

U.S. VEHICLE FIRE TRENDS AND PATTERNS

**Marty Ahrens
Fire Analysis and Research Division
National Fire Protection Association**

August 2005



National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471, www.nfpa.org

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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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Introduction

In this report, trends and characteristics associated with vehicle fires are examined by using data from the National Fire Protection Association's (NFPA's) annual fire experience survey and the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS). The report examines characteristics of vehicle fires that might lead to vehicle redesigns or changes in the actions of civilians and fire departments alike. The layout of the report is dictated by various classes of vehicles: data on highway, rail, water, air and other vehicle types are displayed separately to distinguish their differences. Specifically, information is given on the leading causes of vehicle fires, as well as the leading areas of origin and items first ignited. Additional data is provided on the fire trends, as well as location, month, day, and time patterns.

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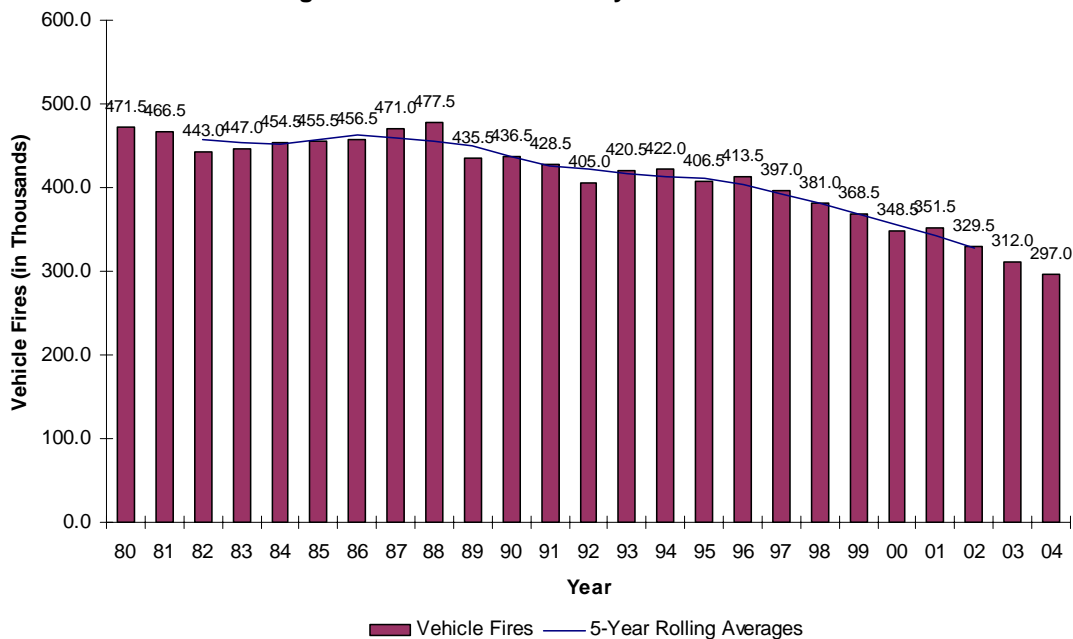
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Overview of the Vehicle Fire Problem

297,000 reported vehicle fires caused 550 civilian deaths in 2004.

Public fire departments responded to an estimated 297,000 vehicle fires in the United States during 2004. These fires caused an estimated 550 civilian deaths, 1,500 civilian injuries and \$1.3 billion in direct property damage. Vehicle fires accounted for 19% of the 1,550,500 fires reported to U.S. fire departments that year. Vehicle fires also caused 14% of all civilian fire deaths, 8% of all civilian fire injuries, and 13% of the nation's property loss to fire in 2004. More people died from vehicle fires than from apartment fires; vehicle fires caused roughly seven times the number of deaths caused by non-residential structure fires.¹ Vehicles include: cars, trucks and other highway vehicles; boats and ships; railroad and mass-transit vehicles; aircraft; and agricultural, construction and yard vehicles.

Figure 1. U.S. Vehicle Fires by Year: 1980-2004



Source: *Fire Loss in the U.S.* series by Michael J. Karter, Jr.

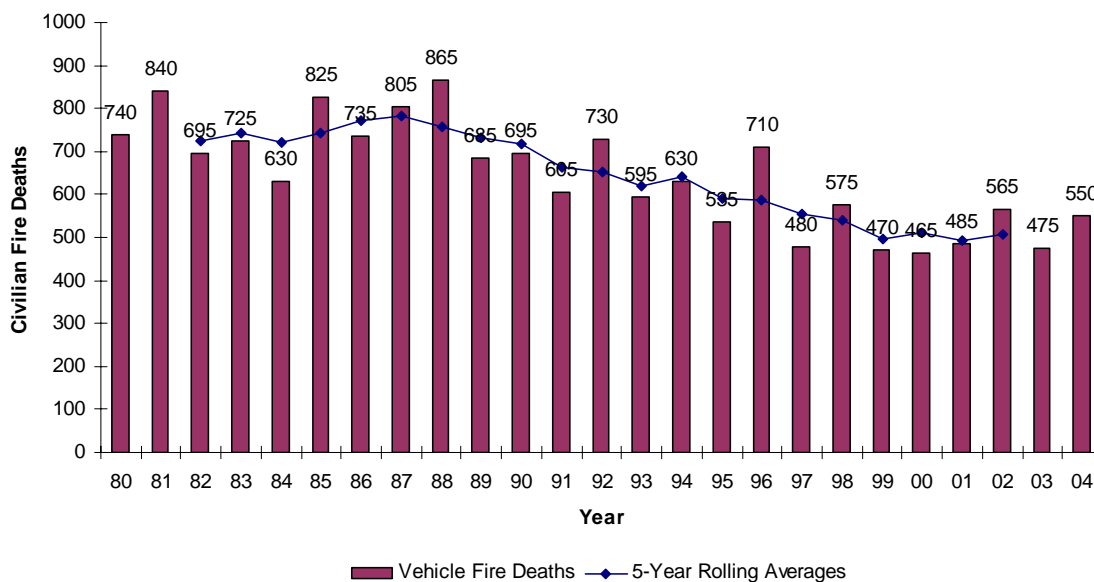
Vehicle fires fell to a record low.

The total number of reported vehicle fires fell 5% from the 312,000 reported in 2003 to 297,000 in 2004. This was the smallest vehicle fire incidence since the National Fire Protection Association (NFPA) began tracking vehicle fires and losses with its current methods. After declining in the early eighties, vehicle fires began increasing in 1983 to a peak of 477,500 in 1988. The 9% drop from 1988 to 1989 was the largest one-year decline seen since NFPA began tracking this data. Since 1980, reported vehicle fires have fallen 37% compared to a 51% drop in reported structure fires and a 48% drop in fires of all types. Figure 1 shows the trend in vehicle fires since 1980.

¹ Michael J. Karter, Jr., *Fire in the United States during 2004: Abridged Report*, Quincy, MA: NFPA, June 2005. This report summarizes the results of the NFPA Annual Fire Department Survey and is the source for 2004 statistics. Overall vehicle fire trend data was obtained from the *Fire In the United States* annual reports for 1980-2004.

Figure 2 shows that the death toll due to vehicle fires fluctuates greatly from year to year. Vehicle fire deaths rose 16% from 475 in 2003 to 550 in 2004. A generally downward trend can be seen in the five-year rolling averages. Only fires and fire deaths reported to local public fire departments in the United States are counted. Fires or fire deaths on the open seas or not attended by local fire departments are not captured in these statistics.

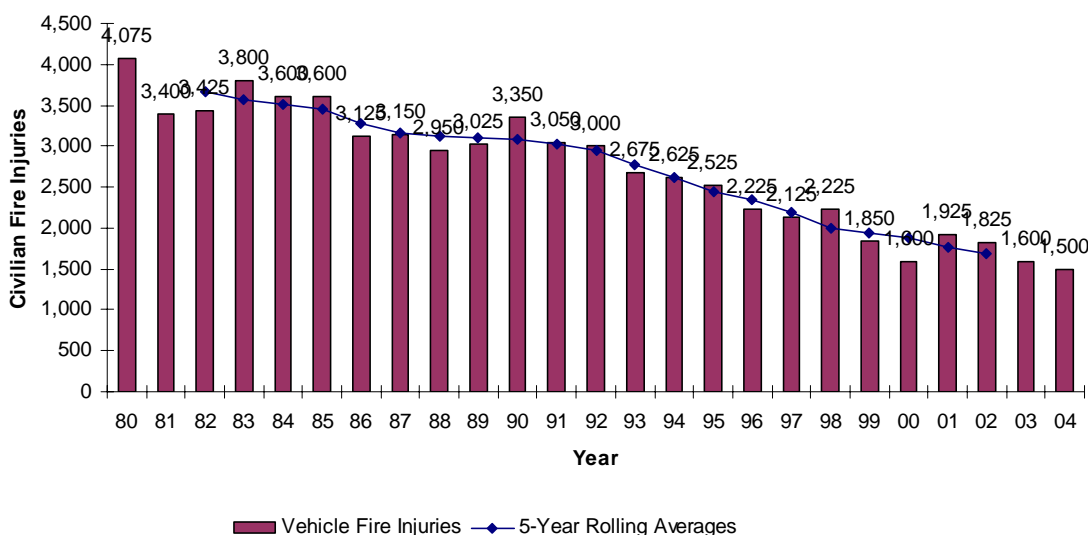
Figure 2. U.S. Vehicle Fire Deaths by Year: 1980-2004



Source: *Fire Loss in the U.S.* series by Michael J. Karter, Jr.

Civilian injuries in vehicle fires fell 6% from 1,600 in 2003 to 1,500 in 2004; the lowest point since tracking began. The 63% drop in reported civilian vehicle fire injuries from 1980 to 2004 is larger than the 37% drop in reported vehicle fires and larger still than the 26% drop in reported civilian vehicle fire deaths during the same period.

Figure 3. U.S. Vehicle Fire Injuries by Year: 1980-2004



Source: *Fire Loss in the U.S.* series by Michael J. Karter, Jr.

2004 data came from the NFPA Fire Experience Survey.

The NFPA Fire Analysis and Research Division use two data sources in most of its analyses. The first, the NFPA Annual Fire Experience Survey, provides an overview of the fire experience in the previous year. Each year, all large departments serving populations over 100,000 and one-third of the smaller departments, in a sample stratified by size, are asked about their fire and firefighter injury experience. The final sample of respondents contains roughly one-tenth of all local fire departments. A summary of the fire experience for the previous year is issued in the summer or fall of the following year. The 2004 data cited in this report came from the NFPA survey.

NFIRS data provide the details.

The survey provides the big picture; data from the National Fire Incident Reporting System (NFIRS) fill in the details. Local fire officers complete fire reports describing the facts of the incident – the when, where, what and how of each fire. These reports (or data from these reports) are forwarded to or submitted through state fire agencies. After the states process the data, they forward or release it to the U.S. Fire Administration (USFA). NFIRS is the largest, most detailed source of incident information about fire in the world.

Unfortunately, this data is not available as early as the data from the survey. At the time this report was written, the most current available NFIRS data was from 2002.

Version 5.0 of NFIRS was first introduced in 1999, and NFPA received the national 1999-2002 databases in the Version 5.0 format. However, in 1999, more than 90% of the fires were collected in an older format and converted to Version 5.0. In 2002, 62% of the vehicle fires were originally collected in the Version 5.0 format. The share in Version 5.0 has increased each year. Data definitions and coding rules are not identical in the different versions. Some codes have been added, some combined, and others dropped. New incident types have been introduced to describe specific types of vehicle fires. These include:

Code: Incident Type

- 131 Passenger vehicle fire, including cars, buses, and pickup trucks
- 132 Road freight or transport vehicle fire
- 133 Rail vehicle fire
- 134 Water vehicle fire
- 135 Aircraft fire
- 136 Self-propelled motor home or recreational vehicle fire
- 137 Camper or recreational vehicle fire in non-self-propelled vehicle
- 138 Off-road vehicle or heavy equipment fire
- 130 Unclassified vehicle fire, including all vehicle fires originally collected in an older version of NFIRS

Some inconsistencies exist between the mobile property type and incident type. As noted earlier, this analysis uses mobile property type for categorization. However, a new field asks if mobile property was or was not involved in ignition and if it burned. Information on the type of vehicle is only required if the vehicle was involved in the ignition. If it was not involved in ignition, the mobile property type is likely to be unreported.

NFIRS and the NFPA Survey were used to develop national estimates.

Because some states and some departments do not participate in NFIRS every year, and reporting practices are not uniform among those who do participate, the raw NFIRS numbers would dramatically underestimate the extent of the fire problem. Total fires, casualties and losses reported to NFIRS are compared to those found in the NFPA Fire Experience Survey. Scaling ratios are then derived to apply to the raw NFIRS numbers to develop national estimates. Analysts from the USFA, the U.S. Consumer Product Safety Commission (CPSC) and the NFPA developed this method of calculating national estimates. A more detailed description of this methodology is found in the appendix.

Five categories of vehicles are discussed in this report.

The remainder of this report details the causes of fires, civilian deaths and injuries, and direct property damage in five separate mobile property classes, as defined by NFIRS. Table 2 gives an overview of fire experience by general class of mobile property. About four of every five vehicle fires involved highway vehicles. To prevent this category of vehicles from obscuring patterns in other types of vehicles, the rest of this report has been divided into sections specific to each class of vehicle.

The broad categories of vehicle types are listed below:

Code	Mobile Property Type
10 - 29	Highway vehicles
30 - 39	Rail transport vehicles
40 - 49	Water transport vehicles
50 - 59	Aircraft
60 - 79	Industrial, agricultural, construction, special and miscellaneous vehicles.

Most of the tables in the remainder of the report show national estimates based on 1999-2002 data. The first table in each section shows estimates of fires and associated losses by year for 1980-2002. The second shows the estimated annual averages of fires, civilian deaths and injuries, and direct property damage for each type of vehicle in that category. Subsequent tables show patterns by month, day of week and time of day. These are followed by tables on the property use where the fire occurred and the causal factors: cause, factor contributing to ignition, factor contributing to ignition grouping, heat source, area of origin, and item first ignited. All vehicle fires identified in the NFPA Survey are classified as either highway or other vehicles. In NFIRS, the mobile property type was unknown, unclassified or not reported in 20% of the vehicle fires. These incidents were not allocated proportionally. Consequently, the national estimate of highway vehicle fires is lower in the detailed breakdowns found in this report than in the *Fire Loss in the United States* series of reports.

It is important to remember that there is a certain amount of overlap in the fire cause categories. A short circuit or a part failure may have occurred because the car was not maintained properly or something had worn out. A mechanical malfunction or failure may have resulted from poor maintenance or improper use, or it could be a manufacturer's defect.

Department of Transportation (DOT) has regulatory authority.

The Department of Transportation (DOT) and its divisions regulate vehicles. Questions about regulations or specific makes and models should be addressed to the DOT or its subdivisions. Larry Strawhorn's chapter on "Motor Vehicles" in the 19th edition of NFPA's *Fire Protection Handbook* provides information on the agencies, regulations and standards that pertain to vehicle fires, details on vehicle systems and hazards, information on tank trucks and a bibliography for further reading.²

Strawhorn reports that the National Highway Traffic Safety Administration (NHTSA) of DOT is authorized to set minimum safety standards for new motor vehicles and motor vehicle equipment and to investigate defects in motor vehicles, including fire hazards. It may order recalls when necessary.

Since its inception in 1966, the NHTSA has issued four fire-safety standards for new motor vehicles. The Federal Motor Vehicle Safety Standard (FMVSS) 301 was developed to reduce the danger from fuel leakage following crashes involving cars, trucks and buses weighing less than 10,000 pounds.

Federal Motor Vehicle Safety Standard 302 sets flammability standards for the materials used in the driver and passenger area of vehicles. This standard aims to reduce the danger of interior fires caused by matches or smoking. The other two standards address vehicles using compressed natural gas.

Multiple strategies are needed to reduce losses from vehicle fires.

The thrust of efforts to prevent fire and associated losses in the United States has primarily been in making structures (and their occupants and contents) less fire-prone and more fire-safe. The emphasis in home fire safety has focused on installing smoke alarms and home fire sprinklers, redesigning products, and educating the public to take action to protect themselves through fire safety and fire prevention messages. Building codes and standards, safety guidelines, fire detection equipment, and sprinklers have all contributed to more fire-safe non-residential structures.

The fire community has given only intermittent attention to vehicle fires, and that attention has typically focused narrowly on major multiple-death incidents. As in buildings, most vehicle fire deaths occur in ones and twos in private settings such as personal cars. Attempts to further reduce fires and their related losses necessitate strategies that reduce both the occurrence and the severity of vehicle fires.

Vehicle fires are a major component of the fire death problem. In 1999-2002, three-quarters of vehicle fire deaths resulted from highway vehicles fires, with the largest share resulting from automobile fires. Additional and more in-depth fire testing of automobiles can increase our knowledge of how these fires develop. This detailed information can provide engineers with the information needed to develop solutions to the automobile fire death problem (similar to the advances, such as the airbag, which have resulted from collision testing). Through redesign, we can produce more fire-safe automobiles.

² Larry Strawhorn, "Motor Vehicles," *Fire Protection Handbook*, 19th edition, Section 14, Chapter 1, p. 14-5, Quincy, MA: NFPA, 2003.

The Society of Automotive Engineers (SAE) sponsored its first program on fire safety at its 2005 World Congress in Detroit in April 2005.

In most categories of vehicles, many, if not most, fire deaths occur in fires following survivable collisions. Additional reductions in vehicle fire deaths may result from public safety programs and studies designed to reduce the number of collisions that occur in the United States. This two-pronged approach would very likely produce a positive impact on the vehicle fire death problem.

The NFPA is a partner in Healthy People 2010. Several objectives pertain to deaths and injuries from motor vehicle crashes. Reducing deaths and injuries from motor vehicle crashes in general and from alcohol-related crashes, reducing the proportion of adolescents who rode with a driver who had been drinking, and making the maximum blood alcohol concentration 0.08% for drivers over 21 years old could decrease the number of people who are killed by fires caused by collisions.³

The National Transportation Safety Board released its *Evaluation of U.S. Department of Transportation Efforts in the 1990s to Address Operator Fatigue* in May of 1999. The U.S. Department of Transportation began conducting research on operator fatigue in transportation in 1989. Several transportation agencies have developed public education materials on the subject. Although fatigue is an acknowledged factor in transportation incidents, it was felt that the hours-of-service regulations do not incorporate the latest research findings on fatigue and sleep. The report makes recommendations for improved regulations in this area to several federal agencies involved in transportation. However, these regulations would not apply to the private individual in a personal vehicle.⁴

It is hoped that the information in this report will help individuals, industry and regulatory bodies to devise new ways to lessen the vehicle fire problem.

³ Task Force on Community Preventive Services, "Motor-Vehicle Occupant Injury: Strategies for Increasing Use of Child Safety Seats, Increasing Use of Safety Belts, and Reducing Alcohol-Impaired Driving." *MMWR Recommendations and Reports*, May 18, 2001, from <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5007a1.htm>.

⁴ National Transportation Safety Board, *Safety Report – Evaluation of U.S. Department of Transportation Efforts in the 1990s to Address Operator Fatigue*, Washington, D.C.: NTSB/SR-99/01, PB99-917002, Notation 7155, May 1999, pp. 25-28, from <http://www.nts.gov/publictn/1999/SR9901.pdf>.

U.S. Vehicle Fire Problem, by Year: 1980-2004

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	Direct Property Damage (in Millions of 2004 Dollars)
1980	471,500	740	4,075	\$685	\$1,570
1981	466,500	840	3,400	\$594	\$1,231
1982	443,000	695	3,425	\$591	\$1,154
1983	447,000	725	3,800	\$694	\$1,313
1984	454,500	630	3,600	\$749	\$1,358
1985	455,500	825	3,600	\$792	\$1,387
1986	456,500	735	3,125	\$783	\$1,349
1987	471,000	805	3,150	\$842	\$1,398
1988	477,500	865	2,950	\$941	\$1,502
1989	435,500	685	3,025	\$963	\$1,466
1990	436,500	695	3,350	\$967	\$1,398
1991	428,500	605	3,050	\$1,049	\$1,453
1992	405,000	730	3,000	\$965	\$1,298
1993	420,500	595	2,675	\$1,030	\$1,345
1994	422,000	630	2,625	\$1,111	\$1,415
1995	406,500	535	2,525	\$1,152	\$1,426
1996	413,500	710	2,225	\$1,333	\$1,605
1997	397,000	480	2,125	\$1,269	\$1,492
1998	381,000	575	2,225	\$1,337	\$1,549
1999*	368,500	470	1,850	\$1,324	\$1,499
2000	348,500	465	1,600	\$1,381	\$1,514
2001	351,500	485	1,925	\$1,512	\$1,612
2002	329,500	565	1,825	\$1,392	\$1,460
2003**	312,000	475	1,600	\$1,356	\$1,392
2004**	297,000	550	1,500	\$1,304	\$1,304

* Changes introduced in 1999 with Version 5.0 of NFIRS can make it advisable to analyze data from 1999 on separately from earlier years. Most of the statistical information in the remainder of this report is presented as 1999-2002 annual averages. The 2002 data is the most recent available from NFIRS.

**Data from the NFPA survey gives us the statistics on total vehicle fires for 2003 and 2004.

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 were estimated to the nearest five hundred, civilian deaths to the nearest five, civilian injuries to the nearest twenty-five, and direct property damage was rounded to the nearest million dollars.

Source: NFPA survey, and "Purchasing Power of the Dollar" custom table from Bureau of Labor Statistics at <http://www.bls.gov/cpi/>. (Accessed on June 23, 2005).

**U.S. Vehicle Fire Problem, by Type of Vehicle
1999-2002 Annual Averages**

Vehicle Type	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Highway vehicle	269,890	(77%)	383	(77%)	1,309	(73%)	\$1,005	(72%)
Passenger road vehicle	243,830	(70%)	316	(64%)	1,099	(61%)	\$796	(57%)
Freight road transport vehicle	26,060	(7%)	67	(13%)	210	(12%)	\$209	(15%)
Industrial, agricultural, construction or special vehicle	8,350	(2%)	8	(2%)	59	(3%)	\$103	(7%)
Industrial, agricultural or construction vehicle	6,930	(2%)	6	(1%)	44	(2%)	\$99	(7%)
Miscellaneous mobile property, including home or garden vehicles, armored vehicles, shipping containers, aerial tramways, missiles and space vehicles	1,420	(0%)	1	(0%)	16	(1%)	\$4	(0%)
Water vessel	1,490	(0%)	3	(1%)	58	(3%)	\$24	(2%)
Rail transport vehicle	770	(0%)	6	(1%)	79	(4%)	\$17	(1%)
Aircraft	230	(0%)	35	(7%)	19	(1%)	\$12	(1%)
Unclassified or unknown-type mobile property	68,850	(20%)	61	(12%)	278	(15%)	\$240	(17%)
Total	349,570	(100%)	496	(100%)	1,802	(100%)	\$1,403	(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 is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

The U.S. Highway Vehicle Fire Problem

An average of 269,900 highway vehicle fires was reported annually in 1999-2002.

Highway vehicles include any vehicle that is customarily used on a highway, including cars, trucks, buses, motorcycles and recreational vehicles. A highway vehicle fire can occur on many different types of properties, not only highways. The estimated 269,900 highway vehicle fires reported to U.S. fire departments per year caused an estimated annual average of 380 civilian deaths, 1,310 civilian fire injuries and \$1.0 billion in direct property damage. On average, 31 highway vehicle fires were reported per hour. These fires killed one person a day.

Highway vehicle fires rose 9% from 2001 to 2002.

In 2000, highway vehicle fires hit their lowest total since 1980, the first year of available data. These fires rose 2% from 2000 to 2001, and 9% from 2001 to 2002. In 2002, an estimated 281,600 highway vehicle fires caused 480 civilian fire deaths, 1,540 civilian fire injuries, and \$1.1 billion in direct property damage. From 1980 to 2002, these fires fell 32%. Structure fires fell 51% during the same period.

Civilian deaths from these fires rose 21% from 390 in 2001 to 480 in 2002, the highest point since 1993. These deaths have fluctuated markedly although the general trend has been downward. Civilian injuries in highway vehicle fires rose 7% from 1,440 in 2001 to 1,540 in 2002. From 1980 to 2002, these injuries fell 54%. Direct property damage, adjusted for inflation, rose 7%. While property damage figures also show considerable fluctuation, the average loss per fire has generally been increasing over the past two decades.

Highway vehicle fires accounted for nearly all vehicle fires of known vehicle type.

During 1999-2002, highway vehicles accounted for 77% of the 349,600 reported vehicle fires, 77% of the 500 vehicle fire deaths, 73% of the 1,800 civilian injuries, and 72% of the \$1.4 billion in direct property damage. The type of vehicle involved was unknown, unclassified or not reported in 20% of the vehicle fires. It is probable that many of these were also highway vehicles. Passenger cars were involved in 80% of the highway vehicle fires; pick-up trucks or non-motorized hauling rigs were involved in 4% of the incidents. The coding system does not have a separate category for sport utility vehicles.

Highway vehicle fires tend to be more common in the summer.

The peak month for these fires was July. August ranked second and June ranked third. November and December had the smallest number of fires. Friday was the peak day of the week for these fires; Saturday ranked second. The fewest fires occurred on Sunday.

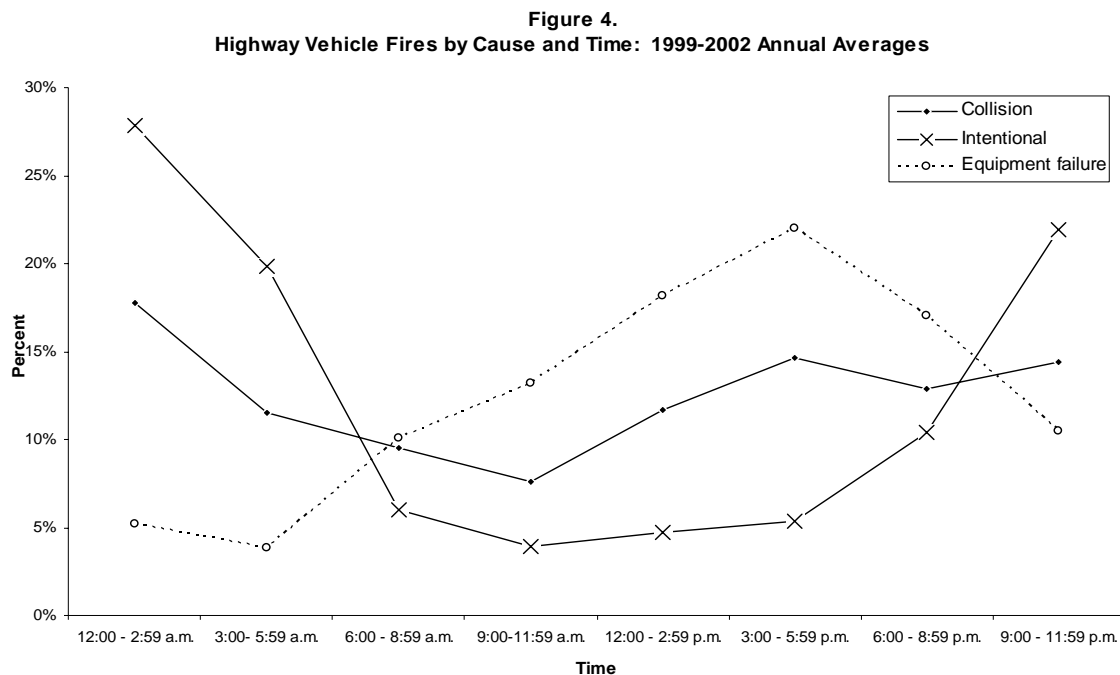
Vehicle fire times correlate with times vehicles are in use and vary by fire cause.

Figure 4 shows that vehicle fire times appear to be correlated with the times vehicles are in use. The smallest number of fires occurred between 3:00 and 5:59 a.m. These fires increased steadily as the day moved on, peaking between 3:00 and 5:59 p.m. (perhaps related to rush hour traffic). From that point, fires steadily decreased to the 3:00 to

5:59 a.m. period. This pattern is almost identical to the time of day pattern for home structure fires except that the peak time for fires in homes was during the 6:00 to 7:00 p.m. period when the returning household members may turn up the heat and cook the evening meal.⁵

The largest share of deaths from highway vehicle fires resulted from incidents between midnight and 2:59 a.m. The period from 3:00 to 5:59 p.m. ranked second. Only 17% of the highway vehicle fires occurred between midnight and 5:59 a.m., but these hours accounted for 37% of the highway vehicle fire deaths

Figure 4 shows that the time a highway vehicle fire occurs varies with the cause of the fire. While 70% of intentionally set highway vehicle fires occurred between 9:00 p.m. and 5:59 a.m., only 44% of the fires started by collisions or overturns occurred during these hours. Only 20% of the highway vehicle fires caused by equipment failure started during this nine-hour period. Fifty-seven percent of the equipment failure fires started between the hours of noon and 8:59 p.m.



Source: National estimates based on NFIRS and NFPA survey.

Most highway vehicle fires occurred on road properties.

Roughly three-quarters (73%) of the highway vehicle fires occurred on some type of road property. Thirty-seven percent occurred on streets, roads or driveways or driveways; 15% were in parking lots or parking areas. The 13% that occurred on highways or divided highways accounted for 31% of the associated fire deaths.

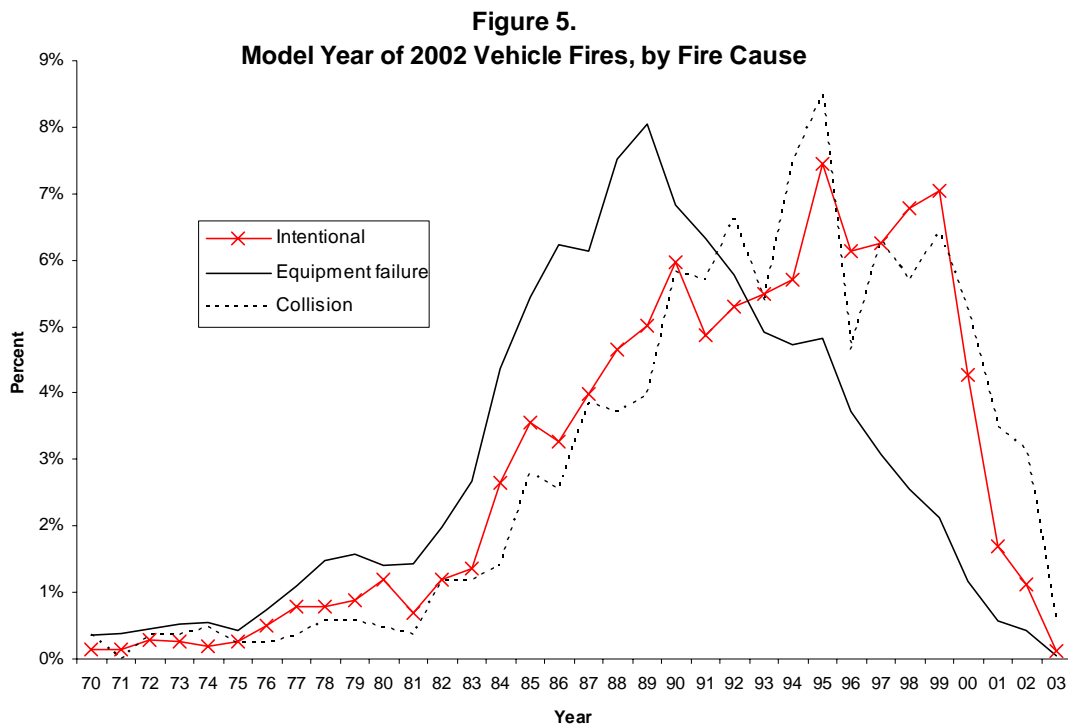
⁵ Marty Ahrens, *The U.S. Fire Problem Overview Report*, Quincy, MA: NFPA, Fire Analysis and Research Division, June 2003, p. 99.

Fifteen percent of the highway vehicle fires were intentionally set.

During 1999-2002, an annual average of 41,100 intentionally set highway vehicle fires caused 11% of the highway civilian vehicle fire deaths and 5% of the civilian fire injuries per year. Twenty-five percent of the highway vehicle fire property damage was caused by the 15% of fires that were intentionally set. More than half of the intentional highway vehicle fires in 2002 involved vehicles of model year 1993 or later.

3 of every 5 highway vehicle fire deaths occurred in fires caused by collisions or overturns.

Collisions or overturns were factors contributing to the ignition in only 3% of the fires in this group, but these fires caused 57% of these vehicle fire deaths. Because of the changes and conversion issues from ignition factor in older versions of NFIRS to factor contributing to ignition in Version 5.0, the percentages of factors contributing to ignition are based on fires reported originally in Version 5.0. Roughly one of every 26 highway vehicle fires in which a collision or overturn was a factor resulted in death. This is *not* the same as saying that roughly one of every 26 highway vehicle collisions resulted in death. Nevertheless, it is very clear that highway vehicle fires caused by collision or overturn have a high fatality rate. According to National Highway Traffic Safety Administration’s (NHTSA’s) statistics, “Fires occurred in 0.2% of the vehicles involved in all traffic crashes in 2002. For fatal crashes, however, fires occurred in nearly 3 percent of the vehicles involved.”⁶ Some of these deaths may have resulted from the collision itself rather than the fire. In 2002, more than half of highway vehicle fires started by collisions involved model years of 1994 or later.



Source: National estimates based on NFIRS and NFPA survey.

⁶ U.S. Department of Transportation, National Highway traffic Safety Administration, *Traffic Safety Facts 2002: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System*, 2004, p. 61, available at <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2002Final.pdf> .

Mechanical or electrical failures caused more than 2/3 of highway vehicle fires, but only 11% of the deaths.

Some form of mechanical failure or malfunction, such as leaks or breaks, backfires, or worn-out parts, contributed to nearly half (48%) of the highway vehicle fires reported in 1999-2002. Electrical failures or malfunctions contributed to 23% of the highway vehicle fires reported during this time. The heat source was identified as arcing in 22% of the highway vehicle fires. Older vehicles were more likely to have a fire caused by equipment failure. In 2002, more than half of all highway vehicle fires resulting from the failure of equipment or heat source involved older vehicles with model years of 1989 or earlier.

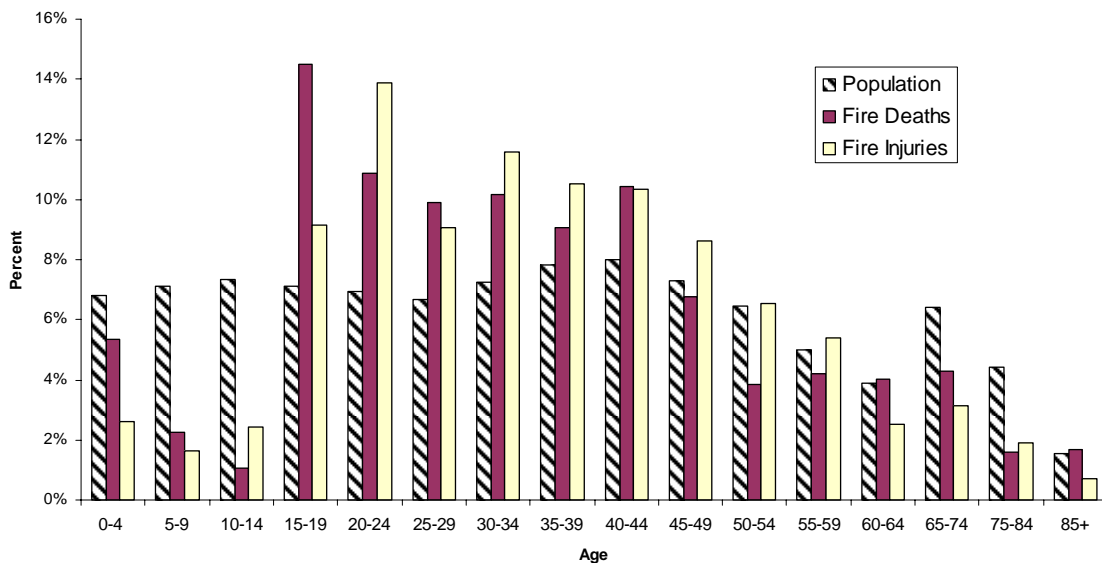
Figure 5 shows that intentional passenger road vehicle fires and vehicle fires resulting from collisions tend to be in newer vehicles than the fires resulting from equipment failure.

Fires started in engine, running gear or wheel area most often, but fuel tank or fuel line fires were more likely to result in death.

Two-thirds (66%) of the highway vehicle fires began in the engine, running gear or wheel area. Forty percent of the civilian fire deaths, 49% of the civilian fire injuries and 54% of the direct property damage resulted from fires that originated in this area. Only 2% of the passenger road vehicle fires started in the fuel tank or fuel line area, but these fires caused 17% of the deaths in this group.

Electrical wire or cable insulation was the item first ignited in 27% of the highway vehicle fires. These fires accounted for only 3% of the associated deaths and 12% of the associated injuries. Twenty-six percent of the highway vehicle fires began with the ignition of flammable or combustible liquids or gases, including fuel and accelerants. These fires caused 65% of the deaths and 48% of the injuries. In 75% of the fires starting with a flammable or combustible liquid or gas, gasoline was the type of material first ignited.

Figure 6.
Highway Vehicle Civilian Fire Deaths and Injuries by Victims' Age: 1999-2002



Source: National estimates based on NFIRS and NFPA survey.

Older teens and young adults are at highest risk of highway vehicle fire death.

Figure 6 shows that although only 7% of the U.S. population was between 15 and 19 in 2001, 15% of the people killed in highway vehicle fires during 1999-2002 were in this age group, giving them a risk twice that of the general population. Young adults between 20 and 24 had the second highest risk of fire death and the highest risk of injury. Young children and adults 65 or older, the groups most at risk of home fire death,⁷ were generally at low risk of highway vehicle fire death or injury. Those 85 or older had a vehicle fire death risk that was only slightly above average. Death rates from motor vehicle accidents overall show a somewhat different pattern. In 2003, teens and young adults ages 15-24 have the highest death rates, followed closely by people aged 75 or older.⁸

The victim's activity at time of injury was unclassified in 46% of the highway vehicle deaths. Thirty-one percent of the people who died in highway vehicle fires in 1999-2002 were unable to act at the time of the fire, 11% were acting irrationally, and 6% were escaping. It is possible that activity at time of injury may also include the immediate moments before the fire started. Thirty-four percent of the people who sustained non-fatal injuries in these fires were engaged in fire control activities when they were injured, 27% were engaged in unclassified activities, 15% were escaping, 7% were unable to act, and 5% were acting irrationally.

79% of U.K. car fires were "malicious."

Highway vehicle fires have a different profile in the United Kingdom. In 2002, 101,200 road vehicles resulted in 63 fatalities and 643 injuries. These fires fell 1% from 2001 to 2002, the first decrease since 1997. Cars accounted for 86% of these fires, vans 6% and trucks or lorries were burned in 2% of the fires. Eighty-one percent of the car fires were "malicious." The number of malicious car fires has been climbing since 1997, increasing 17% from 1997 to 1998, 32% from 1998 to 1999, 12% from 1999 to 2000, and 11% from 2000 to 2001. Progress was seen with the smaller 1% increase from 2001 to 2002. Unintentional car fires fell 8% from 2001 to 2002 and 34% from 1992 to 2002. As in the U.S., malicious car fires were more common late at night or in the early morning hours, while unintentional car fires were more spread out and peaked in the late afternoon.⁹

In 2001, the 11,300 ground transport vehicle fires in Canada caused 23 civilian deaths and 100 civilian injuries.¹⁰

Many government bodies, agencies, organizations, and individuals are working on vehicle fire safety.

As with other fire problems, efforts to address the vehicle fire problem have included technology, standards and regulations, education and enforcement. Larry Strawhorn's

⁷ John R. Hall, Jr. *Characteristics of Home Fire Victims*, Quincy, MA: NFPA, Fire Analysis and Research Division, July 2005, p. 1.

⁸ National Safety Council. *Injury Facts*®, 2004 Edition, Itasca, IL, 2004, p. 88.

⁹ David Champion, Georgina Ford, Jon Gamble, David Bovill, and Darren Sugg. *Fire Statistics --United Kingdom, 2002*, London, U.K., Office of the Deputy Prime Minister, Fire Statistics and Research, April 15, 2004, pp. 50-52 available from http://www.odpm.gov.uk/stellent/groups/odpm_fire/documents/downloadable/odpm_fire_028259.pdf.

¹⁰ Council of Canadian Fire Marshals and Fire Commissioners, *Annual Report 2001 - Fire Losses in Canada*, November 2004, p. 22, available from http://www.ccfmfc.ca/stats/stats_e.html.

chapter on “Motor Vehicles” in the 19th edition of NFPA’s *Fire Protection Handbook* provides information on the agencies, regulations and standards that pertain to vehicle fires, details on vehicle systems and hazards, information on tank trucks and a bibliography for further reading. Some of the relevant NFPA codes and standards include NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*; NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids*; and NFPA 1192 *Standard on Recreational Vehicles*. A new standard, NFPA 556, *Guide for Identification and Development of Mitigation Strategies for Fire Hazard to Occupants of Road Vehicles*, has been proposed.

The Society of Automotive Engineers (SAE) sponsored its first program on fire safety at its 2005 World Congress in Detroit in April 2005. The first of four sessions focused on fire statistics and accident analysis, the second on material flammability properties and crash and burn testing, the third on vehicle fire suppression systems, and the fourth addressed hydrogen and electric vehicle safety.

The Motor Vehicle Fire Research Institute funds and compiles research on many different aspects of automobile fire safety. Final reports and descriptions of ongoing projects can be found at <http://www.mvfri.org/>.

The National Highway Traffic Safety Administration regulates highway vehicles and orders recalls.

Passenger road vehicles are regulated by The National Highway Traffic Safety Administration (NHTSA) of the Department of Transportation (DOT). The DOT sets minimum safety standards for new motor vehicles and motor vehicle equipment and investigates reports of defects in motor vehicles, including fire hazards. Recalls are ordered when necessary. Information about safety problems, issues and recalls can be found at <http://www.nhtsa.dot.gov/cars/problems/>.

The NHTSA has issued four fire safety-standards for new motor vehicles since it was created in 1966. The Federal Motor Vehicle Safety Standard (FMVSS) 301 was developed to reduce the danger from fuel leakage following crashes involving cars, trucks and buses weighing no more than 10,000 pounds. Initially affecting cars manufactured on or after January 1, 1968, it has become more stringent.

Flammability standards for the materials used in the driver and passenger area of vehicles were set in Federal Motor Vehicle Safety Standard 302 to reduce the danger of interior fires caused by matches or smoking. The other two standards address vehicles using compressed natural gas.¹¹

Burned/Recovered Motor Vehicle Act reduced vehicle arson 95% in Massachusetts.

As mentioned earlier, intentional motor vehicle fires cause a disproportionate share of the vehicle fire dollar loss. The Commonwealth of Massachusetts passed legislation to address the problem of vehicle arson motivated by insurance fraud. Effective August 1987, the Burned/Recovered Motor Vehicle Act required owners of burned motor

¹¹ Larry Strawhorn, “Motor Vehicles,” *Fire Protection Handbook*, 19th edition, Section 14, Chapter 1, p. 14-5, Quincy, MA: NFPA, 2003.

vehicles to personally appear and complete a report at fire headquarters in the community where the fire occurred before the insurance company could pay their claim for fire damages. Vehicle arson in Massachusetts dropped 95% from 1987 to 2003.¹²

Different road and vehicle configurations and alternate fuels pose challenges to emergency personnel.

Firefighters and other emergency personnel are often called to vehicle collisions with and without fire. The vast array of vehicle makes and models, the different fuel or power sources, and the different locations of batteries, airbags, and other equipment can make it difficult to conduct operations in ways that maximize the safety of vehicle occupants and the emergency personnel. Ron Moore of [Firehouse.com](http://www.firehouse.com) has proposed that vehicle safety data sheet placards containing this type of information be required in all new vehicles as well as available online for training purposes.¹³ Carl Rivkin's chapter, "Alternative Fuels for Vehicles," also in the 19th edition of NFPA's *Fire Protection Handbook* provides an overview of some of the safety issues involved with these vehicles. Readers may also be interested in NFPA 52, *Compressed Natural Gas (CNG) Vehicular Fuel Systems Code*.

NFPA's Fire Protection Research Foundation held a research agenda planning workshop on January 25, 2004 with members of NFPA technical committees, the fire service, researchers, government agencies and industry in attendance. NFPA's Hydrogen Coordinating Group is working to ensure that the different NFPA documents that address hydrogen are harmonious with each other. Details on both of these activities may be found on NFPA's website at www.nfpa.org.

Vehicle fires in tunnels pose unusual challenges. These are discussed in Arthur G. Bendelius's *Fire Protection Handbook* chapter "Fire Protection For Road Tunnels" provides an overview of the issues involved. NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*, is another resource.

¹² Massachusetts Fire Incident Reporting System - 2003 Annual Report: Stow, Massachusetts, 2005, p. 74.

¹³ Ron Moore. "Vehicle Safety Data Sheet," updated 08/02/2004, accessed at <http://cms.firehouse.com/content/article/article.jsp?sectionId=19&id=731> on June 27, 2005.

U.S. Highway Vehicle Fire Problem, by Year: 1980-2002

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	Loss in 2002 Dollars (in Millions)
1980	411,300	600	3,350	\$478	\$1,044
1981	417,500	680	2,930	\$477	\$942
1982	398,400	570	2,850	\$409	\$761
1983	405,400	640	3,250	\$532	\$959
1984	411,600	550	3,080	\$592	\$1,024
1985	417,000	710	3,060	\$702	\$1,172
1986	417,600	740	3,180	\$608	\$998
1987	429,300	700	2,620	\$687	\$1,088
1988	416,000	730	2,520	\$728	\$1,108
1989	379,100	520	2,570	\$751	\$1,090
1990	383,000	590	2,920	\$792	\$1,092
1991	371,200	480	2,500	\$801	\$1,058
1992	335,700	590	2,510	\$758	\$971
1993	354,600	500	2,380	\$723	\$900
1994	330,100	460	1,960	\$779	\$946
1995	334,700	380	1,780	\$790	\$932
1996	327,800	470	1,520	\$774	\$888
1997	355,100	430	1,860	\$1,025	\$1,149
1998	313,600	420	1,610	\$1,010	\$1,115
1999*	288,000	350	1,150	\$911	\$984
2000	252,400	310	1,100	\$903	\$943
2001	257,500	390	1,440	\$1,064	\$1,081
2002	281,600	480	1,540	\$1,143	\$1,143
1980-2002					
Annual average	360,400	530	2,330	\$758	\$1,017
1999-2002					
Annual average	269,900	380	1,310	\$1,005	\$1,038

* NFIRS data for 1999 and later was received in the Version 5.0 format. Due to the many coding changes, the 1999-2002 data can better be analyzed separately from data from previous years.

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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars.

Source: NFIRS and NFPA survey; Table 697, "Purchasing Power of the Dollar" from U.S. Census Bureau's *Statistical Abstract of the United States: 2004-2005 (124th Edition)*.

U.S. Highway Vehicle Fire Problem, by Type of Vehicle 1999-2002 Annual Averages

Vehicle Type	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Passenger or road transport vehicles	243,800	(90%)	320	(83%)	1,100	(84%)	\$796	(79%)
Passenger car	214,800	(80%)	260	(68%)	820	(63%)	\$649	(65%)
Motor home, camper or bookmobile.	2,100	(1%)	0	(1%)	70	(5%)	\$23	(2%)
Motorcycle or trail bike	1,900	(1%)	0	(1%)	20	(2%)	\$28	(3%)
Bus, school bus or trackless trolley	1,800	(1%)	0	(1%)	20	(1%)	\$20	(2%)
Travel trailer designed to be towed	900	(0%)	0	(0%)	20	(2%)	\$5	(0%)
Off-road recreational vehicle	800	(0%)	0	(1%)	10	(0%)	\$2	(0%)
Camping or collapsible trailer	300	(0%)	0	(0%)	10	(1%)	\$1	(0%)
Manufactured home	200	(0%)	0	(0%)	0	(0%)	\$2	(0%)
Unclassified or unknown-type passenger road vehicle	21,100	(8%)	40	(11%)	130	(10%)	\$66	(7%)
Freight road vehicles	26,100	(10%)	70	(17%)	210	(16%)	\$209	(21%)
Pickup truck or non-motorized hauling rig	11,200	(4%)	20	(6%)	80	(6%)	\$50	(5%)
General use truck, dump truck or fire apparatus	6,800	(3%)	10	(1%)	40	(3%)	\$45	(4%)
Semi-trailer designed for freight	4,200	(2%)	20	(5%)	50	(4%)	\$62	(6%)
Garbage, waste or refuse truck	1,200	(0%)	0	(0%)	10	(0%)	\$8	(1%)
Tank truck for flammable or combustible liquid	300	(0%)	10	(3%)	10	(1%)	\$12	(1%)
Tank truck for nonflammable cargo	100	(0%)	0	(0%)	0	(0%)	\$2	(0%)
Tank truck for compressed gas or LP-gas	0	(0%)	0	(0%)	0	(0%)	\$0	(0%)
Unclassified or unknown-type freight road transport vehicle	2,300	(1%)	10	(2%)	20	(2%)	\$29	(3%)
Total	269,900	(100%)	380	(100%)	1,310	(100%)	\$1,005	(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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Month
1999-2002 Annual Averages**

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	23,400	(9%)	40	(9%)	100	(8%)	\$92	(9%)
February	20,500	(8%)	30	(7%)	120	(9%)	\$69	(7%)
March	22,000	(8%)	30	(8%)	110	(8%)	\$91	(9%)
April	21,900	(8%)	20	(6%)	110	(8%)	\$75	(7%)
May	23,700	(9%)	30	(9%)	120	(9%)	\$89	(9%)
June	24,700	(9%)	40	(10%)	120	(9%)	\$87	(9%)
July	25,800	(10%)	40	(10%)	140	(10%)	\$89	(9%)
August	25,000	(9%)	30	(9%)	130	(10%)	\$107	(11%)
September	22,300	(8%)	30	(8%)	100	(8%)	\$74	(7%)
October	21,300	(8%)	30	(8%)	110	(8%)	\$81	(8%)
November	19,600	(7%)	30	(9%)	90	(7%)	\$81	(8%)
December	19,600	(7%)	30	(7%)	80	(6%)	\$71	(7%)
Total	269,900	(100%)	380	(100%)	1,310	(100%)	\$1,005	(100%)
Monthly average	22,500	(8%)	30	(8%)	110	(8%)	\$84	(8%)

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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Day of Week
1999-2002 Annual Averages**

Day of Week	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	35,700	(13%)	60	(15%)	170	(13%)	\$135	(13%)
Monday	39,200	(15%)	50	(12%)	190	(15%)	\$143	(14%)
Tuesday	38,300	(14%)	50	(12%)	200	(15%)	\$129	(13%)
Wednesday	37,600	(14%)	50	(13%)	180	(14%)	\$149	(15%)
Thursday	37,900	(14%)	50	(12%)	180	(14%)	\$130	(13%)
Friday	41,300	(15%)	60	(17%)	180	(14%)	\$169	(17%)
Saturday	40,000	(15%)	70	(19%)	210	(16%)	\$149	(15%)
Total	269,900	(100%)	380	(100%)	1,310	(100%)	\$1,005	(100%)
Daily average	38,600	(14%)	50	(14%)	190	(14%)	\$144	(14%)

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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the day of week was unknown or not reported have been allocated proportionally among fires with known day of week.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Time of Day
1999-2002 Annual Averages**

Time of Day	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Midnight - 2:59 a.m.	26,400 (10%)	80 (20%)	120 (9%)	\$148 (15%)
3:00- 5:59 a.m.	19,300 (7%)	60 (17%)	90 (7%)	\$103 (10%)
6:00 - 8:59 a.m.	24,400 (9%)	40 (10%)	100 (8%)	\$84 (8%)
9:00 - 11:59 a.m.	30,600 (11%)	30 (9%)	170 (13%)	\$109 (11%)
Noon - 2:59 p.m.	42,300 (16%)	30 (9%)	230 (18%)	\$130 (13%)
3:00 - 5:59 p.m.	50,700 (19%)	40 (11%)	260 (20%)	\$162 (16%)
6:00 - 8:59 p.m.	42,100 (16%)	40 (12%)	220 (17%)	\$126 (13%)
9:00 - 11:59 p.m.	34,100 (13%)	50 (14%)	120 (10%)	\$143 (14%)
Total	269,900 (100%)	380 (100%)	1,310 (100%)	\$1,005 (100%)
Average	60,000 (13%)	90 (13%)	290 (13%)	\$223 (13%)

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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Time of Day and Selected Causal Factors
1999-2002 Annual Averages**

Time of Day	Collision	Intentional	Equipment Failure
Midnight-2:59 a.m.	18%	28%	5%
3:00-5:59 a.m.	12%	20%	4%
6:00-8:59 a.m.	9%	6%	10%
9:00-11:59 a.m.	8%	4%	13%
Noon-2:59 p.m.	12%	5%	18%
3:00-5:59 p.m.	15%	5%	22%
6:00-8:59 p.m.	13%	10%	17%
9:00-11:59 p.m.	14%	22%	11%
Total	100%	100%	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. Sums may not equal totals due to rounding errors. These percentages were based on known data collected in both Version 5.0 and earlier versions of NFIRS.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Property Use
1999-2002 Annual Averages**

Fixed Property Use	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Street, road or driveway	100,400	(37%)	130	(33%)	410	(31%)	\$333	(33%)
Vehicle parking area	41,700	(15%)	10	(4%)	160	(12%)	\$123	(12%)
Highway or divided highway	34,200	(13%)	120	(31%)	220	(17%)	\$154	(15%)
Unclassified or unknown-type road property	19,600	(7%)	30	(8%)	80	(6%)	\$76	(8%)
One- or two-family dwelling	11,500	(4%)	10	(3%)	90	(7%)	\$47	(5%)
Open land or field	5,100	(2%)	20	(4%)	30	(2%)	\$24	(2%)
Service station or gas station	3,500	(1%)	0	(0%)	30	(3%)	\$7	(1%)
Unclassified or unknown-type outside or special property	3,000	(1%)	10	(2%)	20	(1%)	\$14	(1%)
Motor vehicle or boat sales, service, or repair facility	3,000	(1%)	0	(0%)	20	(2%)	\$14	(1%)
Apartment or multifamily dwelling	2,600	(1%)	0	(0%)	10	(1%)	\$7	(1%)
Vacant lot	2,400	(1%)	0	(0%)	0	(0%)	\$10	(1%)
Food, beverage, or grocery store	1,500	(1%)	0	(0%)	10	(1%)	\$2	(0%)
Parking garage or vehicle storage	3,000	(1%)	0	(0%)	20	(1%)	\$14	(1%)
Other known property use	14,200	(5%)	20	(5%)	110	(9%)	\$62	(6%)
Unclassified or unknown-type property use	24,300	(9%)	40	(9%)	90	(7%)	\$117	(12%)
Total	269,900	(100%)	380	(100%)	1,310	(100%)	\$1,005	(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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Cause
1999-2002 Annual Averages**

Cause	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Failure of equipment or heat source	154,900 (57%)	40 (11%)	470 (36%)	\$458 (46%)
Unintentional	60,100 (22%)	250 (65%)	690 (53%)	\$211 (21%)
Intentional	41,100 (15%)	40 (11%)	70 (5%)	\$255 (25%)
Unclassified cause	13,200 (5%)	50 (12%)	80 (6%)	\$79 (8%)
Act of nature	600 (0%)	0 (0%)	10 (0%)	\$2 (0%)
Total	269,900(100%)	380 (100%)	1,310 (100%)	\$1,005 (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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the cause was under investigation, undetermined or not reported were allocated proportionally among fires with known cause.

Source: NFIRS and NFPA survey.

**Highway Vehicle Fires, by Factor Contributing to Ignition
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Unclassified or unknown-type mechanical failure, malfunction	24%	2%	10%	21%
Leak or break	13%	6%	15%	11%
Unclassified or unknown-type electrical failure or malfunction	9%	1%	3%	9%
Unspecified short-circuit arc	7%	0%	4%	6%
Backfire	6%	1%	7%	3%
Unclassified factor contributed to ignition	6%	12%	7%	10%
Exposure fire	6%	3%	3%	11%
Short circuit arc from defective or worn insulation	4%	0%	2%	3%
Worn out	4%	0%	2%	2%
Collision, knock down, run over or roll over	3%	57%	13%	8%
Flammable liquid or gas spilled	2%	4%	5%	2%
Heat source too close to combustibles.	2%	2%	5%	3%
Abandoned or discarded material	2%	2%	2%	2%
Unclassified or unknown-type misuse of material or product	2%	4%	6%	2%
Unclassified or unknown-type operational deficiency	2%	1%	3%	1%
Short circuit arc from mechanical damage	2%	1%	2%	1%
Arc or spark from operating equipment	1%	1%	1%	1%
Equipment not being operated properly	1%	2%	3%	1%
Installation deficiency	1%	0%	1%	0%
Flammable liquid used to kindle fire	1%	2%	1%	1%

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. More than one factor contributing to ignition could be entered. Property damage figures are not adjusted for inflation. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 17%, deaths - 22%, injuries – 10%, property damage – 27%) or fires with “none” (fires - 28%, deaths - 16%, injuries – 19%, property damage – 27%) generally exceeded those for undetermined (fires - 11%, deaths - 11%, injuries – 10%, property damage – 13%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**Highway Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Mechanical failure or malfunction	48%	9%	34%	37%
Leak or break	13%	6%	15%	11%
Backfire	6%	1%	7%	3%
Worn out	4%	0%	2%	2%
Unclassified or unknown-type mechanical failure or malfunction	24%	2%	10%	21%
Electrical failure or malfunction	23%	2%	12%	22%
Unspecified short-circuit arc	7%	0%	4%	6%
Short circuit arc from defective or worn insulation	4%	0%	2%	3%
Short circuit arc from mechanical damage	2%	1%	2%	1%
Arc or spark from operating equipment	1%	1%	1%	1%
Unclassified or unknown-type electrical failure or malfunction	9%	1%	3%	9%
Misuse of material or product	11%	16%	25%	11%
Flammable liquid or gas spilled	2%	4%	5%	2%
Heat source too close to combustibles.	2%	2%	5%	3%
Abandoned or discarded material	2%	2%	2%	2%
Unclassified or unknown-type misuse of material or product	2%	4%	6%	2%
Flammable liquid used to kindle fire	1%	2%	1%	1%
Cutting or welding too close to combustibles	1%	0%	1%	0%
Improper fueling technique	1%	1%	3%	0%
Operational deficiency	7%	61%	20%	13%
Collision, knock down, run over or roll over	3%	57%	13%	8%
Equipment not being operated properly	1%	2%	3%	1%
Failure to clean	1%	0%	0%	0%
Unclassified or unknown-type operational deficiency	2%	1%	3%	1%
Fire spread or control	6%	5%	4%	11%
Exposure fire	6%	3%	3%	11%
Design, manufacturing or installation deficiency	1%	0%	1%	2%
Installation deficiency	1%	0%	1%	0%
Natural condition	0%	1%	1%	1%
Unclassified factor contributed	6%	12%	7%	10%

**Highway Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0
(Continued)**

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. More than one factor contributing to ignition could be entered. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 17%, deaths - 22%, injuries – 10%, property damage – 27%) or fires with “none” (fires - 28%, deaths - 16%, injuries – 19%, property damage – 27%) generally exceeded those for undetermined (fires - 11%, deaths - 11%, injuries – 10%, property damage – 13%) suggesting that this type of allocation would be most appropriate. Except for the group headings, only factors contributing that accounted for at least 1% of the fires are shown. Groups are shown in descending order, and within groups, factors exceeding 1% are also shown in descending order. Unclassified type factors are shown last. Group sums include all factors within the group, even when the factors were under 1% and consequently not shown.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Heat Source
1999-2002 Annual Averages**

Heat Source	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Arcing	59,700 (22%)	10 (3%)	160 (12%)	\$204 (20%)
Radiated or conducted heat from operating equipment	47,800 (18%)	90 (23%)	230 (18%)	\$164 (16%)
Heat from equipment with unclassified or unknown-type power	33,700 (12%)	40 (9%)	160 (12%)	\$100 (10%)
Backfire from internal combustion engine	19,300 (7%)	10 (2%)	100 (8%)	\$54 (5%)
Spark, ember or flame from operating equipment	17,900 (7%)	50 (14%)	170 (13%)	\$59 (6%)
Unclassified or unknown-type hot or smoldering object	17,200 (6%)	30 (8%)	90 (7%)	\$49 (5%)
Unclassified heat source	15,900 (6%)	30 (8%)	70 (5%)	\$79 (8%)
Heat or spark from friction	10,100 (4%)	40 (11%)	60 (4%)	\$51 (5%)
Match	9,900 (4%)	10 (2%)	40 (3%)	\$52 (5%)
Heat from other unclassified or unknown-type open flame or smoking material	8,700 (3%)	20 (5%)	30 (3%)	\$59 (6%)
Radiated heat from another fire	4,600 (2%)	0 (0%)	0 (0%)	\$14 (1%)
Heat from direct flame or convection current	3,800 (1%)	10 (1%)	0 (0%)	\$27 (3%)
Cigarette	3,600 (1%)	10 (2%)	50 (3%)	\$9 (1%)
Multiple heat sources, including multiple ignitions	3,600 (1%)	30 (7%)	20 (1%)	\$23 (2%)
Unclassified heat spread from another fire	2,700 (1%)	0 (1%)	10 (1%)	\$13 (1%)
Incendiary device	2,400 (1%)	0 (1%)	10 (1%)	\$12 (1%)
Cigarette lighter	1,600 (1%)	10 (2%)	60 (4%)	\$6 (1%)
Other known heat source	7,300 (3%)	10 (1.6%)	70 (5%)	\$30 (3%)
Total	269,900 (100%)	380 (100%)	1,310 (100%)	\$1,005 (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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the heat source was undetermined or not reported were allocated proportionally among fires with known heat source.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Area of Fire Origin
1999-2002 Annual Averages**

Area of Fire Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Engine area, running gear, wheel area	176,900	(66%)	150	(40%)	640	(49%)	\$543	(54%)
Operator or passenger area	45,100	(17%)	80	(20%)	240	(18%)	\$235	(23%)
Unclassified vehicle area	10,800	(4%)	40	(11%)	50	(4%)	\$43	(4%)
Exterior, exposed vehicle surface	8,500	(3%)	10	(1%)	40	(3%)	\$28	(3%)
Cargo or trunk area of vehicle	8,000	(3%)	10	(3%)	90	(7%)	\$37	(4%)
Fuel tank or fuel line	4,400	(2%)	60	(17%)	130	(10%)	\$28	(3%)
On or near highway, parking lot or street	3,500	(1%)	10	(2%)	10	(1%)	\$15	(2%)
Unclassified area of origin	3,300	(1%)	10	(3%)	10	(1%)	\$19	(2%)
Separate operator or control area	3,000	(1%)	0	(1%)	10	(1%)	\$18	(2%)
Other known area	6,600	(2%)	10	(3%)	80	(6%)	\$40	(4%)
Total	269,900	(100%)	380	(100%)	1,310	(100%)	\$1,005	(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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the area or origin was unknown or not reported were allocated proportionally among fires with known area of origin.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires, by Item First Ignited
1999-2002 Annual Averages**

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Electrical wire or cable insulation	73,200 (27%)	10 (3%)	150 (12%)	\$197 (20%)
Flammable or combustible liquid or gas, including accelerants, aerosols, and atomized vapor	70,600 (26%)	250 (65%)	620 (48%)	\$255 (25%)
Unclassified item first ignited	41,800 (15%)	40 (11%)	150 (12%)	\$149 (15%)
Multiple items first ignited	29,100 (11%)	40 (10%)	90 (7%)	\$174 (17%)
Vehicle seats or upholstered furniture	19,600 (7%)	20 (5%)	60 (5%)	\$86 (9%)
Tire	5,400 (2%)	0 (0%)	20 (2%)	\$33 (3%)
Unclassified or unknown-type liquid, piping or filter	3,900 (1%)	0 (1%)	30 (2%)	\$10 (1%)
Rubbish, trash, or waste	3,200 (1%)	0 (1%)	10 (1%)	\$7 (1%)
Light vegetation, including grass and leaves	2,200 (1%)	0 (1%)	10 (1%)	\$10 (1%)
Unclassified or unknown-type structural component or finish	1,600 (1%)	0 (1%)	10 (1%)	\$9 (1%)
Drive belt, V-belt or conveyor belt	1,500 (1%)	0 (0%)	0 (0%)	\$3 (0%)
Other known item	17,900 (7%)	20 (3%)	160 (10%)	\$72 (7%)
Total	269,900 (100%)	380 (100%)	1,310 (100%)	\$1,005 (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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were 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 were allocated proportionally among fires with known item first ignited.

Source: NFIRS and NFPA survey.

**U.S. Highway Vehicle Fires in which a Flammable or Combustible Liquid or Gas was the
Item First Ignited by Type of Material First Ignited
1999-2002 Annual Averages**

Type of Material	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Gasoline	53,200	(75%)	190	(76%)	460	(73%)	\$178	(70%)
Unclassified or unknown-type flammable or combustible liquid	5,500	(8%)	20	(9%)	40	(6%)	\$24	(9%)
Unclassified or unknown-type flammable gas	3,400	(5%)	10	(6%)	50	(7%)	\$8	(3%)
Class IIIB combustible liquid, including transformer, cooking and lubricating oil	2,900	(4%)	0	(0%)	10	(1%)	\$7	(3%)
Class IA flammable liquid, including ether and pentane	1,700	(2%)	0	(0%)	10	(2%)	\$7	(3%)
Class II combustible liquid, including kerosene, numbers 1 and 2 fuel oil and diesel fuel	1,000	(1%)	20	(7%)	20	(3%)	\$21	(8%)
Plastic	700	(1%)	0	(0%)	0	(1%)	\$2	(1%)
Multiple types of material	400	(1%)	0	(0%)	10	(1%)	\$1	(1%)
Other known type	1,900	(3%)	0	(2%)	40	(6%)	\$7	(3%)
Total	70,600	(100%)	250	(100%)	620	(100%)	\$255	(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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. This table includes a proportional share of fires in which the item first ignited was unknown or not reported. Fires in which the type of material first ignited was unknown or not reported were allocated proportionally among fires with known type of material first ignited.

Source: NFIRS and NFPA survey.

**Civilian Fire Deaths and Injuries in U.S. Highway Vehicle Fires, by Age Group
1999-2002 Annual Averages**

Age Group	2001		Civilian		Fire Death	Civilian		Fire Injury
	Population		Deaths		Risk Index	Injuries		Risk Index
	(in Millions)							
0-4	19.4	(7%)	20	(5%)	0.79	30	(3%)	0.39
5-9	20.2	(7%)	10	(2%)	0.32	20	(2%)	0.23
10-14	20.9	(7%)	0	(1%)	0.15	30	(2%)	0.33
15-19	20.3	(7%)	60	(15%)	2.04	120	(9%)	1.29
20-24	19.8	(7%)	40	(11%)	1.57	180	(14%)	2.00
25-29	19.0	(7%)	40	(10%)	1.49	120	(9%)	1.36
30-34	20.7	(7%)	40	(10%)	1.40	150	(12%)	1.59
35-39	22.3	(8%)	30	(9%)	1.16	140	(11%)	1.35
40-44	22.8	(8%)	40	(10%)	1.30	140	(10%)	1.29
45-49	20.8	(7%)	30	(7%)	0.93	110	(9%)	1.18
50-54	18.4	(6%)	10	(4%)	0.59	90	(7%)	1.01
55-59	14.2	(5%)	20	(4%)	0.85	70	(5%)	1.08
60-64	11.1	(4%)	20	(4%)	1.03	30	(3%)	0.64
65-74	18.3	(6%)	20	(4%)	0.67	40	(3%)	0.49
75-84	12.6	(4%)	10	(2%)	0.36	20	(2%)	0.43
85+	4.4	(2%)	10	(2%)	1.07	10	(1%)	0.46
Total	285.1	(100%)	380	(100%)	1.00	1,310	(100%)	1.00

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. Civilian deaths and injuries are rounded to the nearest ten. Sums may not equal totals due to rounding errors. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the victim's age was unknown or not reported were allocated proportionally among fires with known victim's age.

Source: NFIRS and NFPA survey.

U.S. resident population statistics from the U.S. Census Bureau were obtained from Table 11, "Resident Population by Age and Sex: 1980 to 2003" in *Statistical Abstract of the United States: 2004-2005*.

**Civilian Fire Deaths and Injuries in U.S. Highway Vehicle Fires
by Activity at Time of Injury
1999-2002 Annual Averages**

Activity at Time of Injury	Civilian Deaths		Civilian Injuries	
Unclassified activity	170	(46%)	350	(27%)
Unable to act	120	(31%)	90	(7%)
Irrational act	40	(11%)	70	(5%)
Escaping	20	(6%)	200	(15%)
Sleeping	20	(4%)	60	(4%)
Rescue attempt	0	(1%)	60	(4%)
Returning to vicinity of fire before control	0	(0%)	30	(2%)
Fire control	0	(0%)	450	(34%)
Returning to vicinity of fire after control	0	(0%)	10	(1%)
Total	380	(100%)	1,310	(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. Civilian deaths and injuries are rounded to the nearest ten. A value of zero may indicate a true zero or that the estimated annual average number of deaths is less than five and rounds to zero. Sums may not equal totals due to rounding errors. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the victim's age was unknown or not reported were allocated proportionally among fires with known victim's age.

Source: NFIRS and NFPA survey.

U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous Vehicle Fire Problem

8,350 of these fires, on average, were reported annually in 1999-2002.

During the four-year period of 1999-2002, local fire departments responded to an estimated average of 8,350 heavy industrial, agricultural, construction, lawn, garden and special vehicle fires per year. These fires cause an estimated annual average of eight civilian deaths, 59 civilian fire injuries and \$103,300,000 in direct property damage. These vehicle fires rose 6% from 8,180 in 2001 to 8,640 in 2002. Since 1980, they have fallen only 15%.

These vehicles accounted for 2% of all vehicle fires.

In 1999-2002, industrial, agricultural, construction, special and miscellaneous vehicles accounted for 2% of the 349,570 reported vehicle fires, 2% of the 496 vehicle fire deaths, 3% of the 1,802 civilian injuries, and 7% of the \$1.4 billion in direct property damage.

Agricultural vehicles accounted for largest share of fires in this group.

Agricultural vehicles, including balers, tractors, harvesters and pickers, accounted for 43% of the fires in this category. Construction or earth moving equipment accounted for 14% of these incidents; home or garden vehicles accounted for 13%; and industrial loaders, such as forklifts, stackers or industrial tow motors, accounted for 8% of these fires.

These fires were more common during the afternoon.

Nineteen percent, or more than twice the monthly average, of fires involving these vehicles occurred in October. These fires were much less common from December through March. Fires by day of week showed a drop-off on the weekend, as Sunday had the smallest share (9%), followed by Saturday (13%). Fifty-four percent of the fires occurred between noon and 5:59 p.m. An additional 17% occurred in the morning from 9:00 a.m. to 11:59 a.m. These fires were much less common between 9:00 p.m. and 8:59 a.m.

These fires occurred on or in a variety of properties.

Twenty-three percent of these vehicle fires occurred on open land or in fields; 11% were in crops or orchards; and 9% occurred on streets, roads or driveways.

About three-fifths of these fires resulted from equipment failure.

Fifty-nine percent of these fires were caused by failure of equipment or of the heat source. Some form of mechanical factor or malfunction contributed to 47% of these fires. Electrical failures or malfunctions contributed to 21% of these ignitions. Only 4% of these fires were intentionally set.

Radiated or conducted heat from operating equipment was the heat source in 23% of these fires; arcing was the heat source in 17%.

Fifty-nine percent of the fires in heavy equipment vehicles began in the engine, running gear, or wheel area.

The most common item first ignited was a flammable or combustible liquid or gas. In roughly one-fourth (24%) of these fires, a flammable or combustible liquid or gas was the item first ignited. These incidents caused 48% of the civilian fire deaths and 58% of the civilian fire injuries associated with this type of vehicle fire. In 52% of the fires starting with a flammable or combustible liquid or gas, gasoline was the type of material first ignited. A Class II combustible liquid, such as kerosene, number 1 or 2 fuel oil, or diesel fuel, was the type of material first ignited in 17% of the fires starting with flammable or combustible liquids or gases.

Electrical wire or cable insulation was the item first ignited in 18% of the heavy industrial, agricultural, construction special or miscellaneous vehicle fires; agricultural crops were first ignited in 15% of these fires.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fire Problem by Year: 1980-2002**

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	Direct Property Damage (in Millions of 2004 Dollars)
1980	10,170	3	238	\$44.1	\$89.3
1981	10,160	12	122	\$31.3	\$57.2
1982	9,770	17	156	\$39.2	\$67.7
1983	9,410	4	175	\$52.9	\$88.5
1984	9,720	4	160	\$57.7	\$92.4
1985	9,600	12	202	\$40.3	\$62.3
1986	9,680	10	146	\$35.6	\$54.2
1987	10,400	9	120	\$47.1	\$69.1
1988	9,200	6	67	\$70.8	\$99.9
1989	8,610	7	117	\$54.7	\$73.6
1990	8,470	10	130	\$68.1	\$86.9
1991	8,390	7	108	\$68.2	\$83.5
1992	7,210	4	97	\$54.1	\$64.3
1993	8,070	10	62	\$58.9	\$67.9
1994	8,240	3	70	\$86.4	\$97.3
1995	8,240	14	114	\$75.8	\$82.8
1996	7,590	4	102	\$61.1	\$65.0
1997	9,240	8	92	\$93.5	\$97.1
1998	8,960	16	92	\$115.6	\$118.3
1999*	9,310	15	69	\$104.4	\$112.7
2000	7,250	4	60	\$93.4	\$97.6
2001	8,180	7	46	\$98.0	\$99.6
2002	8,640	4	62	\$117.3	\$117.3
1980-2002 Annual average	8,890	8	113	\$68.2	\$89.8
1999-2002 Annual average	8,350	8	59	\$103.3	\$106.8

* NFIRS data for 1999 and later was received in the Version 5.0 format. Due to the many changes, data from 1999 on is better be analyzed separately from data from previous years.

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 is rounded to the nearest hundred thousand dollars.

Source: NFIRS and NFPA survey; Table 697 "Purchasing Power of the Dollar: 1950 to 2003" U.S. Census Bureau's *Statistical Abstract of the United States: 2004-2005 (124th Edition)*.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires, by Type of Vehicle
1999-2002 Annual Averages**

Vehicle Type	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Industrial, agricultural or construction vehicle	6,930 (83%)	6 (81%)	44 (74%)	\$99.4 (96%)
Agricultural vehicle, baler or chopper	3,560 (43%)	2 (27%)	17 (28%)	\$37.5 (36%)
Construction vehicle	1,140 (14%)	1 (18%)	7 (12%)	\$22.8 (22%)
Industrial loader, including fork lifts, tow motors and stackers	650 (8%)	1 (17%)	8 (14%)	\$9.2 (9%)
Construction equipment	220 (3%)	0 (6%)	1 (2%)	\$3.3 (3%)
Timber harvest vehicle*	150 (2%)	0 (0%)	0 (0%)	\$5.5 (5%)
Crane	80 (1%)	0 (0%)	5 (8%)	\$3.9 (4%)
Drilling rig for petroleum and gas only	10 (0%)	0 (0%)	0 (0%)	\$0.1 (0%)
Unclassified industrial, agricultural or construction vehicle	1,130 (14%)	1 (14%)	6 (10%)	\$17.0 (16%)
Miscellaneous mobile property	1,420 (17%)	1 (19%)	16 (26%)	\$3.9 (4%)
Home or garden vehicle	1,100 (13%)	1 (19%)	16 (26%)	\$1.5 (1%)
Mechanically moved shipping container*	20 (0%)	0 (0%)	0 (0%)	\$0.1 (0%)
Armored vehicle	20 (0%)	0 (0%)	0 (0%)	\$0.1 (0%)
Mechanically moved waste container*	10 (0%)	0 (0%)	0 (0%)	\$0.2 (0%)
Unclassified, other or unknown-type special vehicle	270 (3%)	0 (0%)	0 (0%)	\$2.1 (2%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (100%)

*New codes in Version 5.0.

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires by Month
1999-2002 Annual Averages**

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	350	(4%)	2	(24%)	2	(4%)	\$4.9	(5%)
February	310	(4%)	0	(6%)	2	(4%)	\$6.2	(6%)
March	410	(5%)	1	(7%)	5	(8%)	\$7.2	(7%)
April	600	(7%)	1	(13%)	1	(2%)	\$7.6	(7%)
May	740	(9%)	0	(0%)	6	(10%)	\$8.9	(9%)
June	800	(10%)	0	(6%)	10	(17%)	\$7.0	(7%)
July	850	(10%)	0	(0%)	5	(9%)	\$9.7	(9%)
August	760	(9%)	1	(12%)	4	(8%)	\$9.9	(10%)
September	880	(11%)	1	(13%)	7	(11%)	\$9.0	(9%)
October	1,550	(19%)	1	(13%)	8	(14%)	\$16.9	(16%)
November	760	(9%)	1	(7%)	6	(10%)	\$11.3	(11%)
December	350	(4%)	0	(0%)	2	(4%)	\$4.6	(4%)
Total	8,350	(100%)	8	(100%)	59	(100%)	\$103.3	(100%)
Monthly average	700	(8%)	1	(8%)	5	(8%)	\$8.6	(8%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fire Problem by Day of Week
1999-2002 Annual Averages**

Day of Week	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Sunday	740 (9%)	0 (6%)	3 (6%)	\$7.1 (7%)
Monday	1,260 (15%)	1 (13%)	9 (16%)	\$16.2 (16%)
Tuesday	1,310 (16%)	3 (35%)	13 (21%)	\$16.8 (16%)
Wednesday	1,310 (16%)	1 (18%)	10 (16%)	\$17.2 (17%)
Thursday	1,340 (16%)	1 (14%)	11 (19%)	\$17.4 (17%)
Friday	1,290 (16%)	1 (7%)	6 (11%)	\$16.4 (16%)
Saturday	1,090 (13%)	1 (7%)	6 (10%)	\$12.1 (12%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (100%)
Daily average	1,190 (14%)	1 (14%)	8 (14%)	\$14.8 (14%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the day of week was unknown or not reported have been allocated proportionally among fires with known day of week.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fire Problem by Time of Day
1999-2002 Annual Averages**

Time of Day	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
12:00 - 2:59 a.m.	250 (3%)	0 (0%)	1 (2%)	\$6.1 (6%)
3:00 - 5:59 a.m.	180 (2%)	0 (0%)	1 (1%)	\$3.6 (4%)
6:00 - 8:59 a.m.	490 (6%)	0 (0%)	5 (8%)	\$6.1 (6%)
9:00 - 11:59 a.m.	1,430 (17%)	1 (11%)	11 (19%)	\$19.4 (19%)
Noon - 2:59 p.m.	2,220 (27%)	5 (65%)	15 (26%)	\$26.7 (26%)
3:00 - 5:59 p.m.	2,250 (27%)	1 (18%)	16 (28%)	\$24.5 (24%)
6:00 - 8:59 p.m.	1,140 (14%)	0 (0%)	6 (11%)	\$11.3 (11%)
9:00 - 11:59 p.m.	380 (5%)	0 (6%)	3 (5%)	\$5.5 (5%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (100%)
Average	1,040 (13%)	1 (13%)	7 (13%)	\$12.9 (13%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires, by Property Use
1999-2002 Annual Averages**

Fixed Property Use	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Open land or field	1,910 (23%)	1 (19%)	10 (18%)	\$21.9 (21%)
Crops or orchard	900 (11%)	1 (14%)	4 (7%)	\$11.1 (11%)
Street, road or driveway	730 (9%)	2 (21%)	4 (6%)	\$6.5 (6%)
Unclassified outside or special property	530 (6%)	0 (0%)	3 (5%)	\$5.5 (5%)
Livestock production	410 (5%)	0 (6%)	1 (1%)	\$3.8 (4%)
One- or two-family dwelling	380 (5%)	0 (6%)	7 (12%)	\$1.3 (1%)
Vehicle parking area	300 (4%)	1 (7%)	4 (7%)	\$3.7 (4%)
Unclassified or unknown-type road property	280 (3%)	0 (6%)	2 (3%)	\$2.5 (2%)
Highway or divided highway	240 (3%)	0 (0%)	1 (1%)	\$1.7 (2%)
Manufacturing or processing	200 (2%)	0 (6%)	4 (6%)	\$5.5 (5%)
Construction site	160 (2%)	0 (0%)	1 (2%)	\$4.4 (4%)
Unclassified or unknown-type utility, defense, agriculture or mining	150 (2%)	0 (0%)	1 (1%)	\$1.1 (1%)
Forest, timberland or woodland	150 (2%)	0 (0%)	0 (0%)	\$5.0 (5%)
Graded or cared-for plot of land*	140 (2%)	0 (0%)	2 (3%)	\$1.0 (1%)
Vacant lot	100 (1%)	0 (0%)	0 (0%)	\$1.2 (1%)
Warehouse	70 (1%)	0 (0%)	1 (1%)	\$0.9 (1%)
Dump or sanitary landfill	70 (1%)	0 (0%)	0 (0%)	\$3.6 (4%)
Vehicle storage or parking garage	70 (1%)	0 (0%)	1 (1%)	\$1.3 (1%)
Outside material storage area*	60 (1%)	0 (0%)	2 (4%)	\$1.4 (1%)
Motor vehicle or boat sales, service or repair	50 (1%)	0 (0%)	0 (0%)	\$0.3 (0%)
Outbuilding or shed	50 (1%)	0 (0%)	1 (1%)	\$0.4 (0%)
Livestock or poultry storage	50 (1%)	0 (0%)	1 (1%)	\$0.4 (0%)
Unclassified or unknown-type residential property	40 (1%)	0 (0%)	1 (1%)	\$0.3 (0%)
Other known property use	410 (5%)	1 (17%)	6 (10%)	\$7.4 (7%)
Unclassified or unknown-type property use	890 (11%)	0 (0%)	5 (8%)	\$11.1 (11%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (100%)

* These are new codes in Version 5.0 and are consequently underreported relative to the others.

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires by Cause
1999-2002 Annual Averages**

Cause	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Failure of equipment or heat source	4,890 (59%)	2 (23%)	22 (38%)	\$64.3 (62%)
Unintentional	2,730 (33%)	5 (68%)	36 (61%)	\$28.1 (27%)
Unclassified cause	360 (4%)	1 (9%)	1 (1%)	\$3.3 (3%)
Intentional	310 (4%)	0 (0%)	0 (0%)	\$6.7 (6%)
Act of nature	60 (1%)	0 (0%)	0 (0%)	\$1.0 (1%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the cause was under investigation, undetermined or not reported were allocated proportionally among fires with known cause.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires by Factor Contributing to Ignition
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Unclassified mechanical failure or malfunction	26%	35%	11%	29%
Leak or break	14%	0%	15%	21%
Unclassified electrical failure or malfunction	7%	31%	4%	6%
Failure to clean	6%	0%	0%	5%
Unclassified factor contributed to ignition	6%	35%	8%	6%
Exposure fire	5%	0%	0%	4%
Unspecified short circuit arc	5%	0%	4%	4%
Short circuit arc from defective, worn insulation	5%	0%	4%	2%
Worn out	5%	0%	0%	2%
Heat source too close to combustible material.	4%	0%	8%	3%
Backfire	3%	0%	0%	1%
Flammable liquid or gas spilled	2%	0%	15%	1%
Arc or spark from operating equipment	2%	0%	0%	2%
Unclassified operational deficiency	2%	0%	0%	1%
Cutting or welding too close to combustible material	2%	0%	0%	2%
Improper fueling technique	1%	0%	6%	1%
Unclassified misuse of material or product, other	1%	0%	0%	1%
Unclassified natural condition	1%	0%	0%	1%
Short circuit arc from mechanical damage	1%	0%	15%	0%
Collision, knock-down or overturn	1%	0%	26%	4%
Equipment not operated properly	1%	0%	4%	1%
Arc from faulty contact or broken conductor	1%	0%	0%	0%
Overloaded equipment	1%	0%	0%	0%
Unattended equipment	1%	0%	0%	2%
Outside or open fire for debris or waste disposal	1%	0%	0%	2%
Other known factor	4%	0%	0%	5%

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires, by Factor Contributing to Ignition
Version 5.0 Data Only
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0
(Continued)**

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 12%, deaths - 0%, injuries – 6%, property damage – 17%) or fires with “none” (fires - 27%, deaths - 21%, injuries – 6%, property damage – 19%) generally exceeded those for undetermined (fires - 9%, deaths - 19%, injuries – 6%, property damage – 10%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fire Problem, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Mechanical failure or malfunction	47%	35%	26%	52%
Leak or break	14%	0%	15%	21%
Worn out	5%	0%	0%	2%
Backfire	3%	0%	0%	1%
Unclassified mechanical failure or malfunction	26%	35%	11%	29%
Electrical failure or malfunction	21%	31%	27%	15%
Unspecified short circuit arc	5%	0%	4%	4%
Short circuit arc from defective, worn insulation	5%	0%	4%	2%
Arc or spark from operating equipment	2%	0%	0%	2%
Short circuit arc from mechanical damage	1%	0%	15%	0%
Arc from faulty contact or broken conductor	1%	0%	0%	0%
Unclassified electrical failure or malfunction	7%	31%	4%	6%
Operational deficiency	11%	0%	30%	12%
Failure to clean	6%	0%	0%	5%
Collision, knock-down or overturn	1%	0%	26%	4%
Equipment not operated properly	1%	0%	4%	1%
Overloaded equipment	1%	0%	0%	0%
Unattended equipment	1%	0%	0%	2%
Unclassified operational deficiency	2%	0%	0%	1%
Misuse of material or product	11%	0%	29%	8%
Heat source too close to combustible material.	4%	0%	8%	3%
Flammable liquid or gas spilled	2%	0%	15%	1%
Cutting or welding too close to combustible material	2%	0%	0%	2%
Improper fueling technique	1%	0%	6%	1%
Unclassified misuse of material or product	1%	0%	0%	1%
Fire spread or control	6%	0%	0%	7%
Exposure fire	5%	0%	0%	4%
Outside or open fire for debris or waste disposal	1%	0%	0%	2%
Natural condition	2%	0%	0%	3%
Unclassified natural condition	1%	0%	0%	1%
Design, manufacturing or installation deficiency	1%	0%	0%	1%
Unclassified factor contributed to ignition	6%	35%	8%	6%

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0
(Continued)**

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 12%, deaths - 0%, injuries – 6%, property damage – 17%) or fires with “none” (fires - 27%, deaths - 21%, injuries – 6%, property damage – 19%) generally exceeded those for undetermined (fires - 9%, deaths - 19%, injuries – 6%, property damage – 10%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires, by Heat Source
1999-2002 Annual Averages**

Heat Source	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Radiated or conducted heat from operating equipment	1,880 (23%)	1 (18%)	12 (20%)	\$21.6 (21%)
Arcing	1,450 (17%)	2 (26%)	10 (17%)	\$17.8 (17%)
Heat from unclassified powered equipment	1,320 (16%)	2 (23%)	12 (21%)	\$16.9 (16%)
Spark, ember or flame from operating equipment	750 (9%)	1 (14%)	6 (9%)	\$7.5 (7%)
Heat or spark from friction	710 (8%)	0 (0%)	3 (5%)	\$6.8 (7%)
Unclassified hot or smoldering object	650 (8%)	0 (6%)	9 (15%)	\$9.4 (9%)
Unclassified heat source	340 (4%)	1 (8%)	1 (1%)	\$4.6 (4%)
Backfire from internal combustion engine	250 (3%)	0 (0%)	3 (4%)	\$2.1 (2%)
Heat from unclassified or unknown-type open flame or smoking materials	150 (2%)	0 (0%)	1 (1%)	\$3.2 (3%)
Radiated heat from another fire	100 (1%)	0 (0%)	0 (0%)	\$1.4 (1%)
Unclassified heat spread from another fire	100 (1%)	0 (0%)	1 (1%)	\$2.1 (2%)
Heat from direct flame or convection currents	100 (1%)	0 (0%)	0 (0%)	\$1.2 (1%)
Molten or hot material	90 (1%)	0 (0%)	1 (2%)	\$1.7 (2%)
Hot ember or ash	70 (1%)	0 (0%)	0 (0%)	\$2.4 (2%)
Chemical reaction	70 (1%)	0 (0%)	0 (0%)	\$0.6 (1%)
Multiple heat sources, including multiple ignitions	50 (1%)	0 (0%)	0 (0%)	\$2.1 (2%)
Match	50 (1%)	0 (0%)	0 (0%)	\$0.3 (0%)
Unclassified static discharge	50 (1%)	0 (0%)	1 (2%)	\$0.1 (0%)
Other known heat source	170 (2%)	0 (6%)	1 (1%)	\$1.6 (2%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (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 an injury to the nearest one and direct property is rounded damage to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the heat source was undetermined or not reported were allocated proportionally among fires with known heat source.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fire Problem, by Area of Fire Origin
1999-2002 Annual Averages**

Area of Fire Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Engine area, running gear or wheel area	4,940 (59%)	2 (31%)	25 (43%)	\$63.1 (61%)
Unclassified vehicle area	690 (8%)	0 (0%)	3 (6%)	\$7.2 (7%)
Open outside area, including farmland or field	510 (6%)	0 (0%)	3 (5%)	\$6.5 (6%)
Exterior or exposed surface of vehicle	360 (4%)	1 (14%)	3 (5%)	\$3.6 (4%)
Fuel tank or fuel line	350 (4%)	2 (22%)	12 (20%)	\$5.0 (5%)
Operator or passenger area of vehicle	310 (4%)	1 (7%)	3 (5%)	\$4.9 (5%)
Separate operator or control area of vehicle	290 (3%)	1 (18%)	2 (3%)	\$4.9 (5%)
Unclassified area of origin	200 (2%)	1 (8%)	4 (6%)	\$1.9 (2%)
Cargo or trunk area of vehicle	200 (2%)	0 (0%)	1 (2%)	\$0.9 (1%)
Unclassified outside area	100 (1%)	0 (0%)	0 (0%)	\$0.6 (1%)
On or near highway, parking lot or street	70 (1%)	0 (0%)	0 (0%)	\$0.6 (1%)
Unclassified equipment or service area	60 (1%)	0 (0%)	1 (1%)	\$0.4 (0%)
Other known area	270 (3%)	0 (0%)	2 (3%)	\$3.5 (3%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the area or origin was unknown or not reported were allocated proportionally among fires with known area of origin.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires, by Item First Ignited
1999-2002 Annual Averages**

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Flammable or combustible liquid or gas, including accelerants, aerosols, and atomized vapor	1,970 (24%)	4 (48%)	34 (58%)	\$23.0 (22%)
Electrical wire or cable insulation	1,470 (18%)	0 (0%)	2 (3%)	\$15.6 (15%)
Agricultural crop, including fruit and vegetables	1,230 (15%)	0 (0%)	4 (7%)	\$12.1 (12%)
Unclassified item first ignited	1,130 (14%)	3 (42%)	6 (10%)	\$19.0 (18%)
Grass or light vegetation, excluding crops	540 (6%)	0 (0%)	1 (1%)	\$4.0 (4%)
Multiple items first ignited	470 (6%)	0 (0%)	3 (4%)	\$9.1 (9%)
Tire	240 (3%)	1 (10%)	6 (10%)	\$3.7 (4%)
Dust, fiber or lint, including sawdust and excelsior	240 (3%)	0 (0%)	0 (0%)	\$2.7 (3%)
Rubbish, trash, or waste	220 (3%)	0 (0%)	0 (0%)	\$1.6 (2%)
Unclassified flammable or combustible liquid, piping or filter	130 (2%)	0 (0%)	1 (1%)	\$3.1 (3%)
Unclassified organic material	130 (2%)	0 (0%)	1 (2%)	\$1.4 (1%)
Conveyor belt, drive belt or V-belt	90 (1%)	0 (0%)	0 (0%)	\$2.0 (2%)
Upholstered sofa, chair or vehicle seat	80 (1%)	0 (0%)	0 (0%)	\$0.6 (1%)
Pipe, duct, conduit, hose or associated covering	50 (1%)	0 (0%)	1 (2%)	\$1.3 (1%)
Other known item	330 (4%)	0 (0%)	1 (2%)	\$4.0 (4%)
Total	8,350 (100%)	8 (100%)	59 (100%)	\$103.3 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were 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 were allocated proportionally among fires with known item first ignited.

Source: NFIRS and NFPA survey.

**U.S. Heavy Industrial, Agricultural, Construction, Special and Miscellaneous
Vehicle Fires in which a Flammable or Combustible Liquid or Gas was the Item First Ignited
by Type of Material First Ignited
1999-2002 Annual Averages**

Type of Material	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Gasoline	1,030	(52%)	1	(30%)	23	(66%)	\$4.0	(17%)
Class II combustible liquid, including kerosene, numbers 1 and 2 fuel oil and diesel fuel	330	(17%)	1	(34%)	1	(3%)	\$6.8	(29%)
Unclassified or unknown-type flammable or combustible liquid	230	(12%)	1	(35%)	3	(9%)	\$5.5	(24%)
Unclassified or unknown-type flammable gas	120	(6%)	0	(0%)	1	(3%)	\$0.9	(4%)
Class IIIB combustible liquid, including transformer, cooking and lubricating oil	110	(6%)	0	(0%)	1	(4%)	\$1.9	(8%)
LP gas	30	(1%)	0	(0%)	3	(10%)	\$0.2	(1%)
Class IA flammable liquid, including ether and pentane	20	(1%)	0	(0%)	0	(0%)	\$0.2	(1%)
Class IIIA combustible oil, including cottonseed and creosote oil	10	(1%)	0	(0%)	0	(0%)	\$1.6	(7%)
Plastic	10	(1%)	0	(0%)	0	(0%)	\$0.1	(0%)
Other known type of material	70	(4%)	0	(0%)	2	(5%)	\$1.9	(8%)
Total	1,970	(100%)	4	(100%)	34	(100%)	\$23.0	(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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. This table includes a proportional share of fires in which the item first ignited was unknown or not reported. Fires in which the type of material first ignited was unknown or not reported were allocated proportionally among fires with known type of material first ignited.

Source: NFIRS and NFPA survey.

U.S. Water Transport Vehicle Fire Problem

1,490 of these fires, on average, were reported annually in 1999-2002.

During the four-year period of 1999-2002, local fire departments responded to an estimated average of 1,490 water transport vehicle fires per year. These fires caused an estimated annual average of three civilian deaths, 58 civilian fire injuries and \$24.4 million in direct property damage. These figures reflect estimates of water transport vehicle fires reported to U.S. fire departments. They do not include fires on the open seas outside of the jurisdiction of a local fire department. Water transport vehicle fires rose 11% from 1,630 in 2001 to 1,810 in 2002. In 1988, the peak year for these incidents, 2,640 water transport vehicle fires were reported. These fires were generally declining through the 1990s, hitting lows of 1,260 in 1999 and 2000. They started to increase again in 2001 and 2002. The estimated total of 1,810 fires in 2002 is only 25% lower than the 2,430 in 1980.

Water transport vehicle fires were a small share of the vehicle fire problem.

In 1999-2002, water transport vehicles accounted for less than 1% of the 349,570 reported vehicle fires, 1% of the 496 vehicle fire deaths, 3% of the 1,802 civilian injuries, and 2% of the \$1.4 billion in direct property damage.

Sixty-nine percent of the water transport vehicle fires involved motor craft vessels under 65 feet in length. Personal watercrafts were involved in 7% of these incidents.

Water transport vehicle fires were more common in summer and on weekends.

July was the peak month for these incidents. June ranked second and August was third. These fires were much less common from November through February. The fewest water transport vehicle fires occurred in January and February.

Twenty percent of these fires occurred on Saturday and 17% occurred on Sunday. Water transport vehicle fires were more common in the afternoon and evening. They peaked between 3:00 and 5:59 p.m. The period from noon to 2:59 p.m. ranked second. The smallest share of these fires occurred between 6:00 a.m. and 8:59 a.m.

Water transport vehicle fires occurred on or in a variety of properties.

Many water transport vehicle fires occurred in places other than water properties. Roughly one-quarter (26%) of these vehicle fires began in or on some sort of water property; 11% occurred at one- or two-family dwellings; 10% were on a street, road, or driveway; 8% were at docks, marinas, piers or wharves, 7% were in vehicle parking areas; and 5% were at facilities engaged in motor vehicle or boat sales, service or repair. As previously mentioned, these statistics reflect fires reported to public fire departments only. Fires outside of their jurisdictions are not included.

More than one-third of these fires resulted from equipment failure.

Thirty-seven percent of the water transport vehicle fires were caused by equipment or heat source failures. This was the smallest share of equipment failures seen in the five vehicle groups studied. Some form of electrical failure or malfunction contributed to 27% of these

ignitions. Some form of mechanical factor or malfunction contributed to 15% of these incidents. Exposure to another fire was a contributing factor in 27% of these ignitions, a larger share than was seen for any other type of vehicle. The misuse of a material or product was a contributing factor in 19%. Eighteen percent of these fires were intentionally set, a larger share than was seen in the other vehicle groupings.

Radiated or conducted heat from operating equipment was the heat source in 23% of these fires; arcing was the heat source in 17%.

Thirty percent of the water transport vehicle fires began in the engine, running gear, or wheel area. Fifteen percent originated in the operator or passenger area and 11% started along the exterior or exposed surface of the vessel.

The most common item first ignited was a flammable or combustible liquid or gas.

In roughly one-fourth (24%) of these fires, a flammable or combustible liquid or gas was the item first ignited. These incidents caused 79% of the civilian fire injuries associated with this type of vehicle fire. In 65% of the fires starting with a flammable or combustible liquid or gas, gasoline was the type of material first ignited.

Electrical wire or cable insulation was first ignited in 16% of water transport vehicle fires.

***Fire Protection Handbook's* chapter "Marine Vessels" has more information.**

The chapter "Marine Vessels," revised by Randall Eberly and Guy Colonna, in the 19th edition of the *NFPA Fire Protection Handbook*, provides information on fire prevention and protection in pleasure and small commercial boats as well as ships. A bibliography is included.

Reports of the U.S. National Transportation Safety Board's (NTSB's) recent investigations into marine accidents, including fires, are available on-line at http://www.nts.gov/Publictn/M_Acc.htm. In the United Kingdom, the Marine Accident Investigative Branch (MAIB) publishes several editions of *Safety Digest: Lessons from Marine Accident Reports* each year. These reports are available on-line at <http://www.maib.gov.uk/home/index.cfm>.

U.S. Water Transport Vehicle Fires by Year: 1980-2002

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	Direct Property Damage (in Millions of 2004 Dollars)
1980	2,430	8	157	\$18.8	\$41.1
1981	2,500	9	182	\$15.5	\$30.6
1982	2,260	7	154	\$61.8	\$115.0
1983	2,260	11	215	\$27.4	\$49.4
1984	2,360	9	168	\$27.9	\$48.2
1985	2,250	7	174	\$10.5	\$17.5
1986	2,390	6	245	\$11.9	\$19.5
1987	2,420	9	155	\$17.6	\$27.9
1988	2,640	10	187	\$27.7	\$42.1
1989	2,170	10	99	\$41.1	\$59.7
1990	2,280	14	123	\$37.5	\$51.7
1991	2,150	7	118	\$25.9	\$34.2
1992	1,820	4	127	\$24.6	\$31.5
1993	1,710	10	71	\$20.3	\$25.3
1994	1,620	11	81	\$21.9	\$26.6
1995	1,710	3	67	\$22.7	\$26.8
1996	1,470	13	58	\$31.4	\$36.0
1997	1,530	4	82	\$17.7	\$19.8
1998	1,370	0	78	\$10.7	\$11.8
1999*	1,260	2	72	\$20.6	\$22.3
2000	1,260	6	36	\$22.8	\$23.9
2001	1,630	0	52	\$31.9	\$32.4
2002	1,810	4	74	\$22.4	\$22.4
1980-2002 Annual average	1,970	7	121	\$24.8	\$35.5
1999-2002 Annual average	1,490	3	58	\$24.4	\$25.2

* NFIRS data for 1999 and later was received in the Version 5.0 format. Due to the many coding changes, the 1999-2002 data can better be analyzed separately from data from previous years.

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Source: NFIRS and NFPA survey; Table 697 "Purchasing Power of the Dollar: 1950 to 2003" U.S. Census Bureau's *Statistical Abstract of the United States: 2004-2005 (124th Edition)*.

**U.S. Water Transport Vehicle Fires, by Type of Vehicle
1999-2002 Annual Averages**

Vehicle Type	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Motor craft under 65 feet in length	1,030	(69%)	1	(48%)	43	(74%)	\$12.4	(51%)
Personal water craft*	100	(7%)	0	(0%)	4	(6%)	\$0.5	(2%)
Sailboat*	50	(3%)	1	(16%)	2	(4%)	\$1.2	(5%)
Commercial fishing or processing vessel	50	(3%)	0	(0%)	2	(4%)	\$2.2	(9%)
Vessel over 65 feet but under 1,000 gross tons	30	(2%)	0	(0%)	2	(4%)	\$1.1	(4%)
Barge, petroleum balloon or towable water vessel or other non-self propelled vessel	20	(1%)	0	(0%)	0	(0%)	\$0.6	(2%)
Cargo or military ship of at least 1,000 tons	10	(1%)	0	(0%)	2	(4%)	\$0.4	(2%)
Tank ship	10	(0%)	0	(0%)	0	(0%)	\$0.7	(3%)
Unclassified, other or unknown-type water transport vessel	190	(13%)	1	(35%)	2	(4%)	\$5.5	(22%)
Total	1,490	(100%)	3	(100%)	58	(100%)	\$24.4	(100%)

* The codes for sailboats and personal watercraft are new in Version 5.0 of NFIRS. In earlier versions, sailboats were captured under unclassified water vessels.

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Month
1999-2002 Annual Averages**

Month	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
January	60 (4%)	0 (0%)	0 (0%)	\$1.3 (5%)
February	60 (4%)	1 (16%)	0 (0%)	\$2.4 (10%)
March	100 (7%)	1 (35%)	3 (4%)	\$1.2 (5%)
April	130 (9%)	0 (0%)	1 (1%)	\$3.1 (13%)
May	130 (9%)	0 (0%)	7 (12%)	\$0.8 (3%)
June	210 (14%)	0 (14%)	7 (12%)	\$6.1 (25%)
July	230 (15%)	1 (18%)	8 (14%)	\$1.7 (7%)
August	180 (12%)	0 (0%)	18 (31%)	\$1.3 (5%)
September	130 (9%)	0 (0%)	9 (15%)	\$1.8 (8%)
October	100 (7%)	0 (0%)	3 (5%)	\$2.3 (9%)
November	80 (6%)	0 (0%)	3 (5%)	\$1.1 (5%)
December	70 (5%)	1 (16%)	1 (1%)	\$1.3 (5%)
Total	1,490 (100%)	3 (100%)	58 (100%)	\$24.4 (100%)
Monthly average	120 (8%)	0 (8%)	5 (8%)	\$2.0 (8%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Day of Week
1999-2002 Annual Averages**

Day of Week	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Sunday	250 (17%)	1 (48%)	9 (15%)	\$2.6 (11%)
Monday	190 (13%)	0 (0%)	6 (10%)	\$3.0 (12%)
Tuesday	170 (12%)	0 (0%)	1 (2%)	\$3.6 (15%)
Wednesday	200 (13%)	1 (16%)	10 (17%)	\$3.0 (12%)
Thursday	180 (12%)	0 (0%)	4 (7%)	\$3.7 (15%)
Friday	200 (14%)	1 (35%)	8 (14%)	\$2.6 (11%)
Saturday	290 (20%)	0 (0%)	20 (34%)	\$5.9 (24%)
Total	1,490 (100%)	3 (100%)	58 (100%)	\$24.4 (100%)
Daily average	210 (14%)	0 (14%)	8 (14%)	\$3.5 (14%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the day of week was unknown or not reported have been allocated proportionally among fires with known day of week.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Time of Day
1999-2002 Annual Averages**

Time of Day	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
12:00 - 2:59 a.m.	160 (11%)	2 (66%)	2 (3%)	\$2.6 (11%)
3:00 - 5:59 a.m.	140 (10%)	0 (0%)	1 (2%)	\$6.3 (26%)
6:00 - 8:59 a.m.	90 (6%)	0 (0%)	4 (7%)	\$1.7 (7%)
9:00 - 11:59 a.m.	180 (12%)	1 (16%)	14 (24%)	\$2.8 (11%)
Noon - 2:59 p.m.	240 (16%)	0 (0%)	7 (12%)	\$3.4 (14%)
3:00 - 5:59 p.m.	300 (20%)	0 (0%)	14 (23%)	\$3.4 (14%)
6:00 - 8:59 p.m.	220 (14%)	1 (18%)	11 (18%)	\$1.8 (7%)
9:00 - 11:59 p.m.	160 (11%)	0 (0%)	6 (10%)	\$2.4 (10%)
Total	1,490 (100%)	3 (100%)	58 (100%)	\$24.4 (100%)
Average	190 (13%)	0 (13%)	7 (13%)	\$3.1 (13%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Fixed Property Use
1999-2002 Annual Averages**

Fixed Property Use	Fires		Civilian		Civilian		Direct	
			Deaths	Injuries	Property Damage	(in Millions)		
Unclassified or unknown-type water area	180	(12%)	1	(30%)	12	(21%)	\$5.4	(22%)
Lake, river or stream	160	(11%)	0	(0%)	8	(13%)	\$1.1	(4%)
One- or two-family dwelling	160	(11%)	0	(0%)	5	(8%)	\$1.6	(6%)
Street, road or driveway	150	(10%)	0	(0%)	2	(3%)	\$1.5	(6%)
Dock, marina, pier or wharf	120	(8%)	1	(16%)	13	(23%)	\$2.9	(12%)
Vehicle parking area	100	(7%)	0	(0%)	1	(1%)	\$0.6	(2%)
Motor vehicle or boat sales, services or repair	80	(5%)	0	(0%)	3	(5%)	\$3.3	(14%)
Open land or field	60	(4%)	1	(18%)	0	(0%)	\$0.2	(1%)
Open ocean, sea or tidal waters	60	(4%)	0	(0%)	2	(4%)	\$1.8	(7%)
Unclassified outside or special property	50	(4%)	1	(35%)	2	(3%)	\$0.9	(4%)
Vehicle storage or parking garage	30	(2%)	0	(0%)	2	(3%)	\$0.2	(1%)
Highway or divided highway	30	(2%)	0	(0%)	0	(0%)	\$0.1	(0%)
Unclassified or unknown-type road property	30	(2%)	0	(0%)	0	(0%)	\$0.2	(1%)
Manufacturing or processing	20	(1%)	0	(0%)	4	(7%)	\$0.5	(2%)
Graded or cared-for plot of land*	20	(1%)	0	(0%)	0	(0%)	\$0.1	(0%)
Unclassified or unknown-type residential property	20	(1%)	0	(0%)	0	(0%)	\$0.1	(1%)
Vacant lot	20	(1%)	0	(0%)	0	(0%)	\$0.1	(1%)
Yacht club	10	(1%)	0	(0%)	0	(0%)	\$0.1	(0%)
Service station or gas station	10	(1%)	0	(0%)	1	(2%)	\$0.1	(0%)
Other known property use	60	(4%)	0	(0%)	4	(7%)	\$0.7	(3%)
Unclassified or unknown-type property use	130	(9%)	0	(0%)	1	(1%)	\$2.8	(11%)
Total	1,490	(100%)	3	(100%)	58	(100%)	\$24.4	(100%)

* This is a new code in Version 5.0 and is consequently underreported relative to the others.

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Cause
1999-2002 Annual Averages**

Cause	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Failure of equipment or heat source	550 (37%)	* (*%)	22 (38%)	\$8.4 (34%)
Unintentional	450 (30%)	* (*%)	34 (58%)	\$8.2 (33%)
Intentional	270 (18%)	* (*%)	1 (1%)	\$2.4 (10%)
Act of nature	20 (1%)	* (*%)	1 (2%)	\$0.1 (0%)
Unclassified cause	200 (13%)	* (*%)	1 (1%)	\$5.4 (22%)
Total	1,490 (100%)	3 (100%)	58 (100%)	\$24.4 (100%)

*The causes of all fire deaths in these vehicles during this period were undetermined or not reported.

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the cause was under investigation, undetermined or not reported were allocated proportionally among fires with known cause.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Factor Contributing to Ignition
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Exposure fire	27%	*%	0%	34%
Unclassified electrical failure or malfunction	11%	*%	4%	8%
Unclassified mechanical failure or malfunction	8%	*%	4%	3%
Unclassified factor contributed to ignition	8%	*%	4%	20%
Unspecified short circuit arc	7%	*%	16%	6%
Heat source too close to combustible material.	6%	*%	12%	13%
Flammable liquid or gas spilled	4%	*%	20%	7%
Short circuit arc from defective, worn insulation	3%	*%	0%	0%
Leak or break	3%	*%	3%	1%
Backfire	3%	*%	4%	1%
Unclassified misuse of material or product	2%	*%	0%	2%
Arc or spark from operating equipment	2%	*%	4%	1%
Abandoned or discarded material or product	2%	*%	0%	2%
Cutting or welding too close to combustible material	2%	*%	0%	0%
Improper startup	2%	*%	12%	0%
Unclassified operational deficiency	2%	*%	0%	0%
Short circuit arc from mechanical damage	1%	*%	0%	0%
Water caused short-circuit arc	1%	*%	0%	0%
Playing with heat source	1%	*%	0%	0%
Unattended equipment	1%	*%	0%	0%
Arc from faulty contact or broken conductor	1%	*%	4%	0%
Flammable liquid used to kindle fire	1%	*%	0%	0%
Collision, knock-down or overturn	1%	*%	0%	0%
Improper fueling technique	1%	*%	15%	0%
Storm	1%	*%	0%	0%
Outside or open fire for debris or waste disposal	1%	*%	0%	0%
Equipment not operated properly	1%	*%	0%	0%
Unintentionally turned on or not turned off	1%	*%	8%	0%
Automatic control failure	1%	*%	0%	1%
Worn out	1%	*%	0%	0%
Equipment not used for intended purpose	1%	*%	0%	0%
Installation deficiency	1%	*%	0%	3%
Other known factor	1%	*%	4%	0%

**U.S. Water Transport Vehicle Fires, by Factor Contributing to Ignition
Version 5.0 Data Only
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0
(Continued)**

* Factors contributing to ignition in all fire deaths in these vehicles during this period were undetermined or not reported.

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 17%, deaths - 100%, injuries – 18%, property damage – 9%) or fires with “none” (fires - 26%, deaths - 0%, injuries – 6%, property damage – 15%) generally exceeded those for undetermined (fires - 8%, deaths - 0%, injuries – 8%, property damage – 8%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Fire spread or control	28%	*%	0%	34%
Exposure fire	27%	*%	0%	34%
Outside or open fire for debris or waste disposal	1%	*%	0%	0%
Electrical failure or malfunction	27%	*%	29%	16%
Unclassified electrical failure or malfunction	11%	*%	4%	8%
Unspecified short circuit arc	7%	*%	16%	6%
Short circuit arc from defective, worn insulation	3%	*%	0%	0%
Arc or spark from operating equipment	2%	*%	4%	1%
Short circuit arc from mechanical damage	1%	*%	0%	0%
Water caused short-circuit arc	1%	*%	0%	0%
Arc from faulty contact or broken conductor	1%	*%	4%	0%
Misuse of material or product	19%	*%	46%	25%
Heat source too close to combustible material.	6%	*%	12%	13%
Flammable liquid or gas spilled	4%	*%	20%	7%
Unclassified misuse of material or product, other	2%	*%	0%	2%
Abandoned or discarded material or product	2%	*%	0%	2%
Cutting or welding too close to combustible material	2%	*%	0%	0%
Playing with heat source	1%	*%	0%	0%
Flammable liquid used to kindle fire	1%	*%	0%	0%
Improper fueling technique	1%	*%	15%	0%
Mechanical failure or malfunction	15%	*%	12%	5%
Unclassified mechanical failure or malfunction	8%	*%	4%	3%
Leak or break	3%	*%	3%	1%
Backfire	3%	*%	4%	1%
Automatic control failure	1%	*%	0%	1%
Worn out	1%	*%	0%	0%

**U.S. Water Transport Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0
(Continued)**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Operational deficiency	7%	*%	24%	1%
Improper startup	2%	*%	12%	0%
Unclassified operational deficiency	2%	*%	0%	0%
Unattended equipment	1%	*%	0%	0%
Collision, knock-down or overturn	1%	*%	0%	0%
Equipment not operated properly	1%	*%	0%	0%
Unintentionally turned on or not turned off	1%	*%	8%	0%
Equipment not used for intended purpose	1%	*%	0%	0%
Natural condition	1%	*%	0%	0%
Storm	1%	*%	0%	0%
Design, manufacturing or installation deficiency	1%	*%	0%	3%
Installation deficiency	1%	*%	0%	3%
Unclassified factor contributed to ignition	8%	*%	4%	20%

* Factors contributing to ignition in all fire deaths in these vehicles during this period were undetermined or not reported.

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as "none" were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of "other", the share of incidents with unreported data (fires - 17%, deaths - 100%, injuries - 18%, property damage - 9%) or fires with "none" (fires - 26%, deaths - 0%, injuries - 6%, property damage - 15%) generally exceeded those for undetermined (fires - 8%, deaths - 0%, injuries - 8%, property damage - 8%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Heat Source
1999-2002 Annual Averages**

Heat Source	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Arcing	250 (17%)	* (*%)	24 (41%)	\$2.7 (11%)
Heat from unclassified powered equipment	170 (12%)	* (*%)	6 (10%)	\$2.5 (10%)
Spark, ember or flame from operating equipment	170 (11%)	* (*%)	12 (20%)	\$4.5 (18%)
Heat from direct flame or convection currents	150 (10%)	* (*%)	0 (0%)	\$5.5 (23%)
Radiated or conducted heat from operating equipment	120 (8%)	* (*%)	8 (13%)	\$3.5 (14%)
Radiated heat from another fire	100 (7%)	* (*%)	0 (0%)	\$1.0 (4%)
Unclassified heat source	80 (5%)	* (*%)	1 (2%)	\$1.3 (5%)
Heat from unclassified or unknown-type open flame or smoking materials	80 (5%)	* (*%)	2 (4%)	\$0.7 (3%)
Unclassified heat spread from another fire	70 (5%)	* (*%)	2 (3%)	\$0.8 (3%)
Match	50 (3%)	* (*%)	0 (0%)	\$0.3 (1%)
Unclassified hot or smoldering object	40 (3%)	* (*%)	1 (2%)	\$0.6 (2%)
Backfire from internal combustion engine	40 (3%)	* (*%)	1 (2%)	\$0.2 (1%)
Fireworks	20 (1%)	* (*%)	0 (0%)	\$0.0 (0%)
Cigarette lighter	20 (1%)	* (*%)	0 (0%)	\$0.1 (0%)
Cigarette	20 (1%)	* (*%)	0 (0%)	\$0.1 (0%)
Hot ember or ash	20 (1%)	* (*%)	0 (0%)	\$0.0 (0%)
Heat or spark from friction	10 (1%)	* (*%)	1 (2%)	\$0.0 (0%)
Lightning	10 (1%)	* (*%)	1 (2%)	\$0.1 (0%)
Molten or hot material	10 (1%)	* (*%)	0 (0%)	\$0.0 (0%)
Multiple heat sources, including multiple ignitions	10 (1%)	* (*%)	0 (0%)	\$0.2 (1%)
Incendiary device	10 (1%)	* (*%)	0 (0%)	\$0.1 (0%)
Flying brand, ember or spark	10 (1%)	* (*%)	0 (0%)	\$0.2 (1%)
Other known heat source	30 (2%)	* (*%)	0 (0%)	\$0.1 (0%)
Total	1,490 (100%)	3 (100%)	58 (100%)	\$24.4 (100%)

* The heat sources were unreported or undetermined in all water transport vehicle fire deaths during this time period. 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 an injury to the nearest one and direct property is rounded damage to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the heat source was undetermined or not reported were allocated proportionally among fires with known heat source.
Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires, by Area of Fire Origin
1999-2002 Annual Averages**

Area of Fire Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Engine area, running gear or wheel area	450 (30%)	0 (0%)	28 (49%)	\$7.1 (29%)
Operator or passenger area of vehicle	220 (15%)	1 (20%)	5 (8%)	\$3.4 (14%)
Exterior or exposed surface of vehicle	160 (11%)	0 (0%)	0 (0%)	\$1.4 (6%)
Unclassified vehicle area	120 (8%)	1 (17%)	2 (4%)	\$1.4 (6%)
Fuel tank or fuel line	70 (5%)	0 (0%)	12 (20%)	\$0.5 (2%)
Separate operator or control area of vehicle	70 (4%)	1 (43%)	1 (1%)	\$0.6 (3%)
Unclassified area of origin	60 (4%)	0 (0%)	1 (2%)	\$1.2 (5%)
Unclassified outside area	40 (3%)	0 (0%)	0 (0%)	\$0.2 (1%)
Vehicle storage area, garage or carport	40 (2%)	0 (0%)	0 (0%)	\$1.4 (6%)
Open outside area, including farmland or field	30 (2%)	0 (0%)	0 (0%)	\$0.1 (0%)
Kitchen or cooking area	30 (2%)	0 (0%)	3 (6%)	\$2.8 (11%)
Unclassified storage area	20 (2%)	0 (0%)	0 (0%)	\$0.1 (0%)
Bedroom or sleeping area	20 (1%)	1 (20%)	1 (1%)	\$0.5 (2%)
Cargo or trunk area of vehicle	20 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Exterior wall surface	20 (1%)	0 (0%)	2 (3%)	\$0.1 (0%)
Machinery room or area	10 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Multiple areas of origin	10 (1%)	0 (0%)	0 (0%)	\$0.6 (2%)
Unclassified function area	10 (1%)	0 (0%)	1 (1%)	\$0.4 (2%)
On or near highway, parking lot or street	10 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Bathroom, lavatory, locker room or check room	10 (1%)	0 (0%)	1 (1%)	\$0.4 (2%)
Other known area	80 (5%)	0 (0%)	2 (4%)	\$2.3 (9%)
Total	1,490 (100%)	3 (100%)	58 (100%)	\$24.4 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the area or origin was unknown or not reported were allocated proportionally among fires with known area of origin.

Source: NFIRS and NFPA survey.

U.S. Water Transport Vehicle Fires, by Item First Ignited 1999-2002 Annual Averages

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Flammable or combustible liquid or gas, including accelerants, aerosols, and atomized vapor	360 (24%)	0 (0%)	46 (79%)	\$4.8 (20%)
Unclassified item first ignited	250 (16%)	0 (0%)	4 (6%)	\$2.9 (12%)
Electrical wire or cable insulation	230 (16%)	0 (0%)	0 (0%)	\$2.6 (11%)
Multiple items first ignited	150 (10%)	0 (0%)	0 (0%)	\$6.5 (27%)
Unclassified structural component or finish	60 (4%)	0 (0%)	1 (2%)	\$2.6 (10%)
Upholstered sofa, chair or vehicle seat	60 (4%)	3 (100%)	1 (1%)	\$0.7 (3%)
Tarpaulin or tent	60 (4%)	0 (0%)	0 (0%)	\$0.3 (1%)
Exterior wall covering or finish	40 (2%)	0 (0%)	0 (0%)	\$0.2 (1%)
Rubbish, trash, or waste	20 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Cabinetry, including built-in cabinetry	20 (1%)	0 (0%)	1 (2%)	\$0.4 (2%)
Unclassified flammable or combustible liquid, piping or filter	20 (1%)	0 (0%)	2 (4%)	\$0.1 (0%)
Floor covering, rug, carpet or mat	20 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Awning or canopy	20 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Grass or light vegetation, excluding crops	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Structural member or framing	10 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Mattress or bedding	10 (1%)	0 (0%)	1 (1%)	\$0.6 (3%)
Box, carton, bag, basket or barrel	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Unclassified adornment or recreational material or sign	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Unclassified furniture or utensil	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Other known item	120 (8%)	0 (0%)	3 (6%)	\$2.3 (10%)
Total	1,490 (100%)	3 (100%)	58 (100%)	\$24.4 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were 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 were allocated proportionally among fires with known item first ignited.

Source: NFIRS and NFPA survey.

**U.S. Water Transport Vehicle Fires in which a Flammable or Combustible Liquid or Gas
was the Item First Ignited by Type of Material First Ignited
1999-2002 Annual Averages**

Type of Material	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Gasoline	230	(65%)	0	(NA)	25	(54%)	\$2.1	(43%)
Unclassified or unknown-type flammable gas	40	(12%)	0	(NA)	4	(8%)	\$0.4	(9%)
Unclassified or unknown-type flammable or combustible liquid	20	(6%)	0	(NA)	1	(2%)	\$1.1	(22%)
Class II combustible liquid, including kerosene, numbers 1 and 2 fuel oil and diesel fuel	10	(4%)	0	(NA)	0	(0%)	\$0.9	(18%)
Plastic	10	(3%)	0	(NA)	0	(0%)	\$0.0	(1%)
Class IA flammable liquid, including ether and pentane	10	(2%)	0	(NA)	10	(22%)	\$0.1	(3%)
LP gas	10	(2%)	0	(NA)	3	(7%)	\$0.0	(1%)
Other known type of material	20	(6%)	0	(NA)	3	(7%)	\$0.1	(2%)
Total	360	(100%)	0	(NA)	46	(100%)	\$4.8	(100%)

NA – Not applicable.

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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. This table includes a proportional share of fires in which the item first ignited was unknown or not reported. Fires in which the type of material first ignited was unknown or not reported were allocated proportionally among fires with known type of material first ignited.

Source: NFIRS and NFPA survey.

U.S. Rail Transport Vehicle Fire Problem

Average of 770 of rail transport vehicle fires were reported annually in 1999-2002.

During the four-year period of 1999-2002, local fire departments responded to an estimated average of 770 rail transport vehicle fires per year. These fires caused an estimated annual average of six civilian deaths, 79 civilian fire injuries and \$17.4 million in direct property damage. Reported rail transport vehicle jumped 35% from 630 in 1999 to 850 in 2001. They rose another 18% from the 850 in 2001 to 1,000 in 2002. The 1,000 fires in 2002 is 61% lower than the 2,580 reported in 1980, the first year NFPA began tracking with current methods. With the exception of a spike to 790 in 1997, reported rail fires had ranged between 600 and 660 from 1992 through 2000 before the recent increases.

Rail transport vehicle fires were a small share of the vehicle fire problem.

In 1999-2002, rail transport vehicles accounted for less than 1% of the 349,570 reported vehicle fires, 1% of the 496 vehicle fire deaths, 4% of the 1,802 civilian injuries, and 1% of the \$1.4 billion in direct property damage.

Half of the rail transport vehicle fires originated in two types of cars.

Twenty-six percent of these fires started in freight, box or hopper cars. Twenty-five percent began in the engine or locomotive, 15% started in diner or passenger cars, and 9% originated in maintenance equipment cars.

Rail transport vehicle fires peaked in the afternoon.

July was the peak month for these fires. August ranked second and October ranked third. Thursday was the peak day for these incidents; the smallest share occurred on Sunday. The noon-2:59 p.m. and 3:00-5:59 p.m. were the peak periods for rail vehicle fires in 1999-2002. The 3:00-5:59 a.m. and 6:00-8:59 a.m. had the smallest number of these incidents.

More than half of the rail transport vehicle fires occurred on railroad properties.

Thirty-two percent of the rail transport fires occurred on railroad rights of way and 23% started in railroad yards. Nine percent of these fires began on streets, roads or driveways; 6% began on highways or divided highways.

Almost half of these fires were caused by equipment problems.

A failure of equipment or heat source caused 47% of the rail transport fires. Some form of mechanical failure or malfunction contributed to the ignition in 47% of the incidents, and electrical failures or malfunctions contributed to the fire in 15% of the incidents. A misuse of material or product contributed to 19% of the ignitions. Twelve percent of these fires were intentionally set.

The leading heat sources were the operating equipment itself. Radiated or conducted heat from operating equipment was the heat source in 16% of the fires; heat from unclassified powered equipment provided the heat in 15%, and sparks, embers or flames from

operating equipment provided the heat in 13% of the fires. Arcing was the heat source in 11% of these incidents.

Forty-five percent of the fires in rail transport vehicles began in the engine, running gear or wheel area; 15% started in the cargo or load carrying area.

The most commonly mentioned item first ignited was unclassified in 22% of the fires. In 17% of the rail transport vehicle fires, a flammable or combustible liquid or gas was the item first ignited. A Class II combustible liquid, such as kerosene, number 1 or 2 fuel oil, or diesel fuel, was the type of material first ignited in 33% of the fires starting with flammable or combustible liquids or gases; gasoline was the type of material first ignited in 17% of the flammable or combustible liquid or gas fires.

Electrical wire or cable insulation was the item first ignited in 16% of rail transport vehicle fires incidents. Rubbish, trash or waste was first ignited in 5% of these fires.

Additional information is in the NFPA *Fire Protection Handbook*

Two chapters in the NFPA *Fire Protection Handbook*, 19th edition, provide additional information on fire protection and safety issues in this property class. Frank J. Chiak's "Fixed Guideway Transit Systems" discusses fire safety in rapid transit systems. "Rail Transportation Systems," revised by James P. Gourley, Arthur Candenquist and Scott Gorton, addresses issues of fire safety and hazardous materials in rail transport.

Reports of the U.S. National Transportation Safety Board's (NTSB's) recent investigations into railroad accidents are available on-line at http://www.nts.gov/Publictn/R_Acc.htm. The reports include the passenger train and truck collision and resulting fire in Illinois on March 15, 1999 that claimed 11 lives. Five of the deaths were due to fire.¹⁴

¹⁴ National Transportation Safety Board, *Railroad Accident Report: Collision of National Railroad Passenger Corporation (Amtrak) Train 59 with a Loaded Truck-Semitrailer Combination at a Highway/Rail Grade Crossing in Bourbonnais, Illinois, March, 15, 1999*, Washington, D.C., NTSB/RAR-02/01, 2002, p. 11, available at <http://www.nts.gov/publictn/2002/RAR0201.pdf>.

U.S. Rail Transport Vehicle Fire Problem, by Year: 1980-2002

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	Direct Property Damage (in Millions of 2004 Dollars)
1980	2,580	0	15	\$18.7	\$40.9
1981	2,390	3	21	\$12.3	\$24.3
1982	1,800	7	143	\$48.6	\$90.5
1983	1,570	0	8	\$9.3	\$16.8
1984	1,650	6	19	\$16.1	\$27.8
1985	1,220	0	35	\$7.7	\$12.9
1986	1,280	4	6	\$6.2	\$10.2
1987	1,280	4	13	\$22.8	\$36.1
1988	1,290	2	11	\$33.6	\$51.1
1989	910	0	2	\$12.9	\$18.7
1990	930	8	20	\$12.2	\$16.8
1991	910	0	13	\$31.5	\$41.6
1992	650	0	2	\$8.0	\$10.3
1993	660	0	16	\$15.0	\$18.7
1994	650	0	4	\$16.4	\$19.9
1995	610	3	27	\$16.9	\$19.9
1996	600	18	6	\$21.0	\$24.1
1997	790	7	20	\$38.1	\$42.7
1998	610	0	3	\$12.4	\$13.7
1999*	600	22	296	\$31.7	\$34.3
2000	630	0	3	\$7.6	\$8.0
2001	850	2	16	\$18.2	\$18.5
2002	1,000	0	0	\$11.9	\$11.9
1980-2002 Annual average	1,110	4	30	\$18.7	\$26.5
1999-2002 Annual average	770	6	79	\$17.4	\$18.2

* NFIRS data for 1999 and later was received in the Version 5.0 format. Due to the many coding changes, the 1999-2002 data can better be analyzed separately from data from previous years.

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 is rounded to the nearest hundred thousand dollars.

Source: NFIRS and NFPA survey; Table 697 "Purchasing Power of the Dollar: 1950 to 2003" U.S. Census Bureau's *Statistical Abstract of the United States: 2004-2005 (124th Edition)*.

**U.S. Rail Vehicle Transport Fire Problem, by Type of Vehicle
1999-2002 Annual Averages**

Vehicle Type	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Box, freight or hopper car	200 (26%)	0 (0%)	2 (2%)	\$5.5 (32%)
Engine or locomotive	190 (25%)	0 (0%)	4 (5%)	\$5.8 (33%)
Diner or passenger car	120 (15%)	5 (84%)	73 (93%)	\$0.7 (4%)
Maintenance equipment car	70 (9%)	1 (9%)	0 (0%)	\$0.4 (2%)
Rapid transit car or trolley, including self-powered rail vehicles	30 (4%)	0 (0%)	0 (0%)	\$0.1 (0%)
Container or piggyback car	30 (4%)	0 (0%)	0 (0%)	\$0.1 (1%)
Tank car	10 (2%)	0 (0%)	0 (0%)	\$0.1 (0%)
Unclassified rail transport vehicle	120 (15%)	0 (7%)	0 (0%)	\$4.7 (27%)
Total	770 (100%)	6 (100%)	79 (100%)	\$17.4 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Month
1999-2002 Annual Averages**

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	60	(7%)	0	(0%)	0	(0%)	\$4.2	(24%)
February	50	(7%)	0	(0%)	0	(0%)	\$0.6	(3%)
March	50	(7%)	5	(84%)	74	(94%)	\$2.1	(12%)
April	70	(9%)	0	(0%)	0	(0%)	\$0.3	(2%)
May	60	(8%)	0	(7%)	2	(2%)	\$0.4	(2%)
June	50	(6%)	1	(9%)	0	(0%)	\$0.2	(1%)
July	90	(12%)	0	(0%)	0	(0%)	\$0.7	(4%)
August	80	(11%)	0	(0%)	3	(4%)	\$4.7	(27%)
September	70	(9%)	0	(0%)	0	(0%)	\$1.6	(9%)
October	70	(10%)	0	(0%)	0	(0%)	\$1.2	(7%)
November	60	(8%)	0	(0%)	0	(0%)	\$0.6	(3%)
December	60	(7%)	0	(0%)	0	(0%)	\$0.7	(4%)
Total	770	(100%)	6	(100%)	79	(100%)	\$17.4	(100%)
Monthly average	60	(8%)	1	(8%)	7	(8%)	\$1.4	(8%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Day of Week
1999-2002 Annual Averages**

Day of Week	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Sunday	90 (12%)	0 (0%)	1 (1%)	\$5.0 (29%)
Monday	100 (13%)	5 (84%)	73 (93%)	\$0.4 (2%)
Tuesday	120 (15%)	1 (16%)	0 (0%)	\$4.2 (24%)
Wednesday	120 (16%)	0 (0%)	0 (0%)	\$1.0 (6%)
Thursday	130 (17%)	0 (0%)	2 (3%)	\$4.8 (28%)
Friday	110 (14%)	0 (0%)	2 (3%)	\$0.6 (3%)
Saturday	100 (14%)	0 (0%)	0 (0%)	\$1.2 (7%)
Total	770 (100%)	6 (100%)	79 (100%)	\$17.4 (100%)
Daily average	110 (14%)	1 (14%)	11 (14%)	\$2.5 (14%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the day of week was unknown or not reported have been allocated proportionally among fires with known day of week.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Time of Day
1999-2002 Annual Averages**

Time of Day	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
12:00 - 2:59 a.m.	70 (10%)	0 (0%)	2 (2%)	\$7.4 (42%)
3:00 - 5:59 a.m.	60 (8%)	0 (0%)	1 (1%)	\$0.8 (5%)
6:00 - 8:59 a.m.	60 (8%)	0 (0%)	0 (0%)	\$2.0 (12%)
9:00 - 11:59 a.m.	110 (14%)	0 (7%)	0 (0%)	\$2.3 (13%)
Noon - 2:59 p.m.	130 (17%)	0 (0%)	0 (0%)	\$1.8 (10%)
3:00 - 5:59 p.m.	130 (17%)	0 (7%)	1 (1%)	\$1.5 (8%)
6:00 - 8:59 p.m.	110 (15%)	0 (0%)	2 (3%)	\$1.3 (8%)
9:00 - 11:59 p.m.	90 (11%)	5 (86%)	73 (93%)	\$0.3 (2%)
Total	770 (100%)	6 (100%)	79 (100%)	\$17.4 (100%)
Average	100 (13%)	1 (13%)	10 (13%)	\$2.2 (13%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Fires, by Fixed Property Use
1999-2002 Annual Averages**

Fixed Property Use	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Railroad right of way	250 (32%)	5 (77%)	78 (98%)	\$11.8 (68%)
Railroad yard	170 (23%)	0 (0%)	1 (1%)	\$3.3 (19%)
Street, road or driveway	70 (9%)	1 (23%)	0 (0%)	\$0.2 (1%)
Highway or divided highway	40 (6%)	0 (0%)	0 (0%)	\$0.6 (3%)
Vehicle parking area	30 (4%)	0 (0%)	1 (1%)	\$0.1 (0%)
Unclassified or unknown-type road property	20 (3%)	0 (0%)	0 (0%)	\$0.0 (0%)
Manufacturing or processing property	20 (3%)	0 (0%)	0 (0%)	\$0.3 (2%)
Vehicle storage or parking garage	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Rapid transit station	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
One- or two-family dwelling	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Unclassified outside or special property	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Outside material storage area	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Other known property use	60 (8%)	0 (0%)	0 (0%)	\$0.6 (4%)
Unclassified or unknown-type property use	70 (9%)	0 (0%)	0 (0%)	\$0.4 (2%)
Total	770 (100%)	6 (100%)	79 (100%)	\$17.4 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Cause
1999-2002 Annual Averages**

Cause	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Failure of equipment or heat source	360 (47%)	0 (0%)	4 (5%)	\$5.3 (30%)
Unintentional	270 (35%)	1 (16%)	0 (0%)	\$8.5 (49%)
Intentional	90 (12%)	0 (7%)	0 (0%)	\$1.5 (9%)
Unclassified cause	40 (5%)	5 (77%)	75 (95%)	\$2.1 (12%)
Act of nature	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Total	770 (100%)	6 (100%)	79 (100%)	\$17.4 (100%)

Note: These are fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies. Fires are rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the cause was under investigation, undetermined or not reported were allocated proportionally among fires with known cause.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Factor Contributing to Ignition
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Unclassified mechanical failure or malfunction	27%	0%	0%	27%
Leak or break	13%	0%	33%	23%
Cutting or welding too close to combustible material	8%	0%	0%	3%
Unclassified electrical failure or malfunction	8%	0%	0%	2%
Unclassified factor contributed to ignition	7%	0%	0%	3%
Heat source too close to combustible material.	5%	0%	0%	2%
Worn out	4%	0%	0%	0%
Exposure fire	3%	0%	0%	32%
Unspecified short circuit arc	3%	0%	0%	0%
Short circuit arc from defective, worn insulation	2%	0%	0%	1%
Backfire	2%	0%	0%	0%
Unclassified natural condition	2%	0%	0%	0%
Abandoned or discarded material or product	2%	0%	0%	0%
Collision, knock-down or overturn	1%	100%	0%	0%
Unclassified misuse of material or product	1%	0%	0%	0%
Unclassified operational deficiency	1%	0%	0%	1%
Failure to clean	1%	0%	0%	3%
Arc or spark from operating equipment	1%	0%	0%	0%
Overloaded equipment	1%	0%	0%	0%
Flammable liquid used to kindle fire	1%	0%	0%	0%
Flammable liquid or gas spilled	1%	0%	0%	1%
Unattended equipment	1%	0%	0%	2%
Manual control failure	1%	0%	0%	0%
Design deficiency	1%	0%	0%	0%
Manufacturing deficiency	1%	0%	0%	0%
Arc from faulty contact or broken conductor	1%	0%	67%	0%
Rekindle	1%	0%	0%	0%
Unclassified fire spread or control	1%	0%	0%	0%
Equipment not operated properly	1%	0%	0%	0%
Other known factor	3%	0%	0%	2%

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 17%, deaths - 0%, injuries - 40%, property damage - 54%) or fires with “none” (fires - 27%, deaths - 0%, injuries - 0%, property damage - 7%) generally exceeded those for undetermined (fires - 11%, deaths - 0%, injuries - 0%, property damage - 9%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Mechanical failure or malfunction	47%	0%	33%	51%
Unclassified mechanical failure or malfunction	27%	0%	0%	27%
Leak or break	13%	0%	33%	23%
Worn out	4%	0%	0%	0%
Backfire	2%	0%	0%	0%
Manual control failure	1%	0%	0%	0%
Misuse of material or product	19%	0%	0%	7%
Cutting or welding too close to combustible material	8%	0%	0%	3%
Heat source too close to combustible material	5%	0%	0%	2%
Abandoned or discarded material or product	2%	0%	0%	0%
Unclassified misuse of material or product	1%	0%	0%	0%
Flammable liquid used to kindle fire	1%	0%	0%	0%
Flammable liquid or gas spilled	1%	0%	0%	1%
Electrical failure or malfunction	15%	0%	67%	6%
Unclassified electrical failure or malfunction	8%	0%	0%	2%
Unspecified short circuit arc	3%	0%	0%	0%
Short circuit arc from defective, worn insulation	2%	0%	0%	1%
Arc or spark from operating equipment	1%	0%	0%	0%
Arc from faulty contact or broken conductor	1%	0%	67%	0%
Operational deficiency	7%	100%	0%	7%
Collision, knock-down or overturn	1%	100%	0%	0%
Unclassified operational deficiency	1%	0%	0%	1%
Failure to clean	1%	0%	0%	3%
Overloaded equipment	1%	0%	0%	0%
Unattended equipment	1%	0%	0%	2%
Equipment not operated properly	1%	0%	0%	0%
Fire spread or control	5%	0%	0%	32%
Exposure fire	3%	0%	0%	32%
Rekindle	1%	0%	0%	0%
Unclassified fire spread or control	1%	0%	0%	0%

**U.S. Rail Transport Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0
(Continued)**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Design, manufacturing, or installation deficiency	2%	0%	0%	0%
Design deficiency	1%	0%	0%	0%
Manufacturing deficiency	1%	0%	0%	0%
Unclassified natural condition	2%	0%	0%	0%
Unclassified factor contributed to ignition	7%	0%	0%	3%

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 17%, deaths - 0%, injuries - 40%, property damage - 54%) or fires with “none” (fires - 27%, deaths - 0%, injuries - 0%, property damage - 7%) generally exceeded those for undetermined (fires - 11%, deaths - 0%, injuries - 0%, property damage - 9%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Heat Source
1999-2002 Annual Averages**

Heat Source	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Radiated or conducted heat from operating equipment	130	(16%)	0	(0%)	17	(21%)	\$3.8	(22%)
Heat from unclassified powered equipment	120	(15%)	0	(0%)	0	(0%)	\$3.0	(17%)
Spark, ember or flame from operating equipment	100	(13%)	0	(0%)	0	(0%)	\$0.6	(4%)
Arcing	90	(11%)	0	(0%)	50	(63%)	\$1.7	(10%)
Unclassified heat source	60	(8%)	6	(100%)	0	(0%)	\$0.3	(2%)
Heat or spark from friction	50	(7%)	0	(0%)	0	(0%)	\$3.0	(17%)
Unclassified hot or smoldering object	50	(6%)	0	(0%)	12	(16%)	\$0.2	(1%)
Chemical reaction	30	(4%)	0	(0%)	0	(0%)	\$0.1	(1%)
Heat from unclassified or unknown-type open flame or smoking materials	30	(3%)	0	(0%)	0	(0%)	\$1.6	(9%)
Match	10	(2%)	0	(0%)	0	(0%)	\$0.1	(1%)
Molten or hot material	10	(2%)	0	(0%)	0	(0%)	\$0.1	(1%)
Hot ember or ash	10	(2%)	0	(0%)	0	(0%)	\$0.0	(0%)
Backfire from internal combustion engine	10	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Radiated heat from another fire	10	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Multiple heat sources, including multiple ignitions	10	(1%)	0	(0%)	0	(0%)	\$0.8	(5%)
Heat from direct flame or convection currents	10	(1%)	0	(0%)	0	(0%)	\$0.1	(0%)
Cigarette	10	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Unclassified chemical or natural heat source	10	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Other known heat source	30	(4%)	0	(0%)	0	(0%)	\$1.7	(10%)
Total	770	(100%)	6	(100%)	79	(100%)	\$17.4	(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 an injury to the nearest one and direct property is rounded damage to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the heat source was undetermined or not reported were allocated proportionally among fires with known heat source.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Area of Fire Origin
1999-2002 Annual Averages**

Area of Fire Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Engine area, running gear or wheel area	340 (45%)	0 (0%)	2 (2%)	\$6.0 (35%)
Cargo or trunk area of vehicle	120 (15%)	0 (0%)	2 (2%)	\$4.2 (24%)
Unclassified vehicle area	70 (9%)	0 (0%)	1 (1%)	\$3.1 (18%)
Exterior or exposed surface of vehicle	50 (6%)	0 (0%)	0 (0%)	\$1.0 (6%)
On or near railroad right of way	40 (6%)	0 (0%)	0 (0%)	\$1.6 (9%)
Operator or passenger area of vehicle	40 (5%)	5 (77%)	75 (95%)	\$0.5 (3%)
Unclassified area of origin	20 (2%)	0 (0%)	0 (0%)	\$0.1 (1%)
Separate operator or control area of vehicle	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Fuel tank or fuel line	10 (1%)	1 (16%)	0 (0%)	\$0.1 (1%)
Storage room, area, tank or bin	10 (1%)	0 (0%)	0 (0%)	\$0.2 (1%)
On or near highway, parking lot or street	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Unclassified storage area	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Other known area	40 (5%)	0 (7%)	0 (0%)	\$0.4 (2%)
Total	770 (100%)	6 (100%)	79 (100%)	\$17.4 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the area or origin was unknown or not reported were allocated proportionally among fires with known area of origin.

Source: NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires, by Item First Ignited
1999-2002 Annual Averages**

Item First Ignited	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Unclassified item first ignited	170 (22%)	2 (40%)	0 (0%)	\$2.1 (12%)
Flammable or combustible liquid or gas, including accelerants, aerosols, and atomized vapor	130 (17%)	2 (30%)	29 (37%)	\$8.0 (46%)
Electrical wire or cable insulation	120 (16%)	0 (0%)	50 (63%)	\$1.4 (8%)
Rubbish, trash, or waste	40 (5%)	0 (0%)	0 (0%)	\$0.1 (1%)
Multiple items first ignited	30 (4%)	0 (0%)	0 (0%)	\$1.5 (9%)
Upholstered sofa, chair or vehicle seat	20 (2%)	2 (30%)	0 (0%)	\$0.2 (1%)
Agricultural crop, including fruits and vegetables	10 (2%)	0 (0%)	0 (0%)	\$0.1 (1%)
Unclassified flammable or combustible liquid, piping or filter	10 (2%)	0 (0%)	0 (0%)	\$1.2 (7%)
Unclassified organic materials	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Baled goods or material	10 (2%)	0 (0%)	0 (0%)	\$1.1 (6%)
Floor covering, rug, carpet or mat	10 (2%)	0 (0%)	0 (0%)	\$0.1 (1%)
Grass or light vegetation, excluding crops	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Interior wall covering excluding drapes	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Railroad ties	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Bulk storage	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Box, carton, bag, basket or barrel	10 (2%)	0 (0%)	0 (0%)	\$0.2 (1%)
Tire	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Palletized material or material stored on pallets	10 (1%)	0 (0%)	0 (0%)	\$0.3 (2%)
Pipe, duct, conduit, hose or associated covering	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Unclassified general materials	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Packing or wrapping material	10 (1%)	0 (0%)	0 (0%)	\$0.1 (0%)
Structural member or framing	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Unclassified structural component or finish	10 (1%)	0 (0%)	0 (0%)	\$0.1 (1%)
Dust, fiber or lint, including sawdust and excelsior	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Magazine, newspaper or writing paper	10 (1%)	0 (0%)	0 (0%)	\$0.0 (0%)
Rolled or wound paper or fabric	10 (1%)	0 (0%)	0 (0%)	\$0.3 (2%)

**U.S. Rail Transport Vehicle Fires, by Item First Ignited
1999-2002 Annual Averages
(Continued)**

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Conveyor belt, drive belt or V-belt	10	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Empty pallet or skid	10	(1%)	0	(0%)	0	(0%)	\$0.0	(0%)
Other known item	30	(4%)	0	(0%)	0	(0%)	\$0.3	(2%)
Total	770	(100%)	6	(100%)	79	(100%)	\$17.4	(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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were 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 were allocated proportionally among fires with known item first ignited.

Source: National estimates based on NFIRS and NFPA survey.

**U.S. Rail Transport Vehicle Fires in which a Flammable or Combustible Liquid or Gas
was the Item First Ignited by Type of Material First Ignited
1999-2002 Annual Averages**

Type of Material	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Class II combustible liquid, including kerosene, numbers 1 and 2 fuel oil and diesel fuel	40	(33%)	2	(100%)	17	(58%)	\$5.3	(66%)
Gasoline	20	(17%)	0	(0%)	0	(0%)	\$1.4	(17%)
Unclassified or unknown-type flammable or combustible liquid	20	(16%)	0	(0%)	0	(0%)	\$0.6	(7%)
Class IIIB combustible liquid, including transformer, cooking and lubricating oil	10	(11%)	0	(0%)	0	(0%)	\$0.2	(2%)
Unclassified or unknown-type flammable gas	10	(8%)	0	(0%)	0	(0%)	\$0.2	(3%)
Other known type of material	20	(15%)	0	(0%)	12	(42%)	\$0.4	(4%)
Total	130	(100%)	2	(100%)	29	(100%)	\$8.0	(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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. This table includes a proportional share of fires in which the item first ignited was unknown or not reported. Fires in which the type of material first ignited was unknown or not reported were allocated proportionally among fires with known type of material first ignited.

Source: NFIRS and NFPA survey.

U.S. Air Transport Vehicle Fire Problem

230 aircraft fires, on average, were reported annually in 1999-2002.

During the four-year period of 1999-2002, local fire departments responded to an estimated average of 230 air transport vehicle fires per year. These fires caused an estimated annual average of 35 civilian deaths, 19 civilian fire injuries and \$12.4 million in direct property damage.

Reported air transport vehicle fires rose 31% from 250 in 2001 to 320 in 2002. The 320 fires in 2002 is 26% lower than the 440 reported in 1980, the first year NFPA began tracking with current methods. Only 170 of these fires were reported in each of the three years of 1998-2000, the lowest points since this tracking began.

These figures reflect estimates of air transport vehicle fires reported to U.S. fire departments based on data provided to the National Fire Incident Reporting System (NFIRS) and scaling ratios derived from the NFPA annual survey. They do not include fires handled by fire brigades or fires outside of the jurisdiction of a local fire department. Casualty statistics can be skewed by the inclusion or absence of one significant fire. For example, it appears that the 1996 fire and plane crash in the Florida everglades was not included in NFIRS. This crash claimed 110 lives. Because of the small numbers of these incidents, data from individual years maybe less representative.

If fire occurred, the risk of death was higher in aircraft than in other vehicles.

In 1999-2002, aircraft accounted for less than 1% of the 349,570 reported vehicle fires, 7% of the 496 vehicle fire deaths, 1% of the 1,802 civilian injuries, and 1% of the \$1.4 billion in direct property damage.

Personal, business or utility aircraft under 12,500 pounds gross weight were involved in 49% of the reported air transport vehicle fires.

Aircraft fires were more common between 9:00 a.m. and 9:00 p.m.

August was the peak month for air transport vehicle fires. September ranked second. Wednesday, Thursday and Saturday were the peak days for these fires. Three-quarters of the air transport vehicle fires occurred between 9:00 a.m. and 9:00 p.m.

44% of these fires occurred on aircraft-related properties.

Seventeen percent of the reported air transport vehicle fires occurred on taxiways or related areas; 14% were on runways; and 13% occurred in aircraft loading areas. Twelve percent occurred in open lands or fields.

Collisions cause a larger share of the fires in aircraft than in other vehicles.

The failure of equipment or heat sources caused 55% of the air transport vehicle fires. Mechanical failures or malfunctions contributed to 44% of air transport vehicle fires and electrical failures or malfunctions contributed to 9%. Collisions, overturns or knock-downs were contributing factors in 18% of the air transport vehicle fires and 64% of the

associated fire deaths. The aircraft category was the only vehicle category in which collisions and overturns was a leading factor. In other vehicle classes, this cause typically accounts for a small percentage of fires but a large percentage of deaths and injuries. Aircraft fires have a very distinctive casualty pattern. In most vehicles, more injuries than deaths result from fires, but aircraft fires result in more deaths than injuries. In aircraft crash-fires, multiple-casualty incidents would be expected to dominate. This makes the methods used for statistical estimation from samples less reliable. Patterns other than those for fire incidents should be considered subject to significant variability.

In 19% of the fires, the heat source came from unclassified powered equipment. Radiated or conducted heat from operating equipment was the source in 17% of the incidents. The heat source was unclassified in 13% of these incidents. A spark, ember or flame from operating equipment was the source of heat in 11% of these fires.

Half of the aircraft fires began in the engine, running gear or wheel area.

Fifty-one percent of fires in aircraft began in the engine, running gear, or wheel area; 11% started in the fuel tank or fuel line area.

Half of the aircraft fires began with the ignition of a flammable or combustible liquid or gas.

In 51% of these fires, a flammable or combustible liquid or gas was the item first ignited. Gasoline was the type of material first ignited in 38% of the air transport vehicle fires that began with flammable or combustible liquids or gases. A Class IB flammable liquid, such as acetone, JP-4 jet fuel or methyl ethyl ketene was the type of material first ignited in 25% of the fires starting with flammable or combustible liquids or gases.

The item first ignited was unclassified in 16% of the air transport vehicle fires. Electrical wire or cable insulation was first ignited in 16% of the incidents.

***Fire Protection Handbook's* chapter "Aviation" has more information.**

The chapter "Aviation," revised by Thomas J. Lett in the 19th edition of the *NFPA Fire Protection Handbook*, provides information on fire safety in aircraft and airports. A bibliography is included.

Reports of the U.S. National Transportation Safety Board's (NTSB's) recent investigations into aviation accidents, including fires, are available on-line at http://www.nts.gov/Publictn/A_Acc1.htm

**U.S. Air Transport Vehicle Fire Problem,
by Year: 1980-2002**

Year	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)	Direct Property Damage (in Millions of 2004 Dollars)
1980	440	72	81	\$79.5	\$173.7
1981	410	100	42	\$31.6	\$62.4
1982	420	88	24	\$7.8	\$14.5
1983	380	71	23	\$10.4	\$18.8
1984	370	54	33	\$13.5	\$23.3
1985	360	90	40	\$13.0	\$21.7
1986	350	77	37	\$4.9	\$8.0
1987	300	55	26	\$28.1	\$44.5
1988	340	75	29	\$22.6	\$34.4
1989	250	90	54	\$32.7	\$47.5
1990	300	48	28	\$11.1	\$15.3
1991	240	91	163	\$38.6	\$51.0
1992	250	91	23	\$18.9	\$24.2
1993	270	28	13	\$90.4	\$112.5
1994	220	69	34	\$13.7	\$16.6
1995	210	30	73	\$8.5	\$10.0
1996*	200	31	10	\$153.2	\$175.8
1997	230	22	0	\$9.5	\$10.6
1998	170	37	8	\$13.4	\$14.8
1999**	170	15	0	\$3.3	\$3.5
2000	170	32	24	\$12.7	\$13.3
2001	250	23	23	\$17.9	\$18.2
2002	320	70	28	\$15.8	\$15.8
1980-2002 Annual average	290	59	35	\$28.3	\$40.5
1999-2002 Annual average	230	35	19	\$12.4	\$12.7

* Does not include the May 11, 1996 plane crash in the Florida everglades that claimed 110 lives.

* NFIRS data for 1999 and later was received in the Version 5.0 format. Due to the many coding changes, the 1999-2002 data can better be analyzed separately from data from previous years.

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 is rounded to the nearest hundred thousand dollars.

Source: NFIRS and NFPA survey; Table 697 "Purchasing Power of the Dollar: 1950 to 2003" U.S. Census Bureau's *Statistical Abstract of the United States: 2004-2005 (124th Edition)*.

**U.S. Air Transport Vehicle Fire Problem, by Type of Vehicle
1999-2002 Annual Averages**

Vehicle Type	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Personal aircraft under 12,500 pounds gross weight.	110 (49%)	19 (55%)	9 (46%)	\$3.1 (25%)
Commercial fixed wing jet	30 (13%)	0 (0%)	2 (12%)	\$1.4 (11%)
Commercial fixed wing propeller plane	20 (9%)	5 (14%)	6 (30%)	\$1.6 (13%)
Personal aircraft of at least 12,500 pounds gross weight	10 (6%)	2 (5%)	0 (0%)	\$0.6 (4%)
Non-military helicopter	10 (3%)	4 (12%)	2 (12%)	\$2.8 (22%)
Military aircraft	10 (5%)	0 (0%)	0 (0%)	\$1.6 (13%)
Unclassified or other air transport vehicles	40 (16%)	5 (14%)	0 (0%)	\$1.3 (11%)
Total	230 (100%)	35 (100%)	19 (100%)	\$12.4 (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, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Month
1999-2002 Annual Averages**

Month	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
January	20	(7%)	2	(5%)	3	(17%)	\$1.1	(9%)
February	10	(5%)	1	(2%)	2	(9%)	\$0.6	(5%)
March	20	(7%)	1	(1%)	1	(4%)	\$1.1	(9%)
April	10	(5%)	1	(1%)	1	(4%)	\$1.1	(8%)
May	20	(10%)	5	(14%)	2	(12%)	\$1.2	(10%)
June	20	(9%)	1	(2%)	0	(0%)	\$0.3	(3%)
July	20	(10%)	3	(8%)	1	(4%)	\$0.8	(6%)
August	30	(13%)	8	(22%)	3	(16%)	\$3.0	(24%)
September	20	(11%)	6	(18%)	2	(8%)	\$1.0	(8%)
October	20	(10%)	8	(22%)	2	(12%)	\$0.3	(3%)
November	20	(7%)	2	(6%)	2	(13%)	\$1.9	(16%)
December	10	(6%)	0	(0%)	0	(0%)	\$0.0	(0%)
Total	230	(100%)	35	(100%)	19	(100%)	\$12.4	(100%)
Monthly average	20	(8%)	3	(8%)	2	(8%)	\$1.0	(8%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Day of Week
1999-2002 Annual Averages**

Day of Week	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Sunday	30 (12%)	5 (15%)	2 (12%)	\$1.3 (10%)
Monday	30 (13%)	7 (19%)	2 (12%)	\$1.8 (15%)
Tuesday	30 (13%)	0 (0%)	2 (12%)	\$1.7 (14%)
Wednesday	40 (16%)	4 (12%)	2 (13%)	\$0.7 (6%)
Thursday	40 (16%)	7 (20%)	5 (29%)	\$3.5 (28%)
Friday	30 (14%)	6 (16%)	0 (0%)	\$2.6 (21%)
Saturday	40 (16%)	7 (19%)	4 (21%)	\$0.8 (6%)
Total	230 (100%)	35 (100%)	19 (100%)	\$12.4 (100%)
Daily average	30 (14%)	5 (14%)	3 (14%)	\$1.8 (14%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the day of week was unknown or not reported have been allocated proportionally among fires with known day of week.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Time of Day
1999-2002 Annual Averages**

Time of Day	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
12:00 - 2:59 a.m.	10 (4%)	3 (9%)	2 (12%)	\$0.8 (7%)
3:00 - 5:59 a.m.	10 (3%)	0 (0%)	0 (0%)	\$0.3 (2%)
6:00 - 8:59 a.m.	30 (13%)	1 (3%)	1 (4%)	\$2.1 (17%)
9:00 - 11:59 a.m.	50 (22%)	15 (42%)	2 (8%)	\$2.3 (19%)
Noon - 2:59 p.m.	40 (18%)	5 (13%)	5 (25%)	\$0.9 (7%)
3:00 - 5:59 p.m.	50 (21%)	4 (11%)	9 (46%)	\$3.3 (27%)
6:00 - 8:59 p.m.	30 (14%)	3 (7%)	1 (4%)	\$1.0 (8%)
9:00 - 11:59 p.m.	10 (7%)	5 (14%)	0 (0%)	\$1.8 (15%)
Total	230 (100%)	35 (100%)	19 (100%)	\$12.4 (100%)
Average	30 (13%)	4 (13%)	2 (13%)	\$1.6 (13%)

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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Fixed Property Use
1999-2002 Annual Averages**

Fixed Property Use	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Aircraft taxi-way	40 (17%)	0 (0%)	0 (0%)	\$2.8 (23%)
Aircraft runway	30 (14%)	3 (7%)	4 (21%)	\$1.7 (14%)
Aircraft loading area	30 (13%)	0 (0%)	0 (0%)	\$1.1 (9%)
Open land or field	30 (12%)	8 (22%)	4 (22%)	\$1.4 (11%)
Unclassified outside or special property	10 (7%)	6 (18%)	4 (20%)	\$0.5 (4%)
Street, road or driveway	10 (6%)	0 (0%)	0 (0%)	\$0.1 (1%)
Airport passenger terminal	10 (3%)	0 (0%)	1 (4%)	\$0.3 (3%)
Highway or divided highway	10 (2%)	0 (0%)	0 (0%)	\$0.0 (0%)
Forest, timberland or woodland	10 (2%)	10 (28%)	0 (0%)	\$0.0 (0%)
Other known property use	30 (15%)	7 (19%)	6 (33%)	\$3.7 (30%)
Unclassified or unknown-type property use	20 (8%)	2 (6%)	0 (0%)	\$0.6 (5%)
Total	230 (100%)	35 (100%)	19 (100%)	\$12.4 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Unknowns have been allocated proportionally.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Cause
1999-2002 Annual Average**

Cause	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Failure of equipment or heat source	130 (55%)	9 (24%)	4 (24%)	\$6.3 (51%)
Unintentional	80 (35%)	26 (73%)	14 (76%)	\$5.5 (44%)
Unclassified cause	20 (7%)	1 (2%)	0 (0%)	\$0.5 (4%)
Other known cause	10 (2%)	0 (0%)	0 (0%)	\$0.2 (1%)
Total	230 (100%)	35 (100%)	19 (100%)	\$12.4 (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, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the cause was under investigation, undetermined or not reported were allocated proportionally among fires with known cause.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Factor Contributing to Ignition
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct (Property Damage)
Unclassified mechanical failure or malfunction	29%	0%	0%	52%
Collision, knock-down or overturn	18%	64%	56%	21%
Unclassified factor contributed to ignition	7%	21%	15%	7%
Leak or break	7%	0%	0%	2%
Backfire	7%	0%	0%	1%
Equipment not operated properly	6%	0%	0%	4%
Unclassified electrical failure or malfunction	4%	0%	0%	0%
Unclassified natural condition	3%	10%	15%	6%
Heat source too close to combustible material.	3%	0%	0%	0%
Improper startup	3%	0%	0%	0%
Unspecified short circuit arc	2%	0%	0%	0%
Arc or spark from operating equipment	2%	0%	0%	0%
Storm	2%	5%	15%	3%
Playing with heat source	1%	0%	0%	4%
Worn out	1%	0%	0%	0%
Abandoned or discarded material or product	1%	0%	0%	0%
Flammable liquid or gas spilled	1%	0%	0%	0%
Washing part painting with flammable liquid	1%	0%	0%	0%
Unclassified operational deficiency	1%	0%	0%	0%
Unclassified mechanical failure or malfunction	29%	0%	0%	52%
Collision, knock-down or overturn	18%	64%	56%	21%
Unclassified factor contributed to ignition	7%	21%	15%	7%

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 16%, deaths - 5%, injuries – 16%, property damage – 12%) or fires with “none” (fires - 28%, deaths - 26%, injuries – 11%, property damage – 32%) generally exceeded those for undetermined (fires - 9%, deaths - 16%, injuries – 33%, property damage – 4%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Factor Contributing to Ignition Grouping
1999-2002 Fires Reported to U.S. Fire Departments in NFIRS Version 5.0**

Factor Contributing to Ignition	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage
Mechanical failure or malfunction	44%	0%	0%	55%
Leak or break	7%	0%	0%	2%
Backfire	7%	0%	0%	1%
Worn out	1%	0%	0%	0%
Unclassified mechanical failure or malfunction	29%	0%	0%	52%
Operational deficiency	28%	64%	56%	25%
Collision, knock-down or overturn	18%	64%	56%	21%
Equipment not operated properly	6%	0%	0%	4%
Improper startup	3%	0%	0%	0%
Unclassified operational deficiency	1%	0%	0%	0%
Electrical failure or malfunction	9%	0%	0%	0%
Unspecified short circuit arc	2%	0%	0%	0%
Arc or spark from operating equipment	2%	0%	0%	0%
Unclassified electrical failure or malfunction	4%	0%	0%	0%
Misuse of material or product	8%	0%	0%	4%
Heat source too close to combustible material.	3%	0%	0%	0%
Playing with heat source	1%	0%	0%	4%
Abandoned or discarded material or product	1%	0%	0%	0%
Flammable liquid or gas spilled	1%	0%	0%	0%
Washing part painting with flammable liquid	1%	0%	0%	0%
Natural condition	6%	15%	29%	9%
Unclassified natural condition	3%	10%	15%	6%
Storm	2%	5%	15%	3%
Unclassified factor contributed to ignition	7%	21%	15%	7%

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. More than one factor contributing to ignition may be entered per incident. Fires, in which the factor contributing to ignition was undetermined, not reported, or coded as “none” were allocated proportionally among fires with known factor contributing to ignition. Although this field is not required for fires that were coded as intentionally set or attributed to a cause of “other”, the share of incidents with unreported data (fires - 16%, deaths - 5%, injuries - 16%, property damage - 12%) or fires with “none” (fires - 28%, deaths - 26%, injuries - 11%, property damage - 32%) generally exceeded those for undetermined (fires - 9%, deaths - 16%, injuries - 33%, property damage - 4%) suggesting that this type of allocation would be most appropriate.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Heat Source
1999-2002 Annual Averages**

Heat Source	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Heat from unclassified powered equipment	40 (19%)	8 (23%)	8 (42%)	\$1.5 (12%)
Radiated or conducted heat from operating equipment	40 (17%)	9 (26%)	2 (10%)	\$2.2 (18%)
Unclassified heat source	30 (13%)	8 (23%)	6 (31%)	\$0.6 (5%)
Spark, ember or flame from operating equipment	20 (11%)	1 (2%)	3 (16%)	\$2.6 (21%)
Heat or spark from friction	20 (11%)	0 (0%)	0 (0%)	\$1.0 (8%)
Arcing	20 (9%)	3 (9%)	0 (0%)	\$0.5 (4%)
Backfire from internal combustion engine	10 (6%)	0 (0%)	0 (0%)	\$0.1 (1%)
Unclassified hot or smoldering object	10 (5%)	2 (7%)	0 (0%)	\$0.4 (4%)
Heat from unclassified or unknown-type open flame or smoking materials	10 (3%)	0 (0%)	0 (0%)	\$0.4 (4%)
Other known heat source	10 (6%)	3 (9%)	0 (0%)	\$3.0 (24%)
Total	230 (100%)	35 (100%)	19 (100%)	\$12.4 (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 an injury to the nearest one and direct property is rounded damage to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the heat source was undetermined or not reported were allocated proportionally among fires with known heat source.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Area of Fire Origin
1999-2002 Annual Averages**

Area of Fire Origin	Fires	Civilian Deaths	Civilian Injuries	Direct Property Damage (in Millions)
Engine area, running gear or wheel area	120 (51%)	11 (30%)	5 (29%)	\$5.5 (44%)
Fuel tank or fuel line	20 (11%)	4 (10%)	6 (33%)	\$2.6 (21%)
Unclassified vehicle area	20 (8%)	2 (5%)	7 (38%)	\$2.3 (19%)
Operator or passenger area of vehicle	20 (7%)	2 (5%)	0 (0%)	\$0.4 (3%)
Unclassified area of origin	10 (4%)	2 (5%)	0 (0%)	\$0.1 (1%)
Exterior or exposed surface of vehicle	10 (4%)	7 (20%)	0 (0%)	\$0.2 (2%)
Separate operator or control area of vehicle	10 (3%)	0 (0%)	0 (0%)	\$0.2 (2%)
Open outside area, including farmland or field	10 (2%)	3 (8%)	0 (0%)	\$0.1 (0%)
Unclassified outside area	10 (2%)	2 (6%)	0 (0%)	\$0.2 (2%)
Other known area	20 (7%)	4 (11%)	0 (0%)	\$0.9 (8%)
Total	230 (100%)	35 (100%)	19 (100%)	\$12.4 (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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. Fires in which the area or origin was unknown or not reported were allocated proportionally among fires with known area of origin.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires, by Item First Ignited
1999-2002 Annual Averages**

Item First Ignited	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Flammable or combustible liquid or gas, including accelerants, aerosols, and atomized vapor	120	(51%)	24	(67%)	15	(83%)	\$10.9	(88%)
Unclassified item first ignited	40	(16%)	4	(11%)	2	(11%)	\$0.3	(3%)
Electrical wire, cable insulation	30	(12%)	0	(0%)	0	(0%)	\$0.2	(1%)
Tire	10	(6%)	2	(7%)	0	(0%)	\$0.2	(2%)
Multiple items first ignited	10	(6%)	5	(15%)	1	(6%)	\$0.7	(6%)
Other known item	20	(8%)	0	(0%)	0	(0%)	\$0.0	(0%)
Total	230	(100%)	35	(100%)	19	(100%)	\$12.4	(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 is rounded to the nearest hundred thousand dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were 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 were allocated proportionally among fires with known item first ignited.

Source: NFIRS and NFPA survey.

**U.S. Air Transport Vehicle Fires in which a Flammable or Combustible Liquid or Gas was
the Item First Ignited by Type of Material First Ignited
1999-2002 Annual Averages**

Type of Material	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Gasoline	40	(38%)	5	(22%)	5	(33%)	\$1.7	(15%)
Class IB flammable liquid, including acetone, JP-4 jet fuel and methyl ethyl ketene	30	(25%)	9	(38%)	8	(53%)	\$7.2	(66%)
Unclassified or unknown-type flammable or combustible liquid	10	(11%)	1	(6%)	2	(13%)	\$0.2	(2%)
Unclassified or unknown-type flammable gas	10	(8%)	1	(3%)	0	(0%)	\$0.3	(2%)
Class II combustible liquid, including kerosene, numbers 1 and 2 fuel oil and diesel fuel	10	(6%)	0	(0%)	0	(0%)	\$0.6	(5%)
Class IA flammable liquid, including ether and pentane	10	(5%)	8	(32%)	0	(0%)	\$0.1	(1%)
Other known type of material	10	(7%)	0	(0%)	0	(0%)	\$0.9	(8%)
Total	120	(100%)	24	(100%)	15	(100%)	\$10.9	(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 hundred, civilian deaths and injuries to the nearest ten, and direct property damage is rounded to the nearest million dollars. Sums may not equal totals due to rounding errors. Property damage figures are not adjusted for inflation. Percentages were calculated on the actual estimates, so two figures with the same rounded-off estimates may have different percentages. This table includes a proportional share of fires in which the item first ignited was unknown or not reported. Fires in which the type of material first ignited was unknown or not reported were allocated proportionally among fires with known type of material first ignited.

Source: NFIRS and NFPA survey.

Appendix A: How National Estimates Statistics Are Calculated

Estimates are made using the National Fire Incident Reporting System (NFIRS) of the Federal Emergency Management Agency's (FEMA's) United States Fire Administration (USFA), supplemented by the annual stratified random-sample survey of fire experience conducted by the NFPA (National Fire Protection Association), which is used for calibration.

Databases Used

NFIRS provides annual computerized data bases of fire incidents, with data classified according to a standard format based on the NFPA 901 Standard. Roughly three-fourths of all states have NFIRS coordinators, who receive fire incident data from participating fire departments and combine the data into a state database. These data are then transmitted to FEMA/USFA. Participation by the states, and by local fire departments within participating states, is voluntary. NFIRS captures roughly one-third to one-half of all U.S. fires each year. More than one-third of all U.S. fire departments are listed as participants in NFIRS, although not all of these departments provide data every year.

The strength of NFIRS is that it 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. (The NFPA survey separates fewer than 20 property use categories and solicits no cause-related information except for intentional fires.) NFIRS also captures information on area of origin, material first ignited and on the performance of detectors and sprinklers.

The NFPA survey is based on a stratified random sample of roughly 3,000 U.S. fire departments (or just over one of every ten fire departments in the country). 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 by the NFPA 901 Standard or Version 5.0 of NFIRS; (2) the number of on-duty firefighter injuries, by type of duty and nature of illness; and (3) information on the type of community protected (e.g., county versus township versus city) and the size of the population protected, which is used in the statistical formula for projecting national totals from sample results.

The NFPA survey begins with the NFPA Fire Service Inventory, a computerized file of about 30,000 U.S. fire departments, which is the most complete and thoroughly validated such listing in existence. The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities protect fewer people per department and are less likely to respond to the survey, so a large 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. NFPA also follows up to confirm that vehicle fire deaths actually resulted from a fire, not an injury caused by trauma.) 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.

Projecting NFIRS to National Estimates

To project NFIRS results to national estimates, one needs at least an estimate of the NFIRS fires as a fraction of the total so that the fraction can be inverted and used as a multiplier or scaling ratio to generate national estimates from NFIRS data. But NFIRS is a sample from a universe whose size cannot be inferred from NFIRS alone. Also, participation rates in NFIRS are not necessarily uniform across regions and sizes of community. Both factors are 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 data base - 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.

There are separate projection formulas for four major property classes (residential structures, non-residential structures, vehicles, and other) and for each measure of fire severity (fire incidents, civilian deaths, and civilian injuries, and direct property damage).

For example, the scaling ratio for 1998 civilian deaths in residential structures is equal to the total number of 1998 civilian deaths in residential structure fires reported to fire departments, according to the NFPA survey (3,250), divided by the total number of 1998 civilian deaths in residential structure fires reported to NFIRS (1,224). Therefore, the scaling ratio is $3,250/1,224 = 2.66$.

The scaling ratios for civilian deaths and injuries and direct property damage are often significantly different from those for fire incidents. Except for fire service injuries, average severity per fire is generally higher for NFIRS than for the NFPA survey. Use of different scaling ratios for each measure of severity is equivalent to assuming that these differences are due either to NFIRS under-reporting of small fires, resulting in a higher-than-actual loss-per-fire ratio, or possible biases in the NFIRS sample representation by region or size of community, resulting in severity-per-fire ratios characteristic only of the oversampled regions or community sizes.

Note that this approach also means that the NFPA survey results for detailed property-use classes (e.g., fires in storage structures) may not match the national estimates of the same value.

Calculating National Estimates of Particular Types of Fires

Most analyses of interest involve the calculation of the estimated number of fires not only within a particular occupancy but also of a particular type. The types that are mostly frequently of interest are those defined by some ignition-cause characteristic. The six

cause-related characteristics most commonly used to describe fires are: form of heat of ignition or heat source that caused the ignition, equipment involved in ignition, form or item and type of material first ignited, the ignition factor or factor contributing to ignition that brought heat source and ignited material together, and area of origin. Version 5.0 added a cause field in which fires can be classified as intentional, unintentional, or resulting from the failure of equipment or heat source. Other characteristics of interest are victim characteristics, such as ages of persons killed or injured in fire.

For any characteristic of interest in NFIRS, some reported fires have that characteristic unknown or not reported. If the unknowns are not taken into account, then the propensity to report or not report a characteristic may influence the results far more than the actual patterns on that characteristic. For example, suppose the number of fires remained the same for several consecutive years, but the percentage of fires with cause unreported steadily declined over those years. If the unknown-cause fires were ignored, it would appear as if fires due to every specific cause increased over time while total fires remained unchanged. This, of course, does not make sense.

Consequently, most national estimates analyses allocate unknowns. This is done by using scaling ratios defined by NFPA survey estimates of totals divided by only those NFIRS fires for which the dimension in question was known and reported. This approach is equivalent to assuming that the fires with unreported characteristics, if known, would show the same proportions as the fires with known characteristics. For example, it assumes that the fires with unknown ignition factor contain the same relative shares of child-playing fires, incendiary-cause fires, short circuit fires, and so forth, as are found in the fires where ignition factor was reported.

In this report, unknown areas of origin, ignition factors or factors contributing to ignition, forms or items of material first ignited, and types of material first ignited were allocated over the known. Only those factors which rounded to at least 100 fires for highway vehicles or 10 fires (i.e., averaged at least 5 fires a year) for other vehicles and had a 1% or greater share of fires were listed separately. Anything else was grouped in the “other known” category.

On the tables showing ignition factor groupings, the group or category heading was listed even if the number of fires rounded to less than ten or one percent. The values listed in the ignition factor group headings add up to the total for that vehicle classification. Specific factors contributing to ignition were included in these tables only if they met the threshold cited in the previous paragraph. Consequently, the entries within a factor contributing to ignition group often do not sum to the group total. If the unclassified and unknown-type data combination in a group met or exceeded the threshold, this value was listed after those for which the specific ignition factor or type of material was known.

In the highway vehicle section, fires were rounded to the nearest hundred, civilian deaths and injuries were rounded to the nearest ten, and direct property damage was rounded to the nearest million. In all other sections, fires were rounded to the nearest ten, deaths and injuries were rounded off to the nearest one, and direct property damage was rounded to

the nearest hundred thousand. Inflation adjustments are provided in trend tables only. The annual averages are not adjusted for inflation. Because of rounding errors, the four-year annual averages may differ slightly from that obtained from averages based on the fire problem by year.

Version 5.0 of NFIRS changed, added and dropped some of the codes used and some of the coding rules. Much of the former “Ignition Factor” converts to “Factor Contributing to Ignition.” However, incendiary and suspicious convert to intentional in the cause category. Fires that had been coded as incendiary or suspicious or that resulted from one of several human factors have been removed from and left blank in “Factor Contributing to Ignition” because they are captured elsewhere. Some codes from Form of Heat of Ignition (particularly electrical codes) convert to “Factor Contributing to Ignition.” Because two entries are allowed for this field, the conversion process causes some double counting of certain factors. In Version 5.0, “none” is also a valid choice for this field.

Version 5.0 also introduced three digit incident types, which in some cases; identify a class of mobile property type. However, all vehicle fires that were collected in an older version converted to “other vehicle fire.” In addition, the mobile property type is no longer required if the vehicle was not involved in the ignition. In practice, it appears that fire departments are entering this information for most fires. This analysis used mobile property type to assign the vehicles to a specific property class.

No allocation of unknowns was done for mobile property type or fixed property use. Consequently, the estimated number of highway vehicles is lower in this analysis than in the estimates derived from NFPA’s annual fire department survey.

Rounding Errors

The possibility of rounding errors exists in all our calculations. One of the notes on each table indicates the extent of rounding for that table, e.g., deaths rounded to the nearest one, fires rounded to the nearest hundred, property damage rounded to the nearest hundred thousand dollars. In rounding to the nearest one, functional values of 0.5 or more are rounded up and functional values less than 0.5 are rounded down. For example, 2.5 would round to 3, and 3.4 would round to 3. In rounding to the nearest one, a stated estimate of 1 could be any number from 0.5 to 1.49, a roughly threefold range.

The impact of rounding is greatest when the stated number is small relative to the degree of rounding. As noted, rounding to the nearest one means that stated values of 1 may vary by a factor of three. Similarly, the cumulative impact of rounding error - the potential gap between the estimated total and the sum of the estimated values as rounded - is greatest when there are a large number of values and the total is small relative to the extent of rounding.

Suppose a table presented 5-year averages of estimated deaths by item first ignited, all rounded to the nearest one. Suppose there were a total of 30 deaths in the 5 years, so the total average would be $30/5 = 6$.

In case 1, suppose 10 of the possible items first ignited each accounted for 3 deaths in 5 years. Then there would be 10 entries of $3/5 = 0.6$, rounded to 1, and the sum would be 10, compared to the true total of 6.

In case 2, suppose 15 of the possible items first ignited each accounted for 2 deaths in 5 years. Then there would be 15 entries of $2/5 = 0.4$, rounded to 0, and the sum would be 0, compared to the true total of 6.

Here is another example: Suppose there was an estimate of 7 deaths total in 1994 through 1998. The 5-year average would be 1.4, which would round to 1; the number we would show as the total. Each death would represent a 5-year average of 0.2.

If those 7 deaths split as 4 deaths in one category (e.g., smoking) and 3 deaths in a second category (e.g., heating), then we would show $4 \times 0.2 = 0.8$ deaths per year for smoking and $3 \times 0.2 = 0.6$ deaths per year for heating. Both would round to 1, there would be two entries of 1, and the sum would be 2, higher than the actual rounded total.

If those 7 deaths split as 1 death in each of 7 categories (quite possible since there are 12 major cause categories), then we would show 0.2 in each category, always rounding to 0, and the sum would be 0, lower than the actual rounded total. The more categories there are, the farther apart the sum and total can -- and often do -- get.

Note that percentages are calculated from unrounded values, and so it is quite possible to have a percentage entry of up to 100%, even if the rounded number entry is zero.