

LARGE-LOSS FIRES IN THE UNITED STATES-2010

**Stephen G. Badger
November 2011**



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

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Acknowledgements

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

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Introduction

Each year, the NFPA reports on large-loss fires and explosions that occurred in the United States the year before. Such fires and explosions are defined as any event that results in property damage of at least \$10 million. In 2010, according to Michael J. Karter Jr., in “U.S. Fire Loss For 2010,” in the September/October issue of *NFPA Journal*, U.S. fire departments responded to an estimated 1,331,500 fires—482,000 structure fires and 849,500 non-structure fires—which caused an estimated loss of \$11.6 billion. Many of these fires were small or resulted in little or no reported property damage. However, 17 of them resulted in losses of \$10 million or more each, for a total of roughly \$652 million in direct property losses. Although these fires accounted for only 0.001 percent of the estimated number of fires in 2010, they accounted for 5.6 percent of the total estimated dollar loss.

NFPA tracks and tries to verify loss information for all large-loss fires reported in the media or by other sources. These 17 large-loss fires are those fires for which an official dollar loss was obtained.

The number of large-loss fires annually has ranged over the past 10 years from 16 to 45, with an average of approximately 24 fires per year. When adjusted for inflation to 2001 dollars, the number of fires in 2010 that could be categorized as large-loss fires—that is, fires resulting in a loss of \$10 million in 2001 dollars—drops to 10, with an adjusted loss of \$479 million in 2001 dollars. (See Table 1 and Figures 1 and 2.)

In 2010, seven fires resulted in more than \$20 million each in property damage. These costliest seven fires, which include five structure fires, one wildland fire, and 1 outside explosion and fire, resulted in a combined property loss of \$532.5 million, which represents 56 percent of the total loss in large-loss fires and 4.6 percent of the total fire losses of 2010. (See Table 2.) Two fires alone resulted in losses of over \$100 million each. The combined loss for these fires, a wildfire and a shopping mall was \$327 million.

The largest of the large-loss fires

On September 6, 2010, the situation in Fourmile Canyon, Colorado, was ripe for a wildland fire. Humidity was a low 7 percent, the winds were from the west-southwest at 12 to 15 mph (19 to 24 kph), and only 1.3 inches (3.3 centimeters) of rain had fallen in more than a month. It was a red flag day, meaning that critical fire weather conditions were present, or shortly would be.

The call came into the fire department at about 10 a.m. Winds had reignited a fire set in a fire pit several days prior, and embers blowing out of the pit ignited what was to become a \$217 million wildfire, the largest wildfire in terms of dollar loss in Colorado’s history.

Driven by the wind, the fire’s surface flames grew 20 to 50 feet (6 to 15 meters) high and started a running crown fire, burning the Ponderosa pine and native shrubs covering the south-facing slopes of the canyon and the Douglas fir on the north-facing slopes. Aspen, grasses, mountain mahogany, cottonwood, mountain maple, river birch, and common riparian vegetation also grew in the canyon.

Fifty firefighters responded within two hours of the initial call, and 34 fire agencies responded during the next 48 hours. Over the next week, they fought the blaze with retardant-dropping aircraft, helicopters, bulldozers, fire engines, and water tenders as the fire burned through steep, heavily forested canyons, destroying outbuildings and homes. By the end of the week, more than 1,100 firefighters had responded to the scene.

The fire was finally contained on September 13, after burning 6,179 acres (2,501 hectares) and destroying 172 structures. Of those structures, 166 were homes. Another 26 homes were damaged, and suppression costs totaled almost \$10 million. Fortunately, there were no fatalities and only seven minor injuries to firefighters.

An interesting description of the burn patterns and building construction can be found in a 6/27/11 blog posting on NFPA's Firewise website "Tour of the Fourmile Canyon fire: questions raised, answers pending," <http://nfpa.typepad.com/firewise/2011/06/index.html>

The Fourmile Canyon Fire was one of 17 large-loss fires that occurred in the United States last year.

Where fires occurred

Fifteen of the 17 large-loss fires of 2010 occurred in structures, resulting in a total property loss of \$369.8 million. Only two, the Fourmile Canyon Fire and an outside natural gas explosion and fire, occurred outside structures, resulting in losses of \$217 and \$65 million, respectively. (See Table 3 and Figure 3.)

Of the 15 structure fires, four occurred in public assembly properties—two in churches, one in a restaurant, and one in a clubhouse—and resulted in a loss of \$50 million. Three fires, which did \$70 million in damage, occurred in storage properties. One was a warehouse containing electronic equipment, another was a produce storage facility, and the third was a paper records storage warehouse.

Another two fires occurred in schools, one a middle school and the other an elementary school. Two fires also occurred in manufacturing properties, a sawmill and a metal products plant. These four fires resulted in total losses of \$65.8 million.

A fire in a shopping mall, a wastewater treatment plant, a building being renovated, and a single-family home resulted in losses of \$110 million, \$52 million, \$12 million, and \$10 million respectively. Information on the operating status was reported for nine of the 15 structure fires. When the fires broke out, three were at full operation or occupancy and six were closed.

Information on the cause of 10 of the structure fires was also reported. Five were deliberately set, resulting in a loss of \$173.5 million, or 26.6 percent of the fire loss in large-loss fires. Other causes included a mechanical failure in a rooftop air-conditioning unit, a light bulb installed too close to combustible items, spontaneous heating of agricultural products, and a rekindle of a previous fire. Six of the fires, all in structures, broke out between 11 p.m. and 7 a.m.

Detection and suppression systems

Information about detection equipment was reported for eight of the 15 structure fires. Three of the fires occurred in properties that had no automatic detection equipment. Of the other five structures, two had complete coverage smoke alarms, two had smoke alarms with unreported coverage, and one had a detection system of an unreported type. Three of the five systems operated effectively, while the operation or effectiveness of the other two systems was not reported.

Information about automatic suppression equipment was reported for nine of the 15 structure fires. Four had no suppression equipment. Of the remaining five, four had wet-pipe sprinklers; one provided complete coverage, one provided partial coverage, and the coverage of the other two was not reported. The fifth structure had a dry-pipe system of unreported coverage.

Three of the five suppression systems operated, and two did not. Of the systems that operated, two were effective and helped control the fire; one was not in the area of ignition, but it controlled the spread of the fire. The third system that operated was shut down prematurely during the fire for unreported reasons. The two systems that failed to operate had been shut down before the fires started.

Complete information on both detection and suppression equipment was reported for eight of the 15 large-loss structure fires. Both systems were present in three structures. Two structures had only detection equipment, and two had only suppression equipment. In one fire, the structure had neither detection nor suppression systems.

What we can learn

This study reports on the small share of fires that account for major losses. There were eight fewer large-loss fires in 2010 than there were in 2009, and associated property losses decreased by more than \$298.4 million, or 31 percent. In seven of the past 10 years, at least one fire has resulted in a loss of more than \$100 million, and in at least three years, there was one loss of more than \$1 billion. In 2010, two fires did more than \$100 million in damage, for a total property loss of \$327 million.

Adhering to the fire protection principles reflected in NFPA's codes and standards is essential if we are to reduce the occurrence of large-loss fires and explosions in the United States. Proper construction, storage, and housekeeping will make fires less likely to occur and help control or limit the fire spread should a fire occur, while proper design, maintenance, and operation of fire protection systems and features can keep a fire that does occur from becoming a large-loss fire.

Where we get our data

NFPA identifies potential large-loss incidents by reviewing national and local news media, including fire service publications. A clipping service reads all U.S. daily newspapers and notifies NFPA's Fire Analysis and Research Division of major large-loss fires. NFPA's annual survey of the U.S. fire experience is an additional data source, although not the principal one.

Once an incident has been identified, we request information about the fire from the fire department or agency having jurisdiction. We also contact federal agencies that have participated in investigations, state fire marshals' offices, and military sources. The diversity and redundancy of these data sources enable NFPA to collect the most complete data available on large-loss fires.

About the author

Stephen G. Badger is a fire data assistant in NFPA's Fire Analysis and Research Division and is a retired firefighter from the Quincy, Massachusetts, Fire Department.

Table 1.
Large-Loss Fires that Caused \$10 Million or More in Property Damage, 2001-2010

Year	Number of Fires	Number of Fires Causing \$10 Million or More in 2000 Dollars	Direct Property Damage (in Millions)	
			As Reported	In 2001 Dollars
2001*	20	20	\$862	\$862
2002	25	22	\$862	\$523
2003	21	17	\$2,623	\$2,486
2004	16	10	\$337	\$259
2005	16	6	\$217	\$104
2006	16	14	\$380	\$315
2007	45	37	\$3,393	\$2,827
2008	35	23	\$2,372	\$1,846
2009	25	18	\$950	\$723
2010	17	10	\$652	\$479

* Excluding the 9/11/01 World Trade center Incident from the loss totals but not the fire incident totals.

Note: Number of fires and unadjusted loss are based on data from studies that appeared in previous annual large-loss studies. Some of the information may differ from previously published material because material was updated after publication.

Note: Adjustment for inflation is based on the Consumer Price Index using 2001 as a base year. Note that adjustment for inflation not only reduces the the total dollar loss for each year but also reduces the number of fires when adjusted losses large enough to qualify as large-loss fires.

Source: NFPA's Fire Incident Data Organization (FIDO)

Table 2.
Large-Loss Fires of \$20 Million or More in 2010

Incident and Location	Loss in Millions
Wildfire, Colorado	\$217.0
Shopping mall, California	\$110.0
Outside gas explosion with fire, California	\$65.0
Wastewater treatment plant, Illinois	\$52.0
Electronics warehouse, Texas	\$40.0
Elementary school, Missouri	\$28.5
Produce storage, California	\$20.0
Total Fires: 7	\$532.5

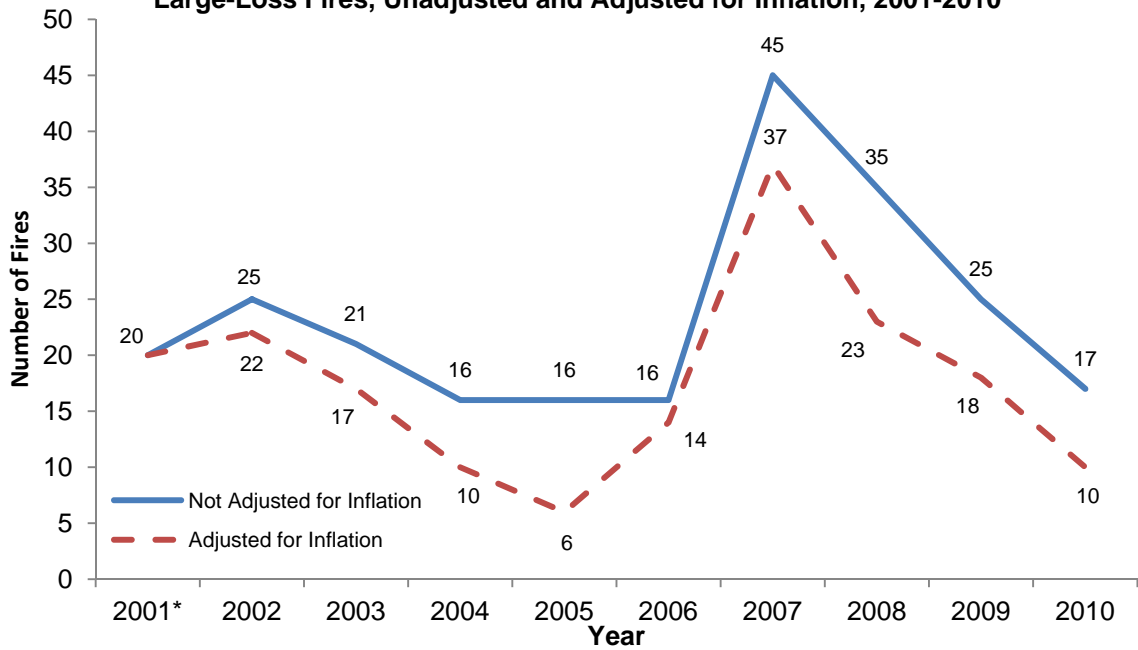
Source: NFPA's Fire Incident Data Organization (FIDO)

Table 3.
2010 Large-Loss Fires by Major Property Use Classification

Property Use	Number of Fires	Percent of Fires	Total Dollar Loss	Percent of Loss
Public Assembly	4	24%	\$50,000,000	7.7%
Storage	3	18%	\$70,000,000	10.7%
Educational	2	12%	\$38,544,733	5.9%
Manufacturing	2	12%	\$27,292,000	4.2%
Wildlands	1	6%	\$217,000,000	33.3%
Stores	1	6%	\$110,000,000	16.9%
Outside with loss	1	6%	\$65,000,000	10.0%
Industry	1	6%	\$52,000,000	8.0%
Special Properties	1	6%	\$12,000,000	1.8%
Residential	1	6%	\$10,000,000	1.5%
Total	17	100%	\$651,836,733	100.0%

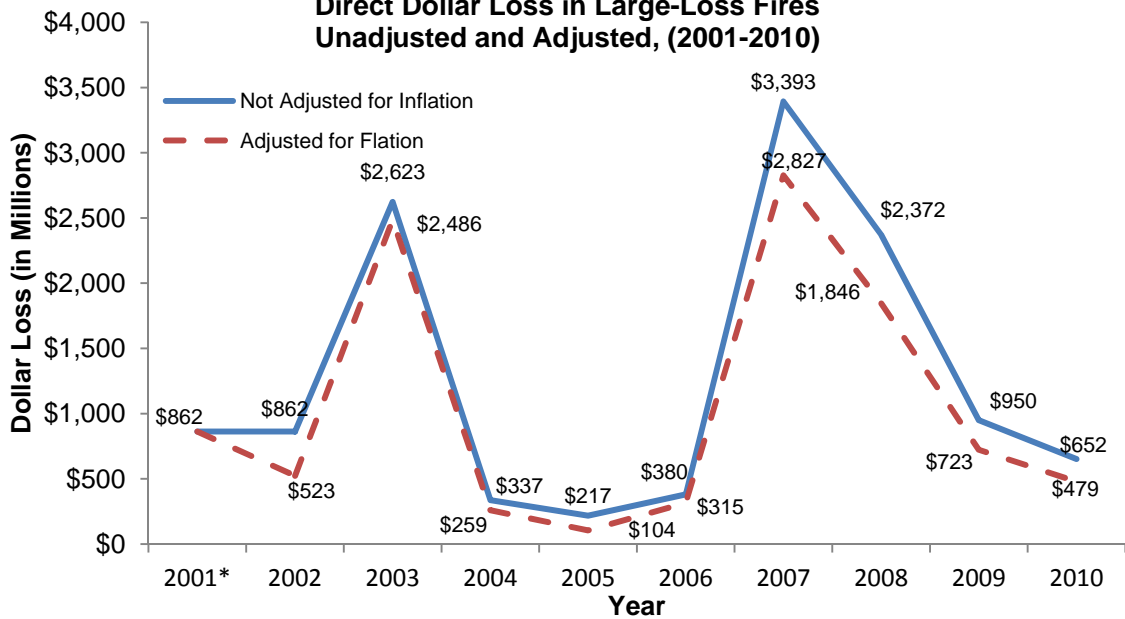
Source: NFPA's Fire Incident Data Organization (FIDO).

Figure 1.
Large-Loss Fires, Unadjusted and Adjusted for Inflation, 2001-2010



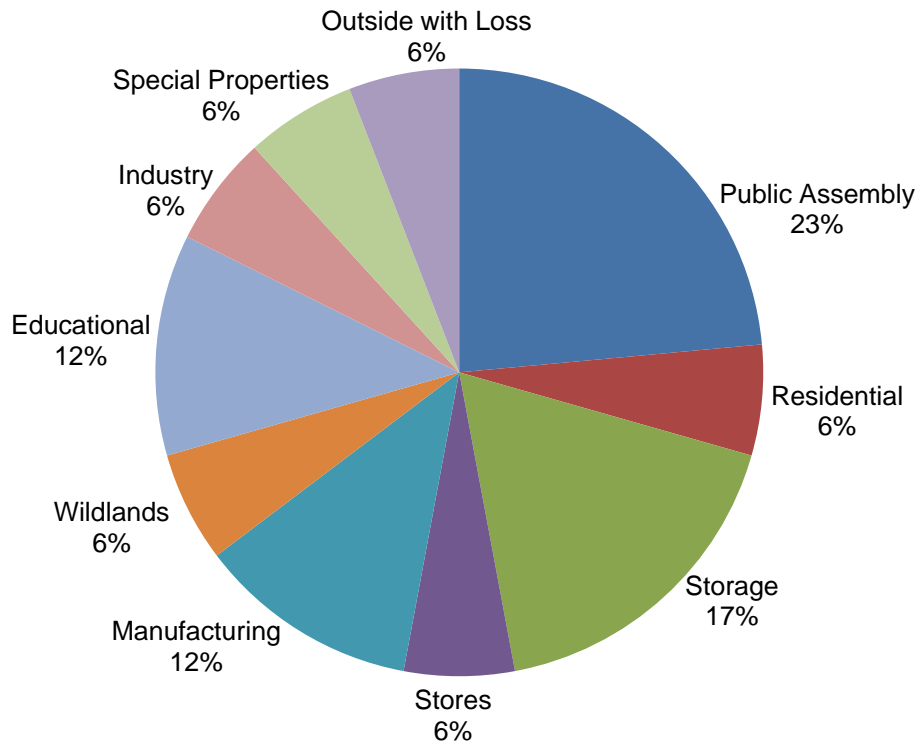
*Note: The 2001 totals include the 9/11/01 World Trade Center Incident.

Figure 2
Direct Dollar Loss in Large-Loss Fires Unadjusted and Adjusted, (2001-2010)



*Note: The 2001 totals include the 9/11/01 World Trade Center Incident.

Figure 3.
Large-Loss Fires by Major Property Use, 2010



2010 Large-Loss Fire Incidents

Public Assembly

Texas

Date, Time of Alarm, Dollar Loss

January, 5:23 a.m., \$15 million

Property Characteristics and Operating Status

This three-story church of unprotected wood-frame construction covered 15,000 square feet (1,394 square meters) and contained offices and classrooms. It was unoccupied at the time of the fire.

Fire Protection Systems

No detection system was present. There was a wet-pipe sprinkler system that was not in the area of ignition, but it activated and helped contain the fire.

Fire Development

This incendiary fire was set in a second-story hallway and stairwell area using ordinary combustible materials found in the hallway. The fire then spread to and through the common attic.

Contributing Factors and Other Details

Fire walls and fire doors activated and helped reduce the spread of the fire. One firefighter was injured.

Utah

Date, Time of Alarm, Dollar Loss

December, 2:34 a.m., \$15 million

Property Characteristics and Operating Status

This large church, which was equal in height to four stories, was of heavy-timber construction with masonry walls. It covered 8,064 square feet (749 square meters). The church was closed at the time of the fire.

Fire Protection Systems

The alarm system of unreported type and coverage activated. There was no automatic suppression equipment.

Fire Development

A 300-watt light bulb in the attic 44 feet (13 meters) above the floor ignited a wooden enclosure of an audio speaker. The fire spread throughout the plywood ceiling and up a stairway to the truss roof.

Contributing Factors and Other Details

When the alarms activated, a security guard reset the alarm and left the building. Sometime later, another guard nearby noticed smoke rising from the top of the building. He notified a third guard, who entered the church and discovered a fire on a stage and flames coming through a hole in the ceiling. He left the building and notified the fire department. Factors contributing to fire spread and fire loss were listed as an inadequate detection and notification system (this was not explained in the report), lack of automatic sprinklers, an additional fuel load (a set had been added for a play), and human error. The loss to the structure was estimated at \$10 million and to its contents at \$5 million.

Louisiana

Date, Time of Alarm, Dollar Loss

January, 11:00 a.m., \$10 million

Property Characteristics and Operating Status

This two-story restaurant of protected noncombustible construction covered 300,000 square feet (27,871 square meters) and was one of several businesses in a plaza. It was closed at the time of the fire.

Fire Protection Systems

No information was reported on detection system. There was no automatic suppression equipment.

Fire Development

The cause and origin is listed as undetermined.

Contributing Factors and Other Details

No information was reported.

South Carolina

Date, Time of Alarm, Dollar Loss

March, 5 a.m., \$10 million

Property Characteristics and Operating Status

This two-story golf course country club of unprotected wood-frame construction covered 36,720 square feet (3,411 square meters). It was closed at the time of the fire.

Fire Protection Systems

There was a complete-coverage smoke detector system, but it was not reported if it operated. A wet-pipe sprinkler system had been shut down several hours earlier when another fire caused a pipe in the system to burst.

Fire Development

This was a rekindle of a previous fire.

Contributing Factors and Other Details

No information was reported.

Storage

Texas

Date, Time of Alarm, Dollar Loss

August, 4:14 a.m., \$40 million

Property Characteristics and Operating Status

This one-story warehouse stored electronic voting machines and related equipment. It was of unprotected noncombustible construction and covered 20,000 square feet (1,858 square meters). It was not reported whether anyone was in the building at the time of the fire.

Fire Protection Systems

No information was reported.

Fire Development

The cause and origin of the fire is undetermined and under investigation.

Contributing Factors and Other Details

No information was reported.

California

Date, Time of Alarm, Dollar Loss

January, 2:18 p.m., \$20 million

Property Characteristics and Operating Status

This was a raisin storage facility. No additional information was reported.

Fire Protection Systems

No information was reported.

Fire Development

The cause of the fire was listed as spontaneous heating of agricultural products.

Contributing Factors and Other Details

Damage to the structure and its contents was listed at \$10 million each.

New Mexico

Date, Time of Alarm, Dollar Loss

June, 7:47 p.m. , \$10 million

Property Characteristics and Operating Status

This 30-foot (9-meter) tall paper record storage warehouse of unprotected ordinary construction was divided into five different storage facilities. The ground floor area was not reported. Nor was it reported that anyone was in the building at the time of the fire.

Fire Protection Systems

No information was reported on detection or suppression equipment.

Fire Development

The cause and origin of the fire was listed as a malfunctioning air conditioning unit on the roof.

Contributing Factors and Other Details

Strong winds hampered firefighters' efforts.

Educational Properties

Missouri

Date, Time of Alarm, Dollar Loss

April, 11:33 p.m., \$28.5 million

Property Characteristics and Operating Status

This two-story middle school of protected noncombustible construction was unoccupied at the time. The ground floor area was not reported.

Fire Protection Systems

No information was reported on detection or suppression equipment.

Fire Development

This incendiary fire was set in a first-floor office. No additional information was reported.

Contributing Factors and Other Details

The loss to the structure totaled \$24.9 million; damage to its contents totaled \$3.5 million. An arrest was made in relation to this fire.

California

Date, Time of Alarm, Dollar Loss

July, 4:17 a.m., \$10 million

Property Characteristics and Operating Status

This was an elementary school. No additional information can be released due to an ongoing criminal investigation.

Fire Protection Systems

This was an incendiary fire. No additional information can be released due to an ongoing criminal investigation.

Fire Development

No information can be released due to an ongoing criminal investigation.

Contributing Factors and Other Details

No information can be released due to an ongoing criminal investigation.

Manufacturing

Texas

Date, Time of Alarm, Dollar Loss

February, 8:06 p.m., \$15 million

Property Characteristics and Operating Status

This was a one-story, 80,000-square-foot (7,432 square meters) sawmill. No additional information was reported.

Fire Protection Systems

No information was reported.

Fire Development

No information was reported.

Contributing Factors and Other Details

No information was reported.

Tennessee

Date, Time of Alarm, Dollar Loss

September, 1:31 p.m., \$12.3 million

Property Characteristics and Operating Status

This one-story aluminum manufacturing plant of unprotected noncombustible construction had a ground floor area of 30,000 square feet (2,787 square meters). The plant was in operation at the time of the fire.

Fire Protection Systems

Smoke alarms were present and operated, alerting the workers, but the coverage was not reported. A wet-pipe sprinkler system was also present. It operated and was effective, but the coverage was not reported.

Fire Development

The fire broke out when hot materials ignited flammable liquids and spread to the roof. The reason for, and location of, ignition was not reported.

Contributing Factors and Other Details

No information was reported.

Wildfire

Colorado

Date, Time of Alarm, Dollar Loss

September, 10 a.m., \$217 million

Property Characteristics and Operating Status

This was a wildland-urban interface fire.

Fire Development

A fire set in a fire pit several days earlier was thought to have been extinguished, but winds caused embers to reignite and blew them into nearby grass and woods.

Contributing Factors and Other Details

This fire destroyed 172 structures, of which 166 were homes. It damaged another 26 homes and burned more than 6,179 acres (2,501 hectares). There were seven firefighter injuries.

Stores and Offices

California

Date, Time of Alarm, Dollar Loss

October, 10:22 a.m., \$110 million

Property Characteristics and Operating Status

This two-story mall of protected noncombustible construction covered 1.4 million square feet (130,064 square meters) and was open at the time of the fire.

Fire Protection Systems

Smoke alarms were present and operated, alerting the occupants. A wet-pipe sprinkler system with coverage under the ceiling of the entire mall activated properly. During the fire, a mall employee shut down the system for 71 minutes; the reason for this was not reported. When it was turned back on, more than 200 sprinkler heads activated. Fire doors, a water curtain, and fire walls reportedly were effective in stopping the fire from spreading into the stores.

Fire Development

This incendiary fire was started in the stockroom of a store on the second level when someone soaked toilet paper rolls in flammable liquids and ignited them with an open flame. The fire spread to the attic through a space where a ceiling tile had been removed. While the sprinkler system was off, the fire spread to the sales floor and adjoining stores.

Contributing Factors and Other Details

It was reported that three primary factors contributed to this loss: there were no sprinklers above the ceiling, the sprinkler system was shut down for 71 minutes, and the fire burned for nearly four hours, during which time suppression efforts were begun but were curtailed because police had received a report that someone had placed a bomb in the building before setting the fire. The perpetrator was arrested and convicted.

Outside of Structures with Loss

California

Date, Time of Alarm, Dollar Loss

September, 6:12 p.m., \$65 million

Property Characteristics and Operating Status

This was a 30-inch (76-centimeter) natural gas transmission pipeline under a residential neighborhood.

Climate

Winds were blowing at 20 miles (32 kilometers) per hour, the temperature was 65°F (18°C), and humidity was 58 percent.

Fire Development

A rupture in this gas transmission pipeline released more than 47 million cubic feet (1.3 million cubic meters) of natural gas that was ignited by an undetermined source, creating a fireball reported to be 200 feet (61 meters) high. It left a crater approximately 76 feet (23 meters) long by 26 feet (8 meters) wide.

Contributing Factors and Other Details

Eight people died and 52 were injured in this explosion and fire, which also destroyed 38 homes and 52 vehicles. Another 63 homes and 22 vehicles were damaged, and 10 acres (4 hectares) of open space and city infrastructure were burned. At least 2,000 people were evacuated from 600 additional structures. Firefighters had water supply problems because the explosion damaged the water mains, so helicopters were used to drop water from the air. Of the 52 people injured, 10 suffered serious burns. Two of the injured were firefighters. The National Transportation Safety Board (NTSB) is conducting an investigation.

Basic Industry, Utility, and Defense Properties

Illinois

Date, Time of Alarm, Dollar Loss

December, 9 a.m., \$52 million

Property Characteristics and Operating Status

This two-story, 3,750-square-foot (348-square-meter) wastewater treatment plant of protected noncombustible construction was operating at the time of the fire.

Fire Protection Systems

The plant had neither detection nor automatic suppression equipment.

Fire Development

Venting piping in the basement had been disconnected while a maintenance procedure was being performed on a methane burner. Workers provided mechanical ventilation and left the room to allow it to vent. The ignition source is unknown.

Contributing Factors and Other Details

Loss to the structure was estimated at \$42 million. Damage to its content was estimated at \$10 million.

Special Properties

New York

Date, Time of Alarm, Dollar Loss

December, 9 p.m., \$12 million

Property Characteristics and Operating Status

This five-story building was under renovation. No additional information was reported.

Fire Protection Systems

No information was reported.

Fire Development

No information was reported.

Contributing Factors and Other Details

No information was reported.

Residential

Hawaii

Date, Time of Alarm, Dollar Loss

March, 5:42 p.m., \$10 million

Property Characteristics and Operating Status

This two-story, single-family home of unprotected wood-frame and some heavy timber construction covered 20,000 square feet (1,858 square meters). It was unoccupied at the time.

Fire Protection Systems

Complete coverage smoke detection equipment was present, but it's unknown if the system activated. There was no suppression equipment.

Fire Development

The fire's cause and origin are listed as undetermined.

Contributing Factors and Other Details

No information was reported.