Δ Table B.3(d) Reported Library Structure Fires by Area of Origin, 2012–2016 Annual Averages

Area of Origin	Fires	Direct Property Damage (in Thousands)
Lavatory, bathroom, locker room, or check room	23 (22%)	$28 (10%)
Trash or rubbish chute, area, or container	10 (10%)	$0 (0%)
Unclassified outside area	10 (10%)	$6 (2%)
Kitchen or cooking area	7 (7%)	$0 (0%)
Heating equipment room	5 (5%)	$0 (0%)
Lawn, field, or open area	5 (5%)	$0 (0%)
On or near highway, public way, or street	5 (5%)	$0 (0%)
Courtyard, terrace, or patio	3 (3%)	$13 (5%)
Art gallery, exhibit hall, or library	3 (3%)	$2 (1%)
Lobby or entrance way	3 (3%)	$50 (18%)
Unclassified area of origin	2 (2%)	$0 (0%)
Office	2 (2%)	$3 (1%)
Hallway, corridor, or mall	2 (2%)	$0 (0%)
Crawl space or substructure space	2 (2%)	$0 (0%)
Other known area of origin	21 (20%)	$177 (63%)
Total	**105 (100%)**	**$282 (100%)**

Note: Sums might not equal totals due to rounding errors. See "How NFPA's National Estimates Are Calculated for Home Structure Fires" for details about the methodology used.

Source: NFIRS 5.0 and NFPA's Fire Experience Survey.

ity of combustibles in libraries can lead to severe, even catastrophic, losses when fires occur in book stacks. Some typical fires involving one or more of these factors are listed in B.3.2.4 through B.3.2.41, including three that tested the resources of three of the largest cities in the United States — Los Angeles, CA; New York, NY; and San Diego, CA.

B.3.2 Illustrative Fires. The examples in B.3.2.1 through B.3.2.41 illustrate the many ways library fires have started and spread and the destruction they have caused. In these fires alone, tens of millions of valuable books, recordings, and other library collections have needlessly been lost to fire. Damage has been directly proportional to the promptness of discovery, the transmission of an alarm, the availability of automatic fire suppression, and the concentration of combustibles in the fire area. Even the most proficient fire departments are unable to prevent losses such as those experienced during fires at the Jewish Theological Seminary Library, the Klein Law Library, and the Los Angeles Central Public Library in the absence of suitable fire detection and fire suppression systems.

Note: The descriptions in B.3.2.1 through B.3.2.41 are from newspaper articles and other publicly available but unofficial sources; therefore, attributions of cause, estimates of damage, and other facts presented in these descriptions might be open to question. Nevertheless, the descriptions illustrate trends and contain information that can be of value in evaluating the overall fire problem in libraries.

***N* B.3.2.1 Kansas State University Hale Library, Manhattan, Kansas — May 22, 2018.** Estimated $12 million loss. An accidental fire broke out on the roof near the fourth floor of the five-story building during roofing operations, resulting in extensive smoke and water damage throughout the structure. The fire was reported at 4:10 p.m. and went to three alarms prior to containment at approximately 6:30 p.m. Fire damage reportedly was limited to the roof. The new sprinkler system was credited with preventing a worse disaster. The library housed the university's information technology services, email, and online student and employee systems, which went down due to the fire. Approximately 1.5 million library volumes required cleaning.

***N* B.3.2.2 University Library, Mzugu University, Malawi — December 18, 2015.** Total loss. The fire was discovered at 3:00 a.m. Students who witnessed the fire stated that it was started by a "simple spark" close to the library's main entrance. The first fire truck on the scene ran out of water while fighting the fire. Two additional engines that arrived shortly thereafter were reportedly driven off by onlookers. By 5:00 a.m., the main portion of the library collapsed. Structural woodwork and carpeting fueled the fire. A total of 45,000 volumes, 80 computers, and all furniture were lost.

***N* B.3.2.3 Academic Institute of Scientific Information on Social Sciences (INION), Moscow, Russia — January 30, 2015.** Partial loss. INION lost 5.42 million of its 14 million volume library collection. Of those destroyed, 2.32 million were unique documents. The fire broke out at approximately 10:00 p.m. on the second floor and continued to burn for approximately 25 hours. At the point of extinguishment, the fire had consumed over 2000 m^2 (21,500 ft^2) of the building and collapsed 1000 m^2 (10,764 ft^2) of roof. Over 150 firefighters fought the fire throughout Friday night and Saturday. Officials suspected the cause to be an electrical short circuit but also could not rule out arson. Fortunately, the fire did not result in any injuries. The building was closed at the time of the fire, and employees had left for the day. Water was cited as responsible for much of the damage to the collection. According to the museum director at the time, the need for a modern fire extinguishing system had been raised with the Academy of Sciences for decades, but the Academy reportedly did not have adequate funding. Founded in 1918, the library's extensive collection included documents in ancient and modern Eastern European languages dating back to the 16th century.

B.3.2.4 Glasgow School of Art Library, Glasgow, Scotland — May 23, 2014. Total loss. Fire broke out in this listed iconic building just before 12:30 p.m., starting in the basement, and quickly spreading upward through the entire five floors. Although the fire was brought under control quite quickly, significant damage was done to the historic studios and stairways, and the renowned Mackintosh library was destroyed. The fire was attributed to flammable gasses in a canister of spray foam being ignited by a hot projector nearby. A staff member was present when the fire was ignited, but was unable to contain the fast-spreading flames. Contributing to the rapid fire spread were the number of timber lined walls and voids, original ventilation ducts running both vertically and horizontally throughout the building, and a vertical service void running the entire height of the building which allowed the fire to travel unabated. At the time of the fire, installation of a new fire suppression system was nearing completion, but it had been delayed due to the discovery of asbestos.

Charles Rennie Mackintosh is lauded as Scotland's most influential architect and designer, with the art school building that bears his name considered by many to be his greatest masterpiece.

B.3.2.5 Georgetown Neighborhood Library, DC Public Library, Washington, DC — April 30, 2007. The fire broke out around 12:30 p.m. and quickly spread to the roof, and within minutes of receiving the call, firefighters began to arrive. Firefighters were eventually able to bring the fire under control. All patrons and staff were evacuated from the building safely. The building contained a special collection of Georgetown "local history" known as the Peabody Room. The Peabody collection received only smoke and water damage and was quickly removed from the building and flash frozen. About 90 to 95 percent of the collection was able to be saved, including several paintings and rare items. The general circulating collection received significant water and fire damage resulting in a substantial loss. The Georgetown Library was renovated at a cost of about $26 million.

B.3.2.6 Anna Amalia Library, Weimar, Germany — September 2004. Estimated 60 million euro ($73 million) loss. A fire in the Anna Amalia Library in Weimar, Germany, destroyed about 10 percent of the library's books and artwork and caused more than 60 million euros of damage. Investigators believe an overloaded electrical circuit caused a smoldering fire that burned for some time in a second floor room of the library before it began to spread. The library was equipped with smoke detection, but there was no automatic fire suppression system installed. Renovation work was under way in the building at the time of the fire.

B.3.2.7 Alexander Blok Library, St. Petersburg, Russia — February 20, 2004. Partial loss. A five-alarm fire broke out in the building on St. Petersburg's famed Nevsky Prospekt that houses the Alexander Blok Library, as well as an art gallery and shops. The fire was extinguished about five hours after it started. The library's collection of literature and musical scores escaped damage from the flames, but the fire service reported that much of the collection was soaked with water. The building was not sprinklered.

B.3.2.8 University of Georgia Main Library — July 23, 2003. Estimated $10–$12 million loss. An arson fire broke out in the main library at the University of Georgia at 5:45 p.m., with about 200 people in the building. Although the fire was contained in the second floor, there was smoke damage throughout the building because the fire dampers in the air returns did not shut down the air handling system until heat melted the fire links on dampers. The fire was confined to an area surrounding an office that had been converted to a storage room, which contained computers, books and documents. Although the fire was contained within 20 minutes after firefighters arrived, the second floor of the annex portion of the main library sustained several hundred square feet of fire damage, and the fire burned through a collection of historical documents of the Internal Revenue Service, the Food and Drug Administration, the Securities and Exchange Commission, and the State of Georgia. At the time of the fire, the only smoke detectors in the library were located at the fire doors of each egress stair. Smoke detectors activated the fire alarm that summoned the fire department; however, the fire was fully developed by the time the fire department arrived. The original building is four stories and the annex is seven stories with an eighth floor mechanical penthouse. The building is steel frame with concrete and masonry construction. The basement of the annex was the only portion of the building protected by an automatic sprinkler system at the time of the fire. Property loss and restoration costs were estimated at $10 to $12 million.

B.3.2.9 Bibliotheca Alexandrina, Alexandria, Egypt — March 2, 2003. Partial loss. A fire, apparently caused by a short circuit in the fourth-floor administrative area, sent thick smoke swirling through the building that had opened to international fanfare in October 2002. The fire lasted about 45 minutes and was confined to the administrative area. No books were destroyed, and the library was able to reopen later in the day; however, the fire prompted authorities to evacuate the 11-story building, and 29 people were taken to hospitals for treatment for smoke inhalation. The $230 million library, which contains about 240,000 books, a planetarium, conference hall, five research institutes, six galleries, and three museums, is located on Alexandria's renovated seaside promenade. The ancient Alexandria library, founded in about 295 B.C. by Ptolemy I Soter, burned in the fourth century.

B.3.2.10 Glasgow University, Scotland, UK — October 25, 2001. Estimated £12 million ($10.7 million) loss. At 1:30 p.m. a fire broke out on the top floor of the Bower Building, which for 100 years stood out as a proud and distinctive element of the Glasgow University skyline. Around 40 students in the building, which housed an administration center for the Institute of Biomedical and Life Sciences Department, were evacuated by university staff as black smoke billowed from the roof space. Seventy firefighters used aerial jets in an attempt to stop the flames spreading to nearby science buildings on the West End campus. They also removed radioactive material from the top floor of the building. At one point a number of officers were evacuated from inside the building amid fears the weakened structure was in danger of collapsing. Police cordoned off the building as wreckage from the top floor laboratory fell into the second floor. The divisional fire officer said the fire was brought under control at 5 p.m. The cause of the fire is not known, but students reported that firework noises were heard shortly before the blaze broke out at 1:30 p.m.

The blaze destroyed dozens of rare books and manuscripts and records belonging to at least 2000 undergraduate students, as well as equipment worth £3.5 million ($6.25 million), although the greatest loss was a unique collection of 19th century botany books including first editions of Darwin's work and some original manuscripts valued at more than £2 million ($3.6 million). The books were housed in the library in a room

known as the Marshall Room on the third floor of the building underneath the roof space. Damage to the building was estimated at £7 million ($12.5 million).

B.3.2.11 Minnesota Library — 2000. Estimated $2 million loss. At 11:16 p.m. the fire department responded to a fire in a three-story library of masonry construction. The library was part of an educational complex. Arriving firefighters heard alarms but initially did not see smoke, although they did smell plastic. The fire panel showed heavy smoke, and they found smoke coming from a locked room in the basement. Firefighters encountered more doors and heavier smoke and they began to ventilate the basement and first and second floors. They had to remove the windows because the windows did not open. Investigators determined that the fire originated in the area of the electrical fan and cable television electronic equipment in the video control room. Flame damage was confined to the room of origin, and smoke damage was confined to the floor of origin. Property damage was estimated at $2 million. The property did not have automatic sprinklers.

B.3.2.12 National Archives — February 29, 2000. Partial loss. A fire of suspicious origin destroyed about 40,000 pages of archival material stored at the Washington National Records Center in Suitland, MD, which stores more than 3.7 million cubic feet of records. The building's sprinkler alarms activated at 2:30 p.m. and alerted the GSA Control Center that there was a problem. The first fire company arrived sometime between 2:45 p.m. and 2:50 p.m. A fireman on the scene was overcome with smoke at which point firemen abandoned Stack 15 to open the roof hatches to vent the smoke. This process apparently took approximately one hour to accomplish before the firemen returned to Stack 15 to begin to extinguish the fire. The sprinkler system contained the fire during the period between 2:30 p.m. and 3:50 p.m. at which point the firemen were able to enter the stack.

The bulk of the records kept in the area where sprinklers went off were inactive files of deceased war veterans from the Department of Veterans Affairs, and records from the Bureau of Indian Affairs, the Labor Department's Hour and Wage Division, the U.S. Patent and Trademark office, and District of Columbia government offices. Following the fire, conservators stored wet documents in refrigerated trucks to prevent mold and mildew, and the walls, floors, and boxes in the building were professionally cleaned to remove soot and smoke residue.

B.3.2.13 Bryan College Library Collections, Dayton, Tennessee — February 2000. Partial loss. Fire destroyed the top floor of a Bryan College building that contained historical documents from the famed Scopes "Monkey Trial," but few papers tied to the famed case were damaged and no one was hurt. The most significant loss of the college's memorabilia from the trial of John Scopes, a science teacher prosecuted for teaching evolution, was William Jennings Bryan's personal copy of Charles Darwin's *The Origin of Species*. The building was completed in the 1950s and had no sprinkler system.

B.3.2.14 Village Library, Centerburg, Ohio — January 28, 2000. Partial loss. At approximately 2 a.m. the local sheriff deputy spotted smoke coming from the building while making his rounds. Approximately one-third of the second story was involved. Investigation revealed that an electrical heat tape on a water line in the upstairs portion of the building that was used maybe once a month malfunctioned, melted, and ignited. Extinguishment was hindered by an electric line very close to the building and subzero temperatures that caused ice to form as quickly as water was sprayed. The volunteer fire department had no large ladder truck that would reach the roof area of the 2-plus story building, and firefighters had to take down power lines surrounding the library to fight the flames.

The building, a 2-plus story brick building with multiple roof layers, built in 1893, had no fire protection systems. The collection included more than 25,000 videos, CDs, magazines, and historical items. Quick-thinking volunteer firefighters woke the local hardware store owner and got all the plastic sheeting they could find, along with their own tarps, and covered all books shelves before most of the water came down from the second floor. Only 700 books were lost and within six hours of the state fire marshal's release of the building, all materials had been removed. A recovery company freeze-dried some of the books and boxed and stored all materials. The library, which is one of only 17 association libraries in the state of Ohio, was closed for six months following the fire.

B.3.2.15 Central Library, Virginia Beach, Virginia — January 22, 2000. Partial loss. At 10:00 p.m., a small firebomb tossed through a broken window started a fire that damaged the local history and genealogy section of the city's Central Library. A fire department spokesman said the bomb was filled with a petroleum-type substance. Fire investigators noticed that a nearby window, almost floor-to-ceiling in length, had been broken. They said the break was large enough for the bomb to be tossed through, but not for a person to enter. An alarm alerted the fire service at 10:19 p.m., and four minutes later a ladder truck and a second unit arrived at the library. Smoke had filled the library by the time firefighters consulted the control panel to locate the blaze. Fire officials said the blaze had been quickly controlled by the sprinkler system. A computerized card-catalog terminal and two racks of books sustained fire and water damage, fire department and library officials said, and firefighters finished extinguishing the smoldering fire with portable extinguishers.

B.3.2.16 Linkoping City Library, Linkoping, Sweden — September 20, 1996. Partial loss. This important city library was largely destroyed by a fire that appeared to have been set deliberately at 11:00 p.m. in the immigrants' information office, which was located in the same building. Six hundred people attending a conference escaped safely. Within 20 minutes the building was fully involved. The fire services were sparing in their use of water in order to prevent water from entering the basement storage areas where the manuscript collections were located. Most of these were saved, although about 70,000 books were lost.

B.3.2.17 Virginia Library, Hampton, Virginia — July 1996. Estimated $4.5 million loss. At about 10:00 p.m., an occupant of a dormitory in an adjacent structure notified the fire department of a fire on the roof of a structure containing a library and a linen exchange. The one-story building, of ordinary construction, covered an area of 2378 m^2 (25,602 ft^2). Walls were block, the floor framing was concrete, the roof framing and deck were wood, and the roof was covered by built-up tar and gravel. The building had two ceilings. The property was closed for the night. Arriving firefighters found smoke coming from the structure's roof. An investigation revealed that an unknown person had intentionally ignited ordinary combustibles in a rear storage room. Holes in the lower ceiling allowed the fire to spread to the area between the roof and the original ceiling. A brisk wind fanned the fire throughout the building. It is believed that the fire burned for approximately 10 minutes

before it was detected. Automatic heat detectors were present in the library and the linen exchange office, but not in the room where the fire started. They were not activated. No suppression system was present. The structure and contents were destroyed. Two vehicles parked nearby were also damaged by radiant heat. Total direct property damage was estimated at $4,500,000. No injuries were reported.

B.3.2.18 Carrington City Library, Carrington City, North Dakota — November 5, 1994. Total loss. An arson fire destroyed the building and its contents, valued at more than $200,000. Only half of that amount was covered by insurance. The library's entire collection of nearly 13,500 books had to be discarded, with the exception of about 300 books that were in circulation at the time of the fire.

B.3.2.19 Norwich Central Library, Norwich, England — August 1, 1994. Partial loss. Fire destroyed more than 350,000 books, with many priceless manuscripts, some dating to the 11th century, suffering water damage from firefighter hose streams. The fire is believed to have started as a result of faulty wiring in a bookcase. The collections contained more than two million documents, including cathedral records dating back to 1090. The London Daily Telegraph reported, "Norwich refurbished its 31-year-old library earlier this year [1994] but decided not to install a sprinkler system, fearing it would cause too much damage if there was a fire." Even though the library was located adjacent to the city's main fire station, the fire was out of control by the time the fire department arrived.

B.3.2.20 Grand Canyon Community Library, Grand Canyon Village, Arizona — March 18, 1994. Estimated $1 million loss. A 9:00 a.m. fire destroyed approximately 14,000 books in a building that had been listed on the National Register of Historic Places. Only 500 books that were in circulation at the time of the fire were not destroyed. Cause of the fire was not reported. Loss was estimated at over $1 million.

B.3.2.21 Dakota County Library Branch, Hastings, Minnesota — June 4, 1993. Estimated $1.3 million loss. An arson fire involving a juvenile destroyed the entire library collection of 73,500 books and caused $300,000 damage to the building. Damage to books and library furnishings were estimated at more than $1 million. A passing motorist reported the fire at 4:30 a.m. The building had no automatic fire detection or suppression systems because it was considered "up to code" since it had been constructed in 1964 before sprinklers were required.

B.3.2.22 Broward County Main Library, Fort Lauderdale, Florida — March 23, 1993. Partial loss. The library's automatic sprinkler system contained a fire in a first-floor trash room at about 9:57 p.m. on a Sunday. Investigators believe a carelessly discarded cigarette caused the fire. Excess trash from a weekend special event in the library contributed to the severity of the fire. Still, only portions of the first floor were damaged, including security and delivery offices and storage rooms. Some library materials in those areas were also damaged.

B.3.2.23 Rio Vista Library, Rio Vista, California — January 16, 1993. Total loss. A fire caused by a radiator heater igniting combustible materials left nearby when staff departed at 5 p.m. destroyed the library's total collection of 32,000 books and the historic building that housed them. Persons attending a meeting in a second floor room discovered the fire at 10:15 p.m. Losses were estimated at $1.3 million.

B.3.2.24 South Bend Public Library, South Bend, Indiana — October 28, 1992. Partial loss. A fire that started in an elevator shaft during the unoccupied early morning hours spread into a mezzanine area, but damage to the building was minimal. The sprinkler system was credited with containing the fire and preventing it from extending into library collection materials. An alarm to the fire department from the building was delayed because the fire detection systems were still not connected more than two weeks after dedication ceremonies for the renovated and expanded building. The fire department found the fire nearly extinguished by the automatic sprinkler system. Damage was limited to smoke, carpet, elevator and elevator shaft, and glass windows to the main entrance door and rooftop skylights.

B.3.2.25 Calgary Public Library, Thornhill Branch, Calgary, Alberta, Canada — April 1, 1990. Estimated $500,000 loss. Firefighters were called to an arson fire in a building that housed the library and a Calgary social and health services office at 4:30 a.m. Initial estimates of $1 million in losses were subsequently reduced by more than half when it was determined that, of the 60,000 books damaged in the fire, more than 80 percent could be salvaged. These were mostly smoke-damaged books that could be cleaned.

B.3.2.26 Bailey-Howe Library, University of Vermont, Burlington — March 21, 1990. Estimated $105,965 loss. Staff arriving at 7:30 a.m. smelled an electrical burning odor. An electrical fault had ignited the fabric wrapping on an air supply duct in the air return plenum above the suspended ceiling. By the time the source of the smoke was discovered, the fire had burned itself out. At the time of the fire there was no interconnection between the automatic smoke detection system and the air handling system to shut it down upon detection of smoke. Damage to the library was limited to the effects of the smoke and the removal of parts of the ceiling. Final cost to the institution was $105,965. The library reopened two days later, and the most affected part of the building was off-limits to students for the balance of that spring semester. An automatic sprinkler system had been retrofitted to the building in 1981, but only below the suspended ceiling.

B.3.2.27 Nellie McClung Public Library, Victoria, British Columbia, Canada — December 4, 1989. Estimated $1–$2 million loss. Fire was discovered shortly after midnight by a passing police patrol and at first was suspected to be arson because of the explosive pace of fire development. Arson was subsequently ruled out because no trace of forced entry or use of flammable liquid accelerants was found. The 13-year-old building was gutted and 34,000 books destroyed. It took the firefighters 45 minutes to control the fire and five hours to fully extinguish it. The fire caused damage in the range of $1 million to $2 million to the library and its collections. It was reported that automatic sprinkler protection had only been provided in the boiler room, leaving the remainder of the building unprotected.

B.3.2.28 Library of USSR Academy of Science, Leningrad, Russia — February 14, 1988. Partial loss. A fire that started as a result of an electrical defect in a newspaper collection storage room of this great library burned for 2 hours unnoticed because the detection system failed. Forty brigades then pumped water into the flames for the next 19 hours. The incident was deemed by Soviet journalists to be a national disaster on a parallel with the Chernobyl nuclear catastrophe. Destroyed by fire were 400,000 volumes of rare or unique

works; another 3.6 million books were water soaked. As Pravda reported, "The disaster could well have been prevented."

B.3.2.29 Los Angeles Central Library, Los Angeles, California

B.3.2.29.1 April 29, 1986. Partial loss. An arsonist set a fire on tier 5 in the multi-tier book stacks at 10:40 a.m. when there were 400 persons in the library. A detection system gave immediate notice of the fire to a security officer, and the fire department was called. The security officer responded to tier 6 as indicated by the smoke detection annunciator panel but found no fire there at that time. The "deck slits" had not been sealed with smoke barriers when the smoke detection system was installed, as they were still needed for book stack ventilation, which allowed smoke to rise and trigger a detector on another tier. As a result, the opportunity was lost for occupant extinguishment while the fire was small. Time available for occupant action was probably very short because, typical of fires in multi-tier book stacks without automatic sprinkler protection, vertical fire spread through the open deck slits would have been very rapid — possibly less than 10 minutes from tier 5 to the top tier in the book stack (tier 8). The fire department response was prompt, but the fire proved one of the most difficult Los Angeles had ever seen, and it was over 7½ hours later that it was declared under control. More than 400,000 items were destroyed, and 700,000 wet books were placed in freezer warehouses to await eventual restoration. Damage to the reinforced concrete building structure and its historic fabric was extensive and significant. The senior fire service officer, Chief Donald Manning, said "If it had been sprinklered we might have had a few hundred books damaged; we might have had a few thousand dollars damage." *(See "Investigation Report" in NFPA Fire Journal, March/April 1987.)*

B.3.2.29.2 September 3, 1986. Estimated $2 million loss. A second incendiary fire struck the Central Library, causing $2 million damage to music collections, where papers had been stacked to start the fire. The public had been excluded from the building since the April 1986 fire, and only staff members and security people were there.

B.3.2.29.3 October 11, 1988. Estimated $500,000 loss. A third fire resulted when hot metal from welding operations on the third floor dropped down a chute into scrap lumber in the basement. Damage was limited to smudging of the elegant murals that had been cleaned after the 1986 fires at a cost of $500,000. The firefighters put down the flames in 30 minutes.

B.3.2.30 Saint Joseph State Hospital Library, Saint Joseph, Missouri — July 31, 1982. Partial loss. A fire of incendiary origin in the second-floor library of this three-story medical care facility was controlled with the operation of two automatic sprinklers. The minimal damage was confined to the room of origin.

B.3.2.31 Hollywood Regional Library, Hollywood, California — May 2, 1982. Estimated $5 million loss. Vandals broke into the library during the night and set it on fire. There were neither sprinklers nor automatic detection equipment. The destruction was almost total, and the loss amounted to more than $5 million. A large and rare motion picture history collection was destroyed. A new building replacing this library was dedicated in June 1986 with the design incorporating modern protection systems (i.e., automatic suppression and detection).

B.3.2.32 University of Utah, Salt Lake City — December 17, 1981. Estimated $2600 loss. A fire resulting from an overheated slide projector in the basement of the Eccles Health Sciences Library was extinguished with the operation of two automatic sprinklers. Notification of the public fire department was prompt through the action of smoke detectors. An estimated loss of $2600 was confined for the most part to visual aid equipment.

B.3.2.33 San Diego Aerospace Museum and Library, San Diego, California — February 22, 1978. Estimated $16.3 million loss. A fire of incendiary origin destroyed the museum and library. The loss, estimated at $16.3 million, included artifacts, works of art, photographs, and the Prudden Collection of 10,000 volumes. At the time of the fire, the 62-year-old structure was undergoing reconstruction, which involved replacement of exterior cement plaster. During this operation the underlying plywood used in the construction was exposed, and the fire was set in the plywood. The building had neither sprinklers nor automatic fire detection systems.

B.3.2.34 Ceres Public Library, Ceres, California — August 14, 1977. Estimated $230,000 loss. The Gondring Library and several adjacent offices were destroyed in a fire that developed when two youths dropped a paper match into a book return slot. The library loss was approximately $230,000. There were neither sprinklers nor automatic fire detection equipment.

B.3.2.35 University of Toronto Engineering Library, Toronto, Ontario — February 1977. Estimated $6.25 million loss. A fire of undetermined origin in the Sir Sandford Fleming Building caused severe damage to the Engineering Library collections and to the building. The building loss was estimated at $5.85 million and the cost of repair or replacement of books at $700,000. There were no sprinklers in the building. A detection system sent alarms, but, because alarm circuits were being tested during the night, the signals were confused, causing a delayed response.

B.3.2.36 Temple University Law Library, Philadelphia, Pennsylvania — July 1972. Estimated $5 million loss. A fire originating in an office area gutted the Charles Klein Law Library and caused extensive damage to the collections. There were neither sprinklers nor automatic detection equipment, and a passerby reported the fire at 1:45 p.m. The fire department attacked the fire and subdued it in 90 minutes, pouring water into the building at the rate of 41,635 L/min (11,000 gpm) at one point. Salvage of wet books held the damage to collections at $1.72 million, while the total loss was estimated at $5 million. *(See "Investigation Report" by A. Elwood Willey in NFPA Fire Journal, November 1972.)*

B.3.2.37 Jewish Theological Seminary Library, New York, New York — April 1966. Estimated $8.18 million loss. Employees fought an incendiary fire on the 10th floor of a 12-story tower for 20 minutes before calling the fire department. There were no automatic systems for detection or suppression of fire. The loss was estimated at $8.18 million and included irreplaceable books and manuscripts.

B.3.2.38 New York University Library, New York, New York — January 1965. Estimated $7000 loss. A fire in a library book stack was extinguished with the operation of one automatic sprinkler. Total loss was approximately $7000.

B.3.2.39 Michigan State Library and Office Building, Lansing, Michigan — February 8–13, 1951. Estimated $2.85 million loss. An incendiary fire burned for five days, resulting in a loss

of $2.85 million and two floors of the building that could not be salvaged.

B.3.2.40 New York University Library, New York, New York — February 1951. Estimated $1000 loss. A fire in the book stacks of a 10-story, completely sprinklered, fire-resistive building was extinguished with the operation of one sprinkler. Total loss was approximately $1000.

B.3.2.41 University of Michigan Department of Government Library, Ann Arbor, Michigan — June 6, 1950. A daytime fire set by a faculty member resulted in a $637,000 loss.

Δ **B.4 Places of Worship.** There was an annual average of 1,784 place of worship or funeral property fires reported to municipal fire departments in the period 2012–2016 *[see Table B.4(a)]*. Most of these fires (66 percent) occurred during normal operating hours (9 a.m.–9 p.m.) but resulted in only 42 percent of direct property damage costs, while fires that occurred between midnight and 6 a.m. resulted in 35 percent of direct property damage costs *[see Table B.4(b)]*. The majority (57 percent) of direct property damage costs can be attributed to four causes of fire: intentional, electrical distribution equipment, heating equipment, and electronic, office, or entertainment equipment *[see Table B.4(c)]*. While most fires (30 percent) originated in kitchens, cooking, or heating equipment areas, the direct property damage costs for these fires were low (4 percent). The most costly fires originated in attics, roof assemblies, concealed spaces, or large assembly areas *[see Table B.4(d)]*.

Δ **Table B.4(a) Reported Structure Fires in Places of Worship or Funeral Properties by Year, 2012–2016**

Year	Fires
2012	1,750
2013	1,740
2014	1,790
2015	1,890
2016	1,750

Note: These are fires reported to U.S. municipal fire departments and so exclude fires reported only to federal or state agencies or industrial fire brigades. Fires are rounded to the nearest 10.
Source: NFIRS and NFPA's Fire Experience Survey.

Δ **Table B.4(b) Structure Fires in Places of Worship and Funeral Properties by Alarm Time, 2012–2016 Annual Averages**

Alarm Time	Fires	Direct Property Damage (in Millions)
midnight–3 a.m.	110 (6%)	$14 (16%)
3 a.m.–6 a.m.	110 (6%)	$16 (19%)
6 a.m.–9 a.m.	200 (12%)	$8 (10%)
9 a.m.– noon	360 (19%)	$5 (5%)
noon–3 p.m.	280 (16%)	$15 (16%)
3 a.m.–6 p.m.	200 (16%)	$8 (8%)
6 a.m.–9 p.m.	260 (15%)	$11 (13%)
9 p.m.– midnight	150 (9%)	$13 (13%)
Total	**1,780 (100%)**	**$91 (100%)**

Note: Sums might not equal totals due to rounding errors.
Source: NFIRS 5.0 and NFPA's Fire Experience Survey.

Δ **Table B.4(c) Leading Causes of Reported Structure Fires in Places of Worship or Funeral Properties, 2012–2016 Annual Averages**

Leading Major Cause	Fires	Direct Property Damage (in Millions)
Cooking equipment	630 (36%)	$2 (2%)
Intentional	300 (17%)	$22 (24%)
Electrical distribution and lighting equipment	280 (16%)	$16 (18%)
Heating equipment	240 (13%)	$7 (8%)
Fan or air conditioner	100 (5%)	$2 (2%)
Candles	60 (3%)	$3 (3%)
Exposure	50 (3%)	$3 (3%)
Electronic, office, or entertainment equipment	40 (2%)	$7 (7%)
Smoking materials	30 (2%)	$0 (0%)

Note: This table summarizes findings from multiple fields, meaning that the same fire could be listed under multiple causes. The methodology used is described in "Methodology and Definitions Used in Leading Cause of Structure Fires Tables."
Source: NFIRS 5.0 and NFPA's Fire Experience Survey.

B.4.1 Why Fires in Places of Worship Spread. The ways in which places of worship are used and their design and construction create many opportunities for fire spread. Delayed discovery and reporting is one of the primary reasons fires in places of worship generally result in significant damage or a total loss of the facilities. The principal factors affecting the spread of fires in places of worship are undivided open areas, concealed spaces, and combustible construction, interior finishes, and furnishings. Automatic sprinklers combined with fire safe building design and fire-resistive construction, finishes, and furnishings are the best way to ensure fire safety in places of worship.

B.4.2 Illustrative Fires in Places of Worship. The descriptions of fires in B.4.2.1 through B.4.2.38 illustrate some of the more common sources of ignition, factors contributing to fire spread, and the enormity of the losses suffered. It is important to note that these destructive fires are not limited to a particular geographical area or population, but occur across the country — in rural areas and big cities.

Note: The descriptions in B.4.2.1 through B.4.2.38 are from newspaper articles and other publicly available but unofficial sources; therefore, attributions of cause, estimates of damage, and other facts presented in these descriptions might be open to question. Nevertheless, the descriptions illustrate trends and contain information that can be of value in evaluating the overall fire problem in places of worship.

N **B.4.2.1 Cathedral Notre-Dame, Paris, France — April 15, 2019.** At around 18:30 local time, fire broke out in the roof void of the Cathedral Notre-Dame. In less than an hour, flames completely engulfed the cathedral's spire, causing it to collapse. Fire investigators were able to rule out arson early in the investigation, but no definitive cause of the fire has yet been established. Various theories suggesting possible ignition sources have been put forward, including a worker's carelessly discarded cigarette and an electrical fault. It is clear that the fire load created by Notre Dame's massive and enclosed timber

Δ Table B.4(d) Reported Structure Fires in Places of Worship or Funeral Properties by Area of Origin, 2012–2016 Annual Averages

Area of Origin	Fires	Direct Property Damage (in Millions)
Kitchen or cooking area	470 (26%)	$3 (3%)
Unclassified outside area	100 (6%)	$1 (1%)
Small assembly area with less than 100-person capacity	80 (4%)	$4 (4%)
Heating equipment room	70 (4%)	$1 (1%)
Attic or ceiling/roof assembly or concealed space	70 (4%)	$10 (11%)
Unclassified area of origin	60 (3%)	$1 (1%)
Exterior wall surface	60 (3%)	$2 (3%)
Lavatory, bathroom, locker room, or check room	60 (3%)	$1 (1%)
Large assembly area with fixed seats	50 (3%)	$20 (22%)
Exterior roof surface	50 (3%)	$4 (5%)
Office	40 (2%)	$4 (4%)
Large open room without fixed seats	40 (2%)	$4 (4%)
Duct for HVAC, cable, exhaust, heating, or air conditioning	30 (2%)	$1 (1%)
Unclassified storage area	30 (2%)	$1 (2%)
Trash or rubbish chute, area, or container	30 (2%)	$0 (0%)
Unclassified function area	30 (2%)	$2 (2%)
Storage room, area, or bin	30 (2%)	$1 (1%)
Lobby or entrance way	30 (2%)	$3 (3%)
Wall assembly or concealed space	30 (2%)	$1 (1%)
Other known area of origin	430 (24%)	$28 (30%)
Total	**1,780 (100%)**	**$91 (100%)**

Note: Sums might not equal totals due to rounding errors. Confined structure fires other than chimney or flue fires (NFIRS incident type 113, and 115–118) were analyzed separately from nonconfined structure fires (incident type 110–129, except 113–118). See "How NFPA's National Estimates Are Calculated for Home Structure Fires" for details about the methodology used.
Source: NFIRS 5.0 and NFPA's Fire Experience Survey.

roof structure, the lack of any effective fire compartmentation, together with the lack of automatic fire sprinklers and the relative inaccessibility of the structure for effective firefighting efforts, allowed the fire to develop and spread rapidly.

Reports have also suggested that while a fire detection system was present in the roof void, it did not include automatic transmission of alarm and fault notifications to a monitoring service. Alarms were investigated locally by the cathedral's security team prior to calling the fire department. Fire department notification was significantly delayed when security team members were initially unable to locate the fire upon receipt of the first alarm. It was only after an additional alarm was received that security team members returned to the attic space, determined there was a fire, returned to the security office, and subsequently notified the fire department. The time from the initial alarm to fire department notification was reported to be 31 minutes.

B.4.2.2 Lutheran Church of Hope, Anchorage, Alaska — January 30, 2016. Limited loss. Vandals broke into the church through a back window, tipped over the baptismal font in the sanctuary, ripped through some mail, then made their way to the kitchen, where they ignited the stovetop and piled papers on top of the burners. The fire activated the sprinkler system, dousing the fire before it could spread to other parts of the church, with only one head operating. Loss was limited to fire, smoke, and heat damage within the kitchen.

B.4.2.3 Christ the King Catholic Church, Chicago, Illinois — October 7, 2015. Spontaneous combustion of rags that had been used by volunteers to stain the floors of the choir pews in the sanctuary, as part of a major renovation project, was cited as the cause of a fire that engulfed this church, which had been designated as a Chicago Historic Landmark in 2006. The fire traveled from the front to the back of the church, from the second floor all the way up the roof section and then ran the whole length of the building. Flames could be seen shooting through the roof and steeple. A large portion of the wood truss roof collapsed. The multimillion dollar renovation project was planned to restore the building, which had been damaged by a previous fire in the 1970s.

B.4.2.4 Saint-Donatien Basilica, Nantes, France — June 14, 2015. An intense fire engulfed the historic neo-Gothic Basilica dating to the 1890s. The fire broke out after morning mass, with worshipers evacuating the building. Much of the roof was destroyed, although more than 40 firefighters worked to contain the fire. Welders conducting waterproofing work on the roof were reported to have accidentally started the fire and

attempted to extinguish it, without success. The workers were able to escape the fire; people from the area assisted in removing artifacts and historic artwork from inside the building.

B.4.2.5 New Shiloh Christian Center, Melbourne, Florida — February 16, 2015. Estimated $5000 loss. Burglars broke into an area of the building that was slated for a trade school, kicked in doors, scrawled graffiti, and set fire to some furniture and chairs in an attached storage unit, and a locked door leading into the maintenance area where the electrical room and a large diesel tank were located. Sprinklers operated, keeping the fire from spreading to the electrical room. The main sanctuary, housed in the same 11,600 m^2 (125,000 ft^2) building, was not affected by smoke or fire. This was the second time in less than two weeks that vandals attacked the building.

B.4.2.6 Second Baptist Church, Houston, Texas — January 1, 2015. Negligible loss. A single sprinkler extinguished a fire that broke out in a television in the lobby of the church. The building was unoccupied at the time. The fire department ventilated the building with multiple fans and began removal of the water in the lobby. Loss was reportedly limited to a small amount of water damage.

B.4.2.7 St. Mel's Cathedral, Longford, Ireland — December 25, 2009. Estimated €30 million ($43.2 million) loss. Early Christmas-morning fire broke out at the back of this landmark cathedral, dating back to 1856, and quickly spread to engulf the entire building. The fire burned for several hours, with flames at one point reportedly jumping 18 m (60 ft) into the air. Firefighters' attempts to control the fire were hampered by water shortages due to freezing temperatures affecting the municipal water supply during the especially harsh weather. Only the exterior walls of the cathedral survived, along with the campanile and portico — most of the contents of the building were lost. The fire damaged St. Mel's Crosier, a relic dating back over a thousand years; the entire collection of vestments, penal crosses, altar vessels of pewter and silver was lost, as were a number of Harry Clarke's Celtic Revival stained glass windows, although a few were saved and restored. The cause of the loss was listed as an overextension of the heating system.

B.4.2.8 Trinity Cathedral, St. Petersburg, Russia — August 25, 2006. Estimated 1.6 million ruble ($60,000) loss. An early evening fire apparently started on scaffolding on the outside of the church, which was undergoing restoration, collapsing the blue central rooftop dome and destroying one of four smaller cupolas surrounding it. Apparently a fire broke out on the scaffolding after someone threw down a cigarette butt. The fire burned through the scaffolding and spread to the central dome. The fire was contained about four hours after it started. Damage to the cathedral, which is included in UNESCO's World Heritage List, was estimated at over 1.6 million rubles.

B.4.2.9 St. Catherine's Church, Gdansk, Poland — May 23, 2006. Partial loss. A fire in this historic church, which has architectural elements dating back to the 13th century, caused the roof to collapse. Workmen had been repairing the church roof earlier in the day. The church contained Renaissance and Baroque paintings, a museum of church clocks, and a unique carillon — a musical instrument containing several bells. St. Catherine's Church had been largely destroyed by fire in 1905 but had since been reconstructed.

B.4.2.10 University City Church, Charlotte, North Carolina — March 20, 2006. Estimated $500,000 loss. An arsonist caused about $500,000 in damage to the church after setting more than 20 small fires inside. Investigators described the fires as amateurish. One of the fires was set by piling napkins and other paper on top of a stove in the kitchen and turning on a burner. The fires set off sprinklers inside the church, which triggered an alarm to the fire department. Firefighters put the fire out quickly, and no one was injured.

B.4.2.11 St. Jude's Cathedral, Iqaluit, Nunavut – November 13, 2005. Partial loss. A fire of suspicious origin caused extensive damage to this igloo-shaped church, an Arctic landmark. The fire also destroyed art works and other artifacts inside the church, which is shaped like an Inuit snow house with a spire atop the dome.

B.4.2.12 Laurel Grove Baptist Church, Franconia, Virginia — December, 2004. Total loss. An electrical malfunction in the attic of the church ignited a small fire that quickly spread through the 120-year-old wooden structure, destroying the building. The fire was first reported to the county's fire and rescue department at about 4:10 a.m. by a motorist driving by who noticed flames shooting out from the church's roof. About 50 fire and rescue personnel brought the fire under control in about 30 minutes. Two firefighters were slightly injured after slipping on ice created by their hoses.

B.4.2.13 Bethel Church, Elizabeth, West Virginia — December, 2004. Total loss. An arson fire that appeared to have been a cover for a theft destroyed this historic Wirt County church. There was evidence of larceny and breaking and entering prior to the fire, which was reported at around 9:50 p.m. First-responding fire department personnel found the church fully engulfed in fire. Thieves apparently removed a propane heater and all of the church's 1500 mm (5 ft) wooden pews, which were original pieces of the 1898 church, before starting the fire. The pews, built of solid wood and nailed into the floor, were heavy enough to need at least two people to move them. The church was also the victim of arson in the late 1980s. The church, which was not insured, was a complete loss.

B.4.2.14 Harbin New Synagogue, Beijing, China — November, 2004. Partial loss. A fire, caused by construction workers, damaged a historic synagogue in the north China city of Harbin. The building, dating from the 1920s when the city boasted a Jewish community of more than 20,000, was undergoing restoration work before reopening as a museum of Jewish history and culture. The fire destroyed nearly half of the newly restored dome. The building was built in 1921, and it was the largest synagogue in the Far East, with a floor area of 1233 m^2 (13,272 ft^2) and room for 800 worshippers.

B.4.2.15 Ebenezer Baptist Church, Pittsburgh, Pennsylvania — March, 2004. Total loss. A fire, believed to have been electrical in nature, started in the basement of the building and killed two firefighters and injured 29 others when the church collapsed as they tried to put out the fire. According to reports, the fire jumped up the walls and spread rapidly. Firefighters entered the building about an hour after the fire started to douse hot spots when the fire flashed over, engulfing the sanctuary, and the roof and steeple collapsed.

B.4.2.16 Praise International Church, Vancouver, British Columbia — January, 2004. Total loss. A four-alarm fire of suspicious origin destroyed Vancouver's third-oldest church, a stunningly beautiful heritage-listed building in Mount Pleasant. Neighbors called in the alarm shortly after 5 a.m. after seeing smoke coming out a window. By the time firefighters arrived, the fire had broken through the roof and the building was fully involved. At one point flames were roaring 30 m (100 ft) into the air and more than 35 men and 12 trucks were called in. Nothing was saved from the church, which was totally destroyed. Investigators said the fire appeared to have started in the basement sometime before 5 a.m. The Tudor revival style building built in 1909 featured a high hammer beam and truss ceiling and was the only Tudor revival designed church in the city.

B.4.2.17 Exeter Presbyterian Church, Exeter, New Hampshire — November, 2003. Total loss. A four-alarm fire, believed to have been caused by a furnace explosion, destroyed a 158-year-old wood-frame church in downtown Exeter. The fire was already well established when firefighters arrived at 7:15 a.m. Just after 9:30 a.m., flames broke through the roof of the church, and about 15 minutes later pieces of the roof started to collapse. Firefighters initially used water from the town of Exeter's hydrant system but later hooked up hose lines to pipe water from the Exeter River as the town's system was strained.

B.4.2.18 St. John's Lutheran Church, Sycamore, Illinois — February 9, 2003. Total loss. A fire of undetermined origin caused a backdraft that blew the church apart in what has been named the largest backdraft ever documented in the U.S. The backdraft blew the roof off the church and injured two firefighters, who were responding to a rekindle from a fire in the church the day before. The only warning before the blast was a sucking sound. The fire went to a fourth alarm, with 63 firefighters from 11 departments responding. After the fire the church's walls were left standing but the structure was unsalvageable. The church, built in 1937 and measuring 46 m × 49 m (150 ft × 160 ft), was made of stone, plaster, terra cotta tile, heavy timber, and stained glass windows covered with Lexan. The backdraft occurred in the sanctuary, which was located below the main church area and measured 24 m × 46 m (80 ft × 150 ft). Reports indicate that the church had voids, including a crawl space and cold air returns, where heat built up, contributing to the backdraft.

B.4.2.19 Our Lady of the Rosary Church, Pirenopolis, Brazil — September, 2002. Total loss. An early morning fire of unknown origin destroyed a historic Brazilian church, consuming gold and artwork imported from Portugal in colonial times. Built by slaves in 1728, the church was decorated with imported treasures, as Pirenopolis developed into a rich regional center for silver mining.

B.4.2.20 St. Michael Catholic Church, Wheaton, Illinois — March, 2002. Total loss ($4.9 million). An arson fire in the church, which did not have smoke detectors, fire alarms, or sprinklers, burned it to the ground. By the time firefighters arrived about 2 a.m. the fire was out of control. The fire occurred on 3/18/02, and it was set by a young adult member of the church who entered the building late at night or in the early morning on his way home from being out with friends. The fire destroyed the building, which consisted primarily of the sanctuary, and damaged the rectory next door. The replacement church building was dedicated in 2006.

B.4.2.21 Salem United Methodist Church, Allentown, Pennsylvania — August 2001. Partial loss. A fire at about 12:15 p.m., which started as three workers soldered copper on the roof, heavily damaged this 100-year-old wood frame church. The workers noticed smoke while working outside, then used a ladder to get a closer look from inside the attic, before they asked a church employee to call the fire department. The delay in reporting the fire allowed it to spread. The church was most badly damaged in its upper sections.

B.4.2.22 First Presbyterian Church, Lexington, Virginia — August, 2000. Partial loss. A hot iron used to strip paint ignited a fire that destroyed one sanctuary of the church. The hot iron, used to soften paint before it's scraped, likely ignited material in the roof area of the wood-frame structure. Completed in 1845, Lexington Presbyterian was designed in the Greek Revival style by renowned architect Thomas U. Walter. Confederate Gen. Thomas J. "Stonewall" Jackson worshipped at the church in the years leading up to the Civil War. The sanctuary had undergone some renovation since it was built. The dry, 155-year-old wood posed a greater fire hazard than newer material. The contractor chosen for the work gave members a demonstration of the hot-iron technique and they approved. A senior architectural historian with the Virginia Department of Historic Resources advises against using heat to strip paint on old wood fixtures that are hollow or that can't be seen from behind, like the cornices being stripped at Lexington Presbyterian, where rats or birds sometimes build nests in unseen areas that can catch fire without workers knowing it.

B.4.2.23 Immaculate Heart of Mary Catholic Church, Phoenix, Arizona — April, 2000. Estimated $1.5 million loss. A fire, of unknown origin, that caused an estimated $1.5 million damage to the church started about 3:15 a.m. along a wall near a candlelit shrine to the Virgin of Guadalupe and spread under the floor and to a choir loft, destroying the church's organ. Officials said firefighters' efforts were hampered by falling chunks of plaster, some weighing 45 kg (100 lb).

B.4.2.24 St. Luke's, Belfast, Pennsylvania — February 29, 2000. Estimated $1.2 million loss. A spark flying from a saw being used to cut metal siding started a fire within the hollow vestibule wall of the church and, according to the fire investigator, the tower belfry then acted like the chimney of a furnace as fire raced rapidly to the top of the steeple. The wall was not insulated and no modern fire-stops or sprinklers had been installed, so there was nothing to slow the fire's spread. The old church's thick stone side walls and foundation remained intact, but the fire destroyed the sanctuary roof and charred the interior walls, and a portion of the tower collapsed. What the two-hour blaze didn't damage, smoke or water did. No one was injured. The damage was estimated at $1.2 million.

B.4.2.25 St. Mary Magdalene Church, Los Angeles, California — July 2 & 3, 1999. Estimated $200,000 loss. Two deliberately set fires hours apart caused approximately $200,000 damage to this West Los Angeles church. Firefighters managed to extinguish the fires — one set late Friday and the other early Saturday — before they engulfed the entire facility. The church also suffered an arson fire in 1988 and was reportedly the target of repeated vandalism. Both fires broke out in a utility shed attached to the church. The first fire, reported at 10:41 p.m. Friday, was extinguished with little damage after a church alarm system alerted the fire department, but the second fire, shortly after 1 a.m. Saturday, did extensive damage to a chapel adjoining the church, the roof, and the church electrical

system. Church officials and parishioners wondered about possible connections to other nearby church arson fires, including a fire in June 1999 that caused an estimated $1.2 million in damage to St. Thomas the Apostle Roman Catholic Church, four miles to the east. In the last four years, suspicious fires damaged at least two other nearby churches: Our Lady of Lebanon-St. Peter Cathedral Maronite Church and St. Mark Coptic Orthodox Church.

B.4.2.26 Kansas Church — 1999. Estimated $2.5 million loss. Workers were using a circular saw with a metal cutting blade to cut a metal rod that operated several windows on a second-floor balcony in a church under renovation, when showering sparks ignited a fire. A worker saw the sparks fall onto several wooden structural members exposed at the roofline. The wood ignited easily because it suffered from dry rot and termite infestation, and the fire spread under the roof as workers tried to find water to extinguish it. Firefighters, responding to a 911 call from the construction crew at 9:24 a.m., found flames and smoke coming from the corner of the church roof. Workers tried to extinguish the blaze, but the delay in notifying the fire department and the lack of a standby fire extinguisher allowed the fire to spread. The two-story church was of wood-frame construction, with stone walls and a slate roof. It did not have sprinklers or fire detection equipment and was open at the time of the fire. A fire department official observed that, if workers had had access to an extinguisher, it might have been possible to save the building. This type of work qualifies as hot work per NFPA 51B. If NFPA 51B had been followed, a fire watch with an extinguisher would have been established after a hot work permit was issued. Estimated structural loss was reported at $2 million, with contents loss at $500,000. There were no injuries.

B.4.2.27 Barrington United Methodist Church, Barrington, IL — October 28, 1998. Total loss ($4 million). A maintenance worker called 911 at 12:06 p.m. to report a fire in this two-story church that was undergoing exterior renovations. The church, originally built in 1880, had wood frame, balloon construction. The walls, roof framing, and roof deck were wood, and the floors were wood joist. The roof was covered with asphalt shingles. The worker smelled smoke in the chapel area and found fire inside the wall. He tried to put out the fire with an extinguisher but was forced back by smoke. A smoke alarm also sounded, but activation was delayed because of the fire location. A partial sprinkler system in the basement was not a factor in the fire. When firefighters arrived, they found heavy black smoke coming from the roof and bell tower. Upon entering the building, they found heavy fire overhead and were ordered out of the building.

Workers using a heat gun to strip paint from windows stopped working at about 11:45 a.m., but left the heat gun plugged in and lying on the scaffolding. Heat from the gun ignited wood and/or dust on the scaffolding. The fire quickly traveled through the balloon construction to the attic and through the common space. Damage to the structure was estimated at $2 million, and loss to the contents was also estimated at $2 million. Both represented total losses. One civilian and one firefighter were injured in this fire.

B.4.2.28 Kharkiv Synagogue, Kiev, Ukraine — September, 1998. Partial loss. A fire of suspicious origin damaged one of Ukraine's largest synagogues. The fire in the sanctuary of the synagogue began at 2 a.m. and raged for several hours before firefighters put it out. The sanctuary was being reconstructed and had no electric wires or gas pipes at the time. Fire spread to the ceiling of the sanctuary, which is as high as a five-story building, but the Torah scrolls were saved. The synagogue was built around 1910 but shortly afterward was converted into a sports stadium by the Soviet government.

B.4.2.29 Central Synagogue, New York, New York — August, 1998. Partial loss. New York City firefighters spent nearly three hours bringing a fire under control in a landmark Manhattan synagogue. A fire department spokesman says the blaze broke out in the roof of the 126-year-old structure on Lexington Avenue and 55th Street just after 5 p.m. and quickly went to five alarms, with 45 trucks and 250 firefighters responding. Fire crews poured water on the building from the outside and finally controlled the fire just before 8 p.m. Apparently a small fire started while some work was being done on the building's air conditioning system, and workers believed they had put it out.

B.4.2.30 Pennsylvania Church —1998. Estimated $6 million loss. This 2½-story church was constructed of heavy timber and was closed for the night when the fire occurred. The church had no automatic suppression system, and its complete-coverage automatic detection system, of unreported type, failed to activate. However, at 4:52 a.m. a burglar alarm system activated and summoned police, who spotted the fire when they responded. The blaze started in a ceiling/floor assembly over the janitor's room in the basement when an unidentified electrical source ignited wood framing material. The fire spread to the sanctuary. Two firefighters were injured. A contributing factor to the rapid growth of the fire was that as the ceiling over the janitor's room collapsed, the fire spread through voids in the construction.

B.4.2.31 Wisconsin Church — 1998. Estimated $1.1 million loss. A church worker called 911 at 9:19 p.m. to report a fire in this two-story, wood-frame church. The structure measured 61 m × 15 m (200 ft × 50 ft), the walls, floor framing, roof framing, and roof deck were wood, and the roof was covered with asphalt shingles. Several volunteers had been attempting to eliminate bees and/or hornets from under the eaves. One individual sprayed ether into about 12 joist pockets. In one pocket, a cigarette lighter was used to create a blowtorch effect with the ether can, with the intention of burning out the insects. This created a small fireball, which workers attempted to pat out with their hands. Believing the fire was out, they continued to spray other joists. The volunteers noticed smoke coming from the roof peak 15 to 20 minutes later. They entered the church, tore down a piece of suspended ceiling, and found fire in the concealed space. They tried to put the fire out with several extinguishers. When these efforts were unsuccessful, the fire department was called.

The extensive use of ether caused the fire to spread quickly and far. Before a significant interior attack could be launched, firefighters had to ventilate the building of ether vapors. There was about 400 mm (16 in.) of space between the plywood roof deck and the bottom of the joist. About 355 mm (14 in.) of insulation was in place, leaving a 50 mm to 76 mm (2 in. to 3 in.) air space above the insulation and below the plywood. This space acted like a chimney to draw the fire and fumes toward the peak of this 11 m (36 ft) tall structure. Firefighters opened a small area of the roof in an attempt to ventilate the structure and reach the fire, but the fire's rapid acceleration forced them off the roof before completing the task.