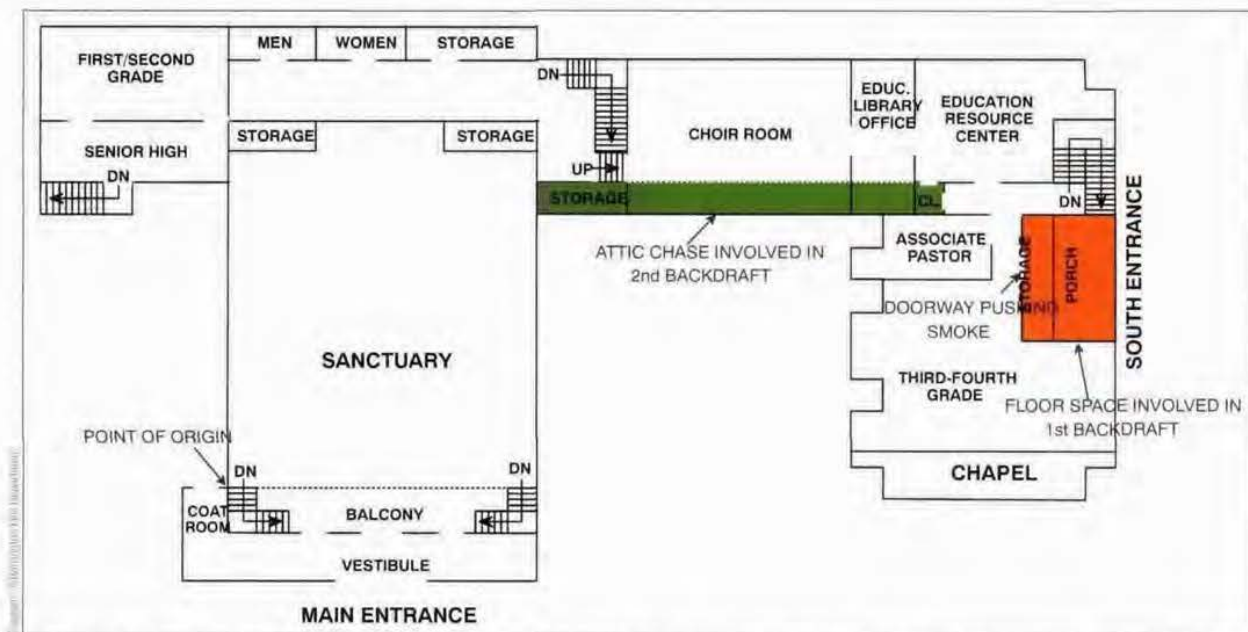




This diagram of the second floor of the church indicates the point of fire origin and the areas that were involved in the backdrafts. Red represents the area involved in the first backdraft, and green represents the area involved in the second.

first occurred in the floor space over the porch. Burn patterns indicated that the fire had actually spread throughout the entire south wing's attic to the attic over the chapel, where it followed the roof rafters down into the joist space between the floor and the porch ceiling. The second backdraft is believed to have come from a closet at the end of the north hallway, near air-handling equipment and ductwork.

An inspection of video footage taken during the fire led investigators to believe that the rapid fire extension through the south wing attic was accelerated when firefighters operating master streams at the rear of the building tried to hit the attic over the brick sections of the structure. The extension wasn't visible due to solid roof construction and wire-mesh plaster ceilings throughout the south wing.

Fortunately, all the firefighters at the scene emerged from this incident unscathed, except, perhaps, the chief, who complained about having to endure two stress tests. Eighty firefighters from 16 departments fought the fire for more than four hours. At the peak of the fire, three trucks and six engines were in operation, flowing 3,500 gallons (13,000 liters) per minute of water.

Although seriously damaged, fire crews managed to save much of the church. The entire basement and the first floor of the south wing suffered only water damage, and much of the second floor remains intact, except for the roof. Preliminary damage estimates peg the loss at more than \$4 million.

Amazingly, the sanctuary walls remain standing and all but one stained glass window is still in place, despite the collapse of the roof and the steeple and the three-hour pounding they took by master streams from three ladder trucks. Even more incredible, a large painting of Jesus dating back to the 1850s that hung on a sanctuary wall survived the blaze. The painting had previously hung in Saint Mary's

Cathedral in Chicago, where it survived the Great Chicago Fire.

Lessons learned

The Barrington Fire Department came away from this fire having learned several lessons. Among other things, firefighters now know that the speed of changing smoke conditions can't be underestimated. They also realize that they should wear full protective clothing and have either a hose line or a tether in place in case swiftly changing conditions leave them disoriented. These precautions should be taken even in apparently clear conditions.

Extreme caution must be exercised when attempting any interior operation in a structure that's being attacked by master streams. Although the master stream operation was well away from the area in which the interior attack was being attempted, the streams severely altered normal fire behavior in the unburned areas of the structure, forcing rapid flame spread through voids and leading to backdraft conditions within the voids.

And, finally, the department experienced, firsthand, the value of an RIT. The assignment of an RIT is a relatively new concept in this part of Illinois. Although departments are starting to assign RITs routinely at major fires, this was the first time the Barrington Fire Department had actually deployed one. It might even have been one of the first deployments in the area. Due to the size of the structure, two teams were assigned. Although they ultimately weren't needed, having them arrive within seconds, ready to act, provided a tremendous element of safety and eliminated the potential chaos of crews abandoning other assignments to help. ♦

Lieutenant Gbar McLeer is a 19-year veteran with the Barrington Fire Department and is currently assigned as a shift commander.

Fire Loss State by State

How is your state doing in the battle against fire?

Kriston L. Welch

We often talk about the U.S. fire picture as a whole, but we seldom take a look at each state individually. As fire protection professionals, we'll always be concerned with the "big picture," but as citizens of a particular state, we're also interested in how our area is doing in the battle against fire, particularly fire deaths. With this in mind, we've provided you with a snapshot of all 50 states that includes key fire statistics, as well as pertinent information that's often correlated with fires.

We've included both the number of fire deaths per state, as well as the number of fire deaths per million people, since the latter is the better indicator of how high or low a state's total actually is. Both numbers are followed in parentheses by the state's overall rank in the category.

We've also included several characteristics that are often related to fires and fire deaths, again followed by the state's rank in each category. Poverty, education, and smoking all have a significant impact on fire deaths. In fact, the 10 states with the highest fire death rates included 8 of the 10 states with the highest percentage of people age 25 or older who lack a high school education, 5 of the 10 states with the highest percentage of people living in poverty, and 5 of the 11 states with the most adults who smoke. The percentage of the population living in

rural areas is also a good predictor, probably because fire death rates are highest in the United State's poor rural areas. On the other hand, age of housing isn't a strong predictor of fires or fire death rates, although it may be a strong predictor of certain types of fires that involve the condition of the building. For example, analyses done by the U.S. Consumer Product Safety Commission (CPSC) show that housing age is significantly connected with the frequency of fixed wiring fires.

The figures for all categories are based on the most recent information we could find. Population, median household income, and fire deaths are all 1996 numbers. Firefighter deaths are from 1997, and the five-year total of firefighter deaths is based on 1993 to 1997 numbers. We've included both numbers because one year isn't always a good indicator of firefighter deaths, as a state might have a particularly good or a particularly bad year. The percentage of the population living below the poverty level is based on 1994 numbers, as is the percentage of adults who smoke. The percentage of housing units in buildings built before 1940 and the percentage of the population living in rural areas are both taken from 1990 studies. And, finally, the percentage of adults without a high school education is from 1997.

With that said, read on to see how your state stacks up.

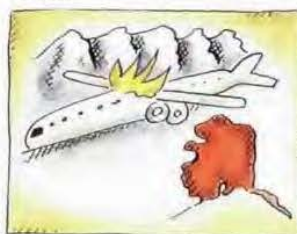
Alabama



Population: 4,287,000
Size of state: 52,237 square miles
(135,293 square kilometers)
Median household income: \$30,302
Fire deaths: 106 (#16)
Fire deaths per million people:
24.7 (#8)
Firefighter deaths (five-year
total): 3 (10)
Percentage living below poverty level:
16.4 (#10)

Percentage living in rural areas: 39.6 (#14)
Percentage of housing built before 1940: 9.3 (#40)
Percentage over 18 who smoke: 24.5 (#15)
Percentage without high school education: 22.4 (#9)
Deadliest fire this century: On April 8, 1911, a coal mine explosion in Littleton killed 128 people.

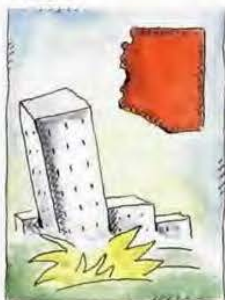
Alaska



Population: 605,000
Size of state: 615,230 square
miles (1,593,444 square kilome-
ters)
Median household income:
\$52,779
Fire deaths: 17 (#35)
Fire deaths per million people:
28.1 (#4)

Firefighter deaths (five-year total): none (none)
Percentage living below poverty level: 10.2 (#38)
Percentage living in rural areas: 32.5 (#22)
Percentage of housing built before 1940: 3 (#49)
Percentage over 18 who smoke: 25 (#12)
Percentage without high school education: 7.9 (#50)
Deadliest fire this century: On November 27, 1970, a post-crash fire on a chartered jet killed 47.

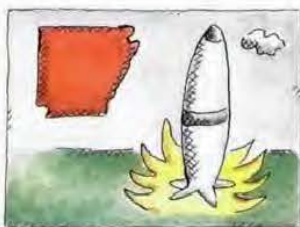
Arizona



Population: 4,434,000
Size of state: 114,006 square miles (295,276 square kilometers)
Median household income: \$31,637
Fire deaths: 40 (#27)
Fire deaths per million people: 9 (#41)
Firefighter deaths (five-year total): 2 (5)
Percentage living below poverty level: 15.9 (#11)
Percentage living in rural areas: 12.5 (#46)

Percentage of housing built before 1940: 3.2 (#48)
Percentage over 18 who smoke: 22.9 (#24)
Percentage without high school education: 17.4 (#21)
Deadliest fire this century: On December 20, 1970, 28 people died in the Pioneer Hotel fire in Tucson.

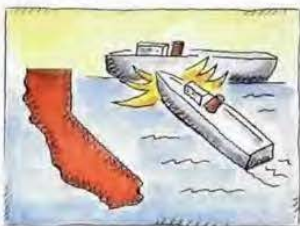
Arkansas



Population: 2,506,000
Size of state: 53,182 square miles (137,742 square kilometers)
Median household income: \$27,123
Fire deaths: 63 (#24)
Fire deaths per million people: 25.1 (#7)
Firefighter deaths (five-

year total): 5 (9)
Percentage living below poverty level: 15.3 (#13)
Percentage living in rural areas: 46.5 (#11)
Percentage of housing built before 1940: 9.4 (#39)
Percentage over 18 who smoke: 25.2 (#10)
Percentage without high school education: 23.1 (#4)
Deadliest fire this century: A fire at an intercontinental ballistic missile silo near Searcy killed 53 people on August 9, 1965.

California



Population: 31,858,000
Size of state: 158,869 square miles (411,470 square kilometers)
Median household income: \$38,812
Fire deaths: 210 (#3)
Fire deaths per million people: 6.6 (#46)

Firefighter deaths (five-year total): 9 (31)
Percentage living below poverty level: 17.9 (#7)

Percentage living in rural areas: 7.4 (#50)
Percentage of housing built before 1940: 10.7 (#35)
Percentage over 18 who smoke: 15.5 (#49)
Percentage without high school education: 19.3 (#15)
Deadliest fire this century: On July 17, 1944, two munitions ships collided at Port Chicago, causing an explosion and fire that spread to a depot and killed 322 people.

Colorado



Population: 3,816,000
Size of state: 104,100 square miles (269,618 square kilometers)
Median household income: \$40,950
Fire deaths: 17 (#35)
Fire deaths per million people: 4.5 (#49)

Firefighter deaths (five-year total): none (16)
Percentage living below poverty level: 9 (#43)
Percentage living in rural areas: 17.6 (#39)
Percentage of housing built before 1940: 13 (#32)
Percentage over 18 who smoke: 21.8 (#31)
Percentage without high school education: 12.4 (#43)
Deadliest fire this century: On April 27, 1917, a coal mine explosion in Hastings killed 121 people.

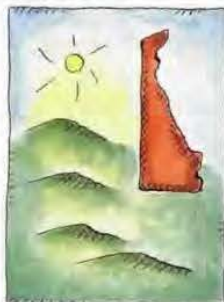
Connecticut



Population: 3,267,000
Size of state: 5,544 square miles (14,358 square kilometers)
Median household income: \$42,119
Fire deaths: 37 (#30)
Fire deaths per million people: 11.3 (#33)
Firefighter deaths (five-

year total): none (7)
Percentage living below poverty level: 10.8 (#32)
Percentage living in rural areas: 20.9 (#36)
Percentage of housing built before 1940: 25.5 (#14)
Percentage over 18 who smoke: 20.8 (#42)
Percentage without high school education: 16 (#24)
Deadliest fire this century: On July 6, 1944, a circus tent fire in Hartford killed 168 people in the deadliest amusement facility fire in U.S. history.

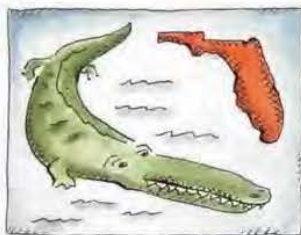
Delaware



Population: 723,000
Size of state: 2,396 square miles (6,206 square kilometers)
Median household income: \$39,309
Fire deaths: 14 (#39)
Fire deaths per million people: 19.4 (#13)
Firefighter deaths (five-year total): 1 (1)
Percentage living below poverty level: 8.3 (#47)
Percentage living in rural areas: 27 (#32)

Percentage of housing built before 1940: 14.3 (#30)
Percentage over 18 who smoke: 25.5 (#9)
Percentage without high school education: 15.6 (#18)
Deadliest fire this century: According to our records, Delaware hasn't had a fire this century that killed 10 or more people.

Florida



Population: 14,419,000
Size of state: 59,928 square miles (155,214 square kilometers)
Median household income: \$30,641
Fire deaths: 148 (#9)
Fire deaths per million people: 10.3 (#35)

Firefighter deaths (five-year total): 2 (7)
Percentage living below poverty level: 14.9 (#14)
Percentage living in rural areas: 15.2 (#43)
Percentage of housing built before 1940: 3.7 (#47)
Percentage over 18 who smoke: 23.1 (#22)
Percentage without high school education: 18.6 (#18)
Deadliest fire this century: On May 11, 1996, an onboard fire caused a ValuJet passenger jet to crash in the Everglades, killing 110 people.

Georgia



Population: 7,334,000
Size of state: 58,977 square miles (152,750 square kilometers)
Median household income: \$32,496
Fire deaths: 185 (#6)
Fire deaths per million people: 25.2 (#6)

Firefighter deaths (five-year total): 2 (11)
Percentage living below poverty level: 14 (#21)
Percentage living in rural areas: 36.8 (#17)
Percentage of housing built before 1940: 8.1 (#43)
Percentage over 18 who smoke: 20.5 (#43)
Percentage without high school education: 21.2 (#13)
Deadliest fire this century: The Winecoff Hotel fire in Atlanta killed 119 people on December 7, 1946.

Hawaii



Population: 1,183,000
Size of state: 6,459 square miles (16,729 square kilometers)
Median household income: \$41,772
Fire deaths: 12 (#41)
Fire deaths per million people: 10.1 (#37)
Firefighter deaths (five-year

total): none (3)
Percentage living below poverty level: 8.7 (#46)
Percentage living in rural areas: 11 (#48)
Percentage of housing built before 1940: 6.7 (#46)
Percentage over 18 who smoke: 17.8 (#48)
Percentage without high school education: 16.3 (#23)
Deadliest fire this century: On January 14, 1969, 24 people died at Pearl Harbor when a fire broke out on the nuclear aircraft carrier U.S.S. Enterprise.

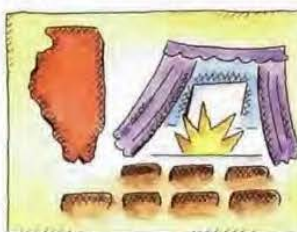
Idaho



Population: 1,188,000
Size of state: 83,574 square miles (216,456 square kilometers)
Median household income: \$34,709
Fire deaths: 6 (#48)
Fire deaths per million people: 5.1 (#48)
Firefighter deaths (five-year total): none (5)
Percentage living below poverty level: 12 (#26)
Percentage living in rural areas: 42.6 (#13)

Percentage of housing built before 1940: 15.9 (#25)
Percentage over 18 who smoke: 19.8 (#46)
Percentage without high school education: 14.3 (#35)
Deadliest fire this century: On May 2, 1972, 91 people died in a silver mine blaze in Kellogg.

Illinois



Population: 11,845,000
Size of state: 57,918 square miles (150,007 square kilometers)
Median household income: \$39,554
Fire deaths: 188 (#4)
Fire deaths per million people: 15.9 (#16)

Firefighter deaths (five-year total): 6 (18)
Percentage living below poverty level: 12.4 (#25)
Percentage living in rural areas: 15.4 (#42)
Percentage of housing built before 1940: 27.1 (#11)
Percentage over 18 who smoke: 23.1 (#22)

Percentage without high school education: 15.6 (#25)
 Deadliest fire this century: On December 30, 1903, 602 people died in the Iroquois Theater fire in Chicago. This is the fourth-deadliest fire and the deadliest single-building fire in U.S. history.

Indiana



Population: 5,828,000
 Size of state: 36,420 square miles (94,328 square kilometers)
 Median household income: \$35,147
 Fire deaths: 110 (#13)
 Fire deaths per million people: 18.9 (#14)
 Firefighter deaths (five-year

total): 1 (#13)

Percentage living below poverty level: 13.7 (#23)
 Percentage living in rural areas: 35.1 (#18)
 Percentage of housing built before 1940: 24.2 (#19)
 Percentage over 18 who smoke: 27.2 (#2)
 Percentage without high school education: 18.1 (#19)
 Deadliest fire this century: A gas explosion at the state fairgrounds coliseum in Indianapolis killed 75 people on October 31, 1963.

Iowa



Population: 2,848,000
 Size of state: 56,276 square miles (145,754 square kilometers)
 Median household income: \$33,209
 Fire deaths: 39 (#29)
 Fire deaths per million people: 13.7 (#24)
 Firefighter deaths (five-year total): none (1)
 Percentage living below poverty level: 10.7 (#33)
 Percentage living in rural areas: 39.4 (#15)
 Percentage of housing built before

1940: 35 (#5)

Percentage over 18 who smoke: 23.2 (#21)
 Percentage without high school education: 13.3 (#41)
 Deadliest fire this century: A fire at a Davenport mental hospital killed 41 people on January 7, 1950.

Kansas



Population: 2,579,000
 Size of state: 82,282 square miles (213,110 square kilometers)
 Median household income: \$32,585
 Fire deaths: 37 (#30)
 Fire deaths per million people: 14.3 (#22)

Firefighter deaths (five-year total): none (5)
 Percentage living below poverty level: 14.9 (#14)
 Percentage living in rural areas: 30.9 (#27)
 Percentage of housing built before 1940: 24.5 (#17)
 Percentage over 18 who smoke: 22 (#27)
 Percentage without high school education: 11.9 (#45)
 Deadliest fire this century: On December 13, 1916, a coal mine blaze in Stone City killed 20 people.

Kentucky



Population: 3,882,000
 Size of state: 40,411 square miles (104,665 square kilometers)
 Median household income: \$32,413
 Fire deaths: 84 (#19)
 Fire deaths per million people: 21.6 (#11)
 Firefighter deaths (five-year total): 2 (#10)

Percentage living below poverty level: 18.5 (#6)
 Percentage living in rural areas: 48.2 (#8)
 Percentage of housing built before 1940: 15.9 (#25)
 Percentage over 18 who smoke: 27.8 (#1)
 Percentage without high school education: 24.6 (#1)
 Deadliest fire this century: On May 28, 1977, a fire at the Beverly Hills Supper Club in Southgate killed 165 people. This is the second-deadliest U.S. fire or explosion of the past 40 years.

Louisiana



Population: 4,341,000
 Size of state: 49,651 square miles (128,595 square kilometers)
 Median household income: \$30,262
 Fire deaths: 111 (#12)
 Fire deaths per million people: 25.6 (#5)

Firefighter deaths (five-year total): 2 (4)
 Percentage living below poverty level: 25.7 (#1)
 Percentage living in rural areas: 31.9 (#24)
 Percentage of housing built before 1940: 10.6 (#36)
 Percentage over 18 who smoke: 25.2 (#10)
 Percentage without high school education: 24.3 (#2)
 Deadliest fire this century: On December 22, 1977, a fire at a grain elevator in Westwego killed 36 people.

Maine



Population: 1,239,000
Size of state: 33,741 square miles
(87,388 square kilometers)
Median household income: \$34,696
Fire deaths: 16 (#38)
Fire deaths per million people: 12.9 (#28)
Firefighter deaths (five-year total): none (3)
Percentage living below poverty level: 9.4 (#40)
Percentage living in rural areas: 55.4 (#3)

Percentage of housing built before 1940: 34.9 (#6)
Percentage over 18 who smoke: 25 (#12)
Percentage without high school education: 14.2 (#36)
Deadliest fire this century: On January 31, 1945, the Lacoste Babies Home orphanage fire in Auburn killed 17 people.

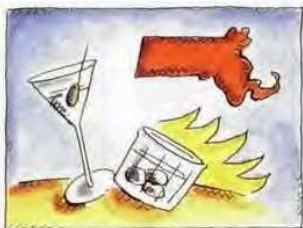
Maryland



Population: 5,060,000
Size of state: 12,297 square miles
(31,849 square kilometers)
Median household income: \$43,993
Fire deaths: 35 (#32)
Fire deaths per million people: 6.9 (#44)

Firefighter deaths (five-year total): 1 (12)
Percentage living below poverty level: 10.7 (#33)
Percentage living in rural areas: 18.7 (#38)
Percentage of housing built before 1940: 15.5 (#29)
Percentage over 18 who smoke: 21.2 (#39)
Percentage without high school education: 15.3 (#28)
Deadliest fire this century: On December 8, 1963, lightning struck three fuel tanks on a passenger airliner in flight somewhere near Elkton. The tanks exploded, killing all 81 people on board.

Massachusetts



Population: 6,085,000
Size of state: 9,241 square miles
(23,934 square kilometers)
Median household income: \$39,494
Fire deaths: 68 (#22)
Fire deaths per million people: 11.2 (#34)
Firefighter deaths (five-year

total): none (7)
Percentage living below poverty level: 9.7 (#39)
Percentage living in rural areas: 15.7 (#40)
Percentage of housing built before 1940: 38.9 (#1)
Percentage over 18 who smoke: 21.7 (#35)
Percentage without high school education: 14.1 (#37)

Deadliest fire this century: On November 28, 1942, the Cocoanut Grove night club fire in Boston killed 492 people. It was the sixth deadliest fire in U.S. history and the second-deadliest involving a single building.

Michigan



Population: 9,731,000
Size of state: 96,705 square miles
(250,465 square kilometers)
Median household income: \$39,225
Fire deaths: 129 (#11)
Fire deaths per million people: 13.2 (#27)

Firefighter deaths (five-year total): 2 (8)
Percentage living below poverty level: 14.1 (#19)
Percentage living in rural areas: 29.5 (#30)
Percentage of housing built before 1940: 20.8 (#22)
Percentage over 18 who smoke: 25.7 (#7)
Percentage without high school education: 14 (#38)
Deadliest fire this century: On November 3, 1926, 51 people died at a metal mine in Ishpeming.

Minnesota



Population: 4,649,000
Size of state: 86,943 square miles
(225,182 square kilometers)
Median household income: \$40,991
Fire deaths: 45 (#26)
Fire deaths per million people: 9.7 (#38)

Firefighter deaths (five-year total): 2 (2)
Percentage living below poverty level: 11.7 (#28)
Percentage living in rural areas: 30.1 (#29)
Percentage of housing built before 1940: 24.5 (#17)
Percentage over 18 who smoke: 20.5 (#43)
Percentage without high school education: 12.1 (#44)
Deadliest fire this century: A forest fire in northern Minnesota killed 559 people on October 12, 1918.

Mississippi



Population: 2,711,000
Size of state: 48,286 square miles
(125,060 square kilometers)
Median household income: \$26,677
Fire deaths: 95 (#18)
Fire deaths per million people: 35 (#1)
Firefighter deaths (five-year total): 2 (8)
Percentage living below poverty level: 19.9 (#3)
Percentage living in rural areas: 52.9 (#4)

Percentage of housing built before 1940: 8.6 (#41)
 Percentage over 18 who smoke: 24 (#18)
 Percentage without high school education: 22.5 (#7)
 Deadliest fire this century: On April 23, 1940, 207 people died in a fire at the Rhythm Club in Natchez.

Missouri



Population: 5,364,000
 Size of state: 69,709 square miles (180,546 square kilometers)
 Median household income: \$34,265
 Fire deaths: 107 (#15)
 Fire deaths per million people: 19.9 (#12)

Firefighter deaths (five-year total): 1 (7)
 Percentage living below poverty level: 15.6 (#12)
 Percentage living in rural areas: 31.3 (#25)
 Percentage of housing built before 1940: 20.4 (#23)
 Percentage over 18 who smoke: 24.3 (#16)
 Percentage without high school education: 19.1 (#16)
 Deadliest fire this century: On February 17, 1957, 72 people died in a fire at the Katie Jane Nursing Home in Warrenton. It was the deadliest nursing home fire in U.S. history.

Montana



Population: 877,000
 Size of state: 147,046 square miles (380,849 square kilometers)
 Median household income: \$28,684
 Fire deaths: 13 (#40)
 Fire deaths per million people: 14.8 (#20)

Firefighter deaths (five-year total): none (2)
 Percentage living below poverty level: 11.5 (#30)
 Percentage living in rural areas: 47.5 (#9)
 Percentage of housing built before 1940: 21.8 (#21)
 Percentage over 18 who smoke: 21.1 (#41)
 Percentage without high school education: 11.4 (#46)
 Deadliest fire this century: On June 8, 1917, 163 people died in a metal mine fire in Butte.

Nebraska



Population: 1,649,000
 Size of state: 77,358 square miles (200,358 square kilometers)
 Median household income: \$34,014
 Fire deaths: 17 (#35)
 Fire deaths per million people: 10.3 (#35)

Firefighter deaths (five-year total): none (4)
 Percentage living below poverty level: 8.8 (#45)
 Percentage living in rural areas: 33.9 (#21)
 Percentage of housing built before 1940: 30.7 (#8)
 Percentage over 18 who smoke: 21.9 (#30)
 Percentage without high school education: 14 (#38)
 Deadliest fire this century: A fire at the Pathfinder Hotel in Fremont killed 20 people on January 10, 1976.

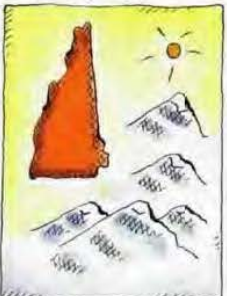
Nevada



Population: 1,601,000
 Size of state: 110,567 square miles (286,367 square kilometers)
 Median household income: \$38,540
 Fire deaths: 11 (#43)
 Fire deaths per million people: 6.9 (#44)
 Firefighter deaths (five-year total): 1 (3)
 Percentage living below poverty level: 11.1 (#31)

Percentage living in rural areas: 11.7 (#47)
 Percentage of housing built before 1940: 2.9 (#50)
 Percentage over 18 who smoke: 26.3 (#4)
 Percentage without high school education: 14.6 (#33)
 Deadliest fire this century: A fire at the MGM Grand Hotel in Las Vegas killed 85 people on November 21, 1980. It was by far the deadliest U.S. fire of the 1980s.

New Hampshire



Population: 1,160,000
 Size of state: 9,283 square miles (24,044 square kilometers)
 Median household income: \$39,407
 Fire deaths: 9 (#45)
 Fire deaths per million people: 7.8 (#43)
 Firefighter deaths (five-year total): none (1)
 Percentage living below poverty level: 7.7 (#49)

Percentage living in rural areas: 49 (#7)
 Percentage of housing built before 1940: 27.1 (#11)
 Percentage over 18 who smoke: 21.5 (#37)
 Percentage without high school education: 14.9 (#31)
 Deadliest fire this century: According to our records, New Hampshire hasn't had a fire this century that killed 10 or more people.

New Jersey



Population: 8,002,000
Size of state: 8,215 square miles
(21,277 square kilometers)
Median household income:
\$47,468
Fire deaths: 77 (#20)
Fire deaths per million people:
9.6 (#39)

Firefighter deaths (five-year total): 3 (#23)
Percentage living below poverty level: 9.2 (#42)
Percentage living in rural areas: 10.6 (#49)
Percentage of housing built before 1940: 24.6 (#16)
Percentage over 18 who smoke: 19.2 (#47)
Percentage without high school education: 15.1 (#30)
Deadliest fire this century: On June 30, 1900, a fire on a steamship of the North German Lloyd line killed 326 people. This is the tenth-deadliest fire in U.S. history.

New Mexico



Population: 1,711,000
Size of state: 121,598 square miles
(314,939 square kilometers)
Median household income:
\$25,086
Fire deaths: 25 (#34)
Fire deaths per million people:
14.6 (#21)

Firefighter deaths (five-year total): 1 (#7)
Percentage living below poverty level: 21.1 (#2)
Percentage living in rural areas: 27 (#32)
Percentage of housing built before 1940: 8.1 (#43)
Percentage over 18 who smoke: 21.2 (#39)
Percentage without high school education: 22 (#10)
Deadliest fire this century: On October 22, 1913, a Dawson coal mine fire killed 263 people.

New York



Population: 18,134,000
Size of state: 53,989 square miles
(139,833 square kilometers)
Median household income:
\$35,410
Fire deaths: 213 (#2)
Fire deaths per million people:
11.7 (#32)

Firefighter deaths (five-year total): 18 (#66)
Percentage living below poverty level: 17 (#8)
Percentage living in rural areas: 15.7 (#40)
Percentage of housing built before 1940: 35.7 (#3)
Percentage over 18 who smoke: 21.5 (#37)
Percentage without high school education: 20 (#14)
Deadliest fire this century: On June 15, 1904, a fire on the steamship

S.S. General Slocum in New York City killed 1,030 people, making this the deadliest U.S. fire of the century. In fact, this fire ranks third on the all-time list of deadly U.S. fires, behind the 1865 S.S. Sultana steamship fire on the Mississippi River and the 1871 Wisconsin forest fire in Peshtigo.

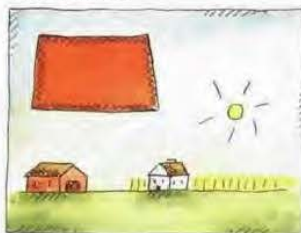
North Carolina



Population: 7,309,000
Size of state: 52,672 square miles
(136,421 square kilometers)
Median household income:
\$35,601
Fire deaths: 165 (#8)
Fire deaths per million people:
22.6 (#9)

Firefighter deaths (five-year total): 1 (#9)
Percentage living below poverty level: 14.2 (#18)
Percentage living in rural areas: 49.6 (#6)
Percentage of housing built before 1940: 9.9 (#38)
Percentage over 18 who smoke: 25.8 (#6)
Percentage without high school education: 21.6 (#11)
Deadliest fire this century: On May 27, 1925, a coal mine fire in Farmville killed 53 people.

North Dakota



Population: 643,000
Size of state: 70,704 square miles
(183,123 square kilometers)
Median household income:
\$31,470
Fire deaths: 9 (#45)
Fire deaths per million people:
14 (#23)
Firefighter deaths (five-year

total): none (none)
Percentage living below poverty level: 10.4 (#36)
Percentage living in rural areas: 46.7 (#10)
Percentage of housing built before 1940: 24.7 (#15)
Percentage over 18 who smoke: 22.7 (#25)
Percentage without high school education: 17.4 (#21)
Deadliest fire this century: According to our records, North Dakota hasn't had a fire this century that killed 10 or more people.

Ohio



Population: 11,163,000
Size of state: 44,828 square miles
(116,103 square kilometers)
Median household income:
\$34,070
Fire deaths: 137 (#10)
Fire deaths per million people:
12.3 (#31)

Firefighter deaths (five-year total): 4 (#15)

Percentage living below poverty level: 14.1 (#19)
 Percentage living in rural areas: 25.9 (#34)
 Percentage of housing built before 1940: 25.8 (#13)
 Percentage over 18 who smoke: 26 (#5)
 Percentage without high school education: 13.8 (#40)
 Deadliest fire this century: On April 21, 1930, 329 people died at the Ohio State Penitentiary in Columbus in the deadliest prison or jail fire in U.S. history.

Oklahoma



Population: 3,295,000
 Size of state: 69,903 square miles (181,048 square kilometers)
 Fire deaths: 73 (#21)
 Fire deaths per million people: 22.2 (#10)
 Firefighter deaths (five-year total): 1 (11)

Percentage living below poverty level: 16.7 (#9)
 Percentage living in rural areas: 32.3 (#23)
 Percentage of housing built before 1940: 12.4 (#33)
 Percentage over 18 who smoke: 21.7 (#35)
 Percentage without high school education: 14.8 (#32)
 Deadliest fire this century: On April 19, 1995, 168 people died in the bombing of the Alfred P. Murrah Federal Building in Oklahoma City.

Oregon



Population: 3,196,000
 Size of state: 97,132 square miles (251,571 square kilometers)
 Median household income: \$35,492
 Fire deaths: 40 (#27)
 Fire deaths per million people: 12.5 (#30)

Firefighter deaths (five-year total): 1 (4)
 Percentage living below poverty level: 11.8 (#27)
 Percentage living in rural areas: 29.5 (#30)
 Percentage of housing built before 1940: 16.8 (#24)
 Percentage over 18 who smoke: 21.8 (#31)
 Percentage without high school education: 15.3 (#28)
 Deadliest fire this century: On August 7, 1959, a blasting agent explosion and fire destroyed or damaged several buildings in downtown Roseburg, killing 13 people.

Pennsylvania



Population: 12,040,000
 Size of state: 46,058 square miles (119,291 square kilometers)
 Median household income: \$34,899
 Fire deaths: 188 (#4)
 Fire deaths per million people: 15.6 (#17)

Firefighter deaths (five-year total): 12 (37)
 Percentage living below poverty level: 12.5 (#24)
 Percentage living in rural areas: 31.1 (#26)
 Percentage of housing built before 1940: 35.1 (#4)
 Percentage over 18 who smoke: 24.2 (#17)
 Percentage without high school education: 17.6 (#20)
 Deadliest fire this century: On May 19, 1928, a coal mine fire killed 273 people in Mather.

Rhode Island



Population: 988,000
 Size of state: 1,231 square miles (3,189 square kilometers)
 Median household income: \$36,986
 Fire deaths: 2 (#50)
 Fire deaths per million people: 2 (#50)
 Firefighter deaths (five-year total):

1 (3)

Percentage living below poverty level: 10.3 (#37)
 Percentage living in rural areas: 14 (#44)
 Percentage of housing built before 1940: 34 (#7)
 Percentage over 18 who smoke: 24.7 (#14)
 Percentage without high school education: 22.5 (#7)
 Deadliest fire this century: On May 26, 1954, a fire broke out on the U.S.S. Bennington, an aircraft carrier located just off shore, killing 103 people.

South Carolina

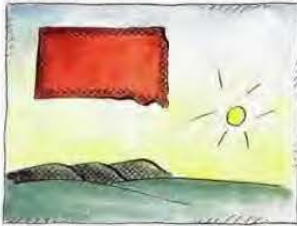


Population: 3,717,000
 Size of state: 31,189 square miles (80,779 square kilometers)
 Median household income: \$34,665
 Fire deaths: 109 (#14)
 Fire deaths per million people: 29.3 (#3)
 Firefighter deaths (five-year

total): none (10)

Percentage living below poverty level: 13.8 (#22)
 Percentage living in rural areas: 45.4 (#12)
 Percentage of housing built before 1940: 8.5 (#42)
 Percentage over 18 who smoke: 23.7 (#19)
 Percentage without high school education: 22.7 (#5)
 Deadliest fire this century: A fire at the Cleveland School in Beulah killed 77 people on May 17, 1923.

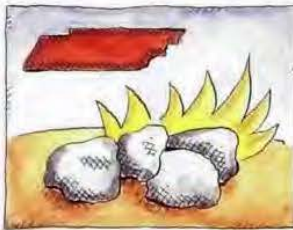
South Dakota



Population: 738,000
Size of state: 77,121 square miles (199,744 square kilometers)
Median household income: \$29,526
Fire deaths: 11 (#43)
Fire deaths per million people: 14.9 (#19)

Firefighter deaths (five-year total): none (none)
Percentage living below poverty level: 14.5 (#17)
Percentage living in rural areas: 50 (#5)
Percentage of housing built before 1940: 30.4 (#9)
Percentage over 18 who smoke: 21.8 (#31)
Percentage without high school education: 14.4 (#34)
Deadliest fire this century: According to our records, South Dakota hasn't had a fire this century that killed 10 or more people.

Tennessee



Population: 5,307,000
Size of state: 42,146 square miles (109,158 square kilometers)
Median household income: \$30,790
Fire deaths: 169 (#7)
Fire deaths per million people: 31.8 (#2)

Firefighter deaths (five-year total): 3 (13)
Percentage living below poverty level: 14.6 (#16)
Percentage living in rural areas: 39.1 (#16)
Percentage of housing built before 1940: 10.2 (#37)
Percentage over 18 who smoke: 26.5 (#3)
Percentage without high school education: 23.9 (#3)
Deadliest fire this century: On May 19, 1902, a coal mine fire in Coal Creek killed 184 people.

Texas



Population: 19,091,000
Size of state: 267,277 square miles (692,248 square kilometers)
Median household income: \$33,072
Fire deaths: 261 (#1)
Fire deaths per million people: 13.7 (#24)
Firefighter deaths (five-year total): 1 (17)
Percentage living below poverty level: 19.1 (#4)
Percentage living in rural areas: 19.7 (#37)

Percentage of housing built before 1940: 7.1 (#45)
Percentage over 18 who smoke: 23.7 (#19)
Percentage without high school education: 21.5 (#12)
Deadliest fire this century: On April 16, 1947, a fire broke out on the S.S. Grandcamp and spread to a dockside Monsanto Chemical plant in Texas City, killing 468 people, making this the seventh-deadliest fire or explosion in U.S. history.

Utah



Population: 2,018,000
Size of state: 84,904 square miles (219,902 square kilometers)
Median household income: \$37,038
Fire deaths: 12 (#41)
Fire deaths per million people: 5.9 (#47)

Firefighter deaths (five-year total): none (1)
Percentage living below poverty level: 8 (#48)
Percentage living in rural areas: 13 (#45)
Percentage of housing built before 1940: 13.5 (#31)
Percentage over 18 who smoke: 13.2 (#50)
Percentage without high school education: 10.5 (#48)
Deadliest fire this century: On May 1, 1900, a coal mine fire in Scofield killed 200 people.

Vermont



Population: 586,000
Size of state: 9,615 square miles (24,903 square kilometers)
Median household income: \$32,358
Fire deaths: 8 (#47)
Fire deaths per million people: 13.7 (#26)
Firefighter deaths (five-year total): none (2)
Percentage living below poverty level: 7.6 (#50)

Percentage living in rural areas: 67.8 (#1)
Percentage of housing built before 1940: 36.5 (#2)
Percentage over 18 who smoke: 22.1 (#26)
Percentage without high school education: 15.6 (#25)
Deadliest fire this century: On February 15, 1924, a fire that began in a hardware store in the Lawrence Building in Montpelier killed 11 people.

Virginia



Population: 6,666,000
Size of state: 42,326 square miles (109,625 square kilometers)
Median household income: \$39,211
Fire deaths: 102 (#17)
Fire deaths per million people: 15.3 (#18)
Firefighter deaths (five-year

total): 2 (12)

Percentage living below poverty level: 10.7 (#33)
Percentage living in rural areas: 30.6 (#28)
Percentage of housing built before 1940: 11 (#34)
Percentage over 18 who smoke: 22 (#27)
Percentage without high school education: 18.7 (#17)
Deadliest fire this century: On April 22, 1938, a coal mine fire in Hangar killed 45 people.

Washington



Population: 5,520,000
Size of state: 70,637 square miles (182,949 square kilometers)
Median household income: \$36,676
Fire deaths: 50 (#25)
Fire deaths per million people: 9.1 (#40)

Firefighter deaths (five-year total): 1 (8)

Percentage living below poverty level: 11.7 (#28)
Percentage living in rural areas: 23.6 (#35)
Percentage of housing built before 1940: 15.7 (#27)
Percentage over 18 who smoke: 20.2 (#45)
Percentage without high school education: 11.2 (#47)
Deadliest fire this century: On July 31, 1943, a fire at Seattle's Lake Forest Sanitarium killed 32 people.

West Virginia



Population: 1,820,000
Size of state: 24,231 square miles (62,759 square kilometers)
Median household income: \$25,247
Fire deaths: 34 (#33)
Fire deaths per million people: 18.7 (#15)

Firefighter deaths (five-year total): none (7)

Percentage living below poverty level: 18.6 (#5)
Percentage living in rural areas: 63.9 (#2)

Percentage of housing built before 1940: 23.7 (#20)

Percentage over 18 who smoke: 25.7 (#7)

Percentage without high school education: 22.7 (#5)

Deadliest fire this century: A coal mine fire in Monongah killed 362 people on December 6, 1907, making it the deadliest coal mine fire in history and the ninth-deadliest fire or explosion in U.S. history.

Wisconsin



Population: 5,146,000
Size of state: 65,499 square miles (169,643 square kilometers)
Median household income: \$40,001
Fire deaths: 65 (#23)
Fire deaths per million people: 12.6 (#29)
Firefighter deaths (five-year

total): 2 (10)

Percentage living below poverty level: 9 (#43)
Percentage living in rural areas: 34.3 (#20)
Percentage of housing built before 1940: 28.5 (#10)
Percentage over 18 who smoke: 21.8 (#31)
Percentage without high school education: 12.9 (#42)
Deadliest fire this century: On September 30, 1987, 12 people died in a single-family dwelling fire in Milwaukee.

Wyoming



Population: 480,000
Size of state: 97,818 square miles (253,349 square kilometers)
Median household income: \$30,953
Fire deaths: 4 (#49)
Fire deaths per million people: 8.3 (#42)
Firefighter deaths (five-year total): none (1)
Percentage living below poverty level: 9.3 (#41)
Percentage living in rural areas: 35 (#19)

Percentage of housing built before 1940: 15.6 (#28)

Percentage over 18 who smoke: 22 (#27)

Percentage without high school education: 8.7 (#49)

Deadliest fire this century: On June 30, 1903, a coal mine fire in Hanna killed 169 people. ♣

Sources other than NFPA: Fire death numbers are from the National Center for Health Statistics death certificate data. Potentially explanatory characteristics are from the Statistical Abstract of the United States 1998 and the Centers for Disease Control survey data cited in Paula Mergenhausen, "People Behaving Badly," American Demographics.

Kriston L. Welch is managing editor of NFPA Journal.

WORKS

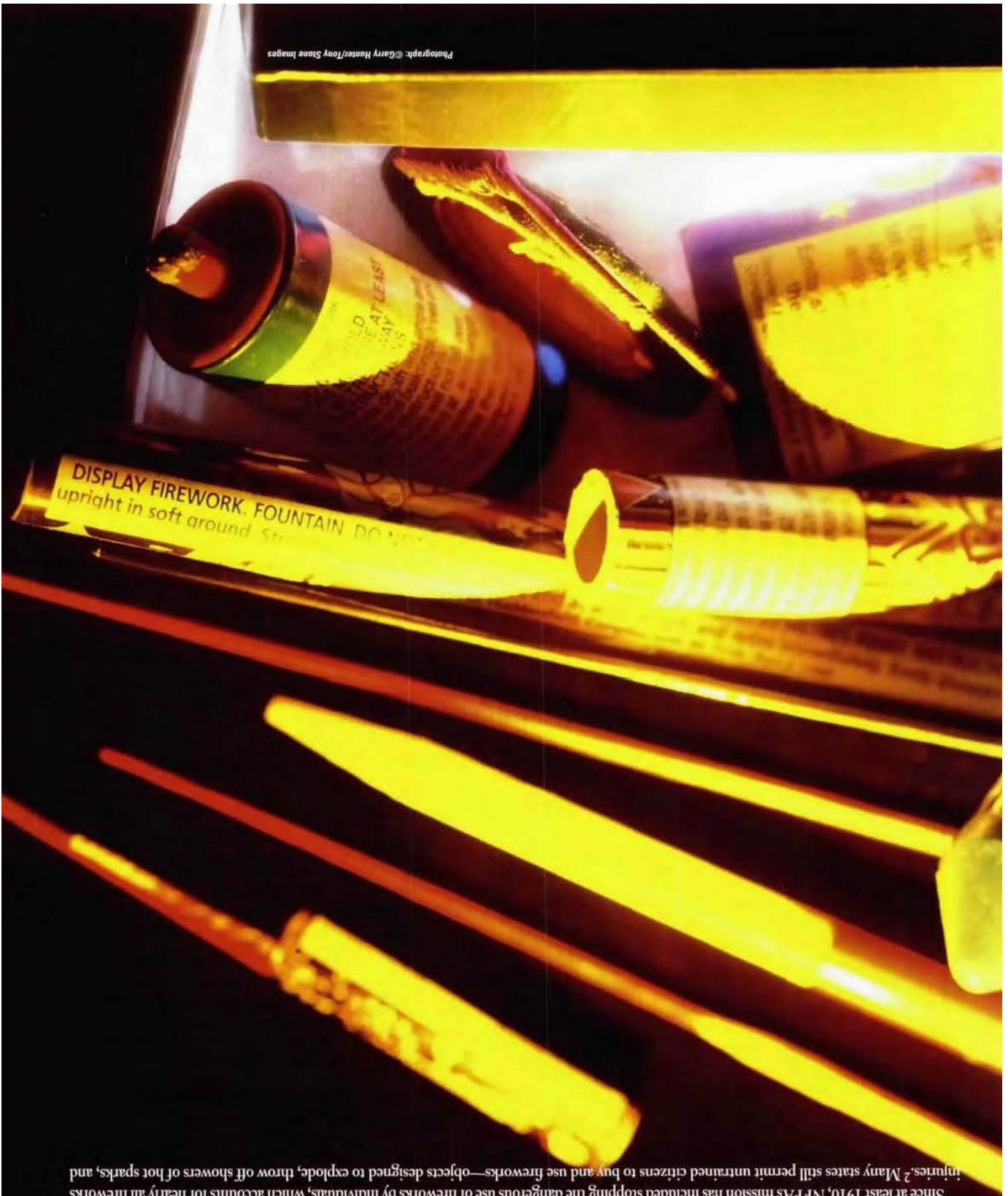
Deaths and Injuries

FIRE

An increase in U.S. fireworks-related injuries in 1997 puts safety advocates and officials on notice.

John R. Hall, Jr.

Fireworks-related injuries treated in U.S. hospital emergency rooms rose by 14 percent in 1997 to roughly the average level of two decades ago.¹ We at NFPA hope this increase isn't the first step back to the very high injury rates we saw from 1985 to 1995. Since at least 1910, NFPA's mission has included stopping the dangerous use of fireworks by individuals, which accounts for nearly all fireworks injuries.² Many states still permit untrained citizens to buy and use fireworks—objects designed to explode, throw off showers of hot sparks, and



Photograph: ©Garry Hunter/Tony Stone Images

TABLE 1

FIRES AND LOSSES ASSOCIATED WITH FIREWORKS 1980-96

(National Estimates of Fires Reported to U.S. Fire Departments)

Year	Residential Structures	Nonresidential Structures	Vehicles	Outdoor and Other	Total
FIRES					
1980	2,900	1,100	500	21,800	26,400
1981	2,900	1,300	500	27,100	31,800
1982	1,700	1,000	500	24,600	27,800
1983	1,400	800	500	25,300	28,000
1984	2,500	1,200	1,000	34,700	39,400
1985	2,700	1,500	900	46,600	51,600
1986	2,400	1,200	1,000	30,500	35,100
1987	2,000	1,100	800	33,200	37,100
1988	2,400	1,400	900	47,400	52,100
1989	1,800	900	800	29,800	33,400
1990	1,700	800	800	30,000	33,300
1991	1,600	900	800	24,700	28,000
1992	1,400	900	700	22,500	25,500
1993	1,300	800	800	27,300	30,200
1994	1,400	900	700	35,100	38,000
1995	1,200	700	700	24,800	27,400
1996	1,100	600	600	22,500	24,800

CIVILIAN DEATHS

1980	0	0	0	0	0
1981	0	0	0	0	0
1982	0	0	0	0	0
1983	0	0	0	0	0
1984	3	0	0	0	3
1985	8	0	3	4	15
1986	4	0	0	0	4
1987	4	3	0	0	7
1988	20	0	0	0	20
1989	4	0	0	0	4
1990	3	0	0	0	3
1991	0	0	0	0	0
1992	0	0	0	1	1
1993	0	0	0	0	0
1994	12	0	0	0	12
1995	0	0	0	1	1
1996	9	18	0	0	27

CIVILIAN INJURIES

1980	31	3	0	16	50
1981	29	16	4	17	66
1982	10	23	2	63	99
1983	45	3	0	28	76
1984	38	10	8	31	87
1985	73	10	29	32	144
1986	55	46	2	22	126
1987	55	10	0	28	93
1988	39	16	16	28	99
1989	49	4	19	34	107
1990	46	6	3	57	112
1991	54	13	10	30	107
1992	42	11	8	42	103
1993	23	18	2	23	66
1994	96	6	5	46	153
1995	53	0	3	37	93
1996	20	21	2	23	67

DIRECT PROPERTY DAMAGE (in Millions)

1980	\$11.7	\$3.2	\$0.4	\$0.3	\$15.5
1981	\$12.0	\$5.8	\$0.3	\$0.5	\$18.6
1982	\$9.0	\$1.6	\$0.4	\$0.4	\$11.4
1983	\$6.5	\$5.2	\$0.5	\$0.4	\$12.6
1984	\$18.9	\$5.6	\$1.9	\$0.5	\$26.9
1985	\$22.5	\$7.4	\$1.2	\$5.5	\$36.5
1986	\$24.2	\$29.1	\$1.6	\$0.7	\$55.7
1987	\$17.1	\$7.1	\$0.8	\$0.3	\$25.3
1988	\$22.4	\$14.4	\$1.3	\$0.9	\$38.9
1989	\$56.5	\$2.7	\$1.1	\$1.7	\$62.1
1990	\$22.1	\$3.8	\$1.5	\$0.6	\$28.1
1991	\$14.1	\$3.3	\$1.5	\$0.2	\$19.1
1992	\$13.6	\$15.9	\$1.4	\$2.6	\$33.4
1993	\$12.5	\$6.2	\$1.2	\$1.4	\$21.3
1994	\$10.1	\$7.5	\$2.0	\$2.3	\$21.9
1995	\$21.6	\$8.6	\$1.7	\$0.6	\$32.5
1996	\$12.3	\$7.0	\$1.3	\$6.2	\$26.8

NOTE: The year 1996 is the latest for which national fire department and police. All estimates of fires and associated losses are based on data reported by local U.S. fire departments to the NFPA and the U.S. Fire Administration (USFA) combined using statistical methods. Estimates of the NFPA, the USFA, and the CPSC. These are estimated to the nearest thousand. Civilian deaths and injuries to the nearest one, and direct property damage to the nearest hundred thousand dollars. Some may not equal row totals because of rounding error. Source: NFPA, NFPA survey.

TABLE 2

DEATHS ASSOCIATED WITH FIREWORKS INCIDENTS 1980-94

Year	Estimated Civilian Deaths in Fires Reported to U.S. Fire Departments	Recorded on U.S. Death Certificates
1980	0	10
1981	0	4
1982	0	5
1983	0	13
1984	3	7
1985	15	11
1986	4	8
1987	7	5
1988	20	4
1989	4	5
1990	3	5
1991	0	4
1992	1	2
1993	0	10
1994	12	4

NOTE: In any year, the figures in these two columns may not exactly agree. *Indian, Accident Facts, Chicago (1980-1992) and Bureau, U.S. (1993-1994); National Safety Council (1995-1997); NFPA, NFPA survey.

reach surface temperatures as high as 1,200°F (600° C). Nearly all the serious injuries and extensive property loss that occur every year arise from this misguided activity. The only acceptably safe way to enjoy fireworks is at a public fireworks display conducted in accordance with NFPA 1123, *Fireworks Display*. Anything else is a violation of the International Fire Marshals Association (IFMA's) Model Fireworks Law.

Fires and losses caused by fireworks

On a typical Fourth of July holiday, fireworks cause more fires in the United States than all other causes of fire on that day combined. But because most Americans encounter the risk of fireworks only once a year, many don't realize how great that risk is, particularly for children, who suffer most from the widespread private use of fireworks, both as spectators and, too often, as active participants.

In 1996, an estimated 24,800 fires involving fireworks were reported to U.S. fire departments (see Table 1). These fires were estimated to have killed 27 civilians, injured another 67, and caused \$26.8 million in direct property damage.

In recent years, fireworks-related fires have typically caused at least \$20 million in property loss annually, a substantial share of which is done by bottle rockets or other fireworks rockets. In 1997, these devices proved deadly, as well. Four occupants of an Arkansas home were setting off fireworks on Independence Day night when a rocket landed on a couch on the porch, igniting the cushion. The occupants, who'd been drinking, knew the rocket had landed on the couch but didn't think it had been affected. After midnight, the fire spread from the couch throughout the small structure, destroying it and killing one of the occupants, whose reactions may have been impaired by alcohol.

The same day, a bottle rocket that landed in or near a roof gutter ignited a duplex in New York. Fire spread to the underside of the roof and through the wood shake shingles that were layered under the asphalt shingles. A 31-year-old firefighter died of smoke inhalation while fighting the blaze.

Of course, deaths due to fireworks-related fires and deaths directly caused by fireworks aren't the same thing. Fireworks can start fires that subsequently cause deaths, and fireworks can kill directly, with-

FIGURE 1

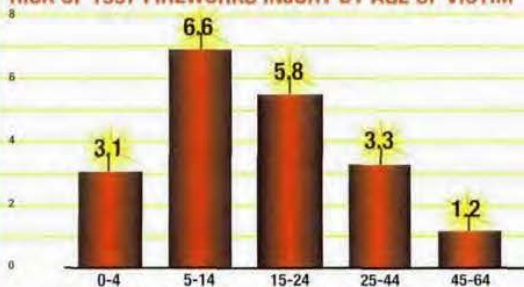
FIREWORKS INJURIES REPORTED TO HOSPITAL EMERGENCY ROOMS



Note: From 1985 to 1989 and from 1991 to 1996, ranges of estimates is given reflecting the transitions between samplings between sampling plans. Source: CPSC National Electronic Injury Surveillance System (NEISS)

FIGURE 2

RISK OF 1997 FIREWORKS INJURY BY AGE OF VICTIM



*Number of 1997 fireworks injuries per 100,000 persons, adjusted by fixed factor to reflect total injuries for year vs. injuries in one-month study period. Source: CPSC NEISS, US Census Bureau.

TABLE 3

1997 FIREWORKS INJURIES BY AGE OF VICTIM

3%	45-64 YEARS
33%	25-44 YEARS
26%	15-24 YEARS
31%	5-14 YEARS
7%	0-4 YEARS

Source: CPSC National Electronic Injury Surveillance System (NEISS)

out producing a fire that requires a fire department response. Table 2 shows statistics on both types of fireworks-related deaths for 1980 through 1994, which is the latest year for which both types of statistics are available.

Most fireworks-related injuries don't involve fires that are reported to fire departments. In 1996, for example, an estimated 67 civilians were injured in reported fires caused by fireworks, but fireworks-related injuries reported to hospital emergency rooms alone totaled 7,300. Other fireworks-related injuries, such as those treated in doctors' offices or at home, aren't documented in any national database, but they'd surely push the total even higher.

In 1997, an estimated 8,300 people suffered fireworks-related injuries severe enough to require treatment in hospital emergency rooms, according to the National Electronic Injury Surveillance System (NEISS) of the U.S. Consumer Product Safety Commission (CPSC). CPSC also updated its sample of emergency rooms and estimated that the new sample would have produced an estimate of injuries 3.33 percent lower in 1996 than the 1996 numbers showed. Figure 1 shows the



Photograph ©Keith Brinkley/Imagery Images

trend in fireworks-related injuries reported to emergency rooms since 1974, with statistics for 1991 to 1996 shown both as they were reported and as they've been adjusted to fit with the new sample. CPSC also adjusted the figures for 1988 to 1990, but these years were already adjusted for an earlier sampling change, so those adjustments, which are small anyway, aren't shown in Figure 1.

Most fireworks injuries involve children, particularly school-aged children (see Table 3). The relative risks by age group don't clearly show what past studies have shown, which is that children ages 10 to 14 are at the highest risk, with older children ages 15 to 19 close behind. In Figure 2, these two age groups are indistinguishable from children ages 5 to 9 and adults ages 20 to 24, respectively.

Male victims accounted for roughly three-fourths of fireworks injuries. Among adults ages 45 to 64, however, women accounted for a narrow majority of fireworks injuries.

The CPSC conducted a detailed analysis of fireworks-related injuries in 1997 in the one-month period around July 4th. In a typical year, two-thirds to three-fourths of all fireworks injuries occur

TABLE 4

1997 FIREWORKS INJURIES BY TYPE OF FIREWORKS*

7%	ILLEGAL FIRECRACKERS
4%	SMALL FIRECRACKERS
20%	UNCLASSIFIED FIRECRACKERS
16%	FIREWORKS ROCKETS
10%	SPARKLERS
8%	FOUNTAINS
5%	NOVELTY DEVICES
4%	ROMAN CANDLES
4%	MULTIPLE-TUBE DEVICES OR SHELLS
3%	PUBLIC DISPLAY
1%	HOMEMADE OR ALTERED
18%	UNKNOWN

*June 23 to July 23 only. Source: CPSC National Electronic Injury Surveillance System (NEISS)



TABLE 5

1997 FIREWORKS INJURIES BY PART OF BODY INJURED

35%	HAND OR FINGER
18%	EYE
22%	OTHER HEAD, FACE, OR NECK
10%	LEG OR KNEE
7%	TRUNK
5%	ARM OR ELBOW
2%	FOOT OR TOE
0%	MULTIPLE PARTS

*June 23 to July 23 only. Source: CPSC National Electronic Injury Surveillance System (NEISS)



TABLE 6

1997 FIREWORKS INJURIES BY TYPE OF INJURY*

58%	BURN
26%	CONTUSION OR LACERATION
2%	FRACTURE OR SPRAIN
14%	OTHER

*June 23 to July 23 only. Source: CPSC National Electronic Injury Surveillance System (NEISS)



during that time. In 1997, 69 percent took place then. The remaining injuries that occur at other times of the year reflect, in part, certain local traditions, such as the use of fireworks during Christmas and New Year's nationally, the Chinese New Year in some areas, and Mardi Gras in parts of the South.

What kinds of fireworks cause the injuries?

A total of 8 percent of injuries—and 10 percent of injuries involving fireworks of a known type—involved fireworks that are illegal under federal law, including homemade or altered devices, which accounted for 1 percent, and illegally large firecrackers, which accounted for 7 percent (see Table 4). Fifty-one percent of injuries—and 61 percent of injuries involving fireworks of a known type—involved fireworks that are permitted under federal law, but not allowed under IFMA's long-standing Model Fireworks Law. Firecrackers of undetermined size

Fireworks Injury Toll for 1997

The largest share of 1997 fireworks injuries treated in emergency rooms involved the hand, wrist, or finger, and injuries of this type accounted for 35 percent of the total number of injuries. They were followed by injuries to the eye, accounting for 18 percent, or other parts of the face, head, or neck, 22 percent; the leg or knee, 10 percent; the trunk, 7 percent; the arm or elbow, 5 percent; and the foot or toe, 2 percent (see Table 5).

At 58 percent, the largest share of 1997 emergency-room fireworks injuries were due to burns, followed by contusions, abrasions, or lacerations, which accounted for 26 percent; fractures or sprains, 2 percent; and other injuries, 14 percent (see Table 6).

accounted for 20 percent of injuries, or 24 percent of injuries involving fireworks of a known type.

Even public displays of fireworks can lead to unexplained injuries. Such displays accounted for 3 percent of the injuries in 1997, or 4 percent of injuries involving fireworks of known type. A grim example of the consequences of public fireworks displays that aren't conducted according to safety procedures occurred the night before Independence Day 1997 in Illinois, when a fireworks rocket misfired and landed in the midst of stored fireworks, igniting them all. One man was killed in the explosion and ensuing fire, and two others caught in the blast were thrown into a river and drowned. Local fire officials investigated the incident with support from four state and federal agencies. News accounts reported that a large fine for safety violations was levied on the firm.

These figures clearly show that substantial progress in reducing the high annual toll of fireworks injuries will require reducing those injuries caused by fireworks that aren't covered by current federal law. Simply enforcing the existing law won't affect the fireworks that cause most of the problem. It's even possible that limited laws, such as the federal law, are actually more difficult to enforce than a broader law would be because the existence of some legal fireworks for private use encourages a climate of acceptance and creates a distribution network, both of which make it easier for amateurs to obtain illegal fireworks.

What does it all mean?

The fact that public fireworks displays consistently account for a very small share of the fireworks problem shows that fireworks can be used safely by trained professionals who follow NFPA 1123, which puts the control of fireworks in their hands. The multifatality incident at a public display in Illinois shows how important it is for operators of public displays to follow the rules of safety.

When things go wrong with fireworks, they go very wrong very fast, far faster than any fire protection provisions can reliably respond. And fireworks are a classic attractive nuisance for children. If children are



Photograph: ©The Stock Market/Chromastorm/Salam MCKAY

Fifty-one percent of 1997 fireworks injuries—and 61 percent of injuries involving fireworks of a known type—involved fireworks that are permitted under federal law but not allowed under IFMA's long-standing Model Fireworks Law.

present to watch, they'll be tempted to touch. Children can move too fast and be badly hurt too quickly if they're close to fireworks, as they inevitably are at home fireworks displays. Why would anyone, especially a parent, who knows the facts about fireworks want to take that chance when everyone can enjoy a festive—and safe—Fourth of July at readily available public displays?

We in the fire protection community must spread the word in order to reduce the awful tolls of injury, death, and damage caused by the use of fireworks by amateurs. We must find a way to convince the public that the safe use of fireworks means no use at all by untrained people. ♦

John R. Hall, Jr., Ph.D., is assistant vice president of NFPA's Fire Research and Analysis Division.

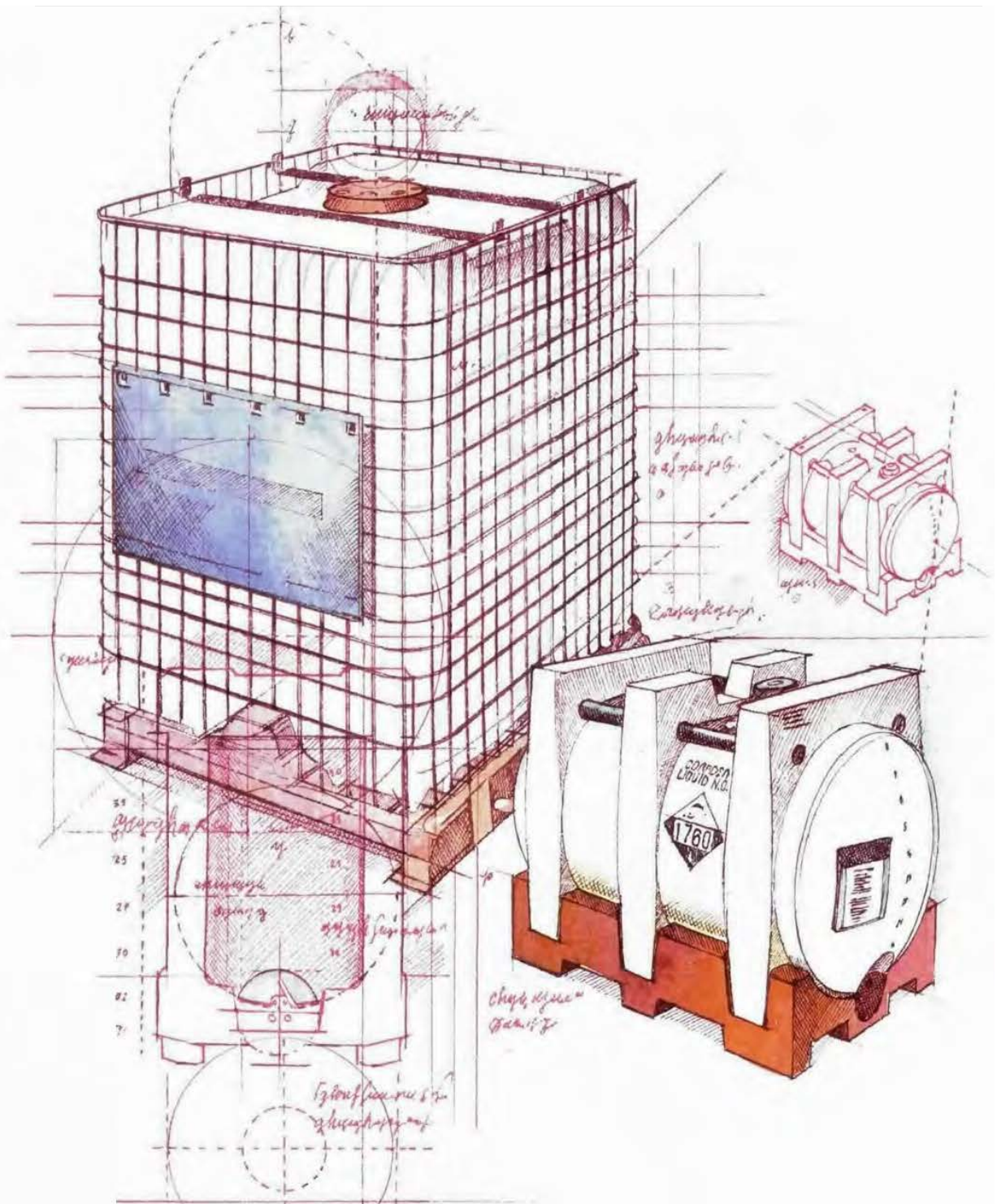
References

1. All fireworks-related injury statistics from hospital emergency rooms come from reports by the CPSC and private communications from Linda E. Smith of the CPSC. Smith also provided the rules for setting the range of fireworks injury estimates during the period between 1985

and 1989, reflecting a change in the sample, and between 1991 and 1996, reflecting the latest change in the sample. Reports referenced include Ron Monticone and Linda Smith, *1997 Fireworks-Related Injuries*; Sheila L. Kelly, *Fireworks Injuries, 1994*; Dr. Terry L. Kissinger, *Fireworks Injuries—Results of a 1992 NEISS Study*; Linda Smith and Sheila Kelly, *Fireworks Injuries, 1990*; Deborah Kale and Beatrice Harwood, *Fireworks Injuries—1981*; and the May/June 1974 issue of *NEISS News*. All were published by the CPSC.

2. Federal law permits public use of what are now referred to as "consumer fireworks" (formerly known as "common" or Class C fireworks), which are defined as "any small fireworks device designed primarily to produce visible effects by combustion" that comply with specific construction, chemical composition, and labeling regulations. These include a 50-milligram maximum limit of explosive composition for ground devices and a 130-milligram maximum limit of explosive composition for aerial devices. "Safe and sane" fireworks include devices such as sparklers, fountains, snakes, party poppers, and ground spinners. Laws based on this approach allow considerable private use of fireworks but exclude any explosive-type devices that lift off the ground that are allowed under federal law.

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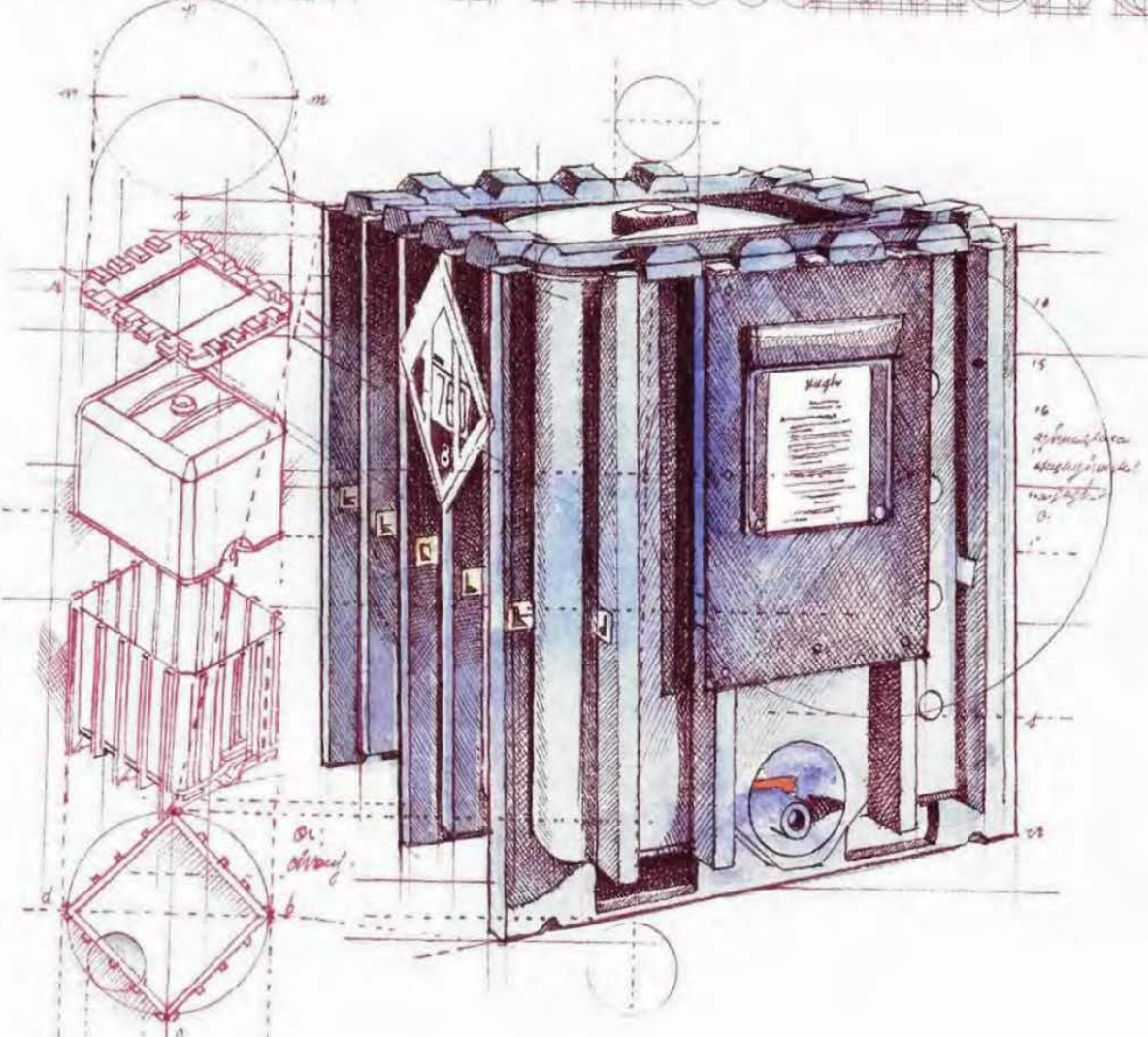
Test data show that many flammable and combustible liquids can be safely stored in IBCs protected by an appropriate sprinkler system.

Alisa Wolf

Illustration © Chris Duke

Fire Testing Intermediate

Bulk Containers



They're light, rugged, and easy to stack. They meet tough Department of Transportation (DoT) and intermodal United Nations standards for stacking strength and abuse resistance. As storage containers for chemicals, they safeguard against the release of hazardous vapors to the atmosphere by allowing users to access contents through a valve connected to a closed system. Since

one container stores more than several smaller containers can, they're economical to use, and they're easy to clean, according to environmental safety standards.

But the main reason paint manufacturers, chemical companies, and many other users have been buying intermediate bulk containers (IBCs) in increasing numbers is because they occupy less space than

other types of drums holding the same amount of liquid. By 1992, these nonmetallic containers, which have been around for 15 to 20 years, were being used to transport and store everything from mushroom soup to mild acids in the United States and overseas.

However, those who wanted to store flammable and combustible liquids in them came up against a problem: IBCs hadn't been proven fire-safe, so U.S. fire codes prohibited anyone from using them to hold such contents.

IBC's were recognized for the first time in the 1996 edition of NFPA 30, *Flammable and Combustible Liquids*, the same year protection criteria for warehousing liquids were changed from recommendations to requirements and moved from the code's appendix to Chapter 4. Since no criteria existed for IBCs, the industry recognized the need for tests to ensure adequate fire protection.

Last fall, representative IBC manufacturers, industry users, fire inspectors, fire research engineers, and insurers decided to put IBCs to the test. Under the auspices of The Fire Protection Research Foundation, they pooled their resources for a series of fire tests at Underwriters' Laboratories (UL) test facility in Northbrook, Illinois.

"We realized that many of the containers had, in fact, never been properly tested," says Larry Thomas, applications engineering manager for Hoover Materials Handling Group, Inc., an IBC manufacturer on the technical advisory committee for the fire tests. Manufacturers who'd run their own tests, Thomas explains, discovered that their methods didn't meet fire engineering standards. This meant that insurers still wouldn't approve their products for use with flammable or combustible liquids.



Fire tests of IBCs with sprinkler protection allowed researchers to develop design modifications to protect models like this one against leaks for 30 minutes.

NFPA Journal May/June 1999

This created difficulties for fire inspectors as well, says Barbara Kofron, assistant to the fire chief of the Phoenix, Arizona, Fire Department, another technical advisory committee member.

"It surprised a lot of people that DoT approval didn't automatically mean fire code approval," she says about reactions she got from IBC users during inspections. "Even if we wanted to allow a variance for storing flammable or combustible liquids in IBCs, there was no guidance in the codes on how to protect them."

IBC users were also concerned about fire code violations, says Jack Higgins, a retired safety and loss prevention consultant for Dow Corning Corp. representing the Silicones Environmental Health and Safety Council on the technical advisory committee. Manufacturers like Dow Corning would be interested in using IBCs for storing silicone compounds, which are Class II and Class III combustible liquids. Currently, NFPA 30 doesn't allow this.

"We'd have to store the containers outside, or be in violation of the code, neither of which we're willing to do," says Higgins.

IBC's were also getting some bad second-hand press, according to Gordon Rousseau, executive director of the Rigid Intermediate Bulk Container Association (RIBCA), one of the fire test's sponsors. He says that fire protection weaknesses that came to light during fire tests on 50- to 70-gallon (189- to 265-liter) plastic containers were generalized to IBCs because many IBCs are made of plastic.

"The feeling was that the results for plastic IBCs would be the same," Rousseau says.

Todd Schumann, research consultant for HSB Industrial Risk Insurers, another technical advisory committee member, agrees.

"Being plastic and storing combustible and flammable liquids, there was a concern that they would fail and cause a catastrophic release that would present a fire threat," he says. "Before the IBCs came along, metal tote tanks were generally used. Many manufacturers have gone to various plastic or composite containers, and those have different fire characteristics than metal tanks. There's nothing in NFPA 30 that deals directly with these units."

As their name suggests, intermediate bulk containers entered a field dominated by much larger and much smaller containers, such as bulk tanks and drums. But IBCs cover such a wide range of capacities—typically 120 to 610 gallons (454 to 2,309 liters)—that the designation "intermediate" may be misleading. And though they share certain characteristics, they're not easy to generalize. For example, all-polyethylene, single-wall models may or may not have a separate plastic or foam-filled base. And other plastic containers, called "composite IBCs" by the DoT, may be enclosed or encased in an outer metal, plastic, or foamed-plastic double-wall structure.

Put to the test

Fortunately, the 1996 edition of NFPA 30 does have fire testing guidelines, according to Joe Scheffey, director of Fire Protection Research and Development at Hughes Associates, Inc.

"These served as a springboard for testing the IBCs," says Scheffey, who served as technical director of the tests, making sure the results were technically solid and that all interested parties were satisfied that the tests were thorough and unbiased.

The fire tests were all done at UL under ceilings 30 feet (9 meters)

high. When the IBCs were stacked, they were stacked two high. The containers tested included thicker-walled "rotomolded" units and thinner-walled "blowmolded" units. Some were all-polyethylene, and others were made of composite materials. International participation included Sweden's Brandforsk and the Swiss Institute of Safety and Security, which joined The Research Foundation as sponsors of different phases of the tests. RIBCA and manufacturers donated the IBCs.

Intermediate and large-scale tests were performed using real-world fire exposures. Then fire was fed by a continuous heptane fuel flow at 2 gallons per minute (gpm) (7.6 Lpm) for 30 minutes, simulating a forklift tine puncture.

Success was measured against two criteria: Whether the IBC held its contents, and whether it was able to avoid pressure buildup, which could potentially rupture the container.

"We assumed some liquid would spill," Scheffey says, "but our objective was to make sure that we didn't have cascading failures from adjacent units. We don't want the units next to the breach to add to the fire."

Testing was done in three phases. In Phase I, 24 IBCs from 15 manufacturers were filled with water and put in pans, then subjected to a liquid hydrocarbon pool fire to see how soon they'd breach. After this round of testing, the team started to look at suppression characteristics with water. But sprinklers weren't expected to douse the fire, says Scheffey.

"The objective was to assess container integrity and cooling from sprinklers. We were looking for that combination of a good container with some inherent resistance and cooling from sprinklers."

In Phase IIA, sprinkler systems were tested on IBCs stacked two high, two wide, and two deep; and in Phase IIB, these same tests were run on large arrays, two units deep and four units long with an adjacent array across an 8-foot (3.4-meter) aisle. IBCs were tested two high with sprinkler protection of 0.60 gpm/ft² (24.5 Lpm/m²), and one high with sprinkler protection of 0.45 gpm/ft² (18.4 Lpm/m²). In most Phase I and IIA tests, all the units were filled with water to normal rated shipping capacity, but as testing continued, heptane, a flammable liquid, was floated on the surface of water-filled containers to determine potential ignition effects from a breach. In Phase IIB, heptane was floated on IBCs filled with water in all but one test, which used an IBC contain-



In Phase II of testing, some IBCs maintained their integrity for a full 30 minutes. Others, like this one, breached earlier.

ing water and enough heptane to burn for 30 minutes. Finally, a standardized evaluation method was tested to correlate results from the large-array to small-scale tests.

Phase III tested IBCs in typical rack storage scenarios. The results of this phase weren't available at the time of this writing.

Results

Even those manufacturers who'd conducted their own ad hoc tests and felt confident that IBCs would hold up were surprised at just how well some IBCs fared.

"I knew the results would be good," says Hoover's Thomas. "But they were far better than I expected."

"It was a surprise for everybody, and I mean everybody," says RIBCA's Rousseau. He points out that not all models did well—in fact, some containers failed within a minute and a half—but others did very well, maintaining their integrity for nearly 20 minutes without help from a suppression system.

These results came as a shock to those who'd assumed that IBCs would perform the same way small plastic containers did in similar tests.

"These units really don't act like small plastic containers, which can breach very quickly," Scheffey says. The thickness of the plastic correlated in some but not all cases with failure time. Blowmolded IBCs that weren't shielded within a metal structure generally failed most

TIME TO BREACH OF REPRESENTATIVE IBCs

(in min:sec)

IBC	No Sprinkler Protection	Sprinkler Protection	
	Phase IA Scoping Tests	Phase II Large-Array Tests	Phase II Reduced-Scale Tests
Composite IBC A	2:58	24:40 (with design improvement)	12:30 (with design improvement)
Composite IBC B	5:52	30:00	30:00
Composite IBC C	1:29	1:50	—
Composite IBC with protective blanket	11:12	<30:00	30:00
All-polyethylene IBC	6:14	12:20	7:00

Chart: Christopher J. McCloskey

The most successful units in almost all cases were composite IBCs.

rapidly, breaching sooner than shielded or unshielded rotomolded units. But some unshielded rotomolded units did very well, says Scheffey, with no need for additional shielding.

The results for composite IBCs were even more encouraging.

"The most successful units in almost all cases were composite IBCs, either with a metal outer shell or with a steel shell with open bottoms and tops," Scheffey says. "Another IBC that has a plastic tank inside a metal cage failed very quickly when unprotected, but when the vendor put on a fire-resistant blanket, it also did very well."

The metal cage heated up early in the fire and caused leaking where it touched the plastic container. But even the leaks didn't create a cascade of product.

"When they did fail, it was very much a controllable failure," says Thomas.

Testers also found that the plastic didn't melt as expected. Higgins compares the effect to what happens when a styrofoam cup burns. An empty cup will ignite quickly, but if it's full of water, he explains, "you can burn the top of a cup down to the waterline, and the water will help prevent the rest from melting." Similarly, liquid in the rotomolded and the blowmolded IBCs kept fire from melting the plastic right away, whether the liquid used was water or heptane and water. This phenomenon played itself out quite noticeably with the all-polyethylene IBCs

with hollow plastic bases. The base would melt, and they'd fall over.

But stabilizing the base was an easy problem to fix, according to Thomas.

"What we very quickly learned was that the biggest problem was finding the appropriate way to educate ourselves about the degree of safety each unit offered and what kind of sprinkler system makes it a safe and usable container," Thomas says. "Plastic isn't necessarily bad."

All units passed the second test criteria, which was avoiding pressure buildup. Even in tests where IBCs were allowed to burn for 30 minutes with sprinkler protection, no pressure buildup was noted. Rousseau explains that this has to do with the volume of liquid in the IBCs taken together with the heat transfer characteristics of plastic.

"You didn't see this pressure buildup because the plastic structure material doesn't permit heating of the liquid very efficiently," he says, "and, considering the large amount of fluid inside the plastic IBC, it absorbs the heat very well." This gives IBCs an inherent advantage over steel, which must be fitted with relief valves or plastic bungs to regulate pressure buildup during a fire.

Since no significant temperature rise in the liquid was observed in Phase I, testers were comfortable using water as the primary laden material. Correlations between the physical characteristics of water and flammable liquids were considered. When heptane was floated on the water, testers observed no significant ignition problems.

Gerald Gordon, a research consultant for Greif Bros. Corporation, another IBC manufacturer, says that the most significant test finding was that "you could put the IBCs into a ferocious fire, and they would protect the product." He adds that "composite IBCs, when constructed with some sort of noncombustible shielding material between a thin-walled tank and the fire, are effectively designed for passing these tests."

In no test did the fire overwhelm the sprinkler system.

Setting a standard

The idea behind the reduced-scale tests in Phase II was to develop a standardized test for manufacturers, to give them the option of running tests on fewer IBCs than required for a full-scale test. The need for this becomes apparent when you consider that IBCs range in price from roughly \$140 to \$2,300 each, according to Rousseau.

"One of the thoughts we had was to find a way not to have to test 20 units in a full array, especially if one failed and it had to be tested again," Rousseau says.

But testers who'd been hoping for a simple standardized test realized early in Phase I that generalizing about IBC performance wasn't going to be an option.

"There's some variation among steel containers and drums and small plastic bottles, but we can make some general characterizations," Scheffey says. "We had hoped to do the same with IBCs, but during the scoping tests, it became obvious that Vendor A's product isn't the same as Vendor B's."

Testers devised a reduced-scale test that showed a 2 to 1 correlation



Wood sheeting was installed on the lower half of these IBCs to separate the plastic tank from the steel mesh. Fire tests showed that rotomolded units can be effectively protected by such design features that reduce full contact of the steel with the plastic.

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for units that leaked in less than 30 minutes in both the two-by-two and larger test arrays. The scaling factor for units that achieved a 30-minute duration in both tests remains unknown, since it's possible units that held up this long might have done so for even longer. But generally, liquid leakage occurred twice as fast in the reduced-scale tests, which testers attributed to modifications in the exposure fire and the sprinkler operating pressure needed to accommodate the smaller array.

Data suggest that the reduced-scale test can be used on composite IBCs with a reasonable degree of assurance and that a 15-minute test provides reasonable assurance that an IBC would survive a 30-minute large-scale test. For approval purposes, a 20-minute test has been recommended to provide a safety factor when using the reduced-scale method. But testers were concerned that the reduced-scale test would treat all-polyethylene units more severely, since pure plastic tended to fail more rapidly in the small-scale test. In fact, one unit that passed the large-array test "failed pretty quick" in the standardized test, says Scheffey. And for the all-polyethylene units, structural stability continues to be a concern. These issues must still be resolved.

Representative IBC performance is shown in the table on the previous page by the effect of the container's inherent design, the impact of sprinkler cooling, and the difference in large-array and reduced-scale tests. The data show that specific units can be protected against breaching and liquid discharge, but that broad generalizations are difficult to make.

Despite these issues, which Phase III of testing might help to clarify, the test results reassured manufacturers.

"A lot of people would never have thought that it was possible to take an all-plastic container and put it into a half-hour fire and have it survive," Rousseau says. "A lot of people were surprised that a large plastic container could take so much punishment."

The future

Manufacturers learned a lot about their products during testing, says Gordon of Greif Bros.

"A number of innovations in manufacturing and design came out of these tests," he says. "Some of the units on first trial didn't do very well. But after some modifications, we were able to put the units in a hot fire, and they sort of sat there smiling."

At the end of Phase II, manufacturers had enough data to bring to the NFPA 30 Chapter 4 committee. If the proposal makes it into the year 2000 edition of the code, manufacturers will be able to list their units that maintain their integrity in a fire when tested using a standardized large or small test array. Units that pass, says Koffron, would be labeled, making her job as an inspector a lot easier.

"This is a product people want, and if we can steer them in the direction for an approved item that can do what they need, then we can do what we need," she says. "There are going to be some IBCs that simply won't be acceptable for storage of flammable and combustible liquids. That's where labeling will help."

Scheffey's optimistic about IBCs as flammable and combustible liquid containers, but with some caveats.

"Thirty-minute protection doesn't guarantee success," he says. "There will always be scenarios that won't be handled. It's important that IBCs be used only in facilities with good housekeeping, appro-



IBCs aren't easy to generalize. From left to right: two stacked sets of composite IBCs with steel outer cages, one set of stacked polyethylene IBCs with an outer layer of foam, and one set of wire-caged IBCs with a fire-resistant blanket.

appropriate handling practices, and few ignition sources, as seems to be the case in most warehouses where IBCs are being used now. The combination of an IBC having inherent fire resistance plus an adequate sprinkler system increases the chances that a fire will be controlled, should an ignition occur."

A water suppression system doesn't put out the fire, Scheffey adds, making timely fire department response essential. If a timely response isn't possible, fire suppression tactics have to change accordingly. Such issues, says Scheffey, continue to be addressed by the NFPA 30 Technical Committee, which considers the probability of successful fire control, fire department or fire brigade capability, and overall risk.

One of the most valuable results of the IBC fire tests may prove to be the success of the process itself, which serves as a model for other industries that want to speed up acceptance of new technologies.

"The Fire Protection Research Foundation's process helps speed up the product acceptance process," says Rick Mulhaupt, The Research Foundation's president. "By convening an independent technical advisory committee of manufacturers, industry users, insurers, fire service professionals, laboratories, and code writers, technical questions are resolved so that the most useful documentation is delivered to the code process. This can also facilitate development of new third-party approvals test protocols, if stakeholders deem it appropriate."

The Phoenix Fire Department's Koffron agrees. She points out that the tests IBC manufacturers ran on their own might have delayed fire-code acceptance of their products. By tapping into The Research Foundation's process, they were able to test using accepted protocol and real-world sprinkler design.

"By putting testing into a proper setting," she says, "the industry actually furthered research in this area and helped improve the code."

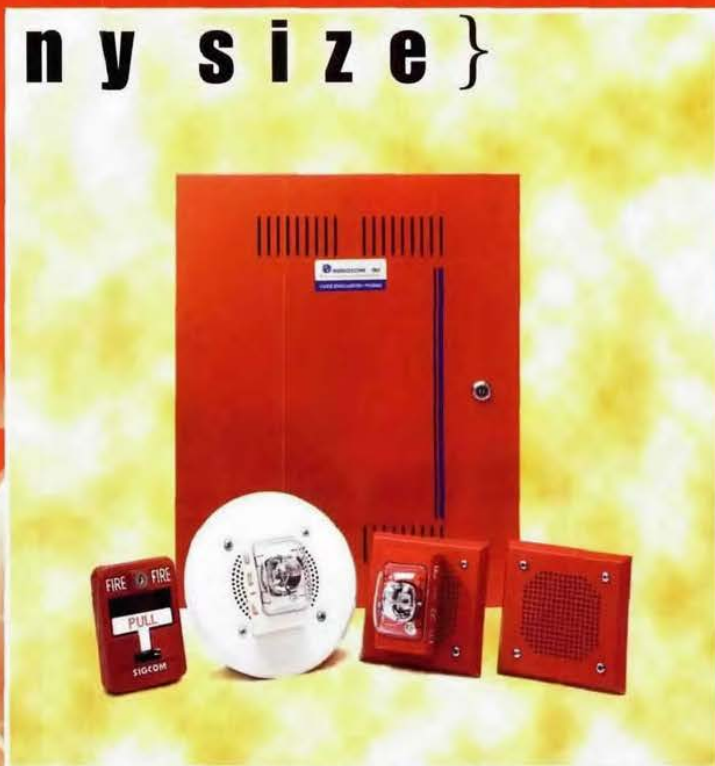
Alicia Wolf is editor of the NFPA Journal.

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Supervising Stations

*Supervising stations play a key role
in implementing a holistic approach to fire protection.*

Dean K. Wilson

In a commercial, municipal, or industrial occupancy, the basic fire alarm system serves the fundamental goal of notifying occupants of a fire so they can escape. For some occupancies, however, this basic function must extend to meet other protection goals, such as connecting the building fire alarm system to a supervising station, where personnel stand ready to receive signals from the protected building and take appropriate action.

The design of fire protection for any facility begins with a careful needs assessment to benchmark the various fire protection systems against the facility's fire protection goals. Typically, these goals include life safety, property protection, mission continuity, heritage preservation, and environmental protection.

A "holistic approach" that emphasizes the organic or functional relationship between parts and wholes usually proves best for developing a strategy to meet each of these goals. In other words, a holistic approach to fire protection asserts that the effectiveness of the strategy depends on a series of interconnected and interrelated protection features, which must function as a complete entity. They can't work properly when applied as individual components.

In light of this, connecting a building fire alarm system to a supervising station must meet certain objectives within the five fire protection goals. If, for example, the occupants of a building can't move freely on their own to escape a fire, a supervising station connection can summon aid from the public fire department or from a private fire brigade. Such a connection significantly enhances the life safety goal.

At a facility with complex property protection issues, the fire alarm system might be used as a tool to help manage overall fire protection. In this case, the fire alarm system can actually oversee the operational readiness of all the other active fire protection systems.

And when mission continuity, heritage preservation, or environmental protection serve as the overriding fire protection goal, the fire alarm system can help manage the availability and operation of the installed fire protection systems.

For example, the fire alarm system can supervise the availability of the private fire protection water supply by monitoring the level in stor-

age tanks, the condition of fire pumps, the air pressure in pressure tanks, or the pressure in a dead-ended water main. It can also oversee the automatic sprinkler systems by supervising the position of control valves and the amount of air pressure in dry-pipe sprinkler systems.

When a facility's management uses the fire alarm system as a tool to manage other systems, they may decide to transmit signals from the protected property to a supervising station to provide continuous coverage. When the supervising station receives signals from the property, operators can notify representatives of management, allowing them to take prompt action.

NFPA 72, *National Fire Alarm Code*, requires that all equipment used in a supervising station fire alarm system, including hardware and software, be listed for the purpose for which it's used by a nationally recognized testing laboratory, such as Underwriters Laboratories, Inc. or Factory Mutual Research Corporation. It's important for representatives of the listing agency to visit the equipment manufacturer to make certain the products rolling off the assembly line match the ones tested in the laboratory.

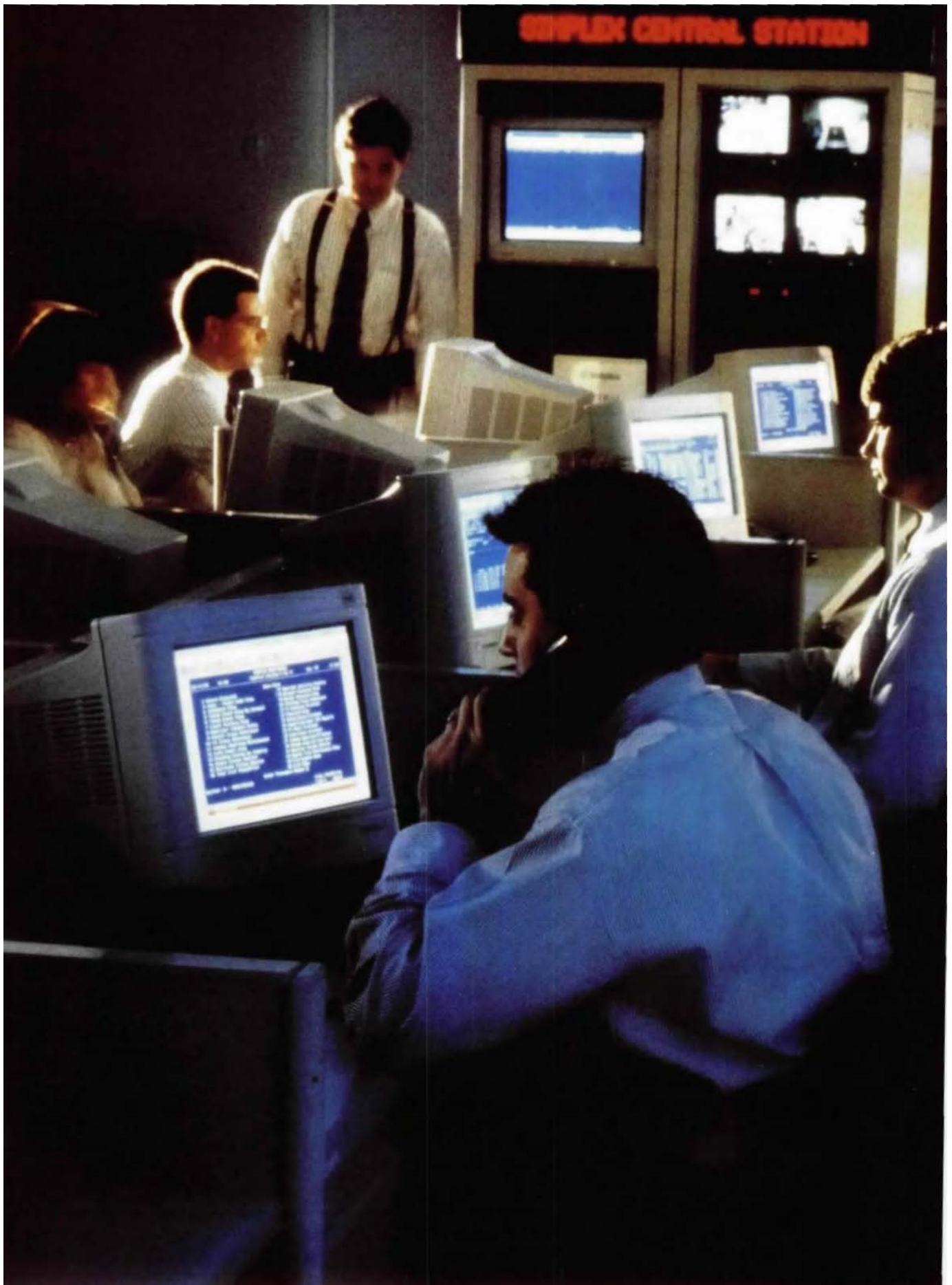
Thus, a fire alarm control unit at a protected building must be listed for use as part of a supervising station fire alarm system. Unfortunately, many fire alarm control units are only listed for a protected property or local fire alarm control unit. When planning a new installation or revising an existing installation, make certain the control unit has the appropriate listing.

Remote supervising stations

Section 4-4 of NFPA 72 defines the simplest supervising station fire alarm system available, the remote supervising station. This system connects the building fire alarm system to a remote supervising station. For alarm signals that indicate a fire, the code expects the remote supervising station to be at the public fire service communication center or at the public agency that dispatches the public fire department.

If the public agency doesn't wish to receive such signals or will accept an alternative location, the remote supervising station may be elsewhere. Locations with continuous occupancy, such as telephone

Photograph © Simulix Time Recorder Company



answering services or the monitoring station of an alarm service provider, will usually serve as the remote supervising station. In more rural areas, any business that operates continuously may serve as the remote supervising station. This may include gasoline service stations, restaurants, even funeral homes.

Supervisory signals, which indicate the need for action with respect to other fire protection systems, may transmit to the same remote supervising station as the fire alarm signals. They may also transmit to another location acceptable to the authority having jurisdiction (AHJ). Trouble signals, which indicate some fault in the fire alarm system wiring or a power failure, will transmit to the remote supervising station associated with alarm signals, supervisory signals, or both.

When operators at the remote supervising station receive signals, they act according to standard operating procedures. For fire alarm signals, this may include dispatching the public fire department or private fire brigade and notifying designated members of a facility's management. For supervisory and trouble signals, this may simply involve notifying designated members of management.

The power supplies for remote supervising station systems, both at the protected property and at the remote supervising station, must meet the requirements of NFPA 72's Section 1-5.2.6, which requires that the system provide 60 hours of standby power. Rechargeable batteries, a combination of an engine-driven generator and four hours of rechargeable batteries, or two engine-driven generators may supply this standby power.

Proprietary supervising stations

Occasionally, the management of a large facility may have its supervising station on site or at another facility under the same ownership. NFPA 72 Section 4-3 describes this as a proprietary supervising station where operators receive signals and take prescribed action, including dispatching a runner to the area that's transmitted the signal.

The proprietary supervising station operators may have other duties, as long as those duties don't interfere with handling signals from the fire alarm system, and the proprietary supervising station may be located at a guard house or security office or some other place at the facility where there are always trained employees. Some large corporations have located their proprietary supervising stations at the corporate headquarters. From this location, the proprietary supervising station receives signals from the various corporate facilities around the United States, or even around the world.

The standby power supply requirements of Section 1-5.2.6 call for 24 hours of standby power for a proprietary supervising station fire alarm system. Again, rechargeable batteries, a combination of an engine-driven generator and four hours of rechargeable batteries, or two engine-driven generators may supply this power.

The code specifically details that the operators should retransmit alarm signals to the public fire department or private fire brigade. Alternatively, they should notify designated individuals when the system receives supervisory and trouble signals.

Central stations

The central station fire alarm system is regarded by many in the industry as the top of the line. Section 4-2 of NFPA 72 requires central station fire

alarm service providers to have a specific listing from a nationally recognized testing laboratory. In one of three prescribed manners, they must provide eight elements of service, four of which pertain to the protected property. The other four elements pertain to the actual central station.

At the protected property, the central station operating company must provide installation, testing, maintenance, and runner service. At the central station itself, the company must manage and service the system, monitor signals, retransmit fire alarm signals or notify designated persons for supervisory and trouble signals, and keep records.

As a prime contractor, the central station may use its own personnel to provide all eight elements, or it may subcontract the four elements at the protected property to another organization. In this case, the central station must retain overall responsibility for the system. The code also permits a listed local alarm service provider to act as the prime contractor, installing, testing, and maintaining the system at the protected property. The local provider then subcontracts the four elements at the central station to a listed central station service provider. Either the listed local company or the listed central station company provides the runner service.

If you read Section 4-2 carefully, you'll soon realize that the requirements seem quite severe, giving an indication of the high level of protection afforded by central station fire alarm systems. At many locations, the central station service provider assumes an almost fiduciary responsibility to oversee the fire protection systems at the facility on behalf of the facility's management.

Historically, central station runners arrived at the protected property with keys to the facility. While this practice has faded, the concept that the central station provides the principal fire protection surveillance at a protected property is deeply rooted in the minds of many AHJs. This is particularly true among the insurance organizations that provide property insurance for high-value properties.

Section 4-2.2.3 of NFPA 72 requires that there be a way to verify that a central station fire alarm system complies with the code. The prime contractor must either get a certificate from the organization that listed the prime contractor or post a placard. This extra step, which goes beyond the requirements for the two other types of supervising station systems, helps motivate service providers to meet code requirements and helps assure the AHJ that high-value properties have an effective and reliable surveillance system in place.

NFPA 72 also references an Underwriters Laboratories, Inc. standard UL 827, which contains the requirements for constructing a central station. In contrast to these detailed requirements, proprietary supervising station systems have only a few requirements, and remote supervising station systems have virtually none. Again, the strictness of the central station requirements reflects the higher level of protection such a system affords.

NFPA 72 covers the disposition of signals in Section 4-2.6.1, a detailed operational procedure that clearly directs operators how to handle each category of signals. They must immediately retransmit fire alarm signals to the agency providing emergency response. And they must dispatch a runner to the protected property within one hour during which the prime contractor must manually reset equipment. In addition, operators must notify facility management as quickly as possible and the AHJ, where required.

When the operators receive a supervisory signal, they must contact



Photograph: ©Samson Time Recorder Company

Operators monitor alarms at a state-of-the-art central station.

the designated representatives of the facility's management. If they can't make contact or if they can't resolve the source of the signal, they must dispatch a runner to the protected property within an hour. They must also notify the AHJ when sprinkler systems or other fire suppression systems or equipment have been out of service for eight hours. When such systems return to service, the operators must let the management representatives and the AHJ know.

Operators must also notify the designated representatives of the facility's management when they receive a trouble signal that indicates a fault in the fire alarm system wiring or a power supply failure, and they must dispatch a technician to the protected property within four hours to begin repairs. If the service interruption lasts more than eight hours, the operators must notify the AHJ.

The operators must also acknowledge any test signals they receive from the protected property and report the details to the facility's management or the AHJ. When the prime contractor must manually reset equipment, the operators must dispatch a runner to the protected property within one hour.

Testing and maintaining supervising stations

Chapter 7 of NFPA 72 covers testing and maintaining fire alarm systems, including supervising station fire alarm systems. In addition to the testing and maintenance required for all other fire alarm systems, this section contains some specific requirements for supervising station systems.

For example, Section 7-1.2.1 requires that the prime contractor test and maintain central station systems. This requirement also supports Section 4-2.7, which says that anyone who can place a central station

system into test mode must have a unique personal identification code, helping to ensure the overall security of the central station system.

In addition, Chapter 7 contains requirements for testing the equipment at the supervising station. Technicians should test some equipment monthly, some quarterly, and some annually, and operators should test all circuits extending from the central station at least once every 24 hours.

Section 4-5 of the code covers the permitted transmission technologies, which encompass active multiplex, including derived local channel and private microwave radio; digital alarm communicator systems, including digital alarm radio systems; McCulloh systems; two-way radio frequency multiplex systems; one-way private radio alarm systems; and directly connected noncoded systems. Each transmission technology has distinct requirements to help ensure overall system reliability. The requirements also help ensure that the various systems present information to the supervising station operators in a user-friendly manner.

Supervising station fire alarm systems provide a valuable means of overseeing a building's fire alarm system, as well as supervising other fire protection systems at a facility. This makes supervising station fire alarm systems a key element in the implementation of a holistic approach to fire protection.

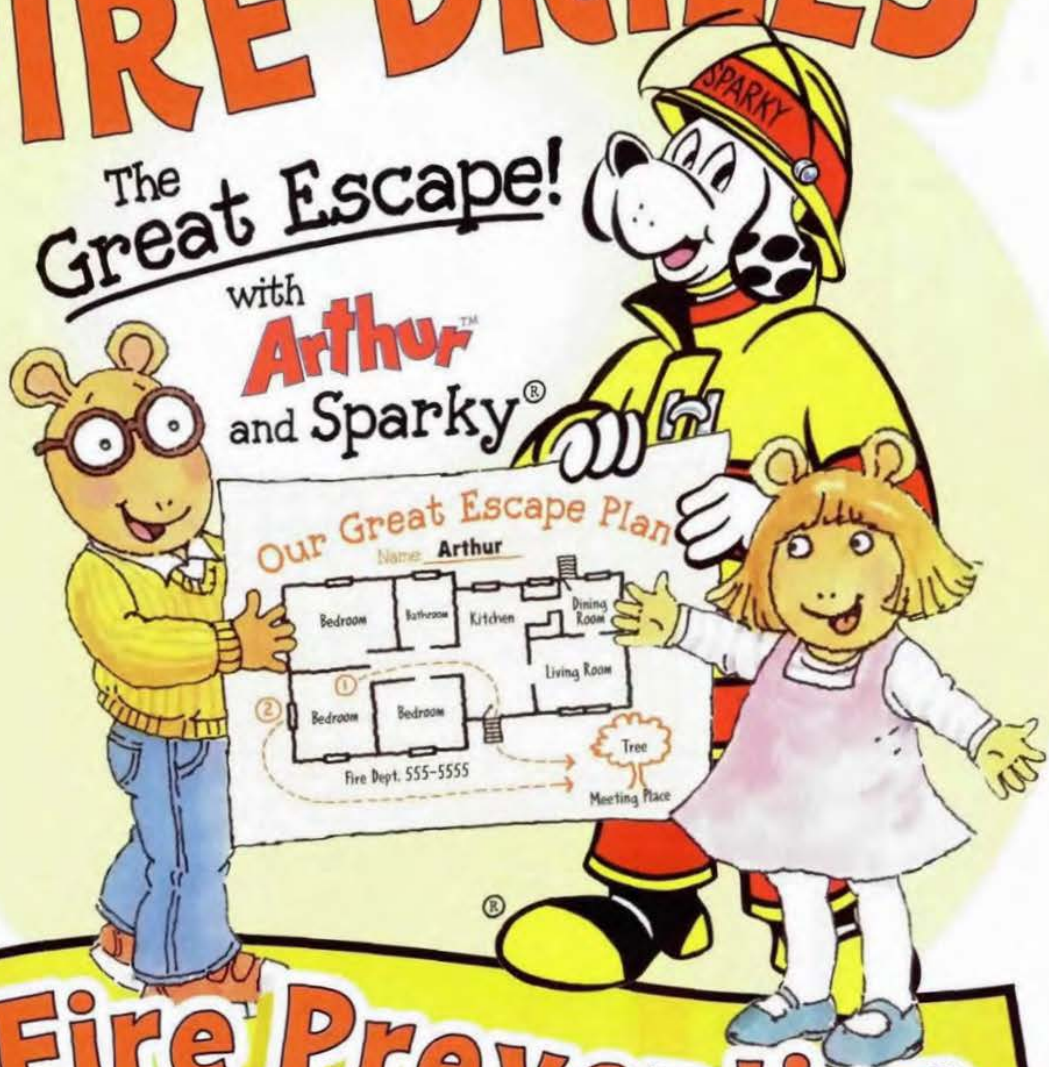
You can find additional information on this topic in Section 5, Chapter 1, of the 18th edition of the *Fire Protection Handbook* and in Chapter 4 of the 1996 edition of the *National Fire Alarm Code Handbook*. ♦

Dean K. Wilson, a licensed professional fire protection engineer, is senior engineer in the Windsor, Connecticut, office of the fire science and engineering consulting firm of Hughes Associates, Inc. He is a member emeritus of the NFPA Technical Correlating Committee on the National Fire Alarm Code.

FIRE DRILLS

The Great Escape!

with
Arthur[™]
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Fire Prevention Week

Oct. 3-9, 1999

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Partnering for Prevention

In the second year of a three-year stint, "The Great Escape" teaches us a few things about joining forces to get the job done.

Shelly Reese

Long a success story in the classroom, National Fire Prevention Week (FPW) is broadening its horizons. During the week beginning October 3, NFPA will expand FPW's reach in communities across North America by taking "The Great Escape," a three-year program launched last year that emphasizes the importance of a fire escape plan, directly into people's homes.

While elementary school children remain a primary audience for The Great Escape message, a strategic alliance with Procter & Gamble (P&G), KIDDE Safety, and the USAA Educational Foundation is enabling NFPA to augment its classroom efforts with advertising and in-store promotions. This expansion means NFPA will no longer have to rely exclusively on grade school children as a conduit for getting fire safety information into the home.

"The thing that excites us about the partnership with P&G is it's sort of like Fire Prevention Week hitting the big time," says Meri-K Appy, vice president of Public Education for NFPA. "To penetrate the consciousness of the general public, you need to connect with people on all levels, and this partnership will do that."

The partnership marks the first time that NFPA's been involved in such a well-funded program, says Julie Reynolds, NFPA's director of Public Relations, and the timing is critical. That's because The Great Escape is entering its second year.

"Although it was well received last year, the second year is always a challenge," says Reynolds. "It's crucial to have a really strong second year to reinforce the lessons of the first year and to set up for year three. A certain amount of saturation is necessary before the message really sinks in."

Casting a wider net

Topping last year's performance won't be easy. The Great Escape, which was publicized on "Good Morning America" and in a number of news-

paper, magazine, radio, and network news segments, made about 150 million impressions last year, according to Reynolds. What's more, nearly 250,000 North American families participated in the home fire escape planning, and at least 20 lives were saved as a result.

To build upon that performance, NFPA has compiled a team that, like all successful teams, brings a broad array of strengths to the program.

The USAA Educational Foundation, a nonprofit branch of the San Antonio-based insurance and financial services company, will produce and duplicate 40,000 educational videos to be distributed to fire departments across the United States and Canada. The video—the third USAA has created for an FPW program—is designed as an instructional tool for children in kindergarten through the third grade and explains the hows and whys behind developing a home escape plan.

"We believe that public and private partnerships can do a lot of good in achieving common goals," explains Lynn Riddick, project coordinator for Loss Prevention and Safety Programs at USAA. "We want to disseminate information on topics we're interested in, like fire safety. Partnering with NFPA enables us to do that."

Through a financial contribution, KIDDE Safety, which manufactures home safety products, is supporting the development of classroom tools that will help teachers educate their classes about The Great Escape. The North Carolina-based firm is also underwriting the cost of a sweepstakes. Children who submit a home escape plan will be eligible for a random drawing to win a Great Escape Getaway for four to Orlando, Florida. Two contests will be held, a general one and one for the children of firefighters.

But it's Cincinnati-based Procter & Gamble's participation in FPW that marks the biggest change from previous years. By linking with the world's largest consumer products company, NFPA has accessed unparalleled media clout. Procter & Gamble's participation in the program

Making Partnerships Work

Partnerships survive and thrive according to the laws of marriage. As with marriage, commitment, compromise, and cooperation are the order of the day.

"Our membership always says, 'We wish we had more opportunities to get involved,'" says Julie Reynolds, NFPA's director of Public Relations. "Partnerships enable them to do that at the community level."

To make such unions work, however, Reynolds and a number of others involved in Fire Prevention Week (FPW) events offer the following advice.

Mutual returns

The theme has to be right for the company with which you're working, advises Cheryl Blau, marketing program manager for Procter & Gamble's Home and Fabric Care Division. "Most companies want to be good corporate citizens, but there has to be a mutual return."

Know your strengths

For a partnership to work, both parties have to bring something to the table. In the case of the NFPA/P&G alliance, for example, the manufacturer brought money and marketing know-how, but NFPA offered a vehicle and message that would enable

P&G to garner a lot of goodwill with its customers. What's more, FPW is a proven commodity.

"We had a process to offer that was tried and true," says Meri-K Appy, NFPA's vice president for Public Education. That meant NFPA wasn't asking P&G to roll the dice on a new or experimental campaign. It could identify its audience and demonstrate its results from previous years.

Compatible missions

While a partnership must offer rewards for both parties, it's equally important they share a mission. When selecting a partner, make sure you choose someone with a genuine interest in fire safety, says Reynolds.

Compromise

"If you're working on your own, you can do things however you like," Reynolds says. "If there are others involved, you have to listen. That's good. It brings fresh ideas to the table."

Diverse resources

Too often, people consider resources purely a matter of dollars and cents. While money is certainly important, Reynolds says it's far from the only consideration. Each of the

partners in FPW brings a unique set of skills, she says. Fire departments should look for partners who can offer something unique. Working with partners who take different approaches to business "forces you to start thinking outside the box."

Start early

"If you're going to try to forge an unusual partnership, start early so you can consider all the possibilities," says Robyn Butler, fire information and education officer for the Anaheim Fire Department, which partnered with the Calgary, Alberta, department to offer The Great Escape winners a trip to the partner city.

Communication

To make a partnership work, everyone must know exactly what his or her role is. Thorough record keeping, periodic updates, and constant communication ensure that details won't fall through the cracks.

Ask

If you want help, you have to solicit it. While local retailers and restaurateurs may be happy to pitch in, they're unlikely to come to you. Don't be afraid to knock on doors.

will include a two-page newspaper supplement promoting The Great Escape in the Sunday, October 3, advertising section of about 50 million newspapers. The advertisements will also include a rebate for a KIDDE safety product.

In addition, P&G will supply its retail partners with advertisements to include in their weekly circulars and with in-store promotional materials such as banners and point-of-sale displays. P&G is also funding an October supplement to *Scholastic Magazine*, which is distributed to 135,000 kindergarten through third-grade teachers. The supplement will include the official escape planning grid and tips to help them teach The Great Escape, as well as a coupon to win additional educational materials. Finally, P&G will recognize five fire departments that have taken a creative approach to The Great Escape and ask them to share their programs with others.

"We call on a lot of food stores, drug stores, and mass merchandisers. We'll be encouraging them to team up with their local fire departments to promote FPW," says Cheryl Blau, marketing program manager for P&G's Home and Fabric Care Division. "We're even encouraging them to get involved at schools and senior centers because it's good public relations for them, and it's good for the community."

While the NFPA/P&G partnership may seem unconventional, it's grounded in synergies, members of both organizations say.

"One of the things that NFPA brings to P&G is a national grass roots program. What we can bring to FPW is the mega part of the equation," says Blau, explaining that while NFPA can take its message to individual classrooms, P&G is "able to supply the mass media, and that's something that NFPA by itself couldn't afford." In other words, says Blau, "We're able to bring the big bang, and they're able to bring the grass roots, so it's a perfect fit."

While the logic behind the link is evident, its genesis was unusual. Most partnerships occur when a program goes in search of a sponsor, but the NFPA/P&G union occurred after Blau, who's responsible for developing promotional campaigns for P&G, went in search of a program.

Blau, whose father and three brothers are firefighters, "was already sold on our mission," Appy says. To her, the idea of sponsoring FPW seemed like a natural for P&G, which manufactures household products such as Tide, Downey, Bounce, Dawn, Cascade, and Gain. Consumers who purchase those types of products are often parents concerned with protecting their families.

"This theme is something that makes a difference to our consumers," says Blau, who contacted one of NFPA's Learn Not to Burn® Champi-

ons to find out about getting involved. "It's something they can use. We have very busy consumers who love their families and want to do the right things, but sometimes they just don't have time to learn what that means. They want us to bring them the information."

Fire departments get creative

Consumers aren't the only ones for whom the message of The Great Escape is important. Firefighters pleased with the success of last year's campaign are looking forward to this year's FPW and are themselves finding creative ways to promote it.

"I think repetition is important, and by having the same theme for three years, we can build on it, and the teachers in our schools won't have to do as much preparation for Fire Prevention Week," says David Walker, public education officer for the North Greece, New York, Fire Department.

Walker has good reason to be enthusiastic about FPW. Last year, his department "hit 100 percent of our target audience" with The Great Escape message, thanks to a cooperative effort with the three other fire districts that serve the community's 100,000 residents. The departments chipped in to buy two huge Great Escape banners, which they draped over two busy thoroughfares. Those banners, which will be used for the next two years, along with visits to kindergarten through fifth-grade classrooms, raised awareness.

Still, firefighters felt the district could do more. To encourage children to participate in The Great Escape and to gain higher visibility in the community, they cooked up a contest of their own.

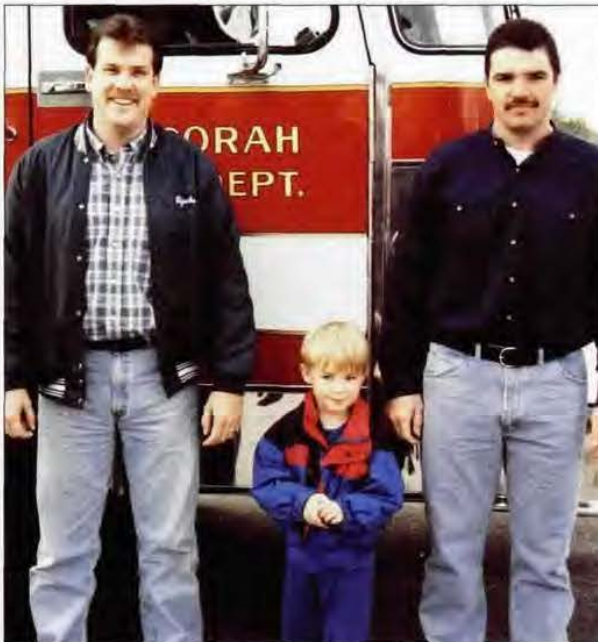
"The NFPA contest was the hook to get people to participate," Walker said, "but with only one winner for the nation, the odds weren't great. So we decided to have a local contest, as well."

As a reward for their participation, student winners from each of the area's 20 elementary schools were given a lift to school on one of the participating departments' trucks. That generated a lot of student interest, Walker said, and a lot of media attention. Best of all, it encouraged about 7,000 residents to submit home escape grids.

Partnering at the local level

Some departments, following NFPA's logic, have also forged partnerships on the local level. In Sharon, Massachusetts, firefighters combined FPW events with Family Week, an annual event in which community service organizations open their doors to the public. In addition to a fire station open house, which included pizza donated by Papa Gino's, firefighters took The Great Escape message to second-graders in 10 area schools. In Sharon alone, about 250 children in the town of 17,500 were targeted. Half returned escape grids, according to Sharon Fire Department Chief Dennis Mann. From those, a winner was chosen to ride on a fire truck during the Family Week parade.

In an even more ambitious partnership, the Anaheim, California, and Calgary, Alberta, fire departments teamed up last year to offer The Great Escape contest winners vacations in their respective cities. Departments in the two NFPA Champion cities solicited help from hotels, airlines, and local businesses to fund the trips. The Anaheim winner and her family will be flown to Calgary in July to participate in the Calgary Stampede Parade, part of a 10-day rodeo celebration. The winning family from Calgary will fly to California for a visit to Dis-



Four-year-old Jacob Miller of Decorah, Iowa, was the winner of "The Great Escape" contest at the Sunflower Day Care Center, and won a ride on a fire truck with firefighters Lee Bierke and Kurt Johnson.

neyland and an Anaheim Angels baseball game, both of which have been donated. They'll also ride on an antique fire engine in the city's Fourth of July Parade.

"Calgary approached us with the idea," explains Robyn Butler, Anaheim's public information and education officer. "I would never have drummed up anything like this. It's very exciting."

Butler hopes that publicity from the July trips will result in greater awareness and participation when FPW rolls around this fall. That's particularly important, she says, because in a city with 301,000 residents and 48 elementary schools, getting the word out through school-based programs is tough.

Although the department takes its message to the schools, it must make The Great Escape more visible in the community if the program is to have a broad impact, Butler says. Partnerships with Ralph's grocery stores and McDonald's restaurants, which distribute The Great Escape grids through their locations, are a great way to disseminate information, but extra publicity from the Calgary partnership and the July trips would be a shot in the arm.

Whether they're being forged among fire departments and local businesses or between NFPA and multinational corporations like P&G, partnerships are an effective way to spread the word about fire safety.

"None of us by ourselves could develop such a comprehensive program, but all of us together have developed the biggest fire safety program ever," Blau says. "This is a pretty comprehensive program because each one of us brings something a little special to the party." ♦

Shelly Reese is a frequent contributor to NFPA Journal.

LIFE SAFETY AT THE BALTIMORE CONVENTION CENTER

Photograph: ©Cochran, Stephenson & Deikervoet

When the Baltimore Convention Center tripled in size, designers were faced with the challenge of making the facility look like and operate as one building. This meant installing a life safety system that could be integrated with the existing structure's fire protection system.



Eileen Mongeau

Tourism is one of Baltimore, Maryland's, major industries due, in part, to the Baltimore Convention Center, host to numerous trade shows, such as auto and boat shows, as well as conventions, meetings, banquets, and other public events. Last year, the facility hosted 210 events, with more than 800,000 people coming through its doors.

The original building wasn't always able to handle this type of volume, however. Two years ago, the facility tripled in size, allowing it to compete for much more convention and meeting business, including NFPA's World Fire Safety Congress and Exposition, which will be held there May 16 to 20, 1999.

"In order to remain competitive in the convention market, we needed to expand both the size and number of conventions that could be held here," says Peggy Daidakis, executive director of the Baltimore Convention Center. So in 1993, the facility began to undergo a major expansion and renovation that nearly tripled its size, from 425,000 square feet (39,500 square meters) to 1,225,000 square feet (114,000 square meters).

The convention center remained in operation during the entire three-year project and during a subsequent seven-month renovation of the existing building. As part of the project, contractors installed a state-of-the-art life safety system in the new portion of the building and integrated it with the existing building's fire protection system, which was also upgraded. Upon its completion in April 1997, the new building won a half-dozen awards for architecture, structural engineering, and mechanical engineering.

Building design

Built in 1979, the original, 425,000-square-foot (39,500-square-meter) Baltimore Convention Center consisted of three levels, including below-grade exhibit halls.

"With the expansion, exhibit space increased dramatically, from 115,000 to 300,000 square feet (11,000 to 28,000 square meters), and meeting room space more than doubled, growing from 40,000 to more than 85,000 square feet (3,700 to 8,000 square meters)," according to Robert Parker, director of building services for the Convention Center. There's also a 36,000-square-foot (3,300-square-meter) ballroom—the largest in the state of Maryland.

"The expanded facility occupies more than two city blocks on four separate elevation levels, ranging from 12 to 105 feet (3.7 to 32 meters) above sea level," explains Parker. The new exhibit halls were built below grade to match the floor elevation of the existing exhibit halls on the lowest, or 100, level. Lobbies and offices occupy the street, or 200, level. Meeting rooms are on the second floor, or 300 level, while the ballroom is on the third floor, or 400 level. The old and new parts of the building are connected by the loading docks, as well as the exhibition and meeting room levels.

"Because of its sheer size and the large number of people that may be in the building at any one time, it was a challenge to develop the optimum life safety system for this type of assembly occupancy facil-

ity," says architect Michael Bolinger of Cochran, Stephenson and Donkervoet (CS&D) of Baltimore, the firm that designed the addition in collaboration with LMN Architects of Seattle. "Certain design elements, such as exhibit space that's 20 to 30 feet (6 to 9 meters) below grade, as well as very high ceilings, created specific fire protection challenges. The ceilings in the exhibit halls and ballroom are 28 to 30 feet (8.5 to 9.1 meters) high, while the ceilings in the atrium are as high as 50 feet (15 meters) in some areas."

There's also a road running between the old and new sections of the building, as well as 26 covered loading docks with direct-drive access to the exhibit floor.

To maximize open floor space, the new exhibition area is virtually free of columns, another unique feature of the building.

"Steel trusses, which are 28 feet (8.5 meters) high and span 180 feet (55 meters) in both north-south and east-west directions, made it possible to have only four columns in the new 185,000-square-foot (17,200-square-meter) exhibit hall," explains Bolinger. "As a fire prevention measure, all of the steel, including the trusses, are protected by spray fireproofing."

"One of the greatest challenges involved the fact that virtually all of the exhibit hall, meeting room, and ballroom space can be configured in a variety of ways," says Bill Koffel of Koffel Associates, a national fire protection engineering and code consulting firm that consulted on the project.

For example, the 300,000 square feet (28,000 square meters) of exhibit space is divided into seven sections. Using floor-to-ceiling partitions, however, the space can be reconfigured several ways, depending on the number and size of events taking place at one time.

"This variability in space configuration impacts everything from the location of fire alarm speaker/strobes to smoke evacuation systems to the location of exit doors and egress paths," Koffel adds. "In designing these systems, we had to consider every possible configuration of space."

Design of life safety system

"Because fire safety considerations were discussed at the beginning design stage, we were able to develop the ideal life safety system for this type of facility," says Bolinger.

This involved input from the mechanical and electrical engineers, fire alarm vendor, fire protection engineer, and other subcontractors working on the project, as well as convention center building and public safety personnel. Because the project received funding from both the city of Baltimore and the state of Maryland, fire officials from both the city and the state also reviewed the life safety system. The convention center is owned and operated by the city, and the expansion project was managed by the Maryland Stadium Authority.

"An addition of this magnitude would typically require a fire wall to physically separate the two parts of the building," says Bolinger. "However, convention center personnel wanted the completed facility to look like one building, particularly from the inside." They also wanted



Certain design elements, such as the 30-foot (9-meter) high ceilings in the third-floor ballroom, presented the designers with specific challenges.

it to operate as one building, both in general and, specifically, for the purpose of life safety.

Although the fire detection and alarm system is integrated and operates as one system, the building operates as two separate buildings in certain instances because of its magnitude. For example, each part of the convention center contains a separate annunciator so the fire department knows which part of the building is in alarm.

Although the original building didn't have a smoke control system, the new fire codes required one in the addition.

"In order to meet code requirements, we installed a horizontal-closing smoke exhaust door on the meeting room level to separate the old and the new portions of the building," says Bolinger.

Fire detection and alarm system

The original building had a Honeywell multiplex fire detection and alarm system.

"Numerous data-gathering FS20 panels located throughout the building monitored the fire detection and alarm system, as well as the security system and environmental controls," says Stephen Downey, senior systems engineer for Honeywell, Inc. Data sent through the panels was digitized and sent to front-end computers in the main public safety office and the engineering office.

"The computerized system identified the zone, but not the exact device, in alarm," he says.

"In the new part of the building, we installed a Honeywell intelligent, addressable fire detection and alarm system, with an upgrade to FS90 panels," says Downey.

The system has more than 1,300 identifiable pull stations, smoke,

heat, and duct detectors, and fire alarm speaker/strobes. In addition, the existing Delta 1000 computers were upgraded to two graphical PCs.

"When an alarm goes off, the control panel automatically displays an architectural drawing of the floor in alarm, indicating the exact device in alarm," he explains.

The fire detection and alarm system also features automatic elevator recall to a designated floor, unless that's where the fire is, in which case, the elevator will automatically go to another designated floor.

Meeting ADA requirements

The expansion and renovation project involved various changes to the fire detection and alarm system to bring it into compliance with the Americans with Disabilities Act (ADA) of 1990, a law that didn't exist when the original convention center was built in the late '70s.

"First, at least 25 pull stations in the existing building were relocated because they were mounted approximately 6 inches higher than the maximum allowed under the ADA," according to Jeanne Tebera, electrical engineer for Henry Adams, Inc., the mechanical/electrical engineering consultants for the project. "The pull stations were lowered to 48 inches to allow a person in a wheelchair to access them through either a side or forward reach," she says. An additional 94 pull stations were installed in the new part of the building.

The original, audio-based voice evacuation system also had to be upgraded to comply with the ADA. More than 450 fire alarm strobe lights and speakers were installed in the new part of the building.

"Determining where to put the speaker/strobes was challenging, however," says Tebera.

Because the exhibit halls can be configured in a variety of ways,



The expanded Baltimore Convention Center, at 1,225,000 square feet (114,000 square meters) is nearly triple its original size. Because of its size and the large number of people who can be inside at one time, it was a challenge for designers to develop the optimum life safety system for this type of assembly occupancy.

strobes couldn't be installed just on the perimeter of the rooms, as is usually done. In addition, exhibitors often hang banners and decorations that may block a strobe from view.

"Taking these factors into consideration, the strobes were placed so that they alternate between being on the perimeter and on the ceiling of the halls, as well as at exit locations," she explains.

The expanded part of the convention center also contains nearly 350 smoke, heat, and duct detectors.

"In addition to the typical smoke detectors, we installed linear beam smoke detectors at the balcony level of the atrium," says Tebera.

These two-part devices, which shoot a beam of light from one to the other, are typically found in hotels' atria or in buildings with very high ceilings.

"Smoke coming up the atrium space from the lower floors will interfere with the beam, causing the smoke detector to go into alarm," she explains.

Heat detectors were installed in the elevator shafts and elevator machine rooms to provide early warning of a fire.

"Connected to a circuit breaker, these detectors trigger the elevator power to shut down first so that the sprinkler system doesn't pour water onto a live electrical system," says Tebera.

Smoke control and evacuation

"The open atrium, vast corridors, and huge lobby areas presented one of the biggest challenges to designing an important part of the fire protection system—the smoke control and evacuation system," says Koffel. In fact, this was one of the first projects to use NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*.

"We determined different fire scenarios and how a fire might

spread, depending on the various configurations of the convention center space," explains Koffel. "We then calculated smoke production rates and the air quantity required to maintain a smoke layer 6 feet above the finished floor." The mechanical engineer used this information to design the smoke evacuation system.

Compared to other high-rise buildings that may have a very well-defined atrium, the convention center's atrium extends around the perimeter of three floors and covers two to three linear blocks.

"There was a mammoth area that needed to be covered by the smoke control system," says Angela Cremeans, a vice president at Henry Adams, Inc.

As in most buildings, the convention center's heating, ventilating, and air conditioning (HVAC) equipment is tied into the fire detection and alarm system. The smoke detectors trigger the HVAC system to shut down its normal operation and go into smoke control mode.

"In the atrium area alone, there are 10 to 20 zoned air-handling units that are equipped with dampers. These dampers direct the air supply low for smoke control purposes or high for air conditioning," says Cremeans. "We also installed special exhaust fans for smoke removal."

Elsewhere in the building, certain doors are equipped with magnetic hold-open devices that automatically release to permit the doors to close when the fire alarm is activated, creating a fire and smoke barrier.

Sprinkler system

The building's combined sprinkler/standpipe system consists of 18 miles (29 kilometers) of sprinkler piping and 7,000 sprinklers.

"Once we determined the hazard classification, the sprinkler system was pretty straightforward," says Cremeans. "Although the majority of the building is covered by a wet sprinkler system, there is a dry sprin-

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For the rest of the story about *Inbal* Deluge Valves, and our other products, including Dry Pipe Valves, Preaction Valves, Remote Reset Deluge Valves, Wet and Dry Alarm Valves, and Pressure Regulating Valves, among others, contact us at:



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Circle No. 047 on Reader Service Card

kler system in the loading dock area, as well as in the large outside air intake plenums. Some areas such as exhibit halls, which are larger than the 40,000-square-foot (3,700-square-meter) sprinkler system area limit, were broken into two zones.

A full-service kitchen on the top, or 400, level provides catering services to the entire convention center.

"For fire protection, this area is equipped with a kitchen hood exhaust and chemical fire suppression system that's tied into the fire detection and alarm system," says Cremeans.

"An ITT A-C Pump fire pump, located in the mechanical room on the mezzanine level, is housed in its own room, as required by the Baltimore city fire codes," adds Tebera.

Communication systems

The convention center's public safety office was expanded during the renovation project.

"This office, which houses the computer-controlled fire alarm and detection system controls, is manned 24 hours a day, 365 days a year, by full-time public safety officers," explains Parker.

Part-time public safety officers are also posted at specific stations to monitor functions in the building. Equipped with walkie-talkies, they alert the public safety office of any potential fire or safety problems.

The fire detection and alarm system has an automatic voice evacuation system that's tied into the public address (PA) system, which has 1,000 audio speakers throughout the new part of the building.

"In addition to a prerecorded message, there's a mechanism to override the PA system with a live message, providing instructions to occupants on where to go and what to do in the event of an emergency," says Parker.

"In the original building, it was only possible to do a total building evacuation," explains Downey. "With the expansion, it's possible to selectively evacuate certain sections of the facility, depending on the device in alarm and the gravity of the situation."

In the original building, the manual pull station in the convention center's public safety office was tied into the local fire department. When the building was originally expanded and renovated, an additional pull station was added to designate the new portion of the building. Since then, the municipal system has been converted. Currently, the fire detection and alarm system is monitored by both the convention center's public safety office and Honeywell's central station, which, in turn, notify the fire department, as needed. As required by code, the fire department is automatically notified if a pull station or water flow device is triggered.

Means of egress and evacuation

The convention center has four main entrances/exits, as well as numerous emergency exits. Some of the doors open directly onto the street level, while others open onto a terrace-level skywalk, where exterior stairs lead to the street level.

The exhibit halls account for 70 percent of the function space in the convention center.

"Because this space is below grade, it was necessary to design the most efficient way to get people up and out of the building as quickly and safely as possible," says Bolinger. "We had to put in a lot of stairways to handle the vertical movement of a large number of people."

In addition to 8 elevators and 23 escalators, the new part of the building has 40 stairways.

"One of the major issues involved the location and width of the egress paths—the corridors, stairwells, and exit doors leading to the outside," says Koffel, who reviewed the original architectural plans. The egress path was determined by taking the many ways the building's space can be configured into consideration.

Koffel Associates' and CS&D's extensive analysis of exit arrangements included travel distance and egress capacity. In order to establish the egress capacity for each floor, they determined, with the help of convention center personnel, how the space would actually be used for functions.

"For example, on the meeting room level, we had to assume simultaneous use of the meeting rooms themselves and the pre-function space that's used for registration," Koffel says.

"Although the convention center determines occupancy load for the various types of space, egress capacity is often higher for egress purposes," says Koffel.

Depending on the seating arrangement, for example, the maximum occupancy of the ballroom ranges from 2,500 to 4,200 people. For egress capacity, however, the figure is 5,600. The egress capacity for the exhibit halls is 12,400, and 10,000 for the meeting rooms and lobbies.

"Taking all factors into consideration, we recommended expanding the width of the corridors, stairwells, and exits," says Koffel.

Emergency power

"The Baltimore Convention Center is unique in that it's serviced by two separate feeds from the Baltimore Gas & Electric Company," says Bolinger. "Despite the slim chance that both substations will lose power at the same time, the convention center also has a back-up power supply."

A diesel generator supplies power to the mechanical equipment and to the egress lighting and the fire detection and alarm system, which includes the smoke control system.

"There's a special mechanism in place for egress lighting in the exhibit hall area," says Tebera.

Because of the 30-foot-high (9-meter-high) ceilings, the exhibit halls are equipped with high intensity discharge (HID) light fixtures that provide a maximum amount of light at this distance, but are still energy-efficient.

"In the event of a power outage, even if the emergency generator comes on immediately, it would take about five minutes for the HID lamps to come back on," says Tebera. "Therefore, many of the light fixtures are also equipped with incandescent quartz lamps that will come on right away and provide sufficient lighting so that people can get out safely."

"Life safety is of utmost importance to us since we host large conventions and trade shows that attract thousands of people," says Parker.

The expansion and renovation of the Baltimore Convention Center presented unique fire protection challenges, and it's a good example of the various types of systems that can be developed for a building of this magnitude. ♦

Eileen Mongeau, principal of Innovative Marketing Solutions, is a freelance writer living in Newton, Massachusetts. She is a frequent contributor to NFPA Journal.

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Exhibitors' Showcase

The 1999 Exposition, to be held May 16 to 18 at the NFPA World Fire Safety Congress and Exposition in Baltimore, Maryland, will feature more than 260 exhibits and demonstrations of new fire safety equipment, safety advances, and services to help you work smarter in your field. Exhibit hours are Sunday from 12 p.m. to 5 p.m., Monday from 11 a.m. to 5 p.m., and Tuesday from 9 a.m. to 3 p.m. This gives you plenty of time to talk to the industry experts.

You can also learn firsthand about new products, ideas, and services from leading suppliers at the Exhibitors' Forums scheduled for Sunday afternoon, Monday, and Tuesday. Participating exhibitors in the forums will answer your questions face to face.

Read on to find out about some of the companies and the products they'll be displaying at the exhibit. And turn to page 170 for a complete list of exhibitors and their booth numbers and a map of the exhibit hall.

This information was compiled on April 1, 1999.

Door Nuisance Eliminator

Access Denied Inc. Ultra-Dog® is an add-on, after-hours, high-security, door nuisance eliminator that adds up to 10,000 pounds of physical resistance to existing doors and hardware. Ultra-Dog ends liability issues associated with deadbolts, elephant chains, and padlocks. It was designed with the intent of immediate egress, minimum effort, and no prior knowledge. It guarantees secondary egress. Visit Booth 1216.



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Power Supply/Chargers

Altronix Corp. is the leading manufacturer of power supply/chargers and UL-listed models for ADA-compliant fire alarm, burglar, and access control applications; video camera power supplies; a wide range of programmable, seven-day, 24-hour,



and annual event timers; a variety of multipurpose and UL-listed relay modules; high output siren drivers; UL-listed transformers; and custom-designed and manufactured electronics to your specification, which are available upon request. Visit Booth 663. Circle Reader Service Card No. 100

Extinguishing Foam

3M Company's 3M™ Light Water™ ATC™ 3.3 percent AR-AFFF is simple to use, highly effective, and environmentally responsible. Designed for use at a 3 percent concentration on both water-soluble polar solvents and on water-insoluble hydrocarbons, ATC3 foam provides fast knockdown and



extinguishment of the most aggressive flammable liquids, while offering improved environmental attributes. Find out more at Booth 729.

Circle Reader Service Card No. 104

Fire Sprinkler Piping

Demanding installations are nothing new, but stronger, tougher BlazeMaster® 2000TM fire sprinkler pipe is. Fully approved and UL-listed, BlazeMaster® CPVC pipe and fittings by BF Goodrich have a 15-year track record of reliability and a 50-year life expectancy with a safety factor of 2. BlazeMaster has outstanding corrosion resistance, low flame spread, low smoke characteristics, and a Hazen-Williams "C" Factor of 150. Stop by Booth 325.

Circle Reader Service Card No. 103

Aboveground Water Storage Tanks

Amfuel manufactures aboveground water storage tanks in sizes ranging from 500 to 1 million gallons. Our tanks, which are constructed of proven elastomer fabrics supported by earthen berms, have been in the market for more than 30 years, with 200 domestic installations. Find out more at Booth 1305.

Circle Reader Service Card No. 106

Fire Extinguishers

Amerex offers a complete range of hand-portable and wheeled fire extinguishers, including "clean agent" water mist and Halotron I. Restaurant and vehicle fire suppression systems along with methane gas detection round out the product line. Getz Manufacturing "service technician's dream" equipment will also be featured. Stop by Booth 238.

Circle Reader Service Card No. 102

Add-on Power Sources

AlarmSaf offers add-on power sources for notification appliance circuits, boosting the power on a Style Y or Z fire warning loop and retaining the fire panel's standard ability to report trouble conditions. Models are available at 1.5 to 6 amperes with one, two, or four zones and are capable of either zone extension or zone expansion. Available models with a regulated listing allow for complete compatibility for retrofit applications. Visit Booth 586.



Circle Reader Service Card No. 105

Portable Fire Extinguishers

Buckeye Fire Equipment Company manufactures all types of dry-chemical, Halotron I, wet-chemical, and carbon dioxide portable fire extinguishers; dry-chemical, carbon dioxide, and foam wheeled fire extinguishers; and standard and alcohol-resis-

Gamewell. The solid red line that keeps you in the black.

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Gamewell's 600 Series' SmartStart™ self-programming feature gives you the power to program, update and reprogram the most complex applications in less than a minute, eliminating human errors and costly downtime. And with SmartNet™, you can network up to 250 control panels.

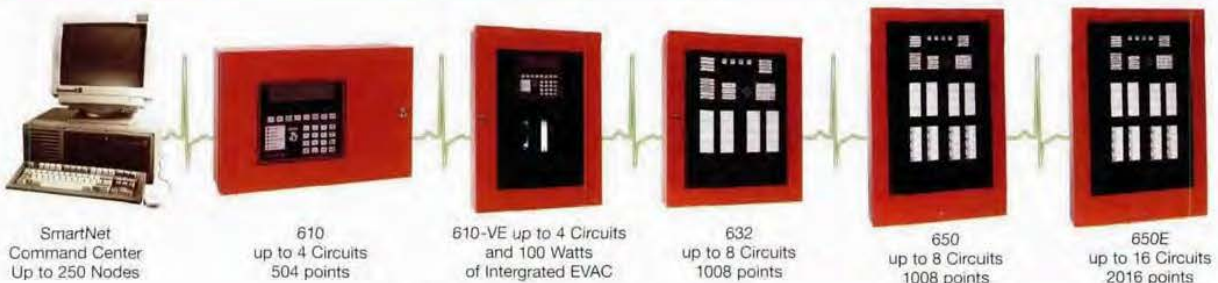
The entire 600 Series easily handles both analog addressable sensors and conventional detectors, for retrofitting

all types of systems. All in less than a minute – and all proven by five years of customer satisfaction in the field.

SmartNet™ is just the latest in more than 140 years of Gamewell innovations. So think Smart. See us at NFPA '99, Booth 619, or call Gamewell at 1-888-FIREBOX to locate the Authorized Gamewell Distributor in your area.



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tant AFFF foams, including freeze protected varieties of both types of foams. Products are ISO 900-certified. Visit Booth 572. Circle Reader Service Card No. 115

Fire and Life Safety

ADT is your one source for fire protection. Our team of fire specialists can help you with fire alarm, voice evacuation, ADA compliant systems, and the integration of security or facility controls. ADT provides inspection, testing, maintenance services, and central station monitoring. ADT remains committed to strategic partnerships and measuring our success based on customer satisfaction. Visit Booth 517.



Circle Reader Service Card No. 107

Audible, Visual Signaling Devices



AMSECO (American Security Equipment Co.) is a world leader in audible and visual signaling devices for the fire alarm industry.

try. The company features a new series of patent-pending Select-A-Strobe with selectable candela output, new low-profile 25V and 70.7Vrms speakers with multiple wattage taps, the lowest current draw motor bells, and motor horns. Learn more at Booth 243. Circle Reader Service Card No. 108

Firefighting Foams



Visit Ansul Incorporated at Booth 607 to preview our quality line of firefighting foam agents and systems used worldwide for protecting flammable liquid hazards. Additional featured products include INERGEN® clean agent systems, CO₂ systems, PIRANHATM restaurant systems, A-101/CHECKFIRE® systems, plus CLEAN-GUARDTM, K-GUARDTM, RED LINE®, and SENTRY® fire extinguishers.

Circle Reader Service Card No. 110

Automatic Control Valves



Bermad, a world leading manufacturer of automatic control valves, offers a complete line of UL-listed and FM-approved pilot-operated, pressure-reducing, pressure relief, pump suction, and deluge control valves. Products

are designed for the fire protection industry. Bermad offers valves in sizes 2 to 110 inches with up to 300 PSI inlet pressures. Stop by Booth 474.

Circle Reader Service Card No. 111

Fire Protection Pumps

Aurora Pump will be exhibiting a complete line of fire protection pumps, including Splitcase, In-Line, and Vertical Turbine. The company will also feature a "Red Hot" quick ship program and new stackable Jockey Pumps. Visit Booth 149.



Circle Reader Service Card No. 112

Residential Sprinklers, Nozzles

"Automatic" Sprinkler will be proudly showing our new Model HR-2 low-flow residential sprinklers, featuring the industry's first residential sidewall capable of room coverage up to 20 by 20 feet. These products complement a full range of sprinklers, valves, devices, and accessories.

Powhatan will be displaying the new large-diameter Storz Fire Department Connection, a new class of industrial nozzles, and a new 4-inch single check valve. These products are only part of the full range of interior products. Visit Booth 329.

Circle Reader Service Card No. 109

Horizontal Doors

Founded in 1926, Bilco is a building industry pioneer in the development of horizontal doors. The company offers a host of residential and commercial access products, including basement doors, window wells, sidewalk

doors, roof hatches, and fire vents. With headquarters in Connecticut, Bilco has manufacturing facilities in New Haven, Connecticut, and Trumann, Arkansas, as well as a national network of dealers, distributors, and factory trained representatives. Learn more at Booth 460.



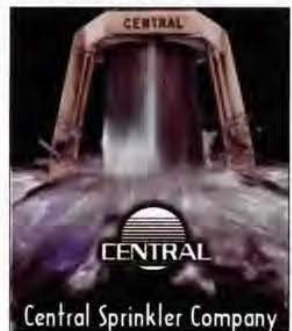
Circle Reader Service Card No. 113

Software Management System

Compliance Software's Compliance-25 is an affordable software management system written especially for the fire protection professional in the implementation of rigid inspection standards. This program is designed to let you establish a unique database to simplify the archiving of records, while scheduling and managing future requirements. Compliance-25 will now synchronize and store results with other computers or field units. Visit Booth 189.

Circle Reader Service Card No. 114

Storage Sprinklers



Central Sprinkler Co. will display several of its product lines at Booth 169 this year. Highlighted features will include the K25 and



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K17 family of storage sprinklers and new CPVC plastic piping concepts, as well as the new hanger assemblies developed specifically for CPVC. Central will also demonstrate the new generation of software products developed for fire protection. Circle Reader Service Card No. 117

Backflow Preventers

Master Series Backflow Preventers, available from FEBCO, a product of CMB Industries, Inc., provide up to 80 percent shorter lay lengths with the shortest dimensions in the industry. Reduce your total installed cost by up to 40 percent and achieve the lowest overall head loss around. In-line, vertical, and N-shape models allow maximum flexibility for fitting into any application. Visit Booth 424. Circle Reader Service Card No. 119

Steel Liquid Storage Tanks

Columbian Steel Tank Company has been manufacturing bolted steel liquid storage tanks for more than a century. Columbian provides superior quality in both product and service. Columbian tanks can be designed to meet AWWA D103-87, NFPA 22, and Factory Mutual standards for water storage. Find out more at Booth 1140. Circle Reader Service Card No. 116

Fire Pump Controllers

Cutler-Hammer has the most complete offering of fire pump controllers on the market. Saturated with standard features, it leaves little to the ordering process. Stop by Booth 173 and view our Multi-Pack FPC. In addition, Cutler-Hammer launches the Arc-Fault Circuit Interrupter, new technology that reduces the risk of electrical fires in dwellings. Circle Reader Service Card No. 125

Alarm Receiving System

The Keltron DMP703 fire/security alarm receiving system multiplexes supervised contacts and FACP point addressable serial outputs while receiving DACTs, direct connects, coders, radio, and derived channel and generating a multiplicity of outputs. Its touchscreen full-color display and printer mean easy operator interfacing. All message displays, printouts, and outputs are field-programmable. Stop by Booth 452. Circle Reader Service Card No. 118

Foam Agents and Foam Systems Equipment

Chemguard is a leading manufacturer of UL-listed and FM-approved foam agents and foam systems equipment. Please come by and visit Booth 267 to find out about the latest earth friendly foams and new equipment.



Circle Reader Service Card No. 121

Fire Alarm and Life Safety Signals

Commercial Products Group (CPG) offers a complete line of fire alarm and life safety signals for use in commercial and industrial applications. CPG will be exhibiting its full line of audible and visual signals, including UL1971 listed strobe products. CPG will also show its complete line of heavy-duty, hazardous area, and explosion-proof signals for life safety applications at Booth 129. Circle Reader Service Card No. 122

Special Hazard Fire Suppression Technology

Chemetron Fire Systems is your single source solution for special hazard fire suppression technology with worldwide distribution, expert engineering and technical support, commissioning, inspections, and repair services. Chemetron offers a broad selection of hardware and agents, including high- and low-pressure CO₂, FM-200®, water mist, and controls. Stop by Booth 523.



Circle Reader Service Card No. 127

Fire Suppression Systems

Fike Protection Systems manufactures a complete line of fire detection, suppression, and monitoring systems. Come to Booth 639 to learn about FM-200®, Carbon Dioxide, and Micromist® fire suppression systems. These broad application suppression systems, together with Fike's Cheetah®, SHP™, and Rhino™ fire detection and control systems, provide the user with the most advanced technology available to the fire protection industry. Circle Reader Service Card No. 128

Fire and Security Reporting Systems

King-Fisher is a leading manufacturer of radio fire and security reporting systems serving the Federal, DoD, and municipal government and industry. King-Fisher systems protect life and property at various facilities and organizations, including branches of the military and municipalities, worldwide. See Booth 627. Circle Reader Service Card No. 124

Clean Agent Fire Extinguishants

DuPont clean agent fire extinguishants are the agents of choice for replacing Halon. DuPont FE-36™ replaces Halon 1211 as a streaming agent in portable extinguishers and other fire protection applications such as total flooding systems. DuPont FE-13™ is a clean, environmentally acceptable replacement for Halon 1301 and can be used in areas that are normally occupied. For more information, stop by Booth 633. Circle Reader Service Card No. 120

Proprietary Alarm Monitoring

The Digitize SYSTEM 3500, a new direction in integrated proprietary alarm monitoring, incorporates an enlarged information-rich display, powerful hardware, and versatile software. SYSTEM 3500 can be used to mix and match a variety of alarm input and output devices. It monitors and controls campus-wide addressable and conventional alarm panels. Visit Digitize at Booth 560.



Circle Reader Service Card No. 123

Fire Alarm Products

Detection Systems, Inc. (DS) is a manufacturer of fire alarm detection devices and fire alarm control panels. DS provides a complete line of smoke detector accessories, smoke beam detectors, and installation tools to install smoke detectors. DS distributes products worldwide. Stop by Booth 739. Circle Reader Service Card No. 126

A photograph of the Space Shuttle Columbia during launch, ascending vertically against a clear blue sky. The shuttle is white with orange solid rocket boosters and a white external tank. A large plume of white smoke and fire is visible at the base of the shuttle.

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Fire Alarm System Products

Faraday announces two new analog/addressable fire alarm system products, the MPC-1000 (one loop, 198 pts.) and the MPC-1500 (two loops, 396 pts. expandable to four loops, 792 pts.). Stop by Booth 647 for more information about Faraday, our new systems, and our complete line of notification appliances. Circle Reader Service Card No. 133

Fire Alarm Systems



Edwards Systems Technology (EST) is proud to offer the industry's most advanced multiplex communications networks

to help create a safer world. EST fire alarm systems have become the choice of industry professionals around the globe. From the smallest component to the entire EST3 Multiple Life Safety System, EST's commitment to ISO 9000 International quality standards is unwavering. Visit us at Booth 821. Circle Reader Service Card No. 129

Fireproof Blankets

FireBlankets, Inc. is a manufacturing company offering a variety of fireproof blankets for suppressing kitchen grease fires, fire rescue blankets, and welding safety blankets. For more information, come by Booth 193. Circle Reader Service Card No. 130

Testing Laboratory

Factory Mutual Research Corporation is an internationally recognized and accredited laboratory that tests and approves



products, materials, and services that are useful in limiting or preventing damages to property and public safety. For more than 160 years, Factory Mutual has partnered with business and industry to reduce property losses. Learn more at Booth 375. Circle Reader Service Card No. 132

Fire Detection, Suppression Equipment

Fire Combat, Inc. offers a complete line of fire detection and fire suppression equipment. A new Halon alternative—Aero-

KTM pyrotechnic aerosol generator—will be on display, as well as UV/IR flame detectors that respond to fire events in milliseconds. See Booth 1402. Circle Reader Service Card No. 131

Electro-Optical Fire Detectors

Fire Sentry Corporation designs and manufactures the world's most technologically advanced electro-optical fire detectors. Using digital solid-state electronics and real-time signal processing developed from military missile warning systems, Fire Sentry products are able to store fire event data in non-volatile memory for post-fire analysis. Products are available for all applications, including oil, gas and petrochemical, semiconductor, finishing, automotive, munitions, and aviation. Visit Booth 659. Circle Reader Service Card No. 136

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Fire Alarm Control Panels

Visit Fire-Lite Alarms, Inc. at Booth 907 to be introduced to the industry's most complete line of low- to mid-sized fire alarm control panels. Panels range from the economical, two-zone Mini-Panel™ Series to the sophisticated MicroScan™-9200, 198-point addressable control. A family of fire alarm control/communicators, an emergency voice evacuation control, slave and stand-alone DACTs, a remote power supply, and a host of alarm initiating devices and notification appliances will be displayed. See Booth 907.



Circle Reader Service Card No. 134

Fire Alarm Control Panels

Fire Control Instruments, Inc. (FCI) develops and markets conventional, analog, and addressable fire alarm control panels and strategically aligned peripheral devices that are unmatched in the industry. Since 1976, FCI has engineered forward-thinking products that have become market standards, and backed every one of these products with world-class support. FCI is a subsidiary of Pittway Corporation and invites you to join us at Booth 225 for more information.

Circle Reader Service Card No. 135

Fire Alarm and Life Safety System

Firecom, Inc. is the manufacturer of LSN-2000, an analog addressable fire alarm and life safety system. For more information, visit us at Booth 569.

Circle Reader Service Card No. 137

Fire Pump Controllers

See the Firetrol D3ATA System Mark II that monitors, displays, and records fire pump system status at Booth 1033. This next generation product offers many enhancements and user benefits. FireCat, the interactive CD-ROM fire pump controller catalog and specification tool, will be demonstrated throughout the show. Also on display, Firetrol's FTA1100-D diesel engine fire pump controller with digital display and printer/recorder.

Circle Reader Service Card No. 139

Spark Detection, Extinguishing System

The FLAMEX spark detection and extinguishing system prevents dust collector fires and explosions. FLAMEX infrared spark detectors rapidly identify sparks and burning embers in pneumatic ductwork, and trigger an automatic extinguishing device to suppress the sparks before they can enter baghouses or dust bins where explosions are likely to occur. Visit Booth 588 for more information.



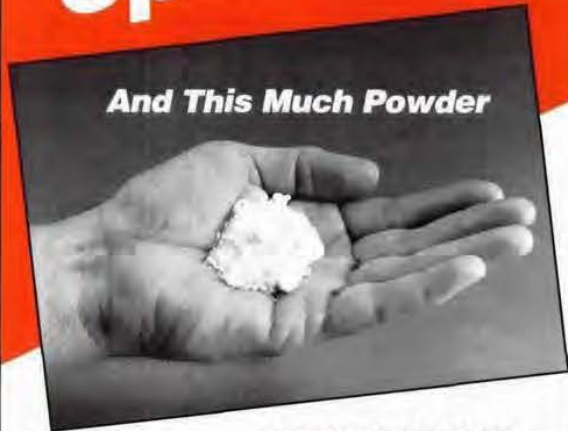
Circle Reader Service Card No. 138

Flexible Fire Sprinkler System

For more than 12 years, Flex-Head Industries has manufactured and distributed its patented FM-approved flexible fire sprinkler system for the protection of industrial exhaust ducts. Also available are numerous FM-approved products for cleanroom ceiling grid installa-

One Spark

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tions. Revolutionary new FM-approved products will be debuted at this prestigious event. Please visit Booth 163.



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Industrial Fire Extinguishers

General Fire Extinguisher Corporation has been a manufacturer of industrial fire extinguishers since 1903. Product selection includes stored pressure, carbon dioxide, outside cartridge, and Halon extinguishers. Units are available in various sizes and chemicals, and carry a UL- or ULC-listing.

General Fire Extinguisher ratings are second to none. If it's worth protecting, it's worth a General. See Booth 255.

Circle Reader Service Card No. 141

Smoke Detector Analyzer

Since 1982, the Gemini 501 smoke detector analyzer has been the standard in universal, UL-listed field testing of smoke detector sensitivity. Battery-operated and fully portable, the Gemini 501 A/B tests all detectors in compliance with NFPA 72. Complete support and service is provided from the Gemini Scientific factory in Sunnyvale, California. Visit Booth 288.

Circle Reader Service Card No. 143

Fire Alarm Control Panel

Gamewell introduces the Identiflex 610, a fourth-generation fire alarm control panel that provides the monitoring and control of analog sensors and addressable

input and output devices and is ideal for small or large projects that require state-of-the-art life safety systems. The analog addressable module has a dedicated microprocessor that monitors each of its circuits while communicating all status information to the main control panel. Visit the Gamewell Company at Booth 619.



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Fire Pump Evaluation

FPE Software's Fire Pump Evaluation Program is designed for recording pump tests and developing performance histo-

ries for fire pumps. The Sprinkler Program is a user-friendly sprinkler hydraulics program. The program's capabilities include supply/demand calculations, 600 pipe/node capacity, data error checking, user-modifiable pipe diameters and fitting equivalent lengths, supply/demand graph output, and more. Visit Booth 290.

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Steel Pipe Covering System

The soffi-steel system by Grice Engineering is today's premier modular steel pipe covering system, designed to provide a durable maintenance-free facing that's attractive and easily installed. The soffi-steel system accommodates all types of sprinkler devices, including institutional, recessed, and concealed. Also, it can function as a shield for cable, wiring, or

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hydraulic systems. Find out more at Booth 264.

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Annunciators, Smoke Control Panels

The H.R. Kirkland Company is a manufacturer of annunciators (graphic, directory, exterior, and backlit), smoke control panels, custom control panels, and graphic maps. All interior Kirkland graphic displays are produced in full color for the same cost as black and white. The H.R. Kirkland Company has been committed to providing outstanding product quality and service since 1930. Come by Booth 565.

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Gas Detection Instruments

Gas Tech, Inc. develops, manufactures, markets, and services portable and fixed system gas



detection instruments, transmitters, and sensors. These instruments check and/or monitor the presence of combustible gases, toxic gases, and oxygen deficiency. The company's product lines are directed primarily toward worker safety, industrial hygiene, and environmental monitoring applications. Stop by Booth 1113.

Circle Reader Service Card No. 145

Fire Protection Products

Gentex Corporation offers a complete line of high-quality fire protection products, including photoelectric smoke detectors, visual and audible signals, speakers, and portable smoke detector/visual units. Our engineering department designs each product to meet or exceed all code and standards requirements, including the American with Disabilities Act (ADA) and strict state and local codes, as well as the performance and installation requirements of NFPA, UBC, and Underwriters Laboratories. See Booth 1017.



Circle Reader Service Card No. 147

Spark Detection and Extinguishment

GreCon spark detection and extinguishment systems prevent fires and explosions in dust collection/pneumatic conveying systems by detecting and extinguishing sparks instantaneously—without interrupting production or adversely affecting the filter media. GreCon also offers new line and I/O cards for improved customization of system parameters to meet individual application needs. Products are FM-approved and Y2K compliant. See Booth 573.

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Fire Protection Systems

No other company provides the full range of fire products and services that are available through Grinnell Fire Protection Systems. We offer one-stop shopping for sprinkler, suppress-

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sion, extinguisher, and fire alarm requirements. We're there every step of the way, providing design, engineering, installation, maintenance, inspection, 24-hour monitoring, and service. Stop by Booth 507 for more information.



Circle Reader Service Card No. 150

Fire Protection Products

Grinnell Supply Sales will feature its entire line of fire protection products. This will include a complete line of GEM sprinkler heads and Aquamist® nozzles. An entire line of deluge

valves, including the Red-E Cabinet® and Gruvlok® grooved-end couplings, and fittings, including Sock-it fittings and Allied Sprinkler Pipe, will be on display. The New CD with tech data and CAD drawings will be featured and demonstrated every 30 minutes at Booth 707.

Circle Reader Service Card No. 151

Lightning Protection Products

This Heary Bros. Lightning Protection Company will be displaying its complete line of lightning protection and grounding products. Featured will be the company's LPA2005 lightning preventor system—the first in the company's extended range protection systems. Also displayed will be a complete line of transient voltage surge suppression equipment. See Booth 371.

Circle Reader Service Card No. 153

Smoke Detectors

Hochiki America Corporation, an ISO 9002-certified company, has been located in Southern California for more than 26 years. Hochiki America manufactures a wide variety of reliable smoke detectors, including the new NS Series direct wire SLR-835B baseless photoelectric smoke detector. Hochiki America is responsible for the sale and distribution of all Hochiki products in North and South America. Visit us at Booth 549.



Circle Reader Service Card No. 152

Fire Alarm Products

Harrington Signal, Inc. offers a complete line of U.S. manufactured, ISO-9001 quality fire alarm products, including control panels from single-zone conventional to multi-loop addressable, as well as combination and networked systems, explosion-proof initiating devices, and signals. Harrington Signal manufactures a complete line of systems and accessories. Visit Booth 901. Circle Reader Service Card No. 156

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fire-resistant closers ever tested under actual fire conditions. Find out more at Booth 543.

Circle Reader Service Card No. 157

Detector Testing

Home Safeguard Industries continues to lead the way in the development and production of reliable, convenient, and economical ways of testing smoke detectors, heat detectors, and carbon monoxide detectors. A recent product, Dustair, permits smoke detectors to be cleaned on site. Learn more at Booth 253.



Circle Reader Service Card No. 154

Fire Protection Software

HRS Systems, Inc. presents the HASS family of fire protection software with WINDOWS and DOS versions of HASS® for sprinkler system analysis, COOSA® for CO₂ system analysis, and COST ESTIMATORS for each. Don't miss HASS HOUSE® for residential sprinkler system analysis. See WINDOWS or DOS units in English and metric, and also in Spanish at Booth 353.



Circle Reader Service Card No. 159

Clean Replacement Agent

Halotron™ I is a clean replacement agent for Halon 1211 that's available worldwide for fire extinguishers, aircraft rescue and

firefighting vehicles, and limited flooding applications. It's approved for UL- and ULC-listed extinguishers (Amerex, Badger, Buckeye); EPA SNAP list for commercial/industrial, maritime, and military use; U.S. Coast Guard; and airport firefighting (FAA). Visit our web site at <http://www.halotron-inc.com> or stop by Booth 485.

Circle Reader Service Card No. 158

Third-Party Certification

Intertek Testing Services is an international leader in third-party product safety certification and performance verification. Products evaluated to support NFPA include electrical, electronic, wire, cable, telecom, building products, lighting, firefighter equipment, and clothing. Intertek has laboratories and offices on three continents, including more than 20 in the United States, Canada, and

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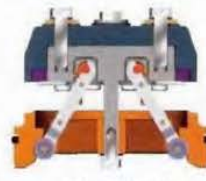
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No More Clapper Trappers.

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Principle Assembly



MODEL 475V
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MODEL 350DA
In-Line Double Check
Detector Assembly



MODEL 375
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Fire Protection Systems

ITT A-C Pump fire protection systems are UL- and ULC-listed, FM-approved, and meet the requirements of NFPA 20. System capacities range from 35 to 5,000 gpm with pressure to 600 psi. Factory-tested systems and house units use a full range of end suction centrifugal, horizontal split-case, vertical turbine, and in-line pumps. Find out more at Booth 333.

Circle Reader Service Card No. 162

Key Boxes, Switches

Knox Company manufactures high-security key boxes, vaults, cabinets, key switches, and padlocks. Fire departments have been depending on Knox-Boxes for safe and secure emergency access since 1975. New products include Knox FDC Caps for protecting standpipes from vandalism and the Knox-Scan Infrared Heat Sensor for detecting hidden hot spots. Stop by Booth 456 for more information.



Circle Reader Service Card No. 165

Fire Pump Controllers

Joslyn Clark Controls offers electric motor and diesel engine fire pump controllers. To find our more information, stop by Booth 467.

Circle Reader Service Card No. 164

Flame Detectors

Meggitt Avionics' Omniguard® flame detectors are known to be superior in both fire detection and false alarm rejection. Now they're also available with a patented infrared sensing capability that allows detection of hydrogen and silane fires. Featured at Booth 449 will be the Fire Chief™ Model 860 UV-IR detector with patented Fire Event Analysis.

Circle Reader Service Card No. 163

Fire Alarm Products

National Time and Signal Corporation is an 80-year-old manufacturer of fire detection

and alarm systems, master clock systems, and tower clocks. Our fire alarm products include a wide array of technology to equip virtually any need, including analog, addressable; voice evacuation; networks; and graphic command centers. Visit Booth 1135.

Circle Reader Service Card No. 167

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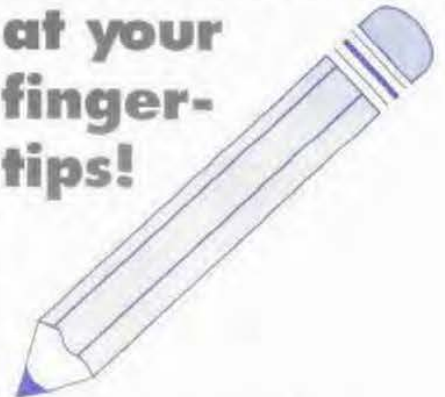
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Circle Reader Service Card No. 169

Fire Pump Controllers

Master Control Systems, Inc. is the complete fire pump controller company, offering NFPA 20, UL-listed, and FM-approved fire pump controllers with 200- to 600-volt electric controllers from 5 to 400 horsepower and 2,300- to 7,200-volt electric controllers from 20 to 1900

horsepower and diesel controllers

and accessories. Exclusive features like our EC series controller and our paperless recorder technology are provided with a 5-year limited warranty. Stop by Booth 941.



Circle Reader Service Card No. 168

NESF Booth

The National Electrical Safety Foundation will offer electrical safety information and publications for the home, school, workplace, and community at Booth 162.

Circle Reader Service Card No. 171

Testing Laboratory



MET Laboratories is an accredited testing and certification laboratory affording manufacturers of electrical devices testing and certification for the global market at one location. MET is an NRTL for U.S. product certification and is accredited by the SCC for Canada. Our field inspection and labeling service is conveniently performed by MET's engineering offices throughout the United States.

MET has an agreement with DNV for the ATEX Directive. Visit Booth 1138.

Circle Reader Service Card No. 170

Foam Systems

National Foam is a world leader in development of environmentally responsible Class A and B foam concentrates, proportioners, aspirating and non-aspirating nozzles, engineered foam systems, apparatus, and training for the fire service. We invite you to come and talk with us about new environmentally responsible methods for testing foam systems at Booth 527.



Circle Reader Service Card No. 172

For fire data and statistics,

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The NFPA's Fire Analysis and Research Division's One-Stop Data Shop is a leading source for fire statistics. We can provide you with the best, most current fire experience information. Our staff can answer your questions on topics such as causes of fires, fire protection systems, firefighter deaths and injuries and more.

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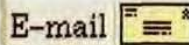
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Automatic Control Valves

OCV Control Valves designs, manufactures, and markets diaphragm actuated automatic control valves. Fire pump relief, pressure reducing, foam pressure control, deluge, and level control valves are some of the many types available. Sizes range from 1 1/4 to 24 inches, in a wide range of materials. Visit us at Booth 145 to learn more about our products.

Circle Reader Service Card No. 175

Fire Pump Controllers

Metron/Eledyne has been the world's foremost manufacturer of fire pump and industrial controllers since the mid-1960s. We're committed to the global market—we occupy ISO 9001 certified engineering and manufacturing facilities in Denver, Colorado, and Grantham, England. Our sales and service organizations are strategically



located around the world. We provide UL- and FM-listed NFPA 20 and LPC fire pump controllers and custom electric products. See us at Booth 249. Circle Reader Service Card No. 173

Fire and Security Management

The future of integrated facilities fire and security management has now advanced to a new level. Notifier® Integrated Systems was first to revolutionize the fire industry by introducing the power of UniFireNet™ graphics and networking software at last year's NFPA show. Notifier now

introduces its latest version, UniFireNet™ Applications Suite at Booth 915.

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Cabling Products

AFC Cable Systems, Inc. manufactures armored and metal clad cables, optical fiber cable, flexible metal conduit, fittings, and specialty cables. For more information, stop by Booth 356.

Circle Reader Service Card No. 178

systems and support devices, including two-zone conventional systems to large campus-style peer-to-peer network intelligent fire alarm systems. Visit Booth 803.



Circle Reader Service Card No. 176

Commercial Fire Alarm Systems

NOTIFIER Fire Systems, a Pittway Company, is the largest manufacturer of commercial fire alarm systems in the world. With more than 1,000 employees and ISO 9001 certification, Notifier provides state-of-the-art, quality fire alarm control panels and peripheral devices for commercial facilities of any size. Notifier manufactures a complete line of

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Now in its seventh decade of providing the finest in interior fire protection, Potter-Roemer manufactures a complete assortment of UL-rated cabinetry, hose and related accessories, extinguishers, valves, connections, and monitors, as well as exterior equipment and hydrant houses and test equipment. Visit Booth 576.

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Fire Alarm Control Panels

The Protectowire Company will introduce the new HD2600 Series fire alarm control panels at Booth 461. The HD2600 Series is designed for industrial applications and offers many unique features, such as automatic zone scanning, digital alarm point annunciation, NEMA-rated enclosures, and intelligent touch sensitive graphic display.

Circle Reader Service Card No. 182

Air Sampling Products



SAFE Fire Detection is proud to feature the IFD Cirrus, Stratos Laser, and the new Stratos Laser

Quadra, which uses four micro-lasers, giving immediate notification of the zone in which the fire has been detected. By adding the Quadra, we now have the broadest air sampling product line in the industry. For more information, see Booth 653.

Circle Reader Service Card No. 180

Duct Wrap, Blankets

Premier Refractories International, through distributors worldwide, supplies high-quality, cost-effective PYROSCAT™ duct wrap, blankets, bulk, boards, and coatings, setting the standard for passive fire protection, fire barriers, and alternate enclosure systems. PYROSCAT™FP products and systems are UL- and ULC-classified and listed with SBCCI-ES and BOCA-ES for grease duct and air (ventilation) ductwork. Visit Booth 1221.

Circle Reader Service Card No. 181

Electronic Fire Detection Systems

Radionics, a division of Detection Systems, Inc., is a manufacturer of advanced electronic fire detection systems. Our company provides conventional, addressable, and analog fire control panels with a full line of system components, software, smoke detection products, and accessories. We have an international distributor network that provides products worldwide. Stop by Booth 739 for more information.

Circle Reader Service Card No. 183

Stationary Fire Pumps

Patterson Pump Company is the world's number one supplier of stationary fire pumps. Products include verticle-in-line, verticle turbine end suction, horizontal split case, and prepackaged systems. Offices in Singapore, Athens, and Greece and manu-

facturing in Ireland serves Patterson worldwide. Stop by Booth 1127.



Circle Reader Service Card No. 177

Chemical Specialty Products

The Rectorseal Corporation is a manufacturer of chemical specialty products. Established in 1937, the company has an outstanding reputation for quality and service. The Rectorseal corporation manufactures a broad range of fire stopping products. The Metacaulk fire stop products are specified and sold worldwide. Stop by Booth 472.

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Cable and Pipe Sealing System

The ROX System by RoxCorp is a mechanical cable and pipe sealing system that provides an extensive range of design applications within many industries. The system is designed to secure and protect cable and pipe penetrations from fire, smoke, gas, water, and EMC interference. The ROX System has approvals worldwide to include IP66/67 and NEMA 1-13P. Visit Booth 1208.

Circle Reader Service Card No. 184

Pull Station Covers

Safety Technology International, Inc., (STI) manufactures products that help stop vandalism, false fire alarms, theft of fire extinguishers and other equipment, and misuse of emergency doors. Best known is its unique and patented Stopper® II cover that's helped stop false fire alarms in schools, hospitals, and

other public buildings around the world for more than a decade. STI offers protective covers for fire pull stations, strobe/horn signals, smoke detectors, clocks, bells, keypads, etc. Many products are UL-listed, ULC-, CUL-, and FM-approved. Stop by Booth 933.



Circle Reader Service Card No. 187

Fire Protection Systems

Securiplex is a world leader in the development, manufacturing, and integration of total fire protection systems designed to meet the needs of various industries, such as marine, oil and gas, power utilities, and semiconductor. Our products range from

detection systems to suppression systems, including CO₂, deluge, foam, clean agents, and the Fire-Scope® 2000, fine water spray system. Visit Booth 849.

Circle Reader Service Card No. 188

Hazardous Materials Storage

Safety Storage's 2x2 Series™ of prefabricated, relocatable buildings are for the storage, handling, and dispensing of chemicals and hazardous materials. They're selectable in 2-foot increments to meet exacting requirements.

Buildings are available in 6-, 8-, 10-, 12-, and 14-foot widths with lengths in 2-foot increments up to 52 feet. See Booth 488.

Circle Reader Service Card No. 186

Gas Detection Systems

Sierra Monitor is a leader with hazardous gas detection systems for monitoring combustible gas, oxygen deficiency, and toxic gases; flame detectors for both industrial and semiconductor wet bench applications; and Communications Bridge, linking together various devices and systems, even if they use different protocols. The Bridge also links your devices to Ethernet. Find out more at Booth 1232.



Circle Reader Service Card No. 189

Voice Evacuation Systems

Signal Communications Corporation is the industry's leading supplier of pre-engineered, custom voice evacuation systems and fire alarm peripherals sold to the OEM and distributor markets. SigCom is the leading supplier of private labeled, ADA-

compliant die-cast metal pull stations for the OEM market. In addition, SigCom offers a wide range of special application stations, in various colors, as well as their SG-32X explosion-proof station with UL and FM approvals and a NEMA 4X rating. Stop by Booth 220.

Circle Reader Service Card No. 190

Fire Alarm and Access Control Systems

Simplex Time Recorder Co. is a multinational company that provides fire detection, security, building communications, and workforce information systems and solutions. Simplex designs and manufactures fire alarm and access control systems and delivers high quality integrated solutions. Simplex also features 170 company-owned offices, an advanced central monitoring center, and flexible financing options. Visit Booth 433.



Circle Reader Service Card No. 191

Door Controls

The DORMA Group North America, comprised of DORMA Architectural Hardware, DORMA Automatics, and DORMA Glas, is the world's largest manufacturer of door controls. DORMA offers a complete line of life/safety products, which provide a wealth of options for constructing a flexible fire and smoke control system. See Booth 466.

Circle Reader Service Card No. 192



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Firestopping Products

Specified Technologies offers firestopping products based upon a unique "two-stage" intumescent technology that comes in the form of sealant, putty, wrap strips, and collars. Also included in the firestopping product line is non-intumescent sealant, silicone sealant, silicone foam, fire-rated mortar, cable spray, elastomeric spray, and sealant. See Booth 843.



Circle Reader Service Card No. 193

Gas and Flame Detectors

Spectrex developed unique products to detect gas and flame quickly and accurately. Our state-of-the-art SharpEye and SatEye models allow you to detect gas or flame extremely fast and over long distances. Our detectors can work in difficult environmental conditions and incorporate sophisticated logic to prevent false alarms. Visit our website at <http://www.spectrex-inc.com> or come by Booth 133.

Circle Reader Service Card No. 194

Glazing Materials

Technical Glass Products is a North American distributor of wireless fire-rated and fire/impact safety-rated glazing materials for interior and exterior applications. The company supplies FireLite, FireLite Plus, FireLite NT, FireLite IGU, Fire-glass 20, and Pyrostop transparent wall panels. All of these products are listed and labeled by Underwriters Laboratories, Inc. See Booth 475.

Circle Reader Service Card No. 195

Signaling Products

Whelen Engineering designs and manufactures audible and visual signaling products for public and industrial warning applications. Products include explosion-proof warning lights, various size strobe lights, rotating beacons, and outdoor/indoor high-power audible warning and evacuation systems. Stop by Booth 155.

Circle Reader Service Card No. 196

Electrical Safety Products

Technology Research Corporation (TRC) is the leading manufacturer of portable electrical safety products for the home and workplace. This includes the shock shield line of ground fault circuit interrupters (GFCIs) and fire shield, an appliance cord and extension cord designed to prevent electrical fires. Learn more at Booth 567.

Circle Reader Service Card No. 198

Fire Protection Consulting

Fire Protection Consultants is the parent company of Rolf Jensen & Associates, Inc. (fire protection engineering), Fire Protection Management, Inc. (construction management services), and Protection Knowledge Concepts, Inc. (knowledge transfer technology, products, and services). Products featured at Booth 277 include Fire Alarm series and Fire Sprinkler series, both available on video or CD-ROM.



Circle Reader Service Card No. 199

Automatic Sprinkler Heads

Victaulic® is introducing its totally new line of automatic sprinkler heads. This complements and enhances the Victaulic devices line, introduced last year. Victaulic now provides the total system package of couplings, fittings, valves, devices, heads, and accessories for fire protection piping systems. Victaulic is an ISO 9001-certified company providing products and service worldwide. See Booth 1025.

Circle Reader Service Card No. 200

Fire Alarm Devices

System Sensor is a manufacturer of premier commercial and residential fire alarm devices. Our broad product line consists of advanced technology intelligent smoke detectors and modules; conventional smoke detectors; beam smoke detectors; duct smoke detectors; ADA compli-

ant strobes, horns, horn/strobes, and speakers; and sprinkler monitoring devices. Visit Booth 719.

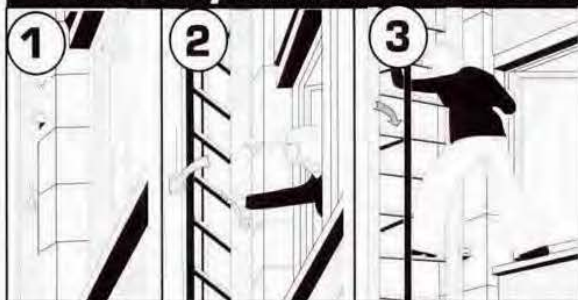


Circle Reader Service Card No. 197

Sprinklers

Star Sprinkler is pleased to introduce our newest products, the StarMax quick response institutional sprinklers, the Pulsar ESFR-25, and the Star Universal Preaction Valve Cabinet. Our staff will also be demonstrating and distributing our CD-ROM version 2.1. Star Sprinkler, Inc. is an ISO 9002-certified full-line manufacturer

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of fire suppression sprinklers, valves, and devices. Visit our website at www.starsprinkler.com or come by Booth 420.



Circle Reader Service Card No. 201

Doors and Frames

Steelcraft Division of Ingersoll-Rand Co. manufactures, services, and continuously improves steel doors, frames, fire-rated doors, and window wall units. In addition to providing the industry's highest quality doors and frames, Steelcraft has the widest selection of sizes, styles, and designs to complement virtually any architectural requirement. Visit Booth 543.

Circle Reader Service Card No. 202

Testing and Certification Organization

Founded in 1894, Underwriters Laboratories, Inc. (UL) is one of the world's largest not-for-profit product safety testing and certification organizations. The familiar UL mark appears on more than 14 billion new products each year, from household appliances to building materials to fire suppression equipment. Find out more at Booth 360.

Circle Reader Service Card No. 203

Fire Protection Engineering School

Worcester Polytechnic Institute provides fire protection engineering education opportunities for students ranging from high school graduates to practicing professionals. Offerings include the dual degree BS/MS program, graduate certificate, and MS and PhD in fire protection engineering. In addition to on-campus offerings,

courses are delivered to off-campus students via the distance learning program. Stop by Booth 1526 for more information.

Circle Reader Service Card No. 208

Automated Management System



Tiscor's completely redesigned PROTRAC TaskMaster is a Windows-based automated management system that uses software and portable data collection devices to increase the productivity and accuracy of inspection and maintenance personnel. By electronically recording activities in the field, TaskMaster significantly reduces

time spent documenting routine information and ensures 100 percent compliance with NFPA, OSHA, and other regulatory agencies. See Booth 352.

Circle Reader Service Card No. 204

Door Exit Hardware

Von Duprin is the leading manufacturer of door exit hardware for panic of fire exit applications and a major supplier for related electrical security products, including electrical strikes, magnetic locks, access control keypad card readers, and other accessory products. Von Duprin will be at Booth 642.

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Notification Appliances

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and sync operation in the same unit. Safepath, supervised audio/fire evacuation systems are available in single, dual, and multi-circuit configurations and are available in easy-to-order packaged systems. Computer-based NAC circuit and voice evacuation design tools will be featured at Booth 207.



Circle Reader Service Card No. 206

Backflow Series

Wilkins Operation/Zurn Industries will feature its innovative backflow design, which uses a

center stem guided check (patent pending) and offers short lay length, lightweight construction, low head loss, and easy installation. The new backflow body has a single access cover and uses no threads or taps, which eliminates exposure to corrosion. The backflow series is available in reduced-pressure principle or double-check detector type and can be of the in-line variety or vertical shape. See Booth 373. Circle Reader Service Card No. 207

Laser Detection Technology

Vision Systems-VESDA™ will unveil a new addition to the VESDA LaserPLUS family—VESDA LaserCOMPACT. COMPACT will make aspiration technology the superior and affordable smoke detection choice in a wider variety of small to mid-size applications. See the VESDA Laser family at Booth



1201...if you want the best laser detection technology!

Circle Reader Service Card No. 209

ESFR and Foam Technology

Would you like to see the latest in ESFR and foam technology? Stop by the Viking Booth 115 and see the new K=14.0 ESFR upright sprinkler and the low-flow foam system that can double warehousing space. Other highlighted products include the ESFR pendent, the institutional pendent and sidewall, and the concealed residential sprinklers. Circle Reader Service Card No. 205

Fire Protection Software

Tim Frost Design Services, Inc., (TFDSI) provides unique fire protection software solutions. TFDSI also provides complete fire protection design and hydraulic services, including Pricer—the premier fire protection estimating software solution; The Inspector—the uniquely flexible inspection software solution; Calcer—the easy-to-use hydraulics software solution; and Stocker—the no CAD stock listing software solution. Visit TFDSI at Booth 392. Circle Reader Service Card No. 210

Fire Alarm Systems

Siemens Cerberus Division will exhibit its intelligent and conventional fire alarm systems, including MXLV, NCC, PXL, SXL, and its Cymphony Integrated Security System. The Fireprint Fire Detector will be featured. The Fireprint Detector

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is programmed with an advanced, proven technology that allows it to distinguish the unique characteristics of genuine fire from deceptive phenomena. Visit Booth 307.



Circle Reader Service Card No. 218

Firestop Products

Johns Manville has unveiled two intumescent firestopping products—Firetemp™ CI caulk and Firetemp SI spray—that are UL-approved and listed for hundreds of firestopping systems installations in both new construction and remodeling of commercial buildings. For more information,

contact the Product Information Center at (800) 654-3103, or visit www.jm.com or Booth 1234.

Circle Reader Service Card No. 099

Special Hazard Protection

SES-Cease Fire designs and manufactures special hazard fire protection components and systems using carbon dioxide, NAFS III (clean agent), and high-, medium-, and low-expansion foam. We also manufacture automatic extinguishers using NAFSIII. See Booth 139.

Circle Reader Service Card No. 084

Sprinkler Monitoring Devices

Potter Electric Signal Company is the leader in the manufacture of sprinkler monitoring devices. Our products include a full line of waterflow switches, pressure switches, supervisory switches, alarm bells, and explosion-proof

devices. We also offer releasing control panels, which include the PFC-4410, a multihazard control panel with features often found only on large systems. Potter Electric is an ISO-certified company. Stop by Booth 833.



Circle Reader Service Card No. 216

Water Heater Accessories

W.H. Safety Products' W.H. Elevator and W.H. Safety Drain Pan/Mini-Stands are the only water heater accessories of their

kind that meet the safety standards of the International Approval Service (IAS 2-96), American Gas Association (AGA 2-96), Canadian Gas Association (CGA 97-001), and the Uniform Plumbing Code (UPC 103-97). We're listed in the American Institute of Architects. See Booth 764.

Circle Reader Service Card No. 219

Water Mist Fire Protection

Marriot Oy, founded in 1985, is a high technology company specializing primarily in the development and manufacture of HI-FOG water mist fire protection systems. The company presents unique and revolutionary systems and high quality components designed to protect various range of fire hazards. Stop by Booth 927 for more information.

Circle Reader Service Card No. 089



INTERNATIONAL FIRE MARSHALS ASSOCIATION Fire Protection Institutes presents **Principles of Fire Protection Engineering**

*June 14-18, 1999 - Tucson, AZ
August 16-20, 1999 - Nashville, TN*

The International Fire Marshals Association (formerly known as the Fire Marshals Association of North America) Fire Protection Institute Course Principles of Fire Protection Engineering is being offered on June 14-18, 1999 in Tucson, AZ August 9-13, 1999 in Nashville, TN. The Principles of Fire Protection Engineering course consists of 10 sessions over a period of four and one-half days. The following topics are covered: Combustion and Ignition Phenomenon, Fire Endurance Evaluation, Construction and Structural Features, Materials Applications, Life Risk Analysis, Fire Protection Design Evaluation, Sprinkler System Developments, Design of Water Suppression Systems, and Egress and Exits.

The fee is \$295 for IFMA (FMANA) or NFFA members and \$350 for non-members. You are responsible for your travel and lodging expenses. Classes will be held at the following locations.

June 14-18, 1999
Sheraton Tucson Hotels and Suites
5151 East Grand Road
Tucson, AZ 85712
800-257-7275

August 16-20, 1999
Doubletree Hotel Nashville
315 4th Avenue North
Nashville, TN
615-244-8200

For additional information or if you wish to sponsor a course please contact:

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Access Denied, Inc.	1216	E-B-I. Fire Engineering	262	International Fire Resistant		RSG, Inc.	280
ADEMCO Group Commercial		EcoVault, Inc.	841	Systems, Inc.	758	Ruskin Manufacturing	185
Systems Division	109	Edwards Manufacturing, Inc.	1104	International Municipal Signal		S-P Products	1317
ADI	284	Elkhart Brass Mfg. Co., Inc.	101	Association	140	SAFE Fire Detection, Inc.	653
ADT Security Services, Inc.	517	EST	821	International Protective Coatings	344	Safety Storage	488
Advanced Innovation, Inc. LPD	1400	Evax Systems	146	Intertek Testing Services	577	Safety Technology Int'l Inc.	933
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Arm Safety Co., Inc.	468	Faciltec Corporation	275	ITI Interactive Technologies	1101	Securplex, Inc.	849
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Altronix Corporation	663	Fairbanks Morse Pump Company	559	Johns Manville	1234	Security Dealer	762
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Amfiel	1305	Fire Combat, Inc.	1402	Keltron Corporation	452	Sentrol Inc. (ESL)	921
AMSECO (American Security		Fire Control Instruments, Inc.	225	Kidde-Fenwal	407	SES-Cease Fire	139
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Angus	329	Fire Safety Displays Co.	368	Knox Company	456	Sierra Monitor Corporation	1232
Ansul, Incorporated	607	Fire Sentry Corporation	659	Leica Geosystems, Inc.	125	Sierra Pine LTD	1043
Aurora Pump Company	149	Fire-Lite Alarms, Inc.	907	Light Engineered Displays, Inc.	553	SigCom (Signal Communications)	220
Automatic Fire Alarm		FireAcad (Division of C&H Fire		Log Books Unlimited	596	Signal Cable Co.	376
Association	144	Suppression)	116	Loos & Company, Inc.	1036	Signature Industries Ltd.	678
"Automatic" Sprinkler Fire		Fireblankets, Inc.	193	Loss Prevention Council	489	Silent Knight Fire Systems	753
Protection Equipment	329	Firecom, Inc.	569	Macurco Gas Detectors	1008	Simplex Time Recorder Co.	433
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AutoSPRINK/MEP CAD, Inc.	273	Firefly Systems, Inc.	355	Master Control Systems, Inc.	941	Society of Fire Protection Engineers	128
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BALTIMORE CONVENTION CENTER
BALTIMORE, MARYLAND



continued from page 52

Q. *If multiple air-handling units are serving a space, do I need to add the capacities together when determining whether I need smoke detectors?*

A. This depends on the arrangement of the units. Consider, for example, a large, open building, such as a warehouse, that's served by two rooftop air-handling units, each with a capacity of 1,200 cfm (34 cmm). Assuming each unit serves the space independently and that the units aren't connected by supply ducts, they can be considered independently. Since each unit handles less than 2,000 cfm (57 cmm), detectors aren't required. If the units are connected by common supply ducts, however, the total system capacity is 2,400 cfm (68 cmm), so detectors would be required.

Or consider two units, each with a capacity of 8,000 cfm (227 cmm). We know that each unit must have supply-side detectors. But what about the return side? If each unit has its own, independently ducted return air system, its return air system capacity is less than 15,000 cfm (425 cmm), and return air detectors aren't required. If the two units share a common return air plenum or common return ducts, however, the total return air system capacity is 16,000 cfm (453 cmm), so return detectors are required. Simple!

Q. *When a duct smoke detector is activated, do all air-handling systems in the building have to shut down?*

A. Not necessarily. Detectors must be arranged to shut down associated fans—that is, any fans connected to the detector by ducts or a plenum. Just because multiple units serve a common space or building doesn't mean they must all shut down when a detector activates.

Q. *When does NFPA 90A require the installation of smoke and fire dampers?*

A. Smoke dampers are required at duct penetrations through smoke barriers required by another code, such as NFPA 101®, *Life Safety Code*®. They're also required to isolate air-handling equipment with a capacity

greater than 15,000 cfm (425 cmm). A smoke damper alone provides no fire resistance; it's intended to keep smoke within a smoke compartment or an isolated portion of the air distribution system.

Fire dampers are required at duct penetrations through fire barriers with a fire-resistance rating of two hours or more and at shaft wall penetrations, regardless of the fire-resistance rating of the shaft. Fire dampers are also required at transfer openings in fire barriers of any fire-resistance rating.

Where a wall serves as both a fire barrier and a smoke barrier, combination fire and smoke dampers may be used to protect penetrations, provided they're arranged to close when heat or smoke is detected. Remember, these are the general rules. Like most codes and standards, there are always exceptions.

Q. *Are fire dampers required at air inlets and outlets in a fire-resistance-rated floor-ceiling or roof-ceiling assembly?*

A. NFPA 90A doesn't specify how to protect penetrations through rated floor-ceiling and roof-ceiling assemblies. Instead, it refers the user to the limitations of the assembly's listing. If an assembly were tested at the laboratory with no penetrations, for example, its listing documentation would indicate whether any penetrations were permitted, and if so, how to protect them. If the assembly were tested and listed with specific penetrations, the listing documentation should again specify limitations on any field-installed penetrations. On a construction job, the architect and mechanical engineer must coordinate to ensure that the fire-resistive integrity of any rated floor-ceiling or roof-ceiling assemblies is maintained.

Q. *How often must dampers be tested?*

A. NFPA 90A requires all smoke and fire dampers to be tested at least once every four years. The test involves operating the dampers to ensure they close completely and, in the case of fusible-link-actuated dampers, removing the link to make sure the damper closes. Large facilities will sometimes stagger the inspections, testing a quarter of the dampers annually, so that every damper is inspected once every four years.

Q. *If I install smoke detectors in a ceiling cavity or a raised-floor air-handling plenum, am I exempt from the requirements for materials permitted in plenums?*

A. No. NFPA 90A generally restricts the materials permitted in air-handling plenums to either noncombustible or limited-combustible, with a maximum smoke-developed index of 50. However, so-called "plenum-rated" cable, which is wire or cable that's been tested in accordance with NFPA 262, *Method of Test for Fire and Smoke Characteristics of Wires and Cables*, is exempted, as are smoke detectors. Smoke detectors installed in plenums needn't be noncombustible or limited-combustible, nor must they have a maximum smoke-developed index of 50.

Q. *Does NFPA 90A prohibit a common air-handling system from serving both a corridor and guest rooms in a hotel or apartment building?*

A. No, provided the system can be designed such that the egress corridor doesn't serve as a portion of a supply, return, or exhaust air system serving the guest rooms or apartments. The egress corridor can't act as a plenum serving adjoining spaces, but this doesn't prohibit plenums above the corridor ceiling. The intent of Section 2-3.11 of NFPA 90A is to prevent air transfer among the corridor and the adjoining rooms because the transfer of air in normal conditions will mean the transfer of smoke during a fire.

In such occupancies, it's critical to keep the egress corridor smoke-free for as long as possible. This is commonly done by providing separate units, one for the egress corridor and one or more for the adjoining spaces. But this isn't mandatory. Either way, it's important that the systems be properly balanced to minimize air transfer among the egress corridor and the adjoining spaces, although the standard recognizes it may not always be possible to eliminate such air transfer completely. ♦

Gregory E. Harrington is a fire protection engineer in NFPA's Building Fire Protection and Life Safety Department and staff liaison for the Technical Committee on Air Conditioning. A statement, written or oral, that's not processed in accordance with Section 16 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its committees and shall not be considered to be, nor relied upon as, a formal interpretation.

NFPA1999 World Fire and Safety Congress and Exposition

Date: May 16-20, 1999
Place: Baltimore, Md.
Contact: The registrar; telephone (617) 984-7310

IAFC 1999 Conferences

Dates and Places: International Hazardous Materials Response Teams Conference, June 3-6, 1999, Towson, Md.; Response '99, June 16-19, 1999, Orlando, Fla.

Contact: Professional Development Department, International Association of Fire Chiefs, 4025 Fair Ridge Drive, Fairfax, VA 22033; telephone (703) 273-0911

Fire Safety Design Conference

Date: June 9-11, 1999
Place: Worcester, Mass.
Description: This conference will focus on social, legal, political, attitudinal, economic, and organizational changes required to bring emerging performance-based fire safety design methods into actual practice in the decades ahead.
Contact: Society of Fire Protection Engineers; fax (301) 718-2242; E-mail sfpehqtrs@sfpe.org

New York State Association of Fire Chiefs Annual Conference

Date: June 10-12, 1999
Place: Syracuse, N.Y.
Description: The New York State Association of Fire Chiefs (NYSAFC) Annual Conference and Convention features displays of equipment, apparatus, and services; educational programs; product demonstrations; interactive displays; and hands-on training activities.
Contact: NYSAFC; telephone (800) 676-FIRE

Emergency Response Update Conference

Date: June 10-13, 1999
Place: Orlando, Fla.
Description: Attendees will have the opportunity to see the latest products in the field, exchange ideas with peers, and learn new techniques and information through educational sessions.
Contact: The National Safety Council; telephone (800) 621-7615, ext. 2106

International Disaster Management Conference

Date: June 14-16, 1999
Place: The Netherlands
Description: This conference is for political decision-makers; professionals from local government and the fire, medical, and ambulance services; and police.
Contact: International Conference on Disaster Management and Medical Relief, Organizing Committee and Conference Secretariat, Ministry of the Interior and Kingdom Relations, DMMR project office, H 1445, Attention: Dick Q. P. Fundter, P.O. Box 20011, 2500 EA The Hague, The Netherlands; telephone +31 (0)70 302 7011, +31 (0)6 5321 7511 (after 17.00 CET); fax +31 (0)70 302 1444; E-mail dmmr@minbiza.nl

Fire Service Administrators Institute

Dates: Legal Aspects of Fire Protection, June 14-18, 1999; Local Government Administration, June 21-25, 1999
Place: Monmouth, Ore.
Contact: Sheri Barber; telephone (508) 378-2100, ext. 219

Firefighting/Service and Maintenance School

Date: June 22-24, 1999
Place: Marinette, Wisc.

Description: This class combines service and hands-on firefighting training for hand-portable and wheeled extinguishers.

Contact: Ansul Incorporated, One Stanton Street, Marinette, WI 54141-2542; telephone (800) 323-8491 or (715) 735-7411; fax (715) 732-3479; Internet www.ansul.com

The Fire Protection Research Foundation Fire Risk & Hazard Symposium

Date: June 23-25, 1999
Place: San Diego, Calif.
Description: The symposium features expert presentations and panels on current developments in fire risk, fire toxicity, wire and cable testing, and plenum fire safety. Come hear about and be heard on these issues.

Contact: Eric Peterson, The Fire Protection Research Foundation; telephone (617) 984-7281; E-mail epeterson@nfpa.org

ASTM Committee Meetings

Dates: Committee E-5 on Fire Standards, June 27-30, 1999; Committee D-26 on Halogenated Organic Solvents and Fire Extinguishing Agents, June 30-July 1, 1999
Place: Seattle, Wash.
Contact: Bode Buckley, ASTM Committee E-5, telephone (610) 832-9740, E-mail bbuckley@astm.org; Cathryna Blackwell, ASTM Committee D-26, telephone (610) 832-9737, E-mail cblackwe@astm.org

ClinCon '99

Date: July 8-11, 1999
Place: Orlando, Fla.
Description: This is the 21st annual Clinical Conference on Out-of-Hospital Emergency Care.

Contact: ClinCon '99 Registrar, Florida Emergency Medicine Foundation, 3717 South Conway Road, Orlando, FL 32812-7607; telephone (407) 281-7396 or (800) 766-6335; E-mail info@fcep.org

National Board Training

Dates: Boiler and Pressure Vessel Inspection Course, July 12-16, 1999; Weld Procedure Specification Workshop, July 21-23, 1999; Nondestructive Examination Workshop, July 26-28, 1999
Place: Columbus, Ohio
Contact: Richard McGuire, Manager of Training; telephone (614) 888-8320

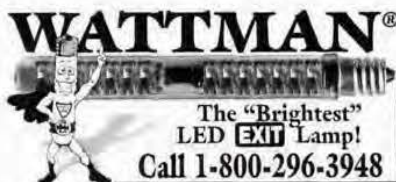
International Forum on Traffic Records

Date: July 18-22, 1999
Place: Danvers, Mass.
Description: This forum features experts who'll discuss how to enhance the quality, accuracy, and timeliness of traffic records.
Contact: The National Safety Council; telephone (800) 621-7615, ext. 2383

State of Idaho 1999 EMS Conference

Date: July 30-August 1, 1999
Place: Boise, Idaho
Description: Informative presentations on current clinical, educational, and managerial issues in EMS will be offered.
Contact: Jeff Long, Provider Resources Coordinator, State of Idaho EMS, P.O. Box 83720, Boise, ID 83720-0036; telephone (208) 334-4000; fax (208) 334-4015

If you'd like us to include your event in "Date Book," please submit full details at least four months before the event to NFPA Journal, One Batterymarch Park, Quincy, MA 02269-9101, or fax the information to (617) 984-7090.



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unique opportunities for the right candidates. The initial staff will be an integral part of the final design and fit-up of the facility, and be involved in the development of laboratory operating procedures and policies.

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Job announcements (#99-042 and #99-043) and application procedures can be found on ATF's website—www.atf.treas.gov/jobs. Application materials are also available from Ms. Vernice C. Ford, ATF Personnel Division—Room 4350, Washington, DC 20226; (202) 927-8395. The jobs are open until filled.

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A fire protection resource web site, offering employment opportunities for, and resumes of, fire protection professionals. If, as a fire protec-

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Bars and Gates the Right Way

We all want to be safe. But what happens when our efforts to be safe from crime put us at risk of injury from fire?

Jenna Padula

We've all seen them, and some of our homes may even have them. We're talking about security bars and other devices. There are bars for windows and bars for doors, bars with quick-release devices and bars with keyed locks. Some people even nail their windows or doors shut, while others block them with appliances.

Most people install security bars to protect themselves against crime. Unfortunately, they can also hinder escape.

There are no national statistics on the number of people using unsafe security devices, but we can estimate the number of deaths that occur in fires in which locked doors or illegal gates or locks are present. From 1992 through 1996, there were an average of 86 deaths per year in home fires in which locked doors contributed to the fatalities, and an average of 18 people died annually in fires in which illegal gates or locks were present.

These figures may seem small, but they don't capture all security-related fire deaths. "Locked doors" can mean an ordinary locked door, as well as a double-cylinder lock with an inside key. "Illegal gates or locks" may miss legal security bars. And both may miss makeshift arrangements, such as nailed windows.

Deadly combinations

Many who die in fires involving security measures tend to be poor.

Poverty is also associated with other factors that affect the risk of dying in a fire, such as not having working smoke detectors, using unsafe heating devices, and leaving children unsupervised.

Children have a higher risk of dying in a fire than adults generally, often because they don't react properly in a fire. Add to that security bars that may be impossible for a child to remove, and you have a deadly combination.

An example of this occurred in South Carolina on September 6, 1996, when five children died in a fire in a house whose exit doors had double-keyed deadbolt locks with no keys in or near them. Firefighters found one door locked and the other blocked by victims' bodies.

When the reduced escape time that results from having to unlock security devices is coupled with a lack of working smoke detectors, you have another deadly combination. On April 26, 1997, for example, nine people died in California when someone set fire to a

car parked under an open carport. The flames spread to a house, whose windows were covered with security bars that had no releases and one of whose exit doors was locked with a slide bolt and hasp. Flames had blocked the only usable exit—and the house had no smoke detectors.

Unsafe heating practices and security measures can also set the stage for disaster. In November 1996, a space heater started a fire that filled an Alabama house with smoke. When the sleeping occupants finally awoke, it was too late to escape. Bars on the doors and windows hindered firefighting.

Looking for answers

NFPA 101®, *Life Safety Code*®, which provides guidelines for exits in both residential and non-residential occupancies, states that security features should be operable without keys, tools, special knowledge, or excessive force.

The Home Security and Fire Safety Task Group formed by NFPA's Center for High-Risk

Outreach to work on solutions to this issue advocates developing industry-wide standards for the design of bars and release devices, the introduction of legislation regulating installation, and a public education program explaining the dangers of fixed bars and the alternatives available.

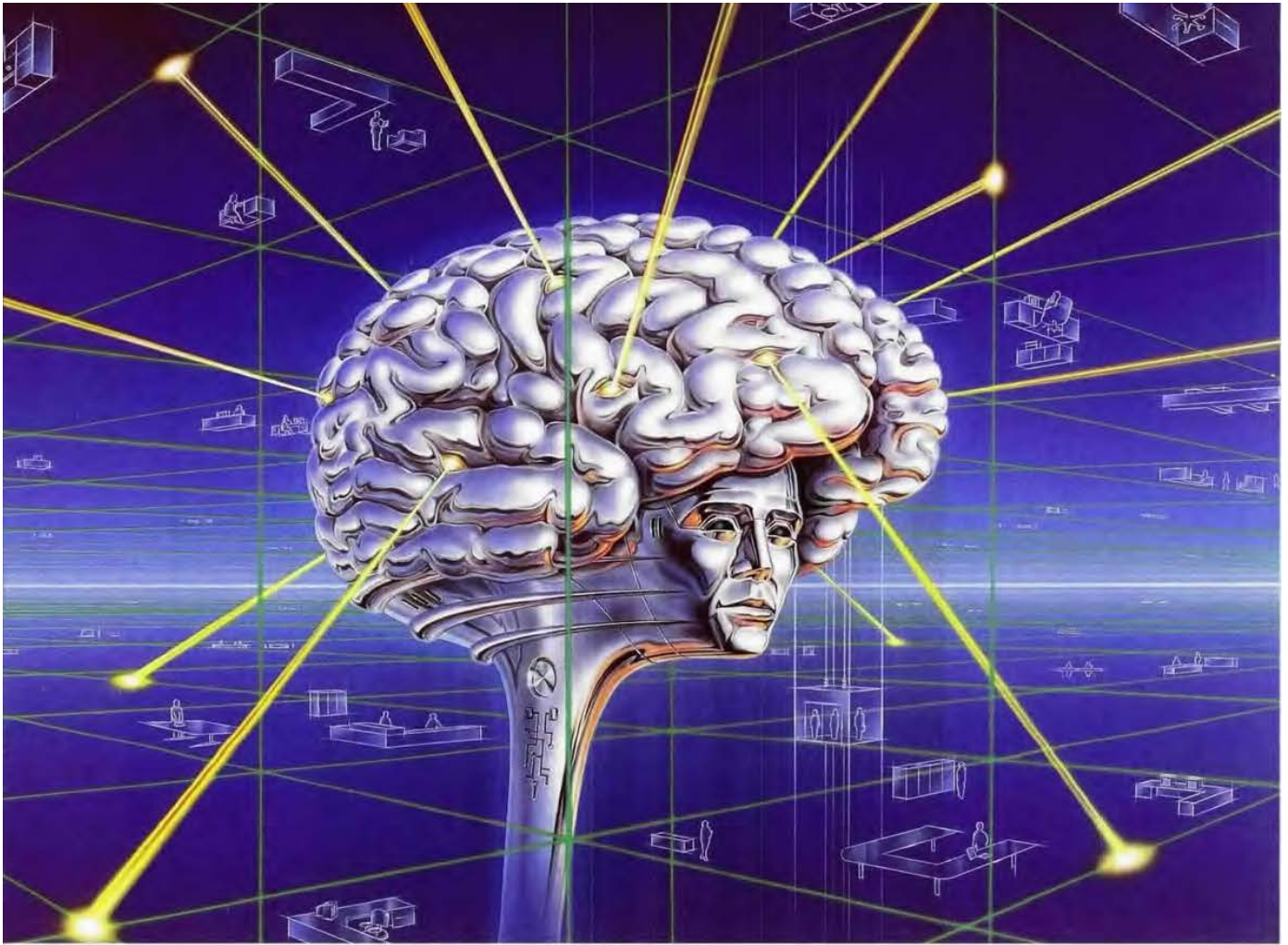
California has passed legislation requiring escape warning labels on bars sold through retail outlets. In addition, cities and towns can regulate security bar installation, even on existing buildings. If security devices are installed in a sleeping room in Mississippi, at least one must have a quick-release device. Texas is in the process of passing quick-release legislation.

Public fire safety education programs should concentrate on four points. First, windows should open easily and fully enough to allow escape. Second, the key to every locked or barred door should be kept near it, and everyone must be able to find and use it. Third, all barred windows needed for escape should have quick-release devices, and everyone should know how to open them. Fourth, families should hold home fire drills, using them to correct obstructions to doors and windows needed for escape.

For more information, contact the Center for High-Risk Outreach at (617) 984-7286. ♦

Jenna Padula is assistant editor of NFPA Journal.



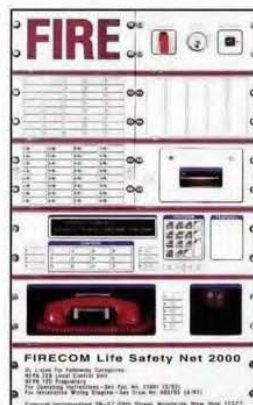


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