HOME FIRES INVOLVING CLOTHES DRYERS OR WASHING MACHINES

John R. Hall, Jr.

September 2012

National Fire Protection Association
Fire Analysis and Research Division

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Abstract

In 2006-2010, there were 16,950 home structure fires per year reported to U.S. fire departments where clothes dryers or washing machines were the equipment involved in ignition, with associated annual losses of 34 civilian deaths, 430 civilian injuries, and $209 million in direct property damage. Dryers alone accounted for 92% of these fires and 87% of the reported deaths. The leading factor contributing to ignition was failure to clean.

These estimates are based on data 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 fire department experience survey.

Keywords: Fire statistics, home fires, clothes washer, clothes dryer, 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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National Fire Protection Association
One-Stop Data Shop
1 Batterymarch Park
Quincy, MA 02169-7471
www.nfpa.org
e-mail: osds@nfpa.org
phone: 617-984-7443

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Table of Contents

	Page
Table of Contents	i
List of Tables and Figures	ii
Clothes Dryers and Washing Machines Fact Sheet	iii
Clothes Dryer Safety Tips	iv
NFPA Resource Page	v
Clothes Dryers and Washing Machines	1
Appendix A – How National Estimates Statistics Are Calculated	19

List of Tables and Figures

		Page
Figure 1.	Home Fires Involving Washers or Dryers, by Year	1
Table A.	Home Fires Involving Washers or Dryers, by Type of Equipment	2
Table B.	Injuries Involving Washers or Dryers Reported to Hospital Emergency Rooms	3
Table 1.	Home Fires Involving Washers or Dryers, by Year	7
Table 2.	Home Fires Involving Washers or Dryers, by Factor Contributing to Ignition	8
	A. Clothes Dryers and Washing Machines	8
	B. Clothes Dryers	9
	C. Washing Machines	10
	D. Combination Washer/Dryers	11
Table 3.	Home Fires Involving Washers or Dryers, by Item First Ignited	12
	A. Clothes Dryers and Washing Machines	12
	B. Clothes Dryers	12
	C. Washing Machines	13
	D. Combination Washer/Dryers	14
Table 4.	Home Fires Involving Washers or Dryers, by Area of Origin	15
	A. Clothes Dryers and Washing Machines	15
	B. Clothes Dryers	15
	C. Washing Machines	16
	D. Combination Washer/Dryers	16

Clothes Dryers and Washing Machines Fact Sheet

In 2010, an estimated 16,800 reported U.S. home* structure fires involving clothes dryers or washing machines (including combination washer/dryers) resulted in an estimated:

- 51 civilian deaths
- 380 civilian injuries
- $236 million in direct property damage

Leading Items First Ignited in Non-Confined Fires Involving Clothes Washer or Clothes Dryer, 2006-2010

Dryer	Fires	Washer	Fires
Dust, fiber, or lint	29%	Wire or cable insulation	26%
Clothing	28%	Appliance housing or casing	21%
Unclassified soft goods or clothing	9%	Drive belt	15%

In 2006-2010:

- Most (81%) home structure fires involving washers or dryers began in a laundry room or area.
- Most of these home fires involve clothes dryers (92%).
- The risk of fire is roughly equal for gas-fueled clothes dryers and electric-powered clothes dryers.
- The leading cause (32%) of home clothes dryer and washer fires was failure to clean.

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

Estimates are derived from the U.S. Fire Administration National Fire Incident Reporting System (NFIRS) Version 5.0 and NFPA's annual fire department experience survey.

Clothes Dryer Safety

Doing laundry is most likely part of your every day routine. But did you know how important taking care of your clothes dryer is to the safety of your home? With a few simple safety tips you can help prevent a clothes dryer fire.

- Have your dryer installed and serviced by a professional.
- Do not use the dryer without a lint filter.
- Make sure you clean the lint filter before or after each load of laundry. Remove lint that has collected around the drum.
- Rigid or flexible metal venting material should be used to sustain proper air flow and drying time.
- Make sure the air exhaust vent pipe is not restricted and the outdoor vent flap will open when the dryer is operating. Once a year, or more often if you notice that it is taking longer than normal for your clothes to dry, clean lint out of the vent pipe or have a dryer lint removal service do it for you.
- Keep dryers in good working order. Gas dryers should be inspected by a professional to make sure that the gas line and connection are intact and free of leaks.
- Make sure the right plug and outlet are used and that the machine is connected properly.
- Follow the manufacturer's operating instructions and don't overload your dryer.
- Turn the dryer off if you leave home or when you go to bed.

AND DON'T FORGET...

Dryers should be properly **grounded**.

Check the **outdoor vent** flap to make sure it is not covered by snow.

Keep the area around your dryer **clear** of things that can burn, like boxes, cleaning supplies and clothing, etc.

Clothes that have come in contact with **flammable substances**, like gasoline, paint thinner, or similar solvents should be laid outside to dry, then can be washed and dried as usual.

FACT

The leading cause of home clothes dryer fires is failure to clean them.

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NFPA's Fire Safety Resources

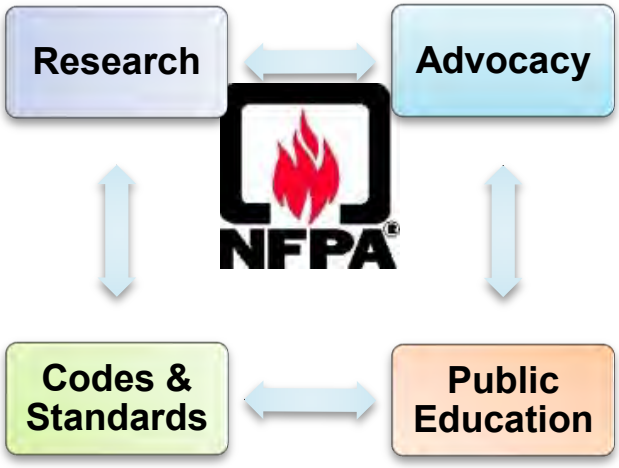
NFPA´s wealth of fire-related research includes investigations of technically significant fire incidents, fire data analysis, and the Charles S. Morgan Technical Library, one of the most comprehensive fire literature collections in the world. In addition, NFPA´s Fire Protection Research Foundation is a source of independent fire test data. Find out more at:

www.nfpa.org/research

Properly installed and maintained smoke alarms are necessary to provide a warning of any fire to all occupants. You can find out more information about smoke alarms here: NFPA Smoke Alarm Information

Home fire sprinkler systems provide even greater protection. These systems respond quickly to reduce the heat, flames, and smoke from a fire until help arrives. More information about home fire sprinklers may be found at www.firesprinklerinitiative.org

Simply put, smoke alarms and fire sprinklers save lives.



NFPA also develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks. Among these are:

NFPA1: Fire Code:

NFPA 101: Life Safety Code®:

NFPA 72, National Fire Alarm Code®

For consumers: NFPA has consumer safety information regarding causes, escape planning, fire & safety equipment, and many other topics.

Sparky.org has important For Kids for kids delivered via fun games, activities, and cartoons.

For public educators: Resources on fire safety education programs, educational messaging, grants & awards, and many other topics.

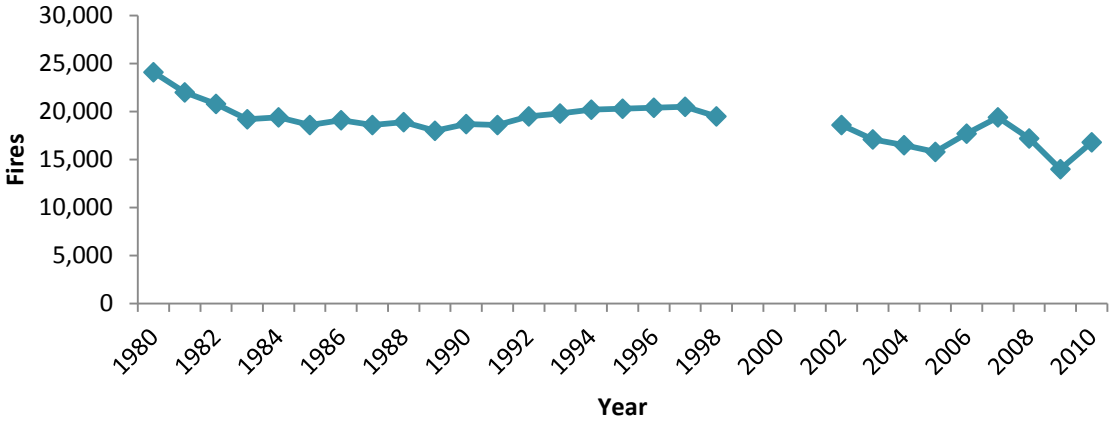
Clothes Dryers and Washing Machines

In 2010, an estimated 16,800 reported U.S. non-confined or confined[1] home structure fires involving clothes dryers or washing machines (including combination washer/dryers) resulted in 51 civilian deaths, 380 civilian injuries, and $236 million in direct property damage.

Washer and dryer fires were mostly level from 1980 to 1998, with only a slight decline in the first years of the period to break the pattern. After some volatility during the transition years as NFIRS Version 5.0 was introduced, the estimates have settled into a new trend with wider year-to-year variations and a trend line slightly lower than the lowest levels of 1980-1998. Civilian injuries have stabilized in a range comparable to that seen in the 1990s. Direct property damage after adjustment for inflation is varying year to year but around a generally higher average then those seen prior to 1999.

In 2010, clothes dryers and washing machines accounted for 4.5% of all reported home structure fires, 1.9% of associated civilian deaths, 2.8% of associated civilian injuries, and 3.1% of associated direct property damage.

Figure 1. Home Fires Involving Washers or Dryers, by Year
Structure Fires Reported to U.S. Fire Departments



Note: See Note on year table.

Source: Data from NFIRS and NFPA survey.

In 2006-2010, washers and dryers were involved in an estimated 1,600 home structure fires per year that were reported as confined fires. They add about 10% to the average of non-confined fires. The largest share of these confined fires was for contained trash fires:

[1] All estimates are based on fires reported through local fire departments to the National Fire Incident Reporting System (NFIRS), scaled up to account for non-reporting fire departments. Analysis is done separately on fires reported as confined to cooking vessel, chimney or flue, fuel burner or boiler, incinerator or compactor, or trash. All estimates include proportional allocation of fires with equipment involved in ignition reported as undetermined or blank, as no equipment involved when not also coded with a non-equipment heat source, or as unclassified or unknown-type personal or household equipment. Some other published estimates may exclude some or all of these projections and allocations, which is tantamount to ignoring most reported fires in any discussion of equipment causes of fires. NFPA believes these alternative approaches result in severe under-estimates.

- Contained trash fire (42% of total reported confined home structure fires involving washer or dryer),
- Confined to fuel burner or boiler (21%),
- Confined to cooking vessel (14%),
- Confined to chimney or flue (12%),
- Confined to incinerator (9%), and
- Confined to commercial compactor (1%).

The confined flue fires are the ones that make the most sense for this kind of equipment. The contained trash or rubbish fires make sense if "trash" is understood to include lint. Most of these fires involved either lint or items (e.g., clothing, other soft goods) that can generate lint in a dryer. The others could include examples of using equipment not designed for clothes drying (cooking vessel, incinerator) as a makeshift clothes dryer. More likely, those categories may have been used because there is no code for dryer, but there are two codes for equipment used to heat the contents of a compartment or enclosure in the equipment. That description fits a clothes dryer, even though the purpose is not cooking or incineration of the contents.

Table A shows that most (92%) home fires involving washers or dryers involved clothes dryers.

Table A. Home Fires Involving Washers or Dryers, by Type of Equipment
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

Equipment	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Clothes dryer	15,520	(92%)	29	(87%)	402	(93%)	$192	(92%)
Washer/dryer combination	740	(4%)	0	(0%)	12	(3%)	$10	(5%)
Washing machine	690	(4%)	4	(13%)	17	(4%)	$7	(4%)
Total washer or dryer	16,950	(100%)	34	(100%)	430	(100%)	$209	(100%)

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million dollars. Damage has not been adjusted for inflation. Figures reflect a proportional share of home fires reported as "no equipment" but lacking a confirming specific heat source (codes 40-99) are also treated as unknown equipment and allocated. Totals may not equal sums because of rounding.

Source: Data from NFIRS Version 5.0 and NFPA survey.

The item first ignited for 2006-2010 home clothes dryer structure fires was usually something being dried or a byproduct of such an item (such as lint), while for home clothes washer structure fires, the first item ignited was usually part of the appliance itself.

The leading items for clothes dryers include dust, fiber, or lint (29% of fires and 85% of deaths), clothing (28% of fires), and unclassified soft goods or clothing (9% of fires). The leading items for clothes washers include wire or cable insulation (26% of fires), appliance housing or casing (21% of fires), and drive belt (15% of fires).

Most (81%) 2006-2010 home structure fires involving washers or dryers began in a laundry room or area.
Other leading areas of origin included garage (3% of fires), crawl space or substructure space (2%), and kitchen (2%).

There is no direct statistical evidence of a home fire problem involving dryers and spontaneous heating of soft goods impregnated by flammable or combustible liquids.
The fires of concern occur when flammable or combustible liquids are absorbed by soft goods like towels, are not completely removed during washing, and then become part of a delayed ignition of goods heated by a clothes dryer. If the pile is large enough, and if the goods have certain physical properties, then it is possible that heat will build up inside the pile faster than heat is lost to the surrounding air. The risk is associated with large piles of goods, more characteristic of a large commercial or institutional laundry than of a home, and the risk is also increased if the dryer cycle is interrupted before completion of the cool-down portion of the cycle. Only 1% of home dryer fires began with the ignition of flammable or combustible liquids and a side analysis showed only 0.2% of home dryer fires involved a chemical reaction or spontaneous heating as the heat source.

The risk of fire is roughly equal for gas-fueled clothes dryers and electric-powered clothes dryers.
In 2006-2010, the risks relative to usage (fires or losses divided by millions of user households) for gas-fueled dryers were 9% higher for fires, 8% higher for civilian deaths, 2% higher for civilian injuries, and 7% lower for direct property damage. Usage statistics are available for 2005, 2007 and 2009, and the weighted average number of households using electric-powered dryers was higher than the weighted average number for gas-fueled dryers by 3.5-to-1.[2]

The estimated difference in risk might be larger if the analysis could adjust for differences in other risk-related characteristics of users of the two types of dryers. For example, the relative usage of electric-powered dryers is considerably greater for some high-risk groups, such as the South region (13.6-to-1), and lower for some low-risk groups, such as the West region (2.0-to-1). In other words, the owners of electric-powered dryers are disproportionately located in regions and in sizes of communities where the overall risk of fire is above average and it is possible that the relative risk advantage of electric dryers is being somewhat muted by the correlation of electric dryer usage with other risk factors.

In 2011, an estimated 14,740 injuries involving clothes dryers and clothes washers were reported to hospital emergency rooms.[3]
Unlike civilian fire injuries, these injuries were more likely to involve clothes washers than clothes dryers. The leading types of injuries were strains and sprains, lacerations,

[2] *American Housing Survey 2005, 2007,* and *2009,* U.S. Department of Commerce and U.S. Department of Housing and Urban Development.
[3] Statistics from the National Electronic Injury Surveillance System (NEISS), queried at the U.S. Consumer Product Safety Commission website, www.cpsc.gov.

and contusions and abrasions. These types of injuries might be expected to occur when trying to move the appliance, when the victim falls on the appliance, or when the appliance falls on the victim. A single case can involve multiple injuries, which seems to have happened here, because total injuries are less than the sum of strain or sprain, contusion or abrasion, and laceration injuries.

Table B. Injuries Involving Washers or Dryers Reported to Hospital Emergency Rooms, 2011

Type of Equipment	Total	Type of Injury: Strain or Sprain	Type of Injury: Contusion or Abrasion	Type of Injury: Laceration
Clothes washer	9,740	4,470	2,890	2,380
Clothes dryer	5,000	2,550	1,430	1,430
Total	14,740	7,020	3,910	3,810

Source: CPSC's National Electronic Injury Surveillance System

Failure to clean is the leading factor contributing to ignition cited for 2006-2010 home structure fires involving washers or dryers (32%) and clothes dryers specifically (33%).

Many other leading factors in washer or dryer fires involve mechanical or electrical failures or malfunctions with little detail provided. Fire deaths often cite human-error factors, including equipment unattended (14 civilian fire deaths per year) and failure to clean (13 deaths per year).

Safety Tips:

- 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.[4]

- Also, 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.

- To remove a blockage in the exhaust path, it may be necessary to disconnect the exhaust duct from the dryer. Remember to reconnect the ducting to the dryer and outside vent before using the dryer again.[5]

[4] *Overheated clothes dryers can cause fires*, CPSC Document #5022, U.S. Consumer Product Safety Commission, Washington, DC, updated June 2003.
[5] *Overheated clothes dryers can cause fires*, CPSC Document #5022, U.S. Consumer Product Safety Commission, Washington, DC, updated June 2003.

- 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.[6]

- Replace plastic or foil, accordion-type ducting material with rigid or corrugated semi-rigid metal duct. Most manufacturers specify the use of a rigid or corrugated semi-rigid metal duct, which provides maximum airflow. The 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 a dryer is plugged into an outlet suitable for its electrical needs.

- Do not leave a dryer running if you leave the home, because if it malfunctions, no one will be there to avert possible disaster.

- Keep the dryer area clear of combustibles like boxes and clothing.

- Have your dryer installed and serviced by a professional.

- Take special care when drying clothes that have been soiled with volatile chemicals such as gasoline, cooking oils, cleaning agents, or finishing oils and stains. If possible, wash the clothing more than once to minimize the amount of volatile chemicals on the clothes and, preferably, hang the clothes to dry. If using a dryer, use the lowest heat setting and a drying cycle that has a cool-down period at the end of the cycle. To prevent clothes from igniting after drying, do not leave the dried clothes in the dryer or piled in a laundry basket.[7,8]

  Even though spontaneous ignition of clothes after drying is statistically rare, that may mean only that few loads of clothing involve clothes with this kind of potentially hazardous soiling.

- It is important to 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.

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[6] For more information on factors in the accumulation, depositing, and ignition of lint, see Arthur Lee, *Electric Clothes Dryers and Lint Ignition Characteristics*, U.S. Consumer Product Safety Commission, Washington, DC, May 2003.

[7] *Overheated clothes can cause fires*, CPSC Document #5022, U.S. Consumer Product Safety Commission, Washington, DC, updated June 2003.

[8] For More information on factors in spontaneous combustion of flammable or combustible liquids in clothes dryers, see Delmar "Trey" Morrison, Yee San Su, and Mark J. Fecke, "Spontaneous combustion tendency of household chemicals and clothes dryers," *ApplianceMagazine.com*, Parts 1 and 2, June and July, 2006.

- 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 help cut down on the number of fires caused by parts breaking and leaks.

- 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.

Table 1. Home Fires Involving Washers or Dryers, by Year
Structure Fires Reported to U.S. Fire Departments

Year	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions) As Reported		In 2010 Dollars	
1980	24,100		7		300		$38		$101	
1981	22,000		19		250		$32		$76	
1982	20,800		49		330		$41		$92	
1983	19,200		5		230		$49		$108	
1984	19,400		7		270		$60		$125	
1985	18,600		5		240		$57		$116	
1986	19,100		17		240		$60		$119	
1987	18,600		25		240		$56		$107	
1988	18,900		32		240		$71		$130	
1989	18,000		8		240		$64		$113	
1990	18,700		24		290		$83		$138	
1991	18,600		10		330		$96		$153	
1992	19,500		8		400		$78		$121	
1993	19,800		8		400		$87		$131	
1994	20,200		6		400		$91		$143	
1995	20,300		27		360		$104		$148	
1996	20,400		31		370		$116		$162	
1997	20,500		36		480		$128		$174	
1998	19,500		25		440		$100		$133	
1999	19,500	(16,900)	0	(0)	160	(160)	$112	($112)	$147	($146)
2000	15,900	(15,200)	0	(0)	440	(440)	$176	($176)	$223	($223)
2001	18,000	(16,900)	31	(31)	330	(330)	$150	($150)	$185	($185)
2002	18,600	(17,100)	50	(50)	430	(430)	$180	($173)	$218	($210)
2003	17,100	(15,400)	18	(18)	480	(470)	$236	($236)	$280	($279)
2004	16,500	(15,100)	22	(22)	460	(460)	$171	($171)	$197	($197)
2005	15,800	(14,400)	14	(14)	440	(440)	$206	($206)	$230	($230)
2006	17,700	(16,400)	15	(15)	360	(360)	$194	($194)	$210	($209)
2007	19,400	(17,200)	0	(0)	590	(590)	$165	($165)	$174	($174)
2008	17,200	(15,700)	98	(98)	490	(490)	$249	($248)	$251	($251)
2009	14,000	(12,500)	11	(11)	340	(340)	$221	($220)	$224	($224)
2010	16,800	(14,900)	51	(51)	380	(340)	$236	($236)	$236	($236)

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 2010 dollars is done using the consumer price index.
Source: Data from NFIRS Version 4.1 (1980-1998) and Version 5.0 (1999-2010) and from NFPA survey.

Table 2. Home Fires Involving Washers or Dryers, by Factor Contributing to Ignition
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

A. Clothes Dryers and Washing Machines

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Failure to clean	5,380	(32%)	13	(39%)	135	(31%)	$47	(22%)
Unclassified mechanical failure or malfunction	3,740	(22%)	0	(0%)	71	(16%)	$50	(24%)
Unclassified electrical failure or malfunction	1,350	(8%)	0	(0%)	41	(10%)	$27	(13%)
Heat source too close to combustibles	1,000	(6%)	0	(0%)	50	(12%)	$18	(9%)
Unspecified short circuit arc	700	(4%)	0	(0%)	23	(5%)	$11	(5%)
Worn out	600	(4%)	0	(0%)	13	(3%)	$4	(2%)
Equipment unattended	590	(3%)	14	(41%)	20	(5%)	$17	(8%)
Unclassified operational deficiency	580	(3%)	0	(0%)	11	(2%)	$6	(3%)
Unclassified factor contributed to ignition	540	(3%)	7	(21%)	19	(4%)	$9	(4%)
Equipment overloaded	510	(3%)	0	(0%)	16	(4%)	$9	(4%)
Installation deficiency	490	(3%)	0	(0%)	7	(2%)	$9	(4%)
Automatic control failure	420	(2%)	0	(0%)	7	(2%)	$4	(2%)
Unclassified misuse of material or product	400	(2%)	0	(0%)	10	(2%)	$7	(3%)
Equipment not being operated properly	370	(2%)	0	(0%)	27	(6%)	$5	(2%)
Arc or spark from operating equipment	260	(2%)	0	(0%)	2	(1%)	$5	(2%)
Short circuit arc from defective or worn insulation	200	(1%)	0	(0%)	4	(1%)	$3	(2%)
Leak or break	190	(1%)	0	(0%)	4	(1%)	$3	(2%)
Abandoned or discarded material or product	150	(1%)	0	(0%)	4	(1%)	$2	(1%)
Short circuit arc from mechanical damage	150	(1%)	0	(0%)	0	(0%)	$1	(0%)
Arc from faulty contact or broken conductor	90	(1%)	0	(0%)	0	(0%)	$1	(1%)
Unclassified design, manufacturing or installation deficiency	90	(1%)	0	(0%)	0	(0%)	$2	(1%)
Other known factors	460	(3%)	0	(0%)	21	(5%)	$4	(2%)
Total fires	16,950	(100%)	34	(100%)	430	(100%)	$209	(100%)
Total factors	18,290	(108%)	34	(100%)	486	(113%)	$245	(117%)

Table 2. Home Fires Involving Washers or Dryers, by Factor Contributing to Ignition (Continued)
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

B. Clothes Dryers

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Failure to clean	5,190	(33%)	11	(39%)	136	(34%)	$44	(23%)
Unclassified mechanical failure or malfunction	3,350	(22%)	0	(0%)	67	(17%)	$45	(24%)
Unclassified electrical failure or malfunction	1,170	(8%)	0	(0%)	37	(9%)	$23	(12%)
Heat source too close to combustibles	930	(6%)	0	(0%)	38	(9%)	$16	(8%)
Unspecified short circuit arc	590	(4%)	0	(0%)	15	(4%)	$9	(5%)
Equipment unattended	560	(4%)	12	(41%)	20	(5%)	$15	(8%)
Unclassified operational deficiency	530	(3%)	0	(0%)	11	(3%)	$5	(3%)
Worn out	500	(3%)	0	(0%)	10	(3%)	$4	(2%)
Unclassified factor contributed to ignition	500	(3%)	6	(21%)	19	(5%)	$9	(5%)
Equipment overloaded	470	(3%)	0	(0%)	10	(2%)	$8	(4%)
Installation deficiency	460	(3%)	0	(0%)	4	(1%)	$8	(4%)
Automatic control failure	410	(3%)	0	(0%)	7	(2%)	$5	(2%)
Unclassified misuse of material or product	370	(2%)	0	(0%)	9	(2%)	$7	(4%)
Equipment not being operated properly	360	(2%)	0	(0%)	27	(7%)	$5	(3%)
Arc or spark from operating equipment	230	(1%)	0	(0%)	0	(0%)	$5	(3%)
Short circuit arc from defective or worn insulation	180	(1%)	0	(0%)	4	(1%)	$3	(2%)
Leak or break	180	(1%)	0	(0%)	4	(1%)	$3	(2%)
Short circuit arc from mechanical damage	120	(1%)	0	(0%)	0	(0%)	$1	(1%)
Abandoned or discarded material or product	120	(1%)	0	(0%)	2	(1%)	$2	(1%)
Arc from faulty contact or broken conductor	80	(1%)	0	(0%)	0	(0%)	$1	(1%)
Unclassified design, manufacturing or installation deficiency	80	(1%)	0	(0%)	0	(0%)	$2	(1%)
Other known factors	400	(3%)	0	(0%)	20	(5%)	$4	(2%)
Total fires	15,520	(100%)	29	(100%)	402	(100%)	$192	(100%)
Total factors	16,770	(108%)	29	(100%)	440	(110%)	$224	(117%)

Table 2. Home Fires Involving Washers or Dryers, by Factor Contributing to Ignition (Continued)
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

C. Washing Machines

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified mechanical failure or malfunction	230	(33%)	NA	(NA)	3	(17%)	$2	(33%)
Unclassified electrical failure or malfunction	100	(15%)	NA	(NA)	3	(17%)	$3	(35%)
Unspecified short circuit arc	90	(13%)	NA	(NA)	5	(32%)	$1	(13%)
Worn out	70	(10%)	NA	(NA)	1	(9%)	$0	(2%)
Equipment overloaded	30	(4%)	NA	(NA)	0	(0%)	$1	(8%)
Heat source too close to combustibles	20	(3%)	NA	(NA)	1	(8%)	$1	(8%)
Unclassified factor contributed to ignition	20	(3%)	NA	(NA)	0	(0%)	$0	(2%)
Arc or spark from operating equipment	20	(2%)	NA	(NA)	1	(9%)	$0	(0%)
Unclassified misuse of material or product	20	(2%)	NA	(NA)	1	(8%)	$0	(0%)
Unclassified operational deficiency	10	(2%)	NA	(NA)	0	(0%)	$0	(4%)
Short circuit arc from defective or worn insulation	10	(2%)	NA	(NA)	0	(0%)	$0	(0%)
Short circuit arc from mechanical damage	10	(2%)	NA	(NA)	0	(0%)	$0	(0%)
Abandoned or discarded material or product	10	(1%)	NA	(NA)	1	(8%)	$0	(0%)
Arc from faulty contact or broken conductor	10	(1%)	NA	(NA)	0	(0%)	$0	(0%)
Equipment unattended	10	(1%)	NA	(NA)	0	(0%)	$0	(0%)
Equipment not being operated properly	10	(1%)	NA	(NA)	0	(0%)	$0	(0%)
Leak or break	10	(1%)	NA	(NA)	0	(0%)	$0	(0%)
Playing with heat source	10	(1%)	NA	(NA)	0	(0%)	$0	(0%)
Failure to clean	10	(1%)	NA	(NA)	0	(0%)	$1	(10%)
Automatic control failure	10	(1%)	NA	(NA)	0	(0%)	$0	(0%)
Water caused short circuit arc	10	(1%)	NA	(NA)	0	(0%)	$0	(0%)
Other known factors	20	(3%)	NA	(NA)	3	(17%)	$0	(1%)
Total fires	690	(100%)	4	(100%)	17	(100%)	$7	(100%)
Total factors	730	(106%)	NA	(NA)	20	(124%)	$9	(117%)

NA – Not applicable because all deaths have unknown factor contributing to ignition.

Table 2. Home Fires Involving Washers or Dryers, by Factor Contributing to Ignition (Continued)
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

D. Combination Washer/Dryers

Factor	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Failure to clean	190	(26%)	0	(NA)	0	(0%)	$2	(18%)
Unclassified mechanical failure or malfunction	170	(23%)	0	(NA)	0	(0%)	$2	(24%)
Unclassified electrical failure or malfunction	80	(10%)	0	(NA)	0	(0%)	$1	(9%)
Heat source too close to combustibles	50	(7%)	0	(NA)	12	(100%)	$1	(15%)
Unclassified operational deficiency	40	(5%)	0	(NA)	0	(0%)	$1	(5%)
Installation deficiency	30	(4%)	0	(NA)	0	(0%)	$1	(11%)
Worn out	30	(3%)	0	(NA)	0	(0%)	$0	(3%)
Unclassified factor contributed to ignition	20	(3%)	0	(NA)	0	(0%)	$0	(1%)
Equipment unattended	20	(3%)	0	(NA)	0	(0%)	$2	(21%)
Unclassified misuse of material or product	20	(3%)	0	(NA)	0	(0%)	$0	(2%)
Abandoned or discarded materials or products	20	(3%)	0	(NA)	0	(0%)	$0	(0%)
Unspecified short circuit arc	20	(3%)	0	(NA)	0	(0%)	$1	(6%)
Equipment overloaded	20	(2%)	0	(NA)	7	(60%)	$0	(0%)
Short circuit arc from mechanical damage	20	(2%)	0	(NA)	0	(0%)	$0	(0%)
Arc or spark from operating equipment	10	(2%)	0	(NA)	0	(0%)	$0	(1%)
Unclassified design, manufacturing or installation deficiency	10	(2%)	0	(NA)	0	(0%)	$0	(0%)
Storm	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Equipment not being operated properly	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Short circuit arc from defective or worn insulation	10	(1%)	0	(NA)	0	(0%)	$0	(1%)
Other known factors	30	(4%)	0	(NA)	0	(0%)	$0	(2%)
Total fires	740	(100%)	0	(NA)	12	(100%)	$10	(100%)
Total factor entries	800	(107%)	0	(NA)	19	(160%)	$12	(119%)

NA – Not applicable because total is zero.
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 survey.

Table 3. Home Fires Involving Washers or Dryers, by Item First Ignited
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

A. Clothes Dryers and Washing Machines

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Dust, fiber, or lint	4,650	(27%)	23	(68%)	116	(27%)	$39	(19%)
Clothing	4,600	(27%)	0	(0%)	130	(30%)	$55	(26%)
Unclassified soft goods or clothing	1,550	(9%)	0	(0%)	27	(6%)	$23	(11%)
Appliance housing or casing	1,440	(9%)	0	(0%)	20	(5%)	$19	(9%)
Wire or cable insulation	1,100	(6%)	7	(21%)	28	(6%)	$14	(7%)
Linen other than bedding	810	(5%)	0	(0%)	29	(7%)	$6	(3%)
Unclassified item	500	(3%)	0	(0%)	2	(0%)	$7	(3%)
Mattress or bedding	430	(3%)	0	(0%)	14	(3%)	$3	(2%)
Interior wall covering	230	(1%)	4	(12%)	11	(3%)	$13	(6%)
Multiple items first ignited	220	(1%)	0	(0%)	6	(2%)	$7	(3%)
Drive belt	190	(1%)	0	(0%)	12	(3%)	$1	(0%)
Flammable or combustible gas or liquid	160	(1%)	0	(0%)	12	(3%)	$2	(1%)
Pipe, duct, conduit or hose	140	(1%)	0	(0%)	5	(1%)	$1	(0%)
Goods not made up, including fabrics and yard goods	130	(1%)	0	(0%)	5	(1%)	$0	(0%)
Structural member or framing	110	(1%)	0	(0%)	0	(0%)	$4	(2%)
Other known items	710	(4%)	0	(0%)	13	(3%)	$16	(8%)
Total fires	16,950	(100%)	34	(100%)	430	(100%)	$209	(100%)

B. Clothes Dryers

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Dust, fiber, or lint	4,440	(29%)	25	(85%)	115	(29%)	$38	(20%)
Clothing	4,400	(28%)	0	(0%)	125	(31%)	$51	(27%)
Unclassified soft goods or clothing	1,470	(9%)	0	(0%)	26	(6%)	$21	(11%)
Appliance housing or casing	1,210	(8%)	0	(0%)	17	(4%)	$16	(8%)
Wire or cable insulation	850	(5%)	0	(0%)	25	(6%)	$12	(6%)
Linen other than bedding	750	(5%)	0	(0%)	29	(7%)	$5	(3%)
Unclassified item	430	(3%)	0	(0%)	2	(0%)	$6	(3%)
Mattress or bedding	400	(3%)	0	(0%)	14	(4%)	$3	(2%)
Interior wall covering	210	(1%)	4	(15%)	10	(2%)	$11	(6%)
Multiple items first ignited	190	(1%)	0	(0%)	2	(0%)	$6	(3%)
Flammable or combustible gas or liquid	150	(1%)	0	(0%)	10	(2%)	$2	(1%)
Pipe, duct, conduit or hose	130	(1%)	0	(0%)	5	(1%)	$1	(0%)
Goods not made up, including fabrics and yard goods	130	(1%)	0	(0%)	5	(1%)	$0	(0%)

Table 3. Home Fires Involving Washers or Dryers, by Item First Ignited (Continued)
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

B. Clothes Dryers

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Structural member or framing	90	(1%)	0	(0%)	0	(0%)	$4	(2%)
Drive belt	90	(1%)	0	(0%)	10	(3%)	$1	(0%)
Other known items	600	(4%)	0	(0%)	10	(2%)	$14	(7%)
Total fires	15,520	(100%)	29	(100%)	402	(100%)	$192	(100%)

C. Washing Machines

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Wire or cable insulation	180	(26%)	4	(100%)	3	(18%)	$1	(13%)
Appliance housing or casing	150	(21%)	0	(0%)	3	(19%)	$2	(29%)
Drive belt	100	(15%)	0	(0%)	0	(0%)	$0	(0%)
Clothing	60	(8%)	0	(0%)	0	(0%)	$1	(8%)
Unclassified item first ignited	50	(7%)	0	(0%)	0	(0%)	$0	(1%)
Dust, fiber, or lint	20	(2%)	0	(0%)	2	(9%)	$0	(3%)
Interior wall covering	20	(2%)	0	(0%)	2	(10%)	$0	(4%)
Trash or waste	10	(2%)	0	(0%)	0	(0%)	$0	(0%)
Linen other than bedding	10	(2%)	0	(0%)	0	(0%)	$0	(1%)
Unclassified soft goods or clothing	10	(2%)	0	(0%)	1	(9%)	$0	(5%)
Multiple items first ignited	10	(2%)	0	(0%)	3	(18%)	$1	(15%)
Unclassified structural component or finish	10	(2%)	0	(0%)	0	(0%)	$1	(7%)
Structural member or framing	10	(1%)	0	(0%)	0	(0%)	$0	(1%)
Flammable or combustible gas or liquid	10	(1%)	0	(0%)	2	(10%)	$0	(0%)
Exterior wall covering or finish	10	(1%)	0	(0%)	0	(0%)	$0	(1%)
Cabinetry	10	(1%)	0	(0%)	0	(0%)	$1	(9%)
Floor covering	10	(1%)	0	(0%)	1	(8%)	$0	(0%)
Other known items	20	(3%)	0	(0%)	0	(0%)	$0	(1%)
Total fires	690	(100%)	4	(100%)	17	(100%)	$7	(100%)

Table 3. Home Fires Involving Washers or Dryers, by Item First Ignited (Continued)
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

D. Combination Washer/Dryers

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Dust, fiber, or lint	170	(23%)	0	(NA)	0	(0%)	$0	(3%)
Clothing	130	(18%)	0	(NA)	6	(51%)	$3	(26%)
Appliance housing or casing	100	(14%)	0	(NA)	0	(0%)	$1	(11%)
Wire or cable insulation	90	(12%)	0	(NA)	0	(0%)	$1	(11%)
Unclassified soft goods or clothing	60	(8%)	0	(NA)	0	(0%)	$2	(19%)
Linen other than bedding	40	(6%)	0	(NA)	0	(0%)	$0	(1%)
Mattress or bedding	20	(3%)	0	(NA)	0	(0%)	$0	(4%)
Unclassified item first ignited	20	(3%)	0	(NA)	0	(0%)	$0	(0%)
Multiple items first ignited	20	(2%)	0	(NA)	2	(16%)	$0	(1%)
Interior wall covering	10	(1%)	0	(NA)	0	(0%)	$1	(8%)
Trash or waste	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Drive belt	10	(1%)	0	(NA)	2	(16%)	$0	(0%)
Pipe, duct, conduit or hose	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Papers	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Flammable or combustible gas or liquid	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Unclassified storage supplies	10	(1%)	0	(NA)	0	(0%)	$0	(1%)
Structural member or framing	10	(1%)	0	(NA)	0	(0%)	$0	(2%)
Other known items	30	(4%)	0	(NA)	2	(17%)	$1	(12%)
Total fires	740	(100%)	0	(NA)	12	(100%)	$10	(100%)

NA – Not applicable because total is zero.

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 survey.

Table 4. Home Fires Involving Washers or Dryers, by Area of Origin
Annual Average of 2006-2010 Structure Fires Reported to U.S. Fire Departments

A. Clothes Dryers and Washing Machines

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	13,680	(81%)	31	(92%)	365	(85%)	$167	(80%)
Garage*	460	(3%)	0	(0%)	11	(2%)	$13	(6%)
Crawl space or substructure space	420	(2%)	0	(0%)	4	(1%)	$5	(2%)
Kitchen	380	(2%)	0	(0%)	11	(3%)	$3	(2%)
Unclassified equipment or service area	270	(2%)	0	(0%)	6	(1%)	$2	(1%)
Laundry or mail chute	200	(1%)	0	(0%)	0	(0%)	$1	(1%)
Duct for HVAC, cable, exhaust, or heating	160	(1%)	0	(0%)	0	(0%)	$1	(1%)
Closet	140	(1%)	0	(0%)	4	(1%)	$1	(1%)
Unclassified area of origin	130	(1%)	0	(0%)	0	(0%)	$1	(0%)
Bathroom	130	(1%)	0	(0%)	5	(1%)	$1	(1%)
Heating equipment room	110	(1%)	0	(0%)	3	(1%)	$1	(0%)
Unclassified storage area	100	(1%)	0	(0%)	3	(1%)	$1	(0%)
Other known areas**	760	(5%)	3	(8%)	19	(4%)	$12	(6%)
Total fires	16,950	(100%)	34	(100%)	430	(100%)	$209	(100%)

* Excluding residential garages coded as separate property.
** The leading area of origin for fire deaths not shown above is unclassified function area (8% of fire deaths).

B. Clothes Dryers

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	12,570	(81%)	27	(91%)	341	(85%)	$155	(81%)
Garage*	430	(3%)	0	(0%)	8	(2%)	$12	(6%)
Crawl space or substructure space	400	(3%)	0	(0%)	4	(1%)	$4	(2%)
Kitchen	330	(2%)	0	(0%)	11	(3%)	$3	(1%)
Unclassified equipment or service area	240	(2%)	0	(0%)	6	(2%)	$2	(1%)
Laundry or mail chute	170	(1%)	0	(0%)	0	(0%)	$1	(0%)
Duct for HVAC, cable, exhaust, or heating	150	(1%)	0	(0%)	0	(0%)	$1	(1%)
Closet	130	(1%)	0	(0%)	3	(1%)	$1	(0%)
Unclassified area of origin	120	(1%)	0	(0%)	0	(0%)	$1	(0%)
Bathroom	110	(1%)	0	(0%)	5	(1%)	$1	(0%)
Heating equipment room	100	(1%)	0	(0%)	3	(1%)	$1	(0%)
Unclassified storage areas	90	(1%)	0	(0%)	3	(1%)	$1	(0%)

Table 4. Home Fires Involving Washers or Dryers, by Area of Origin (Continued)
Annual Average of 2006-2010 Structure Fires Departments

B. Clothes Dryers

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Other known areas**	690	(4%)	3	(9%)	19	(5%)	$10	(5%)
Total fires	15,520	(100%)	29	(100%)	402	(100%)	$192	(100%)

* Excluding residential garages coded as separate property.
** The leading area of origin for fire deaths not shown above is unclassified function area (9% of fire deaths).

C. Washing Machines

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	550	(80%)	4	(100%)	14	(83%)	$5	(65%)
Garage*	30	(4%)	0	(0%)	3	(17%)	$1	(14%)
Kitchen	20	(3%)	0	(0%)	0	(0%)	$0	(2%)
Crawl space or substructure space	20	(2%)	0	(0%)	0	(0%)	$1	(15%)
Unclassified equipment or service area	10	(1%)	0	(0%)	0	(0%)	$0	(0%)
Bathroom	10	(1%)	0	(0%)	0	(0%)	$0	(1%)
Unclassified area of origin	10	(1%)	0	(0%)	0	(0%)	$0	(0%)
Laundry or mail chute	10	(1%)	0	(0%)	0	(0%)	$0	(0%)
Unclassified storage area	10	(1%)	0	(0%)	0	(0%)	$0	(0%)
Other known areas	30	(5%)	0	(0%)	0	(0%)	$0	(2%)
Total fires	690	(100%)	4	(100%)	17	(100%)	$7	(100%)

D. Combination Washer/Dryers

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry room or area	550	(75%)	0	(NA)	11	(89%)	$6	(65%)
Kitchen	30	(4%)	0	(NA)	0	(0%)	$0	(5%)
Unclassified equipment or service area	20	(3%)	0	(NA)	0	(0%)	$0	(3%)
Closet	20	(3%)	0	(NA)	1	(11%)	$0	(3%)
Bathroom	20	(2%)	0	(NA)	0	(0%)	$0	(2%)

Table 4. Home Fires Involving Washers or Dryers, by Area of Origin (Continued)
Annual Average of 2006-2010 Structure Fires Departments

D. Combination Washer/Dryers

Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Laundry or mail chute	20	(2%)	0	(NA)	0	(0%)	$0	(4%)
Duct for HVAC, cable, exhaust, or heating	10	(2%)	0	(NA)	0	(0%)	$0	(0%)
Storage room or area	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Unclassified area of origin	10	(1%)	0	(NA)	0	(0%)	$0	(1%)
Garage*	10	(1%)	0	(NA)	0	(0%)	$0	(1%)
Unclassified function area	10	(1%)	0	(NA)	0	(0%)	$0	(0%)
Other known areas	40	(6%)	0	(NA)	0	(0%)	$2	(16%)
Total fires	740	(100%)	0	(NA)	12	(100%)	$10	(100%)

NA – Not applicable because total is zero.

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 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.

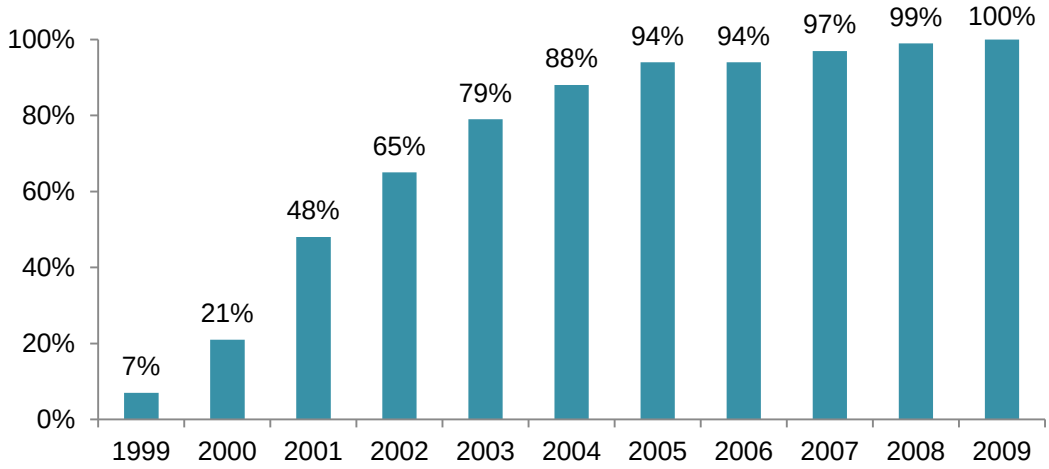
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific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

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.

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



From 1999 data on, analyses are based on scaling ratios using only data originally collected in NFIRS 5.0:

NFPA survey projections
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. 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 and of understating the factors specifically associated with 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 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.

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)
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.