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Home Fires Involving Clothes Dryers and Washing Machines

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Abstract

In 2010-2014, U.S. municipal fire departments responded to an estimated 15,970 home fires involving clothes dryers or washing machines each year. These fires resulted in annual losses estimated at 13 civilian deaths, 440 civilian injuries, and $238 million in direct property damage. As a percentage of all home fires and associated losses, fires involving clothes dryers or washing machines accounted for 4% of fires, 1% of civilian deaths, 3% of civilian injuries, and 4% of direct property damage.

The estimates presented in this report are based on data from the U.S. Fire Administration's National Fire Incident Reporting System and the National Fire Protection Association's annual fire department experience survey.

Keywords: Fire statistics, home fires, clothes dryer, washing machine, 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.

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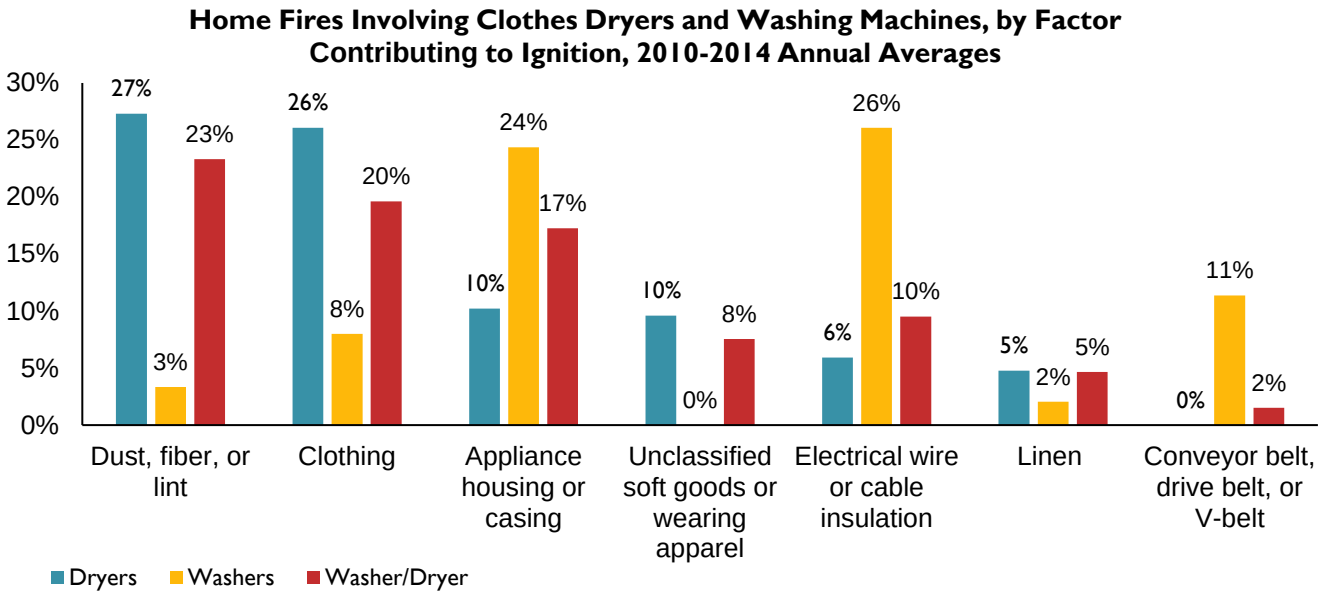
RESEARCH

HOME FIRES INVOLVING CLOTHES DRYERS AND WASHING MACHINES FACT SHEET

In 2010-2014, U.S. municipal fire departments responded to an estimated 15,970 home fires involving clothes dryers or washing machines each year.* These fires resulted in annual losses estimated at: ●13 civilian deaths ●440 civilian injuries ●$238 million in direct property damage



In 2010-2014:

- The leading items first ignited in clothes dryer fires were dust, fiber, or lint (27%) and clothing (26%). In washing machine fires, the leading items first ignited were electrical wire or cable insulation (26%) and appliance housing or casing (24%).
- Most of these home fires involve clothes dryers (92%).
- The leading cause (31%) of home clothes dryer and washer fires was failure to clean.

*Homes are dwellings, duplexes, manufactured homes, apartments, townhouses, rowhouses, and condominiums.

Clothes Dryers and Washing Machines

In 2010-2014, U.S. municipal fire departments responded to an estimated 15,970 home fires involving clothes dryers or washing machines each year. These fires resulted in annual losses estimated at 13 civilian deaths, 440 civilian injuries, and $238 million in direct property damage. As a percentage of all home fires and associated losses, fires involving clothes dryers or washing machines accounted for 4% of fires, 1% of civilian deaths, 3% of civilian injuries, and 4% of direct property damage.

Table A shows the type of equipment involved in homes fires involving washers and dryers. As indicated, the majority of fires (92%) involve clothes dryers, with 5% involving combination washers and dryers and 4% involving washing machines. The table also shows that 95% of civilian injuries, 93% of direct property damage, and 67% of civilian deaths are associated with the fires involving clothes dryers. The table also distinguishes between confined and non-confined fires. Confined fires are fires which are limited to the object of origin. **Because losses in these fires are minimal, the analysis in this report will be limited to non-confined fires.**

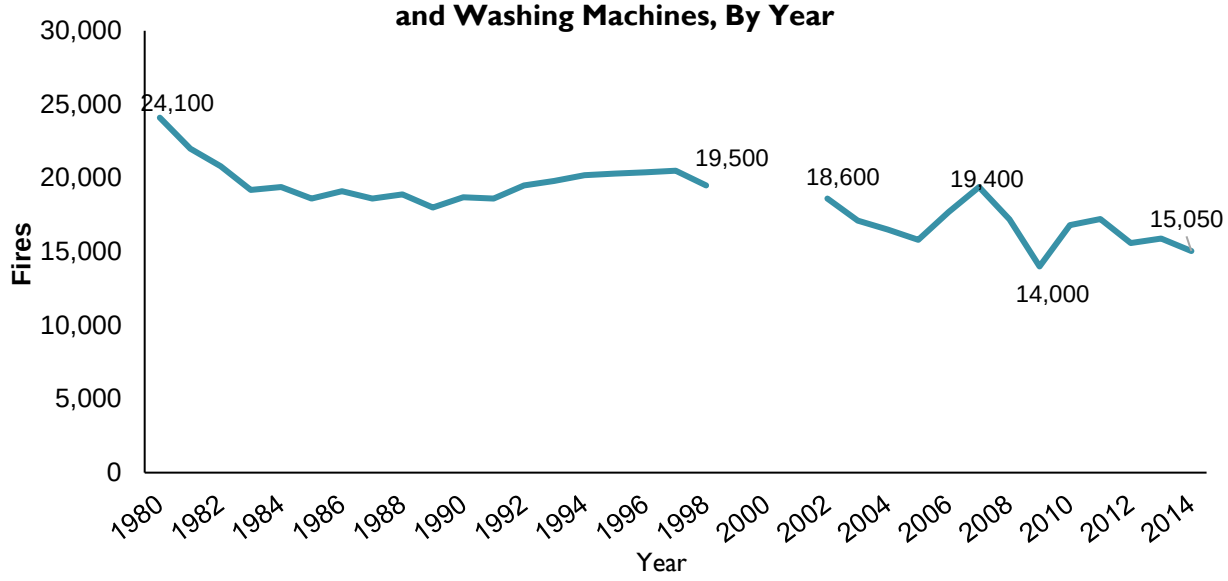
Table A. Home Fires Involving Clothes Dryers and Washing Machines, by Type of Equipment, 2010-2014 Annual Averages

Equipment Involved	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Clothes dryer	14,630	(92%)	9	(67%)	420	(95%)	$222	(93%)
Non-confined	13,360	(84%)	9	(67%)	410	(93%)	$221	(93%)
Confined	1,270	(8%)	0	(0%)	10	(2%)	$0	(0%)
Washer/dryer combination	720	(5%)	0	(0%)	10	(2%)	$10	(4%)
Non-confined	640	(4%)	0	(0%)	10	(2%)	$10	(4%)
Confined	80	(1%)	0	(0%)	0	(0%)	$0	(0%)
Washing machine	620	(4%)	4	(33%)	10	(2%)	$7	(3%)
Non-confined	580	(4%)	4	(33%)	10	(2%)	$7	(3%)
Confined	40	(0%)	0	(0%)	0	(0%)	$0	(0%)
Total	15,970	(100%)	13	(100%)	440	(100%)	$238	(100%)
Non-confined	14,580	(91%)	13	(100%)	430	(98%)	$238	(100%)
Confined	1,390	(9%)	0	(0%)	10	(2%)	$1	(0%)

Source: NFIRS 5.0 and NFPA's fire experience survey.

The estimated annual number of washer and dryer fires fell during the early 1980s before leveling off through the early 1990s, when they began a slight upward trend, as shown in Figure 1. Since 2001, the year to year fluctuation has been more volatile, though the annual number of fires in recent years is consistently lower than those recorded before the 2000s, with the exception of an estimated 19,400 fires in 2007. An estimated 14,000 fires involving washers and dryers in 2009 represents the low point, with an estimated 15,050 fires in 2014. See Table 1 for additional information.

Figure 1. Home Fires Involving Clothes Dryers and Washing Machines, By Year



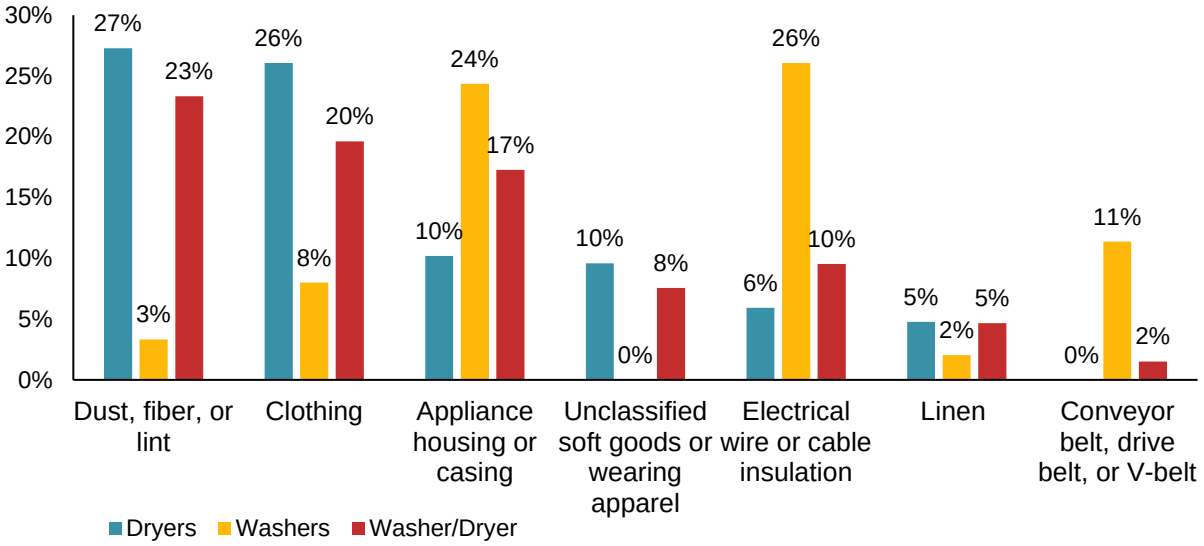
Source: NFIRS 5.0 and NFPA's fire experience survey.

The leading factor contributing to the ignition of home fires involving clothes dryers was failure to clean, accounting for one-third (33%) of dryer fires. These fires were associated with half of the clothes dryer fire deaths, as well as 34% of civilian injuries and 26% of direct property damage. Other leading factors contributing to ignition of dryer fires were mechanical failure or malfunction (28%), electrical failure or malfunction (17%), and heat source too close to combustibles (5%). Equipment not being operated properly was a factor in just 2% of fires, but 49% of dryer deaths, although caution is called for in interpreting this finding due to the small numbers. See Table 2B.

A mechanical or electrical failure or malfunction was involved in the vast majority of home fires involving washing machines. Mechanical failures or malfunctions were involved in 44% of home washing machine fires and electrical failure or malfunction in 42% of the fires. Fires involving electrical failure or malfunction accounted for a much higher share of direct property damage (60%) than those involving mechanical failure or malfunction (23%). Other factors contributing to fires involving washing machines included equipment overloaded (3%), failure to clean (3%), unclassified misuse of material or product (2%), heat source too close to combustibles (2%), equipment unattended (2%), installation deficiency (2%), and unclassified factor (2%). See Table 2C.

Fires involving clothes dryers usually started with the ignition of something that was being dried or was a byproduct (such as lint) of drying, while washing machine fires usually involved the ignition of some part of the appliance. The leading items first ignited clothes dryer fires were dust, fiber, or lint (27%) and clothing (26%) and included unclassified soft goods or wearing apparel (10%), linen (5%), and mattress or bedding (3%), as shown in Table 3B. In washing machine fires, by contrast, the leading items first ignited were electrical wire or cable insulation (26%), appliance housing or casing (24%), conveyor belt, and drive belt, or v-belt (11%). Clothing was the item first ignited in 8% of washing machine fires, with another 3% of fires ignited by dust, fiber, or lint. See Table 3C. Similar to fires involving clothes dryers, the leading items first ignited in combination washer/dryers were dust, fiber, or lint (23%), clothing (20%), and appliance housing or casing (17%), with electrical wire or cable insulation a factor in another 8% of fires. See Table 3D. Figure 2 provides a comparison of leading results of the three types of appliances.

Figure 2. Home Fires Involving Clothes Dryers and Washing Machines, by Factor Contributing to Ignition, 2010-2014 Annual Averages



Source: NFIRS 5.0 and NFPA's fire experience survey.

A laundry room or area is the area of origin for the vast majority of fires involving clothes dryers and washing machines. Fires involving clothes dryers or washing machine originated in a laundry room or area in 82% of dryer fires, 77% of washer fires, and 83% of fires involving washer/dryer combinations. Other areas of origin included garages, kitchens, bathrooms, and unclassified service areas. See Table 4.

The majority of home fires involving washers or dryers are powered by electric line voltage. Equipment powered by electrical line voltage accounted for almost two-thirds of the fires (64%), while equipment fueled by natural gas accounted for 18% of fires, and equipment powered by unclassified electrical power source accounted for 15% of fires, as shown in Table 5. It is important to recognize that the predominance of electric powered equipment in washer and dryer fires does not imply greater risk. Data from the American Housing Survey for 2013 and 2015, for instance, indicate that weighted average number of households using electric-powered clothes dryers outnumbered those using gas-fueled clothes dryers by a 3.9 to 1 margin.[1]

[1] *American Housing Survey 2013 and 2015*, U.S. Department of Commerce and U.S. Department of Housing and Urban Development. Available at: https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html. Accessed March 3, 2017.

Dryer Safety Information

- Clean the lint filter in a dryer before or after each use because accumulated dust and lint can be a fire hazard. If clothing is still damp at the end of a typical drying cycle or drying requires longer times than normal, this may be a sign that the lint screen or the exhaust duct is blocked. Remove accumulated lint around the drum. Do not operate the dryer without a lint filter.
- Periodically check while the dryer is operating to make sure that the air exhaust vent pipe is not restricted and the outdoor vent flap will open. Clean lint out of the vent pipe once a year.
- It may be necessary to disconnect the exhaust duct from the dryer to remove blockage in the exhaust. Remember to reconnect the ducting to the dryer and outside vent before using the dryer again.
- There are long, thin brushes one can buy to make it easier to reach and remove lint in the vent pipe and around the drum. There are also dryer lint removal services. Have a qualified service person clean the interior of the dryer chassis periodically to minimize the amount of lint accumulation.
- Only rigid or flexible metal venting material should be used to sustain proper air flow and drying time. Replace plastic ducting from the dryer. Flexible plastic or foil type duct can more easily trap lint and is more susceptible to kinks or crushing, which can greatly reduce the airflow.
- Ensure that your dryer is plugged into an outlet suitable for its electrical needs.
- Keep the dryer area clear of combustibles like boxes and clothing.
- Do not leave a dryer running if you leave the home, because if it malfunctions, no one will be there to avert possible disaster.
- Have your dryer installed and serviced by a professional.
- Take extra care when drying clothes soiled with volatile chemicals (gasoline, cooking oils, cleaning agents, finishing oils, stains). If possible, wash the clothing more than once or hang the clothes to dry. Use the lowest heat setting and a drying cycle that has a cool-down period at the end. To prevent clothes from igniting after drying, don't leave the clothes in the dryer or piled in a laundry basket.
- Keep dryers in good working order to avoid problems associated with lack of maintenance and part failures. Gas dryers should be inspected by a professional occasionally to ensure that the gas line and connection are intact and free of leaks.
- To help reduce electrical problems associated with washing machines and dryers, make sure the right plug and outlet are used and the machine is connected properly.
- Avoid overloading a washing machine or dryer and follow manufacturer's equipment care and operating instructions. This should reduce the risk of fire due to leaks or broken parts.
- Have a professional check the equipment if there are any doubts that it is running properly or safely.
- Washing machines and dryers should be properly grounded.
- If a fire occurs inside the dryer, do not open the door to try to put the fire out. Opening the door provides more oxygen and could make the fire worse.

Clothes Dryer Safety Standards

In addition to good dryer safety practices in the home, addressing clothes dryer fire safety includes efforts in dryer design and technology. Revisions by Underwriters Laboratories (UL) to UL 2158, Electric Clothes Dryers, include new requirements around fire containment testing for appliance manufactures seeking UL certification. More information is found in a UL white paper: *Fire Containment Tests*. Other recent proposals to improve dryer safety through standards that meet approval by UL and the Canadian Standards Association (CSA) include:

1. *High Limit Temperature Controls*. Proposed by the Consumer Product Safety Commission (CPSC), this standard will disallow clothes dryers from operating on the high limit indefinitely. It has an effective date of March 2019.
2. *Drum Drive.* This standard will ensure that the machine's heating element will de-energize if the drum ceases to operate for any reason, such as a break in the drum belt. It has an effective date of March 2019.
3. *Mandatory Cool Down.* This standard, intended to reduce the likelihood of spontaneous ignition fires, disallows sound or light notification at the end of the drying cycle until the dryer load has reached a lower temperature. It has an effective date of March 2019.
4. *Polymeric Materials Requirement or Nichrome Wire Test.* Also with an effective date of March 2019, this standard requires that all plastic materials be flame resistant if they are within 1/8 inch of an electrical connection or that that each electrical connection of the dryer be heat- and flame-tested to resist ignition.
5. *Maximum Surface Temperatures.* This proposal will reduce the surface temperatures on all exterior surfaces to prevent potential burn injuries to children and adults. This proposed standard is still in process within the UL Standards Technical Panel.

Table 1. Home Fires Involving Clothes Dryers and Washing Machines, by Year
Structure Fires Reported to U.S. Fire Departments

Year	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions) As Reported		In 2014 Dollars	
1980	24,100		7		300		$38		$109	
1981	22,000		19		250		$32		$83	
1982	20,800		49		330		$41		$101	
1983	19,200		5		230		$49		$116	
1984	19,400		7		270		$60		$137	
1985	18,600		5		240		$57		$125	
1986	19,100		17		240		$60		$130	
1987	18,600		25		240		$56		$117	
1988	18,900		32		240		$71		$142	
1989	18,000		8		240		$64		$122	
1990	18,700		24		290		$83		$151	
1991	18,600		10		330		$96		$167	
1992	19,500		8		400		$78		$132	
1993	19,800		8		400		$87		$143	
1994	20,200		6		400		$91		$146	
1995	20,300		27		360		$104		$162	
1996	20,400		31		370		$116		$175	
1997	20,500		36		480		$128		$189	
1998	19,500		25		440		$100		$145	
1999	19,500	(16,900)	0	(0)	160	(160)	$112	($112)	$159	($159)
2000	15,900	(15,200)	0	(0)	440	(440)	$176	($176)	$242	($242)
2001	18,000	(16,900)	31	(31)	330	(330)	$150	($150)	$201	($201)
2002	18,600	(17,100)	50	(50)	430	(430)	$180	($173)	$237	($228)
2003	17,100	(15,400)	18	(18)	480	(470)	$236	($236)	$304	($304)
2004	16,500	(15,100)	22	(22)	460	(460)	$171	($171)	$215	($215)
2005	15,800	(14,400)	14	(14)	440	(440)	$206	($206)	$250	($250)
2006	17,700	(16,400)	15	(15)	360	(360)	$194	($194)	$228	($228)
2007	19,400	(17,200)	0	(0)	590	(590)	$165	($165)	$188	($188)
2008	17,200	(15,700)	98	(98)	490	(490)	$249	($248)	$274	($273)
2009	14,000	(12,500)	11	(11)	340	(340)	$221	($220)	$244	($243)
2010	16,800	(14,900)	51	(51)	380	(340)	$236	($236)	$257	($257)
2011	17,210	(15,770)	0	(0)	550	(530)	$236	($236)	$249	($249)
2012	15,580	(14,220)	15	(15)	510	(480)	$248	($247)	$256	($255)
2013	15,900	(14,560)	0	(0)	360	(360)	$254	($254)	$259	($258)
2014	15,050	(13,700)	0	(0)	410	(410)	$213	($212)	$213	($212)

Note: Figures in parentheses exclude confined fires, which are fires reported as confined to fuel burner or boiler, chimney or flue, cooking vessel, trash, incinerator, or commercial compactor. These are 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. Fires are rounded to the nearest hundred, civilian deaths are expressed to the nearest one, civilian injuries are expressed to the nearest ten, and property damage is rounded to the nearest million dollars. Fires, deaths, and injuries are rounded more on this table than on any other in the report, because otherwise, most of the entries shown would have four significant places, and that would suggest an unreasonably high degree of precision. Figures reflect a proportional share of fires with equipment involved in ignition unknown. 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 2014 dollars is done using the consumer price index.

Source: Data from NFIRS Version 4.1 (1980-1998) and Version 5.0 (1999-2014) and from NFPA Fire Experience Survey.

Table 2. Home Fires Involving Clothes Dryers and Washing Machines, by Factor Contributing to Ignition
2010-2014 Annual Averages

A. Clothes dryers and washing machines

Factor Contributing to Ignition	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Failure to clean	4,540	(31%)	7	(51%)	140	(33%)	$58	(25%)
Mechanical failure or malfunction	4,200	(29%)	0	(0%)	122	(28%)	$71	(30%)
Electrical failure or malfunction	2,630	(18%)	0	(0%)	55	(13%)	$52	(22%)
Heat source too close to combustibles	760	(5%)	0	(0%)	22	(5%)	$17	(7%)
Equipment unattended	510	(3%)	0	(0%)	9	(2%)	$13	(5%)
Equipment overloaded	480	(3%)	0	(0%)	34	(8%)	$7	(3%)
Unclassified operational deficiency	470	(3%)	0	(0%)	19	(4%)	$7	(3%)
Unclassified factor contributed to ignition	420	(3%)	0	(0%)	19	(4%)	$8	(3%)
Installation deficiency	350	(2%)	0	(0%)	12	(3%)	$8	(3%)
Unclassified misuse of material or product	330	(2%)	0	(0%)	13	(3%)	$6	(3%)
Equipment not being operated properly	300	(2%)	6	(49%)	15	(3%)	$7	(3%)
Other known factor contributing to ignition	520	(4%)	0	(0%)	10	(3%)	$8	(3%)
Total fires	14,580	(100%)	13	(100%)	431	(100%)	$238	(100%)
Total factors	15,510	(106%)	13	(100%)	474	(110%)	$262	(110%)

B. Clothes dryers

Factor Contributing to Ignition	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Failure to clean	4,390	(33%)	4	(50%)	139	(34%)	$57	(26%)
Mechanical failure or malfunction	3,720	(28%)	0	(0%)	120	(29%)	$64	(29%)
Electrical failure or malfunction	2,240	(17%)	0	(0%)	46	(11%)	$46	(21%)
Heat source too close to combustibles	710	(5%)	0	(0%)	20	(5%)	$17	(8%)
Equipment unattended	480	(4%)	0	(0%)	3	(1%)	$12	(5%)
Equipment overloaded	440	(3%)	0	(0%)	34	(8%)	$7	(3%)
Unclassified operational deficiency	440	(3%)	0	(0%)	15	(4%)	$6	(3%)
Unclassified factor contributed to ignition	390	(3%)	0	(0%)	18	(4%)	$8	(3%)
Installation deficiency	330	(2%)	0	(0%)	12	(3%)	$8	(3%)
Unclassified misuse of material or product	310	(2%)	0	(0%)	12	(3%)	$6	(3%)
Equipment not being operated properly	280	(2%)	4	(49%)	15	(4%)	$7	(3%)
Other known factor contributing to ignition	480	(4%)	0	(0%)	10	(3%)	$8	(4%)
Total fires	13,360	(100%)	9	(100%)	410	(100%)	$221	(100%)
Total factors	14,200	(106%)	9	(100%)	446	(109%)	$245	(111%)

Table 2. Home Fires Involving Clothes Dryers and Washing Machines, by Factor Contributing to Ignition
2010-2014 Annual Averages (Continued)

C. Washing machine

Factor Contributing to Ignition	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Mechanical failure or malfunction	250	(44%)	0	(0%)	0	(0%)	$2	(23%)
Electrical failure or malfunction	240	(42%)	0	(0%)	3	(50%)	$4	(60%)
Equipment overloaded	20	(3%)	0	(0%)	0	(0%)	$0	(7%)
Failure to clean	10	(3%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified misuse of material or product	10	(2%)	0	(0%)	3	(50%)	$0	(1%)
Heat source too close to combustibles	10	(2%)	0	(0%)	0	(0%)	$0	(2%)
Equipment unattended	10	(2%)	0	(0%)	0	(0%)	$0	(4%)
Installation deficiency	10	(2%)	0	(0%)	0	(0%)	$0	(2%)
Unclassified factor contributed to ignition	10	(2%)	0	(0%)	0	(0%)	$0	(0%)
Other known factor contributing to ignition	30	(6%)	0	(0%)	0	(50%)	$0	(5%)
Total fires	580	(100%)	4	(100%)	6	(100%)	$7	(100%)
Total factors	610	(106%)	4	(100%)	9	(151%)	$7	(104%)

D. Combination washer/dryers

Factor Contributing to Ignition	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Mechanical failure or malfunction	220	(34%)	0	(0%)	2	(12%)	$5	(49%)
Failure to clean	150	(23%)	0	(0%)	0	(0%)	$2	(16%)
Electrical failure or malfunction	150	(23%)	0	(0%)	7	(51%)	$2	(20%)
Heat source too close to combustibles	40	(6%)	0	(0%)	2	(13%)	$0	(1%)
Unclassified operational deficiency	30	(4%)	0	(0%)	4	(25%)	$1	(7%)
Equipment overloaded	30	(4%)	0	(0%)	0	(0%)	$0	(1%)
Equipment unattended	20	(3%)	0	(0%)	6	(38%)	$0	(4%)
Unclassified factor contributed to ignition	20	(3%)	0	(0%)	0	(0%)	$0	(3%)
Unclassified misuse of material or product	10	(2%)	0	(0%)	0	(0%)	$0	(2%)
Equipment not being operated properly	10	(2%)	0	(0%)	0	(0%)	$0	(0%)
Installation deficiency	10	(2%)	0	(0%)	0	(0%)	$0	(1%)
Other known factor contributing to ignition	20	(3%)	0	(0%)	0	(0%)	$0	(1%)
Total fires	640	(100%)	0	(0%)	15	(100%)	$10	(100%)
Total factors	690	(108%)	0	(0%)	20	(138%)	$10	(105%)

Note: Multiple entries are allowed, resulting in more factor entries than fires. Figures exclude confined fires, which are fires reported as confined to fuel burner or boiler, chimney or flue, cooking vessel, trash, incinerator, or commercial compactor. 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 fires with equipment involved in ignition unknown. Fires reported as "no equipment" but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Fires with this equipment and factor contributing to ignition 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 fire experience survey.

Table 3. Home Fires Involving Clothes Dryers and Washing Machines, by Item First Ignited
2010-2014 Annual Averages

A. Clothes Dryers and Washing Machines

Equipment Involved	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Dust, fiber, or lint	3,830	(26%)	3	(25%)	83	(19%)	$54	(23%)
Clothing	3,670	(25%)	0	(0%)	126	(29%)	$60	(25%)
Appliance housing or casing	1,610	(11%)	0	(0%)	35	(8%)	$25	(10%)
Unclassified soft goods or wearing apparel	1,340	(9%)	0	(0%)	63	(15%)	$22	(9%)
Electrical wire or cable insulation	990	(7%)	7	(50%)	8	(2%)	$13	(5%)
Linen (other than bedding)	680	(5%)	0	(0%)	21	(5%)	$9	(4%)
Unclassified item first ignited	490	(3%)	0	(0%)	18	(4%)	$10	(4%)
Mattress or bedding	400	(3%)	0	(0%)	13	(3%)	$5	(2%)
Flammable or combustible liquids or gases, piping or filter	320	(2%)	0	(0%)	32	(7%)	$6	(2%)
Interior wall covering, excluding drapes	250	(2%)	0	(0%)	3	(1%)	$10	(4%)
Other known item first ignited	990	(7%)	3	(25%)	29	(7%)	$25	(10%)
Total	14,580	(100%)	13	(100%)	431	(100%)	$238	(100%)

B. Clothes Dryers

Item First Ignited	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Dust, fiber, or lint	3,650	(27%)	4	(50%)	81	(20%)	$52	(24%)
Clothing	3,480	(26%)	0	(0%)	118	(29%)	$58	(26%)
Appliance housing or casing	1,360	(10%)	0	(0%)	31	(8%)	$22	(10%)
Unclassified soft goods or wearing apparel	1,280	(10%)	0	(0%)	62	(15%)	$21	(10%)
Electrical wire or cable insulation	790	(6%)	0	(0%)	7	(2%)	$10	(4%)
Linen (other than bedding)	640	(5%)	0	(0%)	20	(5%)	$9	(4%)
Unclassified item first ignited	430	(3%)	0	(0%)	18	(4%)	$9	(4%)
Mattress or bedding	380	(3%)	0	(0%)	13	(3%)	$5	(2%)
Flammable or combustible liquids or gases, piping or filter	290	(2%)	0	(0%)	31	(8%)	$6	(3%)
Interior wall covering, excluding drapes	230	(2%)	0	(0%)	3	(1%)	$9	(4%)
Other known item first ignited	820	(6%)	4	(50%)	27	(6%)	$22	(10%)
Total	13,360	(100%)	9	(100%)	410	(100%)	$221	(100%)

Table 3. Home Fires Involving Clothes Dryers and Washing Machines, by Item First Ignited
2010-2014 Annual Averages (Continued)

C. Washing Machines

Item First Ignited	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical wire or cable insulation	150	26%	4	(100%)	1	25%	$2	27%
Appliance housing or casing	140	24%	0	(0%)	1	25%	$1	20%
Conveyor belt, drive belt, or V-belt	70	11%	0	(0%)	1	25%	$0	0%
Clothing	50	8%	0	(0%)	0	0%	$1	11%
Unclassified item first ignited	40	7%	0	(0%)	0	0%	$0	7%
Dust, fiber, or lint	20	3%	0	(0%)	0	0%	$0	3%
Flammable or combustible liquids or gases, piping or filter	20	3%	0	(0%)	0	0%	$0	1%
Interior wall covering, excluding drapes	20	3%	0	(0%)	0	0%	$0	4%
Linen (other than bedding)	10	2%	0	(0%)	0	0%	$0	1%
Structural member or framing	10	2%	0	(0%)	0	0%	$1	15%
Other known item first ignited	60	10%	0	(0%)	1	24%	$1	12%
Total	580	100%	4	(100%)	6	100%	$7	100%

D. Combination Washer/Dryers

Item First Ignited	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Dust, fiber, or lint	150	(23%)	0	(0%)	2	(13%)	$1	(11%)
Clothing	130	(20%)	0	(0%)	9	(63%)	$2	(19%)
Appliance housing or casing	110	(17%)	0	(0%)	4	(25%)	$2	(20%)
Electrical wire or cable insulation	60	(10%)	0	(0%)	0	(0%)	$1	(8%)
Unclassified soft goods or wearing apparel	50	(8%)	0	(0%)	0	(0%)	$1	(6%)
Linen (other than bedding)	30	(5%)	0	(0%)	0	(0%)	$0	(1%)
Unclassified item first ignited	20	(3%)	0	(0%)	0	(0%)	$1	(7%)
Mattress or bedding	20	(3%)	0	(0%)	0	(0%)	$0	(4%)
Interior wall covering, excluding drapes	10	(2%)	0	(0%)	0	(0%)	$1	(8%)
Flammable or combustible liquids or gases, piping or filter	10	(2%)	0	(0%)	0	(0%)	$0	(1%)
Conveyor belt, drive belt, or V-belt	10	(2%)	0	(0%)	0	(0%)	$0	(0%)
Other known item first ignited	50	(7%)	0	(0%)	0	(0%)	$1	(14%)
Total	640	(100%)	0	(100%)	15	(100%)	$10	(100%)

Note: Figures exclude confined fires, which are fires reported as confined to fuel burner or boiler, chimney or flue, cooking vessel, trash, incinerator, or commercial compactor. 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 fires with equipment involved in ignition unknown. Fires reported as "no equipment" but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Fires with this equipment and item first ignited unknown have also been allocated proportionally. Totals may not equal sums because of rounding error.

Source: Data from NFIRS Version 5.0 and NFPA fire experience survey.

Table 4. Home Fires Involving Clothes Dryers and Washing Machines, by Area of Origin
2010-2014 Annual Averages

A. Clothes Dryers and Washing Machines

Area of Origin	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	11,920	(82%)	13	(100%)	346	(80%)	$198	(83%)
Garage or vehicle storage area	360	(2%)	0	(0%)	19	(4%)	$11	(5%)
Crawl space or substructure space	300	(2%)	0	(0%)	10	(2%)	$3	(1%)
Kitchen or cooking area	290	(2%)	0	(0%)	10	(2%)	$4	(2%)
Other known area of origin	1,700	(12%)	0	(0%)	46	(11%)	$21	(9%)
Total	14,580	(100%)	13	(100%)	431	(100%)	$238	(100%)

B. Clothes Dryers

Area of Origin	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	10,950	(82%)	9	(100%)	332	(81%)	$185	(84%)
Garage or vehicle storage area	330	(2%)	0	(0%)	18	(4%)	$10	(5%)
Crawl space or substructure space	290	(2%)	0	(0%)	10	(2%)	$3	(1%)
Kitchen or cooking area	260	(2%)	0	(0%)	7	(2%)	$3	(1%)
Other known area of origin	1,530	(11%)	0	(0%)	44	(11%)	$19	(9%)
Total	13,360	(100%)	9	(100%)	410	(100%)	$221	(100%)

C. Washing Machines

Area of Origin	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	450	(77%)	4	(100%)	5	(83%)	$5	(68%)
Garage or vehicle storage area	20	(4%)	0	(0%)	0	(0%)	$1	(9%)
Kitchen or cooking area	20	(3%)	0	(0%)	0	(0%)	$1	(11%)
Unclassified area of origin	10	(2%)	0	(0%)	0	(0%)	$0	(1%)
Unclassified equipment or service area	10	(2%)	0	(0%)	0	(0%)	$0	(0%)
Other known area of origin	70	(12%)	0	(0%)	1	(17%)	$1	(10%)
Total	580	(100%)	4	(100%)	6	(100%)	$7	(100%)

D. Combination Washer/Dryers

Area of Origin	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	530	(83%)	0	(0%)	10	(66%)	$8	(85%)
Kitchen or cooking area	20	(3%)	0	(0%)	3	(20%)	$0	(1%)
Lavatory or bathroom	10	(2%)	0	(0%)	1	(7%)	$0	(1%)
Closet	10	(2%)	0	(0%)	0	(0%)	$0	(2%)
Unclassified equipment or service area	10	(2%)	0	(0%)	0	(0%)	$0	(3%)
Other known area of origin	50	(8%)	0	(0%)	1	(7%)	$1	(8%)
Total	640	(100%)	0	(100%)	15	(100%)	$10	(100%)

Table 4. Home Fires Involving Clothes Dryers and Washing Machines, by Area of Origin
2010-2014 Annual Averages (Continued)

Note: Figures exclude confined fires, which are fires reported as confined to fuel burner or boiler, chimney or flue, cooking vessel, trash, incinerator, or commercial compactor. 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 fires with equipment involved in ignition unknown. Fires reported as "no equipment" but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. 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 fire experience survey

Table 5. Home Fires Involving Clothes Dryers and Washing Machines, by Power Source
2010-2014 Annual Averages

Equipment Power	Fires		Civilian Fatalities		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical line voltage (>= 50 volts)	9,300	(64%)	6	(50%)	260	(60%)	$150	(63%)
Natural gas or other lighter than air gas	2,640	(18%)	2	(17%)	100	(23%)	$42	(18%)
Unclassified electrical	2,240	(15%)	0	(0%)	50	(13%)	$37	(16%)
LP gas or other heavier than air gas	150	(1%)	4	(33%)	0	(0%)	$2	(1%)
Batteries and low voltage (< 50 volts)	130	(1%)	0	(0%)	10	(2%)	$4	(2%)
Other power source	120	(1%)	0	(0%)	0	(2%)	$2	(1%)
Total	14,580	(100%)	13	(100%)	430	(100%)	$238	(100%)

Note: Figures exclude confined fires, which are fires reported as confined to fuel burner or boiler, chimney or flue, cooking vessel, trash, incinerator, or commercial compactor. 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 fires with equipment power undetermined. 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 fire experience 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 from 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.

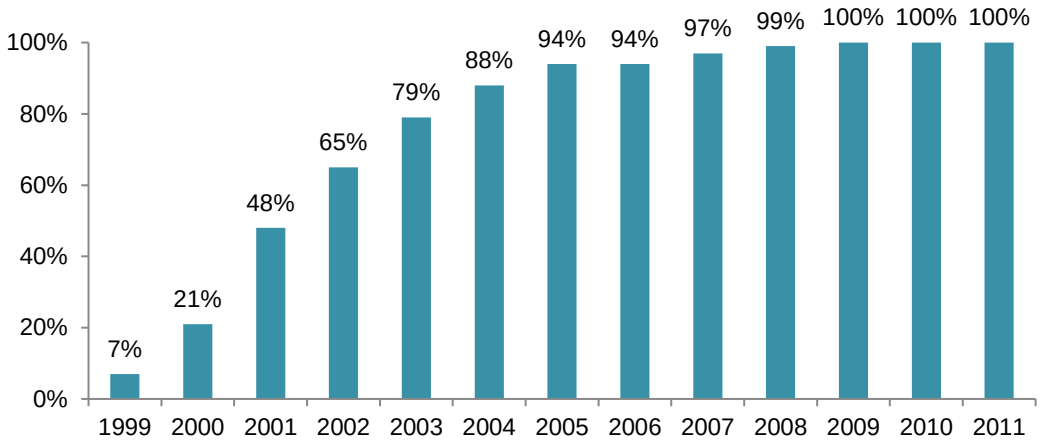
Figure A.1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

From 1999 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.

Figure A.1. Fires Originally Collected in NFIRS 5.0 by Year



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.

Because this analysis focused on fatalities only, no distinction was made between confined and non-confined fires.

For most fields other than Property Use and Incident Type, 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. The percentages of fires with known or unknown data are provided for non-confined fires and associated losses, and for confined fires only.

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.

In the formulas that follow, the term "all fires" refers to all fires in NFIRS on the dimension studied. The percentages of fires with known or unknown data are provided for non-confined fires and associated losses, and for confined fires only.

Cause of Ignition: This field is used chiefly to identify intentional fires. "Unintentional" in this field is a specific entry and does not include other fires that were not intentionally set: failure of equipment or heat source, act of nature, or "other" (unclassified)." The last should be used for exposures but has been used for other situations as well. Fires that were coded as under investigation and those that were coded as undetermined after investigation were treated as unknown.

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 mechanical failure, malfunction (factor contributing to ignition 20-29) are combined and shown as one entry, "mechanical failure or malfunction." This category includes:

21. Automatic control failure;
22. Manual control failure;
23. Leak or break. Includes leaks or breaks from containers or pipes. Excludes operational deficiencies and spill mishaps;
25. Worn out;
26. Backfire. Excludes fires originating as a result of hot catalytic converters;
27. Improper fuel used; Includes the use of gasoline in a kerosene heater and the like; and
20. Mechanical failure or malfunction, other.

Entries in "electrical failure, malfunction" (factor contributing to ignition 30-39) may also be combined into one entry, "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.

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

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

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.

Code Grouping	**EII Code**	**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	120	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
Fixed wiring and related equipment	210	Unclassified electrical wiring
	211	Electrical power or utility line
	212	Electrical service supply wires from utility
	213	Electric meter or meter box
	214	Wiring from meter box to circuit breaker
	215	Panel board, switch board or circuit breaker board
	216	Electrical branch circuit
	217	Outlet or receptacle
	218	Wall switch
	219	Ground fault interrupter
Transformers and power supplies	221	Distribution-type transformer
	222	Overcurrent, disconnect equipment
	223	Low-voltage transformer
	224	Generator
	225	Inverter
	226	Uninterrupted power supply (UPS)
	227	Surge protector
	228	Battery charger or rectifier
	229	Battery (all types)

Code Grouping	EII Code	NFIRS definitions
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

Equipment was not analyzed separately for confined fires. Instead, each confined fire incident type was listed with the equipment or as other known equipment.

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." Chimney is no longer a valid area of origin code for non-confined fires.

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.

Appendix B.
Methodology and Definitions Used in "Leading Cause" Tables

The cause table reflects relevant causal factors that accounted for at least 2% of the fires in a given occupancy. Only those causes that seemed to describe a scenario are included. Because the causal factors are taken from different fields, some double counting is possible. Percentages are calculated against the total number of structure fires, including both confined and non-confined fires. Bear in mind that every fire has at least three "causes" in the sense that it could have been prevented by changing behavior, heat source, or ignitability of first fuel, the last an aspect not reflected in any of the major cause categories. For example, several of the cause categories in this system refer to types of equipment (cooking, heating, electrical distribution and lighting, clothes dryers and washers, torches). However, the problem may be not with the equipment but with the way it is used. The details in national estimates are derived from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS). This methodology is based on the coding system used in Version 5.0 of NFIRS. The *NFIRS 5.0 Reference Guide*, containing all of the codes, can be downloaded from http://www.nfirs.fema.gov/documentation/reference/.

Cooking equipment and heating equipment are calculated by summing fires identified by equipment involved in ignition and relevant confined fires. Confined fires will be shown if they account for at least 2% of the incidents. **Confined cooking fires** (cooking fires involving the contents of a cooking vessel without fire extension beyond the vessel) are identified by NFIRS incident type 113.

Confined heating equipment fires include **confined chimney or flue fires (**incident type 114) and **confined fuel burner or boiler** fires (incident type 116). The latter includes delayed ignitions and incidents where flames caused no damage outside the fire box. The two types of confined heating fires may be combined or listed separately, depending on the numbers involved.

Intentional fires are identified by fires with a "1" (intentional) in the field "cause." The estimate includes a proportional share of fires in which the cause was undetermined after investigation, under investigation, or not reported. All fires with intentional causes are included in this category regardless of the age of the person involved. Earlier versions of NFIRS included codes for incendiary and suspicious. Intentional fires were deliberately set; they may or may not be incendiary in a legal sense. No age restriction is applied.

Fires caused by **playing with heat source** (typically matches or lighters) are identified by code 19 in the field "factor contributing to ignition." Fires in which the factor contribution to ignition was undetermined (UU), entered as none (NN) or left blank are considered unknown and allocated proportionally. Because factor contributing to ignition is not required for intentional fires, the share unknown, by these definitions, is somewhat larger than it should be.

The heat source field is used to identify fires started by: **smoking materials** (cigarette, code 61; pipe or cigar, code 62; and heat from undetermined smoking material, code 63); **candles** (code 66), **lightning** (code 73); and **spontaneous combustion or chemical reaction** (code 72). Fires started by heat from unclassified open flame or smoking materials (code 60) are allocated proportionally among the "other open flame or smoking material" codes (codes 61-69) in an allocation of partial unknown data. This includes smoking materials and candles. This approach results in any true unclassified smoking or open flame heat sources such as incense being inappropriately allocated. However, in many fires, this code was used as an unknown.

The equipment involved in ignition field is used to find several cause categories. This category includes equipment that functioned properly and equipment that malfunctioned.

Cooking equipment Non-confined fire refers to equipment used to cook, heat or warm food (codes 620-649 and 654). Fire in which ranges, ovens or microwave ovens, food warming appliances, fixed or portable cooking appliances, deep fat fryers, open fired charcoal or gas grills, grease hoods or ducts, or other cooking appliances) were involved in the ignition are said to be caused by cooking equipment. Food preparation devices that do not involve heating, such as can openers or food processors, are not included here. As noted in Appendix A, a proportional share of unclassified kitchen and cooking equipment (code 600) is included here.

Heating equipment Non-confined fire (codes 120-199) includes central heat, portable and fixed heaters (including wood stoves), fireplaces, chimneys, hot water heaters, and heat transfer equipment such as hot air ducts or hot water pipes. Heat pumps are not included. As noted in Appendix A, a proportional share of unclassified heating, ventilation and air condition equipment (code 100) is included here.

Confined fires are excluded from the tallies of the remaining categories of fires involving equipment.

Electrical distribution and lighting equipment (codes 200-299) include: fixed wiring; transformers; associated overcurrent or disconnect equipment such as fuses or circuit breakers; meters; meter boxes; power switch gear; switches, receptacles and outlets; light fixtures, lamps, bulbs or lighting; signs; cords and plugs; generators, transformers, inverters, batteries and battery charges.

Torch, burner or soldering iron (codes 331-334) includes welding torches, cutting torches, Bunsen burners, plumber furnaces, blowtorches, and soldering equipment. As noted in Appendix A, a proportional share of shop tools and industrial equipment (code 300) is included here.

Clothes dryer or washer (codes 811, 813 and 814) includes clothes dryers alone, washer and dryer combinations within one frame, and washing machines for clothes. As noted in Appendix A, a proportional share of unclassified personal and household equipment (code 800) is included here.

Electronic, office or entertainment equipment (codes 700-799) includes: computers and related equipment; calculators and adding machines; telephones or answering machines; copiers; fax machines; paper shredders; typewriters; postage meters; other office equipment; musical instruments; stereo systems and/or components; televisions and cable TV converter boxes,, cameras, excluding professional television studio cameras, video equipment and other electronic equipment. Older versions of NFIRS had a code for electronic equipment that included radar, X-rays, computers, telephones, and transmitter equipment.

Shop tools and industrial equipment excluding torches, burners or soldering irons (codes 300-330, 335-399) includes power tools; painting equipment; compressors; atomizing equipment; pumps; wet/dry vacuums; hoists, lifts or cranes; powered jacking equipment; water or gas drilling equipment; unclassified hydraulic equipment; heat-treating equipment; incinerators, industrial furnaces, ovens or kilns; pumps; compressors; internal combustion engines; conveyors; printing presses; casting, molding; or forging equipment; heat treating equipment; tar kettles; working or shaping machines; coating machines; chemical process equipment; waste recovery equipment; power transfer equipment; power takeoff; powered valves; bearings or brakes; picking, carding or weaving machines; testing equipment; gas regulators; separate motors; non-vehicular internal combustion engines; and unclassified shop tools and industrial equipment. . As noted in Appendix A, a proportional share of shop tools and industrial equipment (code 300) is included here.

Medical equipment (codes 410-419) includes: dental, medical or other powered bed, chair or wheelchair; dental equipment; dialysis equipment; medical monitoring and imaging equipment; oxygen administration equipment; radiological equipment; medical sterilizers, therapeutic equipment and unclassified medical equipment. As noted in Appendix A, a proportional share of commercial and medical equipment (code 400) is included here.

Exposures are fires that are caused by the spread of or from another fire. These were identified by factor contributing to ignition code 71. This code is automatically applied when the exposure number is greater than zero.