SELECTIONS FROM
HOME FIRES INVOLVING COOKING EQUIPMENT
GREASE HOODS OR DUCT EXHAUST FANS

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Abstract

During 2003-2006, U.S. fire departments responded to an estimated average of 150,200 home structure fires involving cooking equipment per year. These fires caused an annual average of 500 civilian deaths, 4,660 civilian injuries, and $756 million in direct property damage.

Ranges, with or without ovens, account for the majority (59%) of total reported home structure fires involving cooking equipment and even larger shares of associated civilian deaths (88%) and civilian injuries (77%). Unattended equipment is the leading cause of cooking fires.

Keywords: Range, stove, oven, microwave, toaster, grill, frying, fryer, 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 Consumer Product Safety Commission for their work that helps us understand home fires that are not reported to the fire department.

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

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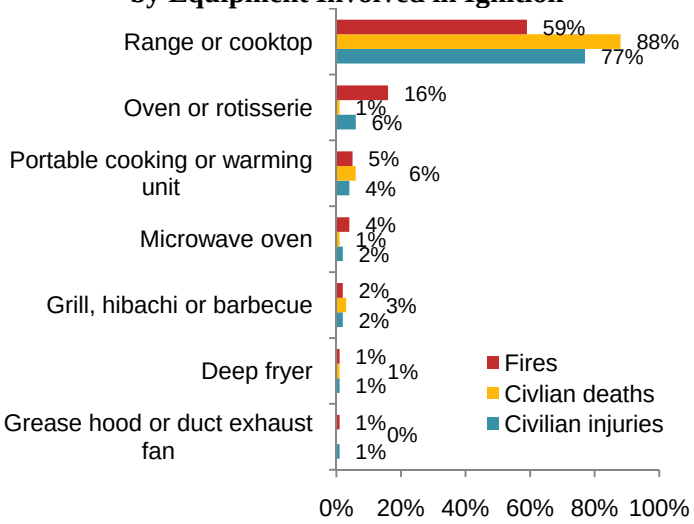
Home Fires Involving Cooking Equipment

Cooking equipment is the leading cause of home structure fires and associated civilian injuries and the third leading cause of home fire deaths.

During the four-year period of 2003-2006:

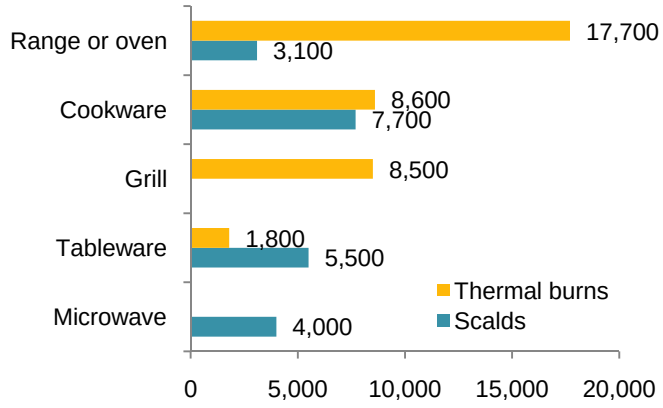
- U.S. fire departments responded to an average of **150,200** home[1] structure fires that involved cooking equipment per year. These fires caused an average of 500 civilian fire deaths, 4,660 civilian fire injuries, and $756 million in direct property damage.
- Cooking equipment was involved in 40% of all reported home fires, 17% of home fire deaths, 36% of home civilian injuries, and 12% of the direct property damage resulting from home fires.
- Unattended cooking was by far the leading contributing factor in these fires. Something that could catch fire was too close to the equipment ranked second and unintentionally turned on or not turned off ranked third.
- Ranges accounted for the largest share (59%) of home cooking fire incidents. Ovens accounted for 16%.
- Three-fifths (57%) of reported home cooking fire injuries occurred when victims tried to fight the fire themselves.

Home Cooking Equipment Fires by Equipment Involved in Ignition



- Households that use electric ranges have a higher risk of fires and associated losses than those using gas ranges.
- In a 1999 study of range fires by the U.S. Consumer Product Safety Commission, 83% of frying fires began in the first 15 minutes of cooking.

2008 Emergency Room Visits for Burns Associated with Cooking and Related Equipment



Most burns associated with cooking equipment, cookware, and tableware were not caused by fire or flame.

In 2008, ranges or ovens were involved in an estimated 17,700 thermal burn injuries seen in U.S. hospital emergency rooms.[1]

- 92% resulted from contact with the hot equipment or some other non-fire source.

Children under five accounted for 52% of the tableware scalds.

[1] Data from the Consumer Product Safety Commission's National Electronic Injury Surveillance System, queried in August 2009.

Grease Hoods or Duct Exhaust Fans

Grease hood or duct exhaust fans were involved in 1% of reported home cooking equipment fires.

During 2003-2006, U.S. fire departments responded to an average of 800 home structure fires per year in which a grease hood or duct exhaust fan was involved in ignition. These fires caused an annual average of 30 civilian injuries, and $6 million in direct property damage. These incidents accounted for 1% of the reported home fires involving cooking equipment, 1% of the associated civilian injuries, and 1% of the direct property damage from cooking equipment fires. No civilian deaths were reported in these incidents.

Data Sources, Definitions and Conventions Used in this Report

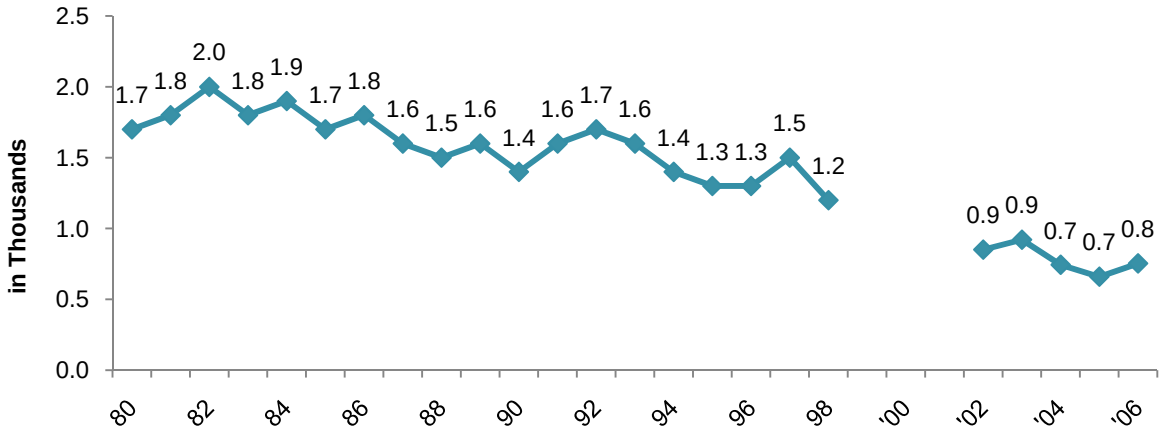
The fire statistics in this analysis are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These national estimates are projections based on the detailed information collected in Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS 5.0) and the NFPA's annual fire department experience survey. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires were rounded to the nearest hundred, civilian injuries to the nearest 10, and direct property damage was rounded to the nearest million dollars. Property damage has not been adjusted for inflation unless so indicated.

NFIRS 5.0 equipment involved in ignition code 654 captures fires involving grease hoods or duct exhaust fans. NFIRS 5.0 incident type codes in the range of 110-129 were used to identify structure fires. Unknown data were allocated proportionally in most fields analyzed except for incident type. NFIRS 5.0, first introduced in 1999, brought major changes to fire incident data, including changes in some definitions and coding rules. Because of these changes, caution should be used when comparing data before 1998 with data from 1999 on. The estimates reflect a proportional share of home fires with equipment involved in ignition unknown or recorded as kitchen or cooking 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.

Certain types of fires collectively referred to as "confined fires," including confined cooking fires, chimney fires, trash fires, and fuel burner or boiler fires (incident types 113-118) can be documented more easily in NFIRS 5.0. Causal data, including equipment involved in ignition, is generally not required for these incidents although it is provided in some cases. Equipment involved in ignition was reported in 22% of the non-confined fires and 4% of the confined fires. Confined and non-confined structure fires were analyzed separately and then summed to obtain estimates of all fires involving ranges. Detailed analyses on causal factors were done of non-confined fires only. Additional details on the methodology used may be found in Appendix A.

Fires involving grease hoods and duct exhaust fans have been falling.
Figure 8.1 and Table 8.1show that the total number of reported home structure fires involving grease hoods or duct exhaust fans was 56% lower in 2006 than in 1980. Because of the changes in data collection rules and definitions that accompanied the introduction of NFIRS 5.0 in 1999, caution must be used in interpreting these findings. NFIRS 5.0 made it much easier to document minor cooking fires.

Figure 8.1. Reported Home Structure Fires Involving Grease Hoods or Duct Exhaust Fans by Year: 1980-2006



Source: Data from NFIRS and NFPA survey. Note: See Notes in year table.

Electrical failures or malfunctions were factors in half of the non-confined home fires involving grease hoods or duct exhaust fans.
Table 8.2 shows that an electrical failure or malfunction was a factor contributing to ignition in 48% of non-confined home structure fires involving grease hoods or duct exhaust fans reported during 2003-2006. An unclassified mechanical failure or malfunction was a factor in 15% and a failure to clean was a factor in 12%.

One-quarter of the non-confined home structure fires involving grease hoods or duct exhaust fans began with the ignition of electrical wire or cable insulation.
Electrical wire or cable insulation was the time first ignited in 27% of these incidents. Table 8.3 shows that cooking materials, including food, were first ignited in 23% of these fires. Sixteen percent began with an appliance housing or casing.

Flame damage was limited to the room of fire origin in 89% of reported grease hood or duct exhaust fan fires.
Table 8.4 shows that 42% of all home structure fires involving deep fryers reported in 2003-2006 were coded with an incident type that indicated the fire was confined to the vessel or object or origin. In an additional 20%, fire spread was coded as confined to the object of origin fires. Flame damage spread beyond the room of origin in 11% of these fires.

Safety Tip

- Follow manufacturer's instructions regarding installation, operation, and especially regular maintenance, including cleaning.

Table 8.1. Home Fires Involving Grease Hoods or Duct Fans, by Year
Structure Fires Reported to U.S. Fire Departments

Year	Fires		Civilian Injuries		Direct Property Damage (in Millions) As Reported		In 2006 Dollars
1980	1,700		30		$5		$12
1981	1,800		30		$6		$13
1982	2,000		20		$5		$10
1983	1,800		20		$7		$14
1984	1,900		30		$6		$12
1985	1,700		20		$6		$11
1986	1,800		20		$7		$13
1987	1,600		50		$3		$5
1988	1,500		60		$11		$19
1989	1,600		50		$5		$8
1990	1,400		30		$7		$11
1991	1,600		60		$11*		$16*
1992	1,700		40		$6		$9
1993	1,600		50		$9		$13
1994	1,400		40		$9		$12
1995	1,300		50		$6		$8
1996	1,300		30		$5		$6
1997	1,500		40		$11		$14
1998	1,200		30		$6		$7
1999	1,000	(700)	0	(0)	$3	($2)	$4
2000	500	(400)	50	(50)	$13	($13)	$16
2001	1,100	(700)	0	(0)	$6	($6)	$7
2002	900	(500)	30	(0)	$2	($2)	$2
2003	900	(500)	70	(70)	$5	($5)	$6
2004	700	(400)	30	(30)	$6	($6)	$6
2005	700	(400)	10	(10)	$8	($8)	$8
2006	800	(500)	10	(10)	$7	($7)	$7

* 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 a cooking vessel and involving cooking equipment; they are analyzed separately. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Because of their small numbers, annual estimates of fire deaths involving this equipment are unreliable and not shown. *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 2006 dollars is done using the consumer price index. Unknowns have been allocated proportionally.

Source: Data from NFIRS Version 4.1 (1980-1998) and Version 5.0 (1999-2006) and from NFPA survey.

Table 8.2. Home Fires Involving Grease Hood or Duct Fan Fires, by Factor Contributing to Ignition
Annual Average of 2003-2006 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)	
Electrical failure or malfunction	200	(48%)	0	(NA)	10	(44%)	$3	(43%)
Unclassified mechanical failure or malfunction	100	(15%)	0	(NA)	0	(0%)	$2	(34%)
Failure to clean	100	(12%)	0	(NA)	0	(12%)	$1	(12%)
Other known factor	100	(34%)	0	(NA)	20	(56%)	$1	(20%)
Total entries	500	(108%)	0	(NA)	30	(112%)	$7	(109%)
Total	400	(100%)	0	(NA)	30	(100%)	$6	(100%)

NA – Not applicable because estimated total is zero.

Note: Multiple entries are allowed, resulting in more factor entries than fires. Home cooking fires involving cooking 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 8.3. Home Fires Involving Grease Hoods or Duct Fans, by Item First Ignited
Annual Average of 2003-2006 Structure Fires Reported to U.S. Fire Departments
(Excluding Fires Reported as Confined Fires)

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical wire or cable insulation	100	(27%)	0	(NA)	0	(0%)	$1	(18%)
Cooking materials, including food	100	(23%)	0	(NA)	20	(71%)	$1	(17%)
Appliance housing or casing	100	(16%)	0	(NA)	10	(20%)	$0	(8%)
Other known item	100	(34%)	0	(NA)	0	(8%)	$4	(57%)
Total	400	(100%)	0	(NA)	30	(100%)	$6	(100%)

NA – Not applicable because estimated total is zero.

Note: Sums may not equal totals due to rounding errors. Unknowns have been allocated proportionally.

Source: Data from NFIRS Version 5.0 and NFPA survey.

Table 8.4. Home Fires Involving Grease Hoods or Duct Exhaust Fan, by Extent of Flame Damage
Annual Average of 2003-2006 Structure Fires Reported by U.S. Fire Departments

Extent of Flame Damage	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	300	(42%)	0	(NA)	0	(0%)	$0	(2%)
Confined to object of origin	200	(20%)	0	(NA)	10	(18%)	$1	(8%)
Confined to room of origin	200	(27%)	0	(NA)	20	(65%)	$2	(30%)
Confined to floor of origin	0	(3%)	0	(NA)	0	(0%)	$2	(26%)
Confined to building of origin	100	(8%)	0	(NA)	0	(17%)	$2	(34%)
Extended beyond building of origin	0	(0%)	0	(NA)	0	(0%)	$0	(1%)
Total	800	(100%)	0	(NA)	30	(100%)	$6	(100%)

Note: Sums may not equal totals due to rounding errors. Unknowns have been allocated proportionally.

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.

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/_download/nfirspaperforms2007.pdf.

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; and (3) information on the type of community protected (e.g., county versus township versus city) and the size of the population protected, which is used in the statistical formula for projecting national totals from sample results. The 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.

Analysts at the NFPA, the USFA and the Consumer Product Safety Commission have developed the specific 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.

Figure 1.

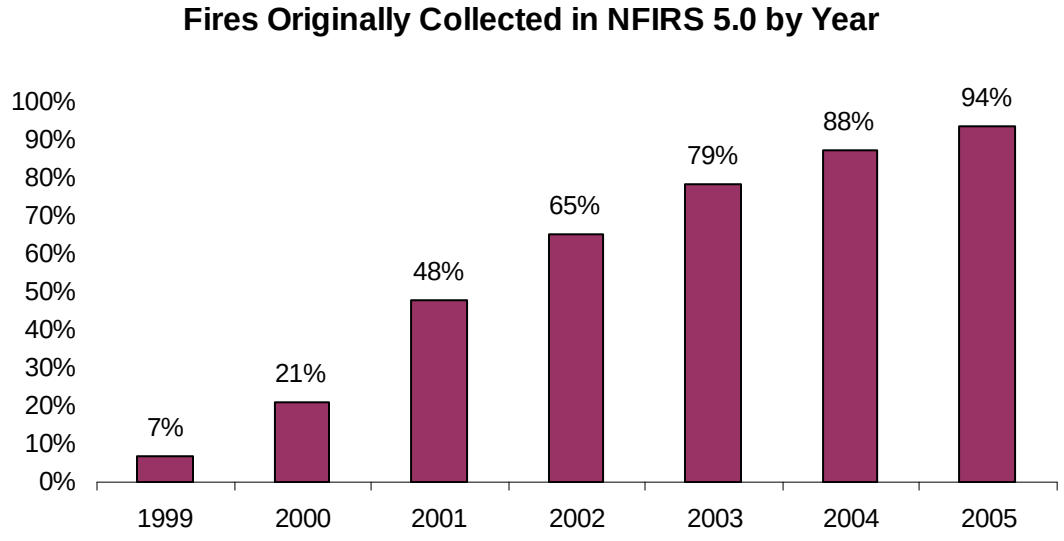


Figure 1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

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.

A second option is to omit year estimates for 1999-2001 from year tables.

NFIRS 5.0 has 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. In order for that limited detail to be used to characterize the confined fires, they must be analyzed separately from non-confined fires. Otherwise, the patterns in a factor for the more numerous non-confined fires with factor known will dominate the allocation of the unknown factor fires for both non-confined and confined fires. If the pattern is different for confined fires, which is often the case, that fact will be lost unless analysis is done separately.

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.

For Factor Contributing to Ignition, 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%. Groupings for this field show all category headings and specific factors if they account for a rounded value of at least 1%.

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, fusee,
68. Backfire from internal combustion engine. Excludes flames and sparks from an exhaust system, (11)
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, the 2006 data is not yet available and a large portion of the fires coded as no equipment involved (NNN) have heat sources in the operating equipment category. 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

$$\frac{\text{All fires}}{\text{(All fires – blank – undetermined –[fires in which EII =NNN and heat source <>40-99])}}$$

Additional allocations may be used in specific analyses. For example, NFPA's report about home heating fires treats Equipment Involved in Ignition Code 120, fireplace, chimney, other" as a partial unknown (like Heat Source 60) and allocates it over its related decade of 121-127, which includes codes for fireplaces (121-122) and chimneys (126-127) but also includes codes for fireplace insert or stove, heating stove, and chimney or vent connector. More general analyses of specific occupancies may not perform as many allocations of partial allocations. Notes at the end of each table describe what was allocated.

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. Values that appear identical may be associated with different percentages, and identical percentages may be associated with slightly different values.