FIRES AT OUTSIDE STORAGE TANKS

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Abstract

In 2007-2011, U.S. fire departments responded to an estimated annual average of 301 fires at outside storage tanks. These fires caused an annual average of 1 civilian injury and $3 million in direct property damage. Four out of five of these fires (79%) took place in outside or other locations at these sites, and 49% of the fires were outside fires involving property of value. Almost one-fifth of the fires (17%) were structure fires, but these fires caused 34% of direct property damage. In structure fires, a torch, burner or soldering iron was the equipment involved in 29% of fires, while shop tools and industrial equipment (23%) and torch, burner or soldering iron (22%) were the types of equipment most frequently involved in outside and other fires. Fires at these facilities peaked during the months from May through August, which accounted for nearly half (46%) of the total.

Keywords: Storage tanks, tank farms, flammable liquids, fire statistics

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Executive Summary

During the five-year period from 2007-2011, U.S. fire departments responded to an estimated annual average of 301 fires at outside storage tanks. These fires causes an annual average of 1 civilian injury and $3 million in direct property damage. Nearly four of five of these fires (79%) took place in outside or other locations at these sites, and 49% were outside fires involving property of value. Nearly one-fifth of the fires (17%) were structure fires, but these fires caused 34% of direct property damage.

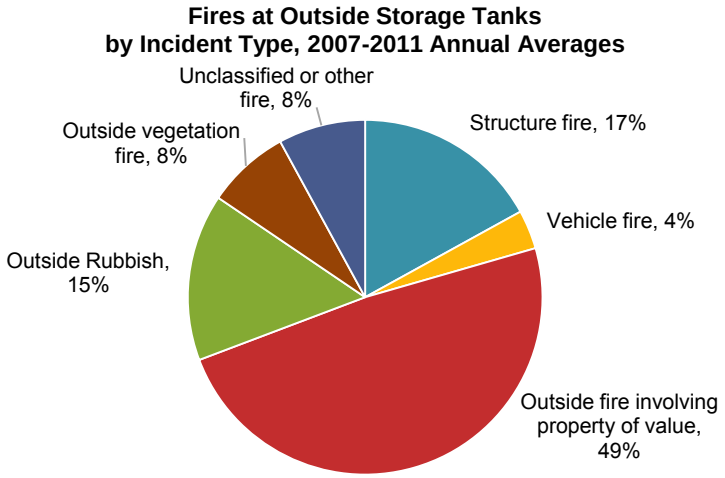
Fires at outside storage tanks have decreased markedly over the past three decades. In 2011, there were an estimated 275 reported fires in these facilities, a 76% decrease from 1,142 estimated fires in 1980. Even since 2000, when there an estimated 608 fires, fires have fallen by 55%. Civilian injuries have also fallen sharply since 1980. In the five years from 1980 to 1984, there were an estimated 28 injuries per year caused by fires at outside storage tanks, compared to an average of one injury per year between 2007 and 2011. In addition, there was an annual average of less than one civilian fatality per year from 2007 to 2011, compared to an average of 3.8 civilian fatalities per year between 1980 and 1984. Reductions in direct property damage have been less dramatic, falling from an estimated $7 million in direct property damage in 1980 to $4 million in 2011, a 46% decrease.

The peak period for fires at outside storage tanks were from May through August, which accounted for nearly half (46%) of the total. Fewer than three in 10 fires (29%) occurred in the five months from October through February. The fewest fires took place on Sundays (11%), but there was no clear in the remaining days of the week. Nearly half (49%) of fires took place between the hours of 12 p.m. and 8 p.m. The overnight hours between 10 p.m. and 7 a.m. accounted for just 15% of the fires in these facilities.

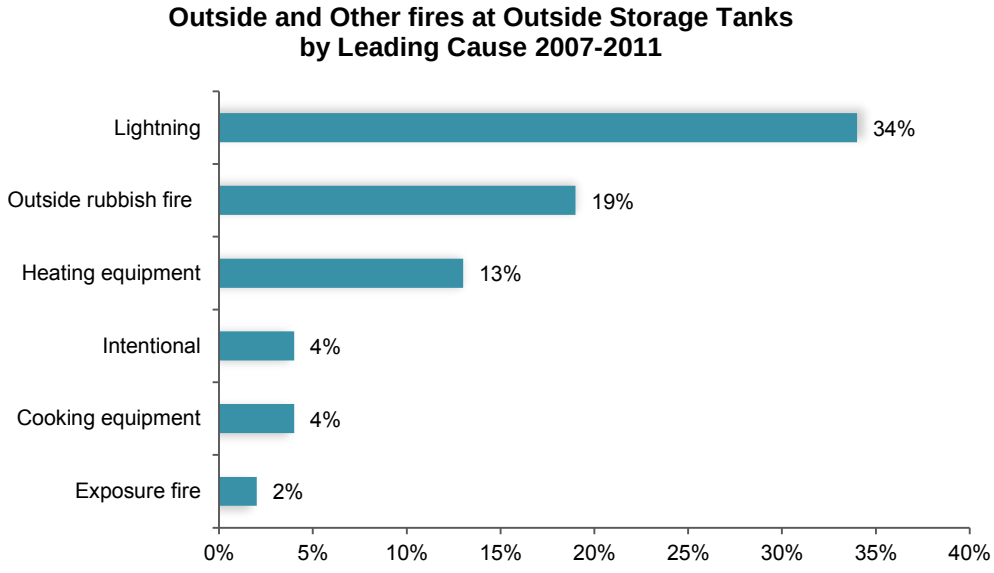
Among the fires at outside and other locations, lightning provided the heat source in one-third of the fires (34%), with a spark, ember or flame from operating equipment providing the heat source in nine percent of the fires. Storms were identified as a factor contributing to one-third (33%) of the fires, and cutting or welding too close to a combustible was cited as a contributing factor in 12% of outside and other fires. Mechanical failure or malfunction was a factor contributing to seven percent of the fires in outdoor or other locations. The most common area of origin was a storage room, area, tank or bin, with 43% of the total for these fires. The leading cause of ignition for structure fires was torch, burner or soldering iron, with 29% of the total, while 17% of these fires were intentional and 16% were caused by lightning. One-tenth (10%) of the structure fires at outside storage tanks were caused by smoking materials.

Fires at Outside Storage Tanks Fact Sheet

During the five-year period from 2007-2011, U.S. fire departments responded to an estimated annual average of 301 fires at outside storage tanks. These fires causes an annual average of one civilian injury and $3 million in direct property damage.



- Storms were identified as factors contributing to 33% of the outdoor and other fires, and cutting or welding too close to a combustible was cited as a contributing factor in 12% of these fires.
- Mechanical failure or malfunction was a factor contributing to another seven percent of the outdoor or other fires.



Fires at Outside Storage Tanks

This report examines fires at outside storage tanks reported to local fire departments. In the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS), Version 5.0, these are identified by fixed property use code 849. Only fires reported to U.S. municipal fire departments are included in this report, and it accordingly excludes fires reported only to Federal or state agencies or industrial fire brigades. The statistics in this analysis are national estimates derived from NFIRS and NFPA's annual fire department experience survey. Details on the methodology may be found in the appendix. Most of the analysis in this report focuses upon fires in structures or in outside and other fires. Outside rubbish fires were excluded from the analysis, and limited information is provided on vehicle fires due to the small number of these incidents.

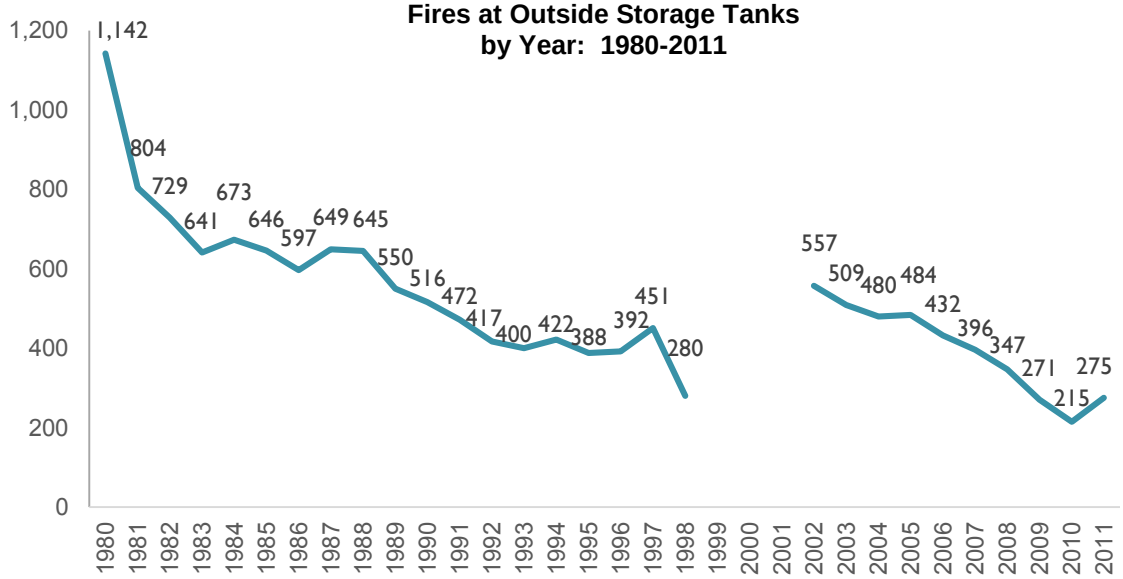
From 2007 through 2011, there were an estimated average of 301 fires in outside storage tanks per year. These fires caused an annual average of one civilian injury and $3 million in direct property damage. There were no civilian fatalities. The single injury is eliminated from analysis in the report. The fires in these facilities included structure fires, vehicle fires, and outside and other fires. Nearly half (49%) of the fires were outside fires involving property of value, and these accounted for 59% of the direct property damage. Structure fires represented almost one-fifth (17%) of the fires and were responsible for 34% of direct property damage. There was no direct property damage caused by outside rubbish fires or natural vegetation fires. Only four percent of fires in outside storage tanks were vehicle fires. See Table A. for more details.

Table A.
Fires at Outside Storage Tanks
by Incident Type, 2007-2011 Annual Averages

Incident Type	Fires		Direct Property Damage (in millions)	
Structure fire	**51**	**(17%)**	**$1**	**(34%)**
Non-confined fires	39	(13%)	$1	(34%)
Confined fires	12	(4%)	$0	(0%)
Vehicle fire	**11**	**(4%)**	$0	**(1%)**
Outside and other fires	**239**	**(79%)**	$2	**(66%)**
Outside fire involving property of value	147	(49%)	$2	(59%)
Outside rubbish	46	(15%)	$0	(0%)
Outside vegetation fire	23	(8%)	$0	(0%)
Unclassified or other fire	24	(8%)	$0	(7%)
Totals	**301**	**(100%)**	**$3**	**(100%)**

Total fires at these facilities fell 76% from 1980 to 2011.
Table 2 and Figure 1 show that the total number of outside storage tank fires fell by 76% between 1980 (1,142 fires) and 2011 (275 fires). The lowest number of fires came in 2010, with the 215 fires that year representing an 81% decrease from 1980. NFIRS Version 5.0, first introduced in 1999, replaced the property use code for flammable or combustible liquid tank storage with "outside storage tanks."

Figure 1.
Fires at Outside Storage Tanks by Year: 1980-2011



Structure fires declined 79% between 1980 (245 fires) and 2011 (52 fires). The 23 structure fires in 1998 represents the lowest number of fires over this period and stands out as an anomaly that is substantially lower than even the next lowest structure fire totals, 41 in 2009 and 42 in 1993. (See Table 3.)

Vehicle fires at outside storage tanks declined 92% from 1980 (71 fires) to 2011 (6 fires). (See Table 4.) Since 1990, vehicle fires at these facilities have fallen by 89%. Because the number of estimated vehicle fires was particularly small (an estimated average of 11 per year), limited information is reported on these fires.

Outside and other fires at outside storage tanks fell 74% from 826 in 1980 to 218 in 2011. (See Table 5.) Between 2007 and 2011, the number of outside and other fires at these facilities fell by 31%, from 315 fires in 2007 to 218 fires in 2011, although an estimated 163 fires in 2010 was even lower. The number of civilian deaths and injuries at outside storage tanks are also much lower in recent years than they were in the early 1980s. The fires included in the outside and other category fires by year include outside fires involving property of value, outside vegetation fires, outside rubbish fires, and unclassified or other fires. Because causal information is not required for outside rubbish fires (an estimated average of 46 per year), they are excluded from analysis of these factors.

It should be noted that the number of structure and vehicle fires reported at these properties was relatively small. The estimation methods are much more reliable with a larger number of fires. One large fire can artificially inflate loss statistics. In addition, although some fluctuation is normal, this normal fluctuation may appear more dramatic with small numbers.

Transport driver fatally injured by fire when floor of storage tank fails

A transport driver was off-loading unleaded gasoline into a 12,000-gallon above-ground storage tank. Gasoline was forced over a containment wall and into the intake of the transport truck engine when the floor of the tank failed, and the driver also became covered in gasoline. Investigators believe that the truck engine ignited the fire and caused a resulting explosion. The employee was air-lifted to a hospital but suffered multiple third degree burns and died 12 days later. The investigators believe that all vents of the tank were frozen shut and caused the tank to rupture.

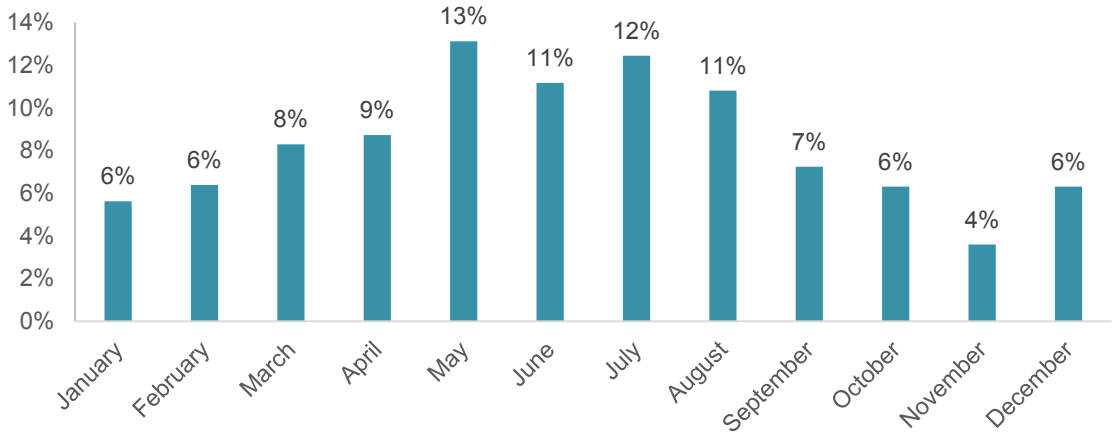
Occupational Safety & Health Administration. "Accident: 200001949 - Employee Dies From Burns When Gasoline Storage Tank Ruptures." Accessed July 18, 2014. https://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=200001949

Timing of Fires

Outside and other fires at outside storage tanks are less common on Sundays, but no other pattern was apparent by day of week. Even less of a pattern was apparent in structure fires, with the fewest fires taking place on Wednesday (9% of total), and 29% of fires taking place on the weekend – 16% on Saturday and 13% on Sunday. See Tables 6 and 7. The need for caution in interpreting these results due to the small number is again noted.

Fires at outside storage tanks are highest during the summer months. As shown in Figure 2 and Table 8, the peak period for outside and other fires at these facilities was the four-month period from May through August, which accounted for nearly half (49%) of the total. For structure fires, the peak period differed somewhat, with 50% of fires taking place from March through July, as shown in Table 9. These latter results should be interpreted cautiously due to the comparatively small number of structures fires.

Figure 2.
Outside or Other Fires at Outside Storage Tanks by Month, 2007-2011



Fires at outside storage tanks are less likely to occur in the overnight hours, with just one-fifth of fires taking place between 10:00 p.m. and 7:00 a.m. (20% of outside and other fires and 21% of structure fires). Just over half of outside and other fires (54%) and structure fires (54%) took place between 12:00 noon and 9:00 p.m. See Table 10A and Table 10B.

Leading Causes

Lightning was the leading cause of outside and other fires (34% of total) and was responsible for 87% of the direct property damage. See Table 11. Heating equipment was responsible for 13% of fires, followed by intentional fires and fires caused by cooking equipment, each with four percent of the total. The leading cause of structure fires at outside storage tanks was torch burner or soldering iron, which accounted for 29% of the fires, followed by intentional fires (17%), lightning ((16%), electrical distribution and lighting equipment (13%), cooking equipment (11%), and smoking materials (10%). Just over half (51%) of direct property damage was due to electrical distribution and lighting equipment. See Table 12.

Equipment Involved in Ignition

Shop tools and industrial equipment (23%) and torch, burner or soldering iron (22%) were the types of equipment most frequently involved in outside and other fires at outside storage tanks. Heating equipment (13%), unspecified equipment (11%), and electrical distribution and lighting equipment (7%) were other leading types of equipment involved in these fires. See Table 13. In structure fires at outside storage tanks, torch, burner, or soldering iron is also the equipment most frequently involved, with 31% of the total. Other leading types of equipment involved in these fires were garden tools and agricultural equipment (19%), electrical distribution and lighting equipment (13%) and fans (12%). See Table 14.

Welder burned while cutting on top of unpurged tank

A welder was using a torch while cutting on the top of a 12,000 gallon carbon-steel tank in a hazardous waste treatment, storage, and recycling facility. The tank was approximately 28.5 feet above the ground and had previously held wastewater contaminated with solvent. Atmosphere inside the tank was monitored with a multi-gas monitoring system, equipped with a sampling pump and tubing, which entered the tank from an eight-inch top hatch. As the welder knelt next to the top hatch on the walkway above the tank while torch cutting through the top of the tank, flames came out of the top of the tank, setting fire to his clothes. The employee's personal fall arrest system allowed him to reach outside the guarded walkway and escape the fire, but he was hospitalized with second and third degree burns. An OSHA investigation revealed that although the tank had been steam cleaned prior to the welding work, it had not been purged and was not isolated. In addition, the tank atmosphere was not sufficiently monitored.

Occupational Safety & Health Administration. "Accident: 201125903 – Employee Is Severely Burned In Fire." Accessed July 18, 2014. https://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=201125903

Heat Source

Lightning was the leading heat source for both outside and other fires and structure fires at outside storage tanks. Lightning was responsible for approximately one-third of outside and other fires (34%) and 16% of structure fires, as shown in Table 15. A spark, ember, or flame from operating equipment was also the second leading heat source for both outside and other fires (9%) and structure fires (13%). In outside and other fires, the next leading heat sources were flame or torch used for lighting (7% of fires) and unclassified heat source (6% of fires). Hot ember or ash and smoking materials each acted as the heat source in 10% of the structure fires. See Table 16.

Factors Contributing to Ignition

Storms were the leading factor contributing to ignition for outside and other and structure fires at outside storage tanks. See Table 17. Storms acted as the leading factor in one-third of outside and other fires (33%) and one in five (21%) structure fires. This is consistent with lightning as the leading heat source. Cutting or welding too close to combustibles was the second leading factor in both outside and other fires (12%) and structure fires (15%), with mechanical failure or malfunction the third leading factor in outside and other fires (7%) and structure fires (14%). An unspecified natural condition was the leading factor contributing to outside and other fires (6%), while a heat source too close to combustibles was the leading factor in 11% of structure fires, as shown in Table 18.

Area of Origin

In both outside and other fires and structure fires, the leading area of fire origin was storage room, area, tank or bin in fires at outside storage tanks. Approximately two of five (43%) outside and other fires and 23% of structure fires originated in this location. The other leading areas of origin for outside and other fires were unclassified outside area (14%), unclassified storage area (11%), and lawn, field, or open area (7%). In structure fires, areas for storage of supplies or tools or dead storage (10%), unclassified outside area (15%), and unclassified storage area (9%) were the next leading areas of fire origin. See Tables 19 and 20.

Employee injured when methanol vapor released from storage tank causes flash fire

An employee was working near a 10,000-gallon above-ground storage tank containing glycerin. Steam lines were used to heat the glycerin in order to liquefy it for transport. The glycerin contained a methanol contaminant from biodiesel production, and during the heating process, methanol was released from the tank and built up inside the Quonset hut where the tank was stored. The employee noticed smoke being emitted from the tank's outside vent pipe and went to investigate. When he opened the door and activated the overhead door opener, the methanol vapor exploded and induced a flash fire. The employee was hospitalized with first, second, and third degree burns on his hands, arms, and face.

Occupational Safety & Health Administration. "Accident: 202088589 – Employee Is Injured When Glycerin Tank Explodes." Accessed July 18, 2014. https://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=202088589

Item First Ignited

In two-thirds (64%) of outside and other fires, the item first ignited was flammable or combustible liquids or gases, piping or filter. Light vegetation, including grass, and unspecified items were each the items first ignited in eight percent of outside and other fires, as shown in Table 21. Flammable or combustible liquids or gases, piping or filter also acted as the leading item first ignited in structure fires, but was less dominant than with outside and other fires, with 23% of the total. Rubbish, trash, or waste and unspecified item were each the item first ignited in 11% of structure fires. See Table 22. Light vegetation, including grass, with six percent of fires, was the next leading item first ignited in structure fires.

CONCLUSIONS

The number of reported fires at outside storage tanks has fallen faster than fires in general. Lightning and torch work are major factors in the fire problem at these facilities.

Outside storage tank facilities require active safety programs in order to minimize the hazards of fires and explosions. The safe handling, transport, and storage of flammable or combustible liquids requires the use of approved tanks and other equipment, proper maintenance and inspection programs, and the application of safe work and hazard communication practices. It is especially important in the storage of flammable or combustible liquids to protect against the ignition of combustible vapors. Potential sources of ignition include open flames, smoking materials, electrical equipment, hot surfaces, static electricity, cutting and welding operations, and lightning. Even tanks that are believed to be empty may constitute a serious explosive hazard if they still contain combustible vapors.

It is essential that the selection and installation of storage tanks conform to prevailing industry standards and/or requirements set out in state or federal law. Liquids that may produce combustible vapors must be stored in tanks equipped with flame arresters in order to prevent any external fire from reaching vapor space inside the tank and with vapor control devices that may limit vapor emissions. All possible sources of ignition must be isolated from tanks and potential fugitive emissions.

Additional information on safe practices may be found in NFPA 30, *Flammable and Combustible Liquids Code*, and in "Storage of Flammable and Combustible Liquids," Section 3, Chapter 21 of the 18th edition of NFPA *Fire Protection Handbook.* The chapter was revised by Anthony M. Ordile.

Table 1.
Fires at Outside Storage Tanks
by Incident Type, 2007-2011 Annual Averages

Incident Type	Fires		Civilian Injuries		Direct Property Damage (in millions)	
Structure fire	**51**	**(17%)**	**0**	**(0%)**	**$1**	**(34%)**
Non-confined fires	39	(13%)	0	(0%)	$1	(34%)
Confined fires	12	(4%)	0	(0%)	$0	(0%)
Vehicle fire	**11**	**(4%)**	**0**	**(56%)**	**$0**	**(1%)**
Outside or other fires	**239**	**(79%)**	**0**	**(44%)**	**$2**	**(66%)**
Outside fire involving property of value	147	(49%)	0	(44%)	$2	(59%)
Outside rubbish	46	(15%)	0	(0%)	$0	(0%)
Outside vegetation fire	23	(8%)	0	(0%)	$0	(0%)
Unclassified or other fire	24	(8%)	0	(0%)	$0	(7%)
Totals	**301**	**(100%)**	**1**	**(100%)**	**$3**	**(100%)**

Note: Fires and civilian injuries are rounded to the nearest one and property damage is rounded to the nearest million dollars. Property damage figures have not been adjusted for inflation.

Source: NFIRS 5.0 and NFPA survey.

Table 2.
All Incident Types
Fires at Outside Storage Tanks,
by Year: 1980-2011

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions) As Reported	Direct Property Damage (in Millions) in 2011 Dollars
1980	1,142	32	$3	$7
1981	804	50	$5	$13
1982	729	23	$2	$3
1983	641	23	$1	$3
1984	673	10	$4	$8
1985	646	31	$1	$3
1986	597	27	$6	$12
1987	649	13	$4	$7
1988	645	33	$5	$10
1989	550	7	$3	$5
1990	516	12	$28	$48
1991	472	4	$2	$3
1992	417	15	$2	$4
1993	400	12	$5	$8
1994	422	4	$2	$3
1995	388	11	$14	$21
1996	392	10	$2	$2
1997	451	6	$5	$7
1998	280	13	$5	$7
1999	450	0	$4	$5
2000	608	16	$1	$1
2001	740	14	$9	$12
2002	557	3	$1	$2
2003	509	8	$1	$1
2004	480	4	$2	$2
2005	484	5	$2	$2
2006	432	5	$2	$2
2007	396	2	$2	$2
2008	347	0	$3	$3
2009	271	1	$3	$3
2010	215	0	$5	$6
2011	275	1	$4	$4

Note: Because of low participation in NFIRS 5.0 during 1999-2001, estimates for these years are highly uncertain and must be used with caution. Inflation adjustment to 2011 dollars is done using the Consumer Price Index. Fires and civilian injuries are rounded to the nearest one and property damage is rounded to the nearest million dollars.
Source: NFIRS and NFPA survey.

Table 3.
Structure Fires at Outside Storage Tanks,
by Year: 1980-2011

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions) As Reported	in 2011 Dollars
1980	245	0	$1	$2
1981	142	3	$4	$11
1982	93	3	$0	$1
1983	72	5	$0	$1
1984	109	0	$2	$3
1985	94	5	$0	$1
1986	84	11	$2	$5
1987	89	3	$3	$5
1988	107	21	$3	$6
1989	101	2	$1	$2
1990	102	5	$1	$2
1991	54	1	$2	$3
1992	75	0	$1	$1
1993	42	2	$2	$3
1994	54	0	$1	$2
1995	50	0	$10	$15
1996	51	2	$0	$0
1997	45	0	$3	$5
1998	23	4	$4	$5
1999	97	0	$1	$1
2000	155	0	$4	$6
2001	154	0	$0	$0
2002	118	0	$0	$0
2003	142	5	$2	$2
2004	84	2	$0	$0
2005	120	2	$2	$3
2006	75	0	$3	$3
2007	59	0	$3	$3
2008	57	0	$1	$1
2009	41	0	$1	$1
2010	47	0	$2	$2
2011	52	0	$1	$1

Note: Because of low participation in NFIRS 5.0 during 1999-2001, estimates for these years are highly uncertain and must be used with caution. Inflation adjustment to 2011 dollars is done using the Consumer Price Index. Fires and civilian injuries are rounded to the nearest one and property damage is rounded to the nearest million dollars.

Source: NFIRS and NFPA survey.

Table 4.
Vehicle Fires at Outside Storage Tanks,
by Year: 1980-2011

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions) As Reported	in 2011 Dollars
1980	71	7	$0	$0
1981	68	34	$0	$1
1982	64	2	$0	$0
1983	74	5	$0	$1
1984	67	7	$0	$1
1985	76	5	$1	$1
1986	77	10	$0	$0
1987	66	3	$0	$1
1988	86	5	$1	$3
1989	77	0	$0	$1
1990	54	2	$0	$1
1991	66	2	$0	$0
1992	38	2	$1	$1
1993	60	1	$0	$0
1994	72	0	$1	$1
1995	52	10	$3	$4
1996	60	6	$0	$0
1997	53	0	$0	$0
1998	35	5	$0	$0
1999	38	0	$0	$0
2000	16	16	$1	$1
2001	50	6	$1	$1
2002	20	0	$0	$1
2003	16	0	$0	$0
2004	23	2	$0	$0
2005	11	2	$0	$0
2006	22	0	$1	$1
2007	22	2	$0	$0
2008	16	0	$0	$0
2009	4	0	$0	$0
2010	6	0	$0	$0
2011	6	0	$0	$0

Note: Because of low participation in NFIRS 5.0 during 1999-2001, estimates for these years are highly uncertain and must be used with caution. Inflation adjustment to 2011 dollars is done using the Consumer Price Index. Fires and civilian injuries are rounded to the nearest one and property damage is rounded to the nearest million dollars.

Source: NFIRS and NFPA survey.

Table 5.
Outside and Other Fires at Outside Storage Tanks,
by Year: 1980-2011

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions) As Reported	in 2011 Dollars
1980	826	25	$2	$5
1981	594	13	$0	$1
1982	572	18	$1	$3
1983	495	13	$1	$2
1984	497	3	$2	$4
1985	476	21	$0	$1
1986	436	6	$3	$7
1987	494	7	$0	$1
1988	452	7	$1	$1
1989	372	5	$1	$3
1990	360	5	$26	$45
1991	352	1	$0	$0
1992	304	13	$1	$1
1993	298	9	$3	$4
1994	296	4	$0	$0
1995	286	1	$1	$2
1996	281	2	$1	$1
1997	353	6	$1	$2
1998	222	4	$1	$2
1999	315	0	$0	$0
2000	436	0	$0	$0
2001	535	8	$1	$1
2002	419	3	$1	$1
2003	351	4	$0	$0
2004	373	0	$1	$1
2005	353	1	$1	$2
2006	335	5	$0	$0
2007	315	0	$2	$2
2008	274	0	$2	$2
2009	226	1	$2	$2
2010	163	0	$5	$5
2011	218	1	$1	$1

Note: Because of low participation in NFIRS 5.0 during 1999-2001, estimates for these years are highly uncertain and must be used with caution. Inflation adjustment to 2011 dollars is done using the Consumer Price Index. Fires and civilian injuries are rounded to the nearest one and property damage is rounded to the nearest million dollars.

Source: NFIRS and NFPA survey.

Table 6.
Outside or Other Fires at Outside Storage Tanks
by Month, 2007-2011 Annual Averages

Month	Fires		Direct Property Damage (in Millions)	
January	13	(6%)	$0	(9%)
February	15	(6%)	$0	(2%)
March	20	(8%)	$0	(3%)
April	21	(9%)	$1	(33%)
May	31	(13%)	$0	(19%)
June	27	(11%)	$0	(4%)
July	30	(12%)	$0	(12%)
August	26	(11%)	$0	(11%)
September	17	(7%)	$0	(2%)
October	15	(6%)	$0	(2%)
November	9	(4%)	$0	(1%)
December	15	(6%)	$0	(2%)
Total	239	(100%)	$2	(100%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS 5.0 and NFPA survey.

Table 7.
Structure Fires at Outside Storage Tanks
by Month, 2007-2011 Annual Averages

Month	Fires		Direct Property Damage (in Millions)	
January	3	(7%)	$0	(7%)
February	3	(7%)	$0	(1%)
March	5	(10%)	$0	(3%)
April	5	(9%)	$0	(1%)
May	4	(8%)	$0	(18%)
June	6	(11%)	$0	(4%)
July	5	(11%)	$0	(7%)
August	4	(7%)	$0	(2%)
September	3	(6%)	$1	(45%)
October	4	(8%)	$0	(7%)
November	4	(8%)	$0	(1%)
December	4	(8%)	$0	(4%)
Total	51	(100%)	$1	(100%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS 5.0 and NFPA survey.

Table 8.
Outside and Other Fires at Outside Storage Tanks,
by Day of the Week, 2007-2011 Annual Averages

Day of Week	Fires		Direct Property Damage (in Millions)	
Sunday	25	(10%)	$0	(11%)
Monday	35	(15%)	$1	(33%)
Tuesday	31	(13%)	$0	(3%)
Wednesday	40	(17%)	$0	(18%)
Thursday	38	(16%)	$1	(23%)
Friday	37	(15%)	$0	(7%)
Saturday	34	(14%)	$0	(5%)
Total	239	(100%)	$2	(100%)

Table 9.
Structure Fires at Outside Storage Tanks,
by Day of the Week, 2007-2011 Annual Averages

Day of Week	Fires		Direct Property Damage (in Millions)	
Sunday	7	(13%)	$0	(9%)
Monday	9	(19%)	$0	(6%)
Tuesday	7	(13%)	$0	(19%)
Wednesday	5	(9%)	$0	(4%)
Thursday	8	(17%)	$0	(6%)
Friday	7	(13%)	$0	(2%)
Saturday	8	(16%)	$1	(53%)
Totals	51	(100%)	$1	(100%)

Note: Fire are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS 5.0 and NFPA survey.

Table 10.
Fires at Outside Storage Tanks,
by Alarm Time, 2007-2011 Annual Averages

All Fires

Alarm Time	Fires		Direct Property Damage (in Millions)	
Midnight-12:59 a.m.	7	(2%)	$0	(1%)
1:00-1:59 a.m.	6	(2%)	$1	(3%)
2:00-2:59 a.m.	5	(2%)	$0	(1%)
3:00-3:59 a.m.	6	(2%)	$1	(2%)
4:00-4:59 a.m.	10	(3%)	$1	(4%)
5:00-5:59 a.m.	5	(2%)	$0	(0%)
6:00-6:59 a.m.	7	(2%)	$0	(0%)
7:00-7:59 a.m.	12	(4%)	$0	(1%)
8:00-8:59 a.m.	11	(4%)	$1	(2%)
9:00-9:59 a.m.	12	(4%)	$1	(4%)
10:00-10:59 a.m.	16	(5%)	$2	(6%)
11:00-11:59 a.m.	10	(3%)	$0	(1%)
12:00-12:59 p.m.	16	(5%)	$2	(7%)
1:00-1:59 p.m.	18	(6%)	$1	(2%)
2:00-2:59 p.m.	22	(7%)	$1	(2%)
3:00-3:59 p.m.	21	(7%)	$1	(4%)
4:00-4:59 p.m.	16	(5%)	$2	(7%)
5:00-5:59 p.m.	20	(6%)	$1	(3%)
6:00-6:59 p.m.	18	(6%)	$2	(5%)
7:00-7:59 p.m.	17	(6%)	$1	(2%)
8:00-8:59 p.m.	16	(5%)	$8	(24%)
9:00-9:59 p.m.	13	(4%)	$4	(11%)
10:00-10:59 p.m.	8	(3%)	$2	(5%)
11:00-11:59 p.m.	10	(3%)	$1	(2%)
Total	301	(100%)	$3	(100%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages

Source: NFIRS 5.0 and NFPA survey.

Table 10A.
Outside and Other Fires at Outside Storage Tanks,
by Alarm Time, 2007-2011 Annual Averages

Alarm Time	Fires		Direct Property Damage (in Millions)	
Midnight-12:59 a.m.	5	(2%)	$0	(1%)
1:00-1:59 a.m.	4	(2%)	$0	(1%)
2:00-2:59 a.m.	4	(2%)	$0	(1%)
3:00-3:59 a.m.	5	(2%)	$0	(2%)
4:00-4:59 a.m.	8	(3%)	$0	(6%)
5:00-5:59 a.m.	4	(2%)	$0	(0%)
6:00-6:59 a.m.	6	(3%)	$0	(0%)
7:00-7:59 a.m.	10	(4%)	$0	(2%)
8:00-8:59 a.m.	10	(4%)	$0	(3%)
9:00-9:59 a.m.	10	(4%)	$0	(6%)
10:00-10:59 a.m.	12	(5%)	$0	(9%)
11:00-11:59 a.m.	8	(3%)	$0	(0%)
12:00-12:59 p.m.	14	(6%)	$0	(10%)
1:00-1:59 p.m.	13	(5%)	$0	(0%)
2:00-2:59 p.m.	18	(8%)	$0	(2%)
3:00-3:59 p.m.	17	(7%)	$0	(1%)
4:00-4:59 p.m.	13	(5%)	$0	(10%)
5:00-5:59 p.m.	15	(6%)	$0	(5%)
6:00-6:59 p.m.	13	(5%)	$0	(3%)
7:00-7:59 p.m.	13	(6%)	$0	(4%)
8:00-8:59 p.m.	14	(6%)	$0	(13%)
9:00-9:59 p.m.	10	(4%)	$0	(8%)
10:00-10:59 p.m.	6	(3%)	$0	(7%)
11:00-11:59 p.m.	8	(3%)	$0	(3%)
Totals	239	(100%)	$2	(100%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS 5.0 and NFPA survey.

Table 10B.
Structure Fires at Outside Storage Tanks,
by Alarm Time, 2007-2011 Annual Averages

Alarm Time	Fires		Direct Property Damage (in Millions)	
Midnight-12:59 a.m.	1	(2%)	$0	(0%)
1:00-1:59 a.m.	2	(4%)	$0	(7%)
2:00-2:59 a.m.	1	(2%)	$0	(0%)
3:00-3:59 a.m.	1	(2%)	$0	(1%)
4:00-4:59 a.m.	2	(4%)	$0	(0%)
5:00-5:59 a.m.	1	(2%)	$0	(0%)
6:00-6:59 a.m.	1	(2%)	$0	(0%)
7:00-7:59 a.m.	2	(4%)	$0	(0%)
8:00-8:59 a.m.	1	(1%)	$0	(0%)
9:00-9:59 a.m.	2	(4%)	$0	(0%)
10:00-10:59 a.m.	2	(5%)	$0	(0%)
11:00-11:59 a.m.	2	(3%)	$0	(3%)
12:00-12:59 p.m.	2	(3%)	$0	(0%)
1:00-1:59 p.m.	4	(7%)	$0	(4%)
2:00-2:59 p.m.	3	(7%)	$0	(0%)
3:00-3:59 p.m.	3	(6%)	$0	(9%)
4:00-4:59 p.m.	3	(5%)	$0	(1%)
5:00-5:59 p.m.	4	(8%)	$0	(1%)
6:00-6:59 p.m.	5	(9%)	$0	(8%)
7:00-7:59 p.m.	3	(6%)	$0	(0%)
8:00-8:59 p.m.	2	(3%)	$1	(46%)
9:00-9:59 p.m.	4	(7%)	$0	(18%)
10:00-10:59 p.m.	1	(2%)	$0	(0%)
11:00-11:59 p.m.	2	(3%)	$0	(0%)
Totals	51	(100%)	$1	(100%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS 5.0 and NFPA survey.

Table 11.
Outside and Other Fires at Outside Storage Tanks,
by Leading Cause, 2007-2011 Annual Averages

Leading Cause	Fires		Direct Property Damage (in Millions)	
Lightning	81	(34%)	$2	(87%)
Heating equipment	32	(13%)	$1	(49%)
Intentional	9	(4%)	$0	(0%)
Cooking equipment	9	(4%)	$0	(0%)
Exposure fire	6	(2%)	$0	(1%)
Outside rubbish fire*	46	(19%)	$0	(0%)
Total	239	(100%)	$2	(100%)

Table 12.
Structure Fires at Flammable or Combustible Liquid Storage Tank Facilities
by Leading Cause, 2007-2011 Annual Averages

Leading Cause	Fires		Direct Property Damage (in Millions)	
Torch, burner or soldering iron	15	(29%)	$0	(13%)
Intentional	9	(17%)	$0	(27%)
Lightning	8	(16%)	$0	(5%)
Electrical distribution and lighting equipment	7	(13%)	$1	(51%)
Cooking equipment	6	(11%)	$0	(0%)
Smoking materials	5	(10%)	$0	(6%)
Heating equipment	3	(6%)	$0	(8%)
Total	51	100%	$1	100%

*Causal information is not required for outside rubbish fires. These incidents were not analyzed further.

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. This table summarizes findings from multiple fields, meaning that the same fire may be listed under multiple causes. The methodology used is described in Appendix B. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS 5.0 and NFPA survey.

Table 13.
Outside and Other Fires at Outside Storage Tanks
by Equipment Involved in Ignition
2007-2011 Annual Averages

Equipment Involved	Fires		Direct Property Damage (in Millions)	
Shop tools and industrial equipment	56	(23%)	$1	(25%)
Torch, burner or soldering iron	52	(22%)	$0	(10%)
Heating equipment	32	(13%)	$1	(49%)
Other equipment involved in ignition	27	(11%)	$0	(16%)
Electrical distribution and lighting equipment	17	(7%)	$0	(0%)
Cooking equipment	9	(4%)	$0	(0%)
Outside rubbish fire*	46	(19%)	$0	(0%)
Total	239	(100%)	$2	(100%)

*Causal information is not required for outside rubbish fires. These incidents were not analyzed further.

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among fires of known equipment involved. Fires in which the equipment involved was entered as none but the heat source indicated equipment involved or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved.

Source: NFIRS 5.0 and NFPA survey.

Table 14.
Structure Fires at Outside Storage Tanks
by Equipment Involved in Ignition
2007-2011 Annual Averages

Equipment Involved	Fires		Direct Property Damage (in Millions)	
Torch, burner or soldering iron	16	(31%)	$0	(13%)
Non-confined	10	(19%)	$0	(13%)
Confined	6	(12%)	$0	(0%)
Garden tools and agricultural equipment	10	(19%)	$0	(17%)
Non-confined	10	(19%)	$0	(17%)
Confined	0	(0%)	$0	(0%)
Electrical distribution and lighting equipment	7	(13%)	$1	(51%)
Non-confined	7	(13%)	$1	(51%)
Confined	0	(0%)	$0	(0%)
Fan	6	(12%)	$0	(11%)
Non-confined	6	(12%)	$0	(11%)
Confined	0	(0%)	$0	(0%)
Cooking equipment	6	(11%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	6	(11%)	$0	(0%)
Heating equipment	3	(6%)	$0	(8%)
Non-confined	3	(6%)	$0	(8%)
Confined	0	(0%)	$0	(0%)
Other known equipment involved in ignition	4	(7%)	$0	(0%)
Non-confined	4	(7%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Total	51	(100%)	$1	(100%)
Non-confined	39	(77%)	$1	(100%)
Confined	12	(23%)	$0	(0%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among fires with known equipment involved. Fires in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Fires in which the equipment was partially unclassified (i.e., unclassified kitchen or cooking equipment, unclassified heating, cooling or air condition equipment, etc.) were allocated proportionally among fires in that grouping (kitchen or cooking equipment; heating, cooling or air conditioning equipment, etc.). Sums may not equal totals due to rounding errors. Source: NFIRS 5.0 and NFPA survey.

Table 15.
Outside and Other Fires at Outside Storage Tanks,
by Heat Source, 2007-2011 Annual Averages

Heat Source	Fires		Direct Property Damage (in Millions)	
Lightning	81	(34%)	$2	(87%)
Spark, ember or flame from operating equipment	22	(9%)	$0	(2%)
Flame or torch used for lighting	16	(7%)	$0	(4%)
Unclassified heat source	14	(6%)	$0	(1%)
Molten or hot material	8	(3%)	$0	(1%)
Unclassified heat from powered equipment	8	(3%)	$0	(1%)
Unclassified hot or smoldering object	7	(3%)	$0	(0%)
Radiated, conducted heat from operating equipment	7	(3%)	$0	(2%)
Arcing	5	(2%)	$0	(0%)
Heat or spark from friction	4	(2%)	$0	(0%)
Hot ember or ash	4	(2%)	$0	(0%)
Other known heat source	16	(7%)	$0	(2%)
				(0%)
Outside rubbish fire*	46	(19%)	$0	(0%)
Total	239	(100%)	$2	(100%)

*Causal information is not required for outside rubbish fires. These incidents were not analyzed further.

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. The statistics on matches, lighters, smoking materials, and candles include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material.

Source: NFIRS 5.0 and NFPA survey.

Table 16.
Structure Fires at Outside Storage Tanks,
by Heat Source, 2007-2011 Annual Averages

Heat Source	Fires		Direct Property Damage (in Millions)	
Lightning	8	(16%)	$0.	(5%)
Non-confined	8	(16%)	$0.	(5%)
Confined	0	(0%)	$0	(0%)
Spark, ember or flame from operating equipment	7	(13%)	$0	(9%)
Non-confined	4	(7%)	$0	(9%)
Confined	3	(6%)	$0	(0%)
Hot ember or ash	5	(10%)	$0	(5%)
Non-confined	5	(10%)	$0	(5%)
Confined		(0%)	$0	(0%)
Smoking materials	5	(10%)	$0	(6%)
Non-confined	2	(4%)	$0	(6%)
Confined	3	(6%)	$0	(0%)
Unclassified heat from powered equipment	4	(7%)	$0	(14%)
Non-confined	2	(4%)	$0	(14%)
Confined	2	(3%)	$0	(0%)
Radiated, conducted heat from operating equipment	4	(7%)	$0	(0%)
Non-confined	2	(4%)	$0	(0%)
Confined	2	(3%)	$0	(0%)
Match	4	(7%)	$0	(3%)
Non-confined	2	(4%)	$0	(3%)
Confined	1	(3%)	$0	(0%)
Molten or hot material	3	(5%)	$0	(1%)
Non-confined	3	(5%)	$0	(1%)
Confined	0	(0%)	$0	(0%)
Unclassified heat source	2	(5%)	$0	(0%)
Non-confined	1	(2%)	$0	(0%)
Confined	2	(3%)	$0	(0%)

Table 16.
Structure Fires at Outside Storage Tanks,
by Heat Source, 2007-2011 Annual Averages (continued)

Heat Source	Fires		Direct Property Damage (in Millions)	
Lighter	2	(4%)	$1	(55%)
Non-confined	2	(4%)	$1	(55%)
Confined	0	(0%)	$0	(0%)
Arcing	1	(3%)	$0	(2%)
Non-confined	1	(3%)	$0	(2%)
Confined	0	(0%)	$0	(0%)
Unclassified hot or smoldering object	1	(2%)	$0	(0%)
Non-confined	1	(2%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Heat or spark from friction	1	(2%)	$0	(1%)
Non-confined	1	(2%)	$0	(1%)
Confined	0	(0%)	$0	(0%)
Unclassified static discharge	1	(2%)	$0	(0%)
Non-confined	1	(2%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Heat from direct flame or convection currents	1	(2%)	$0	(1%)
Non-confined	1	(2%)	$0	(1%)
Confined	0	(0%)	$0	(0%)
Other known heat source	2	(4%)	$0	(0%)
Non-confined	2	(4%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Total	51	(100%)	$1	(100%)
Non-confined	39	(77%)	$1	(100%)
Confined	12	(23%)	$0	(0%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. The statistics on matches, lighters, smoking materials, and candles include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 17.
Outside and Other Fires at Outside Storage Tanks,
by Factor Contributing to Ignition, 2007-2011 Annual Averages

Factor Contributing	Fires		Direct Property Damage (in Millions)	
Storm	80	(33%)	$2	(74%)
Cutting or welding too close to combustible	29	(12%)	$0	(0%)
Mechanical failure or malfunction	17	(7%)	$0	(3%)
Natural condition, other	14	(6%)	$0	(5%)
Other factor contributed to ignition	9	(4%)	$0	(9%)
Electrical failure or malfunction	9	(4%)	$0	(0%)
Heat source too close to combustibles	6	(3%)	$0	(0%)
Exposure fire	6	(2%)	$0	(1%)
Unclassified operational deficiency	4	(2%)	$0	(2%)
Flammable liquid or gas spilled	4	(2%)	$0	(3%)
Rekindle	3	(1%)	$0	(0%)
Other known factor contributing to ignition	22	(9%)	$0	(4%)
Outside rubbish fire*	46	(19%)	$0	(0%)
Total fires	239	(100%)	$2	(100%)
Total factors (including rubbish)	244	(102%)	$2	(101%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Multiple entries are allowed, which can results in sums higher than totals. Fires in which the factor contributing to ignition was coded as "none," unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition. See Appendix A for details.

*Causal information is not required for outside rubbish fires. These incidents were not analyzed further.

Source: NFIRS 5.0 and NFPA survey.

Table 18.
Structure Fires at Outside Storage Tanks,
by Factor Contributing to Ignition, 2007-2011 Annual Averages

Factor Contributing	Fires		Direct Property Damage (in Millions)	
Storm	11	(21%)	$0	(5%)
Non-confined	11	(21%)	$0	(5%)
Confined	0	(0%)	$0	(0%)
Cutting or welding too close to combustible	8	(15%)	$0	(0%)
Non-confined	5	(9%)	$0	(0%)
Confined	3	(6%)	$0	(0%)
Mechanical failure or malfunction	7	(14%)	$0	(4%)
Non-confined	7	(14%)	$0	(4%)
Confined	0	(0%)	$0	(0%)
Heat source too close to combustibles.	6	(11%)	$1	(70%)
Non-confined	3	(5%)	$1	(70%)
Confined	3	(6%)	$0	(0%)
Abandoned or discarded materials or products	4	(9%)	$0	(0%)
Non-confined	2	(4%)	$0	(0%)
Confined	3	(5%)	$0	(0%)
Fire spread or control, other	3	(6%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	3	(6%)	$0	(0%)
Unclassified factor contributing to ignition	3	(6%)	$0	(20%)
Non-confined	3	(6%)	$0	(20%)
Confined	0	(0%)	$0	(0%)
Outside or open fire for debris or waste disposal	3	(5%)	$0	(0%)
Non-confined	3	(5%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Electrical failure or malfunction	2	(3%)	$0	(0%)
Non-confined	2	(3%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Playing with heat source	2	(3%)	$1	(69%)
Non-confined	2	(3%)	$1	(69%)
Confined	0	(0%)	$0	(0%)

Table 18.
Structure Fires at Outside Storage Tanks,
by Factor Contributing to Ignition, 2007-2011 Annual Averages (continued)

Factor Contributing	Fires		Direct Property Damage (in Millions)	
High wind	2	(3%)	$	(0%)
Non-confined	2	(3%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Other known factor contributing to ignition	4	(10%)	$0	(0%)
Non-confined	4	(10%)	$0	(0%)
Confined	0	(0%)	0	(0%)
Total	51	(100%)	$1	(100%)
Non-confined	39	(77%)	$1	(100%)
Confined	12	(23%)	$0	(100%)
Total non-confined factors	42	(106%)	$2	(169%)
Total confined factors	12	(100%)	$0	(0%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Multiple entries are allowed, which can results in sums higher than totals. Fires in which the factor contributing to ignition was coded as "none," unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 19.
Outside and Other Fires at Outside Storage Tanks,
by Area of Origin, 2007-2011 Annual Averages

Area of Origin	Fires		Direct Property Damage (in Millions)	
Storage room, area, tank, or bin	104	(43%)	$2	(67%)
Unclassified outside area	33	(14%)	$0	(3%)
Unclassified storage area	26	(11%)	$0	(9%)
Lawn, field or open area	18	(7%)	$0	(2%)
Vegetation area - wildland module	11	(4%)	$0	(0%)
Unspecified outdoor area of origin	11	(4%)	$0	(1%)
Unclassified equipment or service area	5	(2%)	$0	(10%)
Other known area of origin	31	(13%)	$0	(7%)
Outside rubbish fire*	46	(1%)	$0	(0%)
Total	239	(100%)	$2	(100%)

*Causal information is not required for outside rubbish fires. These incidents were not analyzed further.

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the area of origin was unknown or not reported have been allocated proportionally among fires of known area of origin.

Source: NFIRS 5.0 and NFPA survey.

Table 20.
Structure Fires at Outside Storage Tanks,
by Area of Origin, 2007-2011 Annual Averages

Area of Origin	Fires		Direct Property Damage (in Millions)	
Storage room, area, tank, or bin	12	(23%)	$1	(57%)
Non-confined	12	(23%)	$1	(57%)
Confined	0	(0%)	$0	(0%)
Unclassified outside area	8	(15%)	$0	(0%)
Non-confined	2	(3%)	$0	(0%)
Confined	6	(12%)	$0	(0%)
Storage of supplies or tools or dead storage	5	(10%)	$0	(2%)
Non-confined	5	(10%)	$0	(2%)
Confined	0	(0%)	$0	(0%)
Unclassified storage area	5	(9%)	$0	(1%)
Non-confined	4	(7%)	$0	(1%)
Confined	1	(2%)	$0	(0%)
Trash or rubbish chute, area or container	4	(7%)	$0	(1%)
Non-confined	1	(2%)	$0	(1%)
Confined	3	(5%)	$0	(0%)
Vacant structural area	2	(3%)	$0	(0%)
Non-confined	1	(1%)	$0	(0%)
Confined	1	(2%)	$0	(0%)
Other known area of origin	17	(32%)	$0	(39%)
Non-confined	16	(30%)	$0	(39%)
Confined	1	(2%)	$0	(0%)
Total	51	(100%)	$1	(100%)
Non-confined	39	(77%)	$1	(100%)
Confined	12	(23%)	$0	(0%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined fires (incident type 110-129, except 113-118). See Appendix A for details. Fires in which the area of origin was unknown or not reported have been allocated proportionally among fires of known area of origin. Source: NFIRS 5.0 and NFPA survey.

Table 21.
Outside and Other Fires at Outside Storage Tanks,
by Item First Ignited, 2007-2011 Annual Averages

Item First Ignited	Fires		Direct Property Damage (in Millions)	
Flammable or combustible liquids or gases, piping or filter	152	(64%)	$2	(80%)
Unspecified item first ignited	21	(9%)	$0	(3%)
Light vegetation, including grass	19	(8%)	$0	(0%)
Bulk storage	14	(6%)	$0	(16%)
Rubbish, trash, or waste	6	(3%)	$0	(0%)
Unclassified organic materials	4	(2%)	$0	(0%)
Other known item first ignited	23	(9%)	$0	(1%)
Outside rubbish fire*	46	(19%)	$0	(0%)
Total	239	(100%)	$2	(100%)

*Causal information is not required for outside rubbish fires. These incidents were not analyzed further.

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the item first ignited was unknown or not reported have been allocated proportionally among fires of known item first ignited.

Source: NFIRS 5.0 and NFPA survey.

Table 22.
Structure Fires at Outside Storage Tanks,
Item First Ignited, 2007-2011 Annual Averages

Item First Ignited	Fires		Direct Property Damage (in Millions)	
Flammable or combustible liquids and gases, piping or filter	12	(23%)	$1	(91%)
Non-confined	12	(23%)	$1	(91%)
Confined	0	(0%)	$0	(0%)
Rubbish, trash, or waste	6	(11%)	$0	(0%)
Non-confined	2	(5%)	$0	(0%)
Confined	3	(7%)	$0	(0%)
Unclassified item first ignited	3	(6%)	$0	(1%)
Non-confined	3	(6%)	$0	(1%)
Confined	0	(0%)	$0	(0%)
Light vegetation, including grass	3	(6%)	$0	(1%)
Non-confined	3	(6%)	$0	(1%)
Confined	0	(0%)	$0	(0%)
Box, carton, bag, basket, barrel	2	(5%)	$0	(0%)
Non-confined	1	(2%)	$0	(0%)
Confined	1	(3%)	$0	(0%)
Dust, fiber, lint, including sawdust or excelsior	2	(5%)	$0	(2%)
Non-confined	2	(5%)	$0	(2%)
Confined	0	(0%)	$0	(0%)
Cooking materials, including food	2	(4%)	$0	(0%)
Non-confined	0	(1%)	$0	(0%)
Confined	2	(3%)	$0	(0%)
Electrical wire or cable insulation	2	(4%)	$0	(2%)
Non-confined	0	(1%)	$0	(2%)
Confined	2	(3%)	$0	(0%)
Unclassified storage supplies	2	(4%)	$0	(0%)
Non-confined	0	(1%)	$0	(0%)
Confined	2	(3%)	$0	(0%)

Table 22.
Structure Fires at Outside Storage Tanks,
Item First Ignited, 2007-2011 Annual Averages (continued)

Item Fires Ignited	Fires		Direct Property Damage (in Millions)	
Structural member or framing	2	(4%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Magazine, newspaper, writing paper	2	(3%)	$0	(0%)
Non-confined	2	(3%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Mattress or bedding material	2	(3%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	2	(3%)	$0	(0%)
Bulk storage	1	(3%)	$0	(0%)
Non-confined	1	(3%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Insulation within structural area	1	(3%)	$0	(1%)
Non-confined	0	(0%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Exterior wall covering or finish	1	(3%)	$0	(1%)
Non-confined	0	(0%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Unclassified organic materials	1	(2%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Unclassified structural component or finish	1	(2%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Conveyor belt, drive belt, V-belt	1	(2%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	0	(0%)	$0	(0%)

Table 22.
Structure Fires at Outside Storage Tanks,
Item First Ignited, 2007-2011 Annual Averages (continued)

Item Fires Ignited	Fires		Direct Property Damage (in Millions)	
Interior ceiling cover or finish	1	(2%)	$0	(0%)
Non-confined	0	(0%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Other known item first ignited	2	(4%)	$0	(0%)
Non-confined	2	(4%)	$0	(0%)
Confined	0	(0%)	$0	(0%)
Total	51	(100%)	$1	(100%)
Non-confined	39	(77%)	$1	(100%)
Confined	12	(23%)	$0	(0%)

Note: Fires are rounded to the nearest one and property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures have not been adjusted for inflation. Percentages are calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the item first ignited was unknown or not reported have been allocated proportionally among fires of known item first ignited. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 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.

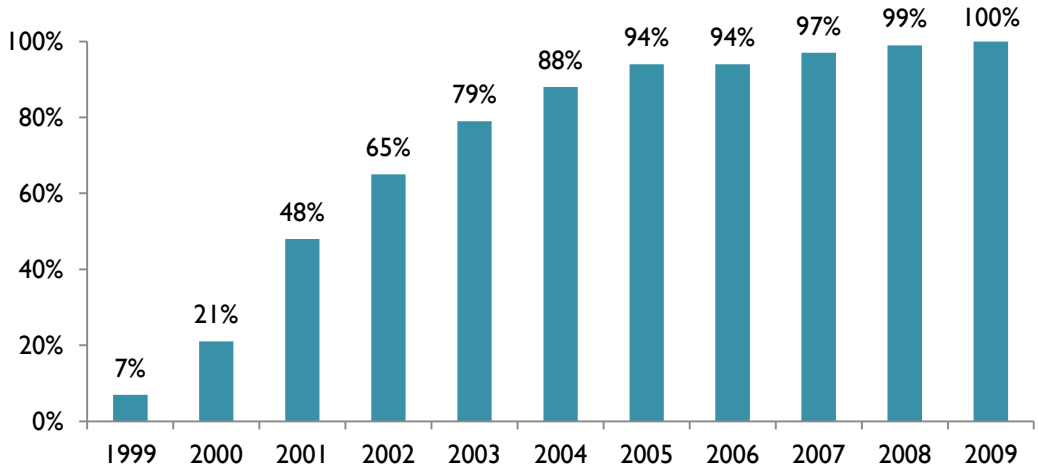
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific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

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.