SUPPLEMENT 1

Case Histories: Fires Influencing the *Life Safety Code*

Paul E. Teague, M.A.
Updated by Chief Ronald R. Farr

Editor's Note: This supplement illustrates how historically significant fires have led to improvements in the Life Safety Code.

Paul E. Teague, former editor of Fire Journal magazine, is a veteran award-winning engineering journalist. Currently, he is the national editor and supplements director for Design News magazine, the largest mechanical engineering magazine in the United States.

Ronald Farr is the Fire Chief of Kalamazoo Township Fire Department in Kalamazoo, Michigan.

Codes and standards are living documents. Born of the efforts of men and women to make their environment safer, codes and standards grow into maturity based on fire experience and the observations and research of those responsible for them. The best codes and standards, such as those produced by NFPA, never age, as they are continually updated with new information that allows them to adapt to an ever-changing world.

Such is the case with NFPA *101®*, *Life Safety Code®*. Originally known as the *Building Exits Code*, it had its origins in the effort to make factories safer for workers in the early days of the twentieth century. Its first focus was on the hazards of stairways and fire escapes, the need for fire drills in various occupancies, and the construction and arrangement of exits.

However, as American society changed, technology blossomed, and fire experience accumulated, the *Code* grew in scope. It began to include provisions for sprinklers, alarm and detection systems, protection of interior finish, and other important features. Of the thousands of fires whose lessons are reflected in the latest edition of the *Code*, probably none has had a bigger impact than the Triangle Shirtwaist fire of March 25, 1911. It was the Triangle Shirtwaist fire that prompted creation of NFPA's Committee on Safety to Life and, ultimately, development of the *Code* itself.

TRIANGLE SHIRTWAIST FIRE

Since its founding in 1896, NFPA has always placed special importance on its life safety work. NFPA's original objectives, "establishing proper safeguards against loss of life and property by fire," placed life safety ahead of property protection. Yet, until the Triangle Shirtwaist fire, there was not one technical committee devoted exclusively to life safety concerns.

The Triangle Shirtwaist Company was located on the eighth, ninth, and tenth floors of the Asch Building at the intersection of Washington Place and Green Street in New York City's Washington Square. The building was a "loft," typical of many in its day. The Triangle Company, with more than 500 employees, was reportedly the largest business of its kind in the city. Most of the employees were young women,

many of them recent immigrants, who worked six days a week in cramped and dirty quarters.

Numerous Fire Hazards

New York City law at the time required buildings 11 stories and higher to have stone floors and metal window frames. The Asch Building was only 10 stories high and was constructed with wood floors, wood trim, and wood window frames. Unsafe as they were, these features of the building's construction were only part of the fire danger that workers unwittingly faced every day.

Buildings with 10,000 ft^2 of floor space per floor were required to have three staircases per floor. The Asch Building had two. The building's architect had pleaded for approval of two staircases, because there was also an outside fire escape that could be reached by windows on each floor. The fire escape terminated at the second floor, not at the ground.

Labor laws in effect at the time required that factory doors open outward, *if practical*. The architect claimed this design was not practical in the Asch Building, because each landing was only one stair width from the door. All doors had to open inward.

Those same labor laws required that factory doors be kept unlocked during the workday. Doors at the Triangle Company reportedly were usually locked during the workday to keep track of the workers and prevent them from stealing material.

Rags consisting of cutaway cloth materials regularly accumulated on the floors. When last collected, an accumulation of 2252 pounds of rags had been removed. At the time of the fire, the rags had not been removed for about two months.

The Triangle workers were crowded together on the top three floors of the Asch Building. Aisles leading to exits were narrow and obstructed. Partitions were placed in front of doors and elevators. A fire insurance inspector had recommended in 1909 that the company keep the doors unlocked during the workday and conduct fire drills. The owners took no action on those recommendations.

Fire Begins in the Rags. No NFPA investigative report was written on the Triangle Shirtwaist fire, but two books describe the horror that took place: *The Triangle Shirtwaist Fire*, by Corinne Naden (Franklin Watts, Inc., 1971); and *The Triangle Fire*, by Leon Stein (J. B. Lippincott, 1962). The descriptions of the building and the fire reported here are summarized from these two books.

It was near quitting time on March 25, 1911, when one of the workers on the eighth floor noticed smoke coming from one of the rag bins. A fire in a rag bin was reportedly not unusual, but this fire spread with astonishing speed, despite the attempts of supervisors to extinguish it using pails of water. The fire spread from the rags to cutting tables and then to cloth patterns hanging on wire above the tables. In no time, flames consumed the wood floor trim, the sewing tables, and the partitions, and then spread to the ceiling.

Workers on the eighth floor rushed for the doors. One door was locked. When workers finally got it unlocked, it opened inward. The panicked workers piled up against the door, making it difficult for those who arrived first to open it. Eventually, they were able to open the door, and workers rushed into the stairway. However, some fell at the seventh floor level, and those behind piled up until there was no more room in the stairway. A policeman, who had seen the fire from the street, saw the pile-up as he ran up the stairs to help. He untangled the pile-up, and about 125 workers escaped down that stairway.

Someone used a telephone connection to the tenth-floor executive offices to report the fire. Other workers frantically rang for the elevators. Because the elevators had been summoned to the tenth floor, at first they didn't stop on the eighth floor. When they did stop, workers crowded into them, one on top of another. The elevators made so many trips to save workers on the eighth and tenth floors that the operators were overcome by smoke and exhaustion.

Some workers on the eighth floor climbed out the windows to the narrow fire escape. At least one worker fell down the fire escape to the courtyard below. Others climbed down to the sixth floor, went back into the building through a window, and walked down the inside staircase.

Many of the workers on the tenth floor escaped to the roof of the building, where law students from an adjacent building rescued them. Of the approximately 70 workers on the tenth floor, only one died. That death occurred because the victim jumped from a window.

The only telephone communication to the ninth floor was through the tenth-floor switchboard. No one on the tenth floor notified the ninth-floor workers of the fire.

Ninth-Floor Workers Were the Last to Be Informed. There were about 260 workers on the ninth floor. There were also eight double rows of sewing machines on 75-ft-long tables that took up nearly the entire floor. The only way to leave the tables was to walk to the north end of the building. Workers sitting at the south end had to walk the entire length of the rows of tables to reach the area where the exits were located. Along

the way, they had to negotiate around chairs, wicker baskets, and other items that obstructed the passageways.

When the quitting bell rang, one worker walked down one of the stairways to go home. When he reached the eighth floor, he saw it was in flames. He was the first ninth-floor worker to learn of the fire. Confused, he simply continued moving. By the time he thought of running back up the stairs to warn his coworkers, it was too late. He was unable to get back up the stairway.

The rest of the workers on the ninth floor learned of the fire when flames leaped through the windows. About 150 people raced for the Green Street exit, and more than 100 of them made it down to the sidewalk. Others ran to the Washington Place exit, but it was locked. Some rushed for the fire escape. Jammed with people and hot from the fire, the fire escape pulled away from the building and partially collapsed, sending bodies flying to the courtyard below.

Many workers, including those who found the Washington Place exit locked, congregated at the elevators and summoned them. However, the elevators were already packed with people from the eighth and tenth floors. Some of the workers jumped or were pushed into the elevator shafts. A few slid down the cables, some landing on the roofs of the elevators.

To escape the searing heat and suffocating smoke, many of the workers climbed out to the window ledge and jumped to their deaths. The impact of their bodies was so great that it not only broke the fire department nets, but also smashed holes in the concrete and glass pavement.

The fire department arrived at the scene early, but could do little except cool the exterior of the building. The department's equipment was good for fighting fires only up to seven stories. In total, about 147 people died in the Triangle Shirtwaist fire.

Move for Reform

The Asch Building was a firetrap, but it was not the worst one in the city. In 1910, a public agency investigated conditions in 1243 coat and suit shops. Nine days before the Triangle Shirtwaist fire, a local New York City newspaper published excerpts from the agency's report. The report stated that 99 percent of the shops were deficient in safety. Many had only one exit, many others had locked doors during the workday, and 94 percent had doors that opened inward rather than outward.

Whether that report by itself would have generated remedial action is open to question. The dismal record of previous attempts by unions and others to mobilize action indicates that improvements would not likely have been made. The Triangle Shirtwaist fire, however, illustrated more than a report ever could the dangers lurking in lofts and other types of buildings.

In fact, the Triangle Shirtwaist fire aroused the nation and eventually revolutionized an industry. Unions, particularly the garment workers' union, intensified their activities to bring about improvements in working conditions for their members. Citizens of all economic classes in New York City banded together to work for safer factories, and politicians passed new laws to protect workers.

Almost immediately after the fire, New York City residents formed the Committee on Safety. Among its members was Frances Perkins, who later became U.S. Secretary of Labor. The chairman was Henry Stimson, who soon left that position to become Secretary of War. He was succeeded as chairman by Henry Morgenthau. The committee became a focal point for efforts to pass laws mandating improvements in factories and other buildings.

In June 1911, New York Governor John Alden Dix created the New York State Factory Investigating Commission to look into conditions in all factories and allocated the commission a $10,000 budget. Chairman of the commission was Robert Wagner, Sr., then a state senator. Samuel Gompers was also on the commission.

In October of the same year, the Sullivan-Hoey Law was passed. It established the New York City Fire Prevention Bureau, the first in the country, and expanded the powers of the fire commissioner.

NFPA Broadens Its Focus to Include Life Safety. NFPA members were shocked but not surprised by the fire. For years, they had warned of many of the dangers present in buildings like the Asch Building, in particular fire escapes. The April 1911 *NFPA Quarterly* stated that fire escapes had long been recognized as a "delusion." For a quarter of a century, the article continued, fire escapes had "contributed the principal element of tragedy to all fires where panic resulted. Iron is quickly heated and expansion of the bolts, stays, and fastenings soon pulls the frame loose so that the weight of a single body may precipitate it into a street or alley."

At the NFPA Annual Meeting in May 1911, R. H. Newbern presented a paper on private fire departments and fire drills, declaring the value of drills in educating factory workers in procedures to help avoid panic and promote survival. A year later, Mr. Newbern's recommendations were published in a pamphlet titled "Exit Drills in Factories, Schools, Department Stores, and Theatres." This was the first safety-to-life publication produced by NFPA. How-

ever, there was still no specific NFPA committee devoted exclusively to life safety.

Formation of the Safety to Life Committee. At the 1913 NFPA Annual Meeting, President H. L. Phillips suggested to members that they could include "a section or committee having for its object the consideration of safety of life against accidents of every description." Later during that meeting, members listened to a speech titled "The Social and Human Cost of Fire" by Frances Perkins of the New York Committee on Safety. She urged them to study hazardous industries, publish the results, and publish rules that would help keep people in factories safe.

Perkins had witnessed the Triangle Shirtwaist fire. She had seen workers leap from the ninth floor to the street below and had been horrified. She told NFPA members that when she counted the social, human, and economic cost of that fire, she found it was enormous. "We lost not only those workers in the Triangle Shirtwaist fire," Perkins said, "we lost their valuable services to society as economic factors. . . . It is because that social and human loss is to the entire community that this problem of fire deserves the closest attention of all people who are interested in the general progress and welfare of humanity. . . . Nothing is so important as human health and happiness . . . and if it costs dollars and cents to procure . . . then we must pay . . . and if it reduces profits we must reduce those profits. . . . You who are more or less technical . . . must help us by giving . . . the correct information . . . which we will be only too glad to use."

On June 23, 1913, NFPA's Executive Committee formed the Committee on Safety to Life and entrusted this new committee to suggest the scope of its work. The July 1913 *Quarterly* stated that the formation of the committee was "the crystalization of a latent feeling which has for some time existed in the membership" for focusing attention on life safety.

The new committee, headed by H. W. Forster, spent the first few years studying fires involving loss of life and attempting to analyze the cause of that loss of life. At the 1914 Annual Meeting, the committee delivered its first report, which included a special section on egress, a statement that sprinklers can save lives, and preliminary specifications for outside fire escapes.

According to the report, the committee's studies showed that existing laws "are exceedingly deficient in this very important matter of egress. A number of states report frankly that they have no real legislation upon the subject."

The preliminary specifications for outside fire escapes were controversial and received a great deal of attention from the membership. The committee members did not like outside fire escapes, and many felt they were a delusion, as stated in the 1911 *Quarterly*. Nevertheless, the committee felt they had to face the fact that fire escapes existed and would be used.

The committee wrote, "Admitting . . . that a fire escape on a building is usually an admission that life is not safe in it, the fact remains that the outside fire escape is the commonest special provision for escape . . . [and] this Association should determine upon proper precautions for such escapes, and use its influence to have them adopted and enforced."

At the 1915 Annual Meeting, NFPA adopted revised specifications for fire escapes. In 1916, the committee's work was published in a pamphlet, "Outside Stairs for Fire Exits." In 1918, another committee report was published in a pamphlet titled "Safeguarding Factory Workers from Fire." The pamphlets were widely circulated, put into general use, and, with other documents, form the basis of the present *Life Safety Code*.

In 1921, the Committee on Safety to Life was enlarged to include representation from interested groups not previously participating in its work. Work was started on the further development and integration of previous committee publications to provide a comprehensive guide to exits and related features of life safety from fires in all classes of occupancy. This work resulted in the publication in 1927 of the first edition of NFPA's *Building Exits Code*.

COCOANUT GROVE FIRE

As anyone involved in any safety endeavor will attest, it often takes a tragedy to alert society to dangers that must be addressed. The Triangle Shirtwaist fire moved the nation toward the prevention of many fire hazards. However, as time passes, the public forgets the lessons it learned and is forced to learn them once again through another tragedy. Thirty-one years after the Triangle Shirtwaist fire, in which locked exits trapped and doomed many workers, the United States witnessed another major fire in a building with locked exits.

The fire occurred in 1942 at the Cocoanut Grove, one of the most popular nightclubs in Boston. It was a one-story-and-basement structure built in 1916. The original property was of reinforced concrete construction. Several additions had been made to the building, and a rolling roof had been installed over the dance floor.

State of Fire Protection: 1911 to 1942

There are many differences between the fire at the Triangle Shirtwaist Company and that of the Cocoanut

Grove. One building was a high-rise factory, and the other was a single-story nightclub. The biggest difference lies in the state of the art of fire protection at the time. In 1911, when the Triangle Shirtwaist fire erupted, there were no universally recognized standards for exits. In 1942, when the Cocoanut Grove burned, those standards existed and were part of NFPA's *Building Exits Code*. Evidently, they were ignored. As a result, 492 people died.

Virtually all the hazards at the Cocoanut Grove were covered by the 1942 edition of the *Building Exits Code*. The main problems appear to have been the chaotic condition of Boston's building regulations and lax enforcement.

As the *Christian Science Monitor* said in an editorial after the fire, "action will be taken to prevent another Cocoanut Grove, and somebody could have taken action to prevent this one."

The late Robert S. Moulton, long-time NFPA Technical Secretary and Secretary to the Committee on Safety to Life, wrote a report on the fire that was widely circulated. Much of the information that follows comes from that report.

Fire Hazards in the Popular Night Spot

In 1942, the Broadway Cocktail Lounge was added to the Cocoanut Grove nightclub. The lounge was installed in a group of old brick-joisted buildings varying in height from two stories to three and one-half stories and was connected to the main property by a passageway with doorways leading to dressing rooms for entertainers.

The basement of the original structure contained the Melody Lounge, another cocktail area. The Melody Lounge had false walls made of light wooden frame covered with light wallboard. Decorations in the lounge included colorful fabrics, artificial leather on the walls, and cloth on the ceiling. In addition, there were imitation coconut palm trees in the lounge and in the main dining/dancing hall. Light fixtures were made from coconut shells, with the wiring concealed in the "foliage." These decorations had reportedly been flame-proofed.

No Easy Way Out. The only obvious exit from the Melody Lounge was a door at the top of the stairway leading to a narrow hallway on the first floor, then to a foyer and the main entrance. Another door, this one leading to an outside alley, was concealed behind the false walls of the lounge. It was locked. A door leading to the street from the narrow hallway at the head of the stairs was equipped with panic hardware. However, this door was locked.

According to writer Paul Benzaquin in his book, *Holocaust* (Henry Holt and Company, 1959), there was also a passageway from the Melody Lounge to the kitchen, but it seems that only employees knew of this passageway. Its door was painted and draped and unlikely to be seen by those who didn't know it was there. Nevertheless, the door was counted as an exit by the city's fire commissioner in his post-fire report.

Many other doors were locked as well, and some opened inward. The false walls obscured many of the windows, and the main doorway of the Cocoanut Grove was blocked by a revolving door.

A Capacity Crowd That Kept Getting Bigger. The official seating capacity of the nightclub was about 600 persons. No one knows exactly how many patrons were there on the night of November 28, 1942, but unofficial estimates indicate that there were about 1000 people. Benzaquin reports that waiters were setting up more tables to accommodate additional patrons.

Overcrowding was not (and probably is still not) unusual in nightclubs. Nightclubs are businesses established to make a profit, and the more patrons they serve, the greater their profit. NFPA's Moulton said he was told the club was often congested, particularly on Saturday evenings.

According to Benzaquin, the club's application for a new license requested permission to install an additional 30 fixed stools for the new cocktail lounge. He writes that the stools were installed *before* permission was granted, on the assumption that there would be no objection.

That was probably a reasonable assumption. A member of the city's licensing board testified at the fire commissioner's hearing that the Cocoanut Grove got its original license and several renewals without any hearings to determine whether it complied with regulations.

The 12-Minute Fire. Benzaquin states in his book that the fire lasted about 12 minutes. It started in the Melody Lounge and was possibly ignited accidentally by a busboy who was holding a match while replacing a light bulb in one of the fake palm trees. As Moulton reported, however, the exact source of ignition was of less importance than the inadequacy of the exits and the extensive use of combustible decorations.

According to the fire commissioner's report, the fire immediately spread throughout the Melody Lounge along the underside of the false ceiling. Feeding on the combustible decorations, the fire reached and ascended the stairway and passed through the connecting passageway into the foyer, past the main entrance, and into the dining room and other areas of the club.

When the fire began to spread rapidly, panic ensued. Most of the patrons in the Melody Lounge raced for the stairway, their only obvious exit. Many died on those stairs. Those who escaped the basement lounge through the stairway piled up in the corridor while attempting to reach the main entrance. If the door from that corridor to the outside had been unlocked, many might have been saved.

Led by a few quick-thinking employees, a few patrons made their escape from the lounge by going through the concealed door to the kitchen area, and some of them escaped through a door to an alley outside. Others tried to get to the main floor but could not because of the heat. A few escaped through a basement window into a courtyard, and a few others survived the fire by seeking refuge in a large refrigerator.

Moulton wrote that about 100 people died at the Broadway entrance to the club, more than 190 ft from the stairway leading from the Melody Lounge, where the fire started. He reported that about 200 were trapped behind the revolving door at the main entrance. That revolving door, which under the best of conditions would slow exit travel, jammed and blocked the exit.

Lessons Learned

There were few "new" lessons to be learned from the Cocoanut Grove fire. Even before the Triangle Shirtwaist fire in 1911, the danger of locked, blocked, and concealed exits was known. After the Triangle Shirtwaist fire NFPA had publicized its views on exits and means of egress in pamphlet form.

The 1942 *Building Exits Code* prohibited revolving doors as exits in places of assembly and required that other occupancies that used revolving doors must also have swinging doors immediately adjacent or within 20 ft.

That same edition of the *Code* required that "decorations of theatres and assembly halls shall be of fire resistive or nonflammable materials. Fabrics and papers used for such purposes shall be treated with an effective flame-proofing material." A cautionary note warned, "Paper and cloth decorative materials should be kept to a minimum in places of assembly since such flimsy materials increase the hazard of the kindling and spread of fire."

The decorative materials in the Cocoanut Grove were supposedly flame-proofed, but, if this was true, the flame-proofing was ineffective. The fire did demonstrate, once again, that "fireproof" buildings — the Cocoanut Grove building was "fireproof" when first erected — can still be death traps due to their contents. It also proved that fire inspections should be conducted when facilities are in operation. According to Moulton, the Boston building inspector reported that he had inspected the building and found the exits adequate. This might have been true when the doors were unlocked and the building was not crowded with 1000 people.

"There is a real danger in attempting to remedy conditions such as were responsible for the Cocoanut Grove tragedy by the enactment of more laws," wrote Moulton. "In our opinion, building and fire officials can now do practically everything that is necessary to assure public safety from fire without any more laws."

Six months after the fire, at the 1943 NFPA Annual Meeting, Moulton reported to the membership that, due to the war, the Safety to Life Committee had been unable to meet. The committee members did exchange correspondence, however, and Moulton said they believed "our existing recommendations, that date back to 1913, are adequate."

Code Changes. There was one change involving the *Building Exits Code* that did come about immediately after and as a direct result of the Cocoanut Grove fire: The *Code* was adopted by many more jurisdictions across the country, due in large part to the efforts of the fire service. The Committee on Safety to Life reported on that increased usage at the 1945 NFPA Annual Meeting.

It was during the 1945 NFPA Annual Meeting that the Committee recommended a change in the method of exit measurement, clarification of the need for stairway enclosure, provisions covering loose chairs in nightclubs, and changes in lighting and signs. These changes were incorporated into the 1946 edition of the *Code*, as was a special note on interior finish.

Interior Finish. Combustible decorations were a factor in the Cocoanut Grove fire. Nevertheless, interior finish continued to be a major fire problem in the 1940s. In 1946, the nation witnessed the LaSalle and Winecoff hotel fires. The latter, with 119 fatalities, was the largest multiple-death hotel fire of the twentieth century.

The Committee on Safety to Life was concerned about the dangers of combustible interior finish. Therefore, it recommended, and the full membership approved, a caution in the 1946 *Code*, which stated, "where interior finish materials are used having a higher combustibility, greater rate of fire spread, or potentialities of greater generation of smoke or fumes than wood, the exits specified in the *Code* may not be sufficient to provide adequate life safety from fire."

The lack of a standard way to measure the combustibility of interior finish hampered the committee. In the July 1943 *Quarterly*, A. J. Steiner of Underwrit-

ers Laboratories described a new method he was developing to test the combustibility of interior finish. The Steiner Tunnel Test was recommended for adoption at the 1953 NFPA Annual Meeting by the NFPA Building Construction Committee. It was eventually incorporated into the *Building Exits Code*.

OUR LADY OF ANGELS SCHOOL FIRE

Combustible interior finish was one of the factors that led to fire spread at the Our Lady of Angels School in Chicago in December 1958. Wood trim in one corridor and combustible ceiling tile in classrooms in one wing (and perhaps in other areas of the building) provided fuel for this fire.

Avoidable Problem

The primary cause of loss of life, according to the NFPA investigative report of the fire, was *the inadequacy of the exit facilities*. As a result of this completely avoidable problem, 90 pupils and three nuns died.

Adequacy of exits, as determined by proper enclosure; provision of at least two exits remote from each other; and sufficient exit capacity were well-established fundamentals of fire protection by 1958. The Triangle Shirtwaist fire, the Cocoanut Grove fire, and hundreds of other fires had demonstrated the consequences of neglected exits. The 1958 edition of the *Building Exits Code* specified exact requirements for adequate exits and for other elements of school fire safety.

Chester I. Babcock, then manager of the NFPA fire records department, and Rex Wilson, then an NFPA engineer and later a consultant, investigated the Our Lady of Angels fire for NFPA. A year later, Babcock wrote, "We know now and have known since before most of today's schools were built how to design and protect a school so that the lives of the pupils and teachers will be safe from fire. Refinements and improvements are needed and undoubtedly will come, but this does not mean that fire protection engineering has been groping for an answer. Practical methods of assuring life safety from fire that have stood the test of time and are based on sound fire protection engineering principles have been available for years."

One Fire Area. In 1953, the two-story school building was connected to another old, two-story, brick, wood-joisted building by a two-story, brick-joisted annex. The NFPA report of the fire stated that the building constituted one fire area, due to open stairways and the fact that the masonry division wall between the north wing and the annex had substandard doorway protection.

The stairways in the school were open except for two located in the front of the north wing. Those stairs were enclosed at the second-story level by substandard doors that were held open at the time of the fire. Because the three stairways from the second floor corridor of the north wing were connected through a common corridor, pupils in second-story classrooms, in effect, had no way out.

Origin of the Fire. About 2:25 P.M., one half-hour before school was normally dismissed, fire broke out in combustible materials at the bottom of the rear stairway of the north wing. Pupils from one of the second-floor classrooms had taken trash to the boiler room incinerator, as was their routine. The students returned to the classroom at 2:30 P.M. and reported that they had smelled smoke. Their teacher informed a teacher in a nearby room, who went to find the principal. When the principal could not be found, both teachers led their classes out of the building to the parish church. Smoke was already at head level in the second-floor corridor. Only after they had their classes settled in the church did one of the teachers run back to the school and operate the fire alarm signal.

The school's janitor noticed smoke and ran to the parish house to tell the housekeeper to call the fire department. Apparently, the housekeeper waited a few minutes before placing the call. The fire department reported that at about 2:42 P.M., it received the first of some 15 calls reporting the fire.

Hot fire gases and smoke billowed up the chimney-like stairwell and mushroomed through the second-story corridor. Eventually the hot gases and combustible interior finish in the corridor ignited. The heat broke the large glass transoms over the classroom doors, and the hot gases and flames entered the rooms.

Those Who Escaped and Those Who Did Not. As soon as the fire alarm rang, occupants of the first floor left the building by means of the five available stairways, according to the NFPA report. The evacuation of pupils in the second-floor annex and south wing was hampered by smoke that came through an open door in the division wall at that level. Either the janitor or a fire fighter closed the door.

Pupils in the second-floor north wing did not escape as easily. Their travel through the corridor to the stairways was blocked by heavy smoke and heat. Some jumped from their classroom windows. Others were taken down fire department ladders. Many died in their classrooms, some at their desks.

Aftermath of the Fire

One immediate effect of the Our Lady of Angels fire was a public awakening to the hazards in the nation's

schools. According to Babcock's followup report, within a year after the fire, hazardous conditions had been eliminated in thousands of schools across the country.

Throughout this country's history, major improvements in safety have been made after terrible fires. The Iroquois Theater fire brought about improvements in theater safety; the Triangle Shirtwaist fire brought about improvements in factories; the Cocoanut Grove fire resulted in improvements in nightclubs; and the LaSalle, Winecoff, MGM Grand, Stouffer's, and DuPont Plaza fires resulted in improvements in hotels.

In 1959, NFPA sampled more than 2000 fire departments to analyze the level of improvements made in school safety. Many improvements had been made. Nearly every community had acted on such issues as frequent and improved exit drills, tighter control of waste disposal, inspections, and proper storage of combustible supplies. However, that same survey revealed that needed improvements had not been made in about 30,000 schools.

NFPA conducted an informal telephone survey in 1978, 20 years after the Our Lady of Angels fire. The consensus from that informal survey was that schools were safer. (Indeed, one respondent said they couldn't help but be safer than they had been in 1958, when they were the "lousiest-constructed buildings in existence!") Unfortunately, schools in 1978 were not as safe as fire professionals had hoped. The passage of time and the growing concern with vandalism and security had blocked out the memories of the Our Lady of Angels tragedy.

Los Angeles School Fire Tests. The most publicized result of the fire was the fire test program conducted by the Los Angeles Fire Department. The tests, conducted in 1959 and 1960 under the direction of then Los Angeles Fire Marshal Raymond M. Hill, were designed to investigate methods of protecting multistory, open-stairway school buildings. One of the conclusions drawn from the tests was that complete automatic sprinkler protection offered the best chance for escape.

The 1958 edition of the *Building Exits Code* provided for sprinklers in schools. The 1960 edition retained those provisions and totally reorganized the section of the *Code* covering educational occupancies. That edition classified schools as follows:

Group A: One-story buildings with exterior or interior access, or multistory buildings with access only by exterior balconies and outside stairs

Group B: Buildings of two stories or more with egress through corridors and interior stairways

Group C: Sprinklered buildings

Group D: Open-plan schools

Group E: Existing buildings

There were somewhat different requirements for each group.

A great deal of discussion took place among members of the Committee on Safety to Life in 1960 regarding whether they should recommend permitting open stairways in two-story sprinklered schools. The committee decided not to make this recommendation that year. The 1961 edition of the *Code*, however, did permit open stairs in sprinklered two-story schools. One reason for this decision was that committee members noted that, in two-story buildings, pupils constantly pass through the doors anyway.

In 1966, the year the *Building Exits Code* was reorganized and renamed the *Life Safety Code*, a provision was added that required all parts of school buildings below grade to be sprinklered. In addition, the allowable travel distance to the nearest exit was increased from 100 ft to 150 ft, under normal conditions, and up to 200 ft in sprinklered school buildings.

BEVERLY HILLS SUPPER CLUB FIRE

Those who study fires can't help but have a feeling of *déjà vu*. It seems that the same fire problems return to haunt us time and again. Inadequate means of egress, lack of employee preparedness and training, and a general noncompliance with proven provisions of the *Life Safety Code* were all factors in the Triangle, Cocoanut Grove, and Our Lady of Angels fires, as well as in countless others.

These problems were critical factors again on May 28, 1977, at the Beverly Hills Supper Club. In a fire at the club, a public assembly occupancy that billed itself as the "Showplace of the Nation," 164 people died. NFPA conducted an in-depth investigation of the fire, and much of what follows was taken from the investigative report prepared by Richard L. Best.

Fire Conditions in the Showplace of the Nation

The Beverly Hills Supper Club was a glamorous nightclub in Southgate, Kentucky, just outside Cincinnati, Ohio. Banquets, dinner dances, balls, floor shows, fashion shows, weddings, wedding receptions, and business meetings were all held in the club's "18" function rooms.

The quotation marks around the number 18 represent the advertised number of function rooms. There were actually five main dining rooms, the large "Cabaret Room," a small function room called the

"Zebra Room," and the main bar. Three of the large dining rooms could be subdivided into smaller rooms by folding partitions.

There had been a wedding reception in the Zebra Room on the day of the fire. The wedding party had left at approximately 8 P.M. Performers were scheduled to entertain guests in the Cabaret Room around 8:30 P.M. There were an estimated 1200 to 1300 guests in the Cabaret Room, about triple the number that could be accommodated safely. Numerous patrons later said that tables were squeezed together and the narrow aisles were obstructed with chairs. There were about 2400 to 2800 patrons in the club altogether.

Delayed Notification. Employees discovered the fire between 8:45 and 8:50 P.M. in the empty Zebra Room. It had started in a concealed space, and the origin was presumed by investigators to have been electrical in nature.

Some employees alerted the club's hostess, while other employees ran around looking for the management. Two managers tried to fight the fire with portable fire extinguishers — with the help of busboys and waiters — but their efforts were to no avail. One of the managers eventually ran to the hostess and told her to evacuate the patrons. By that time, it was about 9:00. Someone notified the fire department about a minute later.

As this general description of events indicates, about 15 minutes might have elapsed between discovery of the fire and notification of employees. That delay was a critical factor in evacuation efforts. Also, it seems that there was some degree of staff confusion regarding evacuation procedures, since employees had not been trained in them.

Once notification of patrons started, an interesting phenomenon took place. According to interviews conducted by the Kentucky State Police after the fire, waiters and waitresses instinctively took responsibility for the safety of the patrons they were serving. They went directly to those guests and to other guests in those rooms and told them to leave. They did not, however, necessarily take responsibility for guests they were not serving or guests in different parts of the building.

The Cabaret Room was isolated from the rest of the club once the show was in progress. There were no waiters, waitresses, busboys, or hostesses traveling to and from the kitchen or standing in the service halls between dining room seatings. This indicates that employees serving the Cabaret Room did not see other employees rushing around notifying patrons and the management of the fire, so they were totally unaware of the danger. However, one busboy, who had just left the Cabaret Room to work in another room, learned of the fire and decided to take action.

Quick Thinking. In a display of courage, calmness, and good sense, the busboy took upon himself the responsibility of evacuating patrons from the Cabaret Room. He was walking down one of the main corridors from the Cabaret Room to the Viennese Room when he learned of the fire. He looked toward the Zebra Room and saw smoke coming through the top edge of the closed doors. He quickly told a bartender to leave, then spun around and ran back to the Cabaret Room.

When he arrived there, he told the host to open the doors of the room. The host also moved the rope divider and reservations stand from the corridor and instructed people waiting in line to walk toward the Garden Room area in another part of the building.

The busboy then walked into the Cabaret Room, calmly climbed up onto the stage where a performance was taking place, took the microphone, and spoke to the guests in the room. This is what he told the post-fire investigators:

> The first thing I did was . . . ask them to look at the exit sign . . . "I want you to all notice that exit sign and I want you to look at the other corner of the room and there will be another exit sign . . . I want the left side of my room to go out of the exit sign behind that I'm pointing to now . . . I want my right half of the room to go out of the other exit sign . . . There is a fire in the small room on the other side of the building . . . I don't think there is any reason to panic or rush . . . you should leave."

Although he later said that some people looked at him as if he were crazy, people did begin to leave. Of the 164 fatalities in the fire, most occurred in the Cabaret Room. There is no way of knowing how many more would have died if the busboy had not taken charge.

Once he was back in the hallway, the busboy saw smoke billowing toward him so he went to an exit. "There were just three doors, and one was locked," he said. "I tried to bang it open with my shoulder [but] I couldn't."

The Human Factor. Post-fire interviews showed, not surprisingly, that people in general did not take the fire threat too seriously at first. Much of the evacuation in the early stages of the fire was without difficulty, partly because people proceeded calmly and deliberately, some perhaps not even believing there was a serious fire in the making.

When heavy smoke and intense heat descended on patrons trying to leave the Cabaret Room, those people suddenly realized the seriousness of the situation.

Some began to rush and push, and some stumbled and fell, blocking exits with their bodies. One fire fighter reported seeing people stacked two and three high.

One bartender told of a young woman who had fallen near an exit. Other people fell on top of her. The bartender and one of his coworkers tried to pull her out, but they were unable to move her. "And there was a man that was on top," the bartender said. "He was a heavy guy and he was reaching up his arms and so I thought he was all right . . . the first thought was to get him off the top so you can do something with the bottom ones . . . I had him wrap his arms around my neck and I pushed up against this door as hard as I could . . . and I didn't have enough strength to lift him and he just looked at me and shook his head . . . there was nothing I could do."

Familiar Factors Contributed to Deaths

The rapid fire spread along the main corridor of the club, delay in notifying patrons in the Cabaret Room, insufficient exit capacity, and an excessive number of people in the Cabaret Room were all major factors that resulted in employees and guests having insufficient time to escape this fire. Virtually all of these factors were covered in the *Life Safety Code* in existence at that time. Some other specific factors covered in the *Code* are examined in the following sections.

Construction. Previous editions of the *Code* defined Class A places of assembly as those having a capacity of 1000 people or more. The Beverly Hills Supper Club's total occupant load was 2375. Unprotected, noncombustible construction such as that of the Beverly Hills Supper Club was not permitted for Class A assembly occupancies. That construction was permitted for Class C occupancies, which were restricted to 300 people or less. (It is now permitted for Class A occupancies, but only if the building is fully sprinklered.)

Number of Exits. The number of exits, based on 100 persons per unit of exit width and on square footage, should have been 27.5 exit units. The actual number was 16.5. The second floor had no exits with components permitted by the *Code*. (The Melody Lounge at the Cocoanut Grove was also overcrowded.) The Cabaret Room should have had four exits, since it was itself a Class A place of assembly. It had only three. (The Cocoanut Grove's Melody Lounge had only one obvious exit.) There was evidence of locked doors and chains and locks on panic hardware. (The same was true at the Cocoanut Grove.) Exits were not well marked. A door to the corridor, for example, appeared to be part of the wall paneling, and it was not marked as an exit. (The Cocoanut Grove's Melody Lounge had a door that was painted and draped and not likely to be seen by patrons. In addition, false walls concealed some windows.)

Obstructions. There was seating in the aisles in the Cabaret Room. Tables were placed too close together, and there were too many chairs and other items restricting the aisles. There also were chairs and tables stored on the platform outside the Viennese Room that led to steps to double doors. (Chairs and tables also blocked aisles at the Cocoanut Grove.)

Enclosures. Vertical openings should be enclosed. The curved stairway in the club's Hallway of Mirrors was neither enclosed nor protected.

Interior Finish. The 1976 *Code* required interior finish in all means of egress in all places of assembly to be Class A — that is, with a flame spread rating of 0–25. The interior finish in the Hallway of Mirrors and the main north-south corridor had a flame spread rating greater than 25. It is interesting to note how many of these factors were also present in the Cocoanut Grove fire 35 years before.

Alarm Systems. One of the factors that made it difficult for patrons to escape was a delay in notification of the fire. An alarm system would have eliminated that delay. The *Code* required alarm systems in all occupancies except storage facilities and places of assembly. Committee members had discussed the importance of alarm systems for a long time, but many felt an alarm system could cause panic. The Beverly Hills Supper Club fire demonstrated the need for an alarm system, however, and so the requirement was added for public assembly occupancies in the next edition of the *Code*, which was published in 1981. Still concerned with the potential for panic and aware of tests showing the value of voice alarms, the committee added an important provision to its alarm requirements.

Manual fire alarm boxes were required to alert occupants. The fire alarm boxes send an alarm to a central office or other location on the property that is continuously staffed while the occupancy is in use. The central office must have a way of then notifying occupants, either through a voice alarm over a public address system or a vocal fire alarm system. The alarm notification requirement was made retroactive to apply to both new and existing buildings.

Sprinklers. Historically, the *Code* had required sprinklers in assembly occupancies used as exhibit halls. Cost was a perceived prohibitive factor in efforts to spread that requirement to other public assembly occupancies. After the Beverly Hills Supper Club fire,

however, the committee realized that the life-saving potential of sprinklers outweighed their cost.

The committee approached sprinkler requirements in the following two ways. Members reassessed construction requirements for all classes of assembly occupancies, consolidated them, and required sprinklers based on construction type and location of assembly occupancy within the building. It was decided that even fire-resistive buildings having four or more stories above the exit discharge should be sprinklered. These provisions applied to new buildings, and some were made retroactive for existing buildings.

In addition, every Class A and Class B occupancy was required to be sprinklered throughout. This requirement applied only to new construction. There were some exceptions, but none that applied to facilities such as the Beverly Hills Supper Club.

Discussion of the value of sprinklering all places of assembly was ongoing after the Beverly Hills Supper Club fire. Numerous fires — including the Gulliver's Discotheque fire in New York and the Upstairs Lounge fire in New Orleans, both of which took place during the 1970s and involved a fire blocking a means of egress — highlighted similar problems and emphasized the need for sprinklers.

RHODE ISLAND NIGHTCLUB FIRE

Tragedy struck again on the night of February 20, 2003, as fans gathered at The Station nightclub in West Warwick, Rhode Island, to see Great White, a 1980s heavy metal band. Within seconds after the band started to perform, sparks from a pyrotechnics display ignited expanded foam plastic insulation that surrounded the stage area. As a result of this tragic fire in which 100 occupants perished, changes would be made to fire and life safety codes in an effort to make public assembly occupancies safer.

Recap of That Night

Published reports (*The Providence Journal*) indicated that more than 400 fans had crowded into the single-story, wood frame building for Great White's late night show. At approximately 11:00 P.M. the band started to play their opening number. The band's manager ignited a "gerb," a pyrotechnic canister that releases a fountain of sparks, as part of the opening. Within seconds, the walls and the ceiling around the stage (covered with the foam) caught fire. Confused as to whether or not the fire was a part of the band's act, many patrons delayed heading for the exits during the initial seconds of the fire. This decision proved fatal in many cases.

The fire quickly spread across the ceiling toward the front doors. The lights didn't go out initially, but the thick smoke limited visibility, and commotion ensued. As patrons began to rush toward exit doorways and windows, people fell and were trampled. As occupants were trying to leave by the main exit, falling patrons jammed it, preventing many from reaching safety. In the confusion, others fled in different directions, some to the bathrooms, which offered no escape. Within four minutes, the club was engulfed in flames.

In the end, the fire claimed 100 lives, injured more than 200, and ranked as the fourth deadliest nightclub fire in U.S. history.

The Building. The single-story, unprotected wood frame building was constructed in 1946. The nonsprinklered structure had a floor area of approximately 6275 ft^2. Between 1946 and 2000, the building changed ownership eight times and had various uses, including meeting house (1964), restaurant (1974), and pub (1985). In 1991, the building reopened as a nightclub and was eventually renamed "The Station" in 2000. In response to complaints from neighbors about loud music and noise, expanded foam plastic material had been installed on the walls and ceiling at the raised platform.

The Hazards. Interior finish played a significant role in the rapid spread of the fire. According to the *Life Safety Code*, the interior finish is required to be Class A or B for general assembly areas with occupant loads of more than 300. Class C interior finish is permitted if the occupant load is 300 or less. In addition, the foam attached to the walls and ceiling at the raised platform would be subject to the provisions for cellular or foamed plastic, which prohibits the use of this particular material as interior finish unless it is in extremely insignificant amounts or the material has been subjected to fire testing that substantiates the combustibility characteristics for the use intended under actual fire conditions.

Exits. The means of egress arrangement leading to the main entrance doors made it difficult for people to escape. The arrangement of the front entrance corridor made occupants negotiate their way through an intermediate door that opened into a small foyer through which they could then reach the main doors leading directly to the outside. The corridor and foyer contained openings into both the club portion of the facility and the bar area. The small foyer was reportedly designed as a control point to prevent occupants from getting into the club without a ticket, but this arrangement proved to be disastrous when the large

crowd rushed to the main entrance, from two directions, to escape the blaze.

Even though there were three other exits from the building, most patrons were unaware of them. The exit in the main bar never became available to occupants in the show area as the fire and heavy black smoke spread through the nightclub. Several occupants familiar with the building and staff managed to escape through the kitchen exit, but most occupants did not realize the kitchen exit was there despite the exit signs marking its location. The exit door near the raised platform was quickly eliminated as an option once the fire spread around the door, preventing escape.

Codes

Three weeks after the Rhode Island nightclub fire, NFPA sponsored a public forum and special meeting of the Technical Committee on Assembly Occupancies in Boston, Massachusetts. The meeting was held in response to the Rhode Island fire. Fire officials and those who lost family and/or friends testified before the Technical Committee. A subsequent meeting of the committee was held on July 8–9, 2003, at NFPA headquarters. As a result of input from members of the Technical Committee and fire service members, a number of Tentative Interim Amendments (TIAs) to the relevant Codes were proposed in an effort to prevent similar tragedies in the future.

On July 25, 2003, the Standards Council reviewed and issued the technical committee's recommended TIAs for NFPA *101*®, *Life Safety Code*®, 2003 edition, and *NFPA 5000*®, *Building Construction and Safety Code*®, 2003 edition. The TIAs, which went into effect August 14, 2003, required the following:

- Fire sprinklers must be installed in new nightclubs and similar assembly occupancies regardless of occupant load and in existing facilities that accommodate more than 100.
- Building owners must inspect exits to ensure they are free of obstructions and must maintain records of each inspection.
- At least one trained crowd manager must be present for all gatherings of more than 50 except religious services. (For gatherings of more than 250, additional crowd managers are required at a ratio of 1:250.)
- Festival seating is prohibited for crowds of more than 250 unless a life-safety evaluation approved by the authority having jurisdiction has been performed. (Festival seating, according to NFPA *101*, is a form of audience/spectator accommodation in which no seating, other than a floor or ground surface, is provided for the audience to gather and observe a performance.)

What's to Come

The TIAs issued by the Standards Council were again reviewed. After modifications were made, they were incorporated into the 2006 edition of NFPA *101* and *NFPA 5000*.

In February 2003, the National Institute of Standards and Technology (NIST) launched an investigation into the tragic nightclub fire. At the conclusion of its investigation, the National Construction Safety Team (NCST) led by NIST recommended specific improvements to building standards, codes, and practices based on its findings and recommended research and other appropriate actions needed to improve the structural fire safety of buildings and evacuation procedures.

ONGOING CHALLENGE

The story of fire protection is one that continues. Fire protection professionals study history and conduct research to determine code requirements needed to protect lives. They continuously use their influence to ensure that those requirements are adopted and enforced. Unfortunately it often takes a tragedy to bolster their efforts, and even then, if action isn't taken immediately, people forget.

In Nevada, momentum toward tighter codes had slowed down a year after the 1980 MGM Grand fire. Subsequent fires brought back memories of that tragedy. Today, the Ballys Las Vegas (formerly the MGM Grand) has installed about 30,000 sprinklers, 8000 loudspeakers, and other fire protection equipment. In addition, the American Automobile Association (AAA) now includes fire protection among the factors it considers when rating hotels in its travel guides.

Sometimes fires demonstrate the wisdom of committee members. For example, the 1987 Dupont Plaza Hotel fire illustrated that the Committee on Safety to Life was correct in requiring corridors and lobbies to be separated from assembly areas by 1-hour rated walls, unless the building is sprinklered or 50 percent of the egress is independent of the lobby.

The Las Vegas Hilton fire in 1981, which resulted in eight deaths, illustrated that committee members were correct in restricting carpeting on walls. That fire saw flames leapfrogging up the side of the building, entering windows, and spreading along carpeting on the walls and ceilings. The committee had been convinced of the dangers of carpeting on walls through

fire tests sponsored by the carpeting industry, which had pushed for regulation of its own products.

It is always tempting to concentrate on the tragedies, because they are so obvious. However, there are positive results to consider, even if they are not as well documented. It is impossible to know the number of lives that have been saved because vertical openings were enclosed; exits were adequate and unlocked; and alarm, detection, and sprinkler systems were in place.

The key, once requirements are put into codes and the codes are adopted, is enforcement. The challenge for everyone who reads this handbook is to make certain that the codes, which contain the accumulated fire protection knowledge of generations, are enforced. To paraphrase Frances Perkins' speech to the 1913 NFPA Annual Meeting, People are not always their own masters. "It is necessary for organizations like yours . . . to insist on safety for them." That is our job.

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