

**HOME FIRES INVOLVING HEATING EQUIPMENT
WATER HEATERS**

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Abstract

In 2007, heating equipment was involved in an estimated 66,400 reported home structure fires, 580 civilian deaths, 1,850 civilian injuries, and \$608 million in direct property damage. The numbers of fires, deaths, and injuries were all higher than in 2006 but fit into a largely level trend over the past few years, coming after a sharp decline from the early 1980s to the late 1990s.

In 2003-2007, most home heating fire deaths (79%) and injuries (62%) and half (49%) of associated direct property damage involved stationary or portable space heaters.

Space heating poses a much higher risk of fire, death, injury, and loss per million users than central heating.

Keywords: Heating, space heater, water heater, furnace, wood stove, heat tape, fireplace, creosote, chimney, fire statistics, home fires, residential fires.

Acknowledgements

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We are also grateful to the U.S. Fire Administration for its work in developing, coordinating, and maintaining NFIRS.

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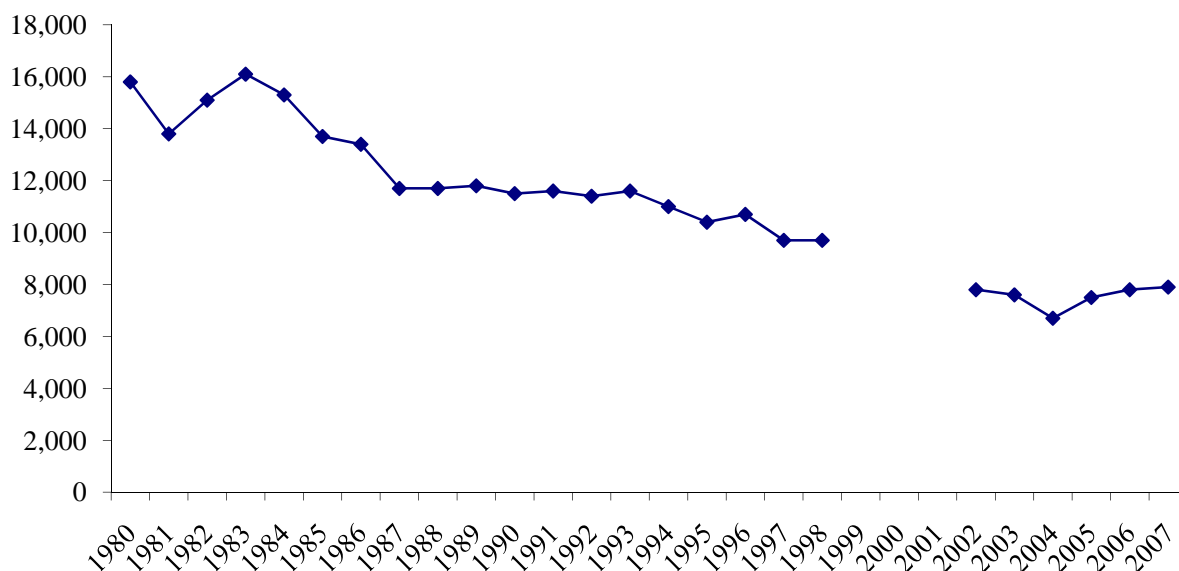
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Section 5. Water Heaters

In 2007, an estimated 7,900 reported home structure fires involving water heaters resulted in 30 civilian deaths, 340 civilian injuries, and \$75 million in direct property damage.

The number of fires and associated losses have declined substantially since 1980, but there has been no sustained, significant decline since 2000. (See Figure 5.1 and Table 5.1.)

Figure 5.1. Home Fires Involving Water Heaters, 1980-2007, by Year



Note: Confined fires are fires reported as confined to chimney, flue, fuel burner, or boiler and involving heating equipment; they are analyzed separately but are included above. 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. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or reported as heating or air conditioning equipment of undetermined type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. *Because of low participation in NFIRS Version 5.0 during 1999-2001, estimates for those years are highly uncertain and must be used with caution.*

Source: Data from NFIRS Version 4.1 (1980-1998) and Version 5.0 (1999-2007) and from NFPA survey.

Three out of five (62%) home water heater fires in 2003-2007, including fires reported as confined fires, involved gas-fueled equipment.

Another 36% involved electric-powered water heaters, and 2% involved liquid-fueled water heaters. For gas-fueled equipment, natural gas outnumbered LP-gas by nearly 5-to-1.

**Table 5.A. Home Water Heater Fires, by Type of Fuel or Power
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Department
(Including Fires Reported as Confined Fires)**

Fuel or Power	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Gas-fueled	4,620 (62%)	41 (93%)	276 (86%)	\$103 (86%)
Electric-powered	2,720 (36%)	3 (7%)	45 (14%)	\$17 (14%)
Liquid-fueled	140 (2%)	0 (0%)	0 (0%)	\$0 (0%)
Solid-fueled	10 (0%)	0 (0%)	3 (1%)	\$0 (0%)
Total	7,480 (100%)	44 (100%)	322 (100%)	\$121 (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. Fires are rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or recorded as heating of air conditioning equipment type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Home heating fires with this equipment and type of fuel or power unknown have also been allocated proportionally.

Source: Data from NFIRS Version 5.0 and NFPA survey.

Water heaters show a very large difference in risk for fires, death, injuries, and direct property damage, with gas-fueled equipment showing higher risk than electric-powered equipment.

In 2005, the last year with published detailed usage statistics, gas-fueled water heaters had 36% more users than electric-powered water heaters (58.7 million households vs. 43.1 million households). By contrast, gas-fueled water heaters had 2½ times as many confined and non-confined 2003-2007 reported home fires, six times as much direct property damage, 13 times as many civilian fire deaths, and six times as many civilian fire injuries.

Water heaters accounted for 4,250 injuries reported to hospital emergency rooms in 2008.¹⁹

For specific equipment, water heaters with unknown-type power or fuel accounted for 2,920 injuries, gas-fueled equipment 860 injuries, faucet water heaters 240 injuries, electric immersion heaters 90 injuries, and other electric water heaters 150 injuries.

In 1998, 2000, 2001, and 2003, there were 2.5 electrocution deaths per year involving electric water heaters.²⁰

These are the only years with separate statistics for water heaters and furnaces. In 1995-1997, statistics were provided for furnaces and water heaters together, and the combined average in those years was higher (5.0) than the combined average (4.3) in the four years cited.

¹⁹ All statistics from CPSC’s National Electronic Injury Surveillance System, at www.cpsc.gov.

²⁰ Risana T. Chowdbury, “2003 Electrocutions Associated with Consumer Products,” December 2006, Table 2, www.cpsc.gov, and previous reports in the series.

One-quarter (23%) of home water heater fires had heat source too close to combustibles as a factor contributing to ignition.

Heat source too close to combustibles accounted for 31% of associated civilian deaths and 44% of associated civilian injuries. (See Table 5.B.) Heat source too close to combustibles had a much larger share of *non-confined* home water heater fires for gas-fueled equipment (39%) than for electric-powered equipment (9%). (See Table 5.2, which includes breakdowns for all water heaters and for gas-fueled and electric-powered water heaters.)

**Table 5.B. Leading Factors Contributing to Ignition for Home Water Heater Fires
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments**

Factor	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Heat source too close to combustibles	1,740 (23%)	14 (31%)	142 (44%)	\$40 (33%)
Unclassified mechanical failure	1,360 (18%)	3 (7%)	33 (10%)	\$19 (16%)
Unclassified electrical failure or malfunction	690 (9%)	0 (0%)	3 (1%)	\$4 (4%)
Unspecified short circuit arc	590 (8%)	0 (0%)	2 (1%)	\$2 (1%)
Leak or break	560 (7%)	13 (29%)	32 (10%)	\$14 (12%)
Total	7,480	44	322	\$121

Note: Multiple entries are allowed, resulting in more factor entries than fires. 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 rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or recorded as heating or air conditioning equipment of undetermined type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Home heating fires with this equipment and factor contributing to ignition listed as unknown, unreported, none, or blank have also been allocated proportionally. Statistics are calculated separately for fires reported as non-confined fires and for fires reported as confined to fuel burner or boiler and with water heater as equipment involved in ignition.

Source: Data from NFIRS Version 5.0 and NFPA survey.

One-fifth (19%) of home water heater fires began with ignition of flammable or combustible gas or liquid.

This may often be the gas or liquid that fuels the equipment, because roughly a third of these fires are reported as confined to the equipment. (Compare Table 5.C to Table 5.3.)

The second leading item first ignited was wire or cable insulation (15%). For gas-fueled equipment, flammable or combustible liquid or gas accounted for 26% of *non-confined* fires and 54% of associated civilian fire deaths, but they accounted for less than 1% of fires for the electric-powered equipment (not enough to be shown on Table 5.3). Wire or cable insulation accounted for 53% of the fires for electric-powered equipment but only 1% of the fires for gas-fueled equipment. (Table 5.3 includes breakdowns for all water heaters and for gas-fueled and electric-powered water heaters.)

The 2001 edition of ANSI Z21.10.1/CSA4.1, *Gas Water Heaters*, introduced a phased schedule for requiring new gas water heaters to pass a new test for resistance to flammable vapor ignition.

**Table 5.C. Leading Items First Ignited for Home Water Heater Fires
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments**

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Flammable or combustible gas or liquid	1,430 (19%)	5 (10%)	49 (33%)	\$13 (17%)
Wire or cable insulation	1,120 (15%)	8 (17%)	5 (4%)	\$9 (12%)
Appliance housing	570 (8%)	0 (0%)	0 (0%)	\$2 (2%)
Unclassified item first ignited	540 (7%)	0 (0%)	2 (1%)	\$4 (5%)
Clothing	530 (7%)	0 (0%)	8 (5%)	\$2 (3%)
Total	7,480	44	322	\$121

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 rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or recorded as heating or air conditioning equipment of undetermined type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Home heating fires with this equipment and item first ignited listed as unknown have also been allocated proportionally. Statistics are calculated separately for fires reported as non-confined fires and for fires reported as confined to fuel burner or boiler and with water heater as equipment involved in ignition.

Source: Data from NFIRS Version 5.0 and NFPA survey.

Two out of five (40%) of home water heater fires began in a designated heating equipment room or area.

The other leading areas of origin were all popular locations for water heaters, including laundry rooms or areas (15%), closets (10%), and garages (6%). (See Tables 5.D and 5.4, which covers only *non-confined* fires and includes breakdowns for all water heaters and for gas-fueled and electric-powered units.)

Safe Heating Behaviors

Messages from NFPA Educational Messaging Advisory Committee

General heating-related messages

- All heaters need space. Keep things that can burn, such as paper, bedding or furniture, at least 3 feet away from heating equipment.
- Use heating equipment that has the label of a recognized testing laboratory.
- Install water heaters according to the local codes and manufacturer’s instructions. Have a qualified professional install the equipment.

Additional safe behaviors for water heaters

- The annual inspection can best be timed for just before the beginning of a new heating season. Inspection is also warranted if you move into a new home or begin use of your equipment after a period of non-use.

**Table 5.D. Leading Areas of Origin for Home Water Heater Fires
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments**

Area of Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Heating equipment room	2,970 (40%)	13 (29%)	107 (33%)	\$39 (32%)
Laundry room or area	1,100 (15%)	5 (12%)	68 (21%)	\$19 (16%)
Closet	750 (10%)	0 (0%)	17 (5%)	\$9 (7%)
Garage*	450 (6%)	0 (0%)	25 (8%)	\$20 (17%)
Crawl space or substructure space	350 (5%)	5 (12%)	16 (5%)	\$6 (5%)
Total	7,480	44	322	\$121

* Excludes garages designated as separate properties

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 rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires with equipment involved to ignition unknown or recorded as heating or air conditioning equipment of undetermined type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Home heating fires with this equipment and area of origin unknown have also been allocated proportionally. Statistics are calculated separately for fires reported as non-confined fires and for fires reported as confined to fuel burner or boiler and with water heater as equipment involved in ignition.

Source: Data from NFIRS Version 5.0 and NFPA survey.

**Table 5.1. Home Fires Involving Water Heaters, by Year
Structure Fires Reported to U.S. Fire Departments**

Year	Fires	Civilian		Civilian		Direct Property Damage (in Millions)	
		Deaths	Injuries	As Reported	In 2007 Dollars		
1980	15,800	140	990	\$86	\$218		
1981	13,800	50	800	\$77	\$174		
1982	15,100	190	930	\$88	\$189		
1983	16,100	70	1,010	\$113	\$235		
1984	15,300	80	790	\$103	\$206		
1985	13,700	80	820	\$101	\$194		
1986	13,400	50	680	\$95	\$180		
1987	11,700	30	890	\$81	\$149		
1988	11,700	40	700	\$101	\$178		
1989	11,800	30	550	\$90	\$151		
1990	11,500	60	620	\$135	\$215		
1991	11,600	70	770	\$170*	\$258*		
1992	11,400	60	550	\$81	\$120		
1993	11,600	50	670	\$97	\$139		
1994	11,000	40	620	\$102	\$143		
1995	10,400	30	510	\$97	\$132		
1996	10,700	70	450	\$129	\$170		
1997	9,700	60	300	\$118	\$153		
1998	9,700	90	510	\$107	\$136		
1999	6,100 (5,600)	0 (0)	170 (170)	\$67 (\$66)	\$83 (\$83)		
2000	7,700 (7,300)	120 (120)	310 (310)	\$95 (\$95)	\$114 (\$114)		
2001	8,800 (7,800)	20 (20)	240 (240)	\$106 (\$104)	\$124 (\$122)		
2002	7,800 (7,100)	50 (50)	220 (220)	\$116 (\$116)	\$134 (\$134)		
2003	7,600 (6,100)	40 (40)	360 (340)	\$121 (\$120)	\$136 (\$136)		
2004	6,700 (5,800)	30 (30)	270 (270)	\$118 (\$118)	\$129 (\$129)		
2005	7,500 (5,900)	80 (80)	320 (300)	\$149 (\$149)	\$159 (\$158)		
2006	7,800 (5,800)	50 (50)	300 (300)	\$167 (\$166)	\$171 (\$171)		
2007	7,900 (6,000)	30 (30)	340 (340)	\$75 (\$75)	\$75 (\$75)		

* All 1991 home fire property damage figures are inflated by estimation problems related to the handling of the Oakland fire storm.

Note: Numbers in parentheses exclude confined fires. Confined fires are fires reported as confined to chimney, flue, fuel burner, or boiler and involving heating equipment; they are analyzed separately. 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 rounded to the nearest hundred, civilian deaths and civilian injuries are expressed to the nearest ten and direct property damage is rounded to the nearest million dollars. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or reported as heating or air conditioning equipment of undetermined type. Fires reported as "no equipment" but lacking a confirming specific heat source (codes (40-99) are also treated as unknown equipment and allocated. *Because of low participation in NFIRS Version 5.0 during 1999-2001, estimates for those years are highly uncertain and must be used with caution.* Inflation adjustment to 2007 dollars is done using the consumer price index.

Source: Data from NFIRS Version 4.1 (1980-1998) and Version 5.0 (1999-2007) and from NFPA survey.

**Table 5.2. Home Water Heater Fires, by Factor Contributing to Ignition
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)**

A. All Water Heaters

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Heat source too close to combustibles	1,680	(28%)	14	(31%)	142	(46%)	\$40	(33%)
Unclassified mechanical failure or malfunction	870	(15%)	3	(7%)	33	(11%)	\$19	(16%)
Unclassified electrical failure or malfunction	460	(8%)	0	(0%)	3	(1%)	\$4	(4%)
Leak or break	430	(7%)	13	(29%)	32	(10%)	\$14	(12%)
Unspecified short circuit arc	410	(7%)	0	(0%)	2	(1%)	\$2	(1%)
Unclassified misuse of material or product	220	(4%)	0	(0%)	22	(7%)	\$7	(6%)
Improper container or storage	220	(4%)	0	(0%)	13	(4%)	\$3	(3%)
Worn out	210	(4%)	0	(0%)	0	(0%)	\$1	(1%)
Flammable liquid or gas spilled	200	(3%)	7	(17%)	24	(8%)	\$16	(13%)
Installation deficiency	200	(3%)	6	(13%)	7	(2%)	\$4	(3%)
Water caused short circuit arc	200	(3%)	0	(0%)	2	(1%)	\$0	(0%)
Unclassified factor	170	(3%)	4	(9%)	2	(1%)	\$5	(4%)
Automatic control failure	130	(2%)	6	(14%)	0	(0%)	\$4	(3%)
Unclassified operational deficiency	130	(2%)	0	(0%)	0	(0%)	\$1	(1%)
Short circuit arc from defective or worn insulation	120	(2%)	0	(0%)	0	(0%)	\$1	(1%)
Arc or spark from operating equipment	100	(2%)	0	(0%)	0	(0%)	\$1	(1%)
Failure to clean	80	(1%)	0	(0%)	4	(1%)	\$1	(0%)
Arc from faulty contact or broken conductor	70	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Equipment not being operated properly	60	(1%)	0	(0%)	5	(2%)	\$1	(0%)
Abandoned or discarded material of product	50	(1%)	0	(0%)	9	(3%)	\$1	(1%)
Washing part or painting with flammable liquid	50	(1%)	0	(0%)	11	(4%)	\$1	(1%)
Short circuit arc from mechanical damage	40	(1%)	0	(0%)	0	(0%)	\$1	(1%)
Storm	30	(1%)	0	(0%)	2	(1%)	\$0	(0%)
Collision, knockdown or overturn	30	(1%)	0	(0%)	4	(1%)	\$0	(0%)
Other known factor	300	(5%)	0	(0%)	24	(8%)	\$7	(6%)
Total fires excluding confined fires	5,900	(100%)	44	(100%)	311	(100%)	\$121	(100%)
Total factor entries	6,480	(110%)	53	(120%)	341	(110%)	\$136	(112%)

**Table 5.2. Home Water Heater Fires, by Factor Contributing to Ignition
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)**

B. Gas-Fueled Water Heaters

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Heat source too close to combustibles	1,470	(39%)	10	(24%)	118	(44%)	\$36	(35%)
Unclassified mechanical failure or malfunction	590	(15%)	3	(8%)	30	(11%)	\$16	(16%)
Leak or break	330	(9%)	13	(32%)	28	(10%)	\$13	(13%)
Unclassified misuse of material or product	200	(5%)	0	(0%)	22	(8%)	\$7	(7%)
Flammable liquid or gas spilled	190	(5%)	8	(19%)	24	(9%)	\$15	(15%)
Improper container or storage	190	(5%)	0	(0%)	13	(5%)	\$3	(3%)
Installation deficiency	160	(4%)	6	(15%)	7	(2%)	\$3	(3%)
Worn out	160	(4%)	0	(0%)	0	(0%)	\$1	(1%)
Unclassified factor	140	(4%)	4	(10%)	2	(1%)	\$5	(5%)
Unclassified operational deficiency	100	(3%)	0	(0%)	0	(0%)	\$1	(1%)
Automatic control failure	90	(2%)	6	(15%)	0	(0%)	\$3	(3%)
Failure to clean	80	(2%)	0	(0%)	4	(1%)	\$1	(1%)
Equipment not being operated properly	50	(1%)	0	(0%)	3	(1%)	\$1	(1%)
Washing part or painting with flammable liquid	50	(1%)	0	(0%)	11	(4%)	\$1	(1%)
Abandoned or discarded material or product	30	(1%)	0	(0%)	7	(3%)	\$1	(1%)
Collision, knockdown or overturn	30	(1%)	0	(0%)	4	(1%)	\$0	(0%)
Improper fueling technique	30	(1%)	0	(0%)	0	(0%)	\$2	(2%)
Unclassified electrical failure or malfunction	30	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Unclassified design, manufacturing or installation deficiency	30	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Improper startup	20	(1%)	0	(0%)	6	(2%)	\$0	(0%)
Other known factor	220	(6%)	0	(0%)	16	(6%)	\$5	(5%)
Total fires excluding confined fires	3,800	(100%)	41	(100%)	271	(100%)	\$103	(100%)
Total factor entries	4,190	(110%)	50	(123%)	295	(109%)	\$115	(112%)

**Table 5.2. Home Water Heater Fires, by Factor Contributing to Ignition
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)**

C. Electric-Powered Water Heaters

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified electrical failure or malfunction	450	(22%)	0	(0%)	4	(11%)	\$4	(26%)
Unspecified short circuit arc	420	(20%)	0	(0%)	2	(5%)	\$2	(11%)
Unclassified mechanical failure or malfunction	250	(12%)	0	(0%)	4	(11%)	\$3	(16%)
Water caused short circuit arc	200	(10%)	0	(0%)	2	(6%)	\$0	(2%)
Heat source too close to combustibles	180	(9%)	3	(100%)	23	(60%)	\$3	(19%)
Short circuit arc from defective or worn insulation	120	(6%)	0	(0%)	0	(0%)	\$1	(4%)
Leak or break	100	(5%)	0	(0%)	0	(0%)	\$1	(6%)
Arc or spark from operating equipment	90	(4%)	0	(0%)	0	(0%)	\$1	(6%)
Arc from faulty contact or broken conductor	60	(3%)	0	(0%)	0	(0%)	\$1	(3%)
Worn out	50	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Short circuit arc from mechanical damage	40	(2%)	0	(0%)	0	(0%)	\$1	(4%)
Automatic control failure	40	(2%)	0	(0%)	0	(0%)	\$1	(4%)
Installation deficiency	30	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified operational deficiency	30	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified factor contributed to ignition	30	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Improper container or storage	20	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Storm	20	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified misuse of material or product	20	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Abandoned or discarded material or product	20	(1%)	0	(0%)	2	(6%)	\$0	(0%)
Equipment not being operated properly	10	(1%)	0	(0%)	2	(6%)	\$0	(0%)
Other known factor	50	(2%)	0	(0%)	0	(0%)	\$1	(6%)
Total fires excluding confined fires	2,050	(100%)	3	(100%)	37	(100%)	\$17	(100%)
Total factor entries	2,220	(108%)	3	(100%)	40	(106%)	\$20	(115%)

Note: Multiple entries are allowed, resulting in more factor entries than fires. 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 rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or recorded as heating or air conditioning equipment of undetermined type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Home heating fires with this equipment and factor contributing to ignition listed as unknown, unreported, none, or blank have also been allocated proportionally. Totals may not equal sums because of rounding error.

Source: Data from NFIRS Version 5.0 and NFPA survey.

Table 5.3. Home Water Heater Fires, by Item First Ignited
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

A. All Water Heaters

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Wire or cable insulation Flammable or combustible	1,120	(19%)	0	(0%)	8	(3%)	\$2	(2%)
gas or liquid	1,030	(17%)	22	(50%)	126	(40%)	\$42	(35%)
Clothing	500	(8%)	5	(10%)	49	(16%)	\$13	(11%)
Structural member or framing	460	(8%)	8	(18%)	5	(2%)	\$9	(7%)
Unclassified item	340	(6%)	0	(0%)	2	(1%)	\$4	(3%)
Appliance housing or casing	320	(5%)	0	(0%)	3	(1%)	\$3	(2%)
Interior wall covering	290	(5%)	0	(0%)	23	(7%)	\$10	(8%)
Floor covering	270	(5%)	7	(17%)	13	(4%)	\$2	(2%)
Unclassified soft goods or clothing	170	(3%)	0	(0%)	7	(2%)	\$5	(4%)
Insulation within structural area	160	(3%)	0	(0%)	5	(2%)	\$1	(1%)
Multiple items first ignited	150	(3%)	0	(0%)	16	(5%)	\$7	(5%)
Box or bag	130	(2%)	0	(0%)	10	(3%)	\$6	(5%)
Unclassified structural component or finish	120	(2%)	2	(5%)	1	(0%)	\$2	(1%)
Exterior wall covering	90	(2%)	0	(0%)	0	(0%)	\$2	(1%)
Unclassified storage supplies	70	(1%)	0	(0%)	0	(0%)	\$2	(2%)
Dust, fiber, or lint	70	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Trash or waste	60	(1%)	0	(0%)	4	(1%)	\$0	(0%)
Papers	60	(1%)	0	(0%)	0	(0%)	\$2	(1%)
Cabinetry	60	(1%)	0	(0%)	3	(1%)	\$1	(0%)
Linen other than bedding	50	(1%)	0	(0%)	5	(1%)	\$1	(1%)
Household utensil	50	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Mattress or bedding	50	(1%)	0	(0%)	2	(1%)	\$1	(1%)
Interior ceiling covering	40	(1%)	0	(0%)	0	(0%)	\$4	(3%)
Other known item	200	(4%)	0	(0%)	31	(10%)	\$3	(2%)
Total fires excluding confined fires	5,900	(100%)	44	(100%)	311	(100%)	\$121	(100%)

B. Gas-Fueled Water Heaters

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Flammable or combustible gas or liquid	1,010	(26%)	22	(54%)	125	(46%)	\$42	(41%)
Clothing	410	(11%)	5	(11%)	43	(16%)	\$11	(11%)
Structural member or framing	380	(10%)	5	(11%)	4	(2%)	\$8	(7%)
Floor covering	240	(6%)	7	(18%)	13	(5%)	\$2	(2%)
Interior wall covering	230	(6%)	0	(0%)	21	(8%)	\$8	(8%)
Unclassified item	220	(6%)	0	(0%)	0	(0%)	\$3	(3%)

Table 5.3. Home Water Heater Fires, by Item First Ignited
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

B. Gas-Fueled Water Heaters (Continued)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified soft goods or clothing	130	(4%)	0	(0%)	7	(2%)	\$4	(4%)
Box or bag	110	(3%)	0	(0%)	10	(4%)	\$5	(5%)
Unclassified structural component or finish	100	(3%)	2	(6%)	2	(1%)	\$1	(1%)
Appliance housing or casing	100	(3%)	0	(0%)	2	(1%)	\$1	(1%)
Multiple items first ignited	100	(3%)	0	(0%)	7	(3%)	\$4	(4%)
Insulation within structural area	80	(2%)	0	(0%)	0	(0%)	\$1	(1%)
Exterior wall covering	70	(2%)	0	(0%)	0	(0%)	\$1	(1%)
Dust, fiber, or lint	60	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Waste or trash	50	(1%)	0	(0%)	5	(2%)	\$0	(0%)
Unclassified storage supplies	50	(1%)	0	(0%)	0	(0%)	\$1	(1%)
Papers	50	(1%)	0	(0%)	0	(0%)	\$2	(1%)
Linen other than bedding	50	(1%)	0	(0%)	5	(2%)	\$1	(1%)
Household utensil	50	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Interior ceiling covering	40	(1%)	0	(0%)	0	(0%)	\$4	(4%)
Cabinetry	30	(1%)	0	(0%)	3	(1%)	\$0	(0%)
Wire or cable insulation	30	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Mattress or bedding	30	(1%)	0	(0%)	0	(0%)	\$1	(1%)
Pipe, duct, conduit or hose	20	(1%)	0	(0%)	3	(1%)	\$0	(0%)
Other known item	170	(4%)	0	(0%)	23	(9%)	\$2	(2%)
Total fires excluding confined fires	3,800	(100%)	41	(100%)	271	(100%)	\$103	(100%)

C. Electric-Powered Water Heaters

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Wire or cable insulation	1,090	(53%)	0	(0%)	8	(20%)	\$2	(13%)
Appliance housing or casing	210	(10%)	0	(0%)	1	(4%)	\$1	(8%)
Unclassified item	120	(6%)	0	(0%)	2	(5%)	\$1	(5%)
Clothing	80	(4%)	0	(0%)	5	(13%)	\$1	(8%)
Insulation within structural area	80	(4%)	0	(0%)	5	(13%)	\$0	(2%)
Structural member or framing	70	(3%)	3	(100%)	1	(4%)	\$1	(7%)
Interior wall covering	60	(3%)	0	(0%)	1	(4%)	\$2	(10%)
Multiple items first ignited	50	(2%)	0	(0%)	7	(19%)	\$2	(11%)
Unclassified storage supplies	30	(1%)	0	(0%)	0	(0%)	\$1	(5%)
Unclassified soft goods or clothing	30	(1%)	0	(0%)	0	(0%)	\$1	(6%)
Mattress or bedding	30	(1%)	0	(0%)	2	(4%)	\$0	(1%)
Box or bag	20	(1%)	0	(0%)	0	(0%)	\$1	(6%)

Table 5.3. Home Water Heater Fires, by Item First Ignited
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

C. Electric-Powered Water Heaters (Continued)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Cabinetry	20	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified structural component or finish	20	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Floor covering	20	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Exterior wall covering	20	(1%)	0	(0%)	0	(0%)	\$1	(5%)
Dust, fiber or lint	10	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Other known item	100	(5%)	0	(0%)	5	(14%)	\$2	(10%)
Total fires excluding confined fires	2,050	(100%)	3	(100%)	37	(100%)	\$17	(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. Fires are rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or recorded as heating or air conditioning equipment of undetermined type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Home heating fires with this equipment and item first ignited unknown have also been allocated proportionally. Totals may not equal sums because of rounding.

Source: Data from NFIRS Version 5.0 and NFPA survey.

Table 5.4. Home Water Heater Fires, by Area of Origin
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

A. All Water Heaters

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Heating equipment room or area	2,190	(37%)	13	(29%)	107	(35%)	\$39	(32%)
Laundry room or area	970	(16%)	5	(12%)	68	(22%)	\$19	(16%)
Closet	660	(11%)	0	(0%)	17	(6%)	\$9	(7%)
Garage*	320	(5%)	0	(0%)	25	(8%)	\$20	(17%)
Crawl space or substructure space	270	(5%)	5	(12%)	13	(4%)	\$6	(5%)
Kitchen	230	(4%)	5	(10%)	24	(8%)	\$5	(4%)
Bathroom	170	(3%)	0	(0%)	8	(3%)	\$2	(2%)
Storage room	140	(2%)	2	(5%)	3	(1%)	\$3	(2%)
Unclassified function area	140	(2%)	0	(0%)	8	(3%)	\$3	(3%)
Unclassified storage area	140	(2%)	0	(0%)	6	(2%)	\$4	(3%)
Unclassified equipment or service area	80	(1%)	0	(0%)	2	(0%)	\$0	(0%)
Attic or other space above top story	70	(1%)	0	(0%)	2	(1%)	\$1	(0%)
Bedroom	70	(1%)	0	(0%)	7	(2%)	\$1	(0%)
Unclassified structural area	70	(1%)	0	(0%)	2	(0%)	\$2	(1%)
Storage of supplies or tools	60	(1%)	2	(5%)	2	(0%)	\$2	(2%)
Wall assembly or concealed space	50	(1%)	0	(0%)	1	(0%)	\$2	(1%)
Unclassified area of origin	50	(1%)	0	(0%)	2	(1%)	\$0	(0%)
Duct for HVAC, exhaust, heating, or air conditioning	30	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Exterior wall surface	30	(1%)	0	(0%)	0	(0%)	\$1	(1%)
Other known area of origin	160	(3%)	11	(26%)**	15	(5%)	\$3	(2%)
Total fires excluding confined fires	5,900	(100%)	44	(100%)	311	(100%)	\$121	(100%)

* Excludes dwelling garages coded as separate property.

** Leading areas for fire deaths not shown above are interior stairway (13% of deaths), lobby or entrance way (7%), and courtyard, terrace or patio (7%).

B. Gas-Fueled Water Heaters

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Heating equipment room or area	1,450	(38%)	13	(31%)	97	(36%)	\$33	(32%)
Laundry room or area	730	(19%)	2	(6%)	58	(21%)	\$18	(17%)
Closet	260	(7%)	0	(0%)	12	(5%)	\$5	(5%)
Garage*	240	(6%)	0	(0%)	23	(8%)	\$19	(19%)

Table 5.4. Home Water Heater Fires, by Area of Origin
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

B. Gas-Fueled Water Heaters (Continued)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Crawl space or substructure space	210	(5%)	5	(13%)	13	(5%)	\$6	(5%)
Kitchen	140	(4%)	5	(11%)	23	(8%)	\$4	(4%)
Unclassified storage area	110	(3%)	0	(0%)	6	(2%)	\$4	(3%)
Bathroom	100	(3%)	0	(0%)	5	(2%)	\$1	(1%)
Storage room or area	100	(3%)	2	(6%)	3	(1%)	\$2	(2%)
Unclassified function area	90	(2%)	0	(0%)	8	(3%)	\$3	(3%)
Attic or other space above top story	40	(1%)	0	(0%)	2	(1%)	\$0	(0%)
Supply or tool storage	40	(1%)	2	(6%)	0	(0%)	\$2	(2%)
Unclassified equipment or service area	40	(1%)	0	(0%)	2	(1%)	\$0	(0%)
Unclassified structural area	40	(1%)	0	(0%)	2	(1%)	\$1	(1%)
Wall assembly or concealed space	30	(1%)	0	(0%)	0	(0%)	\$1	(1%)
Unclassified area of origin	30	(1%)	0	(0%)	2	(1%)	\$0	(0%)
Other known area of origin	150	(4%)	11	(28%)**	15	(6%)	\$3	(3%)
Total fires excluding confined fires	3,800	(100%)	41	(100%)	271	(100%)	\$103	(100%)

* Excludes dwelling garages coded as separate property.

** Leading areas for fire deaths not shown above are interior stairway (14% of deaths), lobby or entrance way (7%), and courtyard, terrace, or patio (7%).

C. Electric-Powered Water Heaters

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Heating equipment room or area	720	(35%)	0	(0%)	10	(27%)	\$6	(32%)
Closet	410	(20%)	0	(0%)	5	(13%)	\$4	(24%)
Laundry room or area	240	(12%)	3	(100%)	6	(17%)	\$2	(9%)
Kitchen	100	(5%)	0	(0%)	1	(4%)	\$1	(5%)
Garage*	70	(4%)	0	(0%)	2	(5%)	\$1	(5%)
Crawl space or substructure space	60	(3%)	0	(0%)	0	(0%)	\$0	(1%)
Bathroom	60	(3%)	0	(0%)	3	(8%)	\$0	(3%)
Bedroom	50	(3%)	0	(0%)	7	(18%)	\$0	(2%)
Unclassified function area	50	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Storage room or area	40	(2%)	0	(0%)	0	(0%)	\$1	(5%)
Unclassified storage area	30	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified equipment or service area	30	(2%)	0	(0%)	0	(0%)	\$0	(1%)

Table 5.4. Home Water Heater Fires, by Area of Origin
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

C. Electric-Powered Water Heaters (Continued)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Attic or other space above top story	30	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified structural area	30	(1%)	0	(0%)	0	(0%)	\$0	(3%)
Duct for HVAC, exhaust, heating, or air conditioning	20	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Wall assembly or concealed space	20	(1%)	0	(0%)	1	(4%)	\$0	(3%)
Supply or tool storage	20	(1%)	0	(0%)	1	(4%)	\$0	(2%)
Exterior wall surface	10	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Unclassified area of origin	10	(1%)	0	(0%)	0	(0%)	\$0	(1%)
Other known area of origin	50	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Total fires excluding confined fires	2,050	(100%)	3	(100%)	37	(100%)	\$17	(100%)

* Excludes dwelling garages coded as separate property.

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 rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires with equipment involved in ignition unknown or recorded as heating or air conditioning equipment of undetermined type. Fires reported as “no equipment” but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Home heating fires with this equipment and item first ignited unknown have also been allocated proportionally. Totals may not equal sums because of rounding.

Source: Data from NFIRS Version 5.0 and NFPA survey.

Appendix A. How National Estimates Statistics Are Calculated

The statistics in this analysis are estimates derived from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual survey of U.S. fire departments. NFIRS is a voluntary system by which participating fire departments report detailed factors about the fires to which they respond. Roughly two-thirds of U.S. fire departments participate, although not all of these departments provide data every year. Fires reported to federal or state fire departments or industrial fire brigades are not included in these estimates.

NFIRS provides the most detailed incident information of any national database not limited to large fires. NFIRS is the only database capable of addressing national patterns for fires of all sizes by specific property use and specific fire cause. NFIRS also captures information on the extent of flame spread, and automatic detection and suppression equipment. For more information about NFIRS visit <http://www.nfirs.fema.gov/>. Copies of the paper forms may be downloaded from http://www.nfirs.fema.gov/documentation/design/NFIRS_Paper_Forms_2008.pdf.

NFIRS has a wide variety of data elements and code choices. The NFIRS database contains coded information. Many code choices describe several conditions. These cannot be broken down further. For example, area of origin code 83 captures fires starting in vehicle engine areas, running gear areas or wheel areas. It is impossible to tell the portion of each from the coded data.

Methodology may change slightly from year to year.

NFPA is continually examining its methodology to provide the best possible answers to specific questions, methodological and definitional changes can occur. *Earlier editions of the same report may have used different methodologies to produce the same analysis, meaning that the estimates are not directly comparable from year to year.*

NFPA's fire department experience survey provides estimates of the big picture.

Each year, NFPA conducts an annual survey of fire departments which enables us to capture a summary of fire department experience on a larger scale. Surveys are sent to all municipal departments protecting populations of 50,000 or more and a random sample, stratified by community size, of the smaller departments. Typically, a total of roughly 3,000 surveys are returned, representing about one of every ten U.S. municipal fire departments and about one third of the U.S. population.

The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities have fewer people protected per department and are less likely to respond to the survey. A larger 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 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 in NFIRS; (2) the number of on-duty firefighter injuries, by type of duty and nature of illness; (3) the number and nature of non-fire incidents; and (4) 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 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

As noted, NFIRS is a voluntary system. Different states and jurisdictions have different reporting requirements and practices. Participation rates in NFIRS are not necessarily uniform across regions and community sizes, both 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 database -- 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.

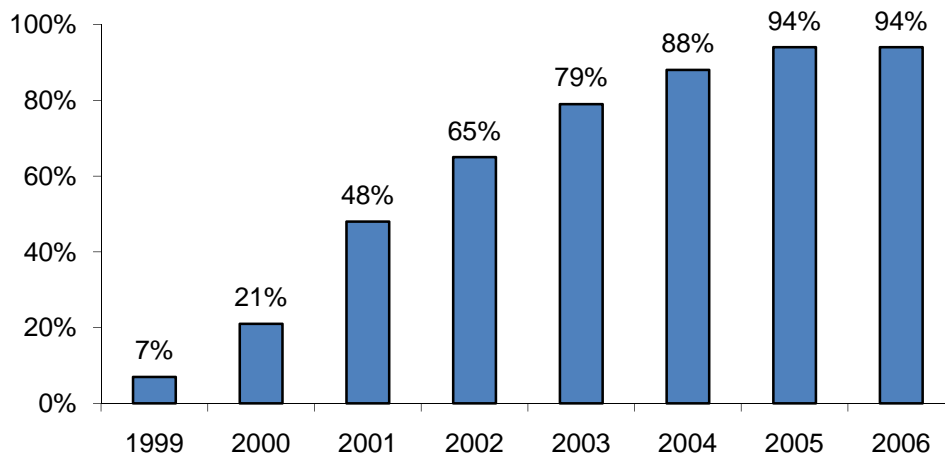
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific fire problems and circumstances are obtained by multiplying the NFIRS data by the scaling ratios. Reports for incidents in which mutual aid was given are excluded NFPA's analyses.

Analysts at the NFPA, the USFA and the Consumer Product Safety Commission developed the specific basic analytical rules used for this procedure. "The National Estimates Approach to U.S. Fire Statistics," by John R. Hall, Jr. and Beatrice Harwood, provides a more detailed explanation of national estimates. A copy of the article is available online at <http://www.nfpa.org/osds> or through NFPA's One-Stop Data Shop.

Version 5.0 of NFIRS, first introduced in 1999, used a different coding structure for many data elements, added some property use codes, and dropped others. The essentials of the approach described by Hall and Harwood are still used, but some modifications have been necessary to accommodate the changes in NFIRS 5.0.

Figure 1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

Figure 1. Fires Originally Collected in NFIRS 5.0 by Year



For 2002 data on, analyses are based on scaling ratios using only data originally collected in NFIRS 5.0:

$$\frac{\text{NFPA survey projections}}{\text{NFIRS totals (Version 5.0)}}$$

For 1999 to 2001, the same rules may be applied, but estimates for these years in this form will be less reliable due to the smaller amount of data originally collected in NFIRS 5.0; they should be viewed with extreme caution.

NFIRS 5.0 introduced six categories of confined structure fires, including:

- cooking fires confined to the cooking vessel,
- confined chimney or flue fires,
- confined incinerator fire,
- confined fuel burner or boiler fire or delayed ignition,
- confined commercial compactor fire, and
- trash or rubbish fires in a structure with no flame damage to the structure or its contents.

Although causal and other detailed information is typically not required for these incidents, it is provided in some cases (typically 10-20%). Some analyses, particularly

those that examine cooking equipment, heating equipment, fires caused by smoking materials, and fires started by playing with fire, may examine the confined fires in greater detail. Because the confined fire incident types describe certain scenarios, the distribution of unknown data differs from that of all fires. Consequently, allocation of unknowns must be done separately.

Some analyses of structure fires show only non-confined fires. In these tables, percentages shown are of non-confined structure fires rather than all structure fires. This approach has the advantage of showing the frequency of specific factors in fire causes, but the disadvantage of possibly overstating the percentage of factors that are seldom seen in the confined fire incident types.

Other analyses include entries for confined fire incident types in the causal tables and show percentages based on total structure fires. In these cases, the confined fire incident type is treated as a general causal factor.

For most fields other than Property Use, NFPA allocates unknown data proportionally among known data. This approach assumes that if the missing data were known, it would be distributed in the same manner as the known data. NFPA makes additional adjustments to several fields. *Casualty and loss projections can be heavily influenced by the inclusion or exclusion of unusually serious fire.*

In the formulas that follow, the term “all fires” refers to all fires in NFIRS on the dimension studied.

Factor Contributing to Ignition: In this field, the code “none” is treated as an unknown and allocated proportionally. For Human Factor Contributing to Ignition, NFPA enters a code for “not reported” when no factors are recorded. “Not reported” is treated as an unknown, but the code “none” is treated as a known code and not allocated. Multiple entries are allowed in both of these fields. Percentages are calculated on the total number of fires, not entries, resulting in sums greater than 100%. Although Factor Contributing to Ignition is only required when the cause of ignition was coded as: 2) unintentional, 3) failure of equipment or heat source; or 4) act of nature, data is often present when not required. Consequently, any fire in which no factor contributing to ignition was entered was treated as unknown.

In some analyses, all entries in the category of electrical failure or malfunction (factor contributing to ignition 30-39) are combined and shown as “electrical failure or malfunction.” This category includes:

31. Water-caused short circuit arc;
32. Short-circuit arc from mechanical damage;
33. Short-circuit arc from defective or worn insulation;
34. Unspecified short circuit arc;
35. Arc from faulty contact or broken connector, including broken power lines and loose connections;

- 36. Arc or spark from operating equipment, switch, or electric fence;
- 37. Fluorescent light ballast; and
- 30. Electrical failure or malfunction, other.

Type of Material First Ignited (TMI). This field is required only if the Item First Ignited falls within the code range of 00-69. NFPA has created a new code “not required” for this field that is applied when Item First Ignited is in code 70-99 (organic materials, including cooking materials and vegetation, and general materials, such as electrical wire, cable insulation, transformers, tires, books, newspaper, dust, rubbish, etc..) and TMI is blank. The ratio for allocation of unknown data is:

$$\frac{\text{(All fires – TMI Not required)}}{\text{(All fires – TMI Not Required – Undetermined – Blank)}}$$

Heat Source. In NFIRS 5.0, one grouping of codes encompasses various types of open flames and smoking materials. In the past, these had been two separate groupings. A new code was added to NFIRS 5.0, which is code 60: “Heat from open flame or smoking material, other.” NFPA treats this code as a partial unknown and allocates it proportionally across the codes in the 61-69 range, shown below.

- 61. Cigarette;
- 62. Pipe or cigar;
- 63. Heat from undetermined smoking material;
- 64. Match;
- 65. Lighter: cigarette lighter, cigar lighter;
- 66. Candle;
- 67 Warning or road flare, fuse;
- 68. Backfire from internal combustion engine. Excludes flames and sparks from an exhaust system, (11); and
- 69. Flame/torch used for lighting. Includes gas light and gas-/liquid-fueled lantern.

In addition to the conventional allocation of missing and undetermined fires, NFPA multiplies fires with codes in the 61-69 range by

$$\frac{\text{All fires in range 60-69}}{\text{All fires in range 61-69}}$$

The downside of this approach is that heat sources that are truly a different type of open flame or smoking material are erroneously assigned to other categories. The grouping “smoking materials” includes codes 61-63 (cigarettes, pipes or cigars, and heat from undetermined smoking material, with a proportional share of the code 60s and true unknown data.

Equipment Involved in Ignition (EII). NFIRS 5.0 originally defined EII as the piece of equipment that provided the principal heat source to cause ignition if the equipment malfunctioned or was used improperly. In 2006, the definition was modified to “the piece of

equipment that provided the principal heat source to cause ignition.” However, much of the data predates the change. Individuals who have already been trained with the older definition may not change their practices. To compensate, NFPA treats fires in which EII = NNN and heat source is not in the range of 40-99 as an additional unknown.

To allocate unknown data for EII, the known data is multiplied by

All fires

(All fires – blank – undetermined – [fires in which EII =NNN and heat source <>40-99])

In addition, the partially unclassified codes for broad equipment groupings (i.e., code 100, - heating, ventilation, and air conditioning, other; code 200- electrical distribution, lighting and power transfer, other; etc.) were allocated proportionally across the individual code choices in their respective broad groupings (heating, ventilation, and air conditioning; electrical distribution, lighting and power transfer, other; etc.). Equipment that is totally unclassified is not allocated further. This approach has the same downside as the allocation of heat source 60 described above. Equipment that is truly different is erroneously assigned to other categories.

In some analyses, various types of equipment are grouped together. (Confined fire incident types are not discussed here)

Code Grouping	EII Co NFIRS definitions	
Central heat	132	Furnace or central heating unit
	133	Boiler (power, process or heating)
Fixed or portable space heater	131	Furnace, local heating unit, built-in
	123	Fireplace with insert or stove
	124	Heating stove
	141	Heater, excluding catalytic and oil-filled
	142	Catalytic heater
	143	Oil-filled heater
Fireplace or chimney	121	Fireplace, masonry
	122	Fireplace, factory-built
	125	Chimney connector or vent connector
	126	Chimney – brick, stone or masonry
	127	Chimney-metal, including stovepipe or flue
Wiring, switch or outlet	210	Unclassified electrical wiring
	211	Electrical power or utility line
	212	Electrical service supply wires from utility
	214	Wiring from meter box to circuit

		breaker
	216	Electrical branch circuit
	217	Outlet, receptacle
	218	Wall switch
Power switch gear or overcurrent protection device	215	Panel board, switch board, circuit breaker board
	219	Ground fault interrupter
	222	Overcurrent, disconnect equipment
	227	Surge protector
Lamp, bulb or lighting	230	Unclassified lamp or lighting
	231	Lamp-tabletop, floor or desk
	232	Lantern or flashlight
	233	Incandescent lighting fixture
	234	Fluorescent light fixture or ballast
	235	Halogen light fixture or lamp
	236	Sodium or mercury vapor light fixture or lamp
	237	Work or trouble light
	238	Light bulb
	241	Nightlight
	242	Decorative lights – line voltage
	243	Decorative or landscape lighting – low voltage
	244	Sign
Cord or plug	260	Unclassified cord or plug
	261	Power cord or plug, detachable from appliance
	262	Power cord or plug- permanently attached
	263	Extension cord
Torch, burner or soldering iron	331	Welding torch
	332	Cutting torch
	333	Burner, including Bunsen burners
	334	Soldering equipment
Portable cooking or warming equipment	631	Coffee maker or teapot
	632	Food warmer or hot plate
	633	Kettle
	634	Popcorn popper
	635	Pressure cooker or canner
	636	Slow cooker
	637	Toaster, toaster oven, counter-top

	broiler
638	Waffle iron, griddle
639	Wok, frying pan, skillet
641	Breadmaking machine

Item First Ignited. In most analyses, mattress and pillows (item first ignited 31) and bedding, blankets, sheets, and comforters (item first ignited 32) are combined and shown as “mattresses and bedding.” In many analyses, wearing apparel not on a person (code 34) and wearing apparel on a person (code 35) are combined and shown as “clothing.” In some analyses, flammable and combustible liquids and gases, piping and filters (item first ignited 60-69) are combined and shown together

Area of Origin. Two areas of origin: bedroom for more than five people (code 21) and bedroom for less than five people (code 22) are combined and shown as simply “bedroom.”

Rounding and percentages. The data shown are estimates and generally rounded. An entry of zero may be a true zero or it may mean that the value rounds to zero. Percentages are calculated from unrounded values. It is quite possible to have a percentage entry of up to 100%, even if the rounded number entry is zero. The same rounded value may account for a slightly different percentage share. Because percentages are expressed in integers and not carried out to several decimal places, percentages that appear identical may be associated with slightly different values.

Inflation. Property damage estimates are not adjusted for inflation unless so indicated.