

**HOME FIRES INVOLVING HEATING EQUIPMENT
HEAT TAPE AND HEAT LAMPS**

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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

The National Fire Protection Association thanks all the fire departments and state fire authorities who participate in the National Fire Incident Reporting System (NFIRS) and the annual NFPA fire experience survey. These firefighters are the original sources of the detailed data that make this analysis possible. Their contributions allow us to estimate the size of the fire problem.

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

For more information about the National Fire Protection Association, visit www.nfpa.org or call 617-770-3000. To learn more about the One-Stop Data Shop go to www.nfpa.org/osds or call 617-984-7443.

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Section 6. Heat Tape and Heat Lamps

A. Heat Tape

In 2007, an estimated 300 reported home structure fires involving heat tape resulted in seven civilian injuries and \$7 million in direct property damage.

There were no civilian deaths reported. In all or nearly all years, there were no heat lamp fires reported as confined to fuel burner, boiler, chimney or flue. The same was true of fires confined to trash although those fires were not allocated in this report. Heat tape was added as a coding choice in 1999. (See Table 6.A.)

Table 6.A. Home Fires Involving Heat Tape, by Year

	Fires	Civilian Injuries	Direct Property Damage (in Millions of Current Dollars)	Direct Property Damage (in Millions of 2007 Dollars)
1999	1,000 (1,000)	0 (0)	\$1 (\$1)	\$2 (\$2)
2000	700 (700)	88 (88)	\$24 (\$24)	\$29 (\$29)
2001	700 (700)	0 (0)	\$16 (\$16)	\$19 (\$19)
2002	700 (700)	12 (12)	\$9 (\$9)	\$10 (\$10)
2003	400 (400)	20 (20)	\$8 (\$8)	\$9 (\$9)
2004	500 (500)	0 (0)	\$13 (\$13)	\$14 (\$14)
2005	300 (300)	8 (8)	\$5 (\$5)	\$5 (\$5)
2006	300 (300)	0 (0)	\$2 (\$2)	\$2 (\$2)
2007	300 (300)	7 (7)	\$7 (\$7)	\$7 (\$7)

Note: These are national estimates of non-confined 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. There are too few civilian deaths reported to support meaningful estimates by individual year. Fires are rounded to the nearest hundred, civilian deaths and civilian injuries are expressed to the nearest one 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 unknown 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 5.0 and NFPA survey.

Heat tapes accounted for 60 injuries reported to hospital emergency rooms in 2008.²¹

The leading factors contributing to ignition for home heat tape fires are all types of electrical failures.

Half of home heat tape fires begin with ignition of insulation, either wire or cable insulation (36%) or thermal, acoustic, or other insulation in a structural area (12%). (See Table 6.2.)

²¹ Statistics from National Electronic Injury Surveillance System at www.cpsc.gov.

Half (50%) of home heat tape fires begin in a crawl space or substructure space. (See Table 6.3.)

B. Heat Lamps

In 2007, an estimated 500 reported home structure fires involving heat lamps resulted in 30 reported civilian injuries and \$11 million in direct property damage.

Heat lamp was added as a coding choice in 1999. In 2003-2007, there were an estimated 6 civilian deaths per year. In most years, there were no heat lamp fires reported as confined to fuel burner, boiler, chimney, or flue. The same was true of fires confined to trash although those fires were not allocated in this report.

Heat lamps accounted for 100 injuries reported to hospital emergency rooms in 2008.²²

The leading factor contributing to ignition for home heat lamp fires was heat source too close to combustibles (64%). (See Table 6.A.) The leading item first ignited was mattress or bedding (13%), and the leading area of origin was bedroom (23%). (See Tables 6.5 and 6.6.)

Table 6.B. Home Fires Involving Heat Lamp, by Year

	Fires	Civilian Injuries	Direct Property Damage (in Millions of Current Dollars)	Direct Property Damage (in Millions of 2007 Dollars)
1999	400 (400)	0 (0)	\$20 (\$20)	\$25 (\$25)
2000	200 (200)	0 (0)	\$10 (\$10)	\$12 (\$12)
2001	300 (300)	0 (0)	\$10 (\$10)	\$12 (\$12)
2002	300 (300)	12 (12)	\$7 (\$7)	\$9 (\$9)
2003	600 (500)	30 (30)	\$26 (\$26)	\$29 (\$29)
2004	500 (400)	0 (0)	\$10 (\$10)	\$11 (\$11)
2005	300 (300)	24 (24)	\$10 (\$10)	\$10 (\$10)
2006	600 (600)	21 (21)	\$14 (\$14)	\$14 (\$14)
2007	500 (500)	30 (30)	\$11 (\$11)	\$11 (\$11)

Note: These are national estimates of non-confined 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. There are too few civilian deaths reported to support meaningful estimates by individual year. Fires are rounded to the nearest hundred, civilian injuries are expressed to the nearest one 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 unknown 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 5.0 and NFPA survey.

²² Statistics from National Electronic Injury Surveillance System at www.cpsc.gov.

Safe Use of Electrical Appliances, Including Heat Tape and Heat Lamps²³

- Select and install equipment for safety and effectiveness.
 - Use heat tape only in locations deemed appropriate by the manufacturer.
 - Make sure your heat tape has the label showing that it is listed by a recognized testing laboratory.
 - Check for product recalls at www.cpsc.gov.
 - Install equipment according to the local codes and manufacturer's instructions.
- Use electric-powered equipment safely, in accordance with manufacturer's instructions.
 - Plug power cords only into outlets with sufficient capacity and never into an extension cord.
 - Do not position electric-powered equipment near water or where there is danger of water being spilled, to avoid serious risk of electric shock.
 - Do not use or store flammable or combustible liquids near or in rooms with energized equipment, in order to avoid a vapor ignition and possible flash fire.
- Inspect and maintain electric-powered equipment regularly for safety.
 - Inspect cords for cracking, loose connections, or broken plugs, and replace any damaged equipment before use.

²³ Not taken from messages from the Educational Messaging Advisory Committee.

**Table 6.1. Home Heat Tape 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)**

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified electrical failure or malfunction	100	(27%)	0	(NA)	3	(36%)	\$1	(14%)
Unspecified short circuit arc	70	(19%)	0	(NA)	0	(0%)	\$2	(25%)
Short circuit arc from defective or worn insulation	50	(13%)	0	(NA)	5	(64%)	\$1	(13%)
Heat source too close to combustibles	40	(12%)	0	(NA)	0	(0%)	\$1	(15%)
Unclassified mechanical failure or malfunction	30	(9%)	0	(NA)	0	(0%)	\$1	(11%)
Worn out	20	(4%)	0	(NA)	0	(0%)	\$0	(7%)
Unclassified misuse of material or product	10	(4%)	0	(NA)	0	(0%)	\$0	(1%)
Installation deficiency	10	(3%)	0	(NA)	0	(0%)	\$0	(4%)
Arc or spark from operating equipment	10	(2%)	0	(NA)	0	(0%)	\$0	(0%)
Unintentionally turned on or not turned off	10	(2%)	0	(NA)	0	(0%)	\$0	(5%)
Arc from faulty contact or broken conductor	10	(2%)	0	(NA)	0	(0%)	\$0	(0%)
Automatic control failure	10	(2%)	0	(NA)	0	(0%)	\$0	(0%)
Unclassified operational deficiency	10	(2%)	0	(NA)	0	(0%)	\$0	(3%)
Equipment not being operated properly	10	(2%)	0	(NA)	0	(0%)	\$0	(0%)
Short circuit arc from mechanical damage	10	(2%)	0	(NA)	0	(0%)	\$0	(2%)
Other known factor	20	(5%)	0	(NA)	0	(0%)	\$1	(8%)
Total fires excluding confined fires	370	(100%)	0	(NA)	7	(100%)	\$7	(100%)
Total factor entries	410	(109%)	0	(NA)	7	(100%)	\$7	(109%)

NA – Not applicable because total is zero.

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 heat tape 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 6.2. Home Heat Tape Fires, by Item First Ignited
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

Item First Ignited	Fires		Civilian		Civilian		Direct Property	
			Deaths	Injuries	Injuries	Damage (in Millions)		
Wire or cable insulation	140	(36%)	0	(NA)	2	(28%)	\$3	(38%)
Structural member or framing	60	(17%)	0	(NA)	4	(51%)	\$1	(17%)
Insulation within structural area	50	(12%)	0	(NA)	0	(0%)	\$1	(11%)
Pipe, duct, conduit, or hose covering	20	(6%)	0	(NA)	0	(0%)	\$0	(0%)
Pipe, duct, conduit or hose	20	(5%)	0	(NA)	0	(0%)	\$0	(2%)
Unclassified item first ignited	20	(4%)	0	(NA)	0	(0%)	\$1	(8%)
Floor covering	10	(3%)	0	(NA)	1	(21%)	\$0	(1%)
Exterior wall covering	10	(3%)	0	(NA)	0	(0%)	\$0	(1%)
Unclassified structural component or finish	10	(3%)	0	(NA)	0	(0%)	\$0	(7%)
Exterior roof covering	10	(2%)	0	(NA)	0	(0%)	\$0	(4%)
Other known item	30	(8%)	0	(NA)	0	(0%)	\$1	(10%)
Total fires excluding confined fires	370	(100%)	0	(NA)	7	(100%)	\$7	(100%)

NA – Not applicable because total is zero.

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 6.3. Home Heat Tape Fires, by Area of Origin
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

Area of Origin	Fires		Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	
Crawl space or substructure space	190	(50%)	0 (NA)	6 (79%)	\$2	(32%)
Ceiling/floor assembly or space between stories	20	(5%)	0 (NA)	0 (0%)	\$0	(4%)
Bedroom	20	(5%)	0 (NA)	0 (0%)	\$0	(1%)
Attic or other space above top story	10	(4%)	0 (NA)	0 (0%)	\$0	(6%)
Exterior roof surface	10	(4%)	0 (NA)	0 (0%)	\$1	(11%)
Bathroom	10	(3%)	0 (NA)	0 (0%)	\$0	(7%)
Unclassified area of origin	10	(3%)	0 (NA)	0 (0%)	\$0	(3%)
Unclassified structural area	10	(2%)	0 (NA)	0 (0%)	\$0	(0%)
Heating equipment room	10	(2%)	0 (NA)	0 (0%)	\$0	(2%)
Conduit, pipe, utility, or ventilation shaft	10	(2%)	0 (NA)	0 (0%)	\$0	(0%)
Unclassified equipment or service area	10	(2%)	0 (NA)	0 (0%)	\$0	(0%)
Kitchen	10	(2%)	0 (NA)	0 (0%)	\$0	(0%)
Wall assembly or concealed space	10	(2%)	0 (NA)	0 (0%)	\$0	(0%)
Laundry room	10	(2%)	0 (NA)	0 (0%)	\$0	(2%)
Exterior wall surface	10	(2%)	0 (NA)	0 (0%)	\$0	(1%)
Storage room or area	10	(2%)	0 (NA)	0 (0%)	\$0	(5%)
Other known area of origin	30	(8%)	0 (NA)	1 (21%)	\$2	(24%)
Total fires excluding confined fires	370	(100%)	0 (NA)	7 (100%)	\$7	(100%)

NA – Not applicable because total is zero.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fire 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 area of origin unknown 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 6.4. Home Heat Lamp Fires, by Factor Contributing to Ignition
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Department
(Excluding Fires Reported as Confined Fires)**

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Heat source too close to combustibles	290	(64%)	5	(67%)	17	(82%)	\$10	(72%)
Unclassified electrical failure or malfunction	30	(7%)	0	(0%)	0	(0%)	\$2	(12%)
Equipment unattended	20	(5%)	0	(0%)	0	(0%)	\$0	(2%)
Animal	20	(5%)	0	(0%)	0	(0%)	\$0	(1%)
Unspecified short circuit arc	20	(4%)	2	(33%)	2	(10%)	\$1	(8%)
Collision, knockdown or overturn	20	(3%)	0	(0%)	2	(8%)	\$0	(2%)
Unclassified mechanical failure or malfunction	10	(2%)	0	(0%)	0	(0%)	\$0	(2%)
Unintentionally turned on or not turned off	10	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Installation deficiency	10	(2%)	0	(0%)	0	(0%)	\$0	(4%)
Unclassified factor	10	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Equipment used for not intended purpose	10	(2%)	0	(0%)	0	(0%)	\$1	(7%)
Design deficiency	10	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Arc or spark from operating equipment	10	(1%)	0	(0%)	0	(0%)	\$0	(0%)
Other known factor	30	(7%)	0	(0%)	0	(0%)	\$0	(2%)
Total fires excluding confined fires	450	100%)	7	(100%)	21	(100%)	\$14	(100%)
Total factor entries	500	110%)	7	(100%)	21	(100%)	\$15	(112%)

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 did react 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 6.5. Home Heat Lamp Fires, by Item First Ignited
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

Item First Ignited	Fires		Civilian		Civilian		Direct Property	
			Deaths	Injuries	Damage (in Millions)			
Mattress or bedding	60	(13%)	3	(50%)	2	(9%)	\$3	(19%)
Floor covering	40	(9%)	0	(0%)	0	(0%)	\$1	(8%)
Structural member or framing	40	(9%)	0	(0%)	0	(0%)	\$0	(3%)
Wire or cable insulation	40	(8%)	0	(0%)	0	(0%)	\$1	(7%)
Box or bag	20	(5%)	0	(0%)	0	(0%)	\$0	(2%)
Upholstered furniture	20	(4%)	0	(0%)	2	(9%)	\$1	(4%)
Unclassified organic material	20	(4%)	0	(0%)	0	(0%)	\$0	(3%)
Unclassified item	20	(4%)	0	(0%)	0	(0%)	\$0	(3%)
Unclassified structural component or finish	20	(4%)	0	(0%)	0	(0%)	\$0	(1%)
Insulation within structural area	20	(4%)	0	(0%)	6	(29%)	\$0	(3%)
Chips	20	(3%)	0	(0%)	0	(0%)	\$0	(2%)
Interior wall covering	10	(3%)	0	(0%)	0	(0%)	\$0	(3%)
Papers	10	(3%)	0	(0%)	0	(0%)	\$0	(3%)
Unclassified soft goods or clothing	10	(3%)	0	(0%)	0	(0%)	\$0	(3%)
Exterior wall covering	10	(3%)	0	(0%)	0	(0%)	\$0	(2%)
Interior ceiling covering	10	(3%)	0	(0%)	2	(9%)	\$1	(7%)
Clothing	10	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Exterior trim including doors	10	(2%)	0	(0%)	0	(0%)	\$0	(2%)
Agricultural crop	10	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified furniture or utensil	10	(2%)	0	(0%)	2	(9%)	\$1	(6%)
Light vegetation including grass	10	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Other known item	40	(8%)	3	(50%)*	8	(36%)	\$2	(18%)
Total fires excluding confined fires	450	(100%)	7	(100%)	21	(100%)	\$14	(100%)

* Leading item for fire deaths not shown above is curtain or drape (50% of deaths).

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 6.6. Home Heat Lamp Fires, by Area of Origin
Annual Average of 2003-2007 Structure Fires Reported to U.S. Fire Department
(Excluding Fires Reported as Confined Fires)

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Bedroom	110	(23%)	5	(67%)	6	(28%)	\$3	(19%)
Garage	50	(10%)	0	(0%)	4	(19%)	\$2	(17%)
Bathroom	40	(9%)	0	(0%)	7	(32%)	\$1	(7%)
Living room, family room, or den	40	(8%)	0	(0%)	1	(7%)	\$1	(6%)
Exterior balcony or unenclosed porch	20	(5%)	0	(0%)	1	(7%)	\$1	(9%)
Attic or other space above top story	20	(4%)	0	(0%)	0	(0%)	\$0	(2%)
Exterior wall surface	20	(4%)	0	(0%)	0	(0%)	\$1	(6%)
Unclassified structural area	20	(4%)	0	(0%)	1	(7%)	\$1	(7%)
Courtyard, terrace or patio	20	(3%)	0	(0%)	0	(0%)	\$1	(10%)
Unclassified outside area	10	(3%)	0	(0%)	0	(0%)	\$0	(0%)
Kitchen	10	(3%)	2	(33%)	0	(0%)	\$0	(3%)
Crawl space or substructure space	10	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Unclassified area of origin	10	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Ceiling/floor assembly or space between stories	10	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Lawn, field or open area	10	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Unclassified storage area	10	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Unclassified function area	10	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Storage room or area	10	(2%)	0	(0%)	0	(0%)	\$0	(1%)
Other known area of origin	40	(10%)	0	(0%)	0	(0%)	\$1	(9%)
Total fires excluding confined fires	450	(90%)	7	(100%)	21	(100%)	\$14	(91%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fire 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 area of origin unknown have also been allocated proportionally. Totals may not equal sums because of rounding error..

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.

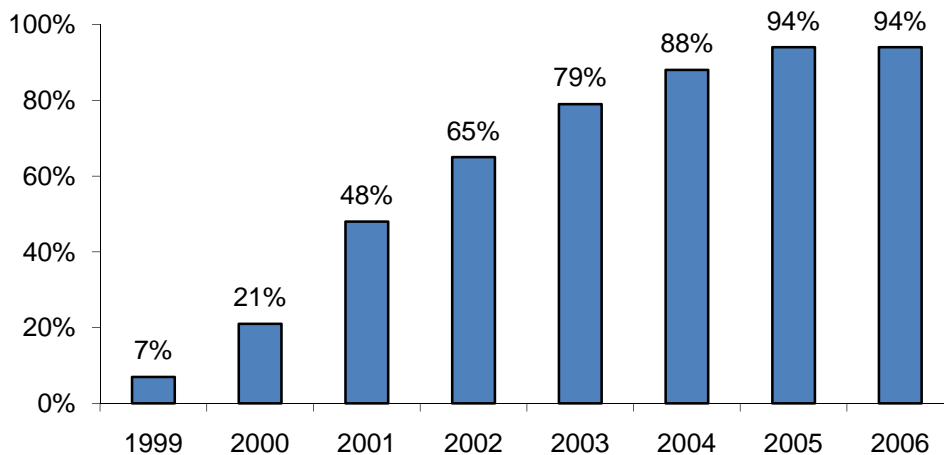
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific 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.