

**U.S. STRUCTURE FIRES IN
STORES AND OTHER MERCANTILE PROPERTIES**

**Ben Evarts
January 2011**



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

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Abstract

Stores and other mercantile properties include an assortment of different types of stores, facilities providing personal services such as barber and beauty shops, laundry or dry cleaning shops, service stations, vehicle or other repair shops and businesses selling professional supplies or services. During 2004-2008, an estimated average of 16,360 structure fires were reported in these properties, causing an annual average of 13 civilian deaths, 242 civilian fire injuries, and \$648 million in direct property damage. Cooking equipment was the leading cause of these fires. Electrical distribution and lighting equipment ranked second, followed by heating equipment, and intentionally set fires. Only 26% of the fires occurred between 9:00 p.m. and 5:00 a.m. but these fires accounted for 48% of the direct property damage. These estimates are based on data from the U.S. Fire Administration's (USFA) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA) annual fire department experience survey.

Keywords: fire statistics, store, mercantile, business, non-residential, laundry, dry cleaning, gas stations, convenience store

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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.

For more information about the National Fire Protection Association, visit www.nfpa.org or call 617-770-3000. To learn more about the One-Stop Data Shop go to www.nfpa.org/osds or call 617-984-7443.

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Executive Summary

During the five-year period of 2004-2008, NFPA estimates that U.S. fire departments responded to an average of 16,360 structure fires in stores and other mercantile properties per year. These fires caused an annual average of 13 civilian deaths, 242 civilian fire injuries, and \$648 million in direct property damage. Reported fires in this occupancy group fell 57% from 37,500 in 1980 to 16,200 in 2008.

Stores and other mercantile properties include an assortment of different types of stores, facilities providing personal services such as barber and beauty shops, laundry or dry cleaning shops, service stations, vehicle or other repair shops and businesses selling professional supplies or services, retail stores, and recreational, hobby, home repair sales, or pet stores. Grocery stores or other stores selling food or beverages accounted for more than one in every four (27%) of these fires.

Fires that occurred during off-business hours caused considerably more damage per fire on average than those fires that occurred during the day. Fires that occurred between 9:00 p.m. and 5:00 a.m. caused an average of \$75,000 of property damage each, while those occurring between 5:00 a.m. and 9:00 p.m. caused an average of \$29,000 of property loss each.

Cooking equipment was involved in 19% of the fires in stores and other mercantile properties. However, only 6% of the direct property damage resulted from cooking fires. Electrical distribution and lighting equipment was involved in 12% of the fires and 19% of property damage. The 10% of fires that were intentional caused 16% of the property damage. Heating equipment was involved in 11% of the fires and 9% of the property damage. Smoking materials started 9% and clothes dryer or washers were involved in 9% of the ignitions.

Sixteen percent of the fires in stores and other mercantile properties began in the kitchen or cooking area; these fires caused 4% of the direct property damage. Five percent of the fires began in the laundry room or area (likely due to the fact that laundries and dry cleaning businesses are included in this group of occupancies). No other area of origin accounted for more than 4% of all fires.

Three-quarters (77%) of the fires were confined to the room of origin.

Individuals interested in keeping stores and other mercantile properties safe should consult *NFPA 101: Life Safety Code*® for information about reducing fires and associated losses. www.nfpa.org/101

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U.S. Stores and other Mercantile Property Structure Fires

U. S. fire departments responded to an estimated average of **16,360** structure fires on stores and other mercantile properties per year during 2004-2008. These fires caused annual averages of

- **13** civilian fire deaths
- **242** civilian fire injuries
- **\$648** million in direct property damage

Fires in this occupancy group fell 57% from 37,500 in 1980 to 16,200 in 2010

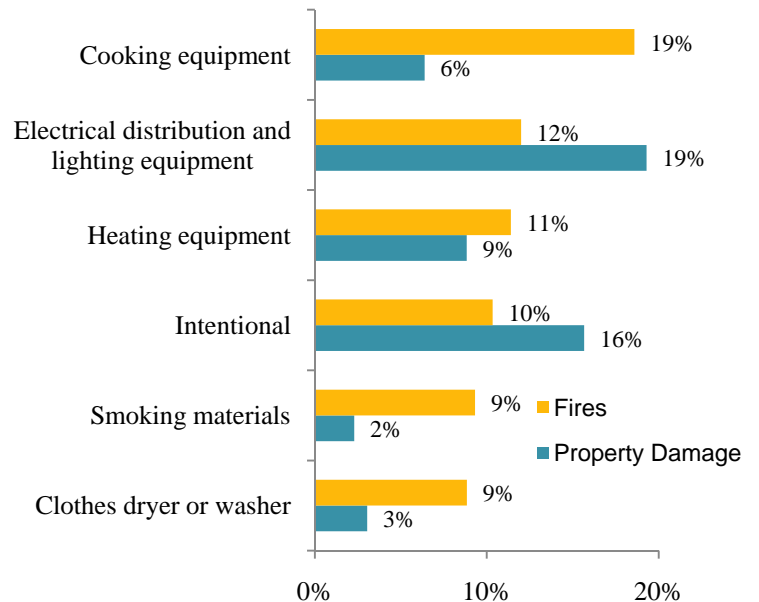
Leading Causes of Structure Fires in Stores and Other Mercantile Properties, 2004-2008

One of every five fires in these properties was caused by cooking. Most of these fires were minor.

Electrical distribution and lighting was the second leading cause.

10% of these fires were intentional, but they accounted for 16% of the direct property damage.

Smoking materials caused 9% of the fires, as did clothes dryer or washers.



- During 2004-2008, fires that occurred between 9:00 p.m. and 5:00 a.m. caused an average of \$75,000 of property damage each, while those occurring between 5:00 a.m. and 9:00 p.m. caused an average of \$29,000 of property loss each.
- The presence of wet pipe sprinklers in stores and other mercantile properties reduced property loss per fire by 31%

Structure Fires in Stores and Other Mercantile Properties

This report contains information about properties that include an assortment of different types of stores, facilities providing personal services such as barber and beauty shops, laundry or dry cleaning shops, service stations, vehicle or other repair shops and businesses selling professional supplies or services.

16,360 structure fires, on average, were reported in these properties per year in 2004-2008.

These fires caused an annual average of 13 civilian deaths, 242 civilian fire injuries, and \$648 million in direct property damage*. Grocery stores or other stores selling food or beverages accounted for more than one in every four (27%) of these fires. The table below provides a more detailed breakdown of losses by occupancy. One third (34%) of the injuries occurred at motor vehicle or boat sales, services, or repair properties. (See Table A.)

Table A.
Structure Fires in Stores and Other Mercantile Properties by Property Use
2004-2008 Annual Averages

Occupancy	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)*	
Grocery or convenience store	4,500	(27%)	2	(12%)	45	(18%)	\$103	(16%)
<i>Food and beverage sales or other grocery store</i>	3,540	(22%)	1	(8%)	36	(15%)	\$84	(13%)
<i>Convenience store</i>	960	(6%)	1	(5%)	9	(4%)	\$19	(3%)
Unclassified or unknown-type mercantile or business	3,050	(19%)	3	(22%)	29	(12%)	\$147	(23%)
Service station or vehicle sales, service or repair	2,290	(14%)	3	(25%)	83	(34%)	\$124	(19%)
<i>Motor vehicle or boat sales, services, repair</i>	1,700	(10%)	3	(21%)	67	(28%)	\$112	(17%)
<i>Service station or gas station</i>	600	(4%)	1	(4%)	15	(6%)	\$12	(2%)
Laundry, dry cleaning, professional supplies or services	1,830	(11%)	1	(8%)	26	(11%)	\$53	(8%)
<i>Laundry or, dry cleaning</i>	1,270	(8%)	1	(6%)	17	(7%)	\$26	(4%)
<i>Professional supplies or services</i>	560	(3%)	0	(2%)	9	(4%)	\$27	(4%)
Specialty shop	1,710	(10%)	3	(20%)	21	(9%)	\$86	(13%)
Department store or unclassified general retail	1,400	(9%)	1	(5%)	16	(7%)	\$60	(9%)
<i>Unclassified general retail</i>	860	(5%)	1	(5%)	8	(3%)	\$39	(6%)
<i>Department or discount store</i>	540	(3%)	0	(0%)	8	(3%)	\$21	(3%)
Personal Service, recreational or home repair	800	(5%)	0	(3%)	11	(4%)	\$26	(4%)
<i>Personal service, including barber and beauty shops</i>	560	(3%)	0	(3%)	6	(3%)	\$15	(2%)
<i>Recreational, hobby, home repair sales or pet store</i>	240	(1%)	0	(0%)	5	(2%)	\$12	(2%)
Textile, or apparel sales	390	(2%)	0	(0%)	7	(3%)	\$17	(3%)
Household goods sales or repairs	390	(2%)	1	(5%)	5	(2%)	\$31	(5%)
Totals	16,360	(100%)	13	(100%)	242	(100%)	\$648	(100%)

*One unusually large fire with \$200,000,000 in property damage was excluded from the analysis

Source: NFIRS 5.0 and NFPA survey.

Fire department statistics are derived from NFIRS and NFPA survey.

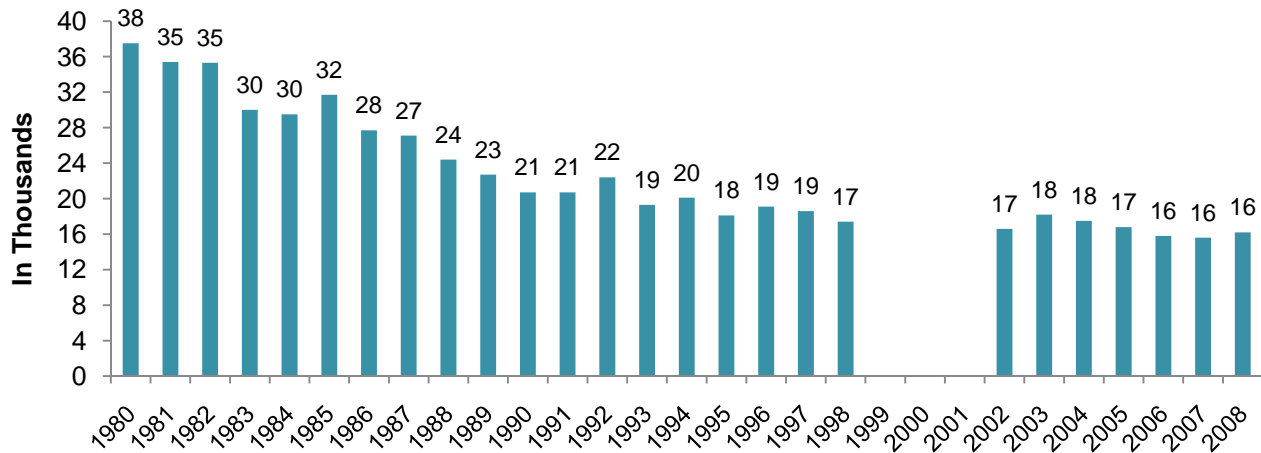
The estimates presented thus far (except for trend data) are projections derived from the detailed information reported in Version 5.0 of the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) combined with data from NFPA's annual fire department experience survey. NFIRS 5.0 was first introduced in some jurisdictions in 1999 and its use has steadily increased since then. Data collected in older versions were excluded from the analysis of 1999 and later data. In order to expedite the reporting process, NFIRS 5.0 does not require causal information for six categories of confined structure fires, including cooking fires confined to the cooking vessel, confined chimney or flue fires, confined incinerator fire, confined fuel burner or boiler fire or delayed ignition, confined commercial compactor fire, and trash or rubbish fires in a structure with no flame damage to the structure or its contents. Although causal information is not required for these incidents, it is provided in some cases. These fires were also excluded from the analysis.

In NFIRS 5.0, fires in stores and other mercantile properties are identified by property use codes 500-589. Estimates for causal factors include a proportional share of fires with unknown data. Annual averages were calculated from the five-year totals rather than the individual year's estimates. Due to the small numbers, deaths are not shown in the supporting tables.

Since 1980, fires in stores and other mercantile properties have fallen 57%.

Fires in this occupancy group fell 57% from 37,500 in 1980 to 16,200 in 2008. Version 5.0 of NFIRS was first introduced in 1999. Fire departments gradually adopted it. Estimates for the transition years of 1999-2001 are more volatile and should be viewed with caution. They are shown in Table 1 but not in Figure 1. There is no evidence of a systematic shift up or down in the estimates due to the introduction of NFIRS 5.0.

Figure 1. Reported Structure Fires in Stores and Other Mercantile Properties by Year 1980-2008



Source: NFIRS and NFPA survey. See note for Table 1.

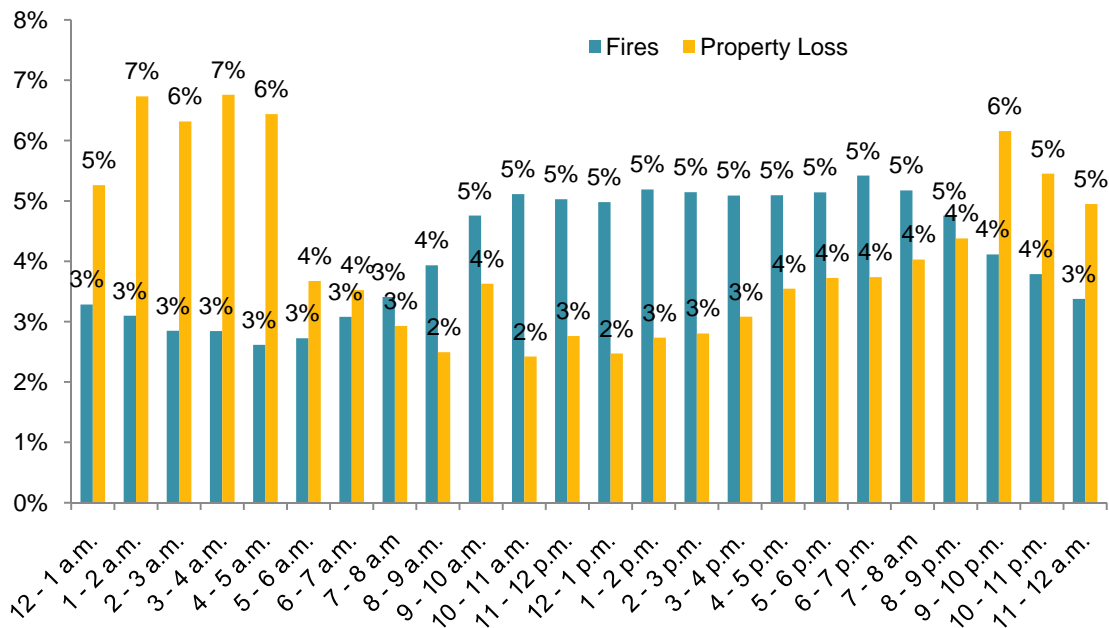
3.1% of all reported structure fires occurred in stores and other mercantile properties.

During 2004-2008, the 16,360 fires in stores and other mercantile properties accounted for 3.1% of all 521,300 reported structure fires per year, 0.4% of the 3,000 civilian structure fire deaths, 1.6% of the 15,100 civilian structure fire injuries, and 6.5% of the \$10 billion in annual direct property loss.

Fires are more common during the day but property loss per fire is greater during off-hours

Tables 2, 3, and 4 show reported structure fires in these properties by month, day of week and time of day, respectively. January was the peak month for fires in these establishments. December ranked second and March third. The variation, however, was small. The smallest number of fires occurred on Sundays. Figure 2 shows fires and property loss by time of day. Fires, (and civilian injuries) are more likely during the daytime hours when these properties are in use, however, property damage spikes during the late evening and early morning hours, when there are fewer people around. Fires that occurred during off-business hours caused considerably more damage than those fires that occurred during the day. Fires that occurred between 9:00 p.m. and 5:00 a.m. caused an average of \$75,000 of property damage each, while those occurring between 5:00 a.m. and 9:00 p.m. caused an average of \$29,000 of property loss each. This finding underscores the need for automatic detection and suppression equipment to protect property.

Figure 2. Reported Structure Fires in Stores and Other Mercantile Properties by Alarm Time, 2004-2008



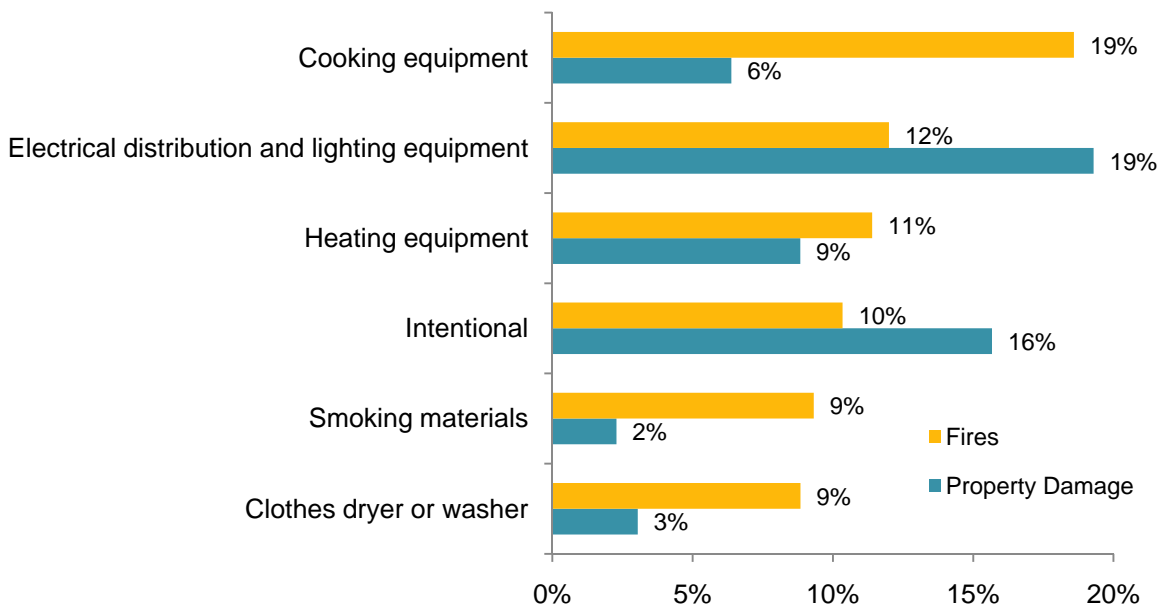
Source: NFIRS 5.0 and NFPA survey.

Cooking equipment was involved in one of every five (19%) of these fires.

Table 5 shows the leading causes of fires in these properties with five characteristics related to cause: equipment involved in ignition, heat source, the “cause” field, factor contributing to ignition, and incident type. The causes shown in this table are not mutually exclusive because they have been pulled from different fields. More detailed information on equipment involved in ignition may be found in Table 6, the cause of ignition in Table 7, factor contributing to ignition in Table 8, and heat source in Table 9. When equipment was involved in ignition, the equipment provided the heat of ignition but may not have malfunctioned.

Cooking equipment was involved in 19% of the fires in stores and other mercantile properties. However, only 6% of the direct property damage resulted from cooking fires, because most of these fires stayed small. Electrical distribution and lighting equipment was involved in 12% of the fires resulting in 19% of the direct property damage. The 11% of fires involving heating equipment caused 9% of the direct property damage. Intentionally set fires accounted for 10% of the fires and 16% of the dollar loss. Smoking materials caused 9% of fires and 2% of property damage, and clothes dryers or washers were responsible for 9% of fires and 3% of property damage in these occupancies.

Figure 3. Leading Causes of Structure Fires in Stores and Other Mercantile Properties, 2004-2008



Source: NFIRS and NFPA survey

Because stores and mercantile properties cover a wide variety of uses, different types of equipment are larger causes in different occupancies

Tables A, B, and C show equipment involved in ignition for laundry or dry cleaning; service stations or gas stations, motor vehicle or boat sales, services repair; and convenience stores, or food and beverage sales, grocery store properties respectively. Further refining property type this way shows that different properties are at risk from different types of equipment. In laundry or dry cleaning properties, clothes dryers were involved in 52% of fires, while only 1% in each of the other two categories (grocery, and gas stations). In service stations or vehicle sales or repair properties, heating equipment was involved in 20% of fires, while electrical distribution or lighting equipment was involved in 13%. In grocery or convenience stores, cooking equipment was involved in 42% of fires, and electrical distribution or lighting equipment was involved in 11% of fires.

Electrical or mechanical malfunctions were major factors contributing to ignition of fires in these properties

Table 8 shows that an electrical failure or malfunction was a factor in 24% of the fires and 30% of the direct property damage. Mechanical failure or malfunction was a factor in 14% of fires. Abandoned or discarded materials or products, failure to clean, and heat source too close to combustibles were all factors in 9% of the fires each. Exposure fires were 5% of total fires but accounted for 11% of the total property loss.

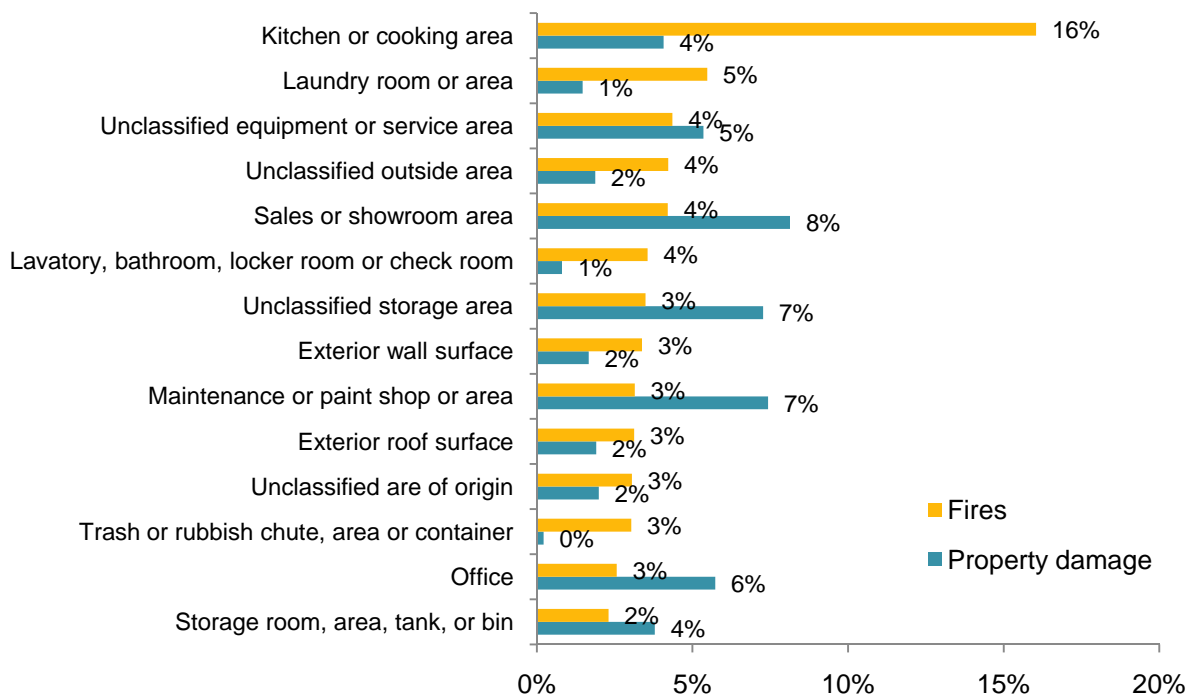
Unclassified heat from powered equipment, and radiated, conducted heat from operating equipment were the leading heat sources for fires in these occupancies.

Eighteen percent of fires had unclassified heat from powered equipment as the heat source, and 15% had radiated or conducted heat from operated equipment. Arcing was the heat source in 14% of fires. (See Table 9).

The kitchen was the most common area of origin for fires in these occupancies.

Figure 4 and Table 10 show that 16% of the reported fires in stores and other mercantile properties began in the kitchen or cooking area; these fires caused 4% of the direct property damage. Five percent of the fires began in the laundry room or area, partially because laundry, dry cleaning businesses are included in this occupancy group.

Figure 4. Leading Areas of Origin in Stores and Other Mercantile Properties, 2004-2008



Source: NFIRS and NFPA survey

In laundry or dry cleaning properties, 54% of fires started in a laundry room or area (See table 10A). In service stations and motor vehicle sales or repair occupancies, maintenance or paint shop areas (15%) and garage or vehicle storage areas (7%) were the most common areas of origin for fires. (See Table 10B)

Almost half of the injuries resulted from fires beginning with flammable or combustible liquids and gases or related items.

Twelve percent of fires in these properties began with food or other cooking materials. Ten percent began with the ignition of electrical wires or cable insulation. Flammable and combustible liquids and gases, piping and filter were first ignited in 9% of fires, these incidents caused 44% of the civilian injuries. Rubbish, trash or waste products were first ignited in 9% of these incidents. (See Table 11.)

Three-quarters of these fires were confined to the room of origin.

One third of the reported structure fires in stores and other mercantile properties had incident types that identified them as confined or contained fires. In addition to the 33% of contained or confined fires, 29% were coded with flame damage confined to the object of origin. Only 23% had damage that spread beyond the room of origin. (See Table 12.)

The presence of wet pipe sprinklers in stores and other mercantile properties reduced property loss per fire by 31%.

Twenty nine percent of these properties have some kind of automatic extinguishing equipment present. The most common type of Automatic Extinguishing System (AES) for these properties is wet pipe sprinklers (64% of AES in these properties). When wet pipe sprinklers are present they operated 91% of the time and operated *effectively* 87% of the time. In the (relatively few) instances where they should have operated but failed to do so, 61% of the time they were shut off before the fire started. When they operated but were not effective, 52% of the time, water did not reach the fire. In department stores and general retail stores, when sprinklers were present, they reduced average property loss per fire by 54%. Table 13 has additional information on automatic extinguishing equipment presence and effectiveness in these properties.

People who are looking for more information on how to protect these occupancies should refer to *NFPA 101: Life Safety Code*®, which provides fire prevention and mitigation procedures for these properties. www.nfpa.org/101

NFPA will be releasing a separate report on service station fires early in 2011.

**Table 1.
Structure Fires in Stores and Other Mercantile Properties, by Year
1980-2008**

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions)	
			As Reported*	In 2008 Dollars
1980	37,500	520	\$445	\$1,163
1981	35,400	541	\$561	\$1,325
1982	35,300	671	\$393	\$875
1983	30,000	707	\$410	\$884
1984	29,500	668	\$491	\$1,015
1985	31,700	560	\$550	\$1,098
1986	27,700	521	\$532	\$1,045
1987	27,100	525	\$462	\$874
1988	24,400	570	\$559	\$1,017
1989	22,700	501	\$440	\$764
1990	20,700	430	\$432	\$712
1991	20,700	347	\$452	\$713
1992	22,400	391	\$910	\$1,395
1993	19,300	560	\$447	\$665
1994	20,100	421	\$448	\$650
1995	18,100	347	\$386	\$545
1996	19,100	353	\$554	\$760
1997	18,600	334	\$448	\$600
1998	17,400	277	\$422	\$557
1999	16,300	305	\$493	\$637
2000	15,900	380	\$530	\$662
2001	18,100	344	\$757	\$919
2002	16,600	252	\$510	\$609
2003	18,200	265	\$612	\$717
2004	17,500	207	\$616	\$702
2005	16,800	224	\$595	\$655
2006	15,800	276	\$494	\$527
2007	15,600	210	\$645	\$669
2008	16,200	296	\$889	\$889

NFIRS 5.0 was first introduced in 1999, although participation was low. Estimates from 1999 on are based on Version 5.0 of NFIRS. Estimates for 1999-2001 are considered particularly unstable and should be used with caution.
 *One unusually large fire with \$200,000,000 in property damage was excluded from the analysis
 Source: NFIRS and NFPA survey. Inflation adjustments were based on the consumer price index found in the U.S. Census Bureau's *Statistical Abstract of the United States: 2010*, "Table 708, Purchasing Power of the Dollar."

Table 2.
Structure Fires in Stores and Other Mercantile Properties, by Month
2004-2008 Annual Averages

Month	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
January	1,530	(9%)	26	(11%)	\$54	(8%)
February	1,350	(8%)	28	(12%)	\$64	(10%)
March	1,460	(9%)	24	(10%)	\$61	(9%)
April	1,390	(8%)	19	(8%)	\$42	(6%)
May	1,370	(8%)	22	(9%)	\$58	(9%)
June	1,310	(8%)	18	(8%)	\$51	(8%)
July	1,330	(8%)	17	(7%)	\$56	(9%)
August	1,280	(8%)	22	(9%)	\$59	(9%)
September	1,200	(7%)	14	(6%)	\$50	(8%)
October	1,340	(8%)	18	(7%)	\$45	(7%)
November	1,330	(8%)	19	(8%)	\$55	(8%)
December	1,480	(9%)	16	(7%)	\$53	(8%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)
Average	1,360	(8%)	20	(8%)	\$54	(8%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 3.
Structure Fires in Stores and Other Mercantile Properties, by Day of Week
2004-2008 Annual Averages Based

Day	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	2,110	(13%)	25	(10%)	\$95	(15%)
Monday	2,390	(15%)	37	(15%)	\$97	(15%)
Tuesday	2,370	(14%)	37	(15%)	\$88	(14%)
Wednesday	2,350	(14%)	32	(13%)	\$86	(13%)
Thursday	2,410	(15%)	43	(18%)	\$94	(14%)
Friday	2,410	(15%)	35	(14%)	\$88	(14%)
Saturday	2,320	(14%)	34	(14%)	\$99	(15%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)
Average	2,340	(14%)	35	(14%)	\$93	(14%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 4.
Structure Fires in Stores and Other Mercantile Properties, by Alarm Time
2004-2008 Annual Averages

Alarm Time	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
	Count	(%)	Count	(%)	Count	(%)
Midnight-12:59 a.m.	540	(3%)	3	(1%)	\$34	(5%)
1:00-1:59 a.m.	510	(3%)	3	(1%)	\$44	(7%)
2:00-2:59 a.m.	470	(3%)	6	(3%)	\$41	(6%)
3:00-3:59 a.m.	470	(3%)	2	(1%)	\$44	(7%)
4:00-4:59 a.m.	430	(3%)	4	(2%)	\$42	(6%)
5:00-5:59 a.m.	450	(3%)	3	(1%)	\$24	(4%)
6:00-6:59 a.m.	500	(3%)	5	(2%)	\$23	(4%)
7:00-7:59 a.m.	560	(3%)	7	(3%)	\$19	(3%)
8:00-8:59 a.m.	640	(4%)	12	(5%)	\$16	(2%)
9:00-9:59 a.m.	780	(5%)	12	(5%)	\$24	(4%)
10:00-10:59 a.m.	840	(5%)	22	(9%)	\$16	(2%)
11:00-11:59 a.m.	820	(5%)	17	(7%)	\$18	(3%)
12:00-12:59 p.m.	810	(5%)	17	(7%)	\$16	(2%)
1:00-1:59 p.m.	850	(5%)	19	(8%)	\$18	(3%)
2:00-2:59 p.m.	840	(5%)	16	(7%)	\$18	(3%)
3:00-3:59 p.m.	830	(5%)	22	(9%)	\$20	(3%)
4:00-4:59 p.m.	830	(5%)	14	(6%)	\$23	(4%)
5:00-5:59 p.m.	840	(5%)	13	(5%)	\$24	(4%)
6:00-6:59 p.m.	890	(5%)	14	(6%)	\$24	(4%)
7:00-7:59 p.m.	850	(5%)	10	(4%)	\$26	(4%)
8:00-8:59 p.m.	780	(5%)	8	(3%)	\$28	(4%)
9:00-9:59 p.m.	670	(4%)	3	(1%)	\$40	(6%)
10:00-10:59 p.m.	620	(4%)	6	(2%)	\$35	(5%)
11:00-11:59 p.m.	550	(3%)	3	(1%)	\$32	(5%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)
Average	680	(4%)	10	(4%)	\$27	(4%)

Note: Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 5.
Leading Causes of Structure Fires in Stores and Other Mercantile Properties
2004-2008 Annual Averages

Causes	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment	3,040	(19%)	34	(14%)	\$41	(6%)
Electrical distribution and lighting equipment	1,960	(12%)	24	(10%)	\$125	(19%)
Heating equipment	1,870	(11%)	16	(7%)	\$57	(9%)
Intentional	1,690	(10%)	25	(10%)	\$102	(16%)
Smoking materials	1,530	(9%)	13	(5%)	\$15	(2%)
Clothes dryer or washer	1,450	(9%)	33	(14%)	\$20	(3%)
Exposure	850	(5%)	2	(1%)	\$69	(11%)
Torch, burner or soldering iron	410	(2%)	31	(13%)	\$20	(3%)
Shop tools and industrial equipment excluding torches, burners, and soldering irons	410	(2%)	29	(12%)	\$29	(4%)
Candle	250	(2%)	8	(3%)	\$8	(1%)

Note: This table summarizes findings from multiple fields, meaning that the same fire may be listed under multiple causes. The methodology is used is described in the appendix.

Source: NFIRS 5.0 and NFPA survey.

Table 6.
Structure Fires in Stores and Other Mercantile Properties
by Equipment Involved in Ignition
2004-2008 Annual Averages

Equipment Involved	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
No equipment involved	3,320	(20%)	48	(20%)	\$212	(33%)
Cooking equipment	3,040	(19%)	34	(14%)	\$41	(6%)
<i>Confined cooking fire</i>	2,410	(15%)	15	(6%)	\$1	(0%)
<i>Deep fryer</i>	150	(1%)	3	(1%)	\$8	(1%)
<i>Range with or without oven, cooking surface</i>	140	(1%)	6	(3%)	\$5	(1%)
<i>Portable cooking or warming equipment</i>	130	(1%)	3	(1%)	\$11	(2%)
<i>Oven, rotisserie</i>	80	(1%)	1	(1%)	\$5	(1%)
<i>Unclassified cooking equipment in non-confined fire</i>	130	(1%)	6	(3%)	\$11	(2%)
Electrical distribution and lighting equipment	1,960	(12%)	24	(10%)	\$125	(19%)
<i>Wiring or related equipment</i>	870	(5%)	8	(3%)	\$53	(8%)
<i>Lamp, bulb or lighting</i>	770	(5%)	11	(4%)	\$41	(6%)
<i>Transformer or power supply</i>	170	(1%)	3	(1%)	\$13	(2%)
<i>Cord or plug</i>	150	(1%)	3	(1%)	\$17	(3%)
<i>Other electrical distribution or lighting equipment</i>	0	(0%)	0	(0%)	\$0	(0%)
Heating equipment	1,870	(11%)	16	(7%)	\$57	(9%)
<i>Confined fuel burner or boiler fire</i>	700	(4%)	2	(1%)	\$0	(0%)
<i>Fixed or portable space heater</i>	440	(3%)	7	(3%)	\$33	(5%)
<i>Confined chimney or flue fire</i>	280	(2%)	0	(0%)	\$0	(0%)
<i>Central heating unit</i>	140	(1%)	0	(0%)	\$16	(2%)
<i>Water heater</i>	190	(1%)	6	(3%)	\$4	(1%)
<i>Other heating equipment</i>	120	(1%)	0	(0%)	\$4	(1%)
Contained trash or rubbish fire	1,740	(11%)	4	(2%)	\$0	(0%)
Clothes dryer	1,340	(8%)	29	(12%)	\$19	(3%)
Fan	500	(3%)	6	(2%)	\$18	(3%)
Torch, burner or soldering iron	410	(2%)	31	(13%)	\$20	(3%)
Other equipment involved in ignition	280	(2%)	5	(2%)	\$19	(3%)
Air conditioner	220	(1%)	0	(0%)	\$17	(3%)
Refrigerator or refrigerator/freezer	220	(1%)	5	(2%)	\$38	(6%)

Table 6.
Structure Fires in Stores and Other Mercantile Properties
by Equipment Involved in Ignition
2004-2008 Annual Averages, (Continued)

Equipment Involved	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Confined commercial compactor fire	150	(1%)	1	(0%)	\$0	(0%)
Other known equipment in non-confined fire	1,260	(8%)	38	(16%)	\$80	(12%)
Other confined fire	70	(0%)	0	(0%)	\$0	(0%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)

The estimates for equipment involved in ignition did not break out the confined fires further.

Note: Non-confined fires in which the equipment involved in ignition was unknown or not reported have been allocated proportionally among fires with known equipment involved. Fires in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Non-confined fires in which the equipment was partially unclassified (i.e., unclassified kitchen or cooking equipment, unclassified heating, cooling or air condition equipment, etc.) were allocated proportionally among fires that grouping (kitchen or cooking equipment; heating, cooling or air conditioning equipment, etc.). Sums may not equal totals due to rounding errors.

Source: NFIRS 5.0 and NFPA survey.

Table 6A.
Structure Fires in Laundry or Dry Cleaning Properties
by Equipment Involved in Ignition
2004-2008 Annual Averages

Equipment Involved	Fires		Direct Property Damage (in Millions)	
Clothes dryer	670	(52%)	\$8.4	(32%)
Contained trash or rubbish fire	130	(10%)	\$0.0	(0%)
Heating equipment	130	(10%)	\$5.2	(20%)
<i>Confined fuel burner or boiler fire</i>	50	(4%)	\$0.0	(0%)
<i>Confined chimney or flue fire</i>	40	(3%)	\$0.0	(0%)
<i>Water heater</i>	10	(1%)	\$0.1	(0%)
<i>Boiler (power, process, heating)</i>	10	(1%)	\$4.0	(15%)
<i>Other known heating equipment in non-confined fire</i>	10	(1%)	\$1.1	(4%)
No equipment involved in ignition	120	(9%)	\$3.2	(12%)
Unclassified equipment involved in ignition	40	(3%)	\$0.4	(2%)
Electrical distribution and lighting equipment	40	(3%)	\$0.6	(2%)
<i>Wiring and related equipment</i>	20	(2%)	\$0.4	(2%)
<i>Lamp, bulb or lighting</i>	20	(1%)	\$0.1	(0%)
<i>Other known electrical distribution and lighting equipment in non-confined fire</i>	0	(0%)	\$0.1	(0%)
Laboratory equipment, other	40	(3%)	\$1.0	(4%)
Washing machine - clothes	20	(2%)	\$0.3	(1%)
Cooking equipment	10	(1%)	\$2.1	(8%)
<i>Confined cooking fire</i>	10	(1%)	\$0.0	(0%)
<i>Other cooking equipment in non-confined fire</i>	0	(0%)	\$2.1	(8%)
Washer/dryer combination (within one frame)	10	(1%)	\$0.1	(0%)
Torch, burner or soldering iron	10	(1%)	\$0.1	(0%)
Other known equipment involved in non-confined fire	40	(3%)	\$4.6	(18%)
Other known confined fires defined by incident type	10	(1%)	\$0.0	(0%)
Non-confined fires	1,020	(80%)	\$25.9	(100%)
Confined Fires	250	(20%)	\$0.1	(0%)
Total	1,270	(100%)	\$26.0	(100%)

Source: NFIRS 5.0 and NFPA survey.

Table 6B.
Structure Fires in Service Stations or Gas Stations
or Motor Vehicle or Boat Sales Services, or Repair Occupancies
by Equipment Involved in Ignition
2004-2008 Annual Averages

Equipment Involved	Fires		Direct Property Damage (in Millions)	
No equipment involved in ignition	580	(25%)	\$34	(28%)
Heating equipment	460	(20%)	\$17	(14%)
<i>Fixed or portable space heater</i>	170	(7%)	\$14	(11%)
<i>Confined fuel burner or boiler fire</i>	140	(6%)	\$0	(0%)
<i>Confined chimney or flue fire</i>	50	(2%)	\$0	(0%)
<i>Water heater</i>	40	(2%)	\$1	(1%)
<i>Central heat</i>	30	(1%)	\$1	(1%)
<i>Fireplace or chimney</i>	20	(1%)	\$0	(0%)
<i>Other known heating equipment in non-confined fire</i>	10	(0%)	\$2	(1%)
Electrical distribution and lighting equipment	310	(13%)	\$25	(20%)
<i>Lamp, bulb or lighting</i>	140	(6%)	\$8	(7%)
<i>Wiring and related equipment</i>	110	(5%)	\$7	(5%)
<i>Transformers and power supplies</i>	40	(2%)	\$5	(4%)
<i>Cord or plug</i>	20	(1%)	\$5	(4%)
Cooking equipment	120	(5%)	\$3	(3%)
<i>Confined cooking fire</i>	80	(4%)	\$0	(0%)
<i>Portable cooking or warming equipment</i>	10	(1%)	\$1	(1%)
<i>Other known cooking equipment in non-confined fire</i>	20	(1%)	\$2	(2%)
Contained trash or rubbish fire	250	(11%)	\$0	(0%)
Torch, burner or soldering iron	160	(7%)	\$11	(9%)
Fan	100	(4%)	\$3	(3%)
Other equipment involved in ignition	50	(2%)	\$8	(7%)
Air compressor	30	(1%)	\$1	(1%)
Clothes dryer	20	(1%)	\$0	(0%)
Refrigerator or refrigerator/freezer	20	(1%)	\$2	(1%)
Air conditioner	20	(1%)	\$0	(0%)
Power sander, grinder, buffer or polisher	10	(1%)	\$1	(1%)
Unclassified painting tools	10	(1%)	\$2	(2%)
Car washing equipment	10	(1%)	\$0	(0%)
Pump	10	(1%)	\$0	(0%)
Other equipment involved in non-confined fire	140	(6%)	\$14	(12%)
Confined incinerator or commercial compactor fires	10	(1%)	\$0	(0%)
Non-confined	1,760	(77%)	\$124	(100%)
Confined	540	(23%)	\$0	(0%)
Total	2,290	(100%)	\$124	(100%)

Source: NFIRS 5.0 and NFPA survey.

Table 6C.
Structure Fires in Grocery Stores, Convenience Stores, or other Food and Beverage Sales Stores
by Equipment Involved in Ignition, 2004-2008 Annual Averages

Equipment Involved	Fires		Direct Property Damage (in Millions)	
Cooking equipment	1,870	(42%)	\$21	(20%)
<i>Confined cooking fire</i>	1,480	(33%)	\$1	(1%)
<i>Deep fryer</i>	120	(3%)	\$6	(6%)
<i>Range with or without oven, cooking surface</i>	80	(2%)	\$1	(1%)
<i>Portable cooking or warming equipment</i>	60	(1%)	\$7	(7%)
<i>Oven, rotisserie</i>	50	(1%)	\$3	(3%)
<i>Grill, hibachi, barbecue</i>	40	(1%)	\$2	(2%)
<i>Other cooking equipment in non-confined fire</i>	40	(1%)	\$1	(1%)
None	610	(14%)	\$26	(26%)
Electrical distribution and lighting equipment	490	(11%)	\$14	(14%)
<i>Wiring and related equipment</i>	240	(5%)	\$10	(10%)
<i>Lamp, bulb or lighting</i>	170	(4%)	\$2	(2%)
<i>Cord or plug</i>	40	(1%)	\$1	(1%)
<i>Transformers and power supplies</i>	40	(1%)	\$1	(1%)
<i>Other electrical distribution and lightning equipment in non-confined fire</i>	0	(0%)	\$0	(0%)
Contained trash or rubbish fire	400	(9%)	\$0	(0%)
Heating equipment	340	(7%)	\$5	(4%)
<i>Confined fuel burner or boiler fire</i>	120	(3%)	\$0	(0%)
<i>Confined chimney or flue fire</i>	70	(2%)	\$0	(0%)
<i>Water heater</i>	70	(2%)	\$2	(2%)
<i>Fixed or portable space heater</i>	40	(1%)	\$1	(1%)
<i>Other heating equipment in non-confined fire</i>	30	(1%)	\$1	(1%)
Fan	150	(3%)	\$2	(2%)
Refrigerator, refrigerator/freezer	150	(3%)	\$24	(24%)
Air conditioner	80	(2%)	\$5	(4%)
Freezer when separate from refrigerator	70	(2%)	\$1	(1%)
Other equipment involved in ignition	40	(1%)	\$1	(1%)
Torch, burner or soldering iron	40	(1%)	\$0	(0%)
Clothes dryer	40	(1%)	\$1	(1%)
Confined commercial compactor fire	30	(1%)	\$0	(0%)
Other known equipment involved in non-confined fire	170	(4%)	\$2	(2%)
Other confined fires	20	(0%)	\$0	(0%)
Non-confined fires	2,380	(53%)	\$102	(99%)
Confined fires	2,120	(47%)	\$1	(1%)
Total	4,500	(100%)	\$103	(100%)

Source: NFIRS 5.0 and NFPA survey.

Table 7.
Structure Fires in Stores and Other Mercantile Properties
by Cause of Ignition
2000-2004 Annual Averages

Cause of Ignition	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Unintentional	8,780	(54%)	178	(73%)	\$325	(50%)
<i>Non-confined fire</i>	5,260	(32%)	157	(65%)	\$324	(50%)
<i>Confined fire</i>	3,520	(22%)	21	(9%)	\$1	(0%)
Failure of equipment or heat source	4,470	(27%)	34	(14%)	\$137	(21%)
<i>Non-confined fire</i>	3,480	(21%)	32	(13%)	\$136	(21%)
<i>Confined fire</i>	990	(6%)	1	(1%)	\$1	(0%)
Intentional	1,690	(10%)	25	(10%)	\$102	(16%)
<i>Non-confined fire</i>	1,120	(7%)	23	(10%)	\$101	(16%)
<i>Confined fire</i>	580	(4%)	1	(1%)	\$0	(0%)
Unclassified cause	1,220	(7%)	6	(2%)	\$74	(11%)
<i>Non-confined fire</i>	980	(6%)	6	(2%)	\$74	(11%)
<i>Confined fire</i>	240	(1%)	0	(0%)	\$0	(0%)
Act of nature	210	(1%)	0	(0%)	\$11	(2%)
<i>Non-confined fire</i>	180	(1%)	0	(0%)	\$11	(2%)
<i>Confined fire</i>	30	(0%)	0	(0%)	\$0	(0%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)
<i>Non-confined</i>	11,010	(67%)	219	(90%)	\$646	(100%)
<i>Confined</i>	5,350	(33%)	23	(10%)	\$2	(0%)

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 8.
Structure Fires in Stores and Other Mercantile Properties
by Factor Contributing to Ignition
2004-2008 Annual Averages

Factor Contributing to Ignition	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Electrical failure or malfunction	3,850	(24%)	25	(10%)	\$197	(30%)
<i>Non-confined fire</i>	3,490	(21%)	25	(10%)	\$197	(30%)
<i>Confined fire</i>	360	(2%)	0	(0%)	\$0	(0%)
Mechanical failure or malfunction	2,210	(14%)	37	(15%)	\$60	(9%)
<i>Non-confined fire</i>	1,410	(9%)	34	(14%)	\$59	(9%)
<i>Confined fire</i>	800	(5%)	3	(1%)	\$0	(0%)
Abandoned or discarded materials or products	1,540	(9%)	9	(4%)	\$33	(5%)
<i>Non-confined fire</i>	720	(4%)	6	(3%)	\$33	(5%)
<i>Confined fire</i>	820	(5%)	3	(1%)	\$0	(0%)
Failure to clean	1,430	(9%)	11	(5%)	\$9	(1%)
<i>Non-confined fire</i>	440	(3%)	8	(3%)	\$9	(1%)
<i>Confined fire</i>	990	(6%)	3	(1%)	\$0	(0%)
Heat source too close to combustibles	1,390	(9%)	29	(12%)	\$56	(9%)
<i>Non-confined fire</i>	1,040	(6%)	27	(11%)	\$55	(9%)
<i>Confined fire</i>	350	(2%)	2	(1%)	\$1	(0%)
Other factor contributed to ignition	1,150	(7%)	12	(5%)	\$59	(9%)
<i>Non-confined fire</i>	750	(5%)	11	(4%)	\$59	(9%)
<i>Confined fire</i>	400	(2%)	2	(1%)	\$0	(0%)
Unclassified misuse of material or product	870	(5%)	26	(11%)	\$16	(2%)
<i>Non-confined fire</i>	480	(3%)	22	(9%)	\$15	(2%)
<i>Confined fire</i>	400	(2%)	5	(2%)	\$0	(0%)
Exposure fire	850	(5%)	2	(1%)	\$69	(11%)
<i>Non-confined fire</i>	830	(5%)	2	(1%)	\$69	(11%)
<i>Confined fire</i>	20	(0%)	0	(0%)	\$0	(0%)
Equipment unattended	640	(4%)	8	(3%)	\$8	(1%)
<i>Non-confined fire</i>	240	(1%)	5	(2%)	\$8	(1%)
<i>Confined fire</i>	400	(2%)	3	(1%)	\$0	(0%)
Cutting or welding too close to combustible	440	(3%)	26	(11%)	\$45	(7%)
<i>Non-confined fire</i>	360	(2%)	26	(11%)	\$45	(7%)
<i>Confined fire</i>	80	(0%)	0	(0%)	\$0	(0%)
Unclassified operational deficiency	280	(2%)	4	(2%)	\$8	(1%)
<i>Non-confined fire</i>	180	(1%)	4	(2%)	\$8	(1%)
<i>Confined fire</i>	110	(1%)	0	(0%)	\$0	(0%)
Other factors contributing	2,590	(16%)	79	(33%)	\$149	(23%)
<i>Non-confined fire</i>	1,690	(10%)	74	(31%)	\$148	(23%)
<i>Confined fire</i>	900	(6%)	5	(2%)	\$0	(0%)

Table 8.
Structure Fires in Stores and Other Mercantile Properties
by Factor Contributing to Ignition
2004-2008 Annual Averages (Continued)

Factor Contributing to Ignition	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Total fires	16,360	(100%)	242	(100%)	\$648	(100%)
<i>Non-confined fire</i>	11,010	(67%)	219	(90%)	\$646	(100%)
<i>Confined fire</i>	5,350	(33%)	23	(10%)	\$2	(0%)
Total entries *	17,250	(105%)	269	(111%)	\$709	(109%)
<i>Non-confined fire</i>	11,630	(71%)	244	(100%)	\$706	(109%)
<i>Confined fire</i>	5,630	(34%)	25	(10%)	\$2	(0%)

* Multiple entries are allowed which can result in sums higher than totals.

Note: Sums may not equal totals due to rounding errors. Fires in which the factor contributing to ignition was coded as “none,” unknown, or not reported have been allocated proportionally among fires with known factor contributing to ignition. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 9.
Structure Fires in Stores and Other Mercantile Properties
by Heat Source
2004-2008 Annual Averages

Heat Source	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Unclassified heat from powered equipment	2,970	(18%)	43	(18%)	\$76	(12%)
<i>Non-confined fire</i>	1,810	(11%)	33	(14%)	\$75	(12%)
<i>Confined fire</i>	1,160	(7%)	10	(4%)	\$1	(0%)
Radiated or conducted heat from operating equipment	2,410	(15%)	22	(9%)	\$58	(9%)
<i>Non-confined fire</i>	1,380	(8%)	19	(8%)	\$58	(9%)
<i>Confined fire</i>	1,030	(6%)	3	(1%)	\$0	(0%)
Arcing	2,350	(14%)	21	(9%)	\$118	(18%)
<i>Non-confined fire</i>	2,170	(13%)	21	(9%)	\$118	(18%)
<i>Confined fire</i>	180	(1%)	0	(0%)	\$0	(0%)
Spark, ember or flame from operating equipment	1,450	(9%)	50	(21%)	\$62	(10%)
<i>Non-confined fire</i>	940	(6%)	48	(20%)	\$62	(10%)
<i>Confined fire</i>	510	(3%)	1	(1%)	\$0	(0%)
Unclassified hot or smoldering object	1,290	(8%)	11	(4%)	\$48	(7%)
<i>Non-confined fire</i>	790	(5%)	8	(3%)	\$48	(7%)
<i>Confined fire</i>	500	(3%)	3	(1%)	\$0	(0%)
Unclassified heat source	1,270	(8%)	14	(6%)	\$73	(11%)
<i>Non-confined fire</i>	800	(5%)	12	(5%)	\$73	(11%)
<i>Confined fire</i>	480	(3%)	1	(1%)	\$0	(0%)
Smoking materials	1,020	(6%)	10	(4%)	\$15	(2%)
<i>Non-confined fire</i>	520	(3%)	7	(3%)	\$15	(2%)
<i>Confined fire</i>	500	(3%)	3	(1%)	\$0	(0%)
Hot ember or ash	640	(4%)	7	(3%)	\$17	(3%)
<i>Non-confined fire</i>	400	(2%)	7	(3%)	\$17	(3%)
<i>Confined fire</i>	230	(1%)	0	(0%)	\$0	(0%)
Match	400	(2%)	4	(2%)	\$10	(1%)
<i>Non-confined fire</i>	170	(1%)	4	(2%)	\$10	(1%)
<i>Confined fire</i>	230	(1%)	0	(0%)	\$0	(0%)
Cigarette lighter	340	(2%)	22	(9%)	\$35	(5%)
<i>Non-confined fire</i>	240	(1%)	19	(8%)	\$35	(5%)
<i>Confined fire</i>	100	(1%)	3	(1%)	\$0	(0%)
Candle	250	(2%)	8	(3%)	\$8	(1%)
<i>Non-confined fire</i>	220	(1%)	8	(3%)	\$8	(1%)
<i>Confined fire</i>	30	(0%)	0	(0%)	\$0	(0%)
Flame or torch used for lighting	250	(2%)	6	(2%)	\$13	(2%)
<i>Non-confined fire</i>	210	(1%)	6	(2%)	\$13	(2%)
<i>Confined fire</i>	30	(0%)	0	(0%)	\$0	(0%)

Table 9.
Structure Fires in Stores and Other Mercantile Properties
by Heat Source
2004-2008 Annual Averages (Continued)

Heat Source	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Other known heat source	1,730	(11%)	26	(11%)	\$115	(18%)
<i>Non-confined fire</i>	1,350	(8%)	26	(11%)	\$115	(18%)
<i>Confined fire</i>	380	(2%)	0	(0%)	\$0	(0%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)
<i>Non-confined fire</i>	11,010	(67%)	219	(90%)	\$646	(100%)
<i>Confined fire</i>	5,350	(33%)	23	(10%)	\$2	(0%)

Note: Sums may not equal totals due to rounding errors. The statistics on matches, lighters, smoking materials and candles include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 10.
Structure Fires in Stores and Other Mercantile Properties
by Area of Origin
2004-2008 Annual Averages

Area of Origin	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	2,630	(16%)	28	(11%)	\$26	(4%)
<i>Non-confined fire</i>	600	(4%)	14	(6%)	\$26	(4%)
<i>Confined fire</i>	2,030	(12%)	13	(6%)	\$1	(0%)
Laundry room or area	900	(5%)	15	(6%)	\$10	(1%)
<i>Non-confined fire</i>	740	(5%)	15	(6%)	\$9	(1%)
<i>Confined fire</i>	160	(1%)	0	(0%)	\$0	(0%)
Unclassified equipment or service area	710	(4%)	12	(5%)	\$35	(5%)
<i>Non-confined fire</i>	530	(3%)	11	(5%)	\$34	(5%)
<i>Confined fire</i>	180	(1%)	1	(0%)	\$0	(0%)
Unclassified outside area	690	(4%)	4	(2%)	\$12	(2%)
<i>Non-confined fire</i>	280	(2%)	4	(2%)	\$12	(2%)
<i>Confined fire</i>	410	(2%)	0	(0%)	\$0	(0%)
Sales or showroom area	690	(4%)	11	(5%)	\$53	(8%)
<i>Non-confined fire</i>	630	(4%)	10	(4%)	\$53	(8%)
<i>Confined fire</i>	60	(0%)	1	(0%)	\$0	(0%)
Lavatory, bathroom, locker room or check room	580	(4%)	9	(4%)	\$5	(1%)
<i>Non-confined fire</i>	420	(3%)	8	(3%)	\$5	(1%)
<i>Confined fire</i>	160	(1%)	1	(0%)	\$0	(0%)
Unclassified storage area	570	(3%)	3	(1%)	\$47	(7%)
<i>Non-confined fire</i>	470	(3%)	3	(1%)	\$47	(7%)
<i>Confined fire</i>	100	(1%)	0	(0%)	\$0	(0%)
Exterior wall surface	550	(3%)	2	(1%)	\$11	(2%)
<i>Non-confined fire</i>	520	(3%)	2	(1%)	\$11	(2%)
<i>Confined fire</i>	30	(0%)	0	(0%)	\$0	(0%)
Maintenance or paint shop or area	520	(3%)	39	(16%)	\$48	(7%)
<i>Non-confined fire</i>	440	(3%)	38	(16%)	\$48	(7%)
<i>Confined fire</i>	80	(0%)	1	(0%)	\$0	(0%)
Exterior roof surface	510	(3%)	3	(1%)	\$12	(2%)
<i>Non-confined fire</i>	480	(3%)	3	(1%)	\$12	(2%)
<i>Confined fire</i>	30	(0%)	0	(0%)	\$0	(0%)
Unclassified area of origin	500	(3%)	1	(1%)	\$13	(2%)
<i>Non-confined fire</i>	320	(2%)	1	(1%)	\$13	(2%)
<i>Confined fire</i>	180	(1%)	0	(0%)	\$0	(0%)

Table 10.
Structure Fires in Stores and Other Mercantile Properties
by Area of Origin
2004-2008 Annual Averages (Continued)

Area of Origin	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Trash or rubbish chute, area or container	500	(3%)	5	(2%)	\$1	(0%)
<i>Non-confined fire</i>	60	(0%)	1	(0%)	\$1	(0%)
<i>Confined fire</i>	440	(3%)	4	(2%)	\$0	(0%)
Office	420	(3%)	6	(2%)	\$37	(6%)
<i>Non-confined fire</i>	370	(2%)	6	(2%)	\$37	(6%)
<i>Confined fire</i>	50	(0%)	0	(0%)	\$0	(0%)
Storage room, area, tank, or bin	380	(2%)	5	(2%)	\$25	(4%)
<i>Non-confined fire</i>	320	(2%)	5	(2%)	\$25	(4%)
<i>Confined fire</i>	60	(0%)	0	(0%)	\$0	(0%)
Heating equipment room	370	(2%)	11	(5%)	\$8	(1%)
<i>Non-confined fire</i>	190	(1%)	10	(4%)	\$8	(1%)
<i>Confined fire</i>	170	(1%)	1	(0%)	\$0	(0%)
Wall assembly or concealed space	330	(2%)	1	(0%)	\$12	(2%)
<i>Non-confined fire</i>	310	(2%)	1	(0%)	\$12	(2%)
<i>Confined fire</i>	10	(0%)	0	(0%)	\$0	(0%)
Attic or ceiling/roof assembly or concealed space	320	(2%)	5	(2%)	\$32	(5%)
<i>Non-confined fire</i>	310	(2%)	5	(2%)	\$32	(5%)
<i>Confined fire</i>	10	(0%)	0	(0%)	\$0	(0%)
Unclassified function area	280	(2%)	8	(3%)	\$13	(2%)
<i>Non-confined fire</i>	230	(1%)	8	(3%)	\$13	(2%)
<i>Confined fire</i>	50	(0%)	0	(0%)	\$0	(0%)
Confined chimney or flue fire	280	(2%)	0	(0%)	\$0	(0%)
<i>Non-confined fire</i>	0	(0%)	0	(0%)	\$0	(0%)
<i>Confined fire</i>	280	(2%)	0	(0%)	\$0	(0%)
Ceiling/floor assembly or concealed space	270	(2%)	2	(1%)	\$14	(2%)
<i>Non-confined fire</i>	260	(2%)	2	(1%)	\$14	(2%)
<i>Confined fire</i>	10	(0%)	0	(0%)	\$0	(0%)
Storage of supplies or tools or dead storage	250	(2%)	4	(1%)	\$25	(4%)
<i>Non-confined fire</i>	220	(1%)	4	(1%)	\$25	(4%)
<i>Confined fire</i>	30	(0%)	0	(0%)	\$0	(0%)
Other area of origin	4,140	(25%)	69	(28%)	\$209	(32%)
<i>Non-confined fire</i>	3,290	(20%)	69	(28%)	\$209	(32%)
<i>Confined fire</i>	840	(5%)	0	(0%)	\$0	(0%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)
<i>Non-confined fire</i>	11,010	(67%)	219	(90%)	\$646	(100%)
<i>Confined fire</i>	5,350	(33%)	23	(10%)	\$2	(0%)

Table 10.
Structure Fires in Stores and Other Mercantile Properties
by Area of Origin
2004-2008 Annual Averages (Continued)

Note: Sums may not equal totals due to rounding errors. All fires with the confined chimney or flue incident type (NFIRS incident type 114) are shown separately. Chimney is longer an area of origin choice for non-confined fires. Other confined structure fires (NFIRS incident type 113, and 115-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 10A.
Structure Fires in Laundry, Dry Cleaning Properties
by Area of Origin
2004-2008 Annual Averages

Area of Origin	Fires		Direct Property Damage (in Millions)	
Laundry room or area	690	(54%)	\$5.5	(21%)
<i>Non-confined fire</i>	580	(45%)	\$5.5	(21%)
<i>Confined fire</i>	110	(9%)	\$0.0	(0%)
Unclassified equipment or service area	110	(9%)	\$3.1	(12%)
<i>Non-confined fire</i>	100	(8%)	\$3.1	(12%)
<i>Confined fire</i>	10	(1%)	\$0.0	(0%)
Confined chimney or flue fire	40	(3%)	\$0.0	(0%)
<i>Non-confined fire</i>	0	(0%)	\$0.0	(0%)
<i>Confined fire</i>	40	(3%)	\$0.0	(0%)
Heating equipment room	40	(3%)	\$0.3	(1%)
<i>Non-confined fire</i>	20	(2%)	\$0.3	(1%)
<i>Confined fire</i>	20	(1%)	\$0.0	(0%)
Duct for HVAC, cable, exhaust, heating, or AC	30	(2%)	\$0.1	(1%)
<i>Non-confined fire</i>	20	(2%)	\$0.1	(1%)
<i>Confined fire</i>	10	(0%)	\$0.0	(0%)
Laundry or mail chute	30	(2%)	\$0.1	(0%)
<i>Non-confined fire</i>	20	(2%)	\$0.1	(0%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Unclassified area of origin	20	(2%)	\$0.7	(3%)
<i>Non-confined fire</i>	20	(2%)	\$0.7	(3%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Processing or manufacturing area, or workroom	20	(2%)	\$2.2	(8%)
<i>Non-confined fire</i>	20	(1%)	\$2.2	(8%)
<i>Confined fire</i>	10	(1%)	\$0.0	(0%)
Unclassified service facility	20	(2%)	\$0.1	(0%)
<i>Non-confined fire</i>	20	(2%)	\$0.1	(0%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Machinery room or area or elevator machinery room	20	(2%)	\$0.1	(0%)
<i>Non-confined fire</i>	20	(1%)	\$0.1	(0%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Other known area of origin	250	(20%)	\$13.8	(53%)
<i>Non-confined fire</i>	200	(16%)	\$13.8	(53%)
<i>Confined fire</i>	50	(4%)	\$0.0	(0%)
Total	1,270	(100%)	\$26.0	(100%)
<i>Non-confined fire</i>	1,020	(80%)	\$25.9	(100%)
<i>Confined fire</i>	250	(20%)	\$0.1	(0%)

Table 10A.
Structure Fires in Laundry, Dry Cleaning Properties
by Area of Origin
2004-2008 Annual Averages (Continued)

Note: Sums may not equal totals due to rounding errors. All fires with the confined chimney or flue incident type (NFIRS incident type 114) are shown separately. Chimney is longer an area of origin choice for non-confined fires. Other confined structure fires (NFIRS incident type 113, and 115-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 10B.
Structure Fires in Service Stations or Gas Stations, Motor Vehicle or Boat Sales, Services Repair Occupancies
by Area of Origin
2004-2008 Annual Averages

Area of Origin	Fires		Direct Property Damage (in Millions)	
Maintenance or paint shop or area	350	(15%)	\$31.5	(25%)
<i>Non-confined fire</i>	300	(13%)	\$31.5	(25%)
<i>Confined fire</i>	50	(2%)	\$0.0	(0%)
Garage or vehicle storage area	150	(7%)	\$17.5	(14%)
<i>Non-confined fire</i>	140	(6%)	\$17.5	(14%)
<i>Confined fire</i>	10	(0%)	\$0.0	(0%)
Unclassified outside area	130	(5%)	\$1.4	(1%)
<i>Non-confined fire</i>	40	(2%)	\$1.4	(1%)
<i>Confined fire</i>	80	(4%)	\$0.0	(0%)
Unclassified equipment or service area	120	(5%)	\$8.0	(6%)
<i>Non-confined fire</i>	110	(5%)	\$8.0	(6%)
<i>Confined fire</i>	10	(1%)	\$0.0	(0%)
Office	110	(5%)	\$9.3	(8%)
<i>Non-confined fire</i>	100	(4%)	\$9.3	(8%)
<i>Confined fire</i>	10	(1%)	\$0.0	(0%)
Unclassified area of origin	80	(3%)	\$2.2	(2%)
<i>Non-confined fire</i>	40	(2%)	\$2.2	(2%)
<i>Confined fire</i>	40	(2%)	\$0.0	(0%)
Exterior wall surface	80	(3%)	\$1.3	(1%)
<i>Non-confined fire</i>	80	(3%)	\$1.3	(1%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Lavatory, bathroom, locker room or check room	80	(3%)	\$1.0	(1%)
<i>Non-confined fire</i>	60	(3%)	\$1.0	(1%)
<i>Confined fire</i>	10	(1%)	\$0.0	(0%)
Trash or rubbish chute, area or container	70	(3%)	\$0.1	(0%)
<i>Non-confined fire</i>	0	(0%)	\$0.1	(0%)
<i>Confined fire</i>	70	(3%)	\$0.0	(0%)
Unclassified service facility	70	(3%)	\$4.0	(3%)
<i>Non-confined fire</i>	60	(3%)	\$4.0	(3%)
<i>Confined fire</i>	10	(0%)	\$0.0	(0%)
Exterior roof surface	70	(3%)	\$0.8	(1%)
<i>Non-confined fire</i>	60	(3%)	\$0.8	(1%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Kitchen or cooking area	60	(3%)	\$2.0	(2%)
<i>Non-confined fire</i>	20	(1%)	\$2.0	(2%)
<i>Confined fire</i>	40	(2%)	\$0.0	(0%)

Table 10B.
Structure Fires in Service Stations or Gas Stations, Motor Vehicle or Boat Sales, Services Repair Occupancies
by Area of Origin
2004-2008 Annual Averages (Continued)

Area of Origin	Fires		Direct Property Damage (in Millions)	
Heating equipment room	60	(3%)	\$1.4	(1%)
<i>Non-confined fire</i>	30	(1%)	\$1.4	(1%)
<i>Confined fire</i>	30	(1%)	\$0.0	(0%)
Wall assembly or concealed space	50	(2%)	\$1.2	(1%)
<i>Non-confined fire</i>	50	(2%)	\$1.2	(1%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Vehicle engine area, running gear or wheel area	50	(2%)	\$2.5	(2%)
<i>Non-confined fire</i>	50	(2%)	\$2.5	(2%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Unclassified storage area	50	(2%)	\$5.1	(4%)
<i>Non-confined fire</i>	40	(2%)	\$5.1	(4%)
<i>Confined fire</i>	10	(0%)	\$0.0	(0%)
Attic or ceiling/roof assembly or concealed space	50	(2%)	\$4.6	(4%)
<i>Non-confined fire</i>	50	(2%)	\$4.6	(4%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Confined chimney or flue fire	50	(2%)	\$0.0	(0%)
<i>Non-confined fire</i>	0	(0%)	\$0.0	(0%)
<i>Confined fire</i>	50	(2%)	\$0.0	(0%)
Storage room, area, tank, or bin	40	(2%)	\$3.5	(3%)
<i>Non-confined fire</i>	40	(2%)	\$3.5	(3%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Unclassified vehicle area	40	(2%)	\$2.3	(2%)
<i>Non-confined fire</i>	30	(1%)	\$2.3	(2%)
<i>Confined fire</i>	10	(0%)	\$0.0	(0%)
Sales or showroom area	40	(2%)	\$2.4	(2%)
<i>Non-confined fire</i>	30	(1%)	\$2.4	(2%)
<i>Confined fire</i>	10	(0%)	\$0.0	(0%)
Storage of supplies or tools or dead storage	40	(2%)	\$2.0	(2%)
<i>Non-confined fire</i>	40	(2%)	\$2.0	(2%)
<i>Confined fire</i>	0	(0%)	\$0.0	(0%)
Duct for HVAC, cable, exhaust, heating, or air conditioning	40	(2%)	\$0.6	(1%)
<i>Non-confined fire</i>	20	(1%)	\$0.6	(1%)
<i>Confined fire</i>	10	(1%)	\$0.0	(0%)

Table 10B.
Structure Fires in Service Stations or Gas Stations, Motor Vehicle or Boat Sales, Services Repair Occupancies
by Area of Origin
2004-2008 Annual Averages (Continued)

Area of Origin	Fires		Direct Property Damage (in Millions)	
Other known area of origin	430	(19%)	\$19.3	(16%)
<i>Non-confined fire</i>	350	(15%)	\$19.3	(16%)
<i>Confined fire</i>	80	(3%)	\$0.0	(0%)
Total	2,290	(100%)	\$124.1	(100%)
<i>Non-confined fire</i>	1,760	(77%)	\$124.0	(100%)
<i>Confined fire</i>	540	(23%)	\$0.1	(0%)

Note: Sums may not equal totals due to rounding errors. All fires with the confined chimney or flue incident type (NFIRS incident type 114) are shown separately. Chimney is longer an area of origin choice for non-confined fires. Other confined structure fires (NFIRS incident type 113, and 115-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

Table 11.
Structure Fires in Stores and Other Mercantile Properties
by Item First Ignited, 2004-2008 Annual Averages

Item First Ignited	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
	Count	Percentage	Count	Percentage	Amount	Percentage
Cooking materials, including food	2,000	(12%)	19	(8%)	\$12	(2%)
<i>Non-confined fire</i>	270	(2%)	10	(4%)	\$11	(2%)
<i>Confined fire</i>	1,730	(11%)	9	(4%)	\$1	(0%)
Electrical wire or cable insulation	1,660	(10%)	12	(5%)	\$62	(10%)
<i>Non-confined fire</i>	1,490	(9%)	10	(4%)	\$62	(10%)
<i>Confined fire</i>	170	(1%)	1	(1%)	\$0	(0%)
Flammable and combustible liquids and gases, piping and filter	1,400	(9%)	107	(44%)	\$84	(13%)
<i>Non-confined fire</i>	850	(5%)	103	(42%)	\$84	(13%)
<i>Confined fire</i>	560	(3%)	5	(2%)	\$0	(0%)
Rubbish, trash, or waste	1,400	(9%)	5	(2%)	\$23	(4%)
<i>Non-confined fire</i>	380	(2%)	3	(1%)	\$23	(4%)
<i>Confined fire</i>	1,020	(6%)	2	(1%)	\$0	(0%)
Unclassified item first ignited	1,370	(8%)	10	(4%)	\$45	(7%)
<i>Non-confined fire</i>	910	(6%)	10	(4%)	\$45	(7%)
<i>Confined fire</i>	460	(3%)	0	(0%)	\$0	(0%)
Structural member or framing	830	(5%)	5	(2%)	\$68	(10%)
<i>Non-confined fire</i>	830	(5%)	5	(2%)	\$68	(10%)
<i>Confined fire</i>	10	(0%)	0	(0%)	\$0	(0%)
Box, carton, bag, basket, barrel	550	(3%)	6	(3%)	\$30	(5%)
<i>Non-confined fire</i>	330	(2%)	6	(3%)	\$30	(5%)
<i>Confined fire</i>	210	(1%)	0	(0%)	\$0	(0%)
Exterior wall covering or finish	540	(3%)	3	(1%)	\$14	(2%)
<i>Non-confined fire</i>	540	(3%)	3	(1%)	\$14	(2%)
<i>Confined fire</i>	0	(0%)	0	(0%)	\$0	(0%)
Clothing	440	(3%)	15	(6%)	\$17	(3%)
<i>Non-confined fire</i>	390	(2%)	15	(6%)	\$17	(3%)
<i>Confined fire</i>	50	(0%)	0	(0%)	\$0	(0%)
Exterior roof covering or finish	430	(3%)	2	(1%)	\$17	(3%)
<i>Non-confined fire</i>	430	(3%)	2	(1%)	\$17	(3%)
<i>Confined fire</i>	0	(0%)	0	(0%)	\$0	(0%)
Multiple items first ignited	410	(3%)	7	(3%)	\$45	(7%)
<i>Non-confined fire</i>	280	(2%)	6	(2%)	\$45	(7%)
<i>Confined fire</i>	130	(1%)	1	(0%)	\$0	(0%)
Dust, fiber, lint, including sawdust or excelsior	410	(3%)	7	(3%)	\$10	(1%)
<i>Non-confined fire</i>	280	(2%)	7	(3%)	\$10	(1%)
<i>Confined fire</i>	130	(1%)	0	(0%)	\$0	(0%)

Table 11.
Structure Fires in Stores and Other Mercantile Properties
by Item First Ignited: 2004-2008 Annual Averages (Continued)

Item First Ignited	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Linen other than bedding	380	(2%)	4	(1%)	\$8	(1%)
<i>Non-confined fire</i>	310	(2%)	4	(1%)	\$8	(1%)
<i>Confined fire</i>	80	(0%)	0	(0%)	\$0	(0%)
Unclassified structural component or finish	340	(2%)	4	(1%)	\$22	(3%)
<i>Non-confined fire</i>	340	(2%)	4	(1%)	\$22	(3%)
<i>Confined fire</i>	0	(0%)	0	(0%)	\$0	(0%)
Appliance housing or casing	330	(2%)	5	(2%)	\$8	(1%)
<i>Non-confined fire</i>	220	(1%)	3	(1%)	\$8	(1%)
<i>Confined fire</i>	110	(1%)	2	(1%)	\$0	(0%)
Magazine, newspaper or writing paper	320	(2%)	1	(1%)	\$12	(2%)
<i>Non-confined fire</i>	170	(1%)	1	(1%)	\$12	(2%)
<i>Confined fire</i>	150	(1%)	0	(0%)	\$0	(0%)
Insulation within structural area	300	(2%)	0	(0%)	\$10	(2%)
<i>Non-confined fire</i>	290	(2%)	0	(0%)	\$10	(2%)
<i>Confined fire</i>	10	(0%)	0	(0%)	\$0	(0%)
Interior wall covering, excluding drapes	290	(2%)	2	(1%)	\$25	(4%)
<i>Non-confined fire</i>	290	(2%)	2	(1%)	\$25	(4%)
<i>Confined fire</i>	0	(0%)	0	(0%)	\$0	(0%)
Interior ceiling cover or finish	260	(2%)	3	(1%)	\$18	(3%)
<i>Non-confined fire</i>	250	(2%)	3	(1%)	\$18	(3%)
<i>Confined fire</i>	0	(0%)	0	(0%)	\$0	(0%)
Other known Item	2,710	(17%)	26	(11%)	\$119	(18%)
<i>Non-confined fire</i>	2,170	(13%)	24	(10%)	\$119	(18%)
<i>Confined fire</i>	540	(3%)	2	(1%)	\$0	(0%)
Total	16,360	(100%)	242	(100%)	\$648	(100%)
<i>Non-confined fire</i>	11,010	(67%)	219	(90%)	\$646	(100%)
<i>Confined fire</i>	5,350	(33%)	23	(10%)	\$2	(0%)

Note: Sums may not equal totals due to rounding errors. Confined structure fires (NFIRS incident type 113-118) were analyzed separately from non-confined structure fires (incident type 110-129, except 113-118). See Appendix A for details.

Source: NFIRS 5.0 and NFPA survey.

**Table 12.
Structure Fires in Stores and Other Mercantile Properties
by Extent of Flame Damage, 2004-2008 Annual Averages**

Extent of Flame Damage	Fires		Civilian Injuries		Direct Property Damage (in Millions)	
Confined fire identified by incident type	5,350	(33%)	23	(10%)	\$2	(0%)
Confined to object of origin	4,750	(29%)	56	(23%)	\$52	(8%)
Confined to room of origin	2,470	(15%)	63	(26%)	\$60	(9%)
Confined to floor of origin	600	(4%)	14	(6%)	\$32	(5%)
Confined to building of origin	2,710	(17%)	66	(27%)	\$406	(63%)
Beyond building of origin	490	(3%)	20	(8%)	\$95	(15%)
Totals	16,360	(100%)	242	(100%)	\$648	(100%)

Note: Sums may not equal totals due to rounding errors

Source: NFIRS 5.0 and NFPA survey.

Table 13.
Automatic extinguishing equipment in Stores and Other Mercantile Properties
2004-2008 Annual Averages

	All Stores and Other Mercantile Properties	Convenience and Grocery Stores	Department Stores, and General Retail Stores	Laundry, Dry Cleaning
Automatic Extinguishment Equipment Presence				
Any AES present	29%	44%	43%	15%
Any sprinklers present	21%	22%	40%	15%
Percent of AES that are sprinklers				
Wet pipe sprinklers	73%	50%	92%	98%
Dry pipe sprinklers	64%	44%	79%	93%
other sprinklers	7%	4%	11%	4%
Wet/dry chemical	2%	2%	2%	1%
18%	33%			
Property Damage per Fire				
With wet pipe sprinklers present	\$52,000	\$49,000	\$62,000	-*
Without AES	\$36,000	\$34,000	\$29,000	-*
Reduction	31%	31%	54%	-*
Wet pipe sprinkler operation				
Operated	91%	90%	88%	91%
Operated effectively	87%	86%	86%	86%
Reasons for failure				
System shutoff	61%	-*	-*	-*
Manual intervention defeated system	20%	-*	-*	-*
Reason for ineffectiveness				
Water did not reach fire	52%	-*	-*	-*
Not enough water	29%	-*	-*	-*
How often did only 1-2 sprinklers operate when wet pipe sprinklers operated?	84%	-*	-*	-*
Wet or dry chemical system operation				
Operated	57%	54%	-*	-*
Operated effectively	37%	35%	-*	-*

*“-“ means there is not enough data for data to be valid
 Note: Sums may not equal totals due to rounding errors
 Source: NFIRS 5.0 and NFPA survey.

Appendix A.

How National Estimates Statistics Are Calculated

The statistics in this analysis are estimates derived from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual survey of U.S. fire departments. NFIRS is a voluntary system by which participating fire departments report detailed factors about the fires to which they respond. Roughly two-thirds of U.S. fire departments participate, although not all of these departments provide data every year. Fires reported to federal or state fire departments or industrial fire brigades are not included in these estimates.

NFIRS provides the most detailed incident information of any national database not limited to large fires. NFIRS is the only database capable of addressing national patterns for fires of all sizes by specific property use and specific fire cause. NFIRS also captures information on the extent of flame spread, and automatic detection and suppression equipment. For more information about NFIRS visit <http://www.nfirs.fema.gov/>. Copies of the paper forms may be downloaded from http://www.nfirs.fema.gov/documentation/design/NFIRS_Paper_Forms_2008.pdf.

NFIRS has a wide variety of data elements and code choices. The NFIRS database contains coded information. Many code choices describe several conditions. These cannot be broken down further. For example, area of origin code 83 captures fires starting in vehicle engine areas, running gear areas or wheel areas. It is impossible to tell the portion of each from the coded data.

Methodology may change slightly from year to year.

NFPA is continually examining its methodology to provide the best possible answers to specific questions, methodological and definitional changes can occur. *Earlier editions of the same report may have used different methodologies to produce the same analysis, meaning that the estimates are not directly comparable from year to year.*

NFPA's fire department experience survey provides estimates of the big picture.

Each year, NFPA conducts an annual survey of fire departments which enables us to capture a summary of fire department experience on a larger scale. Surveys are sent to all municipal departments protecting populations of 50,000 or more and a random sample, stratified by community size, of the smaller departments. Typically, a total of roughly 3,000 surveys are returned, representing about one of every ten U.S. municipal fire departments and about one third of the U.S. population.

The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities have fewer people protected per department and are less likely to respond to the survey. A larger number must be surveyed to obtain an adequate sample of those departments. (NFPA also makes follow-up calls to a sample of the smaller fire departments that do not respond, to confirm that those that did respond are truly representative of fire departments their size.) On the other hand, large city departments are so few in number and protect such a large proportion of the total U.S.

population that it makes sense to survey all of them. Most respond, resulting in excellent precision for their part of the final estimate.

The survey includes the following information: (1) the total number of fire incidents, civilian deaths, and civilian injuries, and the total estimated property damage (in dollars), for each of the major property use classes defined in NFIRS; (2) the number of on-duty firefighter injuries, by type of duty and nature of illness; (3) the number and nature of non-fire incidents; and (4) information on the type of community protected (e.g., county versus township versus city) and the size of the population protected, which is used in the statistical formula for projecting national totals from sample results. The results of the survey are published in the annual report *Fire Loss in the United States*. To download a free copy of the report, visit <http://www.nfpa.org/assets/files/PDF/OS.fireloss.pdf>.

Projecting NFIRS to National Estimates

As noted, NFIRS is a voluntary system. Different states and jurisdictions have different reporting requirements and practices. Participation rates in NFIRS are not necessarily uniform across regions and community sizes, both factors correlated with frequency and severity of fires. This means NFIRS may be susceptible to systematic biases. No one at present can quantify the size of these deviations from the ideal, representative sample, so no one can say with confidence that they are or are not serious problems. But there is enough reason for concern so that a second database -- the NFPA survey -- is needed to project NFIRS to national estimates and to project different parts of NFIRS separately. This multiple calibration approach makes use of the annual NFPA survey where its statistical design advantages are strongest.

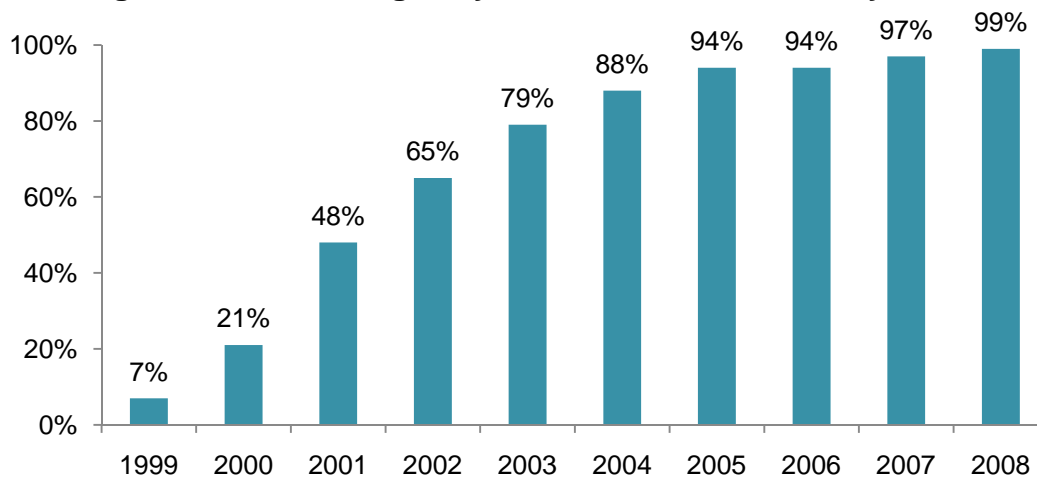
Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific fire problems and circumstances are obtained by multiplying the NFIRS data by the scaling ratios. Reports for incidents in which mutual aid was given are excluded from NFPA's analyses.

Analysts at the NFPA, the USFA and the Consumer Product Safety Commission developed the specific basic analytical rules used for this procedure. "The National Estimates Approach to U.S. Fire Statistics," by John R. Hall, Jr. and Beatrice Harwood, provides a more detailed explanation of national estimates. A copy of the article is available online at <http://www.nfpa.org/osds> or through NFPA's One-Stop Data Shop.

Version 5.0 of NFIRS, first introduced in 1999, used a different coding structure for many data elements, added some property use codes, and dropped others. The essentials of the approach described by Hall and Harwood are still used, but some modifications have been necessary to accommodate the changes in NFIRS 5.0.

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

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



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

NFPA survey projections
NFIRS totals (Version 5.0)

For 1999 to 2001, the same rules may be applied, but estimates for these years in this form will be less reliable due to the smaller amount of data originally collected in NFIRS 5.0; they should be viewed with extreme caution.

NFIRS 5.0 introduced six categories of confined structure fires, including:

- cooking fires confined to the cooking vessel,
- confined chimney or flue fires,
- confined incinerator fire,
- confined fuel burner or boiler fire or delayed ignition,
- confined commercial compactor fire, and
- trash or rubbish fires in a structure with no flame damage to the structure or its contents.

Although causal and other detailed information is typically not required for these incidents, it is provided in some cases. Some analyses, particularly those that examine cooking equipment, heating equipment, fires caused by smoking materials, and fires started by playing with fire, may examine the confined fires in greater detail. Because the confined fire incident types describe certain scenarios, the distribution of unknown data differs from that of all fires. Consequently, allocation of unknowns must be done separately. Table A.1 shows the breakdown of these fires. Figure A.1 shows the percentage of the different confined fires and of non-confined fires for all homes, one-and two-family homes (including manufactured homes), and apartments.

**Table A.1. Confined and Non-Confined Reported Structure Fires in Stores and Other Mercantile Properties
2004-2008 Annual Averages**

Type of Fire	Fires		Civilian		Civilian		Direct	
			Deaths	Injuries	Property Damage (in Millions)			
Confined Fire	5,350	(33%)	0	(0%)	23	(10%)	\$2	(0%)
Confined cooking fire	2,410	(15%)	0	(0%)	15	(6%)	\$1	(0%)
Contained trash or rubbish fire	1,740	(11%)	0	(0%)	4	(2%)	\$0	(0%)
Confined fuel burner or boiler fire	700	(4%)	0	(0%)	2	(1%)	\$0	(0%)
Confined chimney or flue fire	280	(2%)	0	(0%)	0	(0%)	\$0	(0%)
Confined commercial compactor fire	150	(1%)	0	(0%)	1	(0%)	\$0	(0%)
Confined incinerator overload or malfunction fire	70	(0%)	0	(0%)	0	(0%)	\$0	(0%)
Non-confined fire	11,010	(67%)	13	(100%)	219	(90%)	\$646	(100%)
Total	16,360	(100%)	13	(100%)	242	(100%)	\$648	(100%)

Source: NFIRS 5.0 and NFPA survey.

Some analyses of structure fires show only non-confined fires. In these tables, percentages shown are of non-confined structure fires rather than all structure fires. This approach has the advantage of showing the frequency of specific factors in fire causes, but the disadvantage of possibly overstating the percentage of factors that are seldom seen in the confined fire incident types and of understating the factors specifically associated with the confined fire incident types.

Other analyses include entries for confined fire incident types in the causal tables and show percentages based on total structure fires. In these cases, the confined fire incident type is treated as a general causal factor.

For most fields other than Property Use and Incident Type, NFPA allocates unknown data proportionally among known data. This approach assumes that if the missing data were known, it would be distributed in the same manner as the known data. NFPA makes additional adjustments to several fields. *Casualty and loss projections can be heavily influenced by the inclusion or exclusion of unusually serious fire.*

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

Cause of Ignition: This field is used chiefly to identify intentional fires. “Unintentional” in this field is a specific entry and does not include other fires that were not intentionally set: failure of equipment or heat source, act of nature, or “other” (unclassified).” The last should be used for exposures but has been used for other situations as well. Fires that were coded as under investigation and those that were coded as undetermined after investigation were treated as unknown. For non-confined structure fires in stores or other mercantile properties, the cause was known in 71% of the fires, 75% of the civilian injuries, and 45% of the direct property damage.

For confined fires, the cause was known in 15% of the fires.

Factor Contributing to Ignition: In this field, the code “none” is treated as an unknown and allocated proportionally. For Human Factor Contributing to Ignition, NFPA enters a code for “not reported” when no factors are recorded. “Not reported” is treated as an unknown, but the code “none” is treated as a known code and not allocated. Multiple entries are allowed in both of these fields. Percentages are calculated on the total number of fires, not entries, resulting in sums greater than 100%. Although Factor Contributing to Ignition is only required when the cause of ignition was coded as: 2) unintentional, 3) failure of equipment or heat source; or 4) act of nature, data is often present when not required. Consequently, any fire in which no factor contributing to ignition was entered was treated as unknown.

In some analyses, all entries in the category of mechanical failure, malfunction (factor contributing to ignition 20-29) are combined and shown as one entry, “mechanical failure or malfunction.” This category includes:

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

Entries in “electrical failure, malfunction” (factor contributing to ignition 30-39) may also be combined into one entry, “electrical failure or malfunction.” This category includes:

31. Water-caused short circuit arc;
32. Short-circuit arc from mechanical damage;
33. Short-circuit arc from defective or worn insulation;
34. Unspecified short circuit arc;
35. Arc from faulty contact or broken connector, including broken power lines and loose connections;
36. Arc or spark from operating equipment, switch, or electric fence;
37. Fluorescent light ballast; and
30. Electrical failure or malfunction, other.

The factor contributing to ignition was coded as none, undetermined or left blank in 47% of the non-confined structure fires in stores and other mercantile properties, 34% of the associated injuries, 64% of the associated direct property damage and 90% of the confined fires.

Heat Source. In NFIRS 5.0, one grouping of codes encompasses various types of open flames and smoking materials. In the past, these had been two separate groupings. A new code was added to NFIRS 5.0, which is code 60: “Heat from open flame or smoking material, other.” NFPA treats this code as a partial unknown and allocates it proportionally across the codes in the 61-69 range, shown below.

61. Cigarette;

- 62. Pipe or cigar;
- 63. Heat from undetermined smoking material;
- 64. Match;
- 65. Lighter: cigarette lighter, cigar lighter;
- 66. Candle;
- 67 Warning or road flare, fuse;
- 68. Backfire from internal combustion engine. Excludes flames and sparks from an exhaust system, (11); and
- 69. Flame/torch used for lighting. Includes gas light and gas-/liquid-fueled lantern.

In addition to the conventional allocation of missing and undetermined fires, NFPA multiplies fires with codes in the 61-69 range by

$$\frac{\text{All fires in range 60-69}}{\text{All fires in range 61-69}}$$

The downside of this approach is that heat sources that are truly a different type of open flame or smoking material are erroneously assigned to other categories. The grouping “smoking materials” includes codes 61-63 (cigarettes, pipes or cigars, and heat from undetermined smoking material, with a proportional share of the code 60s and true unknown data.

In non-confined structure fires in stores and other mercantile properties, code 60: “heat from open flame or smoking material, other” was entered for 3% of the fires and direct property damage and for 4% of the civilian injuries. The heat source was undetermined in 31% of the non-confined stores and other mercantile property structure fires, 29% of the civilian injuries, and 57% of the direct property damage. The heat source was known in 14% of the confined fires, including less than 1% with heat source code 60.

Equipment Involved in Ignition (EII). NFIRS 5.0 originally defined EII as the piece of equipment that provided the principal heat source to cause ignition if the equipment malfunctioned or was used improperly. In 2006, the definition was modified to “the piece of equipment that provided the principal heat source to cause ignition.” However, much of the data predates the change. Individuals who have already been trained with the older definition may not change their practices. To compensate, NFPA treats fires in which EII = NNN and heat source is not in the range of 40-99 as an additional unknown.

To allocate unknown data for EII, the known data is multiplied by

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

In addition, the partially unclassified codes for broad equipment groupings (i.e., code 100 - heating, ventilation, and air conditioning, other; code 200 - electrical distribution, lighting and power transfer, other; etc.) were allocated proportionally across the individual code choices in their respective broad groupings (heating, ventilation, and air conditioning; electrical distribution, lighting and power transfer, other; etc.). Equipment that is totally unclassified is not allocated further. This approach has the same downside as the allocation of heat source 60 described above. Equipment that is truly different is erroneously assigned to other categories.

In some analyses, various types of equipment are grouped together.

Code Grouping	EII Code	NFIRS definitions
Central heat	132	Furnace or central heating unit
	133	Boiler (power, process or heating)
Fixed or portable space heater	131	Furnace, local heating unit, built-in
	123	Fireplace with insert or stove
	124	Heating stove
	141	Heater, excluding catalytic and oil-filled
	142	Catalytic heater
	143	Oil-filled heater
Fireplace or chimney	120	Fireplace or chimney
	121	Fireplace, masonry
	122	Fireplace, factory-built
	125	Chimney connector or vent connector
	126	Chimney – brick, stone or masonry
	127	Chimney-metal, including stovepipe or flue
	Wiring, switch or outlet	210
211		Electrical power or utility line
212		Electrical service supply wires from utility
214		Wiring from meter box to circuit breaker
216		Electrical branch circuit
217		Outlet, receptacle
218		Wall switch
Power switch gear or overcurrent protection device		215
	219	Ground fault interrupter
	222	Overcurrent, disconnect equipment
	227	Surge protector
Lamp, bulb or lighting	230	Unclassified lamp or lighting
	231	Lamp-tabletop, floor or desk
	232	Lantern or flashlight
	233	Incandescent lighting fixture
	234	Fluorescent light fixture or ballast
	235	Halogen light fixture or lamp
	236	Sodium or mercury vapor light fixture or lamp
	237	Work or trouble light
	238	Light bulb
	241	Nightlight
	242	Decorative lights – line voltage
243	Decorative or landscape lighting – low voltage	
244	Sign	

Cord or plug	260	Unclassified cord or plug
	261	Power cord or plug, detachable from appliance
	262	Power cord or plug- permanently attached
	263	Extension cord
Torch, burner or soldering iron	331	Welding torch
	332	Cutting torch
	333	Burner, including Bunsen burners
	334	Soldering equipment
Portable cooking or warming equipment	631	Coffee maker or teapot
	632	Food warmer or hot plate
	633	Kettle
	634	Popcorn popper
	635	Pressure cooker or canner
	636	Slow cooker
	637	Toaster, toaster oven, counter-top broiler
	638	Waffle iron, griddle
	639	Wok, frying pan, skillet
641	Breadmaking machine	

The equipment involved in ignition was undetermined, not reported, or coded as no equipment with a heat source code outside the range of 40-99 (non-equipment related heat sources) in 84% of the non-confined fires, 78% of the injuries, 90% of the direct property damage. Equipment was not analyzed separately for confined fires. Instead, each confined fire incident type was listed with the equipment or as other known equipment.

Item First Ignited. In most analyses, mattress and pillows (item first ignited 31) and bedding, blankets, sheets, and comforters (item first ignited 32) are combined and shown as “mattresses and bedding.” In many analyses, wearing apparel not on a person (code 34) and wearing apparel on a person (code 35) are combined and shown as “clothing.” In some analyses, flammable and combustible liquids and gases, piping and filters (item first ignited 60-69) are combined and shown together. The item first ignited was undetermined or unreported in 32% of the non-confined structure fires, 21% of the associated injuries, 55% of the direct property damage, and in 85% of the confined structure fires.

Area of Origin. Two areas of origin: bedroom for more than five people (code 21) and bedroom for less than five people (code 22) are combined and shown as simply “bedroom.” Chimney is no longer a valid area of origin code for non-confined fires. The area of origin was unknown or not reported in 9% of non-confined structure fires in stores and other mercantile properties, 4% of associated injuries, and 20% of the direct property damage. It was also unknown in 82% of confined fires excluding those confined to the chimney or flue which were all assumed to have begun in the chimney or flue.

Rounding and percentages. The data shown are estimates and generally rounded. An entry of *U.S. Stores and Other Mercantile Property Fires*, 1/11 42 NFPA Fire Analysis and Research, Quincy, MA

zero may be a true zero or it may mean that the value rounds to zero. Percentages are calculated from unrounded values. It is quite possible to have a percentage entry of up to 100% even if the rounded number entry is zero. The same rounded value may account for a slightly different percentage share. Because percentages are expressed in integers and not carried out to several decimal places, percentages that appear identical may be associated with slightly different values.

In this analysis, when estimates were derived solely from the NFPA survey, fires were rounded to the nearest 500, civilian deaths were rounded to the nearest five, civilian injuries were rounded to the nearest 25, and direct property damage was rounded to the nearest million dollars. For estimates derived from NFIRS and the NFPA survey, 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 dollars.

Inflation. Property damage estimates are not adjusted for inflation unless so indicated. In this analysis, inflation adjusted damage estimates are provided in Table 1.

Data Sources, Definitions and Conventions Used in this Report

Unless otherwise specified, the statistics in this analysis are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. These estimates are projections based on the detailed information collected in Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS 5.0) and the National Fire Protection Association's (NFPA's) annual fire department experience survey. Except for property use and incident type, fires with unknown or unreported data were allocated proportionally in calculations of national estimates. In general, any fire that occurs in or in a structure is considered a structure fire, even if the fire was limited to contents and the building itself was not damaged.

Stores and other mercantile properties were identified by NFIRS 5.0 property use codes in the 500-589 range.

NFIRS 5.0 includes a category of structure fires collectively referred to as "confined fires," identified by incident type. These include confined cooking fires, confined chimney or flue fires, confined trash fires, confined fuel burner or boiler fires, confined commercial compactor fires, and confined incinerator fires (incident type 113-118). Losses are generally minimal in these fires, which by definition, are assumed to have been limited to the object of origin. Although causal data is not required for these fires, it is sometimes present.

Confined and non-confined fires were analyzed separately and summed for Cause of Ignition, Heat Source, Factor Contributing to Ignition, Area of Origin, and Item First Ignited, as well as for the Detection and Automatic Suppression estimates. Non-confined fires were analyzed for Equipment Involved in Ignition. Other types of confined fires were not broken out further and were grouped by incident type with the non-confined fires.

Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Property damage has not been adjusted for inflation. Fires are rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest million. Due to the very small number of deaths, they have been omitted from trend and cause tables. Additional details on the methodology may be found in Appendix A and B.

Appendix B.

Methodology and Definitions Used in “Leading Cause” Tables

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

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

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

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

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

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

results in any true unclassified smoking or open flame heat sources such as incense being inappropriately allocated. However, in many fires, this code was used as an unknown.

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

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

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

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

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

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

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

Shop tools and industrial equipment excluding torches, burners or soldering irons (codes 300-330, 335-399) includes power tools; painting equipment; compressors; atomizing equipment; pumps; wet/dry vacuums; hoists, lifts or cranes; powered jacking equipment; water or gas drilling equipment; unclassified hydraulic equipment; heat-treating equipment;

incinerators, industrial furnaces, ovens or kilns; pumps; compressors; internal combustion engines; conveyors; printing presses; casting, molding; or forging equipment; heat treating equipment; tar kettles; working or shaping machines; coating machines; chemical process equipment; waste recovery equipment; power transfer equipment; power takeoff; powered valves; bearings or brakes; picking, carding or weaving machines; testing equipment; gas regulators; separate motors; non-vehicular internal combustion engines; and unclassified shop tools and industrial equipment. . As noted in Appendix A, a proportional share of shop tools and industrial equipment (code 300) is included here.

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

Mobile property (vehicle) describes fires in which some type of mobile property was involved in ignition, regardless of whether the mobile property itself burned (mobile property involved codes 2 and 3).

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

Appendix C

Selected Published Incidents

The following are selected published incidents involving stores and other mercantile properties. Included are short articles from the "Firewatch" or "Bi-monthly" columns in *NFPA Journal* or its predecessor *Fire Journal* and incidents from either the large-loss fires report or catastrophic fires report. If available, investigation reports or NFPA Alert Bulletins are included and provide detailed information about the fires.

It is important to remember that this is anecdotal information. Anecdotes show what can happen; they are not a source to learn about what typically occurs.

NFPA's Fire Incident Data Organization (FIDO) identifies significant fires through a clipping service, the Internet and other sources. Additional information is obtained from the fire service and federal and state agencies. FIDO is the source for articles published in the "Firewatch" column of the *NFPA Journal* and many of the articles in this report.

Sprinklers Spare Store Major Loss, Oregon

The motor of an HVAC system on the mezzanine of a retail store seized and created enough heat to ignite insulation, starting a fire that spread to the wooden roof joists. Fortunately, two sprinklers controlled the fire until firefighters, responding to a water flow alarm at 11:10 p.m., extinguished it.

The single-story building had a concrete floor and walls, and a wooden roof. A monitored wet-pipe sprinkler system provided full coverage.

The building, valued at \$1,200,000, and its contents, valued at \$300,000, sustained damages estimated at \$20,000 each.

Kenneth J. Tremblay, 2010, "Firewatch," *NFPA Journal*, January/February, 27.

Sprinkler Controls Incendiary Fire in Shopping Mall, Tennessee

A single sprinkler operated during an incendiary fire, sparing a multi-million-dollar shopping mall significant damage.

The two-story, steel-frame mall had concrete floors and walls and contained 1.3 million square feet (121,000 square meters) of floor space. It was protected by a wet-pipe sprinkler system and had a fire detection system that provided smoke detection, elevator recall, and occupant notification, as well as a water flow alarm.

A mall employee discovered the fire shortly after it began in a first-floor housekeeping break room. He notified mall security, which met firefighters responding to the 5:30 p.m. water flow alarm and directed them to the site of the blaze.

Investigators determined that the fire began when an unknown individual used a match or a lighter to ignite a plastic bag on a housekeeping cart in the break room, which was located under a wooden mezzanine. The fire consumed the bag and its contents and began to spread to the underside of the mezzanine before it was subdued by a sprinkler.

The fire did approximately \$10,000 in damage to the building, which was valued at \$120,000 million, and its contents, valued at \$60 million. There were no injuries.

Ken Tremblay, 2010, "Firewatch", *NFPA Journal*, May/June, 42.

Explosion at Propane Filling Station Kills One, Minnesota

An 18-year-old man died instantly in an explosion that occurred as he filled a customer's 100-pound (45 kilogram) tank at a propane filling station next to a large retail store. A 15-year-old boy who was nearby suffered minor burns but escaped more serious injuries.

The retail store sold farm equipment, fertilizer, and propane, which it dispensed at the outdoor filling station. The metal walls of the one-story, steel-frame building were 180 feet (55 meters) long and 170 feet (52 meters) wide, and its metal-deck roof was covered with a rubber membrane. A wet- and dry-pipe sprinkler system had been installed, as had a fire detection system; both were monitored by a central station alarm company.

Approximately 45 sprinklers operated and kept the fire from spreading into the store, as firefighters responded to the 5 p.m. alarm.

The building, valued at \$2 million, sustained \$250,000 in damage, while its contents, valued at \$1.5 million, sustained \$225,000 worth of damage. Investigators were unable to determine the ignition source, and the incident is still under investigation.

Ken Tremblay, 2010, "Firewatch", *NFPA Journal*, July/August, 31.

Sprinkler Extinguishes Fire in Shopping Mall, Pennsylvania

Cardboard boxes pushed too close to lighting in a window display at a clothing store in a shopping mall ignited and burned until a single sprinkler operated and extinguished the flames.

The construction characteristics and size of the mall were not reported, but the store, which was 100 feet (30 meters) long and 60 feet (18 meters) wide, was constructed of wood framing with steel framing supporting the built-up, metal deck roof. The property was protected by a wet-pipe sprinkler system.

Investigators determined that the fire started when heat from ceiling-mounted track lighting ignited a number of decorated cardboard boxes that had been pushed up against them in the display window. The boxes should have been placed no closer to the sprinkler and the light than 18 inches (46 centimeters).

Damage to the store was estimated at \$50,000, as was damage to the store's contents. No one was injured.

Ken Tremblay, 2010, "Firewatch", *NFPA Journal*, September/October, 35.

Sprinklers Control Fire in Furniture Store, South Carolina

Three sprinklers controlled a fire in a furniture store's second-floor electrical room until firefighters arrived and extinguished it.

The two-story, steel-frame building, which was 200 feet (61 meters) long and 200 feet (61 meters) wide, had concrete walls and a metal deck roof that was covered by a rubber membrane. The store was protected by a wet-pipe sprinkler system and a water flow alarm that was only designed to sound locally.

The fire started in the electrical room's main distribution panel, damaging cable insulation and other items in the room. After burning for some time, the electrical wiring eventually short circuited and knocked out a power grid fuse.

The sprinklers held the fire in check until the fire department was notified several minutes later. Once firefighters extinguished the blaze, they shut the sprinklers and drained them to minimize water damage.

Damage to the building, valued at \$4.5 million, and its contents, valued at \$3.5 million, was not reported.

The fire department noted that fire damage was limited to the room of origin. However, smoke had spread throughout the second floor, and light smoke damaged the first floor. Water damage was confined to the area in and around the room of fire origin on both floors.

There were no injuries.

Ken Tremblay, 2010, "Firewatch", *NFPA Journal*, September/October, 35.

Sprinkler Extinguishes Fire Started by Unattended Candle, Florida

A candle left burning unattended over the weekend in a hair salon in a strip mall started a fire that spread to combustibles until a sprinkler activated and extinguished the flames.

The single-story, steel-frame mall had concrete block walls with lightweight steel bar joists supporting a metal deck roof with a built-up surface. A monitored wet-pipe sprinkler system had been installed.

The fire department was notified of the automatic water flow alarm at 8:02 a.m., and firefighters arrived 5 minutes later to find that a sprinkler had extinguished a fire in the salon's bathroom. The door to the bathroom was closed, limiting the smoke and heat damage in the rest of the salon.

Investigators found a candle 8 inches (20 centimeters) in diameter on the top of a three-tier wire shelf. On the lowest shelf was an arrangement of dried flowers. Investigators determined that the candle flame burned through the bottom of the candle, releasing hot wax that dripped down to the flowers and started a smoldering fire.

The \$11 million property suffered less than \$1,000 worth of damage.

Kenneth J. Tremblay, 2010, "Firewatch", *NFPA Journal*, March/April 27.

Sprinklers Douse Pet Shop Fire, Washington

Two sprinklers extinguished a fire caused by an electrical malfunction in the operating equipment of a salt-water aquarium at a pet store. The heat resulting from the malfunction ignited the equipment, and the fire spread to other combustibles before it was extinguished.

The one-and-a-half-story building, which covered approximately 22,000 square feet (2,000 square meters), had concrete block walls and a wooden roof with a built-up surface. The store's

wet-pipe sprinkler system was not monitored; a water motor gong only provided a local flow alarm. There was no fire detection or notification equipment.

When the sprinkler systems activated, the water motor gong failed to operate, and the fire department only learned of the fire some 30 minutes later, when a passerby saw water coming from the building and called 911 at 5:23 a.m. Responding firefighters entered the shop and discovered the sprinkler system operating in the fish tank retail area.

Fire department investigators discovered fire damage on the plastic housing of the heater and filter unit of a saltwater fish tank on a lower shelf. They believe that the tank, which was leaking before the fire began, caused the equipment to malfunction.

The fire did \$20,000 damage to the building, which was valued at \$1 million, and \$60,000 damage to its contents, which were valued at \$750,000. There were no injuries.

Kenneth J. Tremblay, 2010, "Firewatch", *NFPA Journal*, March/April 27.

Sprinkler Extinguishes Fire, Texas

A sprinkler extinguished a fire started by a candle that had been left burning unattended for most of the day in a gift shop in a historic downtown section.

The two-story, wood-frame building, which was 300 feet (91 meters) long and 100 feet (30 meters) wide, had a brick exterior and a flat, wooden roof covered with a built-up roof surface. It had a wet-pipe sprinkler system, but there was no fire detection equipment.

An occupant of an adjacent store smelled smoke and called the fire department at 5 p.m. Responding firefighters forced their way into the gift shop, which was closed at the time, and discovered a sprinkler operating over burned cardboard boxes full of combustible goods on the floor of a grade-level storage room.

Investigators discovered that a candle in a glass jar, which had been lit 22 hours before the fire and placed on a glass shelf above the boxes, had fallen into one of the boxes when the glass jar or the shelf failed. Once the box ignited, the sprinkler activated and extinguished the blaze.

The building, valued at \$2.5 million, sustained \$1,000 in property damage. Its contents, valued at \$50,000, sustained an estimated loss of \$5,000.

Kenneth J. Tremblay, 2009, "Firewatch", *NFPA Journal*, July/August, 20.

Sprinklers Control Fire in Store, Illinois

A fire that began in a retail display containing cigarette lighters, lighter fluid, and other combustibles intensified when the plastic containers of lighter fluid ruptured and created four thermal plumes that activated five sprinklers, giving occupants time to evacuate as smoke filled the store.

The single-story, steel-frame store, which was 100 feet (30 meters) long and 140 feet (43 meters) wide, had concrete block walls covered with a brick veneer; a flat, built-up roof; and a 20-foot (6-meter) ceiling. The building had a wet-pipe sprinkler system and a fire detection system.

Store employees called 911 to report the fire at 5:30 p.m., and the fire department received suppression and detection system notifications shortly afterward. Arriving firefighters found the building, which had already been evacuated, heavily charged with smoke and advanced a 1 3/4-inch hose line into the structure. Once inside, they found that sprinklers had already extinguished the blaze.

Investigators were unable to determine how the fire started, but they discovered the point of ignition near the flammable and combustible items in the display case.

The building, valued at \$4 million, and its contents, valued at \$3 million, sustained damage estimated at \$15,000 and \$100,000, respectively. There were no injuries.

Kenneth J. Tremblay, 2009, "Firewatch", *NFPA Journal*, July/August, 20-21.

Concealed Fire Damages Mall, Kansas

An undetermined electrical malfunction is believed to have ignited lint from a dry cleaner that had accumulated in the void between the ceiling and roof of a strip mall, starting a fire that damaged several businesses.

The single-story mall was 400 feet (122 meters) long and 100 feet (30 meters) wide. It had masonry walls and a flat wooden roof. The structure was equipped with smoke detectors but it had no sprinklers.

The fire was reported at 6:20 p.m. by someone in the mall's parking lot, who saw smoke coming from the building. Firefighters arriving within four minutes also saw the smoke and started laying multiple hose lines to the building. Once inside the mall, crews could see the fire in the dry cleaning store. Additional companies found that masonry fire walls extending to the roof had confined fire damage to two shops that shared attic space.

The property was valued at \$7 million dollars, and its contents were valued at \$5 million. Damage to the building was estimated at \$1.5 million, while damage to the contents was estimated at \$2.5 million.

There were no injuries

Ken Tremblay, 2009, "Firewatch", *NFPA Journal*, September/October, 28-29.

Sprinkler Controls Department Store Fire, Pennsylvania

A single sprinkler operated to control a fire in the stock room of a large department store that was about to open for business, containing it until firefighters could extinguish it. The three-story, steel-frame building, which had concrete block and brick walls, had a wet-pipe sprinkler system and smoke detectors monitored by an alarm company.

The alarm company alerted the fire department to the sprinkler system's water flow alarm at 8:36 a.m. Responding firefighters saw no fire or smoke until they entered the building, where they encountered smoke near a first-floor bathroom and heavy smoke in an adjacent stock room. By then, the fire was out, and firefighters finished ventilation in roughly an hour.

Investigators determined that the fire started when a foam bed pad wrapped in plastic and placed on a shelf next to a radiant ceiling heater ignited when a drop in temperature caused the heater to operate. Melting plastic and foam flowed onto products below the shelf until the sprinkler operated and extinguished the fire. The store was allowed to open about an hour after the fire, although the affected area remained off limits.

The building, valued at \$12 million, sustained structural losses of \$10,000. Its contents, valued at nearly \$30 million, sustained \$300,000 worth of damage. One firefighter suffered a minor eye injury during the operation.

Ken Tremblay, 2009, "Firewatch", *NFPA Journal*, September/October, 28-29.

Welding Starts Fire in Mall, Utah

Two sprinklers operated and controlled a fire that began when welders installing a decorative tree at a mall that was closed for the night ignited the tree's foam material. The two-level mall, which had 50-foot (15-meter) ceilings, was equipped with a wet-pipe sprinkler system.

The fire department received the alarm at 10:59 p.m., and firefighters arrived within three minutes to find smoke coming from the roof of the mall and filling the interior. Advancing a hose line into the building, they found that the smoke had banked down from the ceiling to just 4 feet (1 meter) from the floor, substantially limiting their visibility.

When they finally found the seat of the fire, firefighters used a hose line to complete extinguishment. After the fire was out, however, they noticed that smoke was being generated elsewhere, although the smoke and the height of the ceiling made it difficult to determine whether fire had impinged on the ceiling. Horizontal ventilation improved the situation only slightly because of the building's large size.

As additional crews placed protective hose lines to limit possible fire spread, other crews controlled the mall's HVAC units to exhaust the smoke from the building.

Construction workers reported that the fire started when their welding torch came too close to the spray foam on the tree and that they tried unsuccessfully to control the blaze with portable fire extinguishers.

Structural damage to the building was estimated at \$25,000, while smoke damage was estimated at \$1,175,000.

Ken Tremblay, 2009, "Firewatch", *NFPA Journal*, September/October, 29.

Firefighters Extinguish Blaze in Hair Salon, Florida

A passerby called 911 at 3:00 a.m. to report a fire in a hair salon in a single-story strip mall.

The mall was constructed of concrete block walls over a concrete slab with a steel bar joist roof covered by a metal deck and built-up roof covering.

The building had no sprinklers, and investigators could not determine whether it had any smoke detection equipment.

Firefighters arriving six minutes after receiving the alarm found that the salon's front windows had failed and that fire was rolling from the salon.

Initiating a blitz attack with the deck gun from the engine, fire crews knocked the fire down and entered the salon with a 2 1/2-inch hoseline to extinguish the remaining flames.

Additional crews were sent into the businesses on either side of the salon to make sure the fire had not spread.

Investigators determined that someone started the fire intentionally by pouring flammable liquids in several locations and igniting them using an

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, November/December, 23.

Dryer Vent Fire Damages Mercantile Building, New Hampshire

A fire that started on the second floor of a mercantile building quickly spread to the attic, heavily damaging the building. The fire detection system activated, although the fire was first discovered by an occupant.

The two-and-a-half-story, wood-frame building measured 150 feet by 50 feet (46 meters by 15 meters) and had a wood-truss roof covered with asphalt shingles. Its fire detection system included a combination of smoke and heat detectors throughout the structure, including the attic. The building had no sprinklers.

The owner of a day spa on the second floor had just finished washing and drying towels when she noticed smoke and fire coming from the electric dryer.

She threw some water on the blaze and, assuming she had extinguished it, went to talk to the owner of the business directly below hers, who was investigating the source of the water coming from the ceiling.

When she returned to her business, she discovered that she had not extinguished the fire after all and called 911. Shortly afterward, the building's automatic fire detection system operated.

Responding firefighters found heavy fire coming from the gable end of the roof and immediately ordered a second alarm.

When they entered the building, however, they saw light smoke, but no visible fire. Investigators determined the fire started when an accumulation of lint in the dryer's exhaust vent, which terminated in the attic, ignited, and the fire spread to the attic, where it vented from the building. The point of origin was about 4 feet (1 meter) from the dryer discharge and 3 feet (0.9 meters) from the floor. The dryer showed no signs of failure.

The first floor sustained water damage as a result of extinguishment.

The building, valued at \$1 million, and its contents, valued at \$250,000, sustained combined losses of \$950,000. There were no injuries.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, March/April, 30.

Sprinklers Hold Fire in Check, California

A fire of undetermined origin started in the retail aisle of a home store in an area containing wicker baskets and imitation leather desk items. The fire occurred as the store was open and operating and was held in check by sprinklers although interior visibility was near zero due to smoke production.

The two-story building had a fire detection system and a wet-pipe sprinkler system and each operated to alert the occupants and the fire department. Building construction or the size of the building was not reported. The first due engine arrived on scene within six minutes and found heavy smoke coming from the front doors. Joining another engine company they advanced into the store, but found it difficult to move due to the lack of visibility and excessive fuel load from large amounts of boxed storage.

Crews worked to the rear of the store where several sprinklers were operating and the fire started. Shutting down the sprinklers the crews could overhaul the fire and attempt to ventilate the building. During investigation it was found that portions of the roof were still on fire, as a ladder company located on the roof used a thermal imaging camera to locate hot spots, open the roof and provide for final extinguishment.

The fire is considered undetermined as no ignition source was located. The building is valued at \$5 million dollars with contents of \$3 million dollars. Damages to the building were \$250,000 with contents losses of \$150,000. There were no injuries.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, January/February, 24.

Faulty Light Ballast Ignited Small Fire, Maryland

A small light ballast within the display case of a jewelry store sparked a fire that was quickly detected by the fire detection system and a passing motorist. A 16-square-foot (1.5-square-meter) area was consumed by the fire, but its location in the window display case did not create enough heat for sprinklers to operate.

The single-story row of stories included a jewelry store in the middle. Closed for the night, the store constructed of steel framing with metal-studded walls and a metal-deck roof measured approximately 100 feet (30 meters) in length and 60 feet (18 meters) in width. A smoke detection system and dry-pipe sprinkler system, each monitored by a central station alarm company, provided full protection.

Firefighters were called at 6:37 a.m. and found the display case to the right of the door filled with smoke and evidence of a fire damaging the contents. Fire did not spread to the interior of the store.

The electrical ballast powering lights in the display case showed signs of damage and the burn pattern led directly to the device itself. Failure of this light ballast caused the fire to ignite and spread to some contents. Damage to the building was estimated at \$25,000 with contents of \$5,000 reported to be the only losses.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, January/February, 22.

Fire Engulfs Retail Building, California

Fire burning within a concealed attic and roof space consumed structural wood components, quickly engulfed an enclosed mall, and affected several businesses.

A 10-minute delay occurred as the fire burned undetected while occupants searched for the source before calling the fire department.

The fire occurred in a single-story, enclosed strip mall constructed of wood framing with a flat wooden roof covered by a rubber. A drycleaners was the point of origin. The structure measured 75 feet (22 meters) in length and 30 feet (9 meters) in width. Three other occupancies were in the building. The building lacked fire detection and suppression equipment.

Employees of the dry-cleaners arrived for work at 6 a.m. and ignited a boiler to begin the day's operations. Nearly an hour later, employees saw smoke outside the building and investigated before calling the fire department at 7 a.m. The fire department arrived to find fire in the common attic space and affecting four occupancies. An engine and ladder crew attempted a trench cut the roof for ventilation and fire attack, but partial roof collapse occurred and firefighters fought the fire defensively as it consumed the building.

Investigators were able to determine that the boiler flue stack ran through the attic/roof space and vented out the roof. The flue pipe had rusted through in spots causing holes and allowing heat and products of combustion in the concealed space. Over time, structural wooden members dried and the heat ignited them and quickly spread due to lack of fire stops. The building, valued at \$2,500,000 with \$250,000 of contents, was a total loss. There were no injuries.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, January/February, 22-23.

Sprinklers Control Fire in Sporting Goods Store, Connecticut

A fire in a sporting goods store that was closed for the night was quickly contained when two sprinklers operated.

The unintentional fire started when canoes wrapped in plastic were placed near a ceiling-mounted heating unit. Radiant heat ignited the plastic, the canoes dropped down, and the fire ignited other combustibles below.

The single-story building had high concrete block walls supporting steel roof bar joists and a corrugated steel roof covered by a rubber membrane. The store had 42,000 square feet (3,901 square meters) of space and a wet-pipe sprinkler system with a monitored water flow alarm protected the building. There were no smoke alarms.

The fire department received the alarm at 1:05 a.m. and it responded and found some small fires in the rear storage area. Rack storage in the space included merchandise for sale with the canoes stored on the top.

The building valued at \$5 million suffered a \$5,000 loss, however the contents of the store valued at \$4.5 million dollars had losses of \$3.5 million. There were no injuries.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, January/February, 23.

Incendiary Fire at Department Store Causes \$2 Million Loss, Washington

Someone using an open-flame device intentionally set fire to a rack of women's clothing in a large department and grocery store before leaving the premises. Employees used portable fire extinguishers to control the blaze until the store was safely evacuated.

The one-story, steel-frame big box store covered an area of approximately 220,350 square feet (20,471 square meters) and had a steel-truss roof, concrete block walls, and a high ceiling. A central station alarm company monitored the store's fire detection system, which used beam detectors. The store also had a wet-pipe sprinkler system.

The fire in the display was set at approximately 9:00 p.m. A manager alerted to the fire went to the apparel department where he found someone using a fire extinguisher on the blaze. He told the individual to evacuate the premises and began using fire extinguishers himself. Later, he told investigators that the fire kept flaring up after appearing to be contained, so he kept using extinguishers on it until he was sure everyone was out of the building. In all, the building occupants used four extinguishers to control the blaze.

The fire alarm activated when smoke reached the ceiling, and the alarm company alerted the fire department. Firefighters used a water/foam extinguisher to put it out. The fire was never hot enough to activate the sprinklers.

Although the fire did not spread beyond the display rack, smoke caused an estimated \$2 million in damage to its contents. There was no structural damage, and no one was injured. Investigators confirmed the sequence of events but could not identify or locate the person who started the fire.

Kenneth J. Tremblay, 2008, "Firewatch", *NFPA Journal*, May/June, 32.

Dryer Vent Fire Damages Mercantile Building, New Hampshire

A fire that started on the second floor of a mercantile building quickly spread to the attic, heavily damaging the building. The fire detection system activated, although the fire was first discovered by an occupant.

The two-and-a-half-story, wood-frame building measured 150 feet by 50 feet (46 meters by 15 meters) and had a wood-truss roof covered with asphalt shingles. Its fire detection system included a combination of smoke and heat detectors throughout the structure, including the attic. The building had no sprinklers.

The owner of a day spa on the second floor had just finished washing and drying towels when she noticed smoke and fire coming from the electric dryer.

She threw some water on the blaze and, assuming she had extinguished it, went to talk to the owner of the business directly below hers, who was investigating the source of the water coming from the ceiling.

When she returned to her business, she discovered that she had not extinguished the fire after all and called 911. Shortly afterward, the building's automatic fire detection system operated.

Responding firefighters found heavy fire coming from the gable end of the roof and immediately ordered a second alarm.

When they entered the building, however, they saw light smoke, but no visible fire. Investigators determined the fire started when an accumulation of lint in the dryer's exhaust vent, which terminated in the attic, ignited, and the fire spread to the attic, where it vented from the building. The point of origin was about 4 feet (1 meter) from the dryer discharge and 3 feet (0.9 meters) from the floor. The dryer showed no signs of failure. The first floor sustained water damage as a result of extinguishment.

The building, valued at \$1 million, and its contents, valued at \$250,000, sustained combined losses of \$950,000. There were no injuries.

Kenneth J. Tremblay, 2008, "Firewatch", NFA Journal, March/April, 30.

State: Massachusetts

Dollar Loss: \$26,000,000

Month: July

Time: 4:14 am

Property Characteristics and Operating Status:

This three-story, irregularly-shaped former mill building was used by 56 mercantile businesses and covered 350,000 square feet (32,500 square meters). It was of unprotected ordinary construction. The building was closed at the time of the fire.

Fire Protection Systems:

There was no smoke detection equipment present. There was a full-coverage combination wet- and dry-pipe sprinkler system. A sprinkler valve in the area of ignition was padlocked shut, allowing the fire to quickly overwhelm the rest of the system. The fire department was not notified that the system was shut down.

Fire Development:

Investigators believe the fire started after welding was done in the basement the day before, without a permit from the fire department.

Contributing Factors and Other Details:

Several code noncompliance issues, such as the welding and shutting down the sprinkler system, contributed to the fire. Four hundred firefighters from 78 fire departments in two states responded to this fire. Nine firefighters were injured. The loss was estimated at \$16,000,000 to the structure and \$10,000,000 to the contents.

Stephen G. Badger, 2008, "Large-Loss Fires in the United States in 2007", NFA Fire Analysis and Research, Quincy, MA

State: District of Columbia

Dollar Loss: \$20,000,000

Month: April

Time: 12:56 a.m.

Property Characteristics and Operating Status:

This historic one-story market place covered 27,810 square feet (2,580 square meters) and was of heavy timber construction. The building was closed at the time.

Fire Protection Systems:

There was a local fire alarm system present. No further information was reported. There was no suppression equipment present.

Fire Development:

The cause and origin of the fire was undetermined.

Contributing Factors and Other Details:

Arriving firefighters initiated an interior attack but soon were withdrawn to a defensive attack, due to deteriorating fire conditions.

Stephen G. Badger, 2008, "Large-Loss Fires in the United States in 2007", NFPA Fire Analysis and Research, Quincy, MA

State: Nebraska

Dollar Loss: \$11,700,000

Month: April

Time: 5:30 P.M.

Property Characteristics and Operating Status:

This two-story department store was of unprotected ordinary construction and covered 22,400 square feet (2,100 square meters). The store was closed at the time of the fire.

Fire Protection Systems:

There was no automatic detection or suppression system present.

Fire Development:

This fire broke out in the basement when a portable work light ignited sawdust. The fire spread to cardboard then up through the structure.

Contributing Factors and Other Details:

This store was in a block of businesses that was built in the 1800s. Each business had been remodeled several times, resulting in lots of void spaces. The basement and second-story were open end to end, allowing for rapid fire spread. The loss was set at \$10,500,000 to the structure and \$1,200,000 to the contents.

Stephen G. Badger, 2008, "Large-Loss Fires in the United States in 2007", NFPA Fire Analysis and Research, Quincy, MA

State: Pennsylvania

Dollar Loss: \$5,000,000

Month: February

Time: 4:42 a.m.

Property Characteristics and Operating Status:

This two-story hardware store was of unprotected noncombustible construction and covered 62,000 square feet (5,760 square meters). It was closed at the time of the fire.

Fire Protection Systems:

There was a complete coverage of smoke detection equipment. The system operated and alerted an alarm monitoring company that in turn notified the fire department. There was no automatic suppression equipment present.

Fire Development:

The fire originated in a void area in the front of the store that was used for storage. The cause is undetermined due to the total destruction of the structure.

Contributing Factors and Other Details:

Original efforts to extinguish the fire failed. Officials decided to let the fire burn, due to the tons of insecticides, fertilizer, and other hazardous materials that were present. They also took into consideration water runoff to many nearby streams and farms. The loss was estimated at \$2,000,000 to the structure and \$3,000,000 to the contents.

Stephen G. Badger, 2008, "Large-Loss Fires in the United States in 2007", NFPA Fire Analysis and Research, Quincy, MA

Fire Heavily Damages Convenience Store and Gas Station, Pennsylvania

After smelling something burning at a 24-hour convenience store/gas station, occupants discovered a fire near a walk-in cooler. Employees evacuated the store and shut off electrical power to the cooler and the fuel pumps before leaving. A passerby saw the fire and called 911 at 6:37 p.m.

The wooden-frame, single-story building measured 120 feet (36 meters) by 30 feet (9 meters). Exterior walls were wood framing over a concrete slab with wooden roof trusses creating a flat roof covered by a rubberized surface. The building did not have a fire detection system or sprinklers.

The fire burned 20 to 30 minutes before detection. It started in a wall where a 200-amp electrical service entered the building. An undetermined malfunction occurred within the electrical wiring and ignited structural wood-frame members behind the walk-in cooler. Flames spread vertically into the attic/roof void and externally through a large hole burned through the outside walls.

From 15 blocks away, heavy smoke could be seen coming from the store. Firefighters arrived within three minutes of the 911 call and observed fire coming from the left rear corner of the building. Smoke was pushing out of the façade but no other fire was visible. Two crews advancing hose lines into the building found little smoke or heat and quickly made it to the back of the store. Using a thermal imaging camera crews observed extreme fire involvement of the void space and upon pulling ceilings and applying water into the space, it had no effect and they retreated. Command ordered everyone from the building as roof crews reported the roof sagging

as all crews were accounted for before commencing a defensive attack. Large master streams were used to control the fire, but the roof collapsed 10 minutes after arrival.

Valued at \$375,000 with contents of \$345,000, the building and contents were total losses. One firefighter received minor injury after being struck by a hose line.

Kenneth J. Tremblay, 2007, "Firewatch", *NFPA Journal*, September/October, 31-32.

Electrical Short Ignites Window Display in Store, New York

A building containing six stores was lost to fire. The fire began when an electrical short ignited plastic toys and spread to other combustibles. Firefighters were able to stop the spread of fire at one end of the building and prevent extension to the rest of the block.

The fire began in a seasonal retail store in the middle of the building. The wooden-frame building measured 150 feet (45 meters) by 60 feet (18 meters) and it had a steel beam supporting wooden roof framing and a flat built-up roof. There was no fire detection system. A wet-pipe sprinkler system was installed, but it did not operate because the water supply was disconnected. The store was closed for the season.

A passerby observed fire in a display window and called 911 at 9 a.m. The fire department arrived and found the store and common cockloft well involved. Hose lines were used on several of the occupancies and an aerial truck was located on the left side where crews made a stand. Three stores were lost, however fire crews were able to stop the progression of fire at a fourth store.

The building, valued at \$2 million, and contents, valued at \$1 million, were total losses. There were no injuries.

Kenneth J. Tremblay, 2007, "Firewatch", *NFPA Journal*, March/April, 17-19.

Fire Heavily Damages Store, but Firefighters Limit Exposure Loss, Kansas

Concrete firewalls and firefighters contained a fire burning in the middle of a row of single-story stores. Despite the store being occupied and quick fire department notification, the fire still spread quickly. Flames were blowing out the front door upon arrival. The command ordered defensive operations from the start that allowed protection to either side of the building.

The building was constructed of steel framing supporting wooden roof joists and a built-up roof structure. Brick exterior walls covered an art gallery and firewalls protected the two occupancies to the right and to the left. Details on the fire detection or suppression system were unavailable.

A customer told an employee that she heard a popping and crackling sound when she entered. The employee was getting some merchandise for the customer at the rear of the store when the customer stated the popping and crackling became louder. Shortly thereafter, she also saw the reflection of flames coming from the ceiling near the front display area of the store. The employee grabbed a fire extinguisher but the fire was growing and smoke filled the building. The employee and the customer exited the open store and the customer called 911 on her cell phone. Shortly after leaving the store, the front window failed and flames roared from the building.

The fire department received the alarm at 4:57 p.m. and arrived within two minutes reporting fire and smoke showing. Due to the intensity of the fire, command ordered the use of master streams into the storefront to quickly control fire spread. Calling for additional resources, the chief used other companies for defensive aerial operations and utilized large-diameter hose lines and master streams to control the fire and limit spread to exposures.

A third alarm was called. The additional resources supplied relief crews and water pressure to the overtaxed system. Eventually the roof collapsed and the fire was controlled. Damage to the occupancies on either side of the building was limited to smoke and water damage. The exact cause was not reported and two firefighters were injured. Damage to the building is estimated at \$500,000 of its \$750,000 value. Contents totaling \$300,000 were a total loss.

Kenneth J. Tremblay, 2007, "Firewatch", *NFPA Journal*, March/April, 17.

Sprinkler Controls Mall Fire, Maryland

Three sprinklers operated during a fire in a "dollar"-type retail store on one floor of a multi-story, mini-type mall, preventing the blaze from spreading to other stores in the complex. The type of sprinkler system was not reported.

Firefighters responding to the 6:10 p.m. alarm found smoke showing outside and in the mall's atrium. Heavy smoke was in the store and they discovered that the sprinklers had nearly extinguished the fire burning in an aisle filled with paper goods and stuffed animals.

Using a portable water extinguisher and a hose line, they extinguished remaining fire. Several fire companies helped provide ventilation, checked for extension, and shut down the sprinklers once the fire was out.

The cause of the fire is undetermined. Damage to the building was estimated at \$10,000; damage to the store's contents was estimated at \$15,000. No one was injured.

Kenneth J. Tremblay, 2007, "Firewatch", *NFPA Journal*, January/February, 20.

Fire Destroys Store, Michigan

An intentionally set fire destroyed a store located in a strip mall. The early-morning fire gained considerable headway before firefighters arrived.

The single-story building, which covered an area of approximately 14,310 square feet (4360 square meters), had no suppression systems.

Firefighters arrived at the mall within five minutes of the 1:21 a.m. report of a building fire to find light smoke coming from the store. Advancing a 2 1/2 -inch hose line through the business's unlocked front doors, they saw thick, dark smoke and rolling flames.

They also heard several small explosions and gas being released from a nearby cylinder. They deployed additional hose lines to provide back up and protect adjacent stores. When the fire vented through the roof, the interior crews withdrew to defensive positions outside the building, where large master streams were used to extinguish the blaze.

Investigators determined that the fire began when someone intentionally ignited a flammable liquid. The fire barriers on either side helped prevent the flames from spreading beyond the store of origin.

The building, valued at \$1.4 million, and its contents, valued at \$700,000, suffered structural losses of \$320,000 and \$100,000, respectively.

Kenneth J. Tremblay, 2007, "Firewatch", *NFPA Journal*, January/February, 20.

Fire Destroys Retail Store, Georgia

A used clothing store was destroyed by a fire that started in a centrally located storage room. Local building codes did not require the building to have a sprinkler or alarm system.

The two-story building, which measured 150 feet (meters) by 149 feet (meters), had concrete block walls with a metal truss roof structure and a tar-and-gravel roof. Used clothing and other items were sold in the front half of the building, and the back half was reserved for a receiving area and storage.

An occupant of the store discovered the fire, which had burned for an undetermined amount of time, and called 911 at 8:00 p.m. Investigators determined that an unknown ignition source dropped into a storage bin ignited clothing, resulting in a fire that spread in all directions. The lack of fire detection and suppression systems, the heavy fuel load, a lack of firestopping contributed to the destruction.

The building, valued at \$1 million, and its contents, valued at \$60,000, were destroyed. There were no injuries.

Kenneth J. Tremblay, 2006, "Firewatch", *NFPA Journal*, November/December, 24.

Firewall Slows Fire, Indiana

A firewall in the attic of a strip mall slowed the spread of a fire that started when an electrical transformer malfunctioned and ignited combustibles in the space. The wood-frame firewall was covered with two layers of 5/8-inch drywall on each side.

The unsprinklered single-story building, which was 640 feet (195 meters) long and 60 feet (18.3 meters) wide, had concrete block walls on three sides. Its front wall was made of glass supported by metal upright posts and support header beams. Wooden trusses 20 to 32 feet (6 to 9.8 meters) above the walls created a large void. The building had no fire detection system.

A passerby discovered the fire and called 911 at 7 a.m. Seeing a huge amount of smoke as he approached the scene, the responding incident commander ordered a second alarm. Arriving firefighters discovered heavy fire at the front of the building and attacked the fire using large-diameter hoses as additional crews forced their way into several storefronts, pulled down ceilings, and placed a hose line in the attic to control the blaze.

The transformer that malfunctioned powered the building's lighted signs.

Investigators determined that the transformer, which was used to power the buildings lighter signs, malfunctioned and that the fire fed off the wooden roof framing for an hour or two before it was detected.

Several stores suffered significant losses, but the number of occupancies and the amount of damage was not reported. There were no injuries.

Kenneth J. Tremblay, 2006, "Firewatch", *NFPA Journal*, January/February, 20.

Sprinklers Control Department Store Arson Fire, Colorado

Sprinklers controlled a fire that was intentionally set in an occupied area of a department store.

The two-story, steel-frame building, which was 310 feet (94.5 meters) long and 305 feet (93 meters) wide, had concrete block walls and a metal-deck roof covered by a membrane. It was protected by a wet-pipe sprinkler system that was monitored by a central station monitoring company.

A shopper discovered the fire in the store's women's clothing section within minutes of ignition, and two people tried unsuccessfully to put out it using portable fire extinguishers. Fortunately, two sprinklers activated and controlled the fire, alerting the central station monitoring company, which called the fire department at 6:10 p.m.

Firefighters arrived five minutes later to find smoke filling the store and called for additional resources to help conduct primary and secondary searches. With the flame spread under control, firefighters advanced their hose lines to extinguish several racks of burning clothing. Two sprinklers kept the fire from spreading further, and firefighters used handlines to extinguish the blaze.

Damage to the store and its contents was not reported.

Kenneth J. Tremblay, 2006, "Firewatch", *NFPA Journal*, January/February, 20-22.

Leaking Propane Ignites in Warehouse, Maryland

The open pilot light of a gas-fired water heater ignited propane leaking from a stored cylinder, causing an explosion and fire that heavily damaged a mixed-use retail, business, and warehouse building.

Steel framing supported the metal trusses of the single-story building, and its concrete block walls were covered with a brick veneer. The building, which was 150 feet (45.7 meters) long and 40 feet (12 meters) wide, had several occupants, including a grocery store and a millwork shop. It had no suppression or detection equipment.

An employee of the millwork shop was sitting at his desk when he heard a loud explosion. After ceiling tiles fell on him, he and four others evacuated the building. Once outside, he saw smoke coming from one end of the structure and heard several more explosions. With fire now showing from the building, he went back inside to find his cell phone, left the building, and called the fire department at 9:15 a.m.

Once the fire was extinguished, investigators spoke with several of the building's occupants and found that an employee of the grocery store had discovered that one of five propane cylinders of

the type used to fuel a forklift was leaking in the store's storage area. He told his supervisor, who instructed another man to fix the leak. The two employees were returning to other storage area when the first explosion occurred.

Structural damage to the building, valued at \$7 million, was estimated at \$3 million; its contents, valued at \$2 million, sustained \$1 million in damage. There were no injuries.

Kenneth J. Tremblay, 2006, "Firewatch", *NFPA Journal*, January/February, 16.

State: California

Dollar Loss: \$7,900,000

Month: July, 2006

Time: 10:58 am

Property Characteristics and Operating Status

This one-story department store covered 30,000 square feet (2,787 square meters) and was of protected noncombustible construction. The store was open with 10 employees and 75 customers within.

Fire Protection Systems

There was a combination of heat and smoke detectors present. The coverage was not reported but the system was out of service for an unreported reason when the fire broke out. There was no automatic suppression equipment present. Eight hand-held extinguishers were used by employees of the store and of a contractor who was present. None of these were effective due to the fire load and advancement of the fire.

Fire Development

Welders were installing a steel threshold on the outside of the loading dock. The roll-up door was closed but sparks entered the building through gaps in the door frame. The sparks ignited a large stack of flattened cardboard. From there, the fire spread to the mezzanine and throughout the store.

Contributing Factors and Other Details

An interior fire attack lasting 28 minutes was unsuccessful because there was only one stairwell to the mezzanine and it was involved with fire. As conditions deteriorated in the interior and on the roof, firefighters withdrew for an exterior attack. The loss was estimated at \$1,000,000 to the structure and \$6,900,000 to the contents.

Stephen G. Badger, "Large-Loss Fires in the United States – 2006", November 2007, p. 20.

Welders Start Fire, Maine

A fire started by hot slag dropping on combustibles spread through an occupied supermarket, causing millions of dollars in property damage.

The 54,000-square-foot (5,017 square-meter), steel-frame building had masonry walls and a concrete panel roof with built-up roof covering. It was protected by three wet-pipe sprinkler systems and one dry-pipe system, and smoke and heat detectors, monitored by the fire department, were located throughout the store. However, all the detection and suppression systems were shut off at the time of the fire.

A contractor was welding in a second-floor electrical room when hot slag drop down between electrical conduits to first-floor storage containing pallets of plastic trays on which meat was packaged. When the contractor saw smoke coming from the room, he went to investigate and, discovering the contents of the room on fire, tried to extinguish it. A 911 call to the fire department at 9:55 a.m. alerted firefighters, who put out the fire.

Damage to the property, valued at \$3.5 million, was estimated at \$500,000. The store's contents, valued at \$2 million, were a total loss. Two firefighters suffered burns during the incident.

Kenneth J. Tremblay, 2005, "Firewatch," *NFPA Journal*, January/February, 20.

Malfunctioning Heater Ignites Wood Framing, Maryland

Flames spreading through concealed spaces in this mercantile and residential occupancy made it difficult for firefighters to extinguish the blaze.

The three-story building, which measured 170 feet (52 meters) by 75 feet (23 meters), was of balloon-type construction with heavy timber framing, brick walls, and open chases from the basement to the roof. On the first floor were a clothing store, a restaurant, and a bar, all of which were closed at the time of the fire. On the second and third floors were nine occupied apartments. There were single-station, battery-operated smoke alarms in the apartments and hallways, but many of the batteries had been disconnected or removed. A partial wet-pipe sprinkler system provided coverage on all floor but the basement. However, a frozen intake valve in the basement compromised the system.

An occupant called 911 to report an apartment fire at 6:20 a.m., and responding firefighters and police officers noted light smoke showing from the building when they arrived on the scene. Firefighters advanced a 2-inch hose line to the second floor, where they encountered light smoke and several residents, who were evacuating the building. Another crew discovered the fire in the basement furnace room, although most of the heat from the room had vented up through the wall and broken into the apartments.

The interior crews worked for nearly an hour before the incident commander, fearing collapse, ordered all firefighters from the building. Using ladder pipes and ground monitors, crews played hose streams into the building from safe positions outside until they brought the fire under control. Eventually, the roof and third floor collapsed into the second floor and parts of the first floor.

Investigators determined that a malfunctioning coal-fired furnace ignited first-floor framing and that the fire spread up through the void between a wall and the chimney until it reached the roof. Interior crews reported hearing only one or two smoke alarms when they entered the building and noted that the sprinkler system not working. A firewall prevented the fire from spreading to adjacent buildings.

Damage to the building and its contents losses were estimated at \$1 million. Three firefighters suffered minor injuries.

Kenneth J. Tremblay, 2005, "Firewatch", *NFPA Journal*, January/February, 18-19.

Fire in Concealed Space Damages Building, Pennsylvania

A fire burning undetected in concealed spaces for several hours heavily damaged an historical building that housed an umbrella store that was closed for the evening.

The three-story, wood-frame building, which was 98 feet (30 meters) long and 19 feet (6 meters) wide, had brick walls and an asphalt roof. There were no sprinklers or detection systems.

When people in a neighboring business detected smoke, they went to the store to investigate and called the fire department at 10:45 p.m.

By the time firefighters arrived, the blaze had spread to stock piled to ceiling height and up non-enclosed stairwells from the first floor to upper floors, burning in concealed floor voids. The center part of the building collapsed, and firefighters protected several exposures, including businesses, an apartment house, and other historical buildings.

The fire began in wiring in the first-floor ceiling near the middle of the building. The building, valued at \$300,000, and its contents, valued at \$150,000, were destroyed. No one was injured during the incident.

Kenneth J. Tremblay, 2005, "Firewatch", *NFPA Journal*, January/February, 19.

Sprinkler Controls Fire in Mall, Washington

A single sprinkler controlled a fire in a department store in a large shopping mall, limiting fire damage to the area of origin. However, smoke damaged neighboring occupancies and a common corridor at the rear of the store.

The steel-frame mall, which was 1,185 feet (361 meters) long and 600 feet (183 meters) wide, had concrete floor, and a steel-and-wood roof. It contained 103 retail tenant spaces. A wet-pipe sprinkler system monitored by a central station alarm company provided full coverage and included a partial smoke detection system. The smoke detection equipment in the air handbag ducts was in "power-save" mode and did not operate. The store in which the fire started was closing for the night.

Investigators determined that the fire began when an employee piled broken-down cardboard boxes on top of an electric stove in an employee break room and inadvertently turned on a burner. Fire department notification was delayed when the employee had difficulty locating a telephone after trying unsuccessfully to put the fire out with a portable extinguisher. Firefighters received the 911 call at 9:50 p.m., about the same time they received the water-flow alarm from the central station monitoring company.

First responders extinguished the fire, which a sprinkler had confined to the area of origin. The building, valued at \$60 million, and its contents, valued at \$100 million, sustained a combined loss of \$2,600. There were no injuries.

According to fire department officials, this was the second time a sprinkler extinguished a fire at the mall in six years.

Kenneth J. Tremblay, 2005, "Firewatch", *NFPA Journal*, May/June, 32.

State: Georgia

Dollar Loss: \$11,000,000

Month: June

Time: 11:59 PM

Property Characteristics and Operating Status:

This two-story sporting goods store was of unprotected noncombustible construction and covered 100,000 square feet (9,290 meters). The store was closed at the time of the fire.

Fire Protection Systems:

There was an automatic smoke detection system present that operated. The coverage of the system was not reported. There was no suppression system present.

Fire Development:

A fire of undetermined cause broke out in the storage area of this store. Firefighters making an interior attack were faced with a flashover as the door to the fire area was opened. Firefighters withdrew to a defensive attack at that point.

Contributing Factors and Other Details:

During the fire, multiple rounds of ammunition discharged and several kegs of black powder exploded. The owner had made firefighters aware of these contents as well as a large amount of two-pound propane cylinders and camp fuel stored inside.

Stephen G. Badger, 2005, "Large-Loss Fires For 2004" *NFPA Journal*, November/December, 48.

Propane Torch Ignites Store Roof in South Carolina

Construction workers installing a new roof on a carpet store with a propane torch started a fire that destroyed the building. Investigators found that work crews failed to provide a fire watch and ignored the manufacturer's installation instructions prohibiting the use of direct flame during the roofing process, which is against NFPA 51B, Fire Prevention During Welding, Cutting, and Other Hot Work. NFPA 51B provides requirements for the proper permitting of hot work, as well as fire watch procedures.

The single-story, unsprinklered building, which was 100 feet (30 meters) long and 150 feet (46 meters) wide, had masonry-block walls and a steel bowstring-truss roof. A fire detection system in the retail space didn't activate because the heat and smoke didn't initially enter the store.

Earlier in the day, construction crews used the torch to melt tar before installing a new roof. Shortly after noon, they stopped work to have lunch, returning 30 to 45 minutes later to find the roof on fire. They called the fire department using a cell phone at 1:15 p.m. and left the roof.

The building, valued at \$1,200,000, and its contents, valued at \$70,000, were destroyed. One construction worker injured his thumb while leaving the roof and two firefighters suffered heat exhaustion.

Kenneth J. Tremblay, 2004, "Firewatch", *NFPA Journal*, May/June, 18.

High Winds Spread Fire to Building and Vehicles, Arizona

A cigarette discarded by a passing motorist is believed to have ignited the contents of a display tent in front of a furniture store. High winds fanned the flames, which consumed the tent before they spread to vehicles parked nearby and to the store.

The two-story, wood-framed building, which measured 300 feet (91 meters) by 100 feet (30 meters), had concrete-block walls covered with stucco. Its roof was made of plywood over wooden trusses covered by rolled asphalt. The structure had a fire detection system, but there were no sprinklers.

Store employees discovered the cardboard boxes burning in the tent and tried to extinguish the fire with a garden hose and a portable extinguisher. However, a steady wind of 35 miles per hour (56 kilometers per hour), gusting up to 45 miles per hour (72 kilometers per hour), fanned the flames and the fire quickly spread to the store, when the employees found they couldn't extinguish the blaze, they called the fire department at 11:50 a.m.

Arriving firefighters fought the fire defensively, as flames consumed the two-story building and 13 vehicles, including a tractor-trailer, parked around the tent. The building, valued at an estimated \$2.8 million, and its contents, valued at \$1.5 million, were destroyed. Loss estimates for the vehicles were not reported. Three firefighters suffered minor injuries during suppression efforts.

Kenneth J. Tremblay, 2004, "Firewatch", *NFPA Journal*, March/April, 16.

State: Arizona

Dollar Loss: \$9,260,000

Month: March

Time: 11:59 a.m.

Property Characteristics and Operating Status:

This two-story furniture store of unprotected ordinary construction covered 30,000 square feet (144 square meters). There was a tent in front of the store with sales items. The store was open at the time of the fire.

Fire Protection Systems:

There was a system of unreported type detectors. The coverage was not reported, but the system operated once the fire extended into the store. No automatic suppression equipment was present.

Fire Development:

The fire in this store was an exposure fire. An improperly discarded cigarette blew into the display tent and ignited cardboard boxes. The fire spread rapidly throughout the tent and spread into the store.

Contributing Factors and Other Details:

There was a delay in notifying the fire department as employees attempted to extinguish the fire with a garden hose. High winds of 35 mph and gust to 45 mph fanned the fire. Three firefighters were injured.

Stephen G. Badger, 2004, "Large-Loss Fires For 2003", *NFPA Journal*, November/December, 56.

Fire Damages Mall, Texas

A fire that started in a supermarket approximately 15 minutes after the owner locked up for the evening heavily damaged the market and several other businesses in a strip mall.

The single-story, metal-frame mall building contained 10 stores of various sizes and types in an area of 24,000 square feet (2,230 square meters). The structure, built on a concrete slab, had wood and light metal walls and a flat, steel-truss roof covered with rolled roofing. There were no smoke detectors or fire sprinklers.

A driver for a pizza store, the only mall business still operating that night, discovered a small fire along the wall of the store as he returned from a run and called 911 to report it. The supermarket's owner had just closed the store, turned off the exterior lights and some interior breakers, and set the burglar alarm before leaving at approximately 8:50 p.m.

Firefighters found the supermarket heavily involved in fire, which was spreading to an automobile customizing shop, a church, a barbershop, a restaurant, the pizza shop, a beauty salon, and two vacant stores.

Investigators discovered that the fire started on the floor of the market between the cash registers and a refrigeration unit near the wall that separated the supermarket and automobile shop. They determined that a malfunction in the electrical wiring caused the fire, which heavily damaged the supermarket, the church, and the automobile shop. Smoke and heat damaged all the other occupancies to some extent.

Damage to the building and its contents was estimated at \$500,000 and \$606,000, respectively. Three firefighters suffered stress-related injuries.

Kenneth J. Tremblay, 2004, "Firewatch", *NFPA Journal*, January/February 17.

Sprinklers Extinguish Loading Dock Fire, Washington

Sprinklers protecting a loading dock at a strip mall extinguished an early-morning fire. It was the second time the mall's sprinklers had successfully extinguished a loading dock fire on the property.

The single-story mall building, which was 650 feet (207 meters) long and 119 feet (36 meters) wide, had concrete-block walls and a wooden roof covered with plywood and built-up roofing material. A dry-pipe sprinkler system with a monitored water-flow alarm protected the exterior canopies and loading docks.

The fire department received the central station fire alarm reporting the water flow alarm at 1:08 a.m. When firefighters arrived, they found the remnants of a fire in some cardboard boxes and other waste material on the loading dock and saw one sprinkler operating. Investigators couldn't locate an ignition source in the loading dock area.

The value of the mall was estimated at \$10 million, and it contained \$23 million worth of merchandise and fixtures. Damage to the building was estimated at just \$2,000, and its contents were untouched.

The fire department is working with the building owners to prevent trash and waste from accumulating on the loading docks in the future.

Kenneth J. Tremblay, 2004, "Firewatch", *NFPA Journal*, July/August, 18.

Sprinkler Douses Arson Fire, Arizona

A single sprinkler doused a fire that had been intentionally set in the employees' locker room of a retail store.

The fire occurred in a single-story building that contained a mezzanine constructed of wood roof trusses and concrete-block walls. The building, covering 42,000 square feet (3,901 square meters), had a built-up roof. A water flow switch monitored a wet-pipe sprinkler system that provided full coverage. The store was open for business at the time of the fire.

The store's occupants heard the water flow alarm activate and left the building, but the central station alarm company wasn't operating the day of the incident, so the first indication of trouble the fire department received was a 3:45 p.m. 911 call from a store employee reporting the local alarm activation.

Responding firefighters noticed water coming through the ceiling below the mezzanine and, in searching for its source, found the fire's origin in the store's male locker room. They also found that a sprinkler had already extinguished the fire.

Investigators determined that someone intentionally doused a number of coats on a coat rack with charcoal lighter fluid, then ignited it with a lighter. Heat from the fire activated the sprinkler, limiting fire damage to the immediate area.

The multi-million-dollar property suffered about \$100 in damages. There were no injuries.

Kenneth J. Tremblay, 2004, "Firewatch", *NFPA Journal*, November/December, 20.

Fire Destroys Furniture Store, Florida

A fire and smoke detection system failed to prevent an early-morning blaze from destroying a furniture store. Flames had spread throughout the store by the time the fire department arrived.

The one-story, steel-framed building, which was closed for the night, had a large open area that contained leather furniture and living room accessories, as well as offices, a break room, and a bathroom. The metal-walled structure, measuring 200 feet (61 meters) by 60 feet (18 meters) had no sprinklers.

A passerby saw the fire in the store and called the fire department at 3:01 a.m. When firefighters arrived, they found the front of the building fully involved in flames and noted heavy smoke coming from the store. They forced entry through a door and three holes were cut in the walls.

Investigators later found that the fire began on a wooden office table holding a fax machine, a copier, and a credit card machine, one of which malfunctioned and started the fire. Once the fire began, it spread to combustibles in the office, then raced undetected through the store. The building, valued at \$300,000, and its contents, valued at \$200,000, were destroyed. There were no injuries.

Kenneth J. Tremblay, 2003, "Firewatch", *NFPA Journal*, January/February, 14.

Fire Damages Clothing Store, Ohio

Discarded smoking materials started a fire in the basement of a second-hand clothing and household goods store, and smoke spreading up an open stairwell and through openings made to accommodate the building's support columns filled the building. Although the store had a no-smoking policy, employees questioned after the blaze said people did smoke in the basement and elsewhere in the building.

The one-story store was the anchor of a nine-store shopping mall covering an area of 30,000 square feet (2,787 square meters). Its exterior walls were made of concrete block, and two layers of concrete sandwiched its wooden floor joists. A wet-pipe sprinkler system provided partial protection in the basement only.

The fire department received the alarm at 11:15 a.m., and responding firefighters found light smoke filling the first floor. However, visibility in the basement had been reduced to zero. Fortunately the fire wasn't producing much heat.

Firefighters were sent into the basement in rotation to locate the seat of the fire, but the basement's configuration and the many items stored there thwarted their efforts. To make operations more difficult, the sprinkler system rendered a high-expansion foam system brought in by a mutual-aid company ineffective. Finally, fearing that the floor would collapse, the incident commander ordered everyone out of the building for a defensive attack. Firefighters using several hose lines eventually extinguished the blaze after they breached a masonry wall and directed water into the basement and the voids.

Investigators discovered that fire damage in the area protected by the sprinkler system was minor. However, the remaining areas were heavily damaged. The fire, which began in an unsprinklered portion of the basement where employees had established several informal smoking areas, probably began when abandoned smoking materials ignited stored goods. Investigators also discovered that two fire doors were ajar in a storage room.

Kenneth J. Tremblay, 2003, "Firewatch," *NFPA Journal*, March/April, 25.

Arcing Ballast Ignites Rafters, Missouri

When an antique shop manager discovered smoke and flames coming from a ceiling light fixture, he initially tried to fight the fire instead of calling the fire department. Finding he was unable to control the flames, he finally dialed 911 at 10:17 a.m.

The store was in a two-story, wood-frame building with brick exterior walls. The building, which was 150 feet (46 meters) long and 75 feet (23 meters) wide, was unsprinklered, but it did have local battery-operated smoke alarms. The shop was open when the fire broke out.

Firefighters responding to the 911 call reported light smoke showing outside the building when they arrived. When they entered the store, however, they discovered that the second floor was filled with heavy smoke. As interior crews pulled ceiling to locate the fire, another crew went to the roof. Additional apparatus were staged in defensive positions until firefighters brought the fire under control some 30 minutes later using two 1 3/4-inch hose lines.

The fire began when the ballast of a fluorescent light on the second floor arced, igniting paper-backed insulation. The fire spread above the suspended ceiling to the roof's wooden rafters, doing \$50,000 damage to the \$500,000 building and another \$50,000 damage to its contents, estimated to be worth \$1 million. There were no injuries.

Kenneth J. Tremblay, 2003, "Firewatch," *NFPA Journal*, March/April, 24.

Quick Fire Department Response Stops Arson Fire, Massachusetts

The fire department's rapid response prevented an intentionally set fire from spreading into several businesses that occupied a former shoe factory.

The balloon-framed, L-shaped building was four stories high and constructed of heavy timbers. It had no fire detection systems, although a wet-pipe sprinkler system provided full coverage.

A neighbor called 911 at 4:29 a.m. to report a dumpster fire at the building, and arriving firefighters found the dumpster full involved and flames spreading up the exterior of the building. Using a 1 3/4-inch hose line, one crew started to knock the fire down, while a ladder crew entered the building, encountering moderate smoke on the two lower floors. The crew used a thermal imaging camera and determined that portions of a wall near the floor and around windows were holding heat. They opened these areas up and discovered charring and a smoldering fire.

Investigators determined that someone ignited trash piled against the wall of the building and that the resulting fire quickly spread up the structure's wooden siding to the dumpster. They also determined that the fire sprinkler system didn't activate because the fire's heat didn't build up in the structure.

Damage to the building, valued at \$1.3 million, was estimated at \$20,000. Damage to its contents, valued at \$5 million, was estimated at \$10,000. There were no injuries.

Kenneth J. Tremblay, 2003, "Firewatch", *NFPA Journal*, July/August, 16.

Arson Fire Damages Dry Cleaners, Ohio

A passerby discovered a fire in a dry-cleaning store and called 911 at 10:42 p.m.

The single-story, concrete-block structure, which was 50 feet (15 meters) long and 75 feet (23 meters) wide, had a cement-paneled roof. The shop had no detection or suppression system.

Firefighters arriving on scene within five minutes discovered that someone had forced open the building's rear door, and investigators later discovered several areas of origin. Eight fire apparatus and 24 firefighters extinguished the two fires in about 37 minutes.

The building, valued at \$65,000, sustained \$13,000 in property damage. Its contents, valued at \$90,000, sustained a loss of \$37,000. There were no injuries.

Kenneth J. Tremblay, 2003, "Firewatch," *NFPA Journal*, September/October, 20.

State: Pennsylvania

Dollar Loss: \$13,000,000

Month: January

Time: 10:00 p.m.

Property Characteristics and Operating Status: This one-story home repair specialty sales shop was of unprotected wood-frame construction and covered 7,500 square feet. The shop was closed when the fire broke out.

Fire Protection Systems: There was no automatic detection or suppression equipment present.

Fire Development: This fire was set in a rear stockroom.

Contributing Factors and Other Details: Eight firefighters were treated for exposure to a material that caused facial irritation.

Stephen G. Badger, 2003, "2002 Large-Loss Fires" *NFPA Journal*, November/December 81.

Cutting Torch Ignites Roof Insulation in Ottawa, Ontario

A toy store sustained heavy losses due to a fire caused by a contractor who used a cutting torch to cut steel I-beams. Hot slag ignited insulation and other combustible materials on the exterior wall. The fire spread into the store and to the roof, burning above the sprinkler system, preventing extinguishment.

The 200-square-foot (18-square-meter), steel-frame-and-concrete-block building had a steel truss roof covered with built-up tar and gravel. A wet-pipe sprinkler system and interconnected smoke detectors were monitored by a central station alarm company.

A work crew using cutting torches to remove I-beams protruding from a wall after construction wet down the insulation as a precaution before they began cutting the steel, which proved ineffective. Hot slag ignited the insulation and other combustibles in the wall. The workers, unable to extinguish the fire, called 911 at 12:06 p.m. Although three or four sprinklers activated, they were ineffective because the water was directed below much of the fire. Prolonged sprinkler activation caused extensive water damage.

The building, valued at \$1 million, sustained an estimated \$50,000 in structural damage. Contents, estimated at \$2 million, sustained damage of \$1.5 million. There were no injuries.

Kenneth J. Tremblay, 2002, "Firewatch", *NFPA Journal*, July/August, 18.

State: New Jersey

Dollar Loss: \$10,000,000

Date: May, 2000

Time: 12:34 pm

Property Characteristics and Operating Status

Two-story truck dealership of protected wood-frame construction covering 45,000 square feet (4 180 square meters). The dealership was operating when the fire broke out.

Fire Protection Systems

There was no automatic detection equipment. The complete-coverage dry-pipe sprinkler system was ineffective because the fire started on the roof. It's unreported whether the system activated.

Fire Development

Employees were using a torch to plug holes in the roof when they ignited it.

Contributing Factors and Other Details

Employees delayed notifying the fire department for nearly 20 minutes while they tried to extinguish the blaze. Fire loss was listed as \$5 million to the structure and \$5 million to the contents.

Stephen G. Badger, 2001, "Large-Loss Fires of 2000", *NFPA Journal*, November/December, 62.

State: New Jersey

Dollar Loss: \$10,000,000

Date: May, 2000

Time: 12:34 p.m.

Property Characteristics and Operating Status

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Stephen G. Badger, 2001, "Large-Loss Fires of 2000", *NFPA Journal*, November/December, 62.

Gasoline Vapor Explosion Destroys Liquor Store and Apartments, Connecticut

Gasoline that leaked from an undetermined source into a storm drainage system traveled several hundred yards and collected in the crawl space under a liquor store. The vapors filled the store and ignited two explosions, causing the building to collapse, killing two and injuring nine.

The wood-frame, two-story building, which measured 50 feet (15 meters) by 26 feet (8 meters), contained a liquor store and three apartments. There were no sprinklers, and only the apartments had smoke alarms. All four occupancies were occupied.

A massive explosion occurred at 4:48 p.m., followed by another explosion and several small fires fed by ruptured natural gas lines. When firefighters arrived, they found that the building had collapsed, injuring several people and trapping one in the wreckage. A 20-year-old man died from asphyxia and heat stress, and a 35-year-old man, who was trapped in the rubble, died of smoke inhalation, despite a 3 1/2-hour rescue effort by firefighters. Nine other civilians had injuries ranging from smoke inhalation and burns to cuts and broken bones.

The property, valued at \$500,000, and contents, valued at \$250,000, were a total loss.

Kenneth J. Tremblay, 2000, "Firewatch", *NFPA Journal*, May/June 32.

Single Sprinkler Controls Big-Box Retail Fire, Washington

A large home supply store suffered minor losses after a sprinkler activated during the night and extinguished a fire that began spontaneously in oil-soaked refuse.

The single-story building had concrete tilt-up walls, with open web steel roof trusses and a plywood roof deck with a built-up covering. It was 560 feet (171 meters) long, 275 feet (84 meters) wide, and 25 feet (8 meters) high. The building had a heat detection system and five separate sprinkler systems. Three wet-pipe systems provided coverage to the main part of the building, while a fourth covered the rack storage area. A dry-pipe system covered the loading docks and canopy. A public fire service communication station monitored all the systems.

Firefighters responded to a water flow alarm at 11:58 p.m., four hours after the last employee left for the evening. When they arrived, they found that a cardboard box on the loading dock had ignited and a single sprinkler had extinguished the fire.

Investigators found that rags used to clean up a spill of linseed oil-based paint or stain earlier in the day had been placed in a cardboard box and left by the loading dock.

This type of spontaneous ignition fire had occurred before, only two weeks earlier, but employees had used fire extinguishers to put it out and hadn't called the fire department.

The building was valued at \$15 million, and its contents at \$9 million. The structure suffered \$1,000 in damage, with content loss estimated at \$2,000.

Kenneth J. Tremblay, 2000, "Firewatch", *NFPA Journal*, March/April, 16.

Sprinkler Extinguishes Shopping Mall Fire, New Jersey

A fire began in the kitchen of a food court undergoing renovations when oil- and paint thinner-soaked rags spontaneously ignited in a plastic trash can, damaging the exterior of a walk-in of unprotected steel covered with metal walls and roof decking. It had no fire detection or suppression equipment.

The plant was in full operation when a large amount of flammable glue spilled from a hopper onto the floor of the packaging line's production area. An electrical extension cord, which had been damaged by continuous fork truck traffic, provided the arc that ignited the glue. Employees immediately detected the fire, but at least three minutes passed while they fought the blaze with a garden hose and fire extinguishers before calling the fire department at 2:26 p.m.

Firefighters arrived four minutes after the alarm was sounded to find that the fire had already breached the exterior metal siding. In all, seven engine and three ladder companies were needed to extinguish the blaze. In addition, 10 tankers, 3 engine companies, 2 squads, and 3 chief officers helped provide a continuous water supply. Fortunately, hydrants had recently been installed in the area.

The building, valued at \$700,000, and its contents, valued at \$1,300,000, were destroyed. There were no injuries.

Kenneth J. Tremblay, 1999, "Firewatch", *NFPA Journal*, July/August, 20-21.

Cleaning Rags Ignite Spontaneously, California

Fire destroyed a hardware store when paper towels soaked with a flammable wood stain spontaneously ignited.

The 7,200-square-foot (699-square-meter), one-story building was constructed of unprotected wood framing. It was unsprinklered and had no fire detectors.

A passerby noticed smoke coming from the store and called the fire department at 7:28 a.m. Arriving firefighters ventilated the building, which caused the smoldering fire to burn aggressively. It took firefighters using exterior hose lines and master streams four hours to extinguish the blaze.

The day before the fire, a hardware store employee was showing an organic-based wood stain to a customer when he accidentally spilled it. He cleaned the spill with paper towels, then threw them into a 32-gallon (121.1-liter) plastic trash receptacle filled with other paper trash. Temperatures as high as 95°F (35°C) and lack of ventilation in the building allowed the stained towels to rapidly decompose and create enough heat to ignite. The flames then spread to other combustibles, consuming the oxygen in the store, and the fire then smoldered for approximately 20 hours until the building was ventilated.

The structure, valued at \$225,000, and its contents, valued at \$300,000, were a total loss. There were no injuries.

Kenneth J. Tremblay, 1999, "Firewatch", *NFPA Journal*, July/August, 21-22.

Homeless Man's Smoking Materials Start Fire, Minnesota

A homeless man using the rear loading dock of a vacant furniture store as a shelter is believed to have started a fire by his careless use of smoking materials. The fire heavily damaged the store and other occupancies in the large building.

The two-story building, which was approximately 120 feet (37 meters) long by 50 feet (15 meters) deep, was of heavy timber construction and the extent of coverage provided by the dry-pipe sprinkler system wasn't reported. The building contained six storefront businesses on the first floor and several offices on the second. The fire started in an area formerly occupied by a furniture store and spread to other parts of the building, which were in use but closed for the night.

A neighbor saw flames shooting three stories above the structure and called 911 at 2:42 a.m. Several additional calls to 911 sent firefighters to the scene as fire heavily involved the rear of the structure. A total of four alarms were sounded to bring firefighters to control the blaze, which was largely limited to the exterior loading dock and first floor. No sprinklers operated on the first floor, although they did operate on the second floor.

Investigators determined that the fire began by the rear loading dock near an area occupied by vagrants. In the area, they found a mattress, clothing, and other personal items. Unable to locate any other source of ignition, they believe the fire was caused by careless use of smoking materials, which ignited the combustibles. The fire caused an estimated loss of \$1 million.

Kenneth J. Tremblay, 1999, "Firewatch", *NFPA Journal*, November/December, 20.

Single Sprinkler Controls Fire, Florida

A single sprinkler controlled a fire that started in a storage closet at a shopping mall.

The two-story mall was of masonry and metal construction, with concrete walls and floors and a metal built-up roof on steel framing. A monitored wet-pipe sprinkler system protected the structure.

At approximately 3 p.m. an employee placed a lit cigarette on a cardboard box while he retrieved some merchandise from a stock room where ordinary combustibles were stored. He then left the room leaving the cigarette behind. In about five minutes, the cigarette had ignited the box, and the fire had spread to other combustibles in the room. Fortunately, a standard temperature sprinkler operated and controlled the blaze before firefighters arrived in response to a 911 call and a call from the alarm monitoring company.

Damage to the building and its contents, valued at \$8 million, was limited to \$4,000.

Kenneth J. Tremblay, 1999, "Firewatch", *NFPA Journal*, July/August, 22.

Gasoline Ignites Garage Fire, South Carolina

A fire quickly consumed a large, unsprinklered vehicle transmission shop of unprotected, steel-frame construction.

Shop workers were using a combination of household cleaner and gasoline to clean equipment when they noticed flames in the corner of the building. They immediately called 911 at 12:10 p.m., but the building had already started to collapse when firefighters arrived.

Firefighters were forced to take a defensive exterior attack, establishing a water supply and using master streams and numerous handlines to contain the fire. Additional companies controlled run-off to protect the area from possible contaminants such as engine oil and transmission and hydraulic fluids. They used portable containment dikes in the drainage ditch, and environmental authorities said the run-off caused no damage. They had the blaze under control in 40 minutes, but it was two more hours before it was fully extinguished.

The source of ignition wasn't determined, but the gasoline vapors contributed to the rapid fire spread. The building, valued at \$100,000 and its contents, valued at \$150,000, were a total loss. No one was injured.

Kenneth J. Tremblay, 1997, "Firewatch," *NFPA Journal*, September/October, 26.

Sprinklers Limit Damage in \$3 Million Blaze in Retail Warehouse, Washington

A retail discount warehouse that sold general merchandise in bulk suffered a \$3 million loss when a forklift struck a rack containing a pallet of flammable aerosol lubricant. The pallet fell, damaging the canisters and causing an explosion and fire. The property's fire protection features, including draft curtains, automatic smoke vents, and a sprinkler system, worked well to limit fire spread.

The single-story, 117,204-square-foot structure had 30-foot ceilings and was built on a concrete slab. Unprotected steel columns supported steel bar joists that were covered with metal. The walls and ceilings were insulated with fiberglass, and plywood covered the lower 8 feet of the

U.S. Stores and Other Mercantile Property Fires, 1/11 78 NFPA Fire Analysis and Research, Quincy, MA

interior walls. Rack storage units, which held rows of storage and sales merchandise, were located in the sales/storage area. The property also contained an automotive tire sales and service area, a bakery, and an outside canopied sales area.

The building was fully protected by three wet-pipe sprinkler systems, which were monitored by a central station monitoring company. One of the risers also supplied an auxiliary dry-pipe system that protected the outside canopied area. A 1,000-gpm automatic fire pump designed to maintain 150 psi supported the sprinkler systems. The sprinklers, which had a 17/32-inch nominal orifice and a temperature rating of 286°F, were spaced so that each covered an 80-square-foot area. The building had 138 skylights, 38 of which served as automatic smoke vents. Draft curtains divided the building into seven areas, each measuring approximately 17,000 square feet. The building had no smoke detectors.

At the time of the blaze, the store was operating, and 25 employees were restocking inventory. A forklift operator was removing a pallet of pressure washers from rack storage when the guard protecting the truck's forks struck a cross member for the rack above, knocking over a pallet of aerosol cans containing a flammable solvent/lubricant. The operator saw the pallet falling and got off the truck. As it fell, he saw several canisters release their product and explode. Other witnesses in the area also saw the explosions and flames coming from canisters, as well as broken valves flying through the air like fireworks. All employees were ordered to evacuate as smoke quickly filled the building.

The central station alarm company received a fire pump and water flow alarm activation and notified the fire department at 6:48 a.m. Warehouse employees also called to report the blaze.

Two engines and seven command officers responded to the first alarm. As part of the department's prefire plan, a large number of officers are sent to all structure fires to get the incident command system in place before additional alarms are called and more units arrive. Arriving firefighters saw dark smoke venting from two skylights. They verified that all employees had safely evacuated and determined the involved area.

Five minutes after the first firefighters arrived, command struck another alarm, bringing two additional engine companies to the scene. Firefighters supported the sprinkler system, set up a telesquirt, and began advancing handlines into the building.

Although the roof vents were open and positive pressure ventilation was in use, smoke inside the building obscured visibility. However, crews reported cold smoke, which indicated that sprinklers were controlling the blaze.

Firefighters were hampered by pallets blocking the aisles and oil residue on the floor. Using two 1 1/2-inch handlines, crews located the seat of the blaze and quickly extinguished a few remaining spot fires.

The fire occurred in the northwest corner of the building near an automobile tire display. The most severe fire damage was in the rack storage area near the forklift. Investigators determined that one of the forklift's electrical components ignited the flammable aerosol lubricant. The fire spread vertically to the ceiling, then horizontally until it reached the draft curtain. Thirty-seven sprinklers in two zones activated.

Overall, investigators stated that the systems in place worked very well. In fact, one investigator later said that "the building was saved because of the sprinkler system. With the vapor explosion and the amount of initial fire, along with lightweight trusses, our fire department feels

that the fire would have become a defensive fire before our arrival and would have been fought as such.”

Damage to the building, valued at \$4 million, and its contents, valued at \$7 million, was estimated at \$500,000 and \$2.5 million, respectively. Most of the damage to the contents was attributed to smoke.

One firefighter sustained a chemical burn to his forehead and several sets of firefighting gear had to be decontaminated or destroyed because of oil in the water runoff.

Kenneth J. Tremblay, 1996, “Firewatch”, *NFPA Journal*, July/August, 23.

Christmas Display in Shopping Mall Ignited by Overheated Extension Cords, California

Automatic sprinklers extinguished a fire in a shopping mall that slatted when electrical extension cords overheated and ignited the plastic garland in a Christmas display.

The shopping mall, which covered more than 2 million square feet on two floors, was constructed of protected wood framing and had concrete floors. A wet-pipe sprinkler system that was monitored by a central station alarm company protected the property. At the time of the fire, the mall was closed.

Approximately 20 to 25 electrical extension cords connected in tandem powered a first-floor holiday display depicting Santa's village. The cords overheated and ignited plastic garland decorations. The flames traveled vertically, scorching the walls and the underside of the roof before five sprinklers on the first and second ceiling levels and the roof level operated and extinguished the blaze. The fire department responded to a call from the monitoring company at 5:30 a.m.

The decorations used in the display were fire-retardant, which helped to slow fire development. Damage to the property, which was valued at \$200 million, was estimated at \$25,000.

Kenneth J. Tremblay, 1994, “Firewatch”, *NFPA Journal*, November/December, 35-36.

Torch Ignites Roof during Repairs, Destroys Building in Wisconsin

A building that contained three businesses was destroyed when a roofer's torch started a fire that was spread rapidly by strong winds.

The single-story building, which housed a restaurant, a liquor store, and a dance club, was constructed of unprotected wood framing and measured 50 feet by 100 feet. The building did not contain any sprinklers or smoke detectors.

A roofing contractor who was repairing the roof was using a torch to heat roofing materials and tar. The contractor had stopped for lunch, leaving an assistant on the roof with a portable extinguisher to watch for fire. After about 15 minutes, the assistant saw smoke coming from the roof and used the extinguisher to try to put out the blaze. Unable to extinguish the fire, he left the roof.

Winds blowing at 20 to 25 miles per hour allowed the fire to spread rapidly until it eventually entered the building. A passerby detected the fire and called 911 at 12:59 p.m. Arriving firefighters immediately called for a second and then a third alarm. Ten engines, six ladders, and two rescue trucks were used to put out the blaze.

The building, which was valued at \$1 million, was destroyed. Damage to its contents, which were valued at \$300,000, was estimated at \$250,000. There were no injuries.

Kenneth J. Tremblay, 1994, "Firewatch", *NFPA Journal*, May/June, 29.

Sprinkler Snuffs Shopping Mall Fire, Flows Undetected for Hours, Wisconsin

A single sprinkler extinguished a small fire in a store in this shopping mall, but it was not shut off until the next morning, when the store's owner arrived to open for the day.

At 1:26 a.m., the private alarm company monitoring the sprinkler system received a water flow alarm and notified the municipal fire department. Firefighters who arrived at the mall just minutes later saw nothing amiss; they were unable to enter the 21 individual stores, since each was locked.

For nearly three hours, the firefighters tried in vain to determine whether there was an actual fire inside the mall. A substitute maintenance man, completely unfamiliar with the building and lacking the keys to the separate stores, was of no help. Eventually, the officer in command, finding no evidence of fire, smoke, water flowing, or anything else unusual, decided that the alarm system was malfunctioning. He ordered the power supply to the alarm system cut off, an action condoned by a representative of the building owners, and the fire companies returned to quarters by 3:50 a.m.

Nearly seven hours after the initial alarm sounded, the owner of a drugstore in the mall opened his business and found several inches of water on the floor. He also found the remnants of burned paper towels in a storage area and noticed that one sprinkler had operated. He called the fire department, and firefighters responded to the mall once again, this time to perform salvage operations. They returned to quarters at 12:30 p.m.

Investigators later determined that the fire began when some paper towels that had been saturated with varnish and left on a shelf with some cleaning supplies ignited spontaneously.

Fire officials noted that, despite the subsequent problems with fire department procedures, the sprinkler system had performed as intended and that, even though most of the damage was due to water, the \$1.5 million mall building was spared a potential fire loss. The officials also noted that the mall was equipped with a lock-box key entry system that, if properly used, would have allowed the firefighters to enter the various stores without having to force their way in. Unfortunately, not all of the tenants were willing to put a set of their keys into the box. The officials hoped that this case would highlight the value of easy access in similar situations and that proprietors of other commercial buildings in the community would incorporate lock boxes.

Neal Courtney, 1991, "Firewatch", *NFPA Journal*, January/February, 29.