100	100	580	$85.6
Other	500	30	60	$10.9
Candle	**14,500**	**100**	**1,530**	**$265.0**
By Item First Ignited				
Upholstered Furniture	**9,300**	**440**	**1,070**	**$232.2**
Smoking Material Ignition	4,500	340	570	$100.4
Open Flame Ignition	1,700	30	290	$40.3
Other	3,200	80	210	$91.5
Mattress, Bedding	**17,900**	**330**	**2,070**	**$300.7**
Smoking Material Ignition	5,200	160	550	$89.0
Open Flame Ignition	5,600	70	990	$111.8
Other	7,100	100	540	$99.9
Other Materials				
Cooking Materials	81,500	170	3,450	$289.5
Electric Cable Insulation	27,600	100	590	$310.3
Interior Wall Covering	13,100	90	410	$288.2
Wearing Apparel-Worn	500	140	150	$6.0
Wearing Apparel-Not Worn	12,600	50	670	$133.6
Floor Covering	6,900	110	310	$122.4
Curtains, Drapes	3,400	20	310	$45.0
Magazines, Newspaper	3,400	30	210	$44.2
Thermal Insulation	4,600	*	80	$61.3
Cabinet, Desk	6,800	30	400	$96.6
Trash, Rubbish	20,000	30	350	$105.5
Toy, Game	600	*	90	$7.7
Box, Carton, Bag, Basket, Barrel	4,600	40	180	$58.4

Source: U. S. Consumer Product Safety Commission/EPHA, from data obtained from the U. S. Fire Administration and NFPA.
Note: Estimates exclude losses from intentionally set fires. Fire estimates are rounded to the nearest 100. Death and injury estimates are rounded to the nearest 10. Prop erty loss is rounded to the nearest tenth of a million. Estimates less than 10 are denoted by an asterisk (*). Selected product categories presented; subtotals do not necessarily add to heading totals.

TABLE 3
ESTIMATED RESIDENTIAL STRUCTURE FIRES
HEATING AND COOLING EQUIPMENT, 1999

Equipment	Fires	Civilian Deaths	Civilian Injuries	Property Loss (In Million)
Total Residential	**337,300**	**2,390**	**14,550**	**$4237.7**
Total Heating and Cooling Equipment	**46,500**	**300**	**1,280**	**$563.2**
Solid Fuel	**16,500**	**50**	**130**	**$173.3**
Fixed Heater	2,200	20	20	$29.1
Portable Heater	*	*	*	$0.8
Fireplace, Chimney, Chimney Connector	13,900	30	100	$137.1
Central Heating	100	*	*	$1.4
Water Heater	*	*	*	$0.2
Other	200	*	20	$4.8
Gas-Fired	**11,000**	**120**	**560**	**$124.5**
Fixed Heater	1,900	60	50	$19.9
Portable Heater	700	20	70	$10.4
Fireplace, Chimney, Chimney Connector	800	10	30	$9.2
Central Heating	2,600	20	80	$28.1
Water Heater	4,400	10	260	$48.2
Other	700	10	50	$8.7
Electric	**14,500**	**90**	**450**	**$216.5**
Fixed Heater	2,200	10	150	$45.0
Portable Heater	2,400	40	140	$64.8
Central Heating	3,000	10	20	$25.6
Water Heater	1,700	*	30	$10.5
Central Air Conditioning	1,300	*	10	$9.9
Portable Air Conditioning	900	30	50	$17.1
Other	2,900	*	40	$43.7
Liquid Fuel	**4,500**	**50**	**140**	**$48.2**
Fixed Heater	800	*	20	$4.6
Portable Heater	600	40	60	$14.5
Fireplace, Chimney, Chimney Connector	700	*	*	$5.5
Central Heating	1,900	*	40	$18.3
Water Heater	300	*	20	$2.9
Other	200	10	*	$2.4
All Other Fuel[3]	**100**	*****	*****	**$0.6**

Source: U. S. Consumer Product Safety Commission/EPHA, from data obtained from the U. S. Fire Administration and NFPA.
Note: Estimates exclude losses from intentionally set fires. Fire estimates are rounded to the nearest 100. Death and injury estimates are rounded to the nearest 10. Property loss is rounded to the nearest tenth of a million. Estimates less than 10 are denoted by an asterisk (*). Selected product categories presented; subtotals do not necessarily add to heading totals.

TABLE 4
ESTIMATED RESIDENTIAL STRUCTURE FIRES
SELECTED ELECTRICAL EQUIPMENT, 1999

Equipment	Fires	Civilian Deaths	Civilian Injuries	Property Loss (in Millions)
Total Residential	**337,300**	**2,390**	**14,550**	**$4,237.7**
Total Electrical	**143,700**	**510**	**5,320**	**$1,559.6**
Electrical Heating and Cooling	**14,500**	**90**	**450**	**$216.5**
Central Heating	3,000	10	20	$25.6
Local Fixed Heater	2,200	10	150	$45.0
Portable Heater	2,400	40	140	$64.8
Water Heater	1,700	*	30	$10.5
Fixed, Central Air Conditioning	1,300	*	10	$9.9
Portable Air Conditioner	900	30	50	$17.1
Other	2,900	*	40	$43.7
Electrical Cooking Equipment	**67,300**	**160**	**3,090**	**$378.5**
Range/Oven	54,700	130	2,610	$279.3
Range/Oven Hood	1,000	*	10	$3.3
Deep Fat Fryer	300	*	40	$3.7
Grill	100	*	*	$0.3
Portable Cooking Appliance	3,100	10	90	$26.1
Other	8,000	10	340	$65.7
Electrical Distribution[2]	**39,800**	**180**	**1,090**	**$733.9**
Installed Wiring	14,100	30	210	$260.1
Light Fixture	5,400	10	160	$73.8
Receptacle,Switch	3,300	10	50	$60.6
Cord, Plug	6,700	80	350	$140.7
Lamp, Light Bulb	3,100	10	150	$53.2
Panel Board	1,800	*	30	$29.1
Meter	1,100	*	20	$14.5
Transformer	400	*	*	$4.8
Other	3,900	20	130	$97.1
Electrical Appliances	**21,300**	**90**	**660**	**$208.9**
Clothes Dryer	11,500	*	210	$73.5
Washing Machine	1,400	*	*	$4.4
Television, Radio	1,600	40	140	$29.2
Refrigerator/Freezer	900	10	80	$11.8
Torch	300	*	40	$3.5
Other	5,600	40	190	$86.5

Source: U. S. Consumer Product Safety Commission/EPHA, from data obtained from the U. S. Fire Administration and NFPA. Note: Estimates exclude losses from intentionally set fires. Fire estimates are rounded to the nearest 100. Death and injury estimates are rounded to the nearest 10. Property loss is rounded to the nearest tenth of a million. Estimates less than 10 are denoted by an asterisk (*). Selected product categories presented; subtotals do not necessarily add to heading totals.

TABLE 5
ESTIMATED RESIDENTIAL STRUCTURE FIRES
SELECTED GAS-FIRED EQUIPMENT, 1999

Equipment	Fires	Civilian Deaths	Civilian Injuries	Property Loss (in Millions)
Total Residential	**337,300**	**2,390**	**14,550**	**$4,237.7**
Total Gas-Fired Equipment	**44,600**	**270**	**1,660**	**$320.2**
Gas Heating Equipment	**11,000**	**120**	**560**	**$124.5**
Fixed Heater	1,900	60	50	$19.9
Portable Heater	700	20	70	$10.4
Central Heating	2,600	20	80	$28.1
Fireplace, Chimney, Connector	800	10	30	$9.2
Water Heater	4,400	10	260	$48.2
Other	700	10	50	$8.7
Gas Cooking Equipment	**26,800**	**140**	**850**	**$89.1**
Range/Oven	23,800	110	780	$52.3
Open Gas Grill	1,100	*	30	$18.6
Other	1,800	20	40	$18.2
Other Equipment	**6,800**	**10**	**250**	**$106.6**
Clothes Dryer	3,100	*	90	$13.3
Torch	3,300	10	150	$90.8
Other	400	*	20	$2.4

Source: U. S. Consumer Product Safety Commission/EPHA, from data obtained from the U. S. Fire Administration and NFPA. Note: Estimates exclude losses from intentionally set fires. Fire estimates are rounded to the nearest 100. Death and injury estimates are rounded to the nearest 10. Property loss is rounded to the nearest tenth of a million. Estimates less than 10 are denoted by an asterisk (*). Selected product categories presented; subtotals do not necessarily add to heading totals.

Endnotes for Tables

1 Table 1

This estimate includes cooking fires that were confined to the container where the fire started. Because the specific product was not reported for these fires, they have been allocated among the cooking equipment in proportion to the distribution of cooking equipment fires that were not confined to the container. This is part of the new confined fire issue that is discussed in more detail in the Methodology section.

2 Table 1 and Table 4

Due to the change in the coding system, only the unconverted data provided product-specific codes for installed wiring, receptacles, and switches. As a result, very few deaths, injuries, and property loss in the database were associated with these products. Since the raking algorithm cannot appropriately produce a raked result when cell values are zero or very low, installed wiring, and receptacle/switch deaths, injuries, and property loss were allocated in the same proportion as the fires. See the discussion of Fire Losses Involving Electrical Products in the Methodology section for further detail.

3 Table 3

The estimates for 'All Other Fuel' fires and associated losses are lower than in previous years due to changes in the NFIRS coding system. In 1999 version 5.0, the variable that identifies fuel is called 'Power Source' and refers only to the power source of the equipment involved in the start of the fire. In previous years, the variable that captured fuel was called 'Form of Heat of Ignition' and did not always pertain to the equipment involved. So in 1999 if there was no equipment involved in the fire, there is no fuel-type (Power Source) associated with the fire. Power Source is not considered missing so nothing is allocated for power source in these no equipment cases. These cases maintain no value for power source.

Methodology

This report is based on the National Fire Protection Association's (NFPA) annual survey of fire departments and the U.S. Fire Administration's (USFA) National Fire Incident Reporting System (NFIRS) data. The NFPA survey is a stratified random sample of fire departments in the U.S. The sample is stratified by the size of the community protected by the department. The NFPA makes national estimates of aggregated fires, deaths, injuries, and property loss by weighting sample results according to the proportion of the total U.S. population accounted for by communities of each size.

The NFIRS is a compilation of voluntarily submitted incident reports completed by U.S. fire departments. In 1999, the NFIRS contained reports of 128,287 residential structure fires (including intentional fires) that resulted in 977 civilian deaths, 5,864 civilian injuries, and over $1.5 billion in property loss. These reports came from 40 states and the District of Columbia. Not all the states reporting data included data from all fire departments in the state.

It should be noted that product-specific death and injury estimates fluctuate year-to-year and that a small increase or decrease in any one year is not sufficient to denote a trend. Also, as will be discussed later, 1999 is the first year implementing a major revision of the NFIRS coding system and this may be a source of differences between 1998 and 1999.

Fire Incident Characteristics of Interest

The NFIRS version 5.0 coding system includes many variables but CPSC staff has used only the following for this report:

Variable	Description
Equipment Involved	Equipment that provided the heat which started the fire, e.g. heater, clothes dryer, etc.
Power Source	The type of power for the equipment involved in the fire's ignition. These are grouped into electrical, gas-fueled, liquid-fueled, solid-fueled, and other.
Equipment Portability	Identifies the equipment involved as stationary or portable.
Heat Source	Source of heat that ignited the fire, e.g., candle, lighter, cigarette, heat from operating equipment, hot object, etc.
Item First Ignited	The functional description or use of that which ignited, e.g. upholstered furniture, mattress, bedding, electric cable insulation, curtains or drapes, etc.

Cause of Ignition	The event that allowed the heat source and the material first ignited to combine to start the fire. This indicates whether the fire was intentional, unintentional, or unknown. Failure of equipment or heat source, or an act of nature was considered unintentional.
Factors Contributing to Ignition	Factors adding specificity to the cause of ignition, such as playing with heat source, heat source too close to combustibles, etc.
Human Factors Contributing to Ignition	Factors relating to the person or persons involved with the start of the fire. Examples are asleep, possibly impaired by alcohol or drugs, age was a factor, unattended or unsupervised person, etc.

Estimation Procedures

Weights were computed for fires, deaths, injuries, and property loss respectively by dividing the NFPA estimated totals for residential structure fires, deaths, injuries, and property loss by the NFIRS residential structure totals for fires, deaths, injuries, and property loss. These weights were multiplied by the NFIRS product-specific frequency counts to produce the product estimates that are in the tables. Deaths and injuries to fire fighters are not included.

To obtain the NFIRS estimates, an assumption was made that the unknowns for a characteristic were distributed the same as the known values for that characteristic. To allocate these unknowns for the various characteristics, "raking" was used. A SAS macro[1] performed the raking. The raking maintains the marginal distributions for the known data while allocating the unknown data for all characteristics involved. The raking procedure was applied separately for fires, deaths, injuries, and property loss.

Differences between 1999 and Previous Years

1) NFIRS 5.0

The 1999 NFIRS data provided by the U.S. Fire Administration was constructed using a new version of NFIRS, version 5.0. In 1999, most fire departments recorded incident and loss data using the older system, NFIRS 4.1. When fire departments transmitted their data to USFA in the 4.1 version, the data was converted to the 5.0 version using specially designed computer programs. See the USFA's "National Fire Incident Reporting System Version 5.0 Design Documentation", January 2002, pp 248 –309. The version 5.0 variables and formats are included in USFA's "National Fire Incident Reporting System Version 5.0 Quick Reference Guide". Both documents are available at www.nfirs.fema.gov.

The 5.0 codes for some variables are more specific and extensive than the 4.1 codes. When the two systems don't match one-to-one, it is sometimes not possible to be sure that the data captured by fire departments using the 5.0 version and data converted from 4.1 to 5.0, include the same set of products. An example for fireplaces and chimneys follows:

[1] M. Battaglia, D. Hoaglin and D. Izrael, "A SAS Macro for Balancing a Weighted Sample", SAS Users Group International (SUGI) 25th Annual Conference, April 9-12, 2000, Paper #258-25.

Version 4.1 Equipment Codes for fireplaces and chimneys

14 - 'Indoor fireplace.'
16 - 'Chimney, gas vent flue. Included are masonry, factory built and metal chimneys.'

Version 5.0 Equipment Codes for fireplaces and chimneys

120 - 'Fireplace, chimney, other'

121 - 'Fireplace, masonry'
122 - 'Fireplace, factory built'
123 - 'Fireplace, insert/stove'

126 - 'Chimney - brick, stone, masonry'
127 - 'Chimney - metal, including stovepipe, flue'

Conversion

14 converted to **120**
16 converted to **120**

For data coded initially as either fireplace (14) or chimney (16) in version 4.1 and converted to code 120, 'fireplace, chimney, other' in version 5.0, it was impossible to distinguish fireplaces from chimneys. Since much of the data was converted, fireplaces and chimneys are combined in the tables. A similar situation occurred for other products as well, causing them to be grouped together. It is anticipated that the proportion of data that is coded in version 5.0 by the fire departments will continue to rise in future years, which will eventually enable estimates to be made for some specific products that could not be estimated for 1999.

2) Allocation of Unknowns

In 1998 and previous years some variables, such as equipment, contained two levels of unknowns which were raked in a two-stage process. The first stage involved raking complete unknowns for a characteristic, like unknown equipment, into all the specific codes with reported data. The second stage involved raking of group unknowns into all the specific codes within their respective groups with reported data. An example would be fires reported as 'Cooking Equipment, unable to classify further', which would be distributed among all the more specific codes in the cooking equipment group, maintaining the marginal distributions for the known data.

For 1999, there is no systematic second stage raking because there are no group unknowns in the 5.0 codes. If a case was coded in 4.1 as 'Cooking Equipment, unable to classify further', it converted to 'Kitchen & Cooking Equipment, other' in 5.0. So, in previous years, it would be allocated among the known cooking equipment products (such as range/oven, deep fat fryer, etc.) but now it is counted as 'Other' in the Cooking Equipment subsections of the tables.

This affects every subsection of Tables 1,3,4, and 5. In previous years the 'Other' category at the bottom of each of these subsections was comprised of two things. One was all the individual products within these categories whose estimates were not deemed substantial enough to be given their own line in the table. The second was for the codes ending in 'not classified above' such as 'Heating Systems not classified above'. The codes ending in 'insufficient information to classify further' such as 'Heating Systems; insufficient information to classify further' were allocated among the specific Heating Equipment variables, like fixed heater, fireplace, etc.

For 1999, these 'Other' entries are also comprised of two groups. The first consists of individual products without enough data to stand on their own, just as in 1998. The second includes codes ending in 'other', such as 'Heating, ventilating, and air conditioning, other'. These codes are a combination of the 'not classified above' codes and the 'insufficient information to classify further' codes. They are lumped together now, so the 'insufficient information to classify further' codes weren't raked because it was not known which cases are truly 'insufficient information to classify further' cases and which are actually 'not classified above' cases. The consequence of this is that the other categories include more cases and the specific product categories include fewer cases than they would if there was raking of the group unknowns.

3) Exposure Fires

Some fires involved more than one residential structure. The initial structure is identified as exposure zero in the file. Structure fires that spread from the initial fire are identified as exposures numbered beginning with "one" to however many are necessary. For the first time, CPSC staff converted the fire cause values reported for the exposures to those reported for the initial fire. Thus, if the initial fire was caused by a portable heater, all exposures would be considered portable heater fires. All associated deaths, injuries, and property loss also would be attributed to portable heaters. The effect of this will likely be higher fire and fire loss numbers for specific products than there would otherwise be. Cases that, in previous years, might go as no equipment if they weren't the initial fire will now be associated with the specific product that the initial fire was associated with, if any.

4) Confined Fires

Version 5.0 for the first time includes specific codes for selected kinds of fires that were confined to noncombustible containers. Before 1999 it was thought that, in many cases, these fires were not reported to NFIRS.

Only information on the incident type, property type, and fire losses is required to be reported for these fires. An example is incident type 113, which indicates 'Cooking fire, confined to container'. No additional information is required to be reported for equipment involved or item first ignited. In these confined fire cases, equipment and item first ignited can be inferred from the incident type, so the data set was edited giving codes to equipment involved and item first ignited. In the example of incident type 113, the item first ignited is 'Cooking Materials' and the equipment involved code given is allocated among the more specific cooking products, using raking. See section on Estimation Procedures above.

5) Fire Losses Involving Electrical Products

In the past, some electrical products which were not defined uniquely by the NFIRS codes were included in the estimates. These estimates were achieved with the help of the NFIRS text fields. The codes for which this was done include microwave oven, dishwasher, electric blanket, television, and heat tape.

In NFIRS 5.0 there are specific codes for many of these products. As the proportion of fires that are reported initially in the 5.0 version increases in future years losses associated with these products will be estimated. Until then, these products are either grouped with other products or are not included in the tables.