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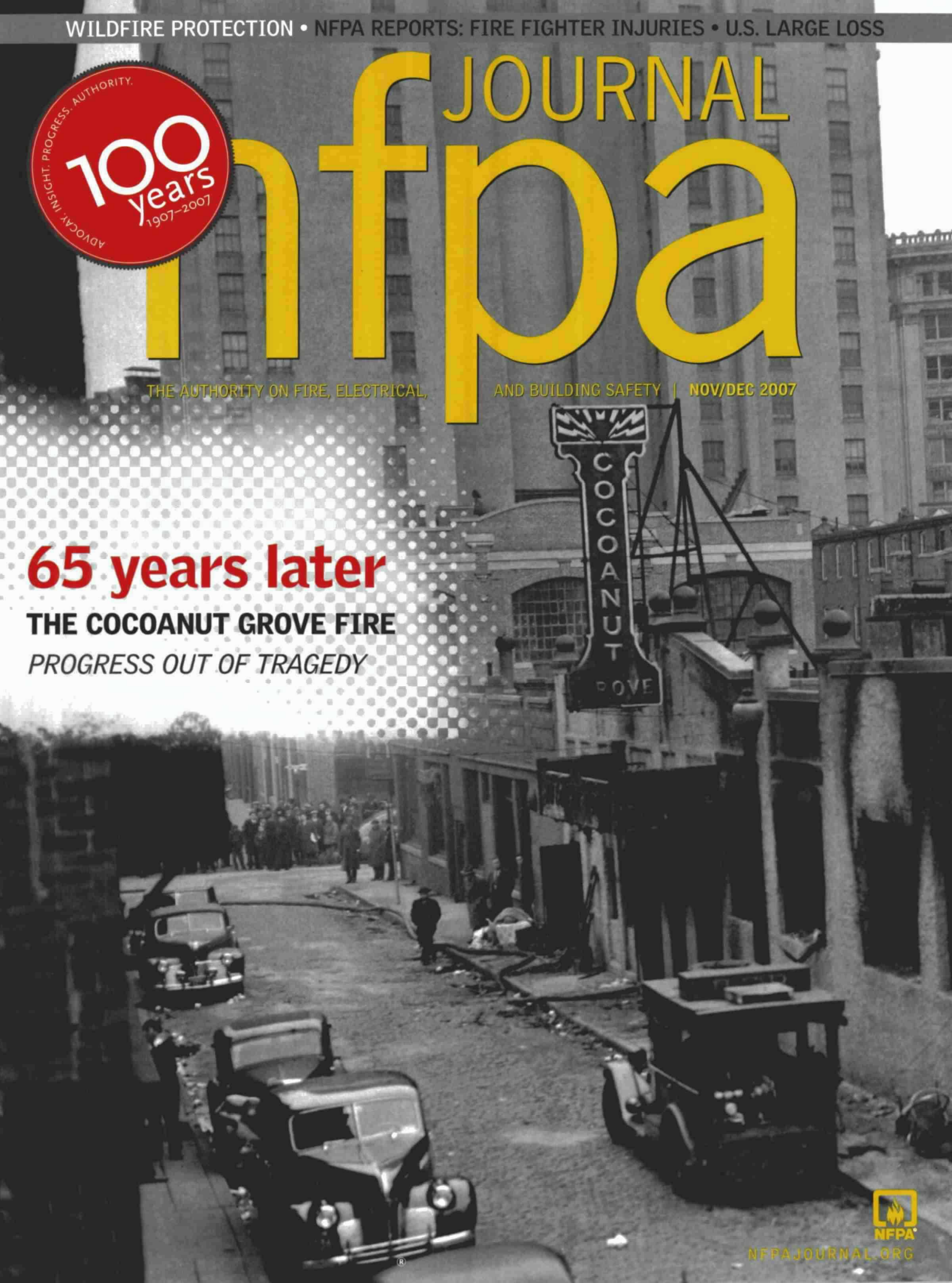

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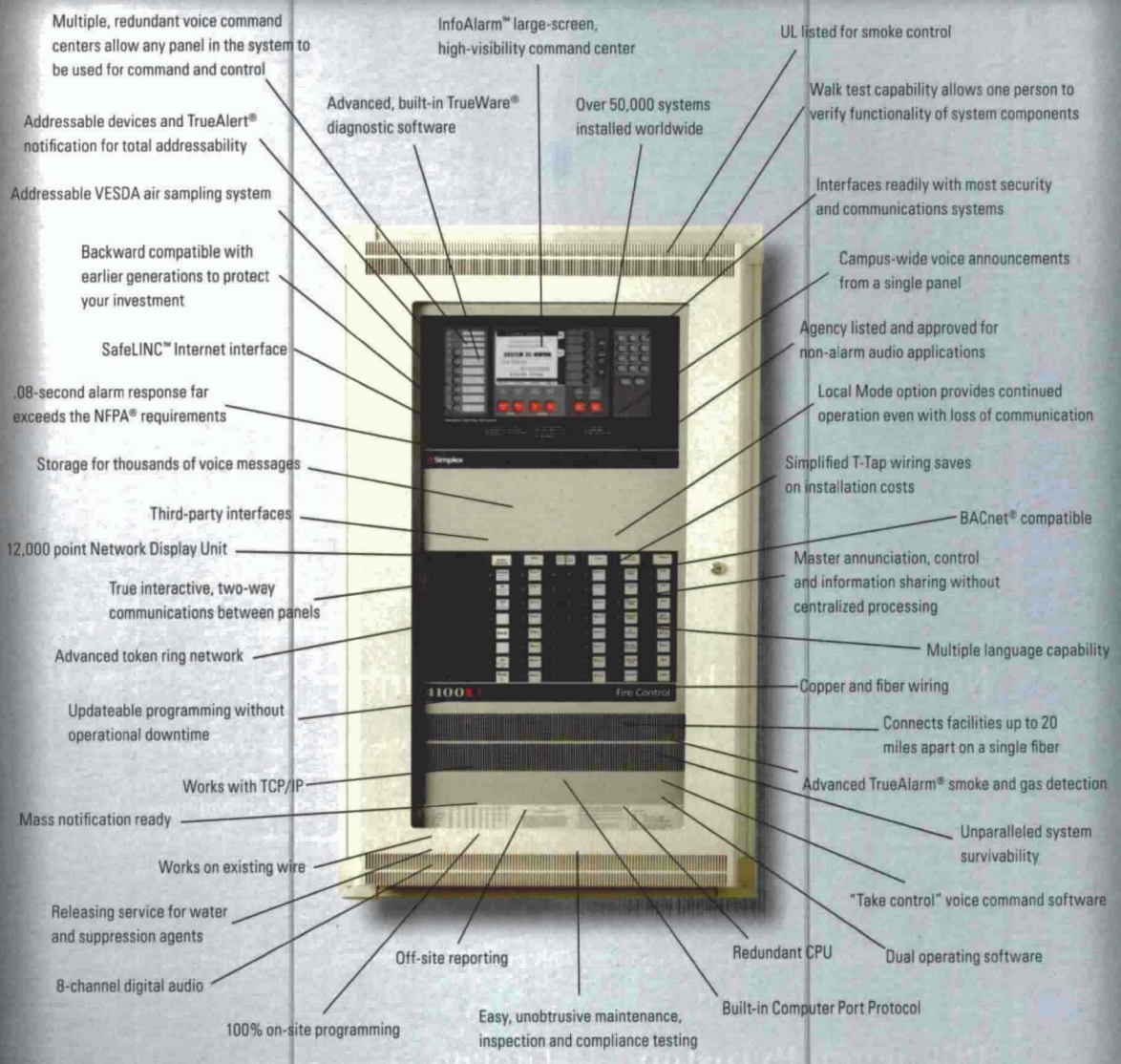

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INSIDE VOLUME 101, NUMBER 6

NOV/DEC 07

Features

Just after 10 p.m. in the Melody Lounge located in the basement, a small fire broke out in a fake palm tree, and then quickly spread across the ceiling decorations.

"Last Dance at the Cocoanut Grove" page 46

ONLINE EXCLUSIVES
- Fire-safe cigarette legislation update
- Flammable ice cream?
- Lessons from bridge collapse

Cover Photograph: Corbis.

National Fire Protection Association
NFPA

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FROM NFPA PRESIDENT **JAMES M. SHANNON**

first word

The Cocoanut Grove fire

AS AN ORGANIZATION that is always trying to create a safer environment, we often find that the best opportunities to make progress grow out of some of the worst tragedies. There is no better example of this than the Cocoanut Grove fire that is written about in this issue of *NFPA Journal*®.

Sixty-five years ago, on November 28, 1942, the fire at Boston's most popular nightclub took the lives of 492 people. It was the deadliest nightclub fire in U.S. history. There are still many people alive today who were there that night and they have carried through their lives memories of an almost unimaginable scene as the crowd desperately tried to flee that inferno.

That fire created the opportunity for NFPA to lead the way to major reforms in fire safety that have had a lasting effect throughout the United States. Jurisdictions that previously showed little commitment to fire safety suddenly realized how vulnerable they were to this type of mass tragedy.

One of the biggest advances was a change in the definition of places of public assembly. Before the Cocoanut Grove fire, many jurisdictions did not consider restaurants and nightclubs to be places of public assembly and so they did not see how dangerous they could be. After Cocoanut Grove, there was a new awareness of the particular dangers when fire occurs in any crowded place where there are inadequate exits.

At the time of the fire, Robert Moulton, NFPA's Technical Secretary and the secretary of the NFPA Committee on Safety to Life, said in a newspaper interview: "The most glaring feature of this tragedy was the lack of proper exits. Revolving doors have long been considered by the National Fire Protection Association Committee on Safety to Life as a menace under fire and panic conditions."

At the 1945 NFPA Annual Meeting, the Committee on Safety to Life recommended a change in the method of exit measurement, clarification of the need for stairway enclosure, provisions regulating loose chairs in nightclubs, and changes in lighting and signs.

Those changes were incorporated into the 1946 edition of the *Building Exits Code*, as was a special note on interior finish.

Today, it is recognized that all assembly occupancies should have at least two separate and remote means of egress, and the necessary number, width, and types of reliable exits based on the expected occupancy should be available.

In addition to the technical changes that were brought forth from Cocoanut Grove, that experience showed how important it is for NFPA to publicize the details of how the tragedies occur. NFPA issued to its membership a 20-page illustrated report with an analysis of the factors involved in the fire and suggested ways that other Cocoanut Groves could be prevented.

There were those, including the Attorney General of Massachusetts, who did not want that report distributed, but NFPA put it out anyway and the story of the Cocoanut Grove fire became a great catalyst for change in fire safety in the United States as more communities rushed to adopt our *Building Exits Code*, the precursor of the *Life Safety Code*®.

It is important that we remember tragedies such as the Cocoanut Grove fire and those who were killed and injured on that horrible night in Boston 65 years ago.

The best way to commemorate those who die in events similar to the Cocoanut Grove fire is to study what happened, apply the lessons learned, and dedicate ourselves to using that knowledge to prevent those tragedies from ever happening again.

Photograph by Stan Rowin

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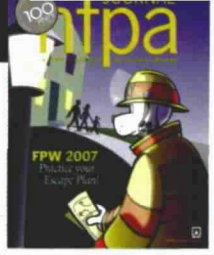

Missing numbers

I must complain of the July/August 2007 *NFPA Journal*® report "Fire Fighter Fatalities Studies 1977 to 2006" by Rita Fahy, Paul LeBlanc, and Joe Molis.

It states the "... NFPA has conducted an annual comprehensive study of on-duty deaths in the U.S.," but the World Trade Center deaths in 2001 are grossly ignored.

The only minor mention is their non-inclusion in Figure 1, which states "Excluding the 340 fire fighter deaths at the WTC."

I am disappointed that the NFPA would allow such a discrepancy just to "prove" the authors' theory that fire fighter deaths are on a downward trend.

I read the *NFPA Journal* for accurate information, not slated views.

RICHARD TRAVERS
Deputy Chief (Retired)
Fire Department of New York

NFPA Responds

The tragic losses at the World Trade Center on September 11, 2001 were unprecedented, and the authors were not ignoring the deaths of those fire fighters.

There is no intent in the special 30-year analysis to slight New York City's losses on September 11th.

The event, in both its cause and consequences, was unprecedented. More fire fighter were killed in that single day than were killed on-duty in the entire country in the previous three years. More fire fighters were killed at the World Trade Center than were killed in structure fires in the U.S. in the previous 11 years.

The attack on the World Trade Center, and the massive loss of civilians and fire fighters, is a unique event that deserves to be studied and reported on separately.

It is simply impossible to do any sort of meaningful trend analysis of fire fighter or civilian deaths including such an overwhelming loss, as it dominates the reported losses for all other years.

We are sorry that we inadvertently omitted the mention of the 340 fire fighter deaths at the World Trade Center in the graphs and figures that appear in the 30-year analysis.

That explanation should appear in any trend line that includes career fire fighter deaths at structure fires (as it does appear in all the relevant figures in the annual fatality study), and will be corrected in the online version of the report.

Thank you for your interest and calling this omission to our attention

RITA F. FAHY
Manager
NFPA Fire Databases and Systems

Need to follow NFPA 72

Twenty years ago, while working at a Department of Energy site in the engineering group responsible for fire protection engineering and oversight of contractor installation and drawing submittals, I found that after completion of a tightly-worded specification and standard for alarm and installation of detection and alarm systems (NFPA 72) we received complaints from the cheaper quality contractors.

They moaned that they could not compete or bid on the fire protection/alarm projects with a more tightly written specification.

A classic was the problem discovered during a meeting at a DOD site. During the meeting pertaining to a proposed modification to the building or systems to support the computing operations, we could hear the sound of a bird chirping.

When I asked what the sound was, we were advised that the older and newer portions of the large building had separate alarm systems that did not work properly nor were they connected into one common alarm to alert personnel of a fire condition.

GEORGE STEWART
Electrical Engineer
Lakewood, Colorado

Errata

Figure 2 in the 2006 *U.S. Fire Loss Report* that appeared in the September/October 2007 issue contained an error. This figure depicted a trend for civilian fire deaths in the home.

This graph uses a baseline that is not zero for the vertical axis. The result a misleading impression to the reader's eye: a decline of just over half, from 5,865 to 2,580, looks like a decline of nearly 100 percent.

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SFPE names NFPA AVP **John R. Hall** person of the year

AT ITS ANNUAL AWARDS LUNCHEON in Las Vegas, the Society of Fire Protection Engineers (SFPE) recognized John R. Hall Jr. as SFPE Person of the Year. Hall is the Assistant Vice President for Fire Analysis and Research with the NFPA. Dr. Hall's division at NFPA is responsible for the measurement of the national fire problem and the communication of the results as a statistical basis for fire protection strategies.

The SFPE is an international professional society of engineers who work to advance the science and practice of fire protection engineering. The Person of the Year Award was created in 1973 to recognize significant achievement in fire protection. The award winner must come from beyond the membership of SFPE.

"Hall is an internationally respected source when it comes to evaluating data related to fire safety," said SFPE Engineering Program Manager Chris Jelenewicz. "His assessments have been used widely to support decisions on research that is aimed at reducing the cost and losses from fire."

Past SFPE Persons of the Year include: Movie & Television Star Dick Van Dyke, University of Maryland's Dr. John L. Bryan, Former FDNY Fire Chief Daniel A. Nigro and Director/Under Secretary for the Federal Emergency Management Agency R. David Paulison.

SPFE recognizes Research Foundation's director Kathleen Almand's service

The Society of Fire Protection Engineers (SFPE) presented the 2007 D. Peter Lund Award to **Kathleen Almand, P.E.**. Almand is a Fellow with SFPE and is currently the Executive Director of NFPA'S Fire Protection Research Foundation.

Presented at the SFPE Annual Awards Luncheon in Las Vegas, the award is made by the SFPE Board of Directors in acknowledgment of contributions to the advancement of professional recognition of the fire protection engineer. It is named in honor of D. Peter Lund, the first executive director of SFPE. The SFPE is an international professional society for engineers who seek to advance the science and practice of fire protection engineering.

Almand was recognized for her service as SFPE Executive Director from 1997 to 2004.

"As a former executive director of SFPE, the stature of the Society increased among the organizations concerned with fire safety," said SFPE Engineering Program Manager Chris Jelenewicz. "Under her leadership, SFPE launched Fire Protection Engineering Magazine, began holding an independent annual meeting, started an aggressive public awareness campaign, expanded its international membership, and amassed a financial reserve to help guarantee future operations.

Maine adopts latest *Life Safety Code*®

THE STATE OF MAINE has adopted the latest edition of several NFPA fire and life safety codes.

NFPA codes are widely used across the United States. The latest adoptions set fire and life safety requirements for new and existing buildings in the state of Maine.

"The use of NFPA codes has long been central to fire prevention and safety efforts in Maine, which improves the safety for our residents and their property," said John C. Dean, Maine state fire marshal.

Maine officials participated in a NFPA-developed training program that is offered to states that have adopted key NFPA codes and standards. Training provided by NFPA technical experts covers code requirements and the numerous ways the codes may be implemented and enforced.

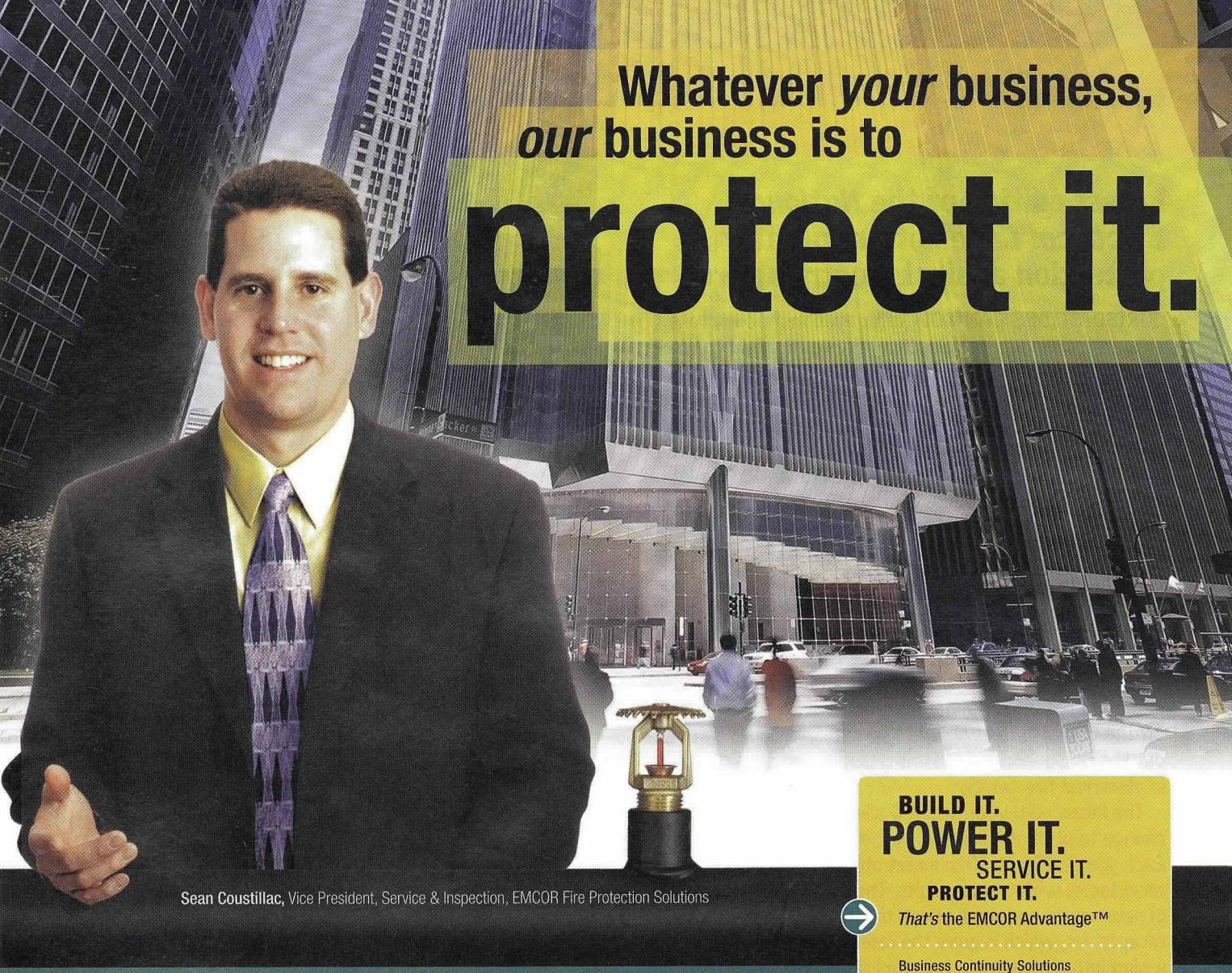
NFPA 1, *Uniform Fire Code*™, recognized worldwide and adopted statewide in 20 states, provides requirements necessary to establish a reasonable level of fire safety and property protection from hazards created by fire and explosion. Its primary purposes are to address basic fire prevention requirements and to reference or extract the fire prevention and protection aspects of many other NFPA codes and standards.

NFPA 101®, *Life Safety Code*®, used in every U.S. state and adopted statewide in 39 states, sets minimum building design, construction, operation, and maintenance requirements necessary to protect building occupants from dangers caused by fire, smoke, and toxic fumes.

NFPA 72®, *National Fire Alarm Code*® is used in every state and adopted statewide in 44 states. It sets requirements for the application, installation, location, performance, inspection, testing, and maintenance of fire alarm systems, fire warning equipment and emergency warning equipment, and their components.

NFPA 13, *Installation of Sprinkler Systems* is adopted statewide in 48 states and provides minimum requirements for the design and installation of automatic sprinkler systems and exposure protection sprinkler systems.

For more information about the code adoption process, please visit www.nfpa.org/codes.



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Sean Coustillac, Vice President, Service & Inspection, EMCOR Fire Protection Solutions

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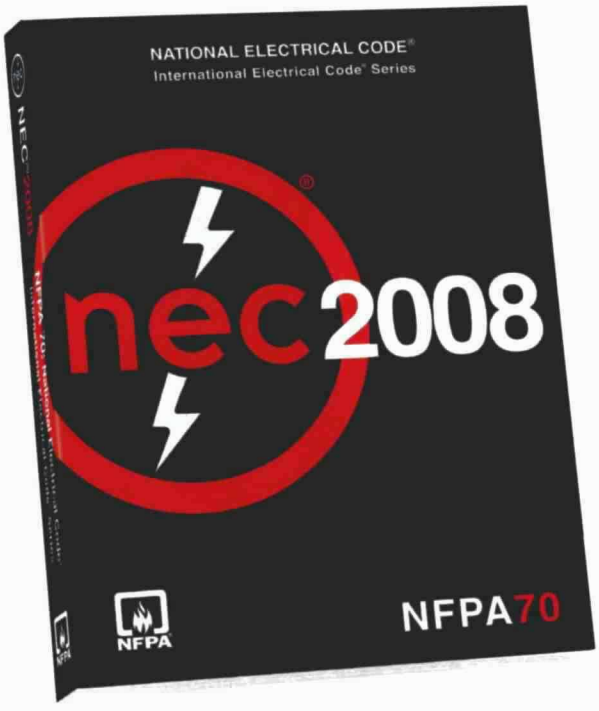
Latest edition of the *National Electrical Code*® offers greater protection against electrical fires

JURISDICTIONS CAN NOW offer even more comprehensive protection against electrical fires and shield children from electric shock by adopting the 2008 edition of NFPA 70, *National Electrical Code*® (NEC®). Previous editions of the NEC are widely adopted throughout the United States and commonly accepted as the definitive reference for electrical safety across the world. The latest edition, the 51st, builds on the NEC's safety benchmark established by previous editions and requires the best available technology to protect against electrical fire and shock hazards.

The 2008 NEC expands requirements covering the use of arc-fault circuit interrupters (AFCIs), important next-generation electrical safety devices that not only provide conventional functions, but also prevent electrical fires by detecting potential dangerous electrical arcs and shutting off the power to that circuit. Fire safety officials throughout the U.S. endorse AFCIs as a significant step forward in electrical fire safety.

The latest edition of the NEC also makes a landmark change to protect children from serious burns and death. Each year 2,400 children insert objects into electrical receptacles with tragic results. The 2008 NEC mandates in new homes and renovations the use of tamper-resistant receptacles, which require the insertion of both prongs of a plug into a receptacle to establish an electrical circuit.



The NEC is developed through NFPA's consensus process, which is accredited by the American National Standards Institute (ANSI). Six thousand volunteers, representing 200 NFPA technical committees are responsible for developing and updating more than 300 codes and standards, including the NEC.

DHS adopts 11 NFPA standards for emergency responders

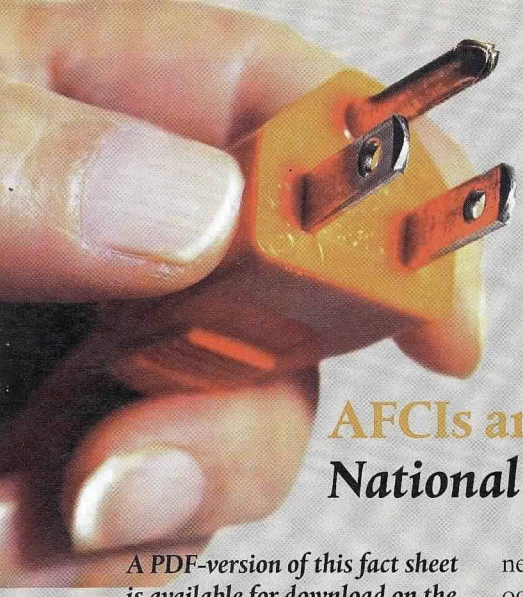
NFPA AND THE U.S. DEPARTMENT OF HOMELAND SECURITY (DHS) recently announced the adoption of 11 NFPA standards for emergency responders by DHS. The newly adopted standards will set requirements to assist federal agencies and state and local officials responsible for procuring equipment and services used by emergency responders.

"It is enormously important that first responders have the tools and qualifications necessary to perform their duties well—their lives and the lives of others depend on it," said James M. Shannon, NFPA president. "DHS has taken an important step in supporting the needs of first responders with the adoption of these standards."

The documents adopted will provide direction and allow officials to make better procurement decisions in the following areas: professional qualifications, occupational safety and health, fire apparatus, personal protective clothing, powered rescue tools and other equipment.

"The threat of fire in any home, school or business is a reality. To expect first responders to run into the current all hazard environment without training, equipment and the basic tools to do their jobs, is unacceptable," said U.S. Fire Administrator Greg Cade. "These newly adopted standards by DHS further ensure communities have well-informed, well-trained and well-equipped first responders, supported by manufacturers, and outside agencies dedicated to protecting the people of this nation."

The adoption of NFPA standards reflect the continuing support of a multi-year program in U.S. Department of Homeland Security's Science and Technology Directorate to build confidence in homeland security technologies, products, services, personnel through the development and adoption of voluntary consensus standards. A list of the standards can be found on the Department of Homeland Security's website and the Responder Knowledge Base.



Q&A

AFCIs and NFPA 70, *National Electrical Code®*

A PDF-version of this fact sheet is available for download on the Fact Sheets page of the Code and Standards section of NFPA.org.

•What are Arc-Fault Circuit Interrupters (AFCIs)?
The 2008 *National Electrical Code®* (*NEC®*) requirement for AFCI protection considerably expands this fire prevention technology to the majority of circuits installed in new and renovated homes. The type of AFCI currently available commercially is a next-generation circuit breaker that not only provides the conventional safety functions, but its advanced design also rapidly detects potentially dangerous arcs and disconnects power in the circuit before a fire can start. Fire safety officials throughout the U.S. endorse AFCIs as a significant step forward in electrical fire safety.

•Why mandate AFCIs for newer homes when statistics show the majority of problems have occurred in older homes?
Fire safety officials recommend the use of AFCIs in all dwellings. While it is true that fire statistics in many cases are derived from older dwellings, damage to appliance cords or to wires hidden in a wall can occur regardless of the home's age. In addition, incorrectly performed electrical installations can occur in both new and old homes. As technology evolves and the NEC is revised, the enhanced level of safety is typically required only in new construction that is subject to the latest adopted edition. Homes wired per the 2008 NEC will have the majority of their circuits protect by AFCIs for the life of the electrical system.

•How do you know AFCIs will prevent fires and save lives?
Since 1999, AFCIs have been thoroughly field-tested. Underwriters Laboratories, the National Association of State Fire Marshals (NASFM), the U.S. Consumer Product Safety Commission, and many other experts have found AFCIs to be reliable and effective. By eliminating a significant source of electrically related fires, future statistics will demonstrate a reduction in fires of electrical origin.

•Are AFCIs expensive?
The cost of the enhanced protection is directly related to the size of the dwelling and the number of circuits installed. Current retail prices of AFCI-type circuit breakers at several national building supply chains are in the range of $35 to $40 per unit. Even for larger homes with more circuits, the cost increase is insignificant compared to the total cost of the home, particularly when the increased level of safety is factored.

Research Foundation awarded major grant

THE FIRE PROTECTION RESEARCH FOUNDATION, an affiliate of NFPA, was awarded $990,000 in a Fire Prevention and Safety Grant from the Emergency Preparedness Directorate of the Federal Emergency Management Agency of the U.S. Department of Homeland Security to conduct three research projects in support of the fire service.

The first project funded by the grant tackles the issue of measuring the effectiveness of enforcement involving fire safety code compliance. The result is anticipated to be a tool for fire safety enforcement organizations to measure how fire prevention activities can reduce fire risk in communities.

The second project will look at firefighting tactics under wind-driven conditions. The results will help determine ways for fire fighters to control structure fires under these challenging circumstances. This information will be especially useful when dealing with large structure fires where fire fighters often face specific challenges due to wind.

The third project will study the thermal capacity of fire fighter protective clothing. Fire fighter protective clothing is designed with a series of layers and air gaps to prevent the energy of the fire environment from being transferred to the firefighter. Information learned through this research will pave the way for enhancements in the testing and design of protective clothing for fire fighters.

All three projects are slated to be completed by July 2008.

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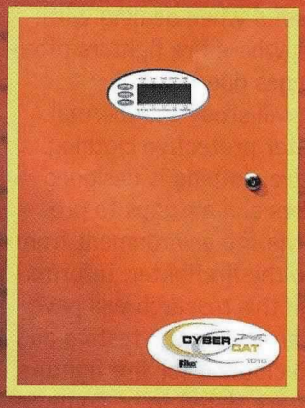

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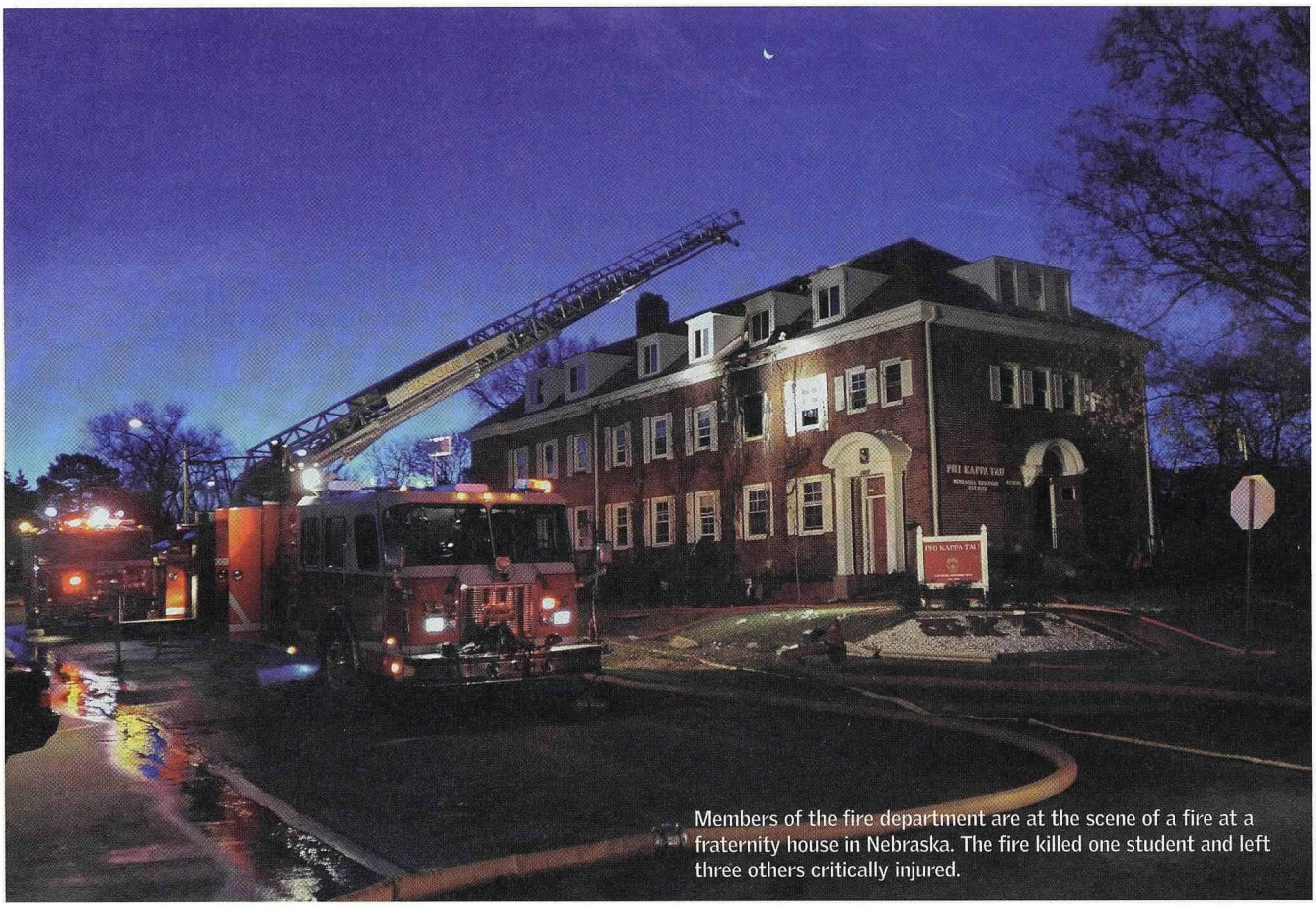

Members of the fire department are at the scene of a fire at a fraternity house in Nebraska. The fire killed one student and left three others critically injured.

RESIDENTIAL

Fraternity house fire kills one and injures three others

NEBRASKA—A fire at three-story fraternity house left one 19-year-old resident dead and several others injured.

At the time of the fire, there were between 30 and 35 people at the house and several had to be rescued by fire fighters. Others escaped uninjured. The wood-frame structure had bedrooms on several levels. Smoke detectors were in the hallway and a fire detection system with manual pull stations was also present. Fire extinguishers were present, but sprinklers were not installed. A party had taken place within the home earlier in the evening and many occupants were still awake when the fire broke out.

Around 4 a.m., one occupant returned to the house and discovered smoke in the stairway He then found smoke coming from a second floor bedroom where he found the room's occupant standing there with a small fire burning on a futon mattress. After telling the occupant to get out of the room, he went down to the end of the hallway and pulled the fire alarm to alert the rest of the house.

The fire department received telephone calls from one occupant and the central station alarm company reporting the fire alarm at 4:04 a.m. On arrival, smoke filled the building with fire on the second floor. With many occupants still in the home, the fire department had a difficult time with its search-and-rescue efforts. The fire burning through the roof forced a defensive response.

Eventually all occupants were removed from the house and those injured sent to area hospitals.

Investigators confirmed that the fire started in the second floor room where it was first discovered. It was also the bedroom of the lone fatality.

Several investigative agencies were utilized to determine the source of ignition and after eliminating many of the possible ignition sources believe the fire occurred from either incendiary origins or the use of fireworks. Earlier in the evening several witnesses reported the use of fireworks in the building. Once the mattress ignited it spread to other combustibles in the room and other areas of the home.

Photograph: AP Photo/Lincoln Journal Star, Ted Kirk

The building was valued at $1,100,000 and had contents of $300,000. Damage to the building was estimated at $750,000 with loss of contents of $150,000. Contributing to the fire, injuries, and death were exit lights being covered in the home and several of the injured were under the influence of alcohol.

Older adult dies in house fire

VIRGINIA—Fire killed an 85-year-old woman living in a single-family home. A paper carrier found smoke coming from the dwelling at 4:10 a.m. and alerted the fire department however, the woman succumbed to smoke inhalation before fire fighters could save her.

The single-story, ranch home was constructed of wood framing and measured 65 feet (19 meters) in length and 30 feet (9 meters) in width. There were no smoke alarms or sprinklers in the home.

An electrical short in the den located in the middle of the structure ignited the fire. The women's bedroom shared the common wall with the room of origin, which allowed products of combustion to fill the victim's bedroom and the rest of the home. The fire department arrived with five minutes and found the woman during the primary search and paramedics pronounced her dead at the scene. A lack of smoke alarms in the home contributed to the death. The home, valued at $110,000 had losses estimated at $55,000. One fire fighter suffered minor injuries during the blaze.

Combustibles near heater ignite deadly fire

TEXAS—A mother, who was awaken by fire spreading from her daughter's bedroom, tried unsuccessfully to fight the fire using a garden hose. Heat and smoke killed the 15-month-old girl in her bed. A space heater at the door to the room ignited combustibles, which engulfed the contents and spread to other areas of the home.

The single-family dwelling was a manufactured home measuring 40 feet (12 meters) in length by 19 feet (5 meters) in width. The home was constructed of wood framing on a steel frame with metal siding and roof. At the time of the fire, the home was occupied by the woman, her 11-year old son, and her young daughter. There were no smoke alarms or sprinklers installed within the home.

Everyone was asleep when the woman woke to fire near the door of her daughter's bedroom. Escaping from the home, the mother instructed her son to go to a neighbor's house and have them call the fire department while she tried to fight the fire. The fire department received the call at 7:09 a.m. and arrived within six minutes. They knocked down the heavy fire and found the victim.

A lack of smoke alarms contributed to the delay in detection and fire blocking the doorway prevented the mother from gaining access to the room. The home and contents, having a combined value of $10,000, were a total loss.

Careless smoking ignites deadly fire

NORTH DAKOTA—Careless smoking started a fire that killed an occupant of a manufactured home. The victim's use of oxygen accelerated the fire.

The single-family home measured 75 feet (22 meters) in length and was 16 feet (4 meters) wide. The home did not have smoke alarms or sprinklers.

At 8:03 p.m., the fire department received a 911 call from a neighbor reporting the fire and a person trapped in the home. When the fire department arrived with three engine companies, fire was venting from windows. Crews entered the fully involved living room where the 54-year old victim was found on a couch.

Fire fighters used two nearby hydrants and stretched four hose lines to control the fire. Investigators determined the victim had fallen asleep on the couch while watching television and smoking a cigarette. The cigarette ignited bedding covering the victim. Fire spread to other combustibles and oxygen tubing causing the fire to accelerate. The home, valued at $24,500, was a total loss.

Kerosene heater tips over, ignites fatal fire

NORTH CAROLINA—One occupant of a single-family home died while another occupant escaped unhurt from a fire.

The fire began when a kerosene heater was accidentally knocked over. The occupants attempted to extinguish the fire themselves but the victim remained in the home despite the other occupant urging him to leave. Fire fighters found the man just 3 feet (1 meter) from a rear door where he succumbed to smoke inhalation and burns.

The manufactured home was 56 feet (17 meters) in length by 12 feet (3.6 meters) in width with a 10 foot (3 meter) by 15 foot (4.5 meter) bedroom addition located at one end. The three-bedroom home included a large living and kitchen area and one bathroom. Smoke alarms could not be located in the debris and may not have been installed. There were no sprinklers.

Shortly before 10 p.m., the male occupant went in the living room where he knocked over a kerosene heater. He returned to one of the bedrooms, alerting the other occupant, a woman, to the fire. They attempted to use a blanket to smother the fire without success and decided to escape. Both occupants headed toward a rear door because fire blocked the front entrance. The woman escaped without injury. Outside, she called several times to the man, but he did not come out of the house.

A police officer who was first to arrive reported that the home was 60 percent involved in fire and he was unable to gain access to save the victim.

Value to the home or contents was not reported, but damage to the home was significant.

Clothes ignite near dryer in fatal fire

KENTUCKY—Three young children under the age of four died of smoke inhalation when an overloaded clothes dryer ignited in the early morning. First-arriving fire fighters administrated first aid and then transported the victims as mutual aid companies controlled the interior fire.

The fire was initially held in check by failure of a domestic water line feeding the water heater. This limited fire loss, but smoke damage was reported.

The fire occurred on one side of a wood-frame duplex that measured 54 feet (16 meters) in length and 46 feet (14 meters) in width. The roof was wooden and covered with asphalt shingles. A garage was located at the front of the house. The front door led to a living room, and a combined dining room and kitchen.

Two bedrooms and a bathroom were down the hallway from the living room. Battery-operated smoke alarms were in the hallway, kitchen/dining area, and garage. However, the kitchen smoke alarm was removed.

Adult occupants were alerted to the fire from the smoke alarm operating in the hallway at 2:54 a.m. Fire fighters were told that three small children were victims and the children were not breathing.

On arrival, crews provided emergency treatment to the children while others entered the home that was filled with smoke. Interior crews found the fire that started in the dining room in a laundry closet containing a washer, dryer, and water heater.

Investigators found that burnt clothing in the dryer and a large amount of clothing stored around the dryer. The exact ignition sequence was not reported however, a delay in detection may have been a factor.

Carbon monoxide poisoning killed a boy and a girl, age 2, and a boy, age 3. Losses to the home and contents were not reported.

Electrical short ignites fire

GEORGIA—Two occupants of a single-family home died when flames filled the first floor of their home and heavily damaged the structure. Investigators found that electrical wiring supplying a wall-mounted electric heater shorted and ignited contents within the home.

Smoke alarms were on the first floor and basement level of the home, but it is unknown if they operated because the occupants died in the fire.

The wood-frame, single-story home had a wooden roof covered with asphalt shingles. It measured 45 feet (13 meters) in length and 28 feet (8.5 meters) in width. The home changed grade to its rear and exposed another living level in the basement. There were no sprinklers.

Shortly before midnight, a neighbor observed what he thought was a brush-fire at the home. Because of his distance from the home, the neighbor used the scope of a rifle to assess the fire and saw that it was not a brush pile but it was his neighbor's home that on fire. He called 911 at 11:42 p.m. and then ran to the home to help out. The fire department arrived to find that the home was well involved and a car in an attached carport was also on fire. Using two hose lines from one end of the home, they knocked down the fire and placed a ladder against a window where witnesses reported the occupants were located.

Fire fighters found one occupant in a bedroom. Additional hose lines were brought in once a water supply was established. The second victim was found at the bottom of the basement stairs.

The fire started in the first-floor living room, spread toward the bedrooms, and then the stairs leading to a finished basement. Investigators removed and examined the wiring of the electric heater before determining the unintentional cause of the fire. The victims, an 88-year-old male and a 90-year-old female, were the sole occupants and they died of smoke inhalation and burn injuries. The home valued at $180,000 and contents of $90,000 were total losses.

Child playing with lighter ignites deadly fire

PENNSYLVANIA—Four members of a family died when a child using a cigarette lighter started a fire.

A lack of operating smoke alarms delayed detection and allowed fire and smoke to travel up a flight of stairs, trapping the family in a bedroom where fire fighters found them.

The single-family home was wood framed and measured 16 feet (4.8 meters) in width by 60 feet (18 meters) in length. The first floor had a living room at the front with a dining room and stairwell in the center, and a kitchen to the rear. Bedrooms were on the second floor. A battery-operated smoke alarm was in the hallway, but the batteries were missing and it was not mounted properly. There were no sprinklers.

A child used the open flame of a cigarette lighter to ignite a cardboard box containing a bed frame near the base of the stairs in the dining room. The fire extended to furnishings and contents of the first floor, as smoke and heat traveled to the second floor, trapping the occupants.

Fire fighters received a 911 call at 9:30 p.m. from a passerby and responded. They were able to rescue three of the four victims from a bedroom however, one victim was pronounced dead at the scene.

Killed in the fire were a 36-year-old female; two girls, age 14 and 8; and a 4-year-old boy. The older girl died of smoke inhalation and burns, but the others suffered fatal smoke inhalation. The home

valued at $50,000 with $10,000 worth of contents was a total loss.

MANUFACTURING

Oily rags ignite fire in cabinet shop

CALIFORNIA—Before it could be extinguished, a fire in a cabinet shop caused $200,000 in fire losses. A stack of oily rags left under a staircase heated spontaneously and burned undetected while the shop was closed for the weekend. A passerby alerted the fire department, they responded within five minutes, located the seat of the fire, and extinguished the flames.

The steel-frame building with metal walls and roof covered approximately 4,500 square feet (418 square meters). Mainly a single-story building, one part included a mezzanine with office above. There were no sprinklers or fire detection system installed.

The fire occurred in the section of the plant where wooden cabinets were stained and finished.

Once the fire started, it spread to nearby cabinets and the office at the top of the stairs. When the fire department arrived, smoke was coming from the warehouse section of the building. Forcing entry into several doors, fire fighter advanced a hose line into the building and extinguished the flames. Other crews ventilated the building, overhauled and investigated the cause of the fire. The building, valued at $750,000, had $100,000 in loss and the contents valued at $500,000 suffered $100,000 in loss. There were no injuries.

Vapors from floor sealant ignite

COLORADO—Two contractors, who had just applied a sealant to a stained concrete floor, were forced to evacuate the worksite when sealant vapors ignited. The men were not in the room when an open flame from a gas-fired water heater ignited the vapors. The building was protected by a full-coverage fire sprinkler system, which operated and extinguished the fire.

The steel-frame building with concrete walls and metal roof covered approximately 28,000 square feet (2,601 square feet). A single-story in height, the light-manufacturing plant was closed for the night with just the two contractors present. A wet-pipe sprinkler system provided full coverage, as did a fire detection system with smoke detectors and each system monitored by a central station alarm company.

A combination of lacquer thinner and concrete sealant had been applied to a breakroom near the center of the building. The room was cleared of all contents and protective paper placed along the base of the walls with masking tape. The contractors left one of the two doors leading to the breakroom open. They were opening other doors in the building for ventilation, when they heard a sound and observed an orange glow from the breakroom.

The fire alarm and sprinkler system quickly operated as the two workers called 911 to report the fire at 9:35 p.m. The contractors met the fire fighters and informed them of the fire and the continued operation of the sprinkler system. Confirming the fire was extinguished with no extension, the fire fighters shutdown the water feeding the four sprinklers operating and began salvage operations.

Investigators determined flammable vapors from the sealant had drifted to a utility room next to the breakroom. The pilot light or operation of the gas-fired water heater was the source of ignition. Few contents in the room and quick operation of the sprinklers limited the fire losses. Damages to the $2 million building were estimated at $3,000 and contents at $5,000 and were considered small. There were no injuries.

Fire in drying oven causes significant loss

OREGON—A large food-processing plant was the site of a significant fire loss when debris build-up on gas burners dislodged and ignited dust and food products.

A dry-pipe sprinkler system providing full coverage to the building failed to operate during the fire and efforts by employees to control the fire were unsuccessful. The single-story, steel-frame building measured 400 feet (121 meters) in length and 200 feet (60 meters) in width. It had metal walls, a metal roof and two food dryers with a dividing wall between them inside the building. The three-section dryers had multiple doors allowing access to the blower section on the bottom, conveyor in the middle, and gas-fired burners and ventilation on the top section. Fire protection included multiple portable fire extinguishers and a fire pump and sprinkler system fed by a water storage reservoir. The plant was operating at the time of the fire.

An employee observed smoke in a section of the building and found a fire burning in the middle section of one of the food dryers. For nearly 10 minutes, employees tried to extinguish the fire using portable fire extinguishers and water-spray equipment that was not designed for fire protection. A 911 call from the employees alerted the fire department, which arrived 27 minutes after alarm.

Fire fighters extinguished the fire and limited damage to just two sections of the oven, and the onions in the oven. There was, however, smoke damage throughout the building. Investigators examined the equipment and found debris covering the gas-fired burners that had fallen off or was dislodged and then ignited. Evidence of previous fires was also noted as employees reported product often ignites within the oven but is usually easily extinguished.

Damage to the building, which was valued at more than $12 million with contents of $300,000, had losses estimated at $3 million and $130,000 in content loss. Investigators also found the fire pump room covered in an oily residue and the fuel tank to the fire pump empty.

Some sprinklers fused during the fire, but were ineffective because there was no water being pumped. Two employees suffered smoke inhalation during extinguishment attempts.

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SMOKE ALARMS IN HOMES have contributed to a 50 percent decrease in fire deaths in the United States since the late 1970s. Despite this success, the NFPA's Fire Protection Research Foundation continually strives to improve this number. Several research studies conducted by the Foundation over the past two years have focused on understanding the factors that impact the effectiveness of smoke alarms and how this changes for certain parts of the population.

The objective of the most recent study, sponsored by the U.S. Department of Homeland Security, was to study the optimization of fire alarm systems for three population groups deemed to be at high risk. The groups (selected through the development and application of a unique vulnerability assessment model) were the hard of hearing, the alcohol impaired and adults in a large group setting.

To study the effectiveness of alarms in waking the hard of hearing and the alcohol impaired, two comprehensive sleep studies with a total of 80 subjects were carried out at Victoria University of Technology. The range of impairments of both groups was in the moderate (not severe) range. In the first study, several auditory signals and a variety of alternative alarms that employ methods other than sound, such as bed shakers, pillow shakers and strobe lights, were studied for their effectiveness in alerting hard-of-hearing individuals of an emergency when they were asleep.

Results showed that the standard audible emergency evacuation signal (a repeating pattern of three tones and a pause) with a lower pitch tone (520 Hz square wave) awakened 92 percent of the hard-of-hearing participants when used at or below the code-minimum sound level of 75 decibels for 30 seconds.

The same device awakened 100 percent of the participants when raised to 95 decibels at the pillow. Researchers also noted that participants that awoke to signals were most likely to do so within the first 10 seconds of the signal's inception. The lower pitch tone was found to be significantly more effective than the higher pitch tone (typically 3150 Hz) commonly used in today's smoke alarms.

Based on the study, the overall single best option for alerting people with mild to moderately severe hearing loss is the use of low-frequency square wave auditory signaling devices. These devices surpass bed shakers, pillow shakers and strobe lights when presented alone. Ideally this square wave signal should be as loud as possible. The study that used moderately alcohol-impaired individuals found similar results.

Overall, the results were consistent and verifiable that the use of low-frequency square wave auditory signaling devices are the most effective for the aged, the young, the alcohol impaired, and the hard of hearing in a range of studies sponsored by the Foundation and others.

In a related discovery, the study that focused on moderately hard-of-hearing individuals found that many people are not aware of their hearing impairment. This finding, together with the findings related to alcohol impairment, suggest that any standard audible smoke alarm for the general population should emit a signal that maximizes the chances hard-of-hearing people will have to awaken (provided such a signal presents no increased risk to other sections of the population).

Reports of these studies are available on the Foundation's website: www.nfpa.org/foundation. The results are under consideration for implementation in the next edition of NFPA 72, *National Fire Alarm Code*.

KATHLEEN H. ALMAND, P.E., FSFPE, *is the executive director of the Fire Protection Research Foundation.*

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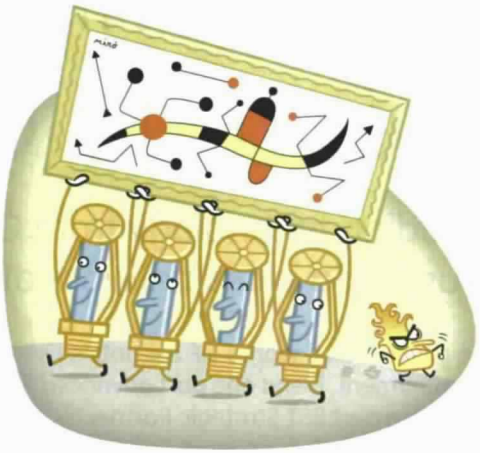
imagination at work

Extra protection for cultural resources

NFPA's codes and standards have a history lesson to teach.



NFPA 909, *CODE* for *the Protection of Cultural Resource Properties – Museums, Libraries and Places of Worship* traces its history back to a 1948 NFPA document: *Protecting Our Heritage.*

During the past 60 years, the NFPA has merged various recommended practices and guides into a comprehensive set of requirements aimed at providing fire safety for culturally significant structures and their contents. Automatic fire sprinkler systems have played an increasing role over the years; the current 2005 edition of NFPA 909 requires automatic sprinkler or alternative fire suppression systems for all new construction. The Technical Committee on Cultural Resources also writes NFPA 914, *Code for Fire Protection in Historic Structures,* which recommends the use of automatic sprinklers.

Many culturally significant properties are protected with simple wet pipe sprinkler systems, appreciated for their performance and reliability. For example, the rare book stacks at the U.S. Library of Congress are protected with clean agent gas extinguishing systems for first strike capability, but these important items are also newly protected with standard wet-pipe automatic sprinkler systems.

Because cultural resource properties often contain rare or irreplaceable collections, the appreciation of sprinkler systems is accompanied by a desire that special efforts be made to ensure and enhance their reputation as reliable and trouble-free systems. NFPA sprinkler standards are therefore viewed as reasonable minimum standards to which the special concerns of the preservation community can be added. For example, although NFPA 13D, *Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes* is the standard applicable for such sized dwellings in preservation community sites, NFPA 914 specifically allows the use of the systems described in NFPA 13, *Installation of Sprinkler Systems* for these dwellings in recognition of the superior property protection afforded by the parent standard.

Beginning with the 2005 edition, NFPA 909 also made an exception to NFPA 13, allowing the use of standard-response sprinklers in light hazard areas of cultural resource properties. Annex wording in the document points out that standard-response sprinklers employ more robust operating elements than fast-response sprinklers and may be more appropriate for use in areas where concern for inadvertent water discharge outweighs the advantages of thermal sensitivity. This same allowance is made in the 2007 edition of NFPA 914.

The NFPA Cultural Resources Committee initiated the recent change to NFPA 13 that requires the pitching of pipe in preaction systems even where the piping is not exposed to freezing. Preaction systems are those in which piping is normally filled with air and require the operation of both a separate detection system and automatic sprinklers before water is released onto a fire. While some museums and libraries endorse the use of preaction sprinkler systems on the basis that they are less likely to result in unwanted discharge of water, these systems can still react negatively to neglect or poor installation. The lack of proper drainage has been found in some cases to result in premature pipe corrosion. Even though NFPA 13 has made the change to require pitching of pipe in its 2007 edition, the Cultural Resources Committee recently pursued an emergency Temporary Interim Amendment (TIA) to its own 909 document to alert users that might be installing sprinkler systems in accordance with earlier editions of the sprinkler standard. The TIA also called for other enhancements aimed at preventing corrosion, such as the use of internally galvanized Schedule 40 steel piping for dry and preaction systems. The entire area of corrosion prevention will receive additional work as the next edition of NFPA 909 is prepared.

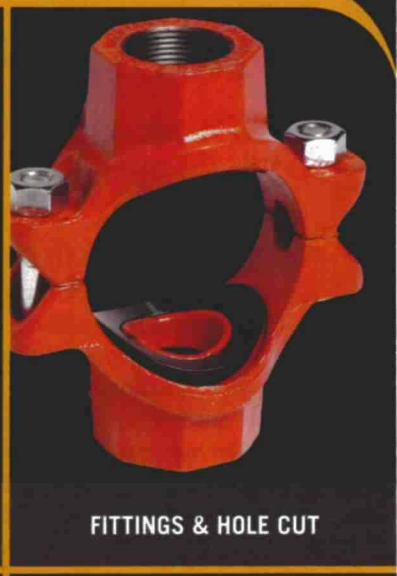
All of these special rules are in recognition of the published scope statements for the NFPA sprinkler standards.

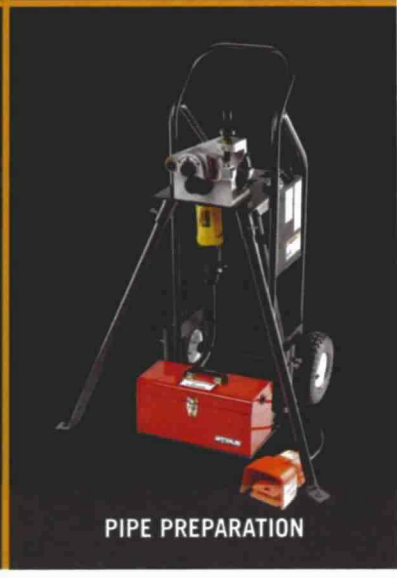
RUSS FLEMING, P.E., *is the executive vice-president of the National Fire Sprinkler Association and a member of the NFPA Technical Correlating Committee on Automatic Sprinklers.*

Illustration by Jack Desrocher

VICTAULIC • FIRE PROTECTION SYSTEMS

INNOVATION





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Roof operations prompt special concerns

Think safety before ordering fire fighter operations on the roof.

THERE ARE MANY reasons why accessing the roof during a structure fire might be necessary. In most cases, the primary objective is vertical ventilation.

Safety is always the first consideration before placing fire fighters on a roof because roof operations can be extremely hazardous. Fire fighters placed on the roof to ventilate must be in full protective clothing and on air. Many times conducting roof operations from an aerial ladder or aerial platform is possible and desirable. A roof ladder should be used when checking peaked roofs if working from an aerial device is not possible. Also, a second means of egress should always be provided for fire fighters working on the roof.

Buildings that have undergone substantial renovation may add lightweight roof structures to replace heavy-duty structural members. Heavy roof loads, such as air conditioning units on the roof, can hasten roof collapse.

Pre-planning information should warn fire fighters of weakened, compromised or excessively loaded roof structures.

We have reviewed many case studies where fire fighters were injured during roof operations when the fire had self-vented through the roof before fire fighters gained access to the roof. In these cases roof operations were generally unsafe and unnecessary.

Deciding where to ventilate can be a complex decision. From a tactical standpoint venting directly over the fire is the most desirable location. Venting over the fire is also the location most prone to structural failure.

A smoke plume with sufficient thermal energy will naturally be pulled toward a vertical opening. Therefore, an improper vent opening—placed away from the fire—will tend to pull the fire through unburned areas of the building, placing occupants and fire fighters located in the ventilation pathway in even greater jeopardy.

Placing the vent opening in the wrong location, such as behind the fire fighters, could prove to be a deadly mistake. The fire will now be pulled into the concealed spaces above the fire fighters working below, possibly blocking their means of egress and enveloping them in fire. Conversely, proper venting will channel fire and smoke directly out the roof, limit extension and provide a safer environment for the fire fighters and occupants below. If a fire in significant volume has already extended into this false space before venting, there could be a sudden and dramatic increase in smoke and heat at the roof level requiring fire fighters to quickly retreat. In these instances it is unsafe for fire fighters to be on or under the roof. Remember, if the roof is too weak to place fire fighters on it, it is also too weak to place fire fighters under it.

Considering the unintentional consequences is critical when performing roof ventilation when the fire is on a floor below the top floor of a multistory building. Opening the roof will not achieve the intended purpose unless there is a pathway from the fire compartment to the roof opening. If the fire is not rapidly extinguished, everyone and everything in this pathway will be placed at increased risk. Timing extinguishment efforts to coincide with ventilation is essential. In the case of the multistory building, improper venting can draw fire into the stairway and result in injury and death to anyone in the stairway, including fire fighters.

Conduct a risk-versus-benefit analysis before placing fire fighters on a roof. Remember that fire fighters working on the roof create an additional load that may contribute to roof failure. Once the objectives for the roof crew have been achieved, fire fighters should immediately leave the roof.

This column is adapted from the book Structural Fire Fighting, *available at www.nfpa.org or (800) 344-3555.*

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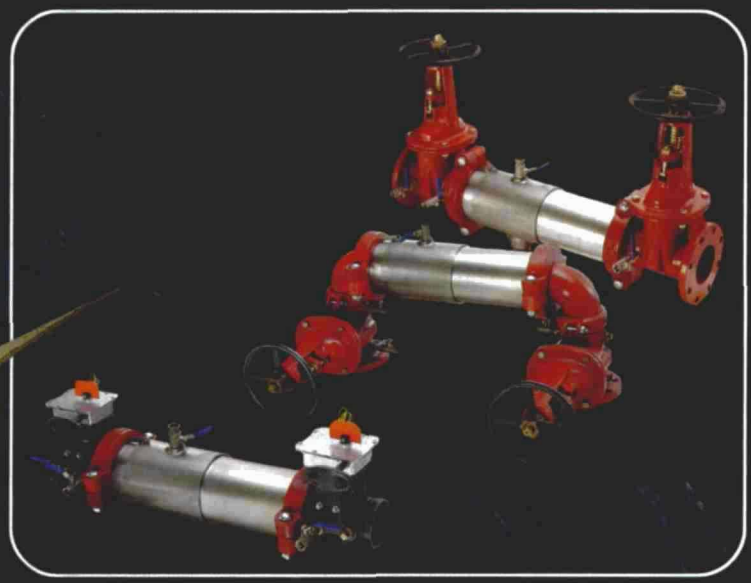

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Intervening rooms and spaces

The *Life Safety Code*® outlines the restrictions and prohibitions.

NFPA 101®, *LIFE SAFETY CODE®* addresses intervening rooms and spaces in sections 7.5.1.6 and 7.5.2.1. These two sections allow occupants to egress through adjoining rooms with no limit on the number of rooms. However, some occupancy chapters do limit egress through one or two rooms maximum. For example, Health Care (Chapters 18 and 19) and Educational (Chapters 14 and 15) have restrictions on the number of intervening rooms in Section – 2.5 of the applicable occupancy chapter. Also, sections 7.5.1.6 and 7.5.2.1 have several other restrictions.

For example, Section 7.5.1.6 states: "Exit access from rooms or spaces shall be permitted to be through adjoining or intervening rooms or areas, provided that such rooms or areas are accessory to the area served. Foyers, lobbies, and reception rooms constructed as required for corridors shall not be construed as intervening rooms. Exit access shall be arranged so that it is not necessary to pass through any area identified under Protection from Hazards in Chapter 11 through Chapter 42."

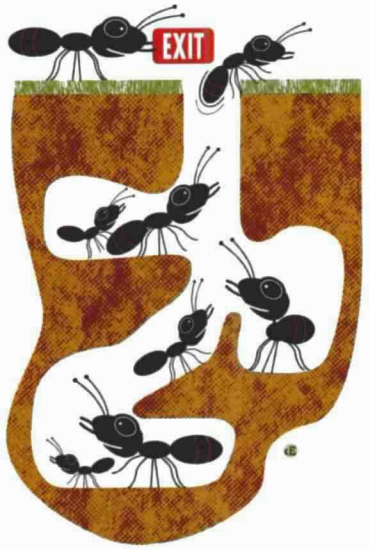
The rooms have to be "accessory". This term is not defined in Chapter 3 so one must use the common definition in the dictionary. That definition is "a subordinate or supplementary part". In other words, the intervening rooms are part of the primary use, are probably present the same hazard, and probably are under the same management and control.

The Code goes on to prohibit egress through areas identified under "Protection from Hazards" in the occupancy chapters. Section – 3.2 of each occupancy chapter addresses those rooms or spaces that are considered hazardous, not necessarily High Hazard as defined in 6.2.2 "Classification of Hazard of Contents". Hazardous means the fire hazard is somewhat higher than what is normally expected in that occupancy. For example, in an existing office building, Section 39.3.2 lists "...general storage, boiler and furnace rooms, and maintenance shops. ..." as areas under the Protection from Hazards category. Therefore, egress from an office area is not permitted through the furnace room to get to an exit in an office occupancy.

Section 7.5.2.1 goes onto to prohibit egress through kitchens and storerooms, except as permitted in Chapters 36 and 37. These chapters address new and existing Mercantile Occupancies. Sections 36/37.2.5.11 do permit egress through storerooms if they meet the conditions listed. However, this is an inspection burden as the storerooms of most mercantile occupancies become a storage problem beginning in about August with back-to-school merchandise, then Halloween, then Thanksgiving, then of course Christmas.

When the delivery truck pulls up, the pallets and boxes of merchandise usually go wherever they can fit, and keeping the egress aisle clear is not necessarily a priority.

Section 7.5.2.1 also restricts egress through restrooms, closets, bedrooms, and rooms subject to locking. The term "subject to locking" is interesting. I have always interpreted that to mean if there is an operable lock on the door, then that door is subject to locking. Even if the owner/occupant says that they never lock that door or don't even know where the key is.

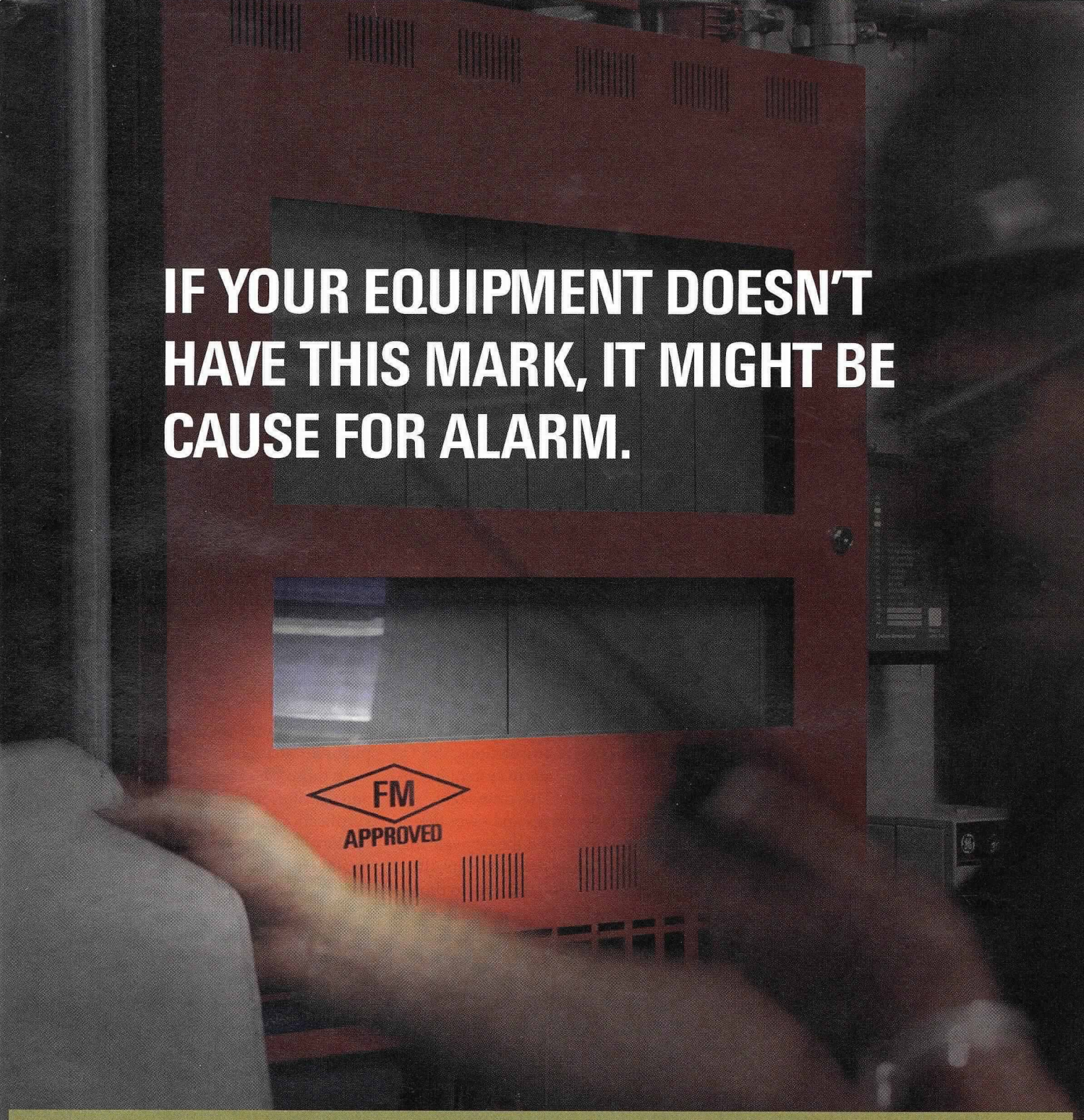


Earlier it was noted that the *Life Safety Code* does not have a restriction on the number of rooms one may egress through, except for a couple of occupancies. The Code does limit common path of travel. Common path of travel is the distance one must travel from the most remote occupiable point to an imaginary point where they suddenly have a choice of two directions to reach two different exits. The common path of travel rule is one of the rules that requires when two exit access doors or two exits are required. Common path of travel will be addressed in another column.

Egress through one or more rooms to the corridor may well be permitted. First confirm that the occupancy chapter does not restrict it, and then conform to all the restrictions in *Life Safety Code* 7.5.1.6 and 7.5.2.1.

CHIP CARSON, P.E., *is owner and president of Carson Associates, Inc., in Warrenton, Virginia. He is also a member of the NFPA Board of Directors.*

Illustration by Dave Ember



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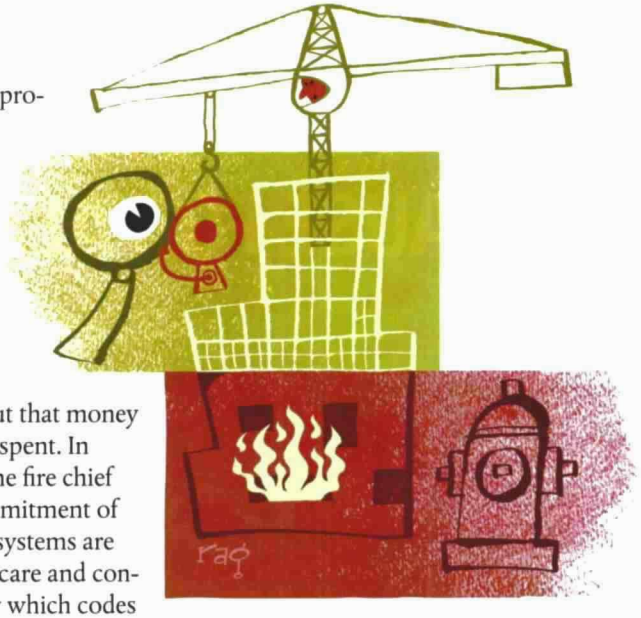

RECENTLY WHILE ATTENDING a meeting regarding proposed changes to fire alarm system codes and standards, I took part in an interesting discussion regarding the "state of the industry."

While many people work diligently within the NFPA system of consensus codes and standards to produce the best NFPA 72, *National Fire Alarm Code*, possible, the participants of this meeting thought we still had too many non-code-compliant fire alarm system installations.

Many were quick to criticize the fire service, manufacturers, dealers, and distributors. Everyone chimed in, offering their theory why we still experienced such a high record of poor installations. Many blamed the manufacturers for signing on "incompetent dealers or distributors to sell their products." Some also blamed the manufacturers for not providing "proper training for their sales people, dealers and distributors."

Of course, several blamed the dealers and distributors for "not making the commitment to attend the training sessions that manufacturers do provide."

I, instead, challenged them to make the system better.

To those who blamed fire chiefs, fire marshals, and inspectors, I challenged them to lobby local decision makers to provide adequate funding. This will support the fire chief so he can provide the argument that a well-trained and active fire prevention and inspection bureau within his or her community is a cost saver and a life saver.

The bottom line: those fire inspection teams need more support. The community needs to provide the money to purchase codes and standards and to provide proper training to ensure that they can do their job in a professional manner. Yes, this means an increase in budget, but that money will certainly be well spent. In jurisdictions where the fire chief has made such a commitment of funds, the fire alarm systems are inspected with more care and contractors learn quickly which codes the inspector will enforce.

In these same jurisdictions, the reliability of fire alarm system installation increases. This ultimately reduces false alarms and saves the fire department and the city valuable resources. Using these benefits, the fire chief can communicate to those responsible for the department's budget approval why they should consider increasing the budget for fire prevention purposes.

In these same jurisdictions, because of increased enforcement of the *National Fire Alarm Code*, the dealers and distributors realize that they too must make a commitment to learn proper installation requirements. The contractors not only increase the training of their employees in the codes and standards, but they ensure that more employees take part in the manufacturer-offered training, as well.

I challenge manufacturers to provide more training and information to the fire inspectors. The inspectors must understand how the systems work and how to ensure code-compliant installations.

To those who blamed the dealers and distributors for "discouraging certification," such as that from the National Institute for Certification in Engineering Technologies (NICET), I challenged them to ask for their employers' support and employees the opportunity to attend fire alarm training courses or for not paying for web-based courses, such as those offered by NFPA and the Automatic Fire Alarm Association (AFAA), to name two training providers.

With just a bit of forethought, the need for a team approach is obvious. The only way for this team to succeed is if everyone is committed to working together to ensure reliable fire alarm system installations and to protect the public.

WAYNE D. MOORE, P.E., FSFPE *is a principal with Hughes Associates and immediate past chair of the NFPA 72 Technical Correlating Committee.*

Illustration by Richard A. Goldberg

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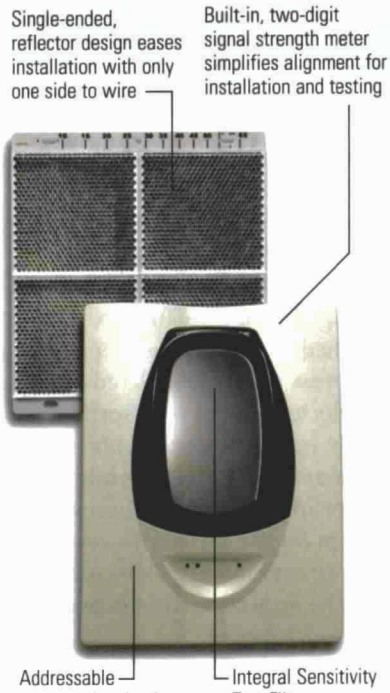

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Side-by-side demonstration

The 'right formula' for education includes a live-fire comparison.

YOU KNOW YOU have the right formula for fire safety education when you can attract a big crowd in 90 degree heat and high humidity, despite competing attractions nearby that include a live band, barbeque food and helicopter rides.

That was the setting in Brookfield, Wisconsin this past August, when I was invited along with the other board members of the Home Fire Sprinkler Coalition (HFSC) to attend a live side-by-side fire demonstration that was being held as part of that city's National Night Out community event.

Coordinated jointly by the Brookfield Fire Department and the National Fire Sprinkler Association's Wisconsin chapter, this demonstration included two five-sided rooms constructed outdoors and similarly outfitted with ordinary household furnishings. Both rooms were equipped with smoke alarms but only one room had a fire sprinkler installed in it.

With the admiration of everyone in the audience, three Brookfield fire fighters in full gear were at the ready with charged hose lines. After a brief presentation about home fire dangers, a fire was lit in a trash can in each room at the same time and the fire soon spread to the upholstered furniture and curtains. The audience stood attentively as the flames rapidly grew—most had never witnessed the progression of a "typical room and contents" home fire.

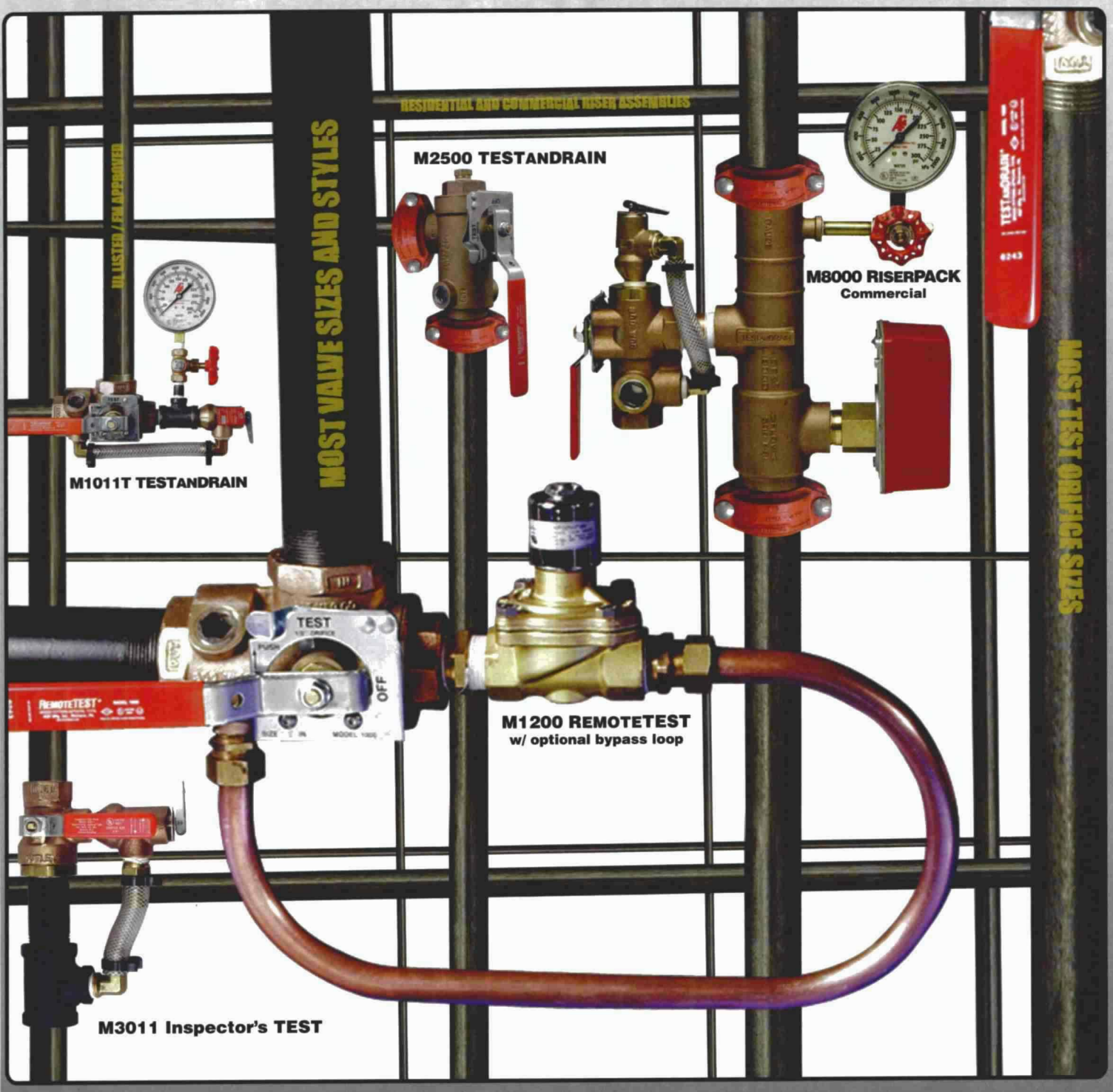
The sprinkler operated quickly and fully doused the flames in one side, while thick smoke billowed out of the unsprinklered side. As the room on this side went to flashover, most everyone in the audience instinctively took a step or two back. With one fire fully extinguished, the fire fighter stepped in to suppress the unsprinklered fire. The results were clear—the sprinklered room had all of its contents intact with minimal damage, while the unsprinklered side was destroyed except for the shell of the room. It was all over in only a few minutes, but the impact on the audience will last much longer.

Looking back on that day in Brookfield, I am reminded why this form of education works so well—even on a sweltering day. No matter the age, people can't resist the combination of fire fighter, fire trucks and a live fire demonstration. A live fire demonstration can convince even the most stubborn among us of fire's true danger. Sure, we can describe how rapidly a fire can grow, or how dark and choking smoke is or how searing the heat is. But nothing is as influential as a first-hand visual—and safe—fire experience.

The key point—that the sprinklered fire is the "preferred fire" is self-evident. There's no need to lecture.

Consider adding this type of demonstration to your community educational outreach. The HFSC offers the fire service a wide range of free educational and presentation materials, including a brand new education kit. The Home Fire Sprinkler Coalition can help supplement that experience. For more information and to obtain these materials, visit the HFSC's website at homefiresprinkler.org.

GARY KEITH *is NFPA's Vice President, Field Operations & Education. He also serves as chair of the Home Fire Sprinkler Coalition.*



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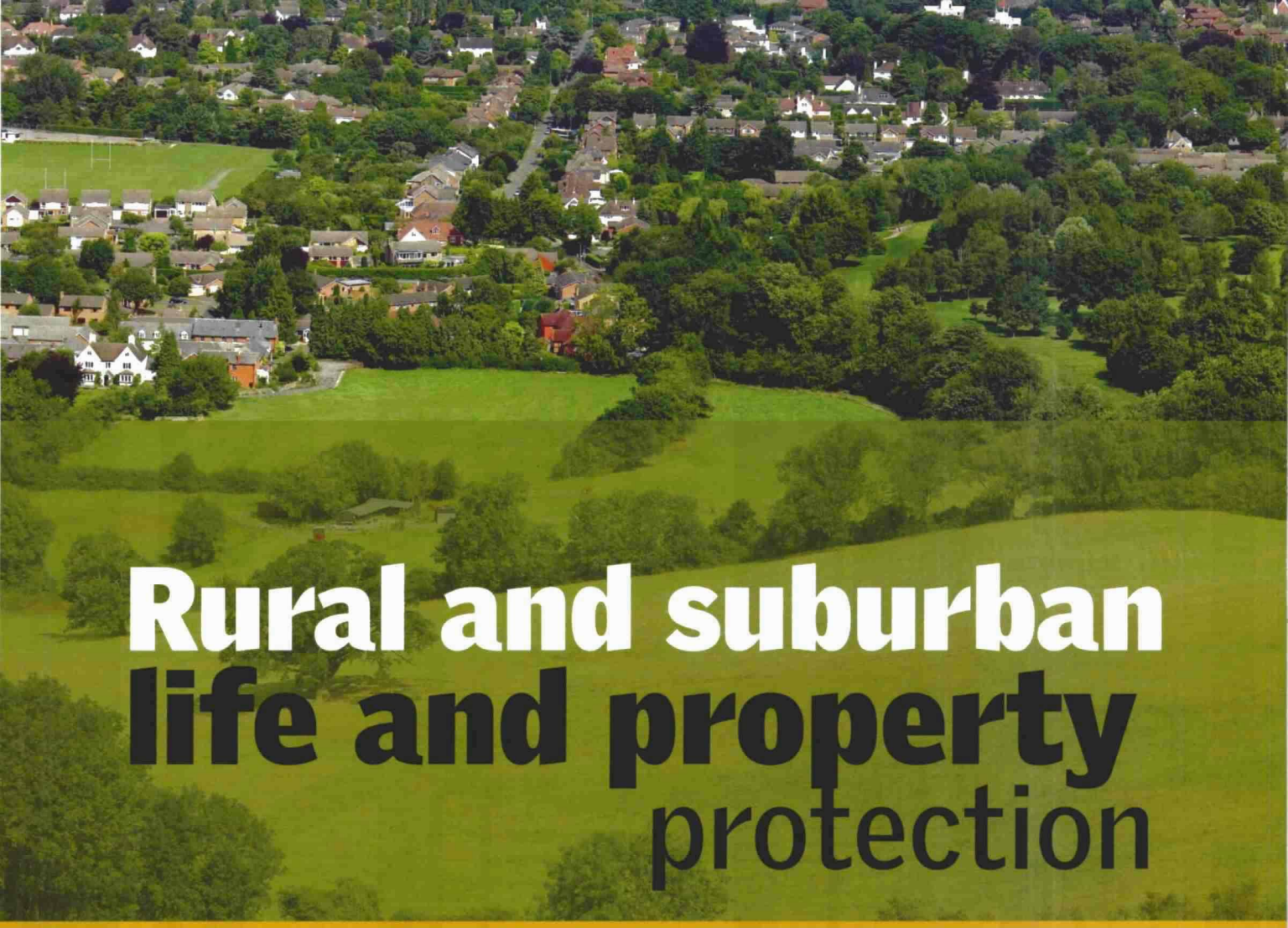

Rural and suburban life and property protection

NFPA 1144, *Protecting Life and Property from Wildfire*, and NFPA 1141, *Fire Protection in Planned Building Groups*, will look like new documents for 2008.

Working closely with the national Firewise Communities program, the NFPA Forest and Rural Technical Committee completely revised both documents to address the increasing challenges of fire protection in suburban and rural locales.

The changes in focus are reflected in the standards' new titles: NFPA 1144, *Reducing Structure Ignition Hazards from Wildland Fire*, and NFPA 1141, *Fire Protection Infrastructure for Land Development in Suburban and Rural Areas*. These two standards linked by locales (forest and rural) and yet independent in application now provide complementary guidance for the wildland/urban interface.

Fire plays a natural role on the landscape. The traditional sense of "fire problem" of the wildland/urban interface is not a result of fire itself but rather a problem situation resulting from inadequate land-use planning, increasing population, severe weather events, and our inability to maintain adequate infrastructure of roads, water, and community services. The solutions to preventing disasters from interface fires lie within each community through better communication, cooperation, and planning.

Origin and development of NFPA 1141

NFPA 1144 is not a new standard. In fact, the basis for it first appeared in 1935 as NFPA 224, *Fire Protection and Prevention for Summer Homes in Forested Areas*, developed by the Forest Committee of NFPA and was presented and adopted at the 1935 Annual Meeting of the Association. In 1952, the document was revised as NFPA 224-T and revised into a 1953 edition as *Fire Prevention Standards for Homes*

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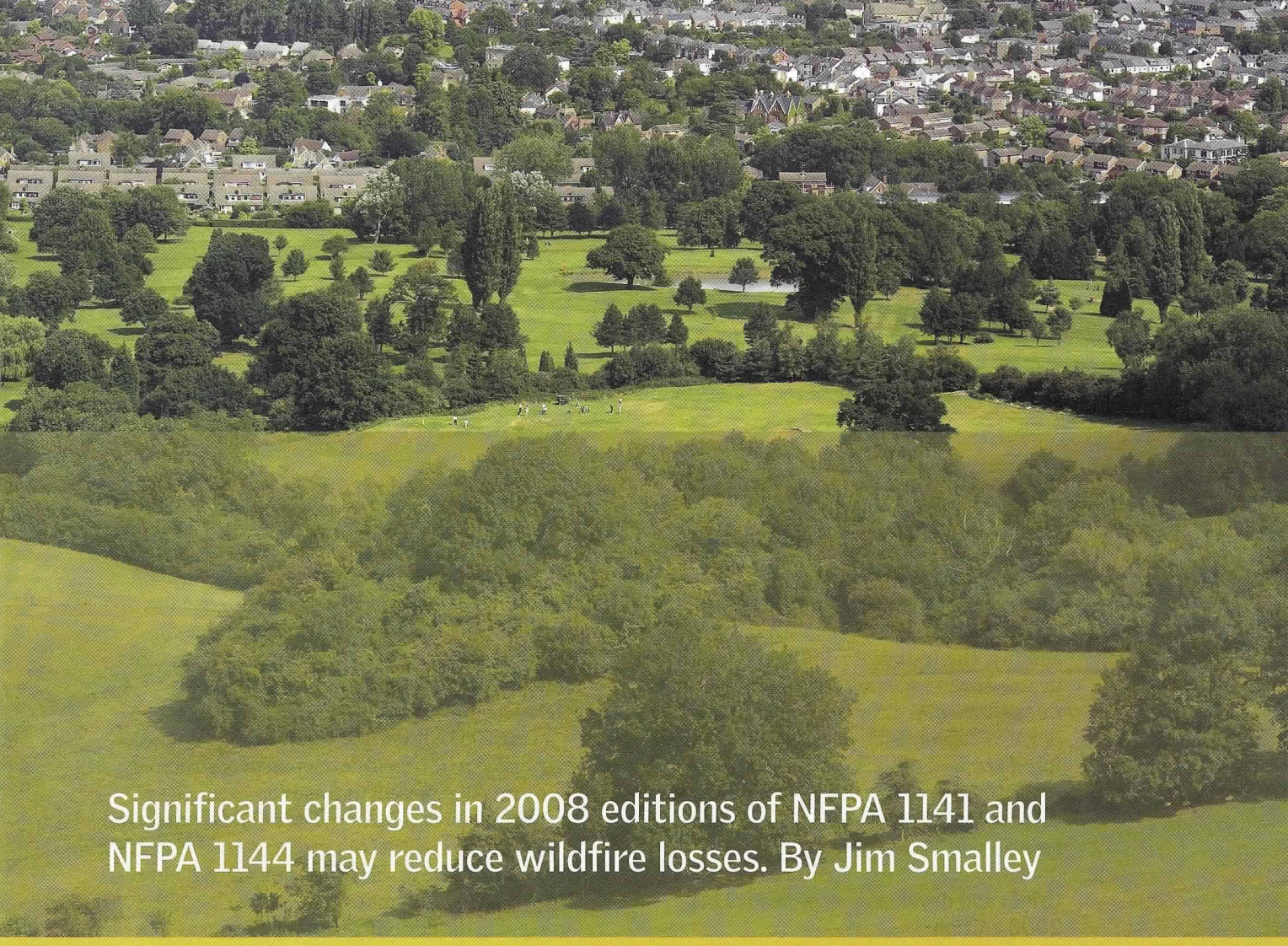


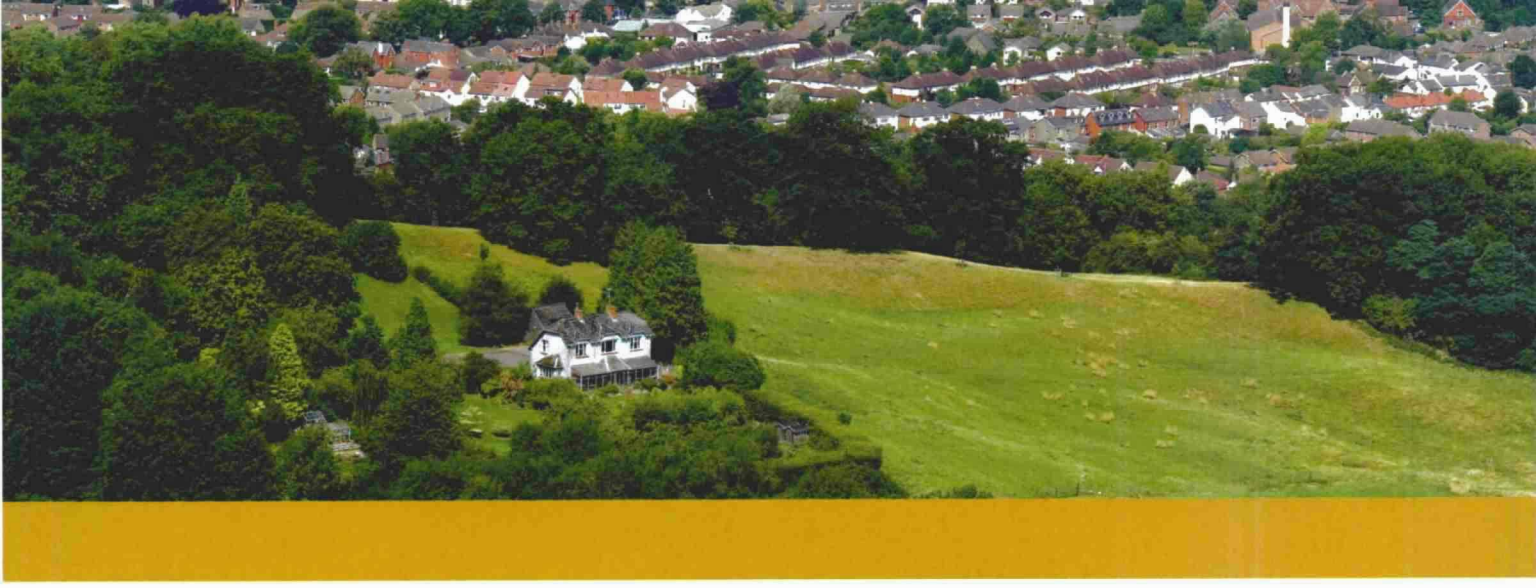
Significant changes in 2008 editions of NFPA 1141 and NFPA 1144 may reduce wildfire losses. By Jim Smalley

and Camps in Forested Areas. The document became designated as NFPA 224M in when it was revised as *Recommended Good Practice for Homes and Camps in Forest Areas* in 1962, 1969, and 1972.

In 1974, the document was renamed the *Standard for Homes and Camps in Forest Areas* and was revised into progressively up-to-date editions in 1979 and 1985. In 1988, the NFPA Forest Committee and Rural Fire Protection committees were combined into the Technical Committee for Forest and Rural Fire Protection, and in May 1991, the larger combined Technical Committee revised the document as NFPA 224, *Homes and Camps in Forest Areas*, was withdrawn and parts of the document were incorporated into NFPA 299, *Protecting Life and Property from Wildfire*, 1991 edition.

The 1991 edition was revised in 1997 with a new approach to protection following the tragic wildfires that resulted in the loss of 44 lives and 1,400 homes in the United States in 1985. More recent wildland/urban interface fires, such as the 1991 conflagration in Oakland, California, and the fires in Laguna Beach, California (1993), and Malibu, California (1996), showed that fire fighters are often placed in dangerous situations due to inadequate planning and design of roadways, signs, water supplies, and other infrastructure considerations as well as the increasing population of residential areas encroaching into wildland areas. The 2000 fire season of resulted in renewed interest in creative alternative methods to reduce historical trends of catastrophic fires.

Renumbered as NFPA 1144, the 1997 edition clarified numerous requirements from the earlier editions and a significant revision of the Wildland Fire Risk and Hazard Severity Assessment system, which was adapted for use by numerous jurisdictions involved in Firewise Communities



planning and assessment. The Technical Committee increased the severity values for non-rated roofing, inadequate separation of vegetation from structures, and separation of structures from one another. The Technical Committee tested a variety of assessment versions through several Firewise Communities Workshops, sponsored by the National Wildland/Urban Interface Fire Program, before arriving at the relative values and hazard levels in the 2002 document. The Technical Committee supports use of these values as relative numbers for planning purposes.

Origin and development of NFPA 1141—2008 edition

The former Technical Committee on Suburban and Rural Fire Prevention and Promotion began work on this standard began in 1972 in response to needs expressed by several members. Several drafts were prepared and a document was adopted by the Correlating Committee on Suburban and Rural Fire Protection and Prevention (predecessor to present Forest and Rural Committee) for presentation at the 1977 Annual Meeting.

Due to technical problems, the standard was withdrawn from the meeting agenda. Following reorganization of the Technical Committee in 1982, a task group undertook a review and update of the 1977 document, which resulted in the 1985 edition, which was updated and revised for the 1990 edition.

The Technical Committee's proposed 1995 edition was returned to the Technical Committee to clarify conflicting requirements between NFPA 1141 and NFPA 1144, NFPA 1, *Uniform Fire Code*™ and NFPA 101®, *Life Safety Code*®. The requisite changes resulted in moving the document to the 1998 revision cycle.

The Technical Committee was able to resolve many of issues in clarity and consistency by bringing the 1998 edition in concert with NFPA 1 and NFPA 101. Because of specific fire protection circumstances found in rural areas listed in the revised scope and purpose, the Committee continued to require that some elements remain more restrictive than comparable elements in other NFPA documents.

In the 2003 edition, the Technical Committee responded to the rapid development of structures into areas that present unusual characteristics to responding fire agencies and has worked extensively on making NFPA 1141 current with other documents and more usable by adopting jurisdictions. The Technical Committee is particularly interested in keeping the flexibility in the application of the standard by jurisdictions so that it works with existing codes and standards that may or may not adequately cover planned building groups.

The scope of the document was revised to focus on providing guidance on the development of the community infrastructure necessary to eliminate fire protection problems that result from rapid growth and change. The title change from *Fire Protection in Planned Building Groups to Fire Protection Infrastructure for Land Development in Suburban and Rural Areas* also reflects this broader look at the challenges facing rural and suburban areas.

While creating this edition, the Technical Committee concurrently revised NFPA 1144 to provide complementary documents for fire protection in rural and suburban development, including special considerations for wildland interface areas. As a result, the requirements for community infrastructure (e.g., roads, water supplies) were moved from the 2001 edition of NFPA 1144 to this document and, as with NFPA 1144, additional guidance was taken from the USDA Forest Service and the National Wildland/Urban Interface Fire Program (Firewise Communities) along with input from several Technical Committee members and special experts.

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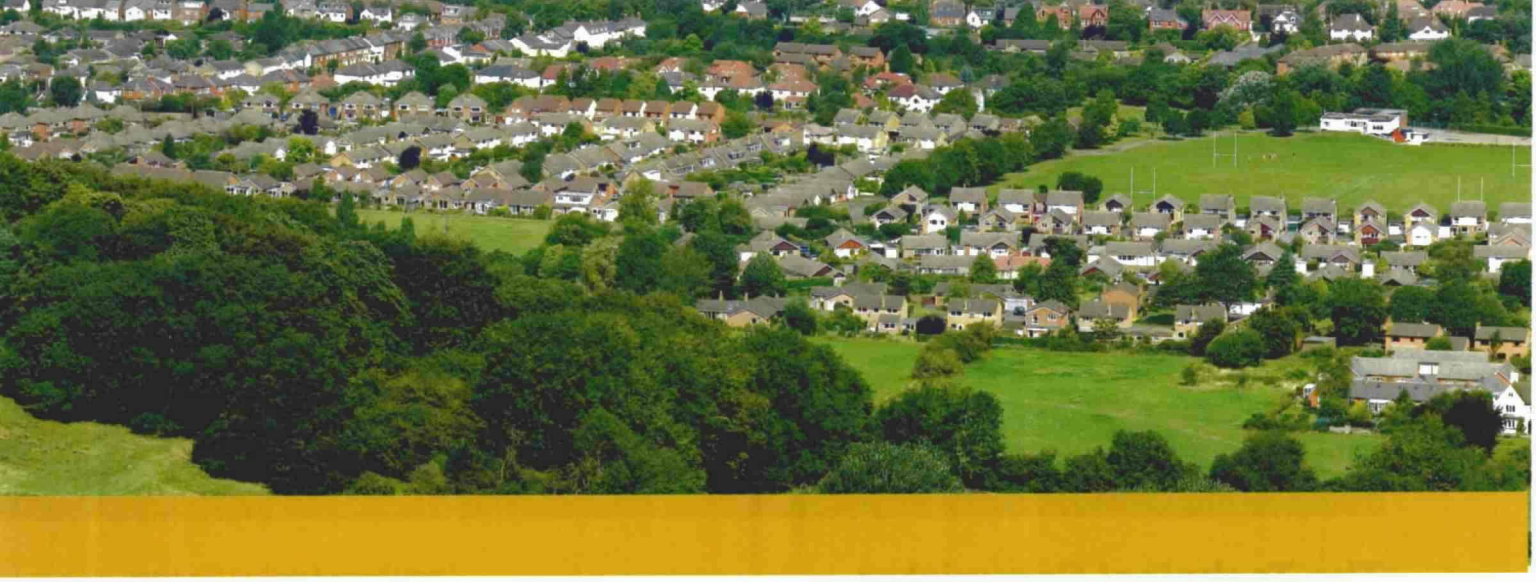


Why revise the standards?

NFPA documents are reviewed and updated on a regular cycle to keep each document current with changes in technology and methods practiced in the area covered by the document. Of course, the other reason to revise to improve the usability of the documents. NFPA 1144, *Protecting Life and Property from Wildfire*, contained some confusing measurements and comparisons in a few areas as pointed out to the Technical Committee by users in assessing hazards and risks in interface areas.

While much needed and used by many small jurisdictions, NFPA 1141 often faced several difficulties in application. For example, exactly what is a planned building group? In rural and suburban areas, these "groups" might be a small office park, multiple medical buildings, residential subdivision of single-family homes or groups of townhouses, shopping centers, strip malls, or some mixed use configuration of all the above. The definition that a planned building group is "Multiple structures constructed on a parcel of land, excluding farmland, under the ownership, control, or development by an individual, a corporation, a partnership, or a firm" often left the AHJ with a difficult interpretations from the simple (strip mall) to the complex (large developments with multiple-owner parcels being developed on different schedules and crossing multiple jurisdictional boundaries).

In addition, the basis for determination of those limitations was vague and left entirely up to the AHJ with little guidance as to which limitation might be more severe, how the limitation was to be measured or articulated (within the context of community development), or how those limitations might negatively impact fire protection. Finally, questions often arose about varied interpretations and conflicting requirements concerning fire lanes, access, separation distances, and the application of sprinkler requirements between NFPA 1141 and NFPA 1. Additional confusion, created through revisions in alternating cycles, were discovered between NFPA 1141 and NFPA 1144. For example, NFPA 1144 overlapped with NFPA 1141, *Fire Protection in Planned Building Groups* in the areas of subdivision requirements in the area of infrastructure (road widths, clearances, building separation).

Sequence of events of Interface Fire Disasters

When lightning causes the ignition of vegetation (wildland fuels) in remote areas, well away from homes and human presence, the resulting wildfire is often called a natural event rather than a disaster. The definition of today's wildland/urban interface fire disaster seems to depend upon fire fighters being unable to prevent homes from burning, that is one in which resources have become overwhelmed and economic loss, property damage, or loss of life results.

Although some variation exists in each severe occurrence, the sequential elements are generally always present and the impacts are consistent time after time.

During extreme fire conditions with dry wildland fuels and high winds, fire fighters, equipment, and water supplies can become depleted as numerous homes ignite and burn. Fire fighting forces struggle to position themselves to stop large flames pushed by strong winds. Suppression effectiveness is dramatically reduced in these conditions as tactics shift and they initiate life/safety procedures by evacuating the public.

In other words, fire engines and crews cannot simultaneously evacuate residents and effectively take suppression action in a subdivision of homes igniting within a few minutes of each other. With multiple ignitions, the effectiveness of fire protection forces in these situations is compromised.

In these disaster scenarios, when our fire protection forces are overwhelmed and our standard

A truck travels past wildfires approaching a community.

The Technical Committee recognizes that wildfires do not respect political or jurisdictional boundaries and to implement the necessary for cooperation in dealing with the wildfire problem

operating procedures fall short; fire protection forces cannot stop the large flames from these intense wildland fires from entering a residential area and cannot prevent numerous homes from becoming ignited. Valiant efforts may save a few homes but most often hundreds of homes are threatened or destroyed in a matter of hours and numerous lives may be lost.

Wildfires will continue to enter communities, yet homes and adjacent vegetative fuel beds do not have to ignite. To shape successful results in these scenarios, our traditional wildland fire strategies need to be considered. A community made up of ignition resistant homes, healthy surrounding forests, and non-continuous fuels (i.e., vegetation to single homes to multiple homes) becomes less vulnerable to encroaching wildfire. Vegetation doesn't combust near homes, houses don't ignite from firebrands and severe structural property losses and human fatalities are dramatically reduced or potentially eliminated.

What are biggest differences from the previous editions?

One of the readily obvious changes in the revision of NFPA 1144 is that the assessment approach outlined in Chapter 4 is spatially segmented or organized. Beginning with the overall landscape, the user conducting the hazard assessment notes the predominant types, densities, and general health of the vegetation and the location of the structure relative to the vegetation and major topographic features, such saddles, ridges, peaks, chimneys, and valleys.

Then, looking at the structure itself, the user assesses possible ignition points (hazards and risks) from the roof peak to the eaves. This area generally includes the condition and type of roofing material, chimney and vents, and the gutters, looking for such things as missing or damaged shingles, cracked or missing bird stops in tile roofing, leaf litter in gutters, and bird nests in eaves. Then, it's on the area from the eaves to the foundation. In examining vertical walls, notation is made on areas below the gutter (soffit material and integrity), vents, eaves, windows (single or multiple panes, sizes, sealing around frames, location relative to the likely path of a wildfire, and screens), and other area ignition hazards.

From the foundation to 30 feet (9 meters) is another critical assessment area. Here, the existence of decks and outbuildings, vegetation type, height, densities, health, and location (particularly from the foundation to 5 feet or 6 feet (1.5 meters or 1.8 meters) outward), firewood, the presence and location gasoline powered equipment (including automobiles and recreational vehicles). From the 30 foot boundary (often referred to as the survivable or defensible space), the assessment progress to extent of the structure ignition zone, an area determined by the AHJ that would, under severe fire conditions, present a hazards from either direct flame or (more likely) the generation and communication of airborne firebrands (embers) that could be showered on the structure from as far away as a mile from the main wildfire.

What were the problems that were corrected in the new revision?

The previous editions of NFPA 1144 included requirements that reflected two sides of "protecting life and property from wildfire" namely, fire prevention/mitigation and fire response/suppression. Fire prevention and mitigation (risk reduction) were the focus of the chapters dealing with

Photograph: AP/Wide World

assessment and planning, building design, location and construction, and fuel modification and fire response and suppression were found in the chapters dealing with water supply, access, and evacuation. While these two approaches are complementary, the result of splitting the focus resulted in some difficulties in applying one of the more popular tools of the standard: the *Wildland Fire Risk and Hazard Severity Assessment Form*.

Since the standard included both individual homes and subdivisions, the assessment form attempted to "score" the relative risk of hazards of both through deficiency points. Specifically, users were asked to compare the risks of inadequate water supplies and narrow road widths and conditions (a fire response/suppression concern) with combustible roof coverings, decks, fences, and the density (clearance), species, and location of hazardous vegetation (an ignition risk concern). In addition, the document contained specifications for subdivision/community infrastructure elements (e.g., roads, hydrants, house and road signs) and individual homes – both of which the form attempted to rate. The result was that the objective of the assessment was not to increase the level of protection for interface homes, but simply to reduce the rating number. In many cases as reported by wildfire officials, homeowners, when faced with the costs of mitigation, reduced the rating number quickly by placing a non-combustible street number sign on their house rather than replacing the aging combustible roof. This was just the opposite of what the Technical Committee intended and what sound hazard reduction is all about as the community infrastructure (road signs, additional water supplies, and wider less-sloping roads) may increase the chances that will help fire fighters in responding but will do little to prevent the home from igniting in the first.

Current users will notice the drastic changes in the suggested assessment form itself. The Technical Committee actually suggests one of two methods for assessing the ignition potential of the structure; both assessment forms follow the requirements for assessment by spatially segmenting or organizing the assessed conditions. The one preferred by the Technical Committee is a walk-around assessment or observation of existing conditions relative to potential extreme fire behavior. Instead of a menu of numeric values for specific hazards, the preferred method is to assess the hazards to which the home might be exposed during an extreme fire behavior scenario and the risks that might accompany those hazards. Because every assessment is site-specific, these hazards and risks are described and then with fire official working on the assessment makes recommendations to the resident/owner about actions that may reduce the potential of the home igniting. There is no numerical rating or ranking of any kind with this method.

The second method provides numerical rankings for several hazard conditions, but the critical rating values are left up to the AHJ. This way the ratings must be specific to the locale.

As always, the assessment forms provide additional information and are part of the Annex materials and are not part of the requirements. This allows the assessment tools to be adapted for local use by the AHJ.

This, then, became the essential intent of the 2008 revision – that wildland interface structures (i.e., homes and critical structures) be designed, built, and maintained to withstand a wildfire by its capability of resisting ignition from the fire and its often accompanying ember (firebrand) shower.

The Technical Committee recognizes that wildfires do not respect political or jurisdictional boundaries and to implement the necessary for cooperation in dealing with the wildfire problem. Therefore, fire agencies and citizens in the urban fringe must develop coordinated and effective efforts to stem the wildland/urban interface wildfire problem. Using the newly revised NFPA 1144 will help local public safety agencies and homeowners focus on preventing ignitions of homes from wildfire (external exposures).

The removal of the infrastructure requirements and the changes in the assessment tool reflect some of the changes needed in a new approach to preventing wildfire disasters and the resulting loss of homes and lives.

What happened to the fire protection infrastructure requirements for communities?

Where previous editions of NFPA 1141 and NFPA 1144 were trying to address similar (or the same) fire protection issues simultaneously, the new editions of both standards are now in sync and consistent in their focus, their separation of scopes and applications, eliminating the overlapping requirements and providing a complementary approach for the rural or small community fire department.

Many of the requirements in 2002 edition of NFPA 1144 were transferred to the 2008 edition of NFPA 1141, whose new title *Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas* reflects the significant change in the Technical Committee's view of the document's application. The purpose of the revised requirements is to provide guidance in designing fire protection

infrastructure for changes in land use and can serve as a planning guide for community development in all areas of the country with some specific requirements and considerations for communities in wildland/urban interface settings.

The new requirements for water supplies for fire fighting, fire lanes and access, building separation and access, parking lot designs, and new road design considerations are based on considerations that were presented to the Technical Committee as real life examples of the challenges faced by small community fire departments.

New road requirements have been based on recent research and proposals to apply the general approach of exiting buildings to exiting subdivisions. Similar to NFPA 1144, the previous editions of NFPA 1141, *Fire Protection in Planned Building Groups*, were trying to fulfill multiple purposes for community infrastructure design, which raised added issues in applying NFPA 1141 and NFPA 1144 documents in a wildland/urban interface setting.

Land use planning, an element of comprehensive planning, helps communities identify appropriate and compatible mixes of land uses within their jurisdictions (e.g., agricultural use, recreational use, industrial use, residential). While the results may be similar, zoning and land use planning are not the same and should not be confused. The best land use planning also connects public safety considerations with the land in a given area. Pressures on real estate increase the pressures on small communities' emergency services. The rapid expansion of development in rural and suburban areas presents a real and immediate challenge to local governments, natural resource managers, planners, and emergency services. Effective planning is the best way for members of a community to cooperatively work to address fire protection and safety concerns.

The 2008 edition of NFPA 1141 can serve as a planning guide for community development of lands. At the very least, it can be a valuable supplement to comprehensive and land use planning regulations and methods. When communities are faced with large scale development, the community aspects of aesthetics, affordability, transportation corridors and traffic flow, school districting, and waste management sometimes are designed into the plans before the fire department may become involved. In other words, the development may have already occurred before the hazards (natural and those resulting from design) are recognized.

Moreover, the new edition can help incorporate fire protection and emergency response concerns into the community planning mix. For example, several small- to medium-sized communities in the country have faced the closing of a military base in the past decade. Sometimes faced with multiple jurisdictions and unclear land use plans, acres of land are debated for years – How much recreational land should be set aside for public use? What about commercial and industrial development to support sagging tax bases? Can the area support an additional shopping mall? What about medical facilities? Whose jurisdiction will be responsible for public school children? These questions arise as the design for the land is being completed. At some point, the developer(s), community administrators, and others may ask "What will be needed as far as fire protection?" When faced with large parcels of land in rural or remote areas like the wildland/urban interface, community planning boards and fire officials can now point to NFPA 1141 for the minimum requirements for fire protection infrastructure design.

What about evacuation of residents in time of natural or human caused threats?

The Technical Committee examined recent traffic studies from Portland, Oregon, and met with a traffic research professor who had loosely applied the evacuation requirements of NFPA 101 for people exiting buildings to cars exiting interface subdivisions. Other experts providing input to the Technical Committee noted that interface communities and subdivisions can be analogous to a high-rise building laid horizontally, in terms of exit requirements and challenges. Of course, because the AHJ may also consider alternatives to evacuation during wildland fires, the Technical Committee also included a requirement for the local consideration of sheltering options of exposed population within subdivision boundaries, in a manner that has been applied in emergency situations like hazardous materials spills and high wind events (e.g., hurricanes and tornadoes).

Do the new editions mean that I can't use the previous edition?

Many communities and jurisdictions are using previous editions of several codes and standards. However, the changes in these two standards clarify issues by locale and situation. By not using the current editions, you may be simply reinforcing the traditional approaches of suppression over prevention and not reducing the ignition risks posed by the threat of wildfire and rapid growth and development in suburban and rural areas.

Jim Smalley, SFPE, IFireE is Manager of NFPA's Wildland Fire Protection division. He can be reached at jsmalley@nfpa.org.

Photograph: istockphoto

A raging wildfire approaches a home.

FIREWISE COMMUNITIES PROGRAM

AS ESSENTIAL AS THE STANDARDS are to good fire protection, the national Firewise Communities program provides the needed support homeowners and local fire departments need to plan a defense against wildfire.

The Firewise Communities (www.firewise.org) program is a multi-agency effort designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire - before a fire starts. The Firewise Communities approach emphasizes community responsibility for planning in the design of a safe community as well as effective emergency response, and individual responsibility for safer home construction and design, landscaping, and maintenance.

The national Firewise Communities program is intended to serve as a resource for agencies, tribes, organizations, fire departments, and communities across the U.S. who are working toward a common goal: reduce loss of lives, property, and resources to wildland fire by building and maintaining communities in a way that is compatible with our natural surroundings.

Firewise Communities is part of the National Wildland/Urban Interface Fire Program, which is directed and sponsored by the Wildland/Urban Interface Working Team (WUIWT) of the National Wildfire Coordinating Group, a consortium of wildland fire organizations and federal agencies responsible for wildland fire management in the United States. The WUIWT includes: USDA Forest Service, USDI Bureau of Indian Affairs, USDI Bureau of Land Management, USDI Fish and Wildlife Service, USDI National Park Service, Federal Emergency Management Agency, US Fire Administration, International Association of Fire Chiefs, National Association of State Fire Marshals, National Association of State Foresters, National Emergency Management Association, National Fire Protection Association.

What you can do to reduce the threat

Whether started by humans or by lightning, they are part of a natural cycle that helps to maintain the health of our forests. Today, more than ever, people are moving into remote areas, with the desire to "get back to nature," without addressing the dangers that exist around them.

A tremendous wildfire danger exists where homes blend together with the wildland, creating the wildland/urban interface. The addition of homes there interrupts the natural cycle of wildfires. Ultimately, this contributes to a dangerous build-up of old vegetation, leading to an uncontrollable wildfire.

You and your local fire department

In a wildfire, your local fire department has two priorities—to remove you and your family from harm's way and to stop the progression of the wildfire. If your home happens to be in the wildfire's path, they may or may not be able to protect it—there are simply no guarantees. Consequently, you must take action before a fire starts.

Just the right conditions

Conditions must be just right for a wildfire to start and spread. Specifically, fuel, weather and topography work together to determine how quickly a wildfire travels and at what intensity.

FUELS: The two basic fuel types in the wildland/urban interface are vegetation and structures.

VEGETATION: Fuel in its natural form consists of living and dead trees, bushes and grasses. Typically, grasses burn more quickly and with less intensity than trees. Any branches or shrubs between 18 inches and 6 feet are considered to be ladder fuels. Ladder fuels help convert a ground fire to a crown fire (tree tops) which moves much more quickly.

STRUCTURAL DENSITY: The closer the homes are together, the easier it is for the flames to spread from one structure to another.

WEATHER: High temperatures, low humidity, and swift winds increase the probability of ignitions and difficulty of control. Short and long-term drought further exacerbates the problem.

SLOPE: Slope is the upward or downward incline or slant of terrain.

For example, a completely flat plain represents a 0 percent slope and a hillside that rises 30 feet for every 100 feet horizontal distance represents a 30 percent slope.

Hot gases rise in front of the fire along the slope face, pre-heating the up-slope vegetation, moving a grass fire up to four times faster with flames twice as long as a fire on level ground.

How your home catches fire

There are three ways that the wildfire can transfer itself from the natural vegetation or other burning homes to your home—through radiation, convection or firebrands.

RADIATION: Wildfires can spread to your home by radiating heat in the same way a radiator heats your rooms in the wintertime. Radiated heat is capable of igniting combustible materials from distances of 100 feet or more.

CONVECTION: Contact with the convection column (flames) may also cause the wildfire to ignite your house. Typically, the convective heat column rises vertically, within the smoke plume.

FIREBRANDS: Firebrands are burning materials that detach from a fire during strong convection drafts in the burning zone. Firebrands can be carried long distances—more than a mile—by the winds associated with the wildfire.

In all cases, your home's building materials and design play a significant role in establishing the level of exposure that can be endured before ignition from radiation, convection, firebrands or any combination of these three.

Taking inventory—Is your property at risk?

The first step in establishing your risk is to assess your property. This assessment will give you a good sense of your property's wildfire risk.

Creating a survivable space for your home

A survivable space is an area of reduced fuels between your home and the untouched wildland. This provides enough distance between the home and a wildfire to ensure that the home can survive without extensive effort from either you or the fire department.

One of the easiest ways to establish a survivable space is to use the zone concept.

Zone 1 is the closest to your home and **Zones 2 and 3** move progressively further away.

ZONE 1: Establish a well-irrigated area around your home. In a low hazard area, it should extend a minimum of 30 feet from your home on all sides. As your hazard risk increases, a clearance of between 50 and 100 feet or more may be necessary, especially on any downhill sides of the lot. Plantings should be limited to carefully spaced indigenous species.

ZONE 2: Place low-growing plants, shrubs and carefully spaced trees in this area. Maintain a reduced amount of vegetation. Your irrigation system should also extend into this area. Trees should be at least 10 feet apart, and all dead or dying limbs should be trimmed. For trees taller than 18 feet, prune lower branches within six feet of the ground. No tree limbs should come within 10 feet of your home.

ZONE 3: This furthest zone from your home is a slightly modified natural area. Thin selected trees and remove highly flammable vegetation such as dead or dying trees and shrubs.

So how far should Zones 2 and 3 extend? Well, that depends upon your risk and your property's boundaries. In a low hazard area, these two zones should extend another 20 feet or so beyond the 30 feet in Zone 1. This creates a modified landscape of over 50 feet total. In a moderate hazard area, these two zones should extend at least another 50 feet beyond the 50 feet in Zone 1. This would create a modified landscape of over 100 feet total.
In a high hazard area, these two zones should extend at least another 100 feet beyond the 100 feet in Zone 1. This would create a modified landscape of over 200 feet total.

The importance of maintenance

Once you have created your home's survivable space, you must maintain it or risk losing the benefit of its protection.


Dine and Dan
COCOANUT GROVE

LAST DANCE AT THE COCOANUT GROVE

The Cocoanut Grove was one of the most popular nightspots in Boston, Massachusetts before and during World War II. Today, the Grove still exists, though only as a piece of history—a poignant niche carved into the edifice of time.

By Casey C. Grant, P.E.

UNLESS OTHERWISE NOTED, ALL PHOTOGRAPHS: CORBIS

TO THOSE unfamiliar with the Cocoanut Grove, the name itself brings to mind palm trees, laughing crowds, cocoanuts, dancing and just a good place to go and enjoy oneself with friends. The Grove had all of this. But, this is not how it's remembered. In Boston, the Cocoanut Grove is etched forever in history as a city's worst nightmare, with piercing screams, wild-eyed panic, and terrible heartbreak.

On the chilly New England Saturday evening of November 28, 1942, the Cocoanut Grove was packed beyond capacity with upwards of 1,000 people. Just after 10 p.m. in the Melody Lounge located in the basement, a small fire broke out in a fake palm tree, and then quickly spread across the ceiling decorations.

In the official Boston Fire Department report released after the fire, Fire Commissioner William Arthur Reilly estimated that the fire took only two to four minutes to develop momentum and cross approximately 40 feet of the Melody Lounge to the only public stairway out of the room. In seconds it had flashed passed the first floor foyer and the main entrance, and into the main dining room. From the first appearance of flame until it had explosively traversed the main dining room and passed, almost 225 feet away, to the entrance of the Broadway Lounge, the commissioner estimated at total time of an incredible five minutes at most. At this point in time, all exits normally open to the public, of which each had something functionally wrong, were useless for a safe escape.

In minutes, the Cocoanut Grove was an inferno from one end to the other. Some escaped untouched but most did not. Rescuers pulled out trapped survivors and victims as quickly as possible, so that by midnight, the once bustling Cocoanut Grove was a blackened, soaking, but now empty hulk of a building. Just like the fire itself, the entire incident was but an instantaneous flash in its history, but the ramifications of this inferno are felt to this day.

This story is an update of my original story that appeared in the *NFPA Journal*® in 1991. I have included additional information that relates to our codes and standards that was not available when the story first ran.

In addition, of the five individuals who were interviewed for this article in 1991, I am aware that Messrs. Graney, Collins, and Moore have passed away. On this basis I've revised the conclusion of each of their personal accounts to be independent of time.

Interior of a bar inside the Cocoanut Grove before the fire

While interviewing the people included in this article, they at times referred back to earlier testimony and interviews. Any similarity to other published material on this subject is based on the interviewee's own reflections on such material.

Sixty-five years have passed since that fateful evening. Many who were in the Grove and escaped, or were involved in some other way, are now gone. But some remain, and nobody knows the Cocoanut Grove's final moments better. Here are their stories.

THE PATRON

"We went to watch Boston College beat Holy Cross, and instead it was one of the greatest upsets in college football history," says Hewson Gray of Waltham, Massachusetts. That afternoon's big football game was the first in a series of events that would lead Gray, along with his wife and their companions, face to face with destiny.

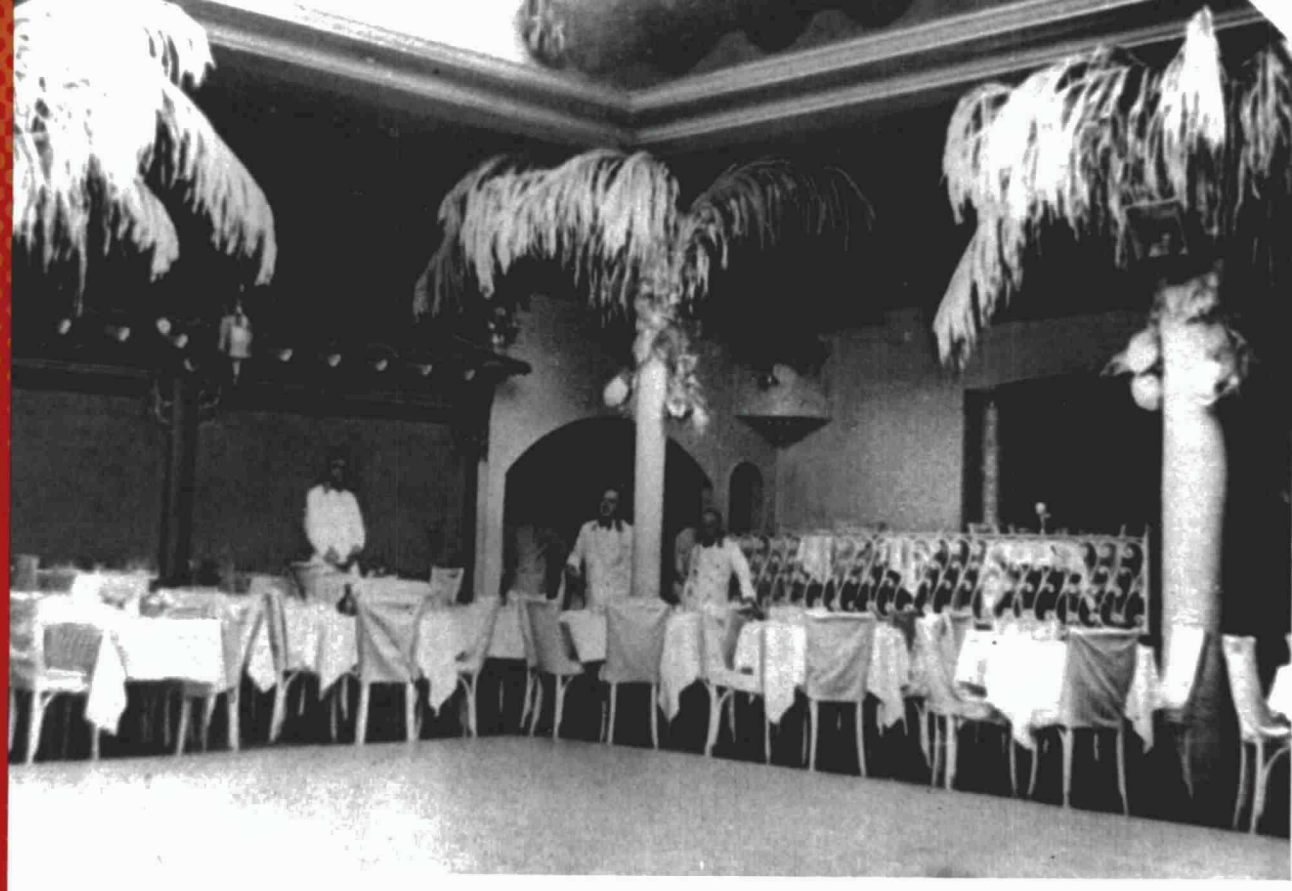
Hewson Gray and his wife, Hilda, went to the game at Fenway Park that afternoon with Hilda's sister Josephine Driscoll, and her husband, Francis. Later that evening, they would meet two other couples at the Cocoanut Grove for dinner.

The Boston College Eagles were better than six to one favorites over Holy Cross. They were undefeated with a very tough schedule, and they looked forward to pounding Holy Cross in the traditional end-of-the-season football rivalry. In contrast to the BC strength, Holy Cross had a balance of wins and losses in accordance with a rather mediocre schedule. Sugar Bowl representatives were in attendance on behalf of Boston College, and the only question before game time was by what margin BC would win.

"I was, and still am, a Boston College fan, but what a sad afternoon it was for the Eagles. We were stunned," says Gray.

The final score was an incredible 55-12 upset, which remarkably were the same numbers of the two BC co-captains shown on the cover of the game program. Yet, even more remarkable is how delicate the balance of fate really is, since BC planned to hold the team's victory party that evening at the Cocoanut Grove. Major Tobin himself would have led the revelry. Of course, all thoughts of a formal party were cancelled because of the magnitude of the defeat, but that loss kept them from an event in which the odds were a mere one to one between life and death.

But some of the BC contingent would carry on with the evening's plans despite that afternoon's



Dance Floor area, pre-fire

debacle. Among these were the Grays and the Driscolls, who were obligated to meet up with the other two couples.

Their reservation at the Grove was for late evening, and in the meantime, they journeyed to several other clubs in the South End and Back Bay districts of Boston. About 8:30 p.m., Gray parked his car on Berkeley Street so that the group could cap the evening off with dinner and a show at the Cocoanut Grove.

The other two couples met them at the Cocoanut Grove. They were friends of Josephine Driscoll, one couple being from Dorchester and the other from Newton. The Grays had never met those other two couples, but they fondly noted that the wife from Dorchester was eight months pregnant. Hewson and Hilda Gray had been married almost ten years, and despite trying to have children, it would be another two years before their first child was born.

After leaving their hats and coats at the coat room, the party of eight waited momentarily in the lobby while their table was located.

"It was so crowded that you had to turn sideways to get through the tables in the dining room," explains Gray. "They were having trouble getting us a table despite our reservation. We had to go all the way across to the far corner of the dining room, over to the other side of the stage. O'Brien was the name reservation on the table that they finally gave us."

Even though this excursion to the far corner was not a big deal, it was somewhat annoying. Yet here fate was kind, since there were four O'Briens killed in the fire.

"We always wondered where the O'Briens sat; that is, where we should have been. We were lucky," he said.

With their table in the corner, Hilda Gray had her back to one wall and remarked at one point that "the wall felt hot." To satisfy their own curiosity, they each took a turn touching the wall and found it warm to the touch. This novelty provided an item of discussion, and since the outside temperature was near freezing, the men joked that if the women felt cold they should just lean against the walls.

"We can't imagine why the walls were noticeably warm like they were," adds Gray, "But after the fire we had to wonder if this somehow contributed to its violent spread. It was so fast."

The nightclub's show was scheduled to begin about 10 p.m. Gray went to the men's room located at the opposite corner of the dining room, just off the lobby at the top of the stairway that led down to the Melody Lounge. Because he had to push through the crowd, this journey was more arduous than usual.

Just as Gray had returned to his table and had sat down, they heard a commotion from over by the lobby where Gray had just come back from. Initially it sounded like people were shouting, "fight," with some of the people bumping each other in an at-

Photograph: NFPA

tempt to clear out of the lobby area. Then they saw a blue and yellow sliver of flame flash up to the ceiling.

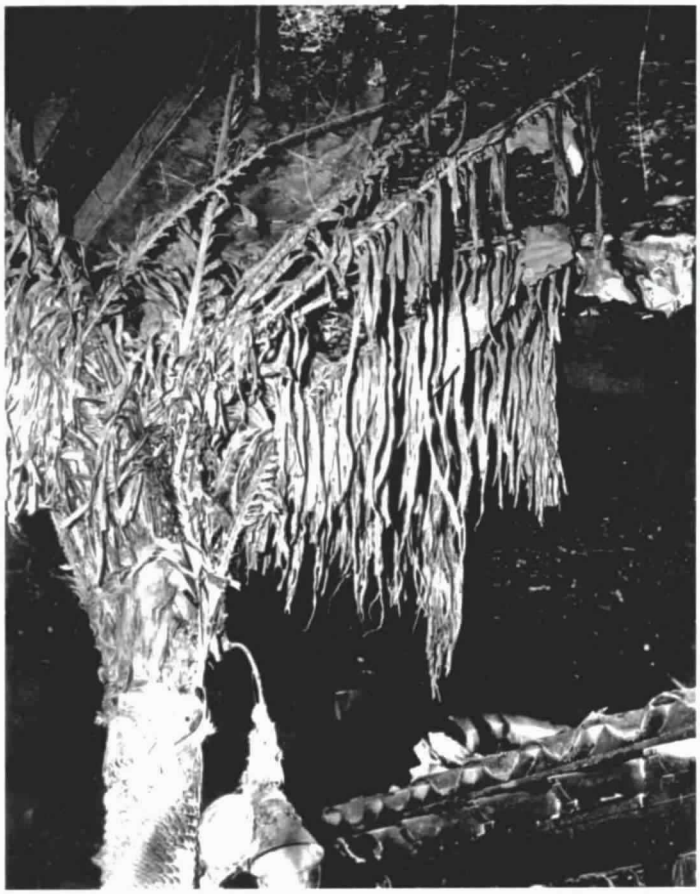
With the realization that a fire was the cause of the activity over on the far side of the dining hall, the instantaneous reaction of those on the other side of the room was—nothing. They weren't sure the fire was bad and it was far across the other side of a very crowded room. One of the waiters immediately rushed across the dance floor and began fumbling through the drapery on the Shawmut Street wall of the dining room, and it became evident that there was a door behind these drapes and he was trying to open it. Then almost as quickly as the commotion had started, the small flame became a fireball, racing toward the center of the dining room, igniting tablecloths and anything else it could touch, and a solid wave of humanity jumped and started running away from it, toward Hewson Gray and his party of eight.

The Grays, the Driscolls and the other two couples in their group jumped to their feet and were pushed toward a service door behind them leading to rooms behind the stage. A mass of people was coming toward them and there was nowhere to go but through the service door and beyond. As they were being swept towards this service door, the waiter and the others with him got the Shawmut Street door open, and people in the dining room started to flood out this open door with fire over their heads. Although Gray and his party were relatively close to this now-opened door, they were being swept away from it and toward the service door in the corner by the crowd of terrified dining room patrons. And then, just as Gray entered the service room off of the dining room, the lights went out.

In the darkness, they followed the person in front of them, not sure where they were going.

"We took a couple of corners and went up some stairs. There were some more stairs that went down, but we didn't take them. We followed a wall, and took some more turns—it was very confusing in the darkness," says Gray.

Hewson and Hilda Gray and the others were still all together, but a minute or two had passed and the smoke was starting to build in the little back rooms now jammed solid with people. Being at the corner table allowed them to be at the front of the tide of humanity, and they could feel in the darkness that they had come to still another door. But it was locked. Several men near the front teamed up to try and break it down. Just when this seemed hopeless, with a loud crash, the door flung open and there were firemen with axes. Outside the club became just as chaotic as the people in the small service rooms poured out into the street into the strikingly cold air. This was one of the first doors opened by the fire department, which by tremendous good fortune happened upon the scene after responding to a nearby car fire.



Dance Floor palms, post-fire

"Once out of the building, we all stumbled in the night air across Shawmut Street," says Gray. "Then we realized the lady from Newton wasn't with us."

The four men started to fight their way back through the outpouring crowd when all of a sudden the missing woman was swept into their midst. She quickly explained that she somehow got separated and found herself going "down a staircase." Without hesitation, she had turned around and now, was out. All eight in their group were safe and reunited on Shawmut Street, allowing the four men to return to the service door entrance as people stumbled out of the burning club.

"Now, people were collapsing as they came out, having had been exposed to the smoke and flames.

Photograph: NFPA

About 10:15 p.m., some of the crowd started to sing along with the lounge piano player as she hammered out a popular wartime tune.

They were dropping all around, even some that looked okay, but some had soot around their faces. They were lying everywhere." Gray says.

In almost no time at all Shawmut Street had become a seething mass of humanity. In addition to the people coming out of the Grove, fire fighters and police officers were arriving on the scene in growing numbers as well as volunteers from many other facets of the community. People were also coming from the other nearby clubs and hotels. In all the commotion, the four men did what they could to help the people get out of the club. It was now readily apparent to Gray and the other three with him that many people had not escaped and the smoke and flames within the building were now unbearable.

After helping all they could, the four men returned to find that the four women were gone from the other side of Shawmut Street. The men knew they were out but they still worried. They searched the outside crowds for almost three-quarters of an hour, then finally came across them sitting in a restaurant at the corner of Shawmut and Broadway having coffee. It turns out that a lady had come by and taken them to her home to give them warm clothes as their coats had been left inside the Grove. The temperature had dropped and was now below freezing, causing numerous ice patches to appear from the water being put on the fire. To control the crowds, the police started blocking off the streets. The four women went to the lady's house, got the warm overcoats they now wore, and then snuck back through the police lines. They finally ended up in the restaurant in a further attempt to stay warm. The party of eight, now reunited, was directed to a nearby hotel that was set up as a base for the Red Cross.

"As we walked up to the hotel a cop in the front was talking to a civilian and said to him 'They were all drunk—that's why they died.' We were furious, all of us, and we gave him hell!" says Gray.

Their hats and coats weren't the only possessions lost in the fire. They also lost their car keys. The Red Cross arranged for rides, and Hewson and Hilda Gray were driven home about an hour after they had left the scene at the Cocoanut Grove. The next day Gray got a ride down to pick his car up on Berkeley Street using a spare set of keys. A number of cars were still there, and he paused for a moment and thought about their owners if they had survived. About one week after the fire, while at home, Gray received a call from the Boston Police Department. His keys, which had an ID tag on them, had been found.

THE EMPLOYEE

On the evening of November 28, 1942, Daniel Weiss was working the cash register on one side of the bar in the Melody Lounge.

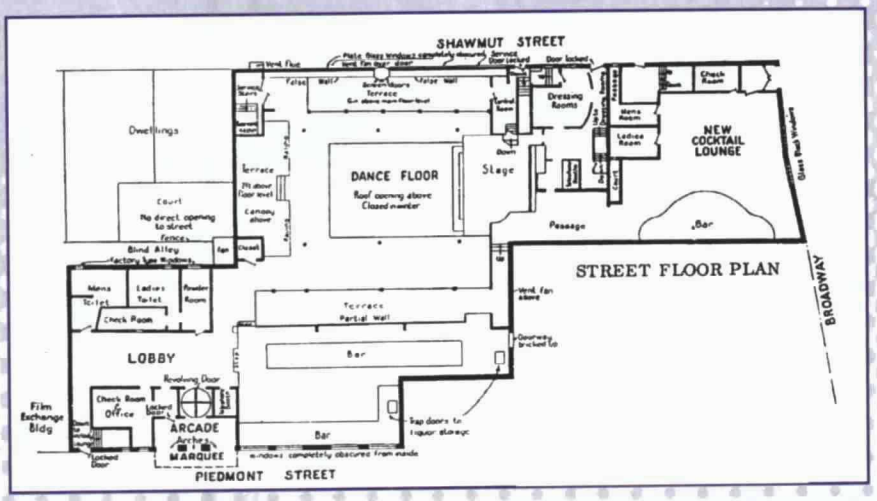
"The evening started, at least, just like any other Saturday at work in the Grove, " says Weiss.

The Melody Lounge was directly below the main lobby of the Cocoanut Grove. A single stairway descended into the lounge, which was comprised entirely of a bar in the center with seating around the bar and throughout the room. With a tropical motif of palm trees, greenery and cocoanut husks, the dimly lit lounge could accommodate up to about one hundred customers without discomfort, but this evening, people were four deep around the bar bringing the total in the basement lounge to probably twice that number.

Daniel Weiss was 24 years old at the time. In his fourth year as a medical student at Boston University he had worked weekends at the Grove for the past three years for his uncle Barney Welansky, owner of the Cocoanut Grove. He was just a few months away from beginning his career in medicine.

About 10:15 p.m., some of the crowd started to sing along with the lounge piano player as she hammered out a popular wartime tune. Despite the overcrowding and the difficulty keeping track of patrons, there was a stir in the corner to the right of the stairs that caught Weiss's attention.

FIRE SAFETY REGULATIONS



THE COCOANUT GROVE FIRE was an immense tragedy. Yet this event brought about very positive changes in regulations concerning fire safety. Furthermore, it stimulated action all over the nation. Fire officials from all over the country came to Boston in the days following the fire to take back with them the painful lesson learned.

Perhaps the most searing discussion of this subject was published in a front page article of the international newspaper *Christian Science Monitor* on the Monday following the fire. The following quotation is from this article, entitled "Call for 'Fire Trap' Cleanup Follows Night Club Disaster".

"Boston building laws are in a 'chaotic condition', subject to 'incompetent enforcement, political influence and careless management' charged Robert S. Moulton of the National Fire Protection Association. 'The Cocoanut Grove night club tragedy,' he declared 'is clearly due to gross violation of several fundamental principles of fire safety, which have been demonstrated by years of experience in other fires, and which should be known to everybody'.

"Expanding upon his charge that Boston's building code is 'chaotic', Mr. Moulton said, 'the most glaring feature of this tragedy was the lack of proper exits. Revolving doors have long been considered by the National Fire Protection Association Committee on Safety to Life as a menace under fire and panic conditions. Even though a revolving door may be a so-called collapsible type, it can readily serve as a death trap.' The principal Piedmont Street entrance to the Cocoanut Grove was a revolving door.

"Mr. Moulton pointed out that the National Fire Protection Association had formulated a standard *Building Exits Code* through representative committees of the Nation's experts. Under this code, night clubs are 'rightly considered essentially a place of public assembly' he declared, 'in the same class as a theater, but having greater possibilities of fire.'"

In the year following the fire, building codes from coast-to-coast were revamped in accordance with the knowledge gained from the fire. In a United Press article entitled "Nation's Cities Order Stringent Fire Prevention" that ran four days after the fire, changes in fire regulations were referenced in St. Louis, Miami, Cleveland, Philadelphia, Detroit, Des Moines, Chicago, Kansas City, Albany, and Helena Montana.

And of course the Massachusetts legislature had introduced and adopted a flurry of new measures regulating fire safety in public buildings. One of the first of a series of changes affecting virtually every public building in the Commonwealth of Massachusetts was symbolized by the removal of the two revolving doors from Boston City Hall four days after the fire.

With the widespread and numerous changes in fire safety regulations, the most notable advancements that had gained recognition can be summarized as follows:

- **Exits.** All portions of a building used for public assemblies should have two separate and remote means of egress. The necessary number of reliable exits should be available for the expected occupancy. Exits should function only with approved panic hardware and swing with the direction of flow. Revolving doors are unacceptable as exits and must be flanked by standard exit doors.

- **Combustible Materials.** No combustible materials should be used for decorations in places of public assembly. Materials used for interior finishes should conform to nationally recognized test methods.

- **Definition of Places of Public Assembly.** Surprisingly, night clubs and restaurants had not been considered in many jurisdictions as places of public assembly. After the fire, however, this changed. The shortcoming of building regulations that had evolved based on political favoritism while neglecting real danger were now painfully obvious.

- **Emergency Lighting.** Lights for an emergency situation should be permanently installed to allow egress from the building. These lights should be reliable and independent from the regular lighting.

- **Automatic Sprinklers.** Even though overshadowed by such flagrant inadequacies as the lack of proper exits, it was recognized that automatic sprinklers would have dramatically changed the outcome of this fire. This gained recognition as an alternative to difficult regulatory situations, such as an existing restaurant or nightclub located below grade.

He had noticed moments earlier that one of the white-jacketed bar boys had been conferring with the head bartender, John Bradley, about turning a light back on in the corner. Apparently, a patron had unscrewed the light to place himself and his girlfriend in a veil of solitude in the already dimly lit lounge.

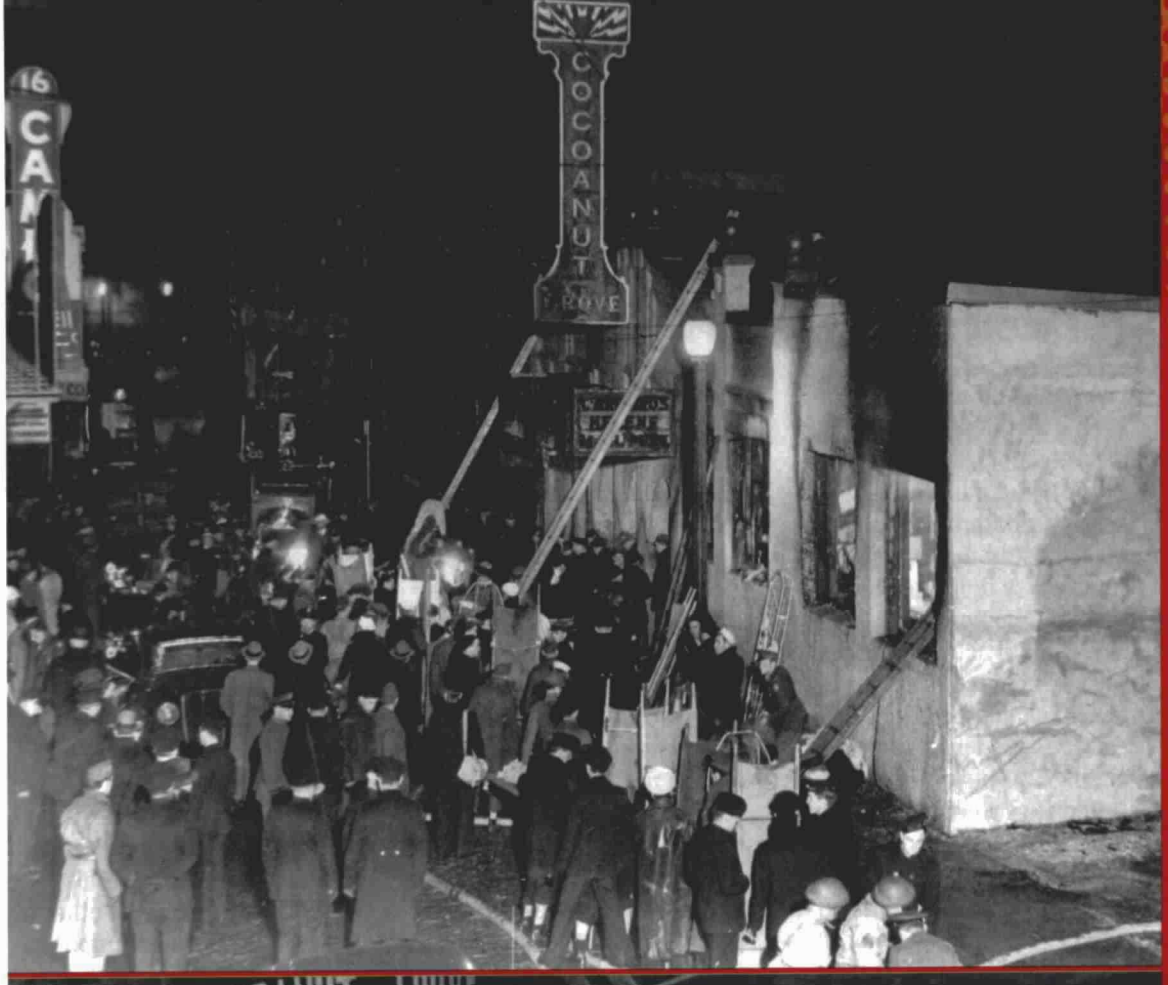
After the bar boy had turned the corner light back on and returned to the bar, a sudden flurry of movement occurred in the corner. While some who were only a few seats away concentrated on the singing and were oblivious to the commotion, several in the immediate vicinity had jumped to their feet, some backing off and peering up. And there it was—a small flicker of blue light dancing about the top of the palm tree where it met the lowered ceiling.

In the next instant, the blue spurt of energy became a ring of orange outlining an ever-widening black hole in the fabric, with little jets of flame jumping up and down on the imitation bamboo.

"Get water quick. There's a fire!" someone shouted.

The anxious pause that followed was as if the hearts of those who could see what was happening skipped a beat.

Weiss guarded his register as was expected of him during any type of commotion while John Bradley and several other employees made a frantic but feeble attack on the flames. Water from a pitcher and a siphon bottle of seltzer were ineffective. A bar boy swiped at the flames with a towel, but the orange and blue flames continued their ever-widening circle across the ceiling decorations. Another employee returned from the kitchen with an extinguisher, but the flames had advanced to a point beyond any appreciable service that the device could offer. The music had stopped, but even so, the noise of the crowd continued and many



Opposite page: Members of the military assist in rescue efforts.

This page: Police and fire officials work to get people out.

Photographs This Page: NFPA

EMERGENCY DISASTER PREPAREDNESS

IT WAS 1942 and the United States was at war. On the weekend before the Cocoanut Grove fire, a mock disaster of a supposed German Luftwaffe "blitz" tested the response of some thirty thousand of metropolitan Boston's Civil Defense workers. All activity throughout the city came to a halt as close to 200 simulated explosions and fires produced approximately 300 phantom casualties. Authorities were pleased with the outcome of the drill, but nobody would have guessed that even before the passing of a single week the value of this drill would be put to its ultimate test.

By tremendous good fortune the Boston Fire Department happened upon the Cocoanut Grove scene after responding to and extinguishing a nearby car fire. This providential circumstance was credited by one estimate as saving upwards of 100 of the building's occupants. In all, the five alarms sounded for this fire brought twenty-five engine companies, five ladder companies, one water tower, one rescue company, and a variety of other emergency apparatus. The Police Department provided ambulance service, maintained law and order in the vicinity, roped off streets, and provided routes for emergency vehicles to transport the casualties. Many other agencies responded to the scene or shifted into operation, including members of the United States Army, Navy, Coast Guard, Civil Defense, Red Cross, and Salvation Army.

At times, a question existed as to who had authority over who at the fire scene, this being compounded by the presence of the Fire Commissioner, Police Commissioner, Mayor, State Fire Marshall, Commissioner of Public Safety, Civil Defense Director, and a variety of United States Military Officials. But this problem was academic, since attacking and extinguishing the fire was relatively straight-forward and accomplished effectively by the Fire Department. The primary focus of the event was rescue, and this was more an instinctive operation that proceeded urgently with minimal needed direction.

Today, the topic of disaster preparedness is directly addressed several documents but perhaps most notably NFPA 1600, *Disaster/Emergency Management and Business Continuity Programs*. Many of the details of the Cocoanut Grove Fire, and in particular the overall response to the disaster, relate to the concepts addressed by NFPA 1600.

For this disaster, the greatest challenge was the disposition of the human wreckage. The numbers of injured, dying, and dead were staggering beyond anyone's comprehension. People, both living and dead, were transported to the hospitals in all available vehicles that included ambulances, police cars, taxi cabs, private cars, and even newspaper delivery trucks.

The only lack of coordination evident in hindsight was the failure to more evenly disperse the victims among the area's hospitals. The customary hospital serving this area is Boston City Hospital, and this single medical facility received the lions-share of victims. Boston City Hospital became so overwhelmed that while victims, living and dead, lined the corridors of the admitting area, vehicles of every kind were outside lined up out of sight, waiting to unload their macabre cargo. Finally, word of this situation reached the fire scene and the overflow was diverted to Massachusetts General Hospital, this being the other of the two medical institutions to receive most of the victims.

In summary, the following hospital statistics highlight the challenges that faced the medical community following the Cocoanut Grove fire:

General Hospital Statistics

- Mass General received 114 casualties by 12:45 a.m. Sunday morning, second only to Boston City Hospital which received over 300. Numerous other civilian hospitals and military installation received only a few patients each. This includes about 30 other victims distributed among the following hospitals: Peter Bent Brigham, Beth Israel, Cambridge City, Kenmore, Faulkner, St. Elizabeth's, Malden City, Massachusetts Memorial, Carney, and St. Margaret's.

- The total casualty list, of both surviving and dead, included persons from twenty-five of

the forty-eight states and the District of Columbia, plus one from Brazil.

- Fifty-one servicemen and two WACS were killed, and 26 others were hospitalized. The fatally injured servicemen, some of whom had ironically returned safely from battle overseas, included 17 from the Army, 26 Navy, 3 Marines, and five from the Coast Guard.

- Anticipated injury to death ratio for a disaster is typically 3 to 5 injured for every death. This disaster had those numbers reversed.

- In two separate reports, 54% of Grove survivors from Boston City Hospital interviewed were afflicted with "post-traumatic neuroses"; this was about 44% at Mass General. It was observed that a surprising number of relatives and friends had an "emotional upset that attained proportions of a major psychiatric condition and needed trained intervention."

- Recognizing that this was a community misfortune, the hospitals rendering service never charged any of the patients from this fire. The Red Cross provided considerable relief in the form of financial aid to both the public and private hospitals. This was especially helpful to Boston City Hospital, receiving generous volunteer medical assistance to offset its enormous influx of patients.

Profile of Boston City Hospital

- In little more than one hour after the first Grove victim was received at Boston City Hospital, over 300 had been received. This calculates to one Grove victim being received at Boston City Hospital every 11 seconds over a time period of approximately 1 hour and 15 minutes. This is one of the all-time highest admittance rates anywhere in the world.

- Within 2 hours of the fire, Boston City Hospital had admitted 132 injured victims, with over 200 dead and still counting.

- By the end of December, 1942, Boston City Hospital's mortality rate was close to 30% (36 out of 132), with a number of these wholly or partially attributable to "full thickness" or third-degree burns.

- By February 1943, the official death toll was 488 and only 3 survivors remained critical, all at Boston City Hospital.

- In May, 1943, the last Grove casualty, a woman from Dorchester, MA died at Boston City Hospital after five months of withstanding both grave burns and compounded internal injuries.

Profile of Massachusetts General Hospital

- Of the 114 Grove victims delivered to Mass General within two hours after the fire, only 39 were still alive to be treated. Seventy-five were dead on arrival or before treatment could be given. (Many of the dead were not burned). Three married couples were among the survivors, but 17 were among the dead, and a number of other survivors had relatives who succumbed.

- Ten of the 39 living admitted to Mass General had significant burn injuries. The other 29 had slight or no external burns, but some of these suffered gravely from severe lung damage and anoxia (restricted oxygen supply to body tissues). All 39 patients at Mass General were bedded down by 3 a.m. Sunday morning. This included 21 males and 18 females. Thirty-two were in stable or good condition, 7 were critical, including movie star Buck Jones.

- Mass General lost 7 of its original 39 surviving patients in the first 3 days. Buck Jones was the fifth among these.

- By the end of December, 1942, Mass General's mortality rate was about 18% (7 our of 39). None of these were directly attributable to burn deaths.

- By the end of January, 1943, nine of the original Grove survivors remained at Mass General Hospital.

- In April, 1943, the last survivor from Mass General was discharged, four and a half month after admittance.

A floor plan of the nightclub details the access and egress points.

seemed to be unaware of the growing concern.

Few people made any effort to leave, as if hypnotized with fascination and disbelief. John Bradley, and a busboy struggled to yank the palm tree, now ablaze like a torch, down off of its wall mooring. With a mighty yank and a shower of sparks, the tree finally came down, glancing off the howling Bradley and dragging a piece of flaming satin ceiling decorations onto the arms of the busboy. Unfortunately, their efforts were to no avail. The fire was now well involved in the ceiling fabric, and as if signaled by the falling tree, it suddenly flashed across the satin ceiling decorations with terrifying speed.

At that moment the spellbound crowd panicked. Screaming and shouting, the mob rushed madly to the stairs, the only obvious exit. Fortunately for some, John Bradley had flung open the camouflaged service door and a small group was shepherded into the kitchen. But most were unaware and scrambled towards the stairway, which had now become a chimney. A few lucky ones made it out before the flames, but without hesitation a wall of bodies appeared as quickly as the panic, blocking the only exit and trapping the mob in the now-searing inferno.

During the panic, "I hesitated, staying at my post despite being terrified," Weiss says.

By instinct, the cashiers were entrusted with safeguarding the bank during a disturbance, which normally would include such comparatively mundane occurrences like a fight. But this situation was very different. The other cashier had already scrambled into the kitchen, and as Daniel

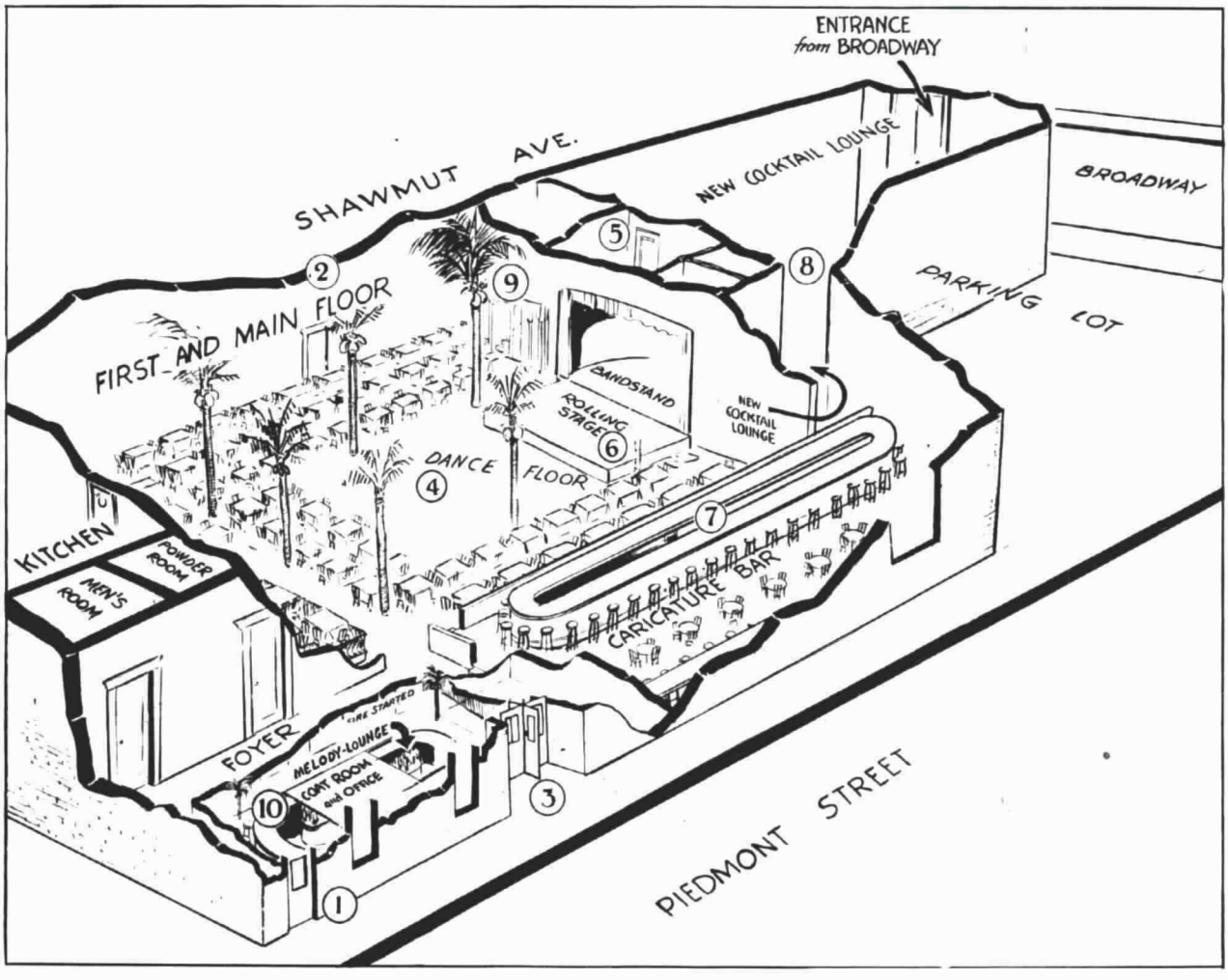


Illustration: NFPA, International News Photos

The burnt out night-club entrance is examined.

Weiss watched in horror as people were being burned alive on the stairs and were falling victim to the ever-thickening smoke and fumes fed by the blowtorch over their heads, he knew he had to get out. Just as he sprang for the gate underneath the bar, the lights went out.

Dropping to his hands and knees, he scrambled in the darkness to the bar gate and pushed, but it was blocked. Remembering the sight of those being asphyxiated, he stayed low. It was becoming difficult to breath, so he maintained his crouch, reaching into one of the sinks and soaked a bar towel in the dishwater. With a seething maelstrom all around him, he placed the cloth over his mouth and nose and lay face down on the floor.

"The closer I was to the floor, the easier it was to breathe," Weiss says.

The smoke was thick and choking, but for the moment this quick-thinking tactic was working. Weiss then realized that the screaming and crying that filled the lounge had subsided into only moaning and scratching, and this in turn was followed by an eerie foreboding silence. What was happening? Even the fire seemed to be gone.

In the darkness and in the silence, Weiss did the only thing he could do—he waited. As the seconds slowly ticked away, he desperately wanted to get out, and crawled to the bar gate, but again it wouldn't budge. Terrified at the thought of dying with the rest, Weiss took a deep breath, rose, and lunged over the counter. But instead of the floor, he landed on bodies.

Scrambling in horror and somehow still holding his breath, he fumbled through the service door into the welcomed chill of the smokeless passageway to the kitchen. Weiss believes he was probably the last person to leave the Melody Lounge alive.

Feeling his way through the dark passageway, Weiss found his way into the spacious basement kitchen. Under the light of a single bulb he was astonished to find several dozen people, most of them patrons, huddled around in an anxious daze. Some of the kitchen help were there, including the club's food cashier, an older lady named Katherine Swett.

"I always thought of her as 'the Irish lady,'" Weiss says. Dutifully, she had no intention of leaving her register and later would become a victim to the intensifying fumes in the basement.

In a flurry of anxious talk, it was unclear as to why these people remained huddled and were not making an effort to leave. Weiss took the initiative and headed for the kitchen stairs that served the main dining room, wondering if the people up in the club had any idea what had happened in the Melody Lounge.

"I got halfway up the stairs, and then it hit me like an inferno—the heat upstairs was unbearable," Weiss says.

It had never occurred to him that the rest of the Cocoanut Grove was now experiencing on a much greater scale the same disaster suffered in the Melody Lounge. Before retreating, he recalled once again hearing screaming, crashing of furniture, and the crescendo of the fire itself.

Remembering the service stairs beyond the furnace room on the other side of the kitchen, Weiss convinced the fearful and hesitating group to follow him through the darkened passageways. These stairs led to the service rooms behind the main dining room stage, and then directly out to Shawmut Street. But as the group apprehensively came through the storage room, they opened the door to the furnace room and were hit by the warm air and soft light from the club's boiler plant. As one woman screamed, another yelled, "He's leading us into the fire!" and the group broke ranks in a panic, retreating to the kitchen.

Once again they were all in the kitchen and he pleaded with the group. Smoke was now curling around the light bulb. This time, clinging to the security of the kitchen, none would follow him and Weiss could only promise that he would send help.

As he came to the top of the service stairs, he found himself exiting among gasping survivors who were somehow still stumbling out of the upstairs part of the club. The scene on Shawmut Street was chaotic. People were running everywhere: firemen, policemen, servicemen and civilians. There was shouting, screaming and sirens. Singed survivors stumbled around in a daze, and everywhere there were bodies, tossed about like rag dolls.

Once outside, Weiss cried out that others were trapped in the basement. Fire fighters were now entering the building in numbers and for him try and re-enter the club was clearly impossible. He drifted about on Shawmut Street in a stunned daze, becoming oblivious to the maddening scene. Not sure what to do, he realized his family would be worried so he wandered over to the nearby Rio Casino, owned by his Uncle Jimmy. He was happy to find that some of the Grove's help and entertainers had also ventured over to the Rio Casino.

As expected, Weiss's frantic parents were greatly relieved to receive his phone call. Immediately, they rushed to meet him. Daniel's father was himself a doctor, and upon seeing blood on Daniel's neck insisted on going to Boston City Hospital.

The scene at City Hospital, which had received the majority of the victims, was like a war zone. People were everywhere. Over 300 casualties were received over a period of a little more than one hour. It was calculated that one Grove victim arrived at Boston City Hospital every 11 seconds over a 75 minute period, ranking this as one of the highest hospital admittance rates ever.

On Sunday, the day after the fire, the police secured the area around the Cocoanut Grove. None of the people who were in the Grove during the disaster would see the inside of the building again, except for the few public officials who were in the Grove when the fire broke out, like Civil Defense Director John Walsh who escaped out the Shawmut Street exit—and Daniel Weiss.

On Sunday afternoon, Weiss was allowed to pass through police lines with an escort to assist in securing the money located in Cocoanut Grove's cash registers. The building was gutted, with everything black and broken and sad, Weiss says. Furniture was upended and scattered everywhere. Below, the Melody Lounge was eerie and water logged.

"I was only doing my duty, it was not necessarily strange. The magnitude of the event was not fully known, I'm not sure I fully realized the extent of what had happened at the time," Weiss says, who recalls the moment with a multitude of emotions.

While the building was heavily damaged and first assaulted his senses as a blackened hulk, he noticed how the fire damage in many places was strangely limited to the upper portions of the facility. In the Melody Lounge much of the bar appeared to be untouched. Even in the main dining room the fire damage seemed to be confined to the upper reaches. A hole was in the dining room ceiling and

Police officers survey the damage in the daylight.

the wall and plate glass windows on both sides of the room had been smashed through, letting in the day's sunlight.

Dr. Daniel Weiss became a well-known psychiatrist. Highly respected in his field, he often served as an expert witness in major court cases. Occasionally, he still gets calls from people asking if he knows what happened to a certain individual.

"I could hardly keep track of myself!" says Weiss. "The only person I ever kept in touch with through the years was a fellow nicknamed 'tar baby'. He was the other bartender working in the Melody Lounge."

A report by Dr. John W. Powell, a Maryland psychiatrist, studied many aspects of the Grove fire and classed it as one of the rare instances of true panic in this century.

"I'm not directly familiar with Powell's report on the Grove fire, but it indeed was one of the rare instances of true panic in the twentieth century," says Weiss.

"Certainly, at the time I had no idea that it would be such a prominent historical event," he says.

THE FIRE FIGHTER

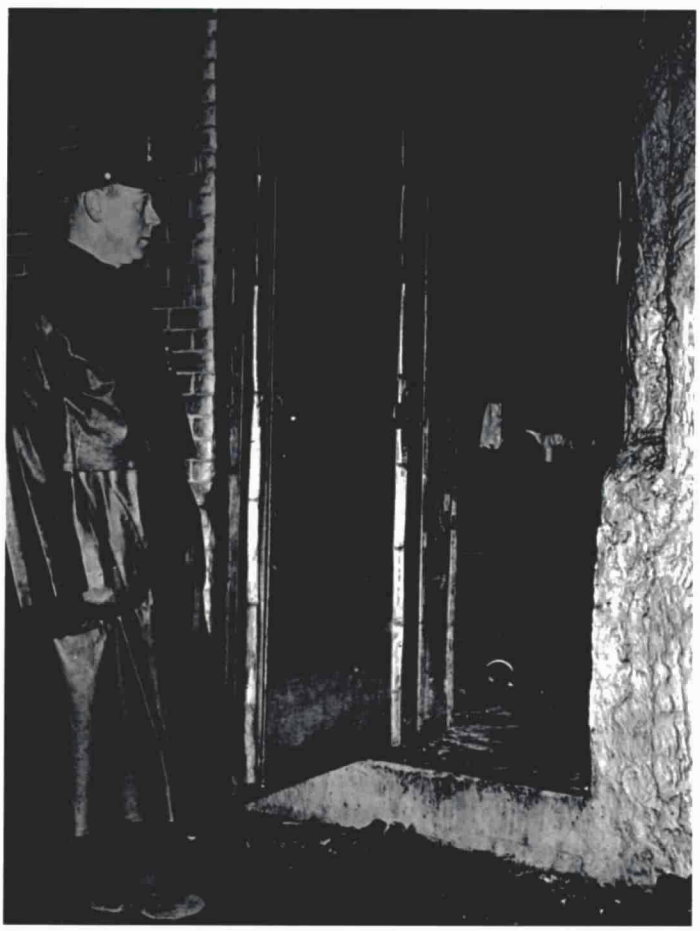
George "Red" Graney reported to work on Saturday evening, November 28, 1942. Graney had been on the Boston Fire Department for five years and at the time was assigned to Engine Company 35. This company was located in the old firehouse on Broadway by Warrenton Street, near the Don Bosco High School along with Engine 26, Rescue 1, Water Tower 2 and District Chief 5.In many ways, Saturday night began like any other, but the mood was still somber in the firehouses throughout Boston. Just two weeks prior, six fire fighters were killed at a major fire in Maverick Square in East Boston. Graney had also worked on that Saturday evening and Engine 35 had responded to the fire on the fourth alarm. Just after they had arrived at the scene the building came down. Ladder 8 was in front of the building and was crushed by the debris. Ladder 8 was known as the white elephant, so named because it was too big to maneuver in Boston's small streets and was painted white instead of the traditional fire engine red. As bad as this tragedy was, it would soon become overshadowed by a calamity of greater proportions.

At 10:15 p.m. an alarm box had begun to sound: one . . . five . . . one . . . four. Fifteen-fourteen; Stewart and Carver Streets, South End. This was a border line call on two districts. The firehouse was only a short distance away and the apparatus arrived in very short time to find an automobile fire. The rear seats of the car were aflame and someone had pulled the street box. Graney and the others on Engine 35 immediately went to work by pulling the

seats out of the rear of the car and throwing them onto the sidewalk. The booster hose from Engine 35 was then used to quickly extinguish the small fire.

Once the fire was extinguished, Graney and fellow fire fighter Arnie Snell were loading the booster hose back on the reel. Hearing a commotion the fire fighters turned around at which point one of them exclaimed, "Hey look, there's another one around the corner." With the hose now back on the pumper, they immediately backed around and drove over to the Broadway Street side of the Cocoanut Grove parking, right in front of the door to the new lounge.

People were running everywhere. Smoke was pouring out the Broadway Street door of the new lounge as screams pierced the air. District Fire Chief Daniel Crowley who had also responded to the car fire had seen enough upon arrival. He immediately ordered one of the fire fighters to get to nearby box fifteen-twenty-one and skip the second alarm and sound a third. This was received at Boston Fire Alarm Headquarters at 10:23 p.m. One minute later at 10:24 p.m, Chief Crowley ordered a fourth alarm be sounded for what would eventually be a five-alarm fire.



A police officer peers into the nightclub.

Engine Company 35 was a two-piece engine company with a hose wagon and a pumper. The pumper was driven and operated alone by Paul Rodd. On the wagon along with Graney were Arnie Snell, Webby Mansour and Captain Jerry "Haddock-Ears" Cronin. The apparatus was able to pull up on Broadway Street right in front of the building. Rescue 1 followed them, but had trouble maneuvering between parked cars.

Graney went to grab the hose from the pumper as Paul Rodd yelled to bring a hose-line to the nearby high-pressure fire hydrant. This section of Boston has high-pressure fire hydrants that can be used directly and don't require a pumper. Then Graney noticed the fire fighters running away from the fire apparatus. As he lugged the hose the entire side of the building suddenly lit up, he saw what the other fire fighters had run to. Inside the door at the corner of Broadway and Shawmut was a man stumbling out in a sheet of flames.

By tremendous good fortune, the fire department had gained a significant time advantage by virtue of coming upon the scene with their equipment. Yet because of the swiftness of the Grove fire, much of this advantage was lost. By the time the men had been able to even approach the club, it was ablaze from the Melody Lounge all the way out to the Broadway exit.

The Broadway Street wall of the new lounge had a wall made of glass bricks. This wall and a small nearby window started to fail from the heat of the fire. Fire fighters worked frantically around the Broadway Lounge door. Inside, they could see people collapsing and bodies piling up, as they desperately tried to gain access and rescue them.

Graney now dragged the charged high-pressure hose-line toward the corner of Shawmut Street and Broadway to the Broadway Lounge door. As he pressed in with the water from the hose deflecting off the ceiling, fire fighters worked to reach unburned limp bodies lying just inside the doorway.

Photograph: NFPA

As these people were dragged out, he noticed smudges around their noses and lips.

The fire fighters now moved forward into the entrance-way. Graney looked down and saw a young woman who, while unburned, was on her back pinned down to the floor by bodies. When she saw Graney she yelled to him, "Please get me out, my father will be worried!" Just then the fire flashed over Graney's head and as he backed out he yelled to the girl to "hang on!" Yelling for another hose line, he didn't wait, but instead pressed inward again, allowing the girl to be pulled by others out to safety.

Never before had Graney confronted such a mountain of human beings. "It was incredible," he says. "I couldn't go forward or to the right because of the bodies, I couldn't even get in with the hose."

In testimony to the desperation of the rescue effort, the fire fighters made the noblest of attempts to rescue as many as they could as quickly as they could, but they were overwhelmed by the shear number of people trapped by the fast-burning fire. Though no fire fighters were included in the list of those who died, several of those first on the scene succumbed to the smoke and flames during their rescue efforts. One of those men was Charley Kenney, Sr. of Rescue 1 who, after pulling over a dozen people out the Shawmut Street Dining Room door, finally went down. Later in the hospital it was noticed that among his injuries he had claw marks on his legs, offering a mute testimonial of the desperate final moments of so many.

The fire was knocked down quickly. In a short period of time, the fire fighters made an effective entry into the main dining room. If this fire had occurred in an unoccupied building, it would have been knocked down even more quickly; however, rescue was obviously the paramount concern.

With the flames now subdued, Graney now found himself with a policeman in the main dining room carrying out bodies.

"The tables weren't all burnt and in some places people, though dead, were only singed, still at their chairs and drooped over their tables. Yet elsewhere other bodies were so badly burned you couldn't tell the men from the women," Graney says.

The false walls on the Shawmut Street wall had been breached and soon lights were brought in so that the extent of fire damage could be seen. Out on the street first aid was given to those who could still receive it.

"I remember seeing a priest standing, quiet and solemn, watching as we carried out the bodies," he says.

Graney eventually worked his way through the building and found himself downstairs in the Melody Lounge. "There were small piles of belongings everywhere," he says.

Most of the bodies were now removed, and the fire fighters continued with their overhaul duties. Venturing into the Melody Lounge was Mayor Tobin and the Boston Fire Department doctor Martin Spellman.

"All of a sudden a small portion of the ceiling came down and Spellman yelled 'Get out!'" says Graney. "He said this remembering Maverick Square, but it turned out to be only a piece of the false ceiling material."

Despite the magnitude of the event, the fire was extinguished and the bodies removed in a relatively short period of time. Red Graney and Engine Company 35 were not released from the scene until around 4:30 to 5:00 a.m. in the morning. The entire event seemed so unreal and taxed reality by playing on everyone's fatigue.

"At the time we had no idea how many were killed, and we guessed that maybe 200 people had been lost," Graney says.

In the days following the fire, the fire fighters who were involved in the event were asked to submit any reasons or thoughts on why the flames had spread so fast. This information would eventually assist the official fire department investigation. Graney was not among those who were asked for official testimony; however, there was much speculation in the firehouse.

"There were all kinds of thoughts," Graney says. "There was talk that vapors from alcoholic drinking along with a lot of smoking contributed to the fire. Some also were saying that it was German sabotage since there were a large number of suspicious fires during the war years."

There was much conjecture, but it would be over a year before the official Boston Fire Department report became available and provided some answers to why the fire had spread with such incredible ferocity.

MEDICAL ADVANCES

IN NOVEMBER of 1942, the city of Boston was able to include upon its voice of recognition the superior medical and scientific research facilities within its domain. After almost a year at war, the urgency of improving certain medical techniques had been given new focus, and Boston found itself directly involved in these efforts.

Medical research initiatives sponsored on a national scale included the search for improved methods to deal with burn victims. It was expected that the casualties of war would place new demands on burn treatment, and better methods were needed. Thus, early in 1942, research projects had been initiated under contract to federal entities like the Office of Scientific Research and Development and the Office of Naval Research.

Regarding burn treatment, the on-going research in 1942 focused on the following four topics:

1) surface management;
2) surgical management;
3) fluids management; and,
4) respiratory management.

While the greatest steps forward for Cocoanut Grove related medical advances are most appropriately addressed into these 4 groups, other milestones were made on related topics. One of these was the fortification against infection. A new weapon against infection was penicillin, but in 1942 it was new, expensive, and scarce. On Wednesday, December 2, 1942, Cocoanut Grove survivors at Massachusetts General Hospital became the first recorded general patients to receive dosages. Much later when more was known about the new drug, however, it was determined that it was administered in dosages that were much too small.

Surface and Surgical Management

At the time of the Cocoanut Grove fire, research on surface management (burn treatment) and on surgical management (skin grafts) was partly underway. Rather than the fire allowing for new discoveries on these subjects, it instead served as the ultimate test for new methods that were already becoming recognized.

The accepted method of surface management in 1942 was the "tanning process" that involved the application of a solution of tannic acid. This created a leathery scab over the wound that acted as a shield against both the invasion of bacteria and for the loss of vital bodily fluids. Yet this was a time-consuming, cumbersome, skill-dependent process that subjected the patient to agonizing pain because of the scrubbing procedure required before the application of the chemical dyes.

A new method of surface management referred to as the "soft" technique had been devised by Dr. Oliver Cope and his colleagues at Massachusetts General Hospital. This simplified method required the burned surfaces to be swathed in gauze impregnated with boric petroleum, promoting a natural healing of the burns that harnessed the bodies formidable regenerative powers. This innovative method had just been implemented prior to the fire at Mass General, and the patients who suffered only from severe burns (without respiratory or other complications) were recovering nicely. In a crisis situation, the method had proven itself as virtually an unqualified success.

Boston City Hospital, however, used the traditional tanning process to treat their patients. This was because of the overwhelming influx of Grove victims for which they were not fully prepared to handle with a new method that was just becoming policy. But to the credit of this institution, the treatment of one young Coast Guardsman named Clifford Johnson made medical history. Under the care of Dr. Newton Browder, Johnson was given no chance to live after having been brought in with horrible third-degree burns over more than 50 percent of his body, and another 25 percent of this flesh blistered by second-degree burns. At that time, it was a medical rarity for anyone to survive third-degree burns over as much as 20 percent of the body. But after almost 12 months and a tremendous ordeal involving diligent care, Clifford Johnson was discharged

Coconut Grove victims are attended to at Boston City Hospital.

from Boston City Hospital as a medical phenomenon.

Fluids Management

Another research topic concerned with burn treatment was fluids management (shock). This research was well underway and the Boston hospital's were well prepared with stockpiles of blood and plasma. But despite these supplies, immense quantities were used on the victims of the fire. In the first 24 hours alone, more blood plasma was given to Cocoanut Grove victims than had been used in Hawaii following the attack on Pearl Harbor. On the day after the fire, 1,200 citizens offered blood, and within days the local Red Cross had collected a much needed 3,800 units.

Respiratory Management

Foremost among all the advancements made in modern burn treatment because of the Cocoanut Grove fire is that involving respiratory management (injury to the lungs). Victims who had succumbed to respiratory tract injuries were significant.

Much to the dismay of medical staff, the effects of these injuries were often delayed and involved individuals who showed very little outward signs of being in danger. A number of these victims had walked into the emergency rooms under their own power and were put aside for patients who were more obviously hurt, only to succumb shortly thereafter.

Postmortem examinations revealed a strange pattern of massive pulmonary edema that developed late and suddenly. This suggested the effects of poison gases, much like the effects of the deadly poison gases used in the first World War. Similar in occurrence was the strange loss of life encountered in the 1929 Cleveland Clinic fire that killed 125. This involved x-ray films that released phosgene gas into the ventilation system. With the Cocoanut Grove, suspicions were aroused that somehow, perhaps from the pyrolysis of the interior finish, a deadly poisonous gas had been released.

It was apparent that many of the hospitalized patients had inhaled a toxic substance. These victims developed post traumatic pulmonary injury and required constant monitoring. The lessons learned from the Cocoanut Grove fire brought an entirely new focus onto the respiratory management of burn victims that revolutionized pulmonary treatment.

The fire-ravaged bar area at the nightclub is a grim scene.

Red Graney retired from the Boston Fire Department after a prestigious career. While president of Local 718 of the International Association of Fire Fighters during 1952 and 1953, he was one of those responsible for introducing the muscular dystrophy campaign to the fire service. He is more widely known for the "Graney Plan," the widely adopted fire department work schedule system still used today throughout North America.

THE SERVICEMAN

John Collins had been on the Boston Fire Department for about one year when the attack occurred at Pearl Harbor. Like many, he enlisted before the draft, immediately after Pearl Harbor. The year 1942 that followed was arguably the most hectic for the gearing up of the U.S. military during World War II.

Because of his fire fighting background, Collins found himself as the first man in the U.S. Navy's fire fighting program based in Boston. This was one of five U.S. Navy fire fighting schools located around the country. The others were located in Norfolk, VA; Pearl Harbor, HI; San Diego, CA and Bremerton, WA. The school in Boston had at any given time ten fire fighters, half of whom were from the New York City Fire Department and half from the Boston Fire Department. This group was lead by Navy Lt. Commander Peter Hogstrom, originally from the New York City Fire Department.

The school in Boston was referred to as a class A school, complete with a simulated ship structure made of concrete. Located at East First and I streets in South Boston, the intent was to prepare the navy fire service for shipboard fire fighting tactics. John Collins and the other instructors lived in barracks located at 500 East First Street. An emphasis was given to several innovative techniques, including the use of foam, and also the use of fog streams.

It was a Saturday night like any other and John Collins, who was on standby, was passing the idle time. As the evening came to a close he had just laid down on his double-decker bunk when the Lt. Commander came in and shouted for everyone to get their turnout gear. They were being called to a bad fire in the "film district" of Boston. The men grabbed their equipment, jammed into a single navy wagon and sped off to the scene.

Upon their arrival, the fire itself was quickly becoming subdued. However, a massive rescue effort was under way and the services of the Navy Fire fighters were clearly needed. As the group approached the Cocoanut Grove building, they came upon the main entrance revolving door on Piedmont Street. A row bodies had been laid out on the street and the rescue efforts had only cleared out the revolving door itself. Inside, a gruesome pile of bodies could be seen piled seven and eight high.

People were running and hollering everywhere, Collins says. Standing near the revolving door exit directing operations was Boston Fire Commissioner William Riley. Being a member of the Boston Fire Department on military leave, John Collins introduced Lt. Commander Hogstrom

to Commissioner Riley. At least with regard to the Navy, Lt. Commander Hogstrom appeared to be the ranking Navy officer on the scene. Riley said that he thought there were about 200 dead.

"I couldn't believe it," says Collins. "Two hundred dead—it seemed so high for such a small place."

The navy men split up and immediately started to work. The fire was being brought under control and the task at hand was to get the people out. Collins began helping to remove bodies at the entrance on Piedmont Street through the now tomb-like main entrance where the revolving doors had been. Just a few feet away other fire fighters finally broke down an adjacent door with much effort, only to reveal a shocking sight. Bodies were piled chest-high against the door.

This door was located at the top of the stairs from the Melody Lounge in the lobby and was equipped with panic hardware, but it was double-bolted shut, with lifeless forms piled against it from the inside. After it was broken open, bodies were brought out through this opening originally intended to provide safe escape.

"Some bodies were very badly burned, but some were not. It was very, very strange," says Collins. "But more than anything else, the stench of burned flesh was terrible. It was overwhelming."

The stairway to the Melody Lounge was now being cleared, and the fire fighters had finally gained access down into the basement Lounge from the lobby. Surprisingly, the fire damage downstairs was minimal. Except for the overhead area, there seemed to be very little damage from the fire itself.

"Of all the vivid impressions made upon me that evening, perhaps the most unforgettable was when we first went down into the Melody Lounge," says Collins. "There, sitting at a table was a very pretty girl. She was sitting with her eyes open and her hand on a cocktail glass, as if waiting for someone. As I first looked at her I wondered why she was just sitting there, thinking she was okay. But, of course, she was dead. It seemed very strange."

The large number of fire service personnel supplemented with the many other rescuers at the scene allowed the fire to be controlled and overhauled quickly. The bodies themselves were removed from the building at a rapid pace, so that by midnight that urgent task at hand was nearly complete. Bodies were removed from the Grove and laid out upon the street so rapidly that the transportation to the nearby hospitals and morgues could not begin to keep up with the high number of dead. Fire department officials forced entry into a garage across the street, making it a temporary morgue, laying out row upon row of bodies on the cold concrete floor.

John Collins and the other Navy fire fighters stayed until all the bodies were removed. In the early morning hours, they gathered together with their Lt. Commander and went to the nearby Mayfair Hotel to have coffee. The night was cold and the nearby hotels and other facilities had opened up, offering coffee, blankets, and anything else to help those working at this disaster.

"Afterwards as we talked, it seemed so unreal, almost as if it was a bad dream," Collins says.

With fatigue blending into reality, they gathered their equipment and went back to the Navy fire fighting school in South Boston. In the early morning hours, they had showers and attempted to get back into their normal routine.

Like most of the people in Boston at that time, John Collins followed very closely the inquiries and activities that transpired after the fire. Convened the following day was a public hearing by the Boston Fire Department. This was chaired by Fire Commissioner Riley and was intended mainly to clarify fire department involvement. The final report from these provocative hearings would appear over a year later.

Another investigation began in the legal forum. Requiring more time to collect sufficient evidence to present to the grand jury, the state attorney general and the county district attorney's office were working on criminal indictments that would eventually be handed down to ten individuals. Nearly a month would pass before they would hand down these indictments.

The investigation by the Boston Fire Department began less than 24 hours after the disaster. Among the questioners with the Fire Commissioner were representatives of various municipal and state agencies, Army and Navy brass, and Federal Government representatives, including the FBI. Among the first witnesses called by Commissioner Riley was one of his own inspectors, Lt. Frank Linney.

Linney had inspected the Cocoanut Grove approximately a week before the fire and turned in the routine report, terming the Grove's safety conditions as "good." This entire single-page report was printed on the front pages of area newspapers. Now, despite having several commendations for heroism, Frank Linney found himself in every fire inspector's worst nightmare.

Linney was pressed to elaborate on his written report during the hearing. Another part of the report had stated glaringly that there were "no inflammable decorations." Linney indicated during the hearings that he had taken some of the fabric and tried to light it with a match after it had been removed. He found the material was very difficult to ignite. This was the normal procedure. The fallacy of these test methods would later be shown, but this unfortunately would not assist Linney during his testimony. John Collins followed the testimony of his comrade very closely.

Riley's hearings were meant to do nothing more than to bring forth public information as quickly as feasible, and would not result in any criminal actions. The fingers of blame pointed in many directions and even included Mayor Tobin himself. In other parts of Boston at the end of 1942, the grand jury handed over the criminal indictments. Among these indictments, charged with accessory after the fact of manslaughter and willful neglect of duty, was Lt. Frank Linney, inspector for the Boston Fire Department.

Linney went to trial in October, 1943. Defending Linney was an African-American lawyer by the name of Lewis, one of the top criminal lawyers in Boston at that time. Linney was a man of modest means and it was not clear to Collins how he had attained such prestigious legal defense.

John Collins went to one of the court sessions relating to the Cocoanut Grove fire, and this was when Frank Linney was being cross-examined by his own lawyer.

"I remember when Linney was on the witness stand and was being examined by Lewis. Lewis kept asking questions and rebuking him, making Linney look bad," says Collins.

Collins could not understand why Lewis was doing this, chastising his own client instead of defending him. Linney, though despondent, managed to keep pace with the relentless questioning.

"All of a sudden, Linney just fell apart and broke into tears. It was heart rendering," says Collins.

Lewis, the shrewd lawyer that he was, was able to demonstrate that Linney had never intentionally meant to do anyone harm and had only followed standard, albeit terribly inept, inspection procedures. Following the testimony, the jury deliberated three and a half hours. The verdict: not guilty.

The painful legacy of Frank Linney in the Cocoanut Grove disaster serves as a classic lesson for all who may find themselves involved in fire inspections. Years later John Collins would recall this lesson as he was walking to work one evening to Ladder 26 in Boston's Back Bay. In uniform, he was passing by Symphony Hall and noticed that a big show was about to go on for that evening. As he sometimes did, he would pass through Symphony hall, more for curiosity than anything else, gaining access as a fire department representative.

"It was a big show, and I was shocked to see that they had put chairs in the aisles blocking some of the exit paths," says Collins. "In my mind I wasn't sure what to do, I could've walked out and pretended that I had never seen any of it."

He didn't. Instead, he contacted the management and told them that they could not start the show until they corrected the problem. As expected, the management was furious, but they had no choice. The show was delayed momentarily while the chairs were cleared, and as a result, some of the patrons were removed from the audience.

"I thought of the Cocoanut Grove and I thought of Frank Linney, and I couldn't bring that upon myself. What he went through should never happen again," Collins says.

After his naval service, John Collins returned to the Boston Fire Department where he stayed until retirement. He ended his career as a Captain, serving as the department's public relation officer. In this capacity he appeared numerous times as the fire department representative on radio and television.

THE DOCTOR

On November 28, 1942, Dr. Francis D. Moore was working as an assistant resident at Massachusetts General Hospital in Boston. This was the third of

Chairs are piled high on the dance floor.

his five years required for post medical work. That evening, he was one of the staff doctors on duty and would find himself thrust into the mist of an event that would become a milestone in the field of medical treatment.

"Charlie Burbank and I were in charge of the emergency room," says Moore. The evening was cold and the hospital had been very quiet. The first Grove patient arrived at Massachusetts General Hospital at approximately 10:35 p.m.

"I was upstairs and came down after hearing the sirens," says Moore.

This would be the beginning of an unprecedented onslaught of patients. But as bad as it would become, it would be worse at nearby Boston City Hospital. For every four victims sent to Boston City Hospital, only one went to Massachusetts General. Later, when City became badly overloaded, this ratio shifted so that about half of the victims went to Massachusetts General.

The victims that were brought in were wet from the fire hoses, dirty from the soot and grime and suffering from the rough handling necessary to get them out of the Grove. They presented with an assortment of afflictions, including burns, partial asphyxia, exposure to the cold, shock and fright. Some stared blankly and said nothing. Others screamed and raved, flinging their arms and legs so violently that they had to be restrained.

The magnitude of the disaster became quickly evident as victims arrived in quick succession. Massachusetts General staff who could not immediately be assigned to medical work were asked to telephone doctors and nurses associated with the hospital.

Not long after the arrival of the first patients, Dr. Oliver Cope arrived. Cope headed an important National Research Council Project regarding the treatment of burns and walked straight into a crisis that would put the new burn treatment techniques that they had developed to an unparalleled test.

Also arriving in the early stages of the staff response was Dr. Nathaniel Faxon, the hospital administrator. He immediately ordered the full use of all phases of the war disaster plan, leading to activity in every wing of the giant hospital. Emergency equipment and extra supplies were assembled and rushed to the Cocoanut Grove Ward.

As staff was being mobilized, the accident floor was cleared of all non-Grove patients. Despite this action, victims continued to pour in and the hospital was running out of space quickly. Thus, patients on the sixth floor of the White Building were rolled, in their beds, to other wards. The entire floor was quickly converted into a Cocoanut Grove Ward.

"The first few hours were spent stabilizing the victims and clearing the dead," says Moore.

Within two hours after the fire, 114 Cocoanut Grove victims were delivered to Massachusetts General Hospital. Seventy-five were dead on arrival or before treatment could be given. This left 39 patients to be treated. Unlike the situation at Boston City Hospital, this was a number that could be effectively accommodated at Mass General. None of these patients showed any sign of drunkenness. Also, in spite of the wild panic, only a few were bruised and none had suffered broken bones.

Ten of the 39 patients admitted to Mass General had significant burn injuries, yet the other 29 had slight or no external burns. Some of them suffered gravely from severe lung damage and anoxia (restricted oxygen supply to body tissues). As the casualties continued to arrive, one facet of the crisis

The scene outside the city morgue was haunting.

that increasingly confounded the medical staff was the seemingly inordinate number of fatalities from causes other than extensive burn damage. Some of the victims appeared to have died instantly without burns at the scene of the fire, while others succumbed after they had reached safety or en route to the hospital. The most baffling were those who came into the hospital apparently with only minor injuries or none at all, and then with little warning, collapsed and died.

Typifying this phenomenon was a 23-year-old Navy Ensign, who was one of the first to arrive at Massachusetts General Hospital. He walked into the accident room under his own power with hands that were badly burned and some burns on his face and neck. Aside from a flushed appearance and his agitation, he seemed to be fit enough to be held aside as the flood of more desperate victims arrived. Despite being told to lie down and stay calm, he was soon pacing back and forth waving his hands in pain. Suddenly, he fell to the floor hardly breathing. Further examination revealed that his nostrils were deeply burned. He soon developed a swelling of the throat and then rapidly began to experience obstruction of the upper respiratory passages. Hours later, he died.

As the crisis continued, one young doctor was assigned directly to each patient. Moore's responsibility was to monitor the emergency room, taking an overview of the area. By 3 a.m. on Sunday morning, all 39 patients at Massachusetts General were bedded down.

"This flood of patients dominated everything for the next several days, there was little rest for anyone," says Moore.

The research project headed up by Cope was intended to develop a superior and simple method of treating burns. Throughout the year every patient suffering burns was treated in accordance with these studies. The new plan of therapy was carefully tested and developed, and involved the use of ointments containing boric acid. After Pearl Harbor, Massachusetts General Hospital administrative staff had developed a plan by which the institution's full facilities could respond to a disaster of war by virtue of their mobilization plan and this ongoing burn research. The hospital was ready for the crisis that impacted them following the Cocoanut Grove fire.

The awful toll in human life of the Cocoanut Grove fire produced taught medical professionals a lesson of enormous value. Those who lost their lives and those who suffered agonizing pain and misery in the days that followed were to make

Photograph: NFPA

available through their sacrifice knowledge that was to save thousands of victims in the future.

Summarizing the diverse hospital experiences of the Cocoanut Grove victims is difficult. Each was excruciating in its own way, but each contributed something to the knowledge of medicine. The Cocoanut Grove fire, with its terrible number of victims, became one of the most informative single tragedies ever approached by physicians.

After the Grove fire Moore spent many years practicing in the field of medicine. As one of those directly involved in this tragedy, he was intimately familiar with the medical advances that followed. Among his noteworthy professional achievements, he became Mosely Professor of Surgery-Emeritus at the Harvard Medical School and Surgeon-in-Chief- Emeritus at Peter Bent Brigham Hospital.

DECADES LATER

With the march of time the fire at Boston's Cocoanut Grove has become an event from far away and long ago. And yet to some, it seems like only yesterday—a bad dream they are still waiting to forget.

The fire was a tragedy of immense proportions. Perhaps most demonstrative of its magnitude is that a few lingering questions regarding the final death toll still continue to remain unanswered. News reports finally settled on the figure of 492 dead based on their information gathering efforts. But depending on the particular count, questions persisted about certain individuals who had been counted twice or not counted at all, or who died later in the hospitals either from direct physical injuries or from serious and deteriorating psychological scars.

In this regard Fire Commissioner Reilly's report carried a "Master List" of the dead and injured that indicated 490 dead and 166 injured. This list had an effective date of December 10, 1942 and adjusted to October 16, 1943. Yet despite its claim to cancel and supersede all other tallies, it did not include the name Eleanor B. Powerell, who had succumbed at Boston City Hospital. Also, regarding the injured, the list did not include patients treated and immediately released, or servicemen and women admitted to military hospitals. And then their were victims like Francis Gatturna, who several weeks after recovering from his own injuries returned to the hospital despondent over the loss of his wife, only to end his suffering by throwing himself through a closed sixth floor hospital window.

As testimony to the healing power of time and how much has changed through the years, finding the precise location of the Cocoanut Grove today is challenging, even for those considering themselves native Bostonians. When standing at the former Grove site, one can see that even the streets have been altered to accommodate a high-rise hotel complex over most of the Grove's main dining room and Broadway Street Lounge. Shawmut Street now curves into Piedmont Street right at the site that was the Grove's main lobby area.

Today's quiet residential streets at Shawmut and Piedmont in Boston's Bay Village allow a person to stand at the exact location of the revolving door and at the top of the stairway to the Melody Lounge—a place were bodies were piled seven and eight high.

The shock of the fire's death toll drove society to make significant changes in fire regulations and emergency procedures that would have taken years to change otherwise.

With regards to advances in medicine, the sheer enormity of the work done in Boston's hospitals along with the timeliness of war-related research allowed significant strides forward in medical knowledge. The fire, with its terrible aggregate of victims, became one of the most informative single tragedies ever approached by physicians.

Perhaps the greatest irony of this tragic event is that, at least in Boston, there will never be another Cocoanut Grove nightclub fire. There is only truth in this statement because immediately following the fire, the Boston Licensing Board ruled that no place of entertainment could ever again use the name Cocoanut Grove. Of course, this was only a measure to prevent future exploitation of this tragedy and not to prevent fires.

Unfortunately, we all know that fires of this magnitude continue to be possible. We can only take comfort by hoping that we've learned from our mistakes, mistakes like the fire at the Cocoanut Grove.

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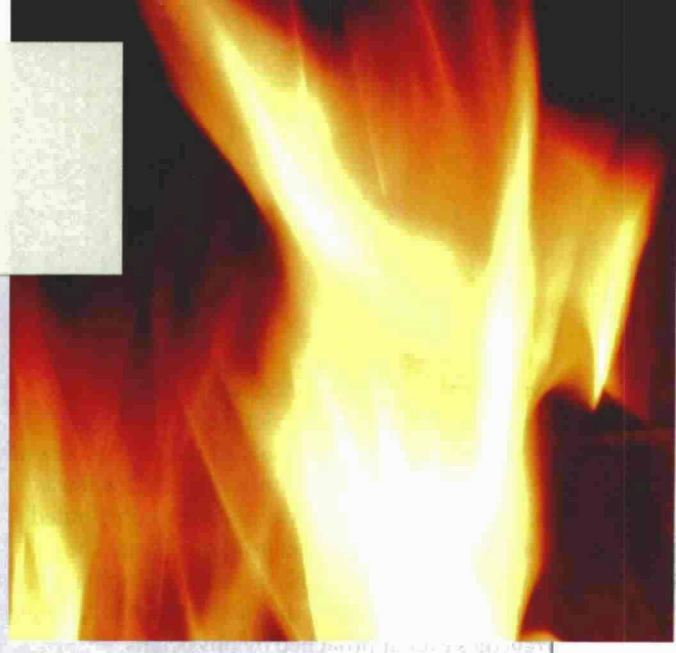
Large Loss for 2006

By Stephen G. Badger



In 2006, fire departments in the United States responded to an estimated 1,642,500 fires, which had an estimated loss of $11.3 billion.[1] Many of these fires were small, with little or no property damage reported; however, 45 resulted in losses of $5 million or more each.[2]

Collectively, these large-loss fires resulted in $551 million in direct property loss, and were responsible for the deaths of six fire fighters and 11 civilians, as well as injuries to 35 fire fighters and 13 civilians. Despite the fact that these fires accounted for just .003 percent of the total fires estimated to have occurred in 2006, they accounted for 4.9 percent of the total estimated dollar loss.

Each year, NFPA reports on large fires and explosion losses in the United States, defined as events resulting in property damage (to structure and contents) of at least $5 million. In 2006, there was an increase of six fires from 2005, and an increase of $201 million, or 57.4 percent, in property losses from the $350 million in 2005. It should be stated that the 2005 total was the lowest since 1987, when the $5 million threshold was set.

Before adjusting for inflation, the number of large-loss fires in 2006 was the second lowest since 1997 (see Table 1, Figure 1 and Figure 2).[3] When adjusted for inflation to 1997 dollars, the number of fires that occurred in 2006 that could be categorized as large-loss (i.e. loss of $5 million in 1997 dollars) drops to 28, with a total adjusted loss of $367 million. This is also the second lowest number of large-loss fires since 1997. The adjusted loss is the second lowest in the 10-year period and 66 percent below the 10-year average adjusted loss total.

In mid-March, the Texas Panhandle was experiencing extreme fire danger and was experiencing a drought. Factors for fire included no rain for five months, low fuel moisture, low humidity, and winds of more than 60 miles (96 kilometers) per hour. Several fires broke out on a Sunday afternoon, when the winds caused electrical wires to touch and short out or the wind brought the wires in contact with ground cover. These fires were known as the East Amarillo Complex and caused an estimated loss of $95 million.

During this outbreak of fires, the smoke reduced visibility on an interstate. One car slowed or stopped in the smoke, causing a chain reaction crash that involved nine vehicles. There were four fatalities in two of the cars. After this crash, a 90-mile (144-kilometer) stretch of the interstate was closed for nine hours due to the smoke conditions.

Within an approximately 45-mile (72-kilometer) radius, four other incidents took the lives of eight people, including one fire fighter.

The fire fighter died when the apparatus he was operating overturned and went down a ravine. Two other fire fighters were injured in this crash. The fire fighters were fighting one of the larger fires in the complex.

Then a car with four occupants went off the roadway due to the blinding smoke conditions. When the vehicle became disabled, the four attempted to flee but the fire overtook them. The fires also overran two structures in which three occupants were preparing to evacuate.

At times, the winds spread these fires at a rate of 5 miles (8 kilometers) per hour and the fire burned everything in its path.

When the fires were extinguished seven days later, the death toll was at 12 and much of the property was destroyed. At least 89 buildings were burned, including nine homes and 80 outbuildings. Also destroyed were 1,040 electric poles, 2,000 miles (3,218 kilometers) of fence, and windmills used for water supply. Also, 4,296 head of cattle were lost.

This wildland fire complex was just one of the 15 fires that caused losses of $10 million or more in property damage last year (see Table 2). Of the 15 fires, 11 were in structures, three were wildland fires, and one involved a vehicle. Collectively, these 15 fires caused a loss of $360 million or 65.3 percent of the total losses in large-loss fires and 3.2 percent of the total fire losses in 2006

The number of large-loss fires and explosions and the losses in these fires fluctuate widely, and show no consistent trend from year to year. The

Photograph: iStock

Table 1 - Large-Loss Fires that Caused $5 million or More in Property Damage, 1997 - 2006

Year	Number of Fires	Number of Fires Causing $5 million or More in 1997 Dollars	Property Loss (unadjusted) (in millions)	Property Loss 1997 Dollars (in millions)
1997	57	57	$885	$885
1998	57	48	$1,167	$1,105
1999	67	55	$2,285	$2,144
2000	65	53	$2,029	$1,835
2001*	52	39	$978	$826
2002	46	39	$698	$591
2003	49	42	$2,811	$2,420
2004	46	31	$524	$380
2005	39	21	$350	$210
2006	45	28	$551	$367

large-loss study only reports on those fires with a confirmed estimated loss.

Where the fires occurred

In 2006, large-loss fires occurred in major property categories except health care and correctional facilities (see Table 3 and Figure 3).

Thirty-eight of the large-loss fires occurred in structures, resulting in combined losses of $396 million. Ten fires occurred in manufacturing properties, resulting in losses of $113 million. Six fires each occurred in storage properties and stores, resulting in losses of $61 million and $51 million, respectively. Five fires occurred in residential properties (two in single-family homes and three in apartment buildings) with resulting losses of $44 million.

Four fires occurred in special properties, resulting in losses of $30 million. All of the special properties were structures under construction.

There were three fires each in education properties and public assembly properties, resulting in losses of $51 million and $21 million respectively. One fire in an educational property spread to 59 other structures. And lastly there was one fire in an industrial property that resulted in a loss of $25 million.

There were also four large-loss fires in wildlands, totaling $125 million in property losses, and three in vehicles (an airplane, a yacht, and a truck), with a total loss of $30 million.

Operating status was reported for 31 of the 38 structure fires. Twenty-two of the properties were at full operation at the time of the fire, one was partially operating, one had workers on the scene, but not in the tunnel where the fire occurred, and seven were closed with no one on the property. The status of operations at the other seven structures was unknown or not reported.

Table 2 - Large-Loss Fires of $10 Million or More in 2006

Incident and Location	Loss in Millions
Brush fire complex, Texas	95.2
Conflagration (began in a school), Alaska	35.0
Plastics products plant, Pennsylvania	34.0
Warehouse, Pennsylvania	26.0
Power plant, Virginia	25.0
Passenger jet aircraft, California	20.0
Food processing plant, Alabama	20.0
Senior living apartment, Pennsylvania	20.0
Dormitory under construction, Washington	13.0
Department store - 1, Arizona	13.0
Department store - 2, Arizona	13.0
Wildland fire, California	12.9
Wildland fire, California	11.7
Food processing plant, Illinois	11.0
Fast food restaurant, Louisiana	10.0
Total: 15 Fires	$ 359.8

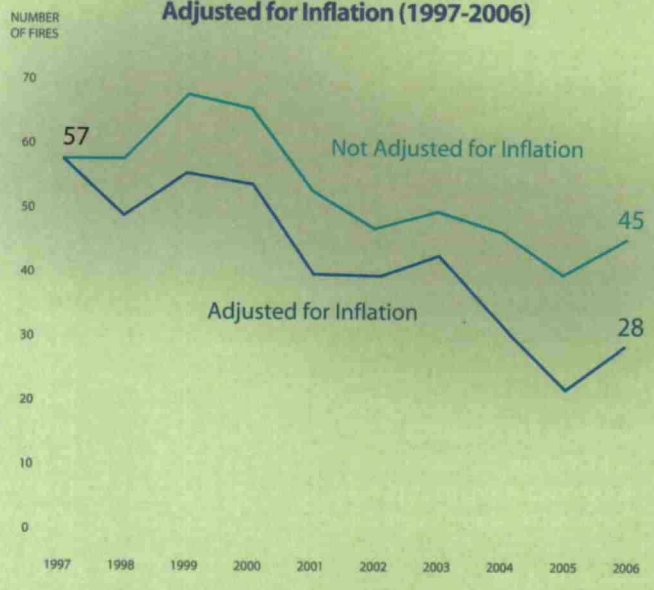
The fire cause was reported for 19 of the structure fires, all four of the wildland fires and two of the vehicle fires. Seven of the structure fires and one of the wildland fires were intentionally set, with a total loss of $125 million, or 22.7 percent of the total fire losses in large-loss fires, and were responsible for the deaths of five fire fighters.

Sixteen of the fires broke out between the hours of 11 p.m. and 7 a.m. Four of these were known to be intentionally set, two were the result

Table 3
Large-Loss Fires by Major Property Use Classification 2006

Property Use	Number of Fires	Percent of Fires	Total Dollar Loss (in millions)	Percent of Loss
Manufacturing	10	22%	113	20.5%
Storage	6	13%	61	11.1%
Stores and Offices	6	13%	51	9.3%
Residental	5	11%	44	8.0%
Wildland	4	9%	125	22.6%
Special Properties	4	9%	30	5.4%
Educational	3	7%	51	9.3%
Vehicle	3	7%	30	5.4%
Public Assembly	3	7%	21	3.8%
Industrial	1	2%	25	4.5%
Totals	45	100%	551	100.0%

FIGURE 1 - Large-Loss Fires, Unadjusted and Adjusted for Inflation (1997-2006)



Note: the 52 and 39 fires in 2001 do not include the 9/11/01 World Trade Center Incident

of mechanical failures, two resulted from short circuits, and one involved an unattended candle. The cause was unknown for the other seven fires.

Detection and suppression systems

Information on detection equipment was reported for 24 of the 38 structure fires. Fourteen occurred in properties that had no automatic detection equipment present. Some form of detection equipment was present in 10 properties. Five of the 10 properties had smoke detection equipment while three had combination smoke and heat detection. The type of system in the other two structures was not reported. This means that only 42 percent of the properties with automatic detection equipment reported had some sort of automatic protection. The coverage of the system was reported in seven of the 10 properties. Five properties had complete coverage. Two were smoke detectors, two were combination heat and smoke detection and the type of the last one was not reported. Two had partial or local coverage smoke detection present.

The operation of these systems was reported in eight fires. In seven of the fires, the systems operated or were sounding when the fire department arrived. One of these tripped the fire department master box on the building. One system did not operate because it was out of service for an unreported reason before the fire. The operation of the other two systems was unknown or not reported.

Information on automatic suppression equipment was reported for 29 of the 38 structure fires. Of these 29 structures, 10 (34 percent), were equipped with some sort of suppression equipment. Nineteen properties, (66 percent), were not equipped with suppression equipment. Four of the 10 protected properties had complete coverage systems. Three of these were protected by wet-pipe sprinkler systems and one by a dry-pipe system. Two structures had partial coverage wet-pipe sprinkler systems. The coverage of four systems was unknown or not reported. These included two wet-pipe and two unknown type sprinkler systems.

Suppression equipment operated in seven of the 10 protected properties. Two systems extinguished the fire; one system controlled the fire. Three systems operated, but two of the three were overpowered by fires that spread from unprotected areas or from outside; and the third operated but was ineffective for an unreported reason. One system partially operated; the system in the area of origin had been damaged by a collapse during a hurricane, the riser was shut down and branch lines capped, but a system in another area of the building did activate. Two systems failed to operate—one had been shut down prior to the fire and the other had a fire pump motor that failed to operate. No information was reported on the other system.

Of the 38 structure fires, 24 had information reported on both detection and suppression equipment. Seven properties, or 29 percent, had no automatic protection at all. Nine had just detection equipment, seven had just suppression equipment, and one had both detection and suppression equipment.

What we can learn

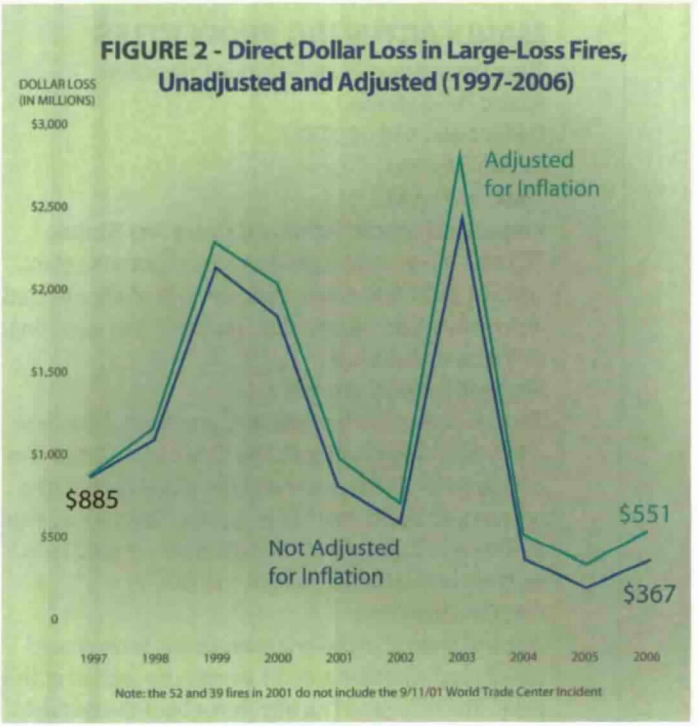
In 2006, the number of large-loss fires increased

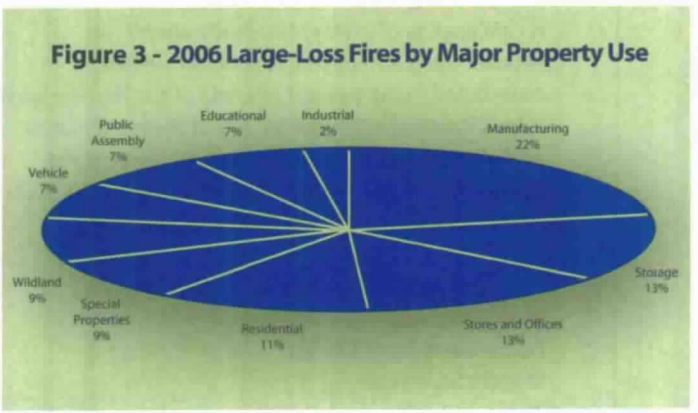
by six, or 15 percent, and the property loss rose by $201 million, or 57 percent. In seven of the past 10 years, from 1997 to 2006, there has been at least one fire with a loss of more than $100 million. NFPA has no record of any confirmed loss of that size in 2006.

Each year the large-loss fire study reports on the proportion of fires accounting for major losses that occurred in properties with and without protection by automatic detection or suppression equipment, partial protection or system rendered ineffective by action or omissions made before fire began. Explosions or structural collapses also sometimes damage systems to the point of being inoperative or ineffective. Table 4 identifies these.

Adherence to the fire protection principles reflected in NFPA's codes and standards is essential if we are to reduce the occurrence of large-loss fires and explosions in the U.S.

There were a range of ignition causes and factors reported among the large-loss fires in 2006, including incendiary, abandoned or discarded smoking materials, mechanical or part failures, short circuits, combustibles too close to heat, and an unattended candle. Proper design, maintenance, and operation of fire protection systems and features can keep a fire from becoming a large-loss fire. Proper construction, storage methods, and housecleaning will make fires less likely and help control or limit the fire spread, if fire occurs.





Endnotes

1. "Fire Loss in the Unites States during 2006," Michael Karter Jr., *NFPA Journal®*, September/October 2007.
2. The 45 large-loss fires of 2006 are those for which losses are reported and verified.
3. The numbers of fires and dollar loss may not show as the numbers in the year originally reported due to late-arriving information.

Where we get our Data

NFPA identifies potential large-loss incidents by reviewing national and local news media, including fire service publications. A clipping service reads all U.S. daily newspapers and notifies NFPA's Fire Analysis and Research Division of major large-loss fires. NFPA's annual survey of the U.S. fire experience is an additional data source, although not the principal one. Once an incident has been identified, we request information on the fire from the fire department or the agency having jurisdiction. We also contact federal agencies that have participated in investigations, the state fire marshal's offices, and military sources.

The diversity and redundancy of these data sources enables NFPA to collect the most complete data available on large-loss fires.

Acknowledgments

NFPA thanks the U.S. fire service for its contributions of data, without which this report would not be possible. In many cases, the fire departments were unable to contribute complete details because legal action is pending or ongoing, or they are unable to determine many pieces of information we need to make our study as complete as possible. The author wishes to thank Norma Candeloro for providing the support this study requires.

STEPHEN G. BADGER is fire data assistant in NFPA's Fire Analysis and Research Division and is retired from the Quincy, Massachusetts, Fire Department.

MANUFACTURING PROPERTIES

Type Occupancy: Manufacturing Properties
State: Pennsylvania
Dollar Loss: $34,000,000
Month: October
Time: 9:00 A.M.
Property Characteristics and Operating Status:
This one-story plastics products manufacturing plant covered 1,821,600 square feet and was of unprotected noncombustible construction. The plant was operating at the time of the fire.
Fire Protection Systems:
There was no detection equipment present. There was a sprinkler system present. The type and coverage was not reported. The system had been disconnected by a previous occupant, and not in service. Several handheld 10-pound dry chemical extinguishers were used by workers in an attempt to fight this fire.
Fire Development:
A fire of undetermined origin broke out in cardboard boxed plastic products in the warehouse section of this plant. The fire spread rapidly throughout the contents.
Contributing Factors and Other Details:
A combination of a heavy fuel-load available, no detectors, and an inoperative sprinkler system contributed to the size and intensity of the fire. The wind helped spread the fire and the size of the facility taxed firefighting resources. Four firefighters were injured fighting this fire. The loss was estimated at $2,000,000 to the structure and $32,000,000 to the contents.

Type Occupancy: Manufacturing Properties
State: Alabama
Dollar Loss: $20,000,000
Month: September
Time: 4:51 P.M.
Property Characteristics and Operating Status:
This was a food preparation plant. No information was reported on the height, size, or type of construction of this building or its operating status.
Fire Protection Systems:
No information reported.
Fire Development:
No information reported
Contributing Factors and Other Details:
A roof collapse forced firefighters out of the building to a defensive attack.

Type Occupancy: Manufacturing Properties
State: Illinois
Dollar Loss: $11,000,000
Month: August
Time: 12:47 PM
Property Characteristics and Operating Status:
This one-story pet food manufacturing plant covered 48,000 square feet and was of unprotected wood-frame construction. The plant was closed for the weekend when the fire broke out.
Fire Protection Systems:
There was no detection or automatic suppression equipment present.
Fire Development:
A fire of unknown cause broke out in the warehouse section of this plant.
Contributing Factors and Other Details:
Four firefighters were injured fighting this fire. The loss was estimated at $9,000,000 to the structure and $2,000,000 to the contents.

Type Occupancy: Manufacturing Properties
State: Washington
Dollar Loss: $9,000,000
Month: June
Time: 5:38 PM
Property Characteristics and Operating Status:
This three-story sawmill at a plywood plant covered 60,000 square feet and was of heavy-timber construction. There were five other structures involved in this fire. The plant was in operation at the time of the fire.
Fire Protection Systems:
There was no detection equipment present. There were several complete coverage dry-pipe sprinkler systems present. The systems were located in several of the structures and did operate but were overpowered by the rapid spread of the fire and an overtaxed water system. A fire pump on the property did not operate properly to supplement the water supply for an unreported reason.
Fire Development:
A fire of undetermined origin began in a pile of sawdust and wood chips approximately 100 feet from the sawmill. Employees attempted to fight the fire before it got out of hand. A 15 to 20 mph wind pushed the fire into the sawmill and other structures along the sawdust and wood chips on the ground.
Contributing Factors and Other Details:
It is the policy at this plant to fight a fire before calling the fire department. Employees attempted to extinguish the fire but it got out of hand, resulting in a delayed alarm. The wind and the sawdust and wood chips on the ground spread the fire into the sawmill and other structures. Seven employees were treated for smoke inhalation.

Type Occupancy: Manufacturing Properties
State: South Carolina
Dollar Loss: $8,153,000
Month: October
Time: 7:15 P.M.
Property Characteristics and Operating Status:

This 12-foot-high hardwood flooring manufacturing plant covered 65,394 square feet and was of unprotected wood-frame construction. The plant was operating at the time of the fire.
Fire Protection Systems:
There was no automatic detection or suppression equipment present.
Fire Development:
This incendiary fire was set by someone who used a lighter to ignite sawdust in the stockroom area. The fire spread upward and across the structure due to excessive sawdust and debris. The fire also spread rapidly through the adjoining area due to the large amount of raw flooring materials and wood stain products.
Contributing Factors and Other Details:
Housekeeping was an issue as sawdust and debris were allowed to build up. One firefighter was injured fighting the fire.

Type Occupancy: Manufacturing Properties
State: Virginia
Dollar Loss: $7,000,000
Month: July
Time: 1:15 A.M.
Property Characteristics and Operating Status:
This two-story snack-food manufacturing plant covered 604,800 square feet and was of unprotected ordinary construction. The plant was operating at the time of the fire.
Fire Protection Systems:
There was partial coverage smoke detection equipment above the commercial ovens. This system activated and alerted an alarm company which contacted the fire department. There was a complete coverage wet-pipe sprinkler system present. The system operated and controlled the spread of the fire.
Fire Development:
During the preparation of snack crackers, vegetable oil is sprayed on the crackers on a conveyor belt. When a power outage occurred, the crackers that were under the stillhot heating elements ignited. The fire then spread to a supply drum of vegetable oil.
Contributing Factors and Other Details:
None reported.

Type Occupancy: Manufacturing Properties
State: Texas
Dollar Loss: $7,000,000
Month: December
Time: 2:59 P.M.
Property Characteristics and Operating Status:
This two-story modular home manufacturing plant covered 86,000 square feet and was of unprotected noncombustible construction. The plant was in operation at the time of the fire.
Fire Protection Systems:
No information reported on detection equipment. There was a wet pipe sprinkler system present of an unreported coverage and 10 heads operated. The system was ineffective for an unreported reason.
Fire Development:
The cause and origin were not determined.
Contributing Factors and Other Details:
The loss was estimated at $4,000,000 to the structure and $3,000,000 to the contents.

Type Occupancy: Manufacturing Properties
State: California
Dollar Loss: $6,500,000
Month: December
Time: 8:00 AM
Property Characteristics and Operating Status:
Crude oil unit in a refinery. No other information reported.
Fire Protection Systems:
No information reported.
Fire Development:
No information reported.
Contributing Factors and Other Details:
None reported.

STORAGE PROPERTIES

Type Occupancy: Storage Properties
State: Pennsylvania
Dollar Loss: $26,000,000
Month: June
Time: 10: 45 PM
Property Characteristics and Operating Status:
This irregularly-shaped warehouse was used for bulk storage of shrink-wrapped paper products for mailing. It was one to three stories in height, covered 251,798 square feet and was of unprotected ordinary construction. At the time of the fire, the warehouse was closed for the night.
Fire Protection Systems:
There was no detection or automatic suppression equipment present.
Fire Development:
This incendiary fire was set in multiple locations, and spread rapidly throughout the structure, which contained a large amount of bulk storage of paper products. The fire resulted in an extensive collapse of the warehouse.
Contributing Factors and Other Details:
One arrest has been made in this case. The loss was estimated at $1,000,000 to the structure and $25,000,000 to the contents.

Type Occupancy: Storage Properties
State: Florida

Dollar Loss: $9,600,000
Month: March
Time: 8:04 PM
Property Characteristics and Operating Status:
The one-story industrial warehouse covered 100,000 square feet and was of unprotected noncombustible construction. The warehouse was in full operation at the time of the fire.
Fire Protection Systems:
There was no detection equipment present. There was a partial coverage wet-pipe sprinkler system with two risers. One riser in the area of ignition had been shut down due to damage from collapse during a hurricane, and the branch lines had been capped. Part of the system away from the fire operated.
Fire Development:
This fire originated as an electrical short in wiring on a wood beam near the ceiling. The fire burned through the ceiling and roof, and throughout the warehouse. First-arriving firefighters found the structure fully engulfed in fire and attacked the blaze with master stream equipment.
Contributing Factors and Other Details:
One firefighter was injured fighting this fire. The loss was estimated at $4,600,000 to the structure and $5,000,000 to the contents.

Type Occupancy: Storage Properties
State: Tennessee
Dollar Loss: $7,102,700
Month: November
Time: 7:00 PM
Property Characteristics and Operating Status:
This two-story plastics products warehouse was of unprotected non-combustible construction. The ground floor area was not reported. The warehouse was operating at the time the fire broke out.
Fire Protection Systems:
There was no detection equipment present. There was a wet-pipe sprinkler system present. Its coverage was not reported. The system failed to operate because its diesel pump motor locked up.
Fire Development:
A worker on a forklift saw sparks coming from a light fixture as he entered the area. The sparks fell on cardboard and plastic materials. The fire then spread throughout the structure.
Contributing Factors and Other Details:
None reported.

Type Occupancy: Storage Properties
State: Washington
Dollar Loss: $7,000,000
Month: July
Time: 1:22 AM
Property Characteristics and Operating Status:
This pier was of heavy timber construction. No one was present at the time the fire broke out. No other information was reported.
Fire Protection Systems:
No detection or suppression equipment was present.
Fire Development:
The cause of this fire is undetermined. Upon arrival, firefighters found 75 to 100 feet of the pier on fire. The fire was also impinging on a 250-foot ship tied up to the pier. The fire traveled down the pier, forcing firefighters to withdraw and fight the fire from the mainlands as a fireboat and a police boat fought the fire from the water side. The fire then spread to several small structures and to vehicles on the pier, as well as a second vessel.
Contributing Factors and Other Details:
Fire traveled several hundred feet underneath the pier, forcing firefighters to withdraw off the pier.

Type Occupancy: Storage Properties
Number: 02012
State: Washington
Dollar Loss: $6,450,000
Month: October
Time: 11:55 AM
Property Characteristics and Operating Status:
The one-story hops warehouse covered 60,000 square feet and was of unprotected noncombustible construction. The warehouse was in full operation at the time of the fire.
Fire Protection Systems:
There was detection equipment present. The type and coverage were not reported. The system operated but failed to alert the occupants; the reason for this was not given. There was no automatic suppression equipment present.
Fire Development:
The cause and origin are undetermined.
Contributing Factors and Other Details:
The loss was estimated at $450,000 to the structure and $6,000,000 to the contents.

STORES AND OFFICE PROPERTIES

Type Occupancy: Stores and Office Properties
State: Arizona
Dollar Loss: $13,000,000
Month: June
Time: 10:00 PM
Property Characteristics and Operating Status:
This one-story department/food (super) store was of protected noncombustible construction and covered 208,437 square feet. The store was open with customers inside.
Fire Protection Systems:

There was no detection equipment present. There was a complete coverage wet pipe sprinkler system. The system operated and extinguished the fire.

Fire Development:
This incendiary fire was set on the sales floor in the silk flower area with a lighter, just below a sprinkler head, which operated rapidly.

Contributing Factors and Other Details:
Two men have been arrested in this case. This was the first of two fires set in the same chain of stores in the same city. The loss was estimated at $1,000 to the structure and $12,999,000 to the contents. The store replaced most its inventory due to smoke and water damage.

Type Occupancy: Stores and Office Properties
State: Arizona
Dollar Loss: $13,000,000
Month: June
Time: 10:45 PM

Property Characteristics and Operating Status:
This fire occurred 45 minutes later in an identical one-story department/food (super) store of protected noncombustible construction that covered 208,437 square feet. The store was open with customers inside.

Fire Protection Systems:
There was no detection equipment present. There was a complete coverage wet pipe sprinkler system. The system operated and extinguished the fire.

Fire Development:
As in the earlier fire, silk flowers on the sales floor were ignited with a lighter. This fire was also set just below a sprinkler head, which operated rapidly.

Contributing Factors and Other Details:
Two men have been arrested in this case. This was the second of two fires set in the same chain of stores in the same city. The loss was estimated at $1,000 to the structure and $12,999,000 to the contents. As in the first fire, the store replaced most of its inventory due to smoke and water damage.

Type Occupancy: Stores and Office Properties
State: California
Dollar Loss: $7,900,000
Month: July
Time: 10:58 AM

Property Characteristics and Operating Status:
This one-story department store covered 30,000 square feet and was of protected noncombustible construction. The store was open with 10 employees and 75 customers within.

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

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

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

Type Occupancy: Stores and Office Properties
State: Pennsylvania
Dollar Loss: $7,000,000
Month: October
Time: 5:10 AM

Property Characteristics and Operating Status:
This two-story general store covered 170,000 square feet. No other information was reported.

Fire Protection Systems:
No information reported.

Fire Development:
No information reported.

Contributing Factors and Other Details:
None reported.

Type Occupancy: Stores and Office Properties
State: Oregon
Dollar Loss: $5,472,000
Month: August
Time: 7:53 AM

Property Characteristics and Operating Status:
This three-story furniture store covered 11,520 square feet, and was of protected noncombustible construction. The store had not yet opened, but employees were just arriving to open up for the day.

Fire Protection Systems:
There was a partial coverage system of smoke detection equipment on each floor connected to a security system. The detectors activated and notified the alarm monitoring company. There was no automatic suppression equipment present.

Fire Development:
This fire originated in the basement in an area with stored mattresses and cardboard. The cause is undetermined.

Contributing Factors and Other Details:
The fire spread via an open stairwell to the main floor, then to the second and third stories. Firefighters originally made an interior attack on the fire, but soon were forced to an exterior attack due to the deteriorating conditions, and also to protect nearby structures. Two firefighters were injured. The loss was estimated at $4,522,000 to the structure and $950,000 to the contents.

Type Occupancy: Stores and Office Properties
State: New Jersey
Dollar Loss: $5,000,000
Month: May
Time: 10:42 AM
Property Characteristics and Operating Status:
This two-story shopping center covered 15,625 square feet. The type of construction was not reported. The mall was open and operating.
Fire Protection Systems:
No information was reported on detection equipment. There was no automatic suppression equipment.
Fire Development:
A fire of undetermined cause broke out in the attic area.
Contributing Factors and Other Details:
Arriving firefighters found the majority of the structure involved with fire and set up a defensives attack with master stream devices and exposure protection. The loss was estimated at $4,000,000 to the structure and $1,000,000 to the contents.

RESIDENTIAL PROPERTIES

Type Occupancy: Residential Properties
State: Pennsylvania
Dollar Loss: $20,000,000
Month: November
Time: 11:35 AM
Property Characteristics and Operating Status:
This two- and three-story senior citizen living complex was of unprotected ordinary construction. The floor area was not reported. The building was occupied at the time of the fire.
Fire Protection Systems:
No information reported.
Fire Development:
No information reported.
Contributing Factors and Other Details:
No information reported.

Type Occupancy: Residential Properties
State: California
Dollar Loss: $9,150,000
Month: December
Time: 1:04 AM
Property Characteristics and Operating Status:
This was a two-story single-family home. The type of construction and floor area were not reported. The home was occupied at the time of the fire.
Fire Protection Systems:
There was no detection or automatic suppression equipment present.
Fire Development:
This fire was caused by a short circuit in Christmas tree lighting. The fire spread rapidly throughout the home.
Contributing Factors and Other Details:
During fire suppression operations, a flashover occurred in the attic area next to the stairway where firefighters were working. There was a partial collapse of the roof and ceilings, which forced firefighters to withdraw to an exterior attack. The loss was estimated as $9,000,000 to the structure and $150,000 to the contents.

Type Occupancy: Residential Properties
State: Minnesota
Dollar Loss: $5,500,000
Month: July
Time: 4:53 PM
Property Characteristics and Operating Status:
This three-story six-unit apartment house was of unprotected wood-frame construction and covered a floor area of 12,500 square feet. The building was occupied.
Fire Protection Systems:
There was a complete coverage smoke detection system present. The system was not a factor because the fire originated outside and spread into the building. It was not reported if the system operated or not. There was no automatic suppression equipment present.
Fire Development:
Carelessly discarded smoking materials ignited patio furniture on a second-story balcony. The fire extended to the third-story deck then into the attic area.
Contributing Factors and Other Details:
Firefighters made an interior attack on the fire in the attic but conditions deteriorated rapidly and crews withdrew to defensive operations. The loss was estimated at $4,000,000 to the structure and $1,000,000 to the contents.

WILDLANDS

Type Occupancy: Wildlands
State: Texas
Dollar Loss: $95,246,750
Month: March
Time: 11:07 AM
Property Characteristics and Operating Status:
This grass and brush fire burned over 907, 245 acres, and the fires in this complex burned over a nine-day period. This complex consisted of two large fires and six smaller fires.

Fire Development:
The fires started when the wind caused electric wires to touching and short out, causing sparks to ignite the ground cover.
Contributing Factors and Other Details:
The Panhandle area of the state had been in a drought for 11 months, and under extremely critical drought conditions for five months. These conditions were ideal for grassfires. The day of the outbreak of fires, the sustained winds were clocked at 46 mph, gusting up to 53 mph. One firefighter and 11 civilians died in this complex of fires. The firefighter was killed and two other firefighters were injured when their fire apparatus overturned. Four people died in a nine-vehicle crash on the smoke-covered interstate Four died when their vehicle ran off the road and the fire overran the occupants as they attempted to flee the fire. Three others died in their homes while preparing to evacuate. Destroyed in the fire were 89 structures, including nine houses, five vehicles, 1,040 electrical poles, and 2,000 miles of fence; 4,296 head of livestock perished. Eight towns were evacuated and a 90-mile stretch of the interstate was closed for nine hours after the crash, due to the blinding smoke conditions.

Type Occupancy: Wildlands
State: California
Dollar Loss: $12,900,000
Month: December
Time: 2:30 A.M.
Property Characteristics and Operating Status:
Wildland/urban interface fire complex.
Fire Development:
An unspecified electrical equipment malfunction caused arcing that ignited ground vegetation.
Contributing Factors and Other Details:
This complex consisted of two fires, Shekel and Happy Camp. Extreme Red Flag conditions existed, with high winds up to 62 mph, low relative humidity and low fuel moisture. Approximtely 4,700 acres burned. A total of 25 structures, 60 horse trailers, 22 vehicles, eight miles of fence, and one bridge were damaged or destroyed. Two firefighters were injured fighting these fires.

Type Occupancy: Wildlands
State: California
Dollar Loss: $11,690,000
Month: October
Time: 1:12 A.M.
Property Characteristics and Operating Status:
Wildland/urban interface fire.
Fire Development:
This incendiary fire was set in a wooded area. Fire spread was rapid and burned through heavy chaparral and manzanita (evergreen shrubs and small trees) and into developed areas and destroyed 10 homes.
Contributing Factors and Other Details:
Five firefighters died while protecting homes in a cul-de-sac. The speed of spread and intensity of the fire rapidly overwhelmed the firefighters.

Type Occupancy: Wildlands
State: Texas
Dollar Loss: $5,000,000
Month: January
Time: 2:30 P.M.
Property Characteristics and Operating Status:
Wildland/urban interface fire.
Fire Development:
A downed cross arm on an electric pole caused arcing and sparks which ignited grass.
Contributing Factors and Other Details:
High winds, drought conditions, and low humidity were present. A total of 58 fire departments responded. Fifty-one structures were destroyed; another 11 suffered major damage and 13 had minor damage.

SPECIAL PROPERTIES

Type Occupancy: Special Properties
State: Washington
Dollar Loss: $13,000,000
Month: March
Time: 12:05 A.M.
Property Characteristics and Operating Status:
This three-story 100-unit university dormitory was under construction. It was of unprotected wood-frame construction, and covered 15,000 square feet. No one was at the site when the fire broke out.
Fire Protection Systems:
It was not known if detection equipment was installed yet. There was no automatic suppression equipment.
Fire Development:
This was an incendiary fire. No additional information was reported.
Contributing Factors and Other Details:
None reported.

Type Occupancy: Special Properties
State: Colorado
Dollar Loss: $6,000,000
Month: January
Time: 6:52 P.M.
Property Characteristics and Operating Status:
This four- to six-story multi-use building was under construction. It was of unprotected wood-frame construction and covered 40,000 square feet. There was to be retail and parking on the first-story and residences on the upper stories. It was not known if anyone was at the site when the fire broke out.
Fire Protection Systems:

No information was reported on detection equipment. There was an automatic suppression system present. No other information on the system was reported.
Fire Development:
The cause of this fire, which broke out on the first-story, is still under investigation.
Contributing Factors and Other Details:
None reported.

EDUCATIONAL PROPERTIES

Type Occupancy: Educational Properties
State: Alaska
Dollar Loss: $35,000,000
Month: August
Time: 6:00 AM
Property Characteristics and Operating Status:
This one-story elementary school covered 12,540 square feet of unprotected wood-frame construction. The school was occupied at the time. This occurred in a remote village.
Fire Protection Systems:
There was a complete coverage of unknown type detection equipment present. The system operated. There was no automatic suppression equipment present.
Fire Development:
This incendiary fire was set under the schoolhouse. Due to high winds, the fire soon became a conflagration, spreading to 57 exposures, including 20 residential properties, three educational properties, 30 storage properties (including metal shipping containers), a store, a boiler room, a steam bath, and one other type of property. Also lost were multiple snow removal machines and other vehicles.
Contributing Factors and Other Details:
There was a delay in detecting the fire because it originated under the structure. The day of the fire, there were extremely high winds. Firefighters responded from villages and towns miles away.

Type Occupancy: Educational Properties
State: Arkansas
Dollar Loss: $9,850,000
Month: August
Time: 2:23 PM
Property Characteristics and Operating Status:
This was a one-story middle, junior and high school of unprotected ordinary construction that covered 101,000 square feet. The school was in session when the fire broke out.
Fire Protection Systems:

The Large-Loss Fire Study is 75 years old this year

"The total estimated fire loss in the United States for the year 1931 is $453,500,000. This amount is based on figures compiled by the National Board of Fire Underwriters for the eleven months ended November 30, 1931, with an estimate for December based upon loss experiences for the same month in previous years adjusted for the trend of losses of the current year."

"During the year 1931 there were 43 fires involving a loss of $250,000 or more..." Source: The Quarterly of the National Fire Protection Association

The loss for those fires was estimated to be $25,388,000. The largest loss in a single fire in 1931 was $5,000,000 at an Armory in New York State. Three other fires resulted in over $1 million in losses.

The large-loss study has gone through several changes in the 75 years. In the past, fires were reported to be in Canada, Alaska (before it was a state), and Newfoundland. Business losses were included in several studies. The study now identifies the fires from the United States, only. Other changes are redefined property classifications, and the study does not include economic (business) losses. The study first appeared in the Quarterly magazine, then went to the Fire Journal. Most important, over the years the threshold that defines large-loss fires has changed several times.

- For the 1931 study the loss had to be over $250,000,
- For the 1978 study the loss had to be over $500,000,
- For the 1980 study the loss had to be over $1,000,000,
- For the 1987 study the loss threshold was raised to where it is today, $5,000,000.

In 2006, there were an estimated 1,642,500 fires with a total estimated loss of $11.3 billion in the United States. In large-loss fires, the total fire loss was $551 million.

Factors noted in the current large-loss study that contributed to a fire becoming a large-loss are very much the same as 75 years ago.

- Heavy fire loads, and poor housekeeping,
- Open construction,
- No detection equipment,
- Lack of working sprinkler systems,
- Delay in alarms as employees fought the fire first.

What will the next 75 years bring? Are we reducing the number of large-loss fires and the severity of the costliest fires? Can we reduce them more? The long-term trend in total fire loss, at least relative to population or the size of the economy, has been significantly down for more than the past 75 years. However, the last 25 years have seen several of the costliest fires of all time, particularly wildland/urban interface fires. Is it realistic to imagine that we will find the way and the will to eliminate large-loss fires—by 2032, 2057, or 2082? One thing is certain; the NFPA team will never stop trying.

There was a complete coverage combination heat and smoke detection system present. The system operated and alerted the occupants. There was no automatic suppression equipment present.
Fire Development:
Sparks or embers from a short in a light fixture ignited nearby combustibles. The fire burned into the attic and spread rapidly because of the wood-frame construction and plywood decking. Fire-fighters attacked the fire inside. When conditions worsened, firefighters evacuated the building and used elevated master streams.
Contributing Factors and Other Details:
The lack of detection and suppression equipment in the attic prevented early detection and intervention. To complicate matters for the firefighters, a severe thunderstorm passed through the area, forcing firefighters to shut down all master streams until it was safe to resume the battle. The loss was estimated at $9,100,000 to the structure and $750,000 to the contents.

Type Occupancy: Educational Properties
State: Hawaii
Dollar Loss: $6,000,000
Month: June
Time: 3:15 PM
Property Characteristics and Operating Status:
This was a one-story K-12 charter school. No other information was reported.
Fire Protection Systems:
No information reported.
Fire Development:
No information reported.
Contributing Factors and Other Details:
None reported

VEHICLES

Type Occupancy: Vehicles
State: California
Dollar Loss: $20,000,000
Month: June
Time: 12:34 PM
Property Characteristics and Operating Status:
This was an aircraft on a maintenance taxiway. Three airline employees were onboard for maintenance.
Fire Development:
As airline employees were conducting a ground run to troubleshoot reported engine problems, a backfire from a turbine engine caused a fire in the engine and wing area of this aircraft. Debris from the explosion caused several punctures in the fuel tanks. Leaking fuel ignited.
Contributing Factors and Other Details:
None reported.

PUBLIC ASSEMBLY PROPERTIES

Type Occupancy: Public Assembly Properties
State: Louisiana
Dollar Loss: $10,000,000
Month: March
Time: 3:00 A.M.
Property Characteristics and Operating Status:
This fire started in a fast-food restaurant in a block of buildings. No other information reported.
Fire Protection Systems:
No information reported.
Fire Development:
No information reported.
Contributing Factors and Other Details:
None reported.

Type Occupancy: Public Assembly Properties
State: Tennessee
Dollar Loss: $5,763,000
Month: October
Time: 2:39 A.M.
Property Characteristics and Operating Status:
This fire originated in a three-story church of unprotected ordinary construction. No other information reported.
Fire Protection Systems:
No information reported.
Fire Development:
No information reported.
Contributing Factors and Other Details:
None reported.

BASIC INDUSTRY, UTILITY PROPERTIES

Type Occupancy: Basic Industry, Utility Properties
State: Virginia
Dollar Loss: $25,000,000
Month: January
Time: 9:00 PM
Property Characteristics and Operating Status:
This was an electrical power generation plant. This fire involved electric transformers in the switch yard. The height and capacity of the operating transformers was not reported. The plant was operating at the time.
Fire Protection Systems:
No detection or automatic suppression equipment present.
Fire Development:
A valve failed in a pipe assembly carrying cooling oil for several transformers. A pressurized leak occurred and the hot transformers ignited the oil. The fire impinged on two transformers and they ruptured, causing a significant flammable liquid fire. The fire also damaged a 30,000-square-foot, six-story building.
Contributing Factors and Other Details:
None reported.

Fire Fighter Injuries for 2006

By Michael J. Karter, Jr. and Joseph L. Molis

Overview of 2006 fire fighter injuries

- 83,400 fire fighter injuries occurred in the line of duty in 2006, an increase of 4.1 percent from the year before.
- 44,210 or 53.0 percent of all fire fighter injuries occurred during fireground operations. An estimated 13,690 occurred during other on duty activities, while 13,090 occurred at non-fire emergency incidents.
- Regionally, the Northeast had the highest fireground injury rate with 5.0 injuries occurring per 100 fires; this was more than twice the rate for the rest of the country.
- The major types of injuries received during fireground operations were: strain, sprain, muscular pain (46.7 percent); wound, cut, bleeding, bruise (17.3 percent); burns (5.9 percent); smoke or gas inhalation (5.6 percent). Strains, sprains, and muscular pain accounted for 56.7 percent of all nonfireground injuries.

Fire fighters work in varied and complex environments that increase their risk of on-the-job death and injury. A better understanding of how these fatal accidents, nonfatal injuries, and illnesses occur can help identify corrective actions, which may minimize the inherent risks.

Each year, NFPA studies fire fighter deaths and injuries to provide national statistics on their frequency, extent, and characteristics. Earlier this year, the NFPA reported 89 fire fighters died on duty (See, "2006 Fire Fighter Fatalities," *NFPA Journal®*, July/August 2007).

This report addresses 2006 fire fighter injuries in the United States. The results are based on data collected during the NFPA *Survey of Fire Departments for U.S. Fire Experience* (2006). An earlier report measured the national fire experience in terms of the number of fires that fire departments attended and the resulting civilian deaths, civilian injuries, and property losses that occurred[1].

This year's report includes among its results:

- An estimate of the total number of 2006 fire fighter injuries.
- Estimates of the number of injuries by type of duty.
- An estimate of the number of exposures to infectious diseases.
- Descriptions of selected incidents that illustrate fire fighter safety problems.

Overall results

Based on survey data reported by fire departments, NFPA estimates that 83,400 fire fighter injuries occurred in the line of duty in 2006. This is an increase of 4.1 percent and the highest it's been since 2000.

In recent years, the number of fire fighter injuries have been considerably lower than they were in the 1990s (Figure 1), but this is due in part to additional questions on exposures, which allows us to place them in their own categories. Previously, some of these exposures may have been included in total injuries under other categories.[2]

NFPA estimates that there were 11,890 exposures to infectious diseases (e.g., hepatitis, meningitis, HIV, others) in 2006. This amounts to 0.8 exposures per 1,000 emergency medical runs by fire departments in 2006.

NFPA estimates that there were 23,580 exposures to hazardous conditions (e.g., asbestos, radioactive materials, chemicals, fumes, other) in 2006. This amounts to 22.5 exposures per 1,000 hazardous condition runs in 2006.

An estimated 15,950 injuries or 19.1 percent of all fire fighter injuries resulted in lost time in 2006.

Injuries by type of duty

Estimates of fire fighter injuries by type of duty are displayed in Figure 2. As in past reports, type of duty is divided into five categories:

- Responding to or returning from an incident

Photograph: iStock

(includes fire and nonfire emergencies).

- Fireground (includes structure fires, vehicle fires, brush fires, etc.), and refers to all activities from the moment of arrival at the scene to departure time (e.g., setup, extinguishment, overhaul).
- Nonfire emergency (includes rescue calls, hazardous calls, such as spills, and natural disaster calls).
- Training
- Other on-duty activities (e.g., inspection or maintenance duties).

Results by type of duty indicate that the largest share of injuries occurs during fireground operations: 44,210 or 53.0 percent of all fire fighter injuries in 2006 and the highest it's been since 1999. Table 1 displays fire fighter injuries at the fireground and injury rates for the 1981 to 2006 period. Injuries at the fireground decreased from their high of 67,500 in 1981 to a low of 36,880 in 2004 for a decrease of 45.4 percent. The rate of injuries per 1,000 fires has generally decreased during the period except for 2005-06. This is because the number of fire incidents also decreased a considerable 46.4 percent for the 1981 to 2004 period (See Figure 2).

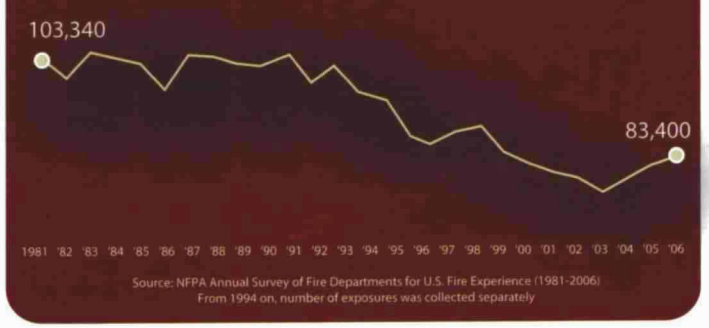
In addition to injuries at the fireground, an estimated 13,690 or 16.4 percent occurred during other on-duty activities, while 13,090 or 15.7 percent occurred at nonfire emergencies.

TABLE 1 - Firefighter Injuries at the Fireground, and at Nonfire Emergencies, 1981-2006

	AT THE FIREGROUND		*AT NONFIRE EMERGENCIES*	
Year	*Injuries*	*Injuries per 1000 Fires*	*Injuries*	*Injuries per 1,000 Incidents*
1981	67,500	23.3	9,600	1.24
1982	61,400	24.2	9,385	1.17
1983	61,700	26.5	11,105	1.29
1984	62,700	26.8	10,600	1.21
1985	61,300	25.9	12,500	1.38
1986	55,900	24.7	12,545	1.30
1987	57,755	24.8	13,940	1.41
1988	61,790	25.4	12,325	1.13
1989	58,250	27.5	12,580	1.11
1990	57,100	28.3	14,200	1.28
1991	55,830	27.3	15,065	1.20
1992	52,290	26.6	18,140	1.43
1993	52,885	27.1	16,675	1.25
1994	52,875	25.7	11,810	0.84
1995	50,640	25.8	13,500	0.94
1996	45,725	23.1	12,630	0.81
1997	40,920	22.8	14,880	0.92
1998	43,080	24.5	13,960	0.82
1999	45,500	25.0	13,565	0.76
2000	43,065	25.2	13,660	0.73
2001	41,395	23.9	14,140	0.73
2002	37,860	22.4	15,095	0.77
2003	38,045	24.0	14,550	0.70
2004	36,880	22.1	13,150	0.62
2005	41,950	26.2	12,250	0.56
2006	44,210	26.9	13,090	0.57

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1981-2006)

FIGURE 1 - Total Firefighter Injuries by Year (1981-2006)



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1981-2006)
From 1994 on, number of exposures was collected separately

Nature of fireground injuries

Estimates of 2006 fire fighter injuries by nature of injury and type of duty are displayed in Table 2. The nature of injury cause categories are based with modifications on NFPA 901, *Uniform Coding for Fire Protection*. Table 2 indicates that the four major types of injuries that occur during fireground operations are strain, sprain (46.7 percent); wound, cut, bleeding, bruise (17.3 percent); burns (6.9 percent); smoke or gas inhalation (5.6 percent); thermal stress (5.1 percent).

Results were fairly consistent during all non-fireground activities, with strains, sprains, and muscular pain accounting for 56.7 percent of all non-fireground injuries, and wound, cut, bleeding, bruise accounting for 17.8 percent.

Causes of fireground injuries

Because fireground injuries are of particular concern their causes were examined (see Figure 4). The definition of cause here refers to the initial circumstance leading to the injury. The cause categories included on the survey were also based on NFPA 901. Overexertion, strain (25.5 percent), fall, slip, jump (23.9 percent), were the leading causes of fireground injuries. Other major causes were contact with object (10.8 percent); and exposure to fire products (8.1 percent), and struck by (8.0 percent).

Fire department vehicle collisions

NFPA reported earlier that 19 fire fighters died in motor vehicle collisions in 2006. (See "2006 Fire Fighter Fatalities" July/August 2007, *NFPA Journal*).

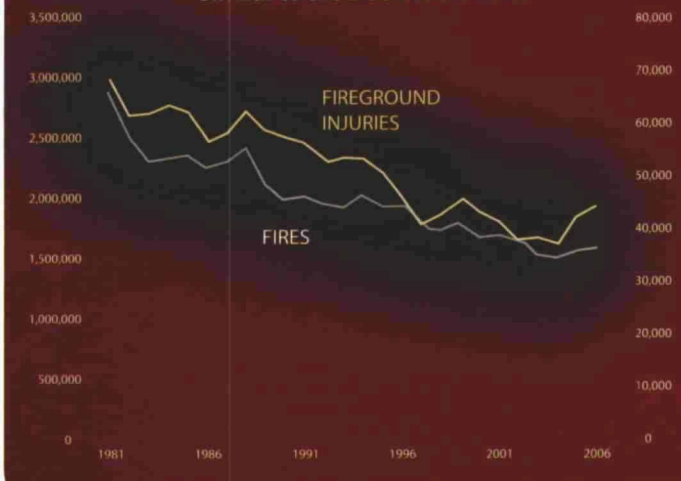
In 2006, there were an estimated 16,020 collisions involving fire department emergency

TABLE 2 - Firefighter Injuries by Nature of Injury and Type of Duty, 2006

NATURE OF INJURY	Responding to or Returning from an Incident NUMBER/%	Fireground NUMBER/%	Nonfire Emergency NUMBER/%	Training NUMBER/%	Other on-duty NUMBER/%	Total NUMBER/%
Burns (Fire or Chemical)	155/3.3	3,070/6.9	100/0.8	245/3.2	180/1.3	3,750/4.5
Smoke or Gas Inhalation	110/2.3	2,475/5.6	120/0.9	40/0.5	80/0.6	2,825/3.4
Other Respiratory Distress	40/0.8	1,280/2.9	125/1.0	60/0.8	120/0.9	1,625/2.0
Burns and Smoke Inhalation	40/0.8	575/1.3	10/0.1	30/0.4	75/0.6	730/0.9
Wound, Cut, Bleeding, Bruise	895/18.9	7,640/17.3	2,140/16.4	1,375/17.9	2,575/18.8	14,625/17.5
Dislocation, Fracture	175/3.7	1,065/2.4	210/1.6	300/3.9	410/3.0	2,160/2.6
Heart Attack or Stroke	35/0.7	350/0.8	155/1.2	100/1.3	360/2.6	1,000/1.2
Strain, Sprain Muscular Pain	2,650/55.9	20,655/46.7	7,855/60.0	4,760/62.1	6,975/51.0	42,895/51.4
Thermal Stress (frostbite, heat exhaustion)	235/5.0	2,280/5.1	190/1.5	205/2.7	190/1.4	3,100/3.7
Other	410/8.6	4,820/10.9	2,185/16.7	550/7.2	2,725/19.9	10,690/12.8
	4,745	*44,210*	*13,090*	*7,665*	*13,690*	*83,400*

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2006. Note: If a firefighter sustained multiple injuries for the same incident, only the nature of the single most serious injury was tabulated.

FIGURE 2 - The Decrease in Fireground Injuries is Similar to the Decrease in Fires



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1981-2006)

vehicles, where departments were responding to or returning from incidents (see Table 3).

To put this number in perspective however, fire departments responded to more than 24.5 million incidents in 2006, so that the number of collisions represents about one tenth of 1 percent of total responses. However, these collisions resulted in 1,250 fire fighter injuries or 1.5 percent of all fire fighter injuries.

Also, 1,070 collisions involving fire fighters' personal vehicles occurred in 2006 while departments were responding to or returning from incidents. These collisions resulted in an estimated 210 injuries.

Average fires and fireground injuries per department by population protected

The average number of fires and fireground injuries per department by population of community protected in 2005 are displayed in Table 4. These tabulations show (1) that the number of fires a fire department responds to is directly related to the population protected, and (2) that the number of fireground injuries incurred by a department is directly related to its exposure to fire, i.e., and the number of fires attended by the department. The second point is clearly demonstrated when we examine the range of the statistic: from a high of 149.4 for departments that protect communities of 500,000 to 999,999 to a low of 0.2 for departments that protect communities of less than 2,500.

A useful way to look at fire fighter injury experience and to obtain a reading on the relative risk that departments face is to examine the number of fireground injuries that occur for every 100 fires attended. This takes into account relative fire experience and allows more direct comparison between departments protecting communities of different sizes. The number of fireground injuries per 100 fires is displayed in column 4 of Table 4. The overall range of rates varied little from a high of 4.7 for departments that protect communities 500,000 to 999,999 to a low of 1.4 for departments that protect communities of less than 2,500 population. Thus, the wide range noted in average fireground injuries by population protected narrows when relative fire experience is taken into account. The

overall injury rate for departments protecting communities of 50,000 population or more was 3.2 injuries per 100 fires or 77 percent higher than the injury rate for departments protecting communities of less than 50,000 population.

The risk of fireground injury per 100 fire fighters by size of community protected was also calculated and is displayed in column 5 of Table 4. Larger departments generally had the highest rates with departments protecting communities of 500,000 to 999,999 having the highest rate with 12.7 injuries per 100 fire fighters. As community size decreases, the rate drops quite steadily to a low of 1.0 for departments protecting less than 2,500 people. That is a more than a twelve-to-one difference in risk of injury between communities of 500,000 to 999,999, and the smallest communities (less than 2,500).

An explanation for this difference is that although a department protecting a community with a population of 500,000 to 999,999 has, on average, more than 50 times as many fire fighters than a department protecting a population of less than 2,500, the larger department attends more than 220 times as many fires, and as a result, it incurs considerably more fireground injuries.

Average fires and fireground injuries

Table 5 displays the average number of fires and fireground injuries per department by population of community protected and region of the country[3]. As in the nationwide results in Table 4, the results of each region of the country indicate that the number of fires a fire department responds to is directly related to the population protected, and the number of fireground injuries incurred by a department is directly related to the number of fires attended. The Northeast reported a substantially higher number of fireground injuries for most community sizes where all departments reported sufficient data by region.

Improving fire fighter safety

As the statistics in this report and previous reports attest, fire fighting presents great risks of personal injury to fire fighters. Moreover, because of the kind of work performed and the hazards of the incident scene environment, it is unlikely that all fire fighter injuries can be eliminated. A risk management system and the application of existing technology, however, can offer options to reduce present injury levels and bring about corresponding reductions that are recommended by NFPA that could be taken at the local level. The reference to the appropriate NFPA Standard is shown with the example in parenthesis:

TABLE 3 - Fire Department Vehicle Collisions and Resulting Firefighter Injuries While Responding to or Returning From Incidents, 1990-2006

	INVOLVING FIRE DEPARTMENT EMERGENCY VEHICLES		*INVOLVING FIRE FIGHTERS' PERSONAL VEHICLES*	
Year	*Collisions*	*Fire Fighter Injuries*	*Collisions*	*Fire Fighter Injuries*
1990	11,325	1,300	950	175
1991	12,125	1,075	1,375	125
1992	11,500	1,050	1,575	150
1993	12,250	900	1,675	200
1994	13,755	1,035	1,610	285
1995	14,670	950	1,690	190
1996	14,200	910	1,400	240
1997	14,950	1,350	1,300	180
1998	14,650	1,050	1,350	315
1999	15,450	875	1,080	90
2000	15,300	990	1,160	170
2001	14,900	960	1,325	140
2002	15,550	1,040	1,030	210
2003	15,900	850	980	85
2004	15,420	980	1,150	220
2005	15,885	1,120	1,080	125
2006	16,020	1,250	1,070	210

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1990-2006)

FIGURE 3 - Total Firefighter Injuries by Type of Duty, 2006

Commitment on the part of top fire service management to reducing injuries (NFPA 1500, *Fire Department Occupational Safety and Health Program*, Section 4.3)

Establishment of a safety committee headed by a safety officer to recommend a safety policy and the means of implementing it (NFPA 1500, Section 4.5).

Develop and implement an investigation procedure that includes all accidents, near misses, injuries, fatalities, occupational illnesses, and exposures involving members. (NFPA 1500, 4.4.4 and 4.4.5)

Provision of appropriate protective equipment and a mandate to use it. (NFPA 1500, Section 7.1 through 7.8)

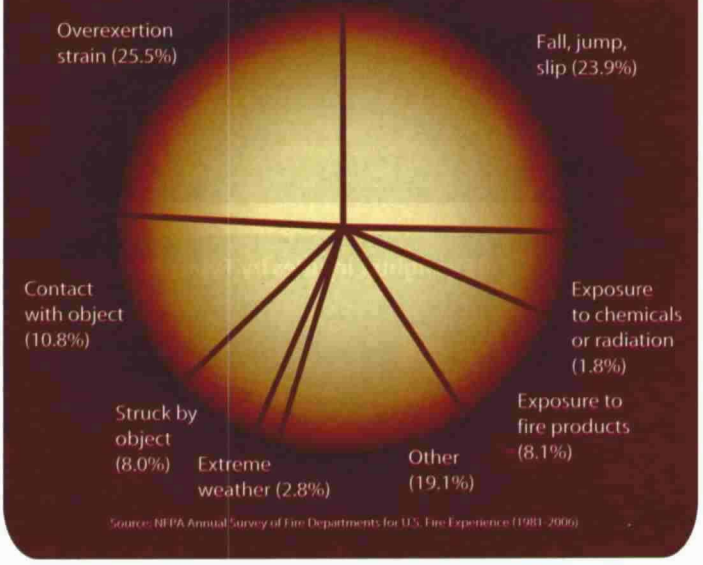
Development and enforcement of a program on the use and maintenance of SCBA (NFPA 1500,

TABLE 4 - Average Number of Fires, Fireground Injuries and Injury Rates by Population of Community Protected, 2006

Population of Community Protected	*Average Number of Fires*	*Average Number of Fireground Injuries*	*Number of Fireground Injuries Per 100 Fires*	*Number of Fireground Injuries Per 100 Firefighters*
500,000 to 999,999	3,204.9	149.4	4.7	12.7
250,000 to 499,999	1,499.3	42.2	2.8	8.9
100,000 to 249,999	610.6	15.8	2.6	7.6
50,000 to 99,999	257.0	7.1	2.8	6.5
25,000 to 49,999	145.1	3.6	2.5	6.7
10,000 to 24,999	74.5	1.6	2.1	4.1
5,000 to 9,999	41.6	0.7	1.7	2.3
2,500 to 4,999	27.3	0.4	1.5	1.8
Under 2,500	14.5	0.2	1.4	1.0

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2006

FIGURE 4 - Fireground Injuries by Cause, 2006



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1981–2006)

Section 7.9 through 7.14

Development and enforcement of policies on safe practices for drivers and passengers of fire apparatus (NFPA 1500, Section 6.2 and 6.3)

Development of procedures to ensure response of sufficient personnel for both fire fighting and overhaul duties. (NFPA 1500, 4.1.2; NFPA 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*; and NFPA 1720, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments*).

Implementation of regular medical examinations and a physical fitness program (NFPA 1500, Section 10.1 through 10.3; NFPA 1582, *Comprehensive Occupational Medical Program for Fire Departments*; and NFPA 1583, *Health-Related Fitness Programs for Fire fighters*).

Adoption and implementation of an incident management system (NFPA 1500, Section 8.1; and NFPA 1561, *Emergency Services Incident Management System*).

Training and education for all members related to emergency operations (NFPA 1500, Chapter 5)

Implementation of programs for the installation of private fire protection systems, so that fires are discovered at an earlier stage, exposing the fire fighter to a less hostile environment (NFPA 1, *Uniform Fire Code*™; NFPA 101®, *Life Safety Code*®; NFPA 5000®, *Building Construction and Safety Code*®

Increased efforts in the area of fire safety education programs, so that citizens are made aware of measures to prevent fires and of correct reactions to the fire situation (NFPA 1201, *Providing Emergency Services to the Public*, Chapter 6) Efforts need to be made to recognize that fire fighter injuries can be reduced. By addressing the priorities listed above Fire Service organizations can make significant strides towards reducing the number and impact of such injuries.

Survey and data collection method

NFPA annually surveys a sample of departments in the United States to make national projections of the fire problem. The sample is stratified by the size of the community protected by the fire department. All U.S. fire departments that protect communities of 100,000 or more are included in the sample, because they constitute a small number of departments with a large share of the total population protected. For departments that protect less than 100,000 population, stratifying the sample by community size permits greater precision in the estimates. Survey returns in recent years have ranged from 2,560 to 3,500

Photograph: AP/Wide World

TABLE 5 - Average Number of Fires and Fireground Injuries per Department and Injuries per 100 Fires, by Population of Community Protected, and Region, 2006

1: Average Reported Number of Fires
2: Average Reported Number of Fireground Injuries
3: Number of Fireground Injuries per 100 Fires

Population of	NORTHEAST			NORTHCENTRAL			SOUTH			WEST		
Community Protected	1	2	3	1	2	3	1	2	3	1	2	3
500,000 to 999,999	*	*	*	*	*	*	3,279.0	49.8	1.5	2,704.6	51.2	1.9
250,000 to 499,999	*	*	*	2,134.2	102.3	4.8	1,243.3	18.0	1.4	1,215.2	17.2	1.4
100,000 to 249,999	660.2	21.2	3.2	544.7	27.4	5.0	827.6	15.3	1.8	414.6	7.9	1.9
50,000 to 99,999	312.0	15.1	4.8	198.7	7.9	4.0	333.6	5.8	1.7	208.4	3.7	1.7
25,999 to 49,999	138.9	4.7	3.2	113.3	4.4	3.9	171.2	2.6	1.5	184.6	2.1	1.1
10,000 to 24,999	63.2	3.0	4.7	61.5	1.2	2.0	98.9	1.4	1.4	79.6	1.6	2.0
5,000 to 9,999	30.9	1.0	3.2	32.9	0.6	1.8	61.2	0.5	0.8	56.6	0.9	1.6
2,500 to 4,999	22.9	0.3	1.3	24.1	0.5	2.1	33.5	0.2	0.6	33.6	0.4	1.2
Under 2,500	12.3	0.2	1.6	12.9	0.2	1.6	21.2	0.5	2.4	14.0	0.2	1.4
Overall Regional Rate	54.5	2.7	5.0	44.2	1.3	2.9	72.1	1.3	1.8	78.4	1.4	1.8

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2006 *Insufficient data

departments annually. The national projections are made by weighting sample results according to the proportion of total U.S. population accounted for by communities of each size. Around any estimate based on a sample survey, there is a confidence interval that measures the statistical certainty (or uncertainty) of the estimate. We are very confident that the actual number of total fire fighter injuries falls within 8.3 percent of the estimate.

The results in this report are based on injuries that occurred during incidents attended by public fire departments. No adjustments were made for injuries that occurred during fires attended solely by private fire brigades, e.g., industrial or military installations.

Data collection for the selected incident summaries was enhanced by a form that was sent to departments requesting information. The form included questions on type of protective equipment worn, age and rank of fire fighters injured, and description of circumstances that led to injury.

Endnotes

1. Michael J. Karter, Jr., "2006 Fire Loss in the United States", *NFPA Journal*, Vol. 101, No. 5 (September/October 2007).

2. Around any estimate based on a sample survey, there is a confidence interval that measures the statistical certainty (or uncertainty) of the estimate. Based on data reported by fire departments responding to the NFPA *Survey for U.S. Fire Experience* (2005), the NFPA is very confident that the actual number of fire fighter injuries falls within the range of 76,400 to 90,400.

3. The four regions as defined by the U.S. Census Bureau include the following 50 states and the District of Columbia:

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

Northcentral: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi,North Carolina, Oklahoma, South Carolina, Tennessee,Texas, Virginia and West Virginia.

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

Acknowledgments

NFPA thanks the many fire departments that responded to the NFPA *Survey for U.S. Fire Experience* (2006) for their continuing efforts in providing in a timely manner the data so necessary to make national projections of fire fighter injuries.

The authors gratefully thank the many NFPA staff members who worked on this year's survey, including Frank Deely, John Baldi, and John Conlon for editing and keying the survey forms and their follow-up calls to fire departments; and Norma Candeloro for handling the processing of survey forms and typing this report.

MICHAEL J. KARTER, JR. is a Senior Statistician with the National Fire Protection Association's Fire Analysis and Research Division. Joseph L. Molis is an NFPA Fire Data Assistant.

Fall—Training

A company officer with 11 years experience suffered a fractured skull after he fell during a training session. The 32-year-old instructor was briefing students on the training activity when the railing he was leaning against collapsed and he fell seven feet (2.1 meters) to the pavement below.

The victim was wearing a partial protective ensemble consisting of his protective coat and pants, helmet, and gloves. He returned to work five months after suffering two skull fractures and a shoulder injury.

Motor Vehicle Crash—Responding Returning

An engine company responding to an emergency medical call crashed and injured four fire fighters and seriously injured the company officer.

The engine swerved to avoid a vehicle and overturned onto its roof after it went through a red traffic light. The responding engine truck was traveling north approaching an intersection when the operator noticed a vehicle traveling east stopped in the middle of the intersection.

The driver applied the brakes and realized he was not going to stop in time. He instinctively turned the truck to the right to avoid the collision but, he turned the apparatus into a second vehicle traveling west in the left turn lane. The driver steered away to avoid a collision with the second vehicle, which caused the apparatus to flip onto its roof and slide for several yards.

All members, except the company officer were wearing seatbelts and only suffered some cuts and bruises. The company officer fractured a leg and had more severe injuries than those wearing seatbelts.

The victims were not wearing structural fire fighting protective clothing because they were responding to the medical call from a training exercise.

According to the department's investigation, the driver admitted to being at fault. He was going too fast and did not stop for the red light. The driver and company officer were disciplined for their actions.

Fire Fighter Struck by Vehicle

A fire fighter with 15 years experience suffered minor injuries when cargo loaded on a tractor trailer struck him at an emergency scene. The 51-year-old was directing traffic to allow a medic unit transporting crash victims cross the road.

The tractor trailer with its oversized load of wooden trusses was passing the fire fighter when it hit him. The trusses, overhanging the trailer by 4 feet (1.2 meters), knocked the victim to the ground. He regained his footing and avoided the trailer's rear axles. The tractor trailer driver stopped the truck after seeing the fire fighter go down in a twisting motion.

The victim was treated for a large abrasion on his shoulder and released from the hospital. He returned to work the next scheduled day. The only protective gear worn at the incident was a fluorescent-reflective vest.

Fall from Ladder

A company officer, 47, was injured while advancing a hoseline up a ground ladder. After stepping onto the roof, he lost his balance and fell approximately 25 feet (7.6 meters). He suffered only minor injuries.

An occupant of a two-family dwelling called the fire department reporting a fire in a rear bedroom. The family, alerted by smoke detectors, had already evacuated the dwelling when the fire department arrived four minutes later. The fire of undetermined origin caused approximately $30,000 in damages.

The department report credits the use of his protective helmet in reducing the severity of his injuries. The officer was wearing a full structural firefighter protective ensemble at the time of his injury. He missed two work days and returned to full duty without any complications.

Fire Fighter Struck by Vehicle

Two fire department units responded to a medical call of a person on an interstate who was in respiratory distress. The closest engine company was staffed with a fire fighter and a paramedic-level ambulance that was staffed with two fire fighters.

The engine company arrived on scene approximately 6 minutes after dispatch and the ambulance arrived 2 minutes later. The ambulance crew reported that the engine company had been struck by a tractor trailer truck and they had a fire fighter down. The ambulance crew requested additional resources and began treating the fire fighter and the patient suffering respiratory distress.

According to the department's investigative report, the engine arrived on scene and parked in the emergency breakdown lane and put on its emergency lights.

The fire fighter, 36, exited the vehicle and was retrieving medical equipment from the driver's side compartment that was behind the pump panel. The fire fighter stated he heard a truck and looked up only to see the truck headed for him.

The truck struck the parked apparatus with its right rear wheel, damaged the left rear tailboard, and tore two compartment doors off the fire engine. The right rear wheels of the passing truck and the flying compartment doors struck the fire fighter. The victim landed in the road but rolled under the fire apparatus.

The fire engine was also damaged.

The truck driver was looking down, trying to retrieve a pair of glasses. When he looked up, he was heading for the fire engine. He was not hurt in the incident.

The fire fighter suffered numerous broken bones and underwent several surgeries. He was hospitalized for more than a month and returned to full duty 11 months after the incident.

First responders work on an injured fire fighter at an accident scene.

Porch Collapse

A fire fighter and a company officer were injured when a porch collapsed during a fire at a single-family dwelling.

The collapse occurred five minutes after fire fighters arrived on scene, while two members of the three-person crew were stretching a handline onto the porch.

After completing his assessment of the fire conditions, the lieutenant, 32, ordered a handline deployed to extinguish the front porch fire. The fire fighter, 25, on the handline extinguished the fire and began moving onto the porch where he was joined the company officer as began forcible entry into the structure.

After completing his task, the lieutenant moved behind the fire fighter and noticed the porch roof shift. He immediately tugged on the handline and warned the fire fighter but the porch collapsed onto the fire fighter.

The roof porch pinned the fire fighter and knocked the lieutenant onto the ground.

The apparatus operator saw the collapse and called a mayday situation. The lieutenant got back on his feet and, despite his injuries, helped two other fire fighters on scene lift a large section of debris to remove the fire fighter from the collapse.

A battalion chief arrived on scene approximately a minute after the collapse and began medical treatment of the injured fire fighter.

The fire fighter suffered second and third degree burns to his left shoulder, hip, and foot. The third degree burns covered nine percent of his body. He was wearing a full protective ensemble that had to be removed from service and destroyed after the incident. He was hospitalized for two weeks and returned to full duty two months after the incident.

The lieutenant suffered second degree burns to his right arm and a puncture wound to his right hand. He was treated and released from the hospital and returned to full duty.

His complete protective ensemble was damaged and removed from service.

The single-family home was undergoing renovations at the time of the fire. The cause was determined to be unintentional and occurred when a nail nicked a wire during renovation. The home also showed signs of a severe termite infestation that required the removal of several studs connected to the porch, weakening the structure before the fire.

Struck by Object—Wildland

A 28-year-old fire fighter was seriously injured when dead tree limb fell and struck him in the back. The victim was hospitalized for three days and has not returned to active firefighting duty.

He was one of three fire fighters assigned to an engine company operating as a strike team. The company was performing mop-up operations when the injury occurred.

The victim's company was under a tree during a rest period when they heard a crack and saw a large section of the tree fall.

The victim was kneeling and could not get out of the way when the large snag broke away from the tree and fell about 10 feet (3 meters) and struck the fire fighter in the back.

The two other fire fighters scrambled to safety. Several crews in the vicinity immediately administered basic life support until an advanced life support crew responded.

The injured fire fighter was carried to a landing zone where a helicopter flew him 39 minutes to a medical facility.

Severe Cut

A fire service veteran suffered a career-ending injury while combating a 5-acre (2-hectare) brush fire.

The victim, who had 39 years experience, was assigned to an engine company as part of a strike team. The crew augmented a hoseline that was already in operation.

While hiking on a narrow trail on a steep hillside, the victim, 61, lost his balance many times. To regain his balance, he used a shovel as leverage and accidentally jammed it into his left foot. He kept walking because he believed he only bruised his foot.

Time passed. He realized he was bleeding profusely. The fire fighter had severed an artery, cut two tendons, and suffered nerve damage. A medic assigned with the crew immediately bandaged his wound and slowed the bleeding.

The injured fire fighter was transported to the hospital. He was hospitalized for four days and underwent two surgical procedures to repair the damage.

Roof Collapse—Structure Fire

A partial collapse of a bowstring truss roof injured two fire fighters during a warehouse fire.

The warehouse was part of a dry cleaning business. Both fire fighters were advancing a 2-inch handline inside the front doors when the collapse forced heat and smoke upon the victims. Both hastily retreated from the building.

The first fire fighter suffered minor burns and returned to full duty. The second burned his hand, wrist, shoulder, and buttocks. He was not hospitalized but missed 11 days of work and was placed on light duty for nearly six months. He made a full recovery.

Both wore full protective structural firefighting protective ensemble. A rapid intervention team of four fire fighters was assembled at the time of the collapse but they were not deployed because the injured fire fighters escaped on their own.

The department credits their complete protective ensemble for limiting their burn injuries. The report states that the fire fighters should not have been inside the building because of the heavy fire conditions, bowstring truss construction, and no one was in the warehouse.

Fire fighters pour water into the scene of a three-alarm fire in New York City. Five fire fighters were trapped and later rescued from the building.

Fall—Structure Fire

A lieutenant, 41, was injured in a fire at a vacant two-story, unsecured mill building. The first floor was the origin of the incendiary fire where several couches and mattresses were ignited.

An officer and three fire fighters deployed a handline through the front doors. While crawling on the floor looking for the seat of the fire, the lieutenant fell 12 feet (3.6 meters) into a pit with debris at the bottom.

The officer, a 19-year veteran, injured his back, knee, and wrist. His mask was dislodged and he had having trouble breathing while inside the pit. He tried called for help but was not heard. He extricated himself from the pit by climbing a fixed ladder on the side of the pit and two fire fighters helped him out of the building.

The lieutenant returned to full duty three months after the incident but continued physical therapy for his injuries. Nearly a year after the incident, he was still having problems with his wrist and required surgery.

He is currently on injury leave but is expected to make a full recovery and return to full duty.

He was wearing a full protective ensemble. At the time of the fall, the rapid intervention team was not on scene. It is unknown why the dispatchers or anybody on scene heard his mayday transmission.

Photograph: AP/Wide World

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in degrees Celsius of the gas or vapor involved or has been tested and found incapable of igniting the gas or vapor. This exception shall not apply to thermionic tubes.

(3) Without Make-or-Break Contacts Transformer windings, impedance coils, solenoids, and other windings that do not incorporate sliding or make-or-break contacts shall be provided with enclosures. General-purpose-type enclosures shall be permitted.

(4) General-Purpose Assemblies Where an assembly is made up of components for which general-purpose enclosures are acceptable as provided in 501.105(B)(1), (B)(2), and (B)(3), a single general-purpose enclosure shall be acceptable for the assembly. Where such an assembly includes any of the equipment described in 501.105(B)(2), the maximum obtainable surface temperature of any component of the assembly shall be clearly and permanently indicated on the outside of the enclosure. Alternatively, equipment shall be permitted to be marked to indicate the temperature class for which it is suitable, using the temperature class (T Code) of Table 500.8(B).

(5) Fuses Where general-purpose enclosures are permitted in 501.105(B)(1) through (B)(4), fuses for overcurrent protection of instrument circuits not subject to overloading in normal use shall be permitted to be mounted in general-purpose enclosures if each such fuse is preceded by a switch complying with 501.105(B)(1).

(6) Connections To facilitate replacements, process control instruments shall be permitted to be connected through flexible cord, attachment plug, and receptacle, provided all of the following conditions apply:

(1) A switch complying with 501.105(B)(1) is p
that the attachment plug is not depended
current.
(2) The current does not exceed 3 am
nominal.
(3) The power-supply cord does not
is of a type listed for extra-hard
if protected by location, and
attachment plug and recepta
grounding type.
(4) Only necessary receptacles ar
(5) The receptacle carries a label
ging under load.

**501.115 Switches, Circuit Bre
Controllers, and Fuses**

(A) Class I, Division 1 In Class I,
switches, circuit breakers, motor contro
cluding pushbuttons, relays, and similar

provided with enclosures, and the enclosure in each case, together with the enclosed apparatus, shall be identified as a complete assembly for use in Class I locations.

Exhibit 501.14 shows an explosionproof panelboard that consists of an assembly of branch-circuit devices enclosed in a cast metal explosionproof housing. Explosionproof panelboards are provided with bolted access covers and threaded conduit-entry hubs designed to withstand the force of an internal explosion.

Exhibit 501.15 shows a cylindrical-type (spin-top) combination motor controller, motor control starter, and circuit breaker in an explosionproof enclosure. The top and bottom covers are threaded on for quick removal for installation and servicing. Exhibit 501.16 shows the same type of equipment in a rectangular enclosure with a hinged, bolted-on cover. These types of housings are designed to accommodate a wide range of manually or magnetically operated across-the-line types of motor starters in a variety of ratings.

Exhibit 501.17 illustrates a standard toggle switch in an explosionproof enclosure.

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Article 501 — Class I Locations 501.115

Exhibit 501.15 An explosionproof enclosure for a motor control ...er and circuit breaker. (Courtesy of Appleton Electric Co., ...S Electrical Group)

Fuses used for supplementary ballast protection are per-...tted to be installed in high-intensity-discharge and fluores-...nt fixtures in accordance with 501.115(B)(4).

(B) Class I, Division 2 Switches, circuit breakers, motor controllers, and fuses in Class I, Division 2 locations shall comply with 501.115(B)(1) through (B)(4).

(1) Type Required Circuit breakers, motor controllers, and switches intended to interrupt current in the normal performance of the function for which they are installed shall be provided with enclosures identified for Class I, Division 1 locations in accordance with 501.105(A), unless general-purpose enclosures are provided and any of the following apply.

(1) The interruption of current occurs within a chamber hermetically sealed against the entrance of gases and vapors.

(2) The current make-and-break contacts are oil-immersed and of the general-purpose type having a 50-mm (2-in.) minimum immersion for power contacts and a 25-mm (1-in.) minimum immersion for control contacts.

Exhibit 501.16 A magnetic motor starter for use in a Class I, Group D location. Note the number of securing bolts and the width of the flange. (Courtesy of O-Z/Gedney, a division of EGS Electrical Group)

Exhibit 501.17 A standard toggle switch in an explosionproof enclosure. (Courtesy of Appleton Electric Co., EGS Electrical Group)

(3) The interruption of current occurs within a factory-sealed explosionproof chamber.

(4) The device is a solid state, switching control without contacts, where the surface temperature does not exceed 80 percent of the ignition temperature in degrees Celsius of the gas or vapor involved.

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FIRE SCIENCE & TECHNOLOGY EDUCATORS

Member Spotlight

Automatic Fire Alarm Initiating Devices: A Case Study

BY JEFFREY D. ZWIRN

A police officer concerned about protecting his own home against burglary and fire called a national alarm company to survey his residence. After the security survey, the parties agreed to a contract that allowed the company to install a burglar and fire alarm system that was to be monitored by the company's central station. The contract also spelled out the initial and recurring costs.

When the security system had been installed for about a year, the house caught fire while the homeowner was on duty. The fire alarm system never activated, and the central station never received any signals indicating that the alarm system had detected the blaze.

One of the first things the homeowner did after he learned that the central station had not notified the fire department was to contact the alarm company to find out what had happened. When he asked the installer why the central station had not receive any fire alarm signals, he was astonished to learn that the company did not know he had a fire alarm system.

However, the central station reassured him that, in case of a fire, there was a button on the keypad depicting a flame and that, if pressed, would alert the central station which would be sure to dispatch the fire department immediately.

When the homeowner asked for a copy of his original contract to investigate the disparity between what he believed he had bought and what he was now being told by the installer, he discovered that the salesperson had indicated in writing that the alarm system did, in fact, have automatic initiating devices under the preprinted fire alarm section of the contract and that the central station was monitoring the system for both burglar and fire alarm signals.

How can a manual button on a keypad ever be considered an automatic initiating device? Simply put, it can't.

If the customer is sleeping when a fire occurs, how can the button automatically activate? What if the customer is not at home? And how would the system installers ever test this device?

There is no electronic, mechanical, or scientific way for this fire alarm automatic initiating device to function as it was originally sold and represented by the alarm company. Even the equipment manufacturer did not support this application or the deceptive way in which the dealer had misrepresented the system's functionality.

Nor is there a code, standard, rule, regulation, or ordinance that would allow the use of a manual keypad button as a safe alternative to a real automatic initiating device, such as a smoke alarm.

Clearly, the alarm company's outrageous misapplication of technology was egregious and reckless, since it created

(continued on next page)

(Member Spotlight continued)

what it knew or should have known was a dangerous condition and failed to disclose it to the customer.

In its defense, the alarm company tried to shift the blame of its legal exposure to the homeowner, saying that the customer should have recognized that they had never installed smoke detectors. As a result, they said, the customer had to know that these types of devices were never connected to his alarm system for monitoring.

The customer countered that he was not an alarm expert and had no way of knowing whether the installer had added something to his existing smoke detectors or used some other technology to accomplish the task the sales person told him the alarm system installation would perform.

Essentially, the improperly trained and supervised sales person and the installers, who should have followed the contract to ensure that the customer was getting what he paid for, were more interested in getting the job than in doing the job properly.

To help minimize loss potential, professional alarm dealers must understand how critical it is to properly present to the customer what the system will incorporate, to have properly trained and supervised employees, and to take the necessary steps to ensure that its work, from design, application, and programming to installation, service, testing, maintenance, and monitoring, is performed diligently.

Jeffrey D. Zwirn is a member of CPP, CFPS, CFE, DABFET, CHS-III, and SET, and is president of IDS Research and Development, Incorporated.

From the Members

EDUCATION

Kitchen Fire or False Alarm?

BY EARL DIMENT

I was at a campus fire safety conference recently, and I heard an interesting comment. The question on the floor was, "Are you having problems with stovetop fires and is it a large issue for you?" One gentleman got up and asked if the speaker was referring to actual kitchen fires or false alarms from burned food.

The comment that struck me was a response from another participant, who asked, "What's the difference?" As I thought about that statement from a fire-service standpoint, I had a pretty significant "ah-ha" moment. I suddenly realized that, in terms of the event and resulting behaviors, there really isn't much difference.

From a management standpoint, both can be equally challenging. Both involve evacuation, notification, investigation, and emergency response. Both have an inherent risk of injury, not only to residents but also emergency responders. Both involve smoke, so both can be equally as emotionally charged. The ultimate result of both scenarios is that residents feel a little less safe with their surroundings and building system because both events rarely go perfectly.

And in the event of recurring incidents of burned food, something with even more frightening consequences begins to happen: apathy. If residents see enough of these events, it really isn't their fault that they begin to ignore alarms. I refer you to the classic children's story, "The Boy Who Cried Wolf."

We tend to only give credence to real incidents. From a life-safety perspective, false alarms don't generally even make the radar screen. They probably won't show up as a fire loss statistic, even if somebody breaks a leg or has a heart attack during the resulting mayhem.

In terms of your overall goals in a life-safety plan, however, there is no difference between a real fire and a false alarm. I take the position that burned popcorn or toast is, in a very real sense, a life-threatening event and undermines your chances for evacuation in the event of the "real" thing. This could set you up for a tragedy in the future.

The real question is to find a way to remedy the situation. There are four ways to deal with this problem: education, engineering, enforcement, and emergency response.

From an educational standpoint, you could put together a program that showed the hazards of unattended cooking, the behaviors that lead to it, and the dangers of false alarms. On the enforcement side, you could levee fines and possibly evict tenants for burned food incidents. You could also try adding monitors to respond more quickly or look to an engineering change that would eliminate cooking fires and false alarms at the source…the stove.

In reality, a combination of these methods will reduce the problem. This article is just a little food for thought, to add a little perspective to some hazards that tend to slide under our radar.

ELECTRICAL

Hey Electricians... Get with the Program!

BY LEE MARCHESSAULT

It seems that everywhere I conduct training for general-industry companies on electrical safety, I hear the same thing: Why don't the electricians we hire have to follow these rules? Of course, I tell them that

all qualified electrical workers need to follow OSHA regulations and use NFPA 70E®, *Electrical Safety in the Workplace®*, as guides for safe work practices to ensure that they get home in one piece. Licensed electricians go through extensive training on the *National Electrical Code®*, but are not typically trained in electrical safety.

As a licensed electrician, I, like most others, received 500 hours of classroom training and 8,000 hours of documented work before I could sit for a comprehensive test. However, it wasn't until I became a safety manager that I heard about NFPA 70E or OSHA Subpart S, and .269 (or, in the construction industry, Subparts K and V). After spending 19 years in the field, it seems a bit late to receive that information. NFPA 70E should be introduced at the first class of the first year to apprentice electricians. And to renew your license, 8 hours, or half of the mandatory update program, should be devoted to safety-related work practices rather than just the *NEC* updates.

I received an email from a qualified person who attended on of my classes. He wrote: "The class was great, but it never prepared me for the sound of a man screaming and the smell of his burning flesh."

On January 1, 2007, this person was working on energized equipment using all the required PPE for his 480-volt job, including FR coveralls, arc shield, electrical-rated hard hat, Class 0 rubber gloves, and insulated tools. Behind him, another electrician who was also working on energized 480-volt equipment had no protective equipment but cotton clothing. When confronted about his lack of PPE, the man said that he had been doing this work for more than 20 years and knew what he was doing. Shortly after the protected worker left area, a loud arc flash took place, and the man began to scream. When the protected worker went to help, he smelled the man's flesh burning. His clothes had been burned and blown completely off his body.

We play Russian roulette every time we touch electricity or take chances around energized parts. There is no reason we should ever touch electricity or get burned by an arc flash.

We must all to follow NFPA 70E and OSHA guidelines whenever we work around electrical apparatus. General industry has begun to drive the electrical contractors into providing training for their electricians, but it is far from universal. Those of us who have a voice in a regulatory entity relating to the type of training electricians receive should encourage the use of NFPA 70E in the first year and as part of an update for seasoned electricians. Who knows? We may save a life or two!

Lee Marchessault is president of Workplace Safety Solutions, Incorporated.

FIRE SERVICE

Using Local Cable Television

BY JOSEPH J. COFFEY

Today's technology has created faster information-sharing via the computer, cell phone, and television, all of which allows the fire service to better inform the public of our mission.

Many departments are under budget constraints and do not have the personnel to meet with the public. Fortunately, the local government cable access channel can provide a cost-effective way of letting our customers know about fire safety in whatever format the department chooses. The opportunities are endless, and, in most cases, the cost to the fire department to produce a program is very small.

If you decide to produce a cable program, remember to advertise it on the government Web site, on the

fire department Web site, or in the local newspaper.

Being creative is important when there is less money to go around. This potential medium can give your department a boost when it comes to getting the fire safety message out.

From the Chair

INDUSTRIAL FIRE PROTECTION

2007 FPW Contest

BY DALE J. ROMME

How many of your companies or businesses did something special for Fire Prevention Week (FPW), which ran from October 7 to 13? This year's theme, "Practice Your Escape Plan," had such a straightforward yet profoundly important message! I hope your companies and businesses hosted junior fire chiefs during the week, educated your employees on their primary and secondary routes of egress, and participated in emergency evacuation exercises and drills.

If your company participated in FPW 2007, I would like to encourage you to share your experience by entering our section's FPW 2007 contest. The application can be completed and submitted on line at http://submissions.nfpa.org/quickforms/ifps.php. You can spend as much or as little time on the application as you wish, but 30 minutes would definitely put you in good stead for a winning entry, which will be recognized at NFPA's 2008 World Safety Conference & Exposition® (WSC&E®)in Las Vegas. It's a very prestigious honor to be recognized in front of 1,500 of your peers at the opening day's key speaker session.

You must submit your application by December 1, 2007. Would you please give some extra thought to making a difference by submitting an FPW 2007 application today? Thanks in advance for those of you who choose to participate.

Responsibility of Technical Committee Representatives

At the section's Fall Meeting in Boston in late September, we decided that all technical committee members representing the section should share feedback on their technical committee's activity and any major points of contention. We can use this feedback to identify potential topics for the business meeting at the 2008 WSC&E. So please be on the lookout for a request for feedback in the near future.

2008 WSC&E Business Meeting

Also at the section's Fall Meeting, the Board voted to move the IFPS's business meeting from 5:30 p.m. on the last day of the conference to a lunch period on the second or third day of the conference. This switch should allow more of section members to participate. We'll also distribute our enviable section exposition booth prizes only to section members present at the business meeting.

Become a Board Member

Finally, if you have ever wanted to get to know others who have responsibilities at their companies similar to those you have at yours, please consider becoming a member of the section Board. It's a fantastic way to network and build lasting friendships in the fire and safety industry.

If you are interested, please email Mike Snyder at mike.snyder@dowcorning.com.

I look forward to seeing all of you at the NFPA's 2008 WSC&E, which will be held at the Mandalay Bay Convention Center in Las Vegas, Nevada, from June 2 to 6.

RESEARCH

NIST Releases Benefit-Cost Analysis of Residential Fire Sprinkler Systems

BY DANIEL MADRZYKOWSKI

A recently released report from the National Institute of Standards and Technology (NIST) documents a benefit-cost analysis performed to measure the expected present value of net benefits resulting from the installation of a multipurpose network fire sprinkler system in a newly-constructed, single-family house. The benefits and costs associated with the installation and use of a fire sprinkler system are compared across three prototypical single-family housing types: colonial, townhouse, and ranch. The installation costs differ by housing types, with the colonial being the most expensive and the ranch the least.

The benefits to residents of single-family dwellings with sprinkler systems, as measured in this report, include reductions in the risk of civilian fatalities and injuries, homeowner insurance premiums, uninsured direct property losses, and uninsured indirect costs. The primary costs examined are for the initial purchase and installation of the sprinkler system. Maintenance and repair costs are not examined because they are negligible.

Results of the benefit-cost analysis show that multipurpose network sprinkler systems are economical, life-saving devices for homeowners. The expected present value of net benefits (PVNB) in 2005 dollars is estimated as $2,919 for the colonial-style house, $3,099 for the townhouse, and $4,166 for the ranch-style house. A sensitivity analysis was performed to measure the variability of the results to changes in the modeling assumptions. The sensitivity analysis confirms the robustness of the baseline analysis. The PVNB range from $704 to $4,801 for the colonial house, from $884 to $4,981 for the townhouse, and from $1,950 to $6,048 for the ranch-style house.

Multipurpose network systems are the lowest life-cycle systems because homeowners can perform their own regular inspections and maintenance, thereby saving on costs they would incur with other systems. Given that they provide a similar level of performance in terms of fire-risk mitigation, multipurpose network systems thus achieve greater cost-effectiveness than alternate systems.

The complete report, *Benefit-Cost Analysis of Residential Fire Sprinkler Systems NISTIR 7451*, by David T. Butry, M. Hayden Brown, and Sieglinde K. Fuller is available at http://www.bfrl.nist.gov/oae/publications/nistirs/NISTIR_7451_Oct07.pdf.

National Strategy for Fire Prevention and Safety

Over the years, many national efforts have assembled recommendations on how to reduce fire loses in the United States. These reports include the 1947 Truman Commission Report, *America Burning, America Burning – Re-Commissioned, Solutions 2000,* and the *Fire Fighter Life Safety Summit.*

It appears that meetings to address the fire loss problem will continue well into the future with limited results unless several critical elements of the process that have been lacking are put into place. They are shared responsibility with commitments from national organizations to promote and support of specific actions; a collaborative effort to maintain communication, track progress, and measure success in achieved desired outcomes; protocols for measuring effectiveness of desired outcomes through prevention programs and initiatives; and an atmosphere that champions fire prevention and safety as priorities for funding and other resources.

Through a grant from the U.S. Department of Homeland Security, the Institution of Fire Engineers is developing a steering committee that includes representatives of the International Association of Fire Chiefs, the International Association of Fire Fighters, International Fire Marshals Association, the International Code Council, the National Fire Protection Association, and the National Volunteer Fire Council. The objective of the committee is to pull together a meeting of a broad group of fire-lossreduction stakeholders to generate a national strategy that can be used by federal fire and life safety agencies and national organizations to address needs that are not being met and to avoid duplication of efforts where resources exist.

The meeting, Vision 20/20: National Strategic Agenda for Fire Loss Prevention, will take place in Washington D.C. on March 31 and April 1, 2008. For more information, go to http://www.ife.org.uk/about/news/ifeusa.

Interflam 2007

Interflam 2007 was held during the first week of September at the Royal Holloway College, University of London, in the United Kingdom. More than 350 researchers from 30 countries participated in the conference, presenting more than 100 papers that covered such research topics as materials testing, suppression, egress and evacuation, testing methods, models for engineering prediction, structural fire resistance, fire dynamics, toxicity, smoke movement, and fire investigations.

The three keynote papers were "Engineering Design and Analysis Using Computer Models: Are We Going Too Fast or Not Fast Enough?" by Vytenius Babrauskas; "Are New Construction Trends Compromising Fire Safety?" by Debbie Smith; and "20/20 Hindsight: Are We Learning the Right Lessons from Major Fires?" by John Hall.

Information on the conference and proceedings can be found at http://www.intercomm.dial.pipex.com/html/events/interflam07a.htm.

Call for Papers for the 9th IAFSS Symposium

The International Association for Fire Safety Science (IAFSS), and the vfdb e.V. (German Fire Protection Association) have joined to sponsor the 9th IAFFS Symposium, to be held from September 21 through 26, 2008, in Karlsruhe, Germany. The deadline for paper submissions is January 12, 2008.

The IAFSS, which was founded in 1950, is a chartered non-profit

association that organizes research and development in fire safety and fire science through interaction at annual meetings, international symposia, and working group activities on various topics. Through the experience and input from both associations and the contributions by authors at the front of fire safety science, the 9th IAFSS symposium is expected to be outstanding congress.

For more information, go to http://www.iafss.org/html/iafss_symposium08_cfp.pdf.

From the Board

EDUCATION

BY PEG PAUL

Home Fire Sprinkler Coalition Announces New Public Educator Kit and Children's Education Program

The non-profit Home Fire Sprinkler Coalition (HFSC) introduced its new public education kit, available free to fire service and public educators nationwide. HFSC has also launched a new interactive educational web site, SprinklerSmarts.org. The new material is part of HFSC's effort to provide the fire service with the materials and tools needed to educate the public on the benefits of residential fire sprinklers.

The new comprehensive public education kit contains all of HFSC's educational and presentation material. The kit includes a CD containing customizable presentations, public relations tools, and programs. The DVD contains all of HFSC's educational videos, including the *Protect What You Value Most* consumer education video, *Built for Life* for builders, and *Living with Sprinklers* for people whose homes are protected by sprinklers. The kit also includes new educational brochures for real estate and insurance professionals.

Children are the main focus of HFSC's *Sprinkler Smarts*, an animated

A TRIBUTE TO BROOKE STAUFFER

BY MARK EARLEY, P.E.

I know that many of you have been following news reports that Brooke Stauffer and his fiancée, Karen Dodds, were reported missing on a flight over Lake Huron. I am sad to report that Karen's body has been found, although the search is still in progress, and we remain hopeful that Brooke may yet be found, as well.

Brooke worked in the electrical industry for most of his career. He spent many years at NEMA, the Smart House Development Venture, and worked for the Association of Home Appliance Manufacturers. Most recently, he worked at the National Electrical Contractors' Association. He served on the *National Electrical Code®'s (NEC®'s)* Code-Making Panel 1 (CMP-1) and on the committee responsible for NFPA 70E, *Electrical Safety in the Workplace®*. He previously served on CMP-2, CMP-20, the NFPA 70B, *Electrical Equipment Maintenance®*, Technical Committee, and the NFPA 73, *Electrical Inspection for Existing Dwellings®* Technical Committee.

He also chaired the NFPA Electrical Section. Those of us who attended this year's World Safety Conference & Exposition® remember his smooth and articulate leadership of the section's business meeting.

Brooke cared deeply about the electrical industry. He was the driving force behind the formation of the Inspection Initiative and the Electrical Code Coalition, which sought to strengthen electrical inspectors and promote adoption of the *NEC*.

Brooke was also an accomplished writer. He wrote for a number of magazines and produced a couple of novels, including a science fiction book for children, as well as a handy pocket travel guide to the Washington, D.C., area. Brooke also rewrote the *National Electrical Code Style Manual*. It was a tedious and thankless job, but the manual is now readable and very user-friendly. Most recently, he wrote several books on the *NEC*.

Brooke was an accomplished writer in another unique way. In this day of modern email communication, he was known for his handwritten notes and cards. Several people I have spoken to told stories about an uplifting card they received from Brooke. If you had a young child, he would send him or her an autographed copy of his science-fiction book.

I knew Karen, Brooke's fiancée, for a few years. She was a talented graphic artist who served as president of Dodds Design, a graphic arts company that designs web sites and brochures. Brooke and Karen developed a passion for exploring the country by air , and we had a few long conversations about our mutual love of flying. I enjoyed the time that I spent with Brooke and Karen immensely. They were a great couple.

Brooke was a good friend to many in this industry on both a professional and a personal level. Please keep Brooke and Karen in your thoughts and prayers.

Brooke has two sons, Christian and Gregory, and a daughter, Hillary. Christian set up a blog where he is providing updates on the search. You may find it at http://karenandbrooke.blogspot.com.

You can also send a note of support to the family on the blog.

Information may also be found on the NECA website at www.necanet.org.

Mark Earley is NFPA's assistant vice-president of Electrical Engineering.

ABOUT NFPA

NFPA has been a worldwide leader in providing fire, electrical, building, and life safety information to the public since 1896. The mission of the international nonprofit organization is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training, and education.

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Membership in NFPA gives you access to the most current fire and life safety research, professional contacts and code updates you need in your job. Benefits include:

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Web site that stars Captain Splash & the Droplettes. It offers fun, interactive games for children while providing teaching materials to help public educators, teachers, and parents educate children. Fire safety officials can use worksheets offered on the Web site, as well as other downloadable material in collaboration with the presentations and games. These materials help children understand fire safety and prevention, and identify fire sprinklers and their benefits through an entertaining form of education.

The public education kit and *Sprinkler Smarts* program were funded through a Department of Homeland Security Fire Act Grant.

To learn more about the new public education kit or to order one for free, visit www.HomeFireSprinkler.org. HFSC's new interactive Web site, *Sprinkler Smarts*, can be found at www.SprinklerSmarts.org.

For additional information on home fire sprinklers, visit www.HomeFireSprinkler.org.

ELECTRICAL

Check Out the Latest Tool from NFPA

The newest Web-based resource for the electrical industry is necplus.org, a subscription service offering full access to both *NEC*® and NFPA 70E®, *Electrical Safety in the Workplace,* as well as exclusive articles, helpful tips, and tables and illustrations. Created for professional use in electrical design, installation, inspection, and training, the site is easy to navigate and search, and provides immediate access to comprehensive electrical information, such as:

- Current and past code information
- All the latest ROPs and ROCs
- Links to related sections of the current *UL White Book*
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- Enhanced information, including staff notes, illustrations, and detailed examples
- Monthly feature articles focusing on a single topic with in-depth and insightful information
- "Code Topic of the Month" to keep you abreast of new requirements, trends, and best practices
- "Cracking the Code," which clarifies code language, and
- "Applying the Code," which offers practical tips

Robust searching capability and simple navigation ensures you can pinpoint precisely what you are looking for quickly and easily. Please visit necplus.org to explore this electrical industry resource.

WILDLAND FIRE MANAGEMENT

New Wildland Fire Report Out

BY DICK MANGAN

NFPA Wildland Fire Section member Dick Mangan recently completed a report on *Wildland Fire Fatalities in the United States: 1990–2006*. The report was sponsored by the NWCG Safety and Health Working Team (SHWT) and can be found on the U.S. Forest Service Technology & Development Web site under "publications," then "Fire" (user: t-d; password: t-d).

This report, an update of the 1999 technical report Dick did while serving as the Fire and Aviation Program Leader at the Missoula, Montana, Technology and Development Center, documents the 310 fatalities that occurred over 17 years, showing causes, agencies, geographic locations, and more. The basic data are derived from the *Safety-Gram* that the SHWT issues annually showing wildland fire deaths.

The leading causes of death in wildland fires over the past 17 years are aircraft accidents, vehicle accidents, heart attacks, and burnovers. Fatalities occurred in 41 states and included federal, state, county, and rural volunteers, contractors, military personnel, and private citizens.

For more information about this study, email Dick at blackbull@bigsky.net.

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what's hot

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A grooved TESTANDRAIN is now available from AGF Manufacturing. The Model 2500 is a multi-directional single handle ball valve that provides both the test and the express drain function for a wet fire sprinkler system. This valve is now available with 2" groove connections. All Model 2500 valves are UL listed and FM approved, rated at 300 PSI and available with all specifiable orifice sizes through K25. Also available with a 2" groove connection are the Model 2511A and 2511T, which include added features such as a pressure relief valve and/or pressure gauge. For more information visit the AGF website www.testandrain.com.
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Alarm System Specification

Gamewell-FCI announces the release of a new Intelli-Spec™ fire alarm system specification writing tool, now available on CD. Through Intelli-Spec, specifiers of all types can create, edit and publish comprehensive specifications in CSI (Construction Specifications Institute) MasterFormat™, output as standard Microsoft® or RTF (rich text format) documents. Intelli-Spec is a comprehensive source of information on Gamewell-FCI's complete portfolio of life safety products, including the new E3 Series™ emergency evacuation system and FocalPoint™ fire alarm monitoring workstation. Designed to save valuable time, Intelli-Spec offers a cafeteria-style menu, making it easy for specifiers to choose the features and hardware required for a particular project. To request a free Intelli-Spec CD, visit www.gamewell-fci.com.
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Pump Control Device

Clarke Fire Protection Products, Inc. received US Patent #US7234922B2: Pump Pressure Limiting Engine Speed Control Device. The Pressure Limiting Driver (PLD) is a UL Listed/FM Approved variable speed device for Clarke diesel engines that prevents sprinkler system over-pressure and eliminates excessive discharge of water from emergency relief valves. Clarke FPP provides diesel engines and related components used in stationary fire protection systems which are designed and constructed to NFPA 20.
Circle Card No. 038

Compressor Package

Victaulic, the original innovator of grooved pipe joining, announced the availability of the Series 7C7 Compressor Package as an enhancement to the FireLock NXT device line. The 7C7 Compressor Package is riser-mounted and preset to the FireLock NXT requirements. The Series 7C7 is able to function directly out of the box with a quick, easy installation and provides operational air pressure within 30 minutes of discharge, in compliance with NFPA 13 standards. The revolutionary FireLock NXT devices offer superior fire protection system productivity and performance to system designers and contractors, facility managers and building owners. The system includes the UL Listed, FM Approved Victaulic Series 757P Air Maintenance Device. For more information, visit www.victaulic.com.
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Reliable's new J112 and JL112 Upright, Pendent & Recessed Pendent Sprinklers are Extended Coverage for both Light and Ordinary Hazards occupancies for coverage areas from 144 ft^2 (13.4m^2) to 400 ft^2 (37.2m^2). They are Quick Response sprinklers for Light Hazard (16' x 16' to 20' x 20' sprinkler spacing) and for Ordinary Hazard (12' x 12' and 14' x 14' sprinkler spacing). They can also be utilized as Standard Response sprinklers for Ordinary Hazard as well (16' x 16' to 20' x 20' sprinkler spacing). They have a K Factor of 11.2 and are cULus Listed. They are available with a Link or 3mm Glass Bulb for applications as per NFPA 13. Multiple finishes are available. For more information, please refer to Bulletin 173 (Upright) and Bulletin 172 (Pendent or Recessed Pendent) or visit www.reliablesprinkler.com
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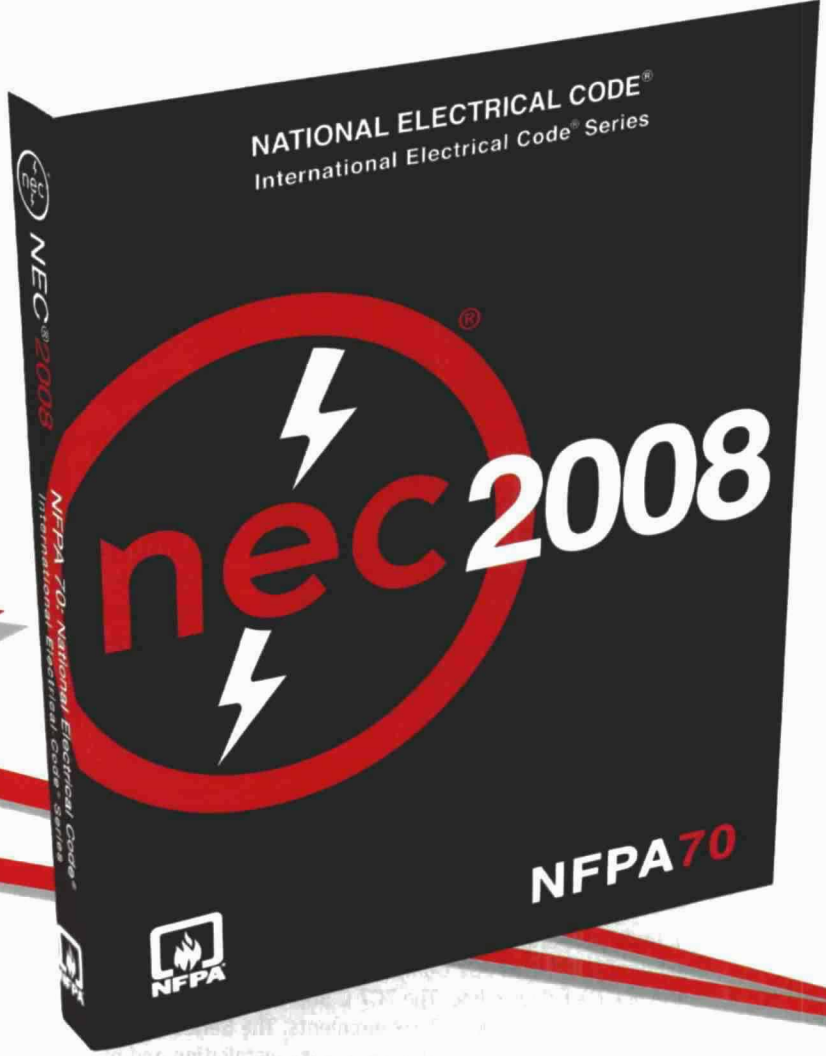

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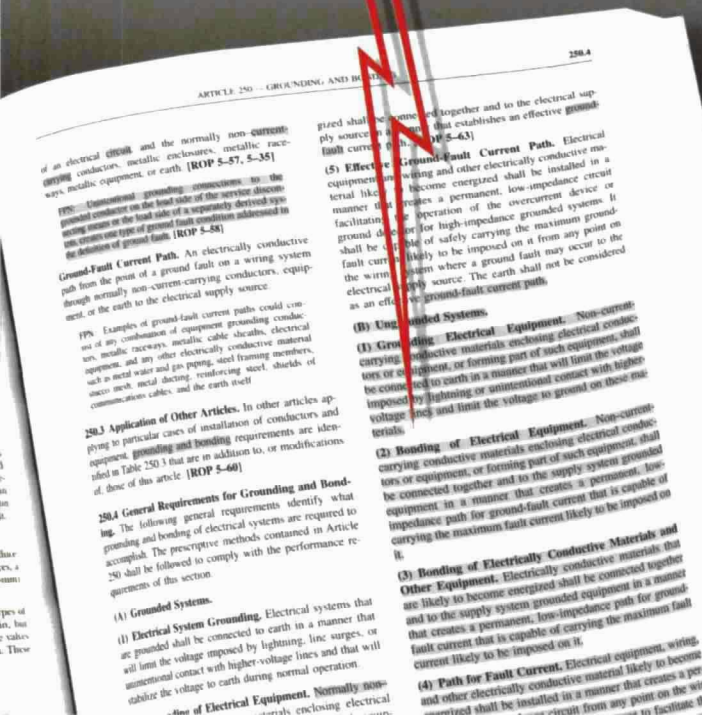

ARTICLE 250 — GROUNDING AND BONDING 250.4

of an electrical circuit and the normally non-current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth. **[ROP 5–57, 5–35]**

FPN: Unintentional grounding connections to the grounded conductor on the load side of the service disconnecting means or the load side of a separately derived system, creates one type of ground fault condition addressed in the definition of ground fault. **[ROP 5–58]**

Ground-Fault Current Path. An electrically conductive path from the point of a ground fault on a wiring system through normally non-current-carrying conductors, equipment, or the earth to the electrical supply source.

FPN: Examples of ground-fault current paths could consist of any combination of equipment grounding conductors, metallic cable sheaths, electrical equipment, and any other electrically conductive material such as metal water and gas piping, steel framing members, stucco mesh, metal ducting, reinforcing steel, shields of communications cables, and the earth itself.

250.3 Application of Other Articles. In other articles applying to particular cases of installation of conductors and equipment, grounding and bonding requirements are identified in Table 250.3 that are in addition to, or modifications of, those of this article. **[ROP 5–60]**

250.4 General Requirements for Grounding and Bonding. The following general requirements identify what grounding and bonding of electrical systems are required to accomplish. The prescriptive methods contained in Article 250 shall be followed to comply with the performance requirements of this section.

(A) Grounded Systems.

(1) Electrical System Grounding. Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

(2) Grounding of Electrical Equipment. Normally non-

grized shall be connected together and to the electrical supply source in a manner that establishes an effective ground-fault current path. **[ROP 5–63]**

(5) Effective Ground-Fault Current Path. Electrical equipment and wiring and other electrically conductive material likely to become energized shall be installed in a manner that creates a permanent, low-impedance circuit facilitating the operation of the overcurrent device or ground detector for high-impedance grounded systems. It shall be capable of safely carrying the maximum ground-fault current likely to be imposed on it from any point on the wiring system where a ground fault may occur to the electrical supply source. The earth shall not be considered as an effective ground-fault current path.

(B) Ungrounded Systems.

(1) Grounding Electrical Equipment. Non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected to earth in a manner that will limit the voltage imposed by lightning or unintentional contact with higher-voltage lines and limit the voltage to ground on these materials.

(2) Bonding of Electrical Equipment. Non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected together and to the supply system grounded equipment in a manner that creates a permanent, low-impedance path for ground-fault current that is capable of carrying the maximum fault current likely to be imposed on it.

(3) Bonding of Electrically Conductive Materials and Other Equipment. Electrically conductive materials that are likely to become energized shall be connected together and to the supply system grounded equipment in a manner that creates a permanent, low-impedance path for ground-fault current that is capable of carrying the maximum fault current likely to be imposed on it.

(4) Path for Fault Current. Electrical equipment, wiring, and other electrically conductive material likely to become energized shall be installed in a manner that creates a permanent, low-impedance circuit from any point on the wiring system where a ground fault may occur to the electrical supply source to facilitate the

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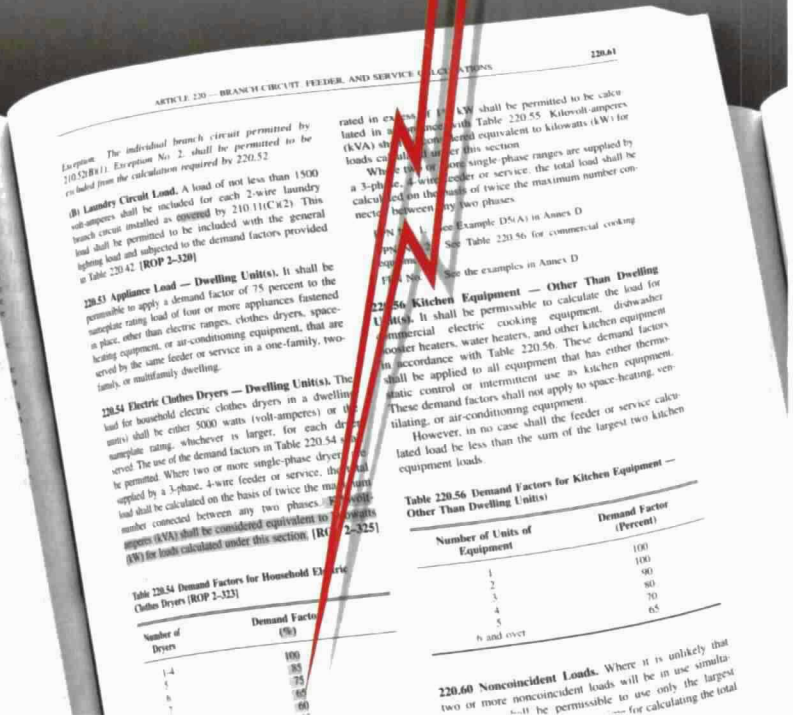

ARTICLE 220 — BRANCH-CIRCUIT, FEEDER, AND SERVICE CALCULATIONS 220.61

Exception: The individual branch circuit permitted by 210.52(B)(1), Exception No. 2, shall be permitted to be excluded from the calculation required by 220.52.

(B) Laundry Circuit Load. A load of not less than 1500 volt-amperes shall be included for each 2-wire laundry branch circuit installed as covered by 210.11(C)(2). This load shall be permitted to be included with the general lighting load and subjected to the demand factors provided in Table 220.42. **[ROP 2–320]**

220.53 Appliance Load — Dwelling Unit(s). It shall be permissible to apply a demand factor of 75 percent to the nameplate rating load of four or more appliances fastened in place, other than electric ranges, clothes dryers, space-heating equipment, or air-conditioning equipment, that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling.

220.54 Electric Clothes Dryers — Dwelling Unit(s). The load for household electric clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, whichever is larger, for each dryer served. The use of the demand factors in Table 220.54 shall be permitted. Where two or more single-phase dryers are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases. Fractional ampere (kVA) shall be considered equivalent to [illegible] watts (kW) for loads calculated under this section. **[ROP 2–325]**

Table 220.54 Demand Factors for Household Electric Clothes Dryers [ROP 2–323]

Number of Dryers	Demand Factor (%)
1–4	100
5	85
6	75
7	65
8	60

rated in excess of 15 kW shall be permitted to be calculated in accordance with Table 220.55. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW) for loads calculated under this section.

Where [illegible] three single-phase ranges are supplied by a 3-phase, 4-wire feeder or service, the total load shall be calculated on the basis of twice the maximum number connected between any two phases.

[illegible] See Example D5(A) in Annex D.

[illegible] See Table 220.56 for commercial cooking equipment.

[illegible] See the examples in Annex D.

220.56 Kitchen Equipment — Other Than Dwelling Unit(s). It shall be permissible to calculate the load for commercial electric cooking equipment, dishwasher booster heaters, water heaters, and other kitchen equipment in accordance with Table 220.56. These demand factors shall be applied to all equipment that has either thermostatic control or intermittent use as kitchen equipment. This section shall not apply to space-heating, ventilating, or air-conditioning equipment.

However, in no case shall the feeder or service calculated load be less than the sum of the largest two kitchen equipment loads.

Table 220.56 Demand Factors for Kitchen Equipment — Other Than Dwelling Unit(s)

Number of Units of Equipment	Demand Factor (Percent)
1	100
2	100
3	90
4	80
5	70
6 and over	65

220.60 Noncoincident Loads. Where it is unlikely that two or more noncoincident loads will be in use simulta-

[illegible] shall be permissible to use only the largest [illegible] for calculating the total

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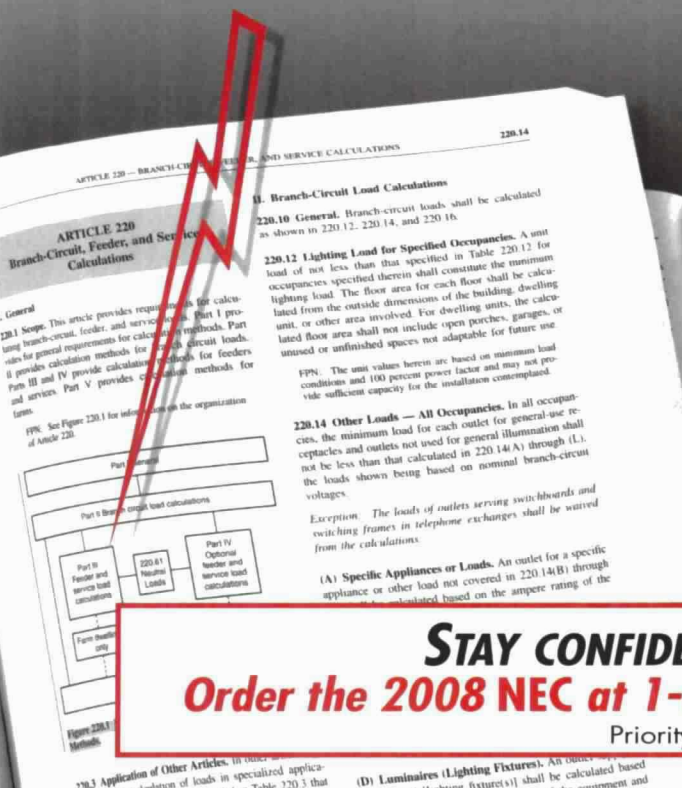

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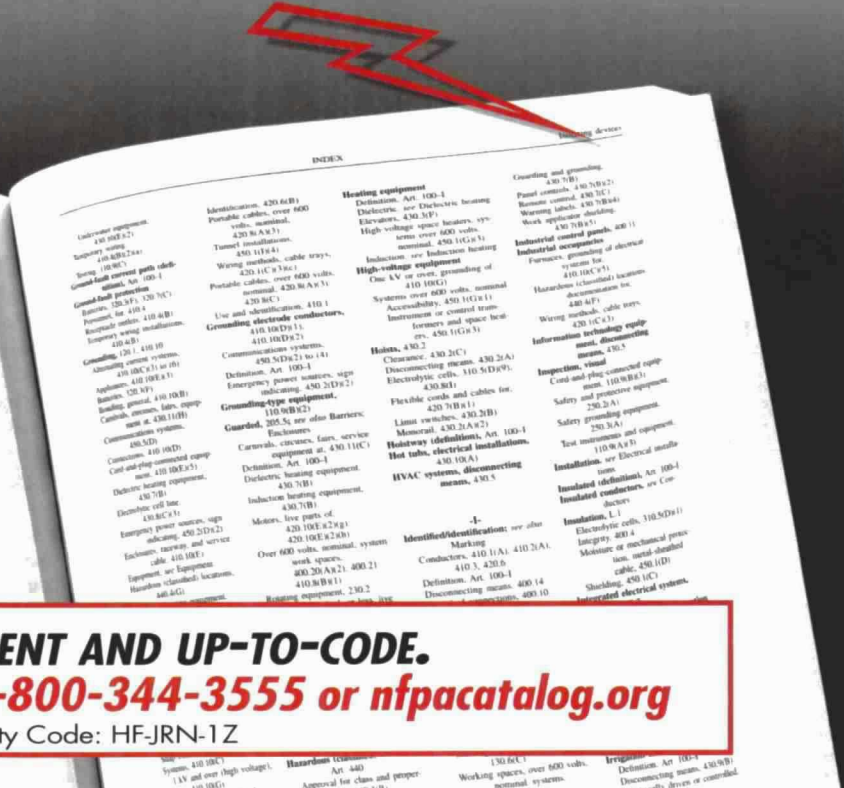

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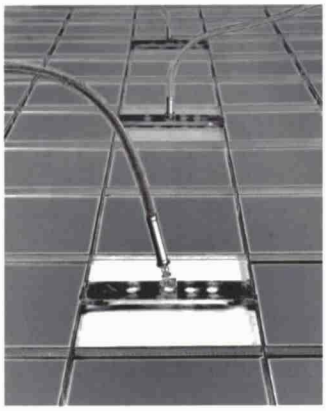

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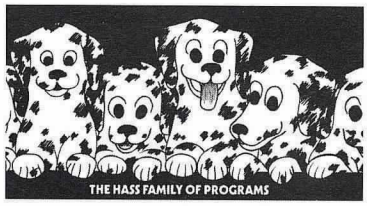

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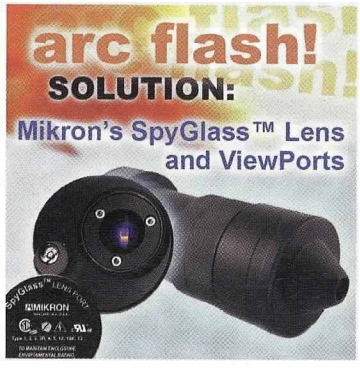

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centennial

IN HIS LANDMARK BOOK, *Automatic Sprinkler Protection*, Gorham Dana wrote in 1914, "It is a noteworthy fact that in all the fires in sprinklered buildings, there has been practically no loss of life. This being the case, it is indeed strange that the sprinkler has not been more frequently installed as a life saver."

Dana was also manager of the Underwriters' Bureau of New England and a frequent contributor to the *Quarterly* of the National Fire Protection Association.

While it took longer than he envisioned, sprinklers are installed and required in many occupancies, including homes in some jurisdictions.

An impetus for change included the Presidential Commission on Fire Prevention and Control's landmark report *America Burning* that set a goal of reducing the U.S. fire death toll by 50 percent in a generation. In response, the NFPA Automatic Sprinkler Committee formed the NFPA 13 Residential Sprinkler Subcommittee. The subcommittee's work led to the development of the first edition of NFPA 13D, *Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes*, in 1975.

The standard was based on the collective experience of the committee members, not on fire testing. Based on a review of fire incident data, NFPA's Technical Committee on Sprinkler Systems developed a residential sprinkler installation standard.

The standard covered the principally occupied areas of a dwelling and met the goals of preventing flashover, providing sufficient time for safe egress or rescue and economic viability.

To keep costs down, the Technical Committee proposed that sprinklers be located only in occupied rooms.

Beginning in 1976, the USFA supported a significant number of research programs on a variety of topics relating to residential sprinkler systems. The objective of the USFA research program was to assess the impact sprinklers would have on reducing deaths and injuries in residential fires.

The USFA worked in conjunction with the NFPA, Factory Mutual Research Corp., Underwriters' Laboratories and others to achieve reliable and acceptable systems, the minimum water discharge rates and automatic sprinkler flow required and response sensitivity and design criteria. It was not until the late 1960s that a "quick-response sprinkler" subcommittee was formed within the NFPA Sprinkler Committee. With regard to speed and sensitivity, the sprinkler of the 1970s changed little from its earlier incarnations.

Research support

USFA-sponsored research showed that a more sensitive sprinkler was needed to respond faster to smoldering and fast-developing home fires. First, fires had to be controlled quickly in order to prevent the development of lethal conditions in typically small home compartments. Second, fires had to be attacked while still small if they were to be controlled with the water supplies typically available in single-family dwellings (20 to 30 gallons per minute).

Research resulted in the development of a prototype fast-response sprinkler that could control or suppress typical residential fires with the operation of not more than two sprinklers. It could also operate fast enough to maintain survivable conditions within the room of origin. Thus, the design of the sprinkler itself expanded from the traditional role of property protection to include life safety.

In the nearly 30 years following the development of the residential sprinkler, special listings involving expanded protection areas and reduced flows proliferated to the point that the original flow and spacing criteria have become all but obsolete. Residential sprinklers are now listed for coverage areas up to 400 square feet (37 square meters) per sprinkler. To address the issue of multifamily occupancies, NFPA 13R, *Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height*, was introduced in 1989. It used the same concept of fast-response sprinkler technology contained in NFPA 13D, but with a maximum of four sprinklers flowing not two.

In 1996, the Home Fire Sprinkler Coalition was formed to provide information about the life-saving value of home fire sprinkler protection. In 2006, NFPA 101®, Life Safety Code® and NFPA 5000™, *Building Construction and Safety Code*™, became the first codes in the nation to require sprinklers in new one- and two-family dwellings.

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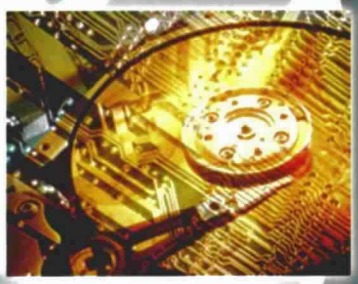

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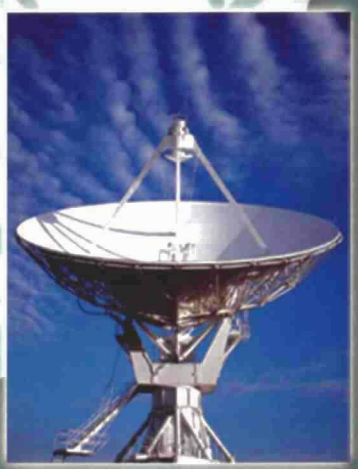

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