

welcoming sprinklers into the home

Nicholson, John

It is hard to argue against the statistics, the advances in technology, and life-safety benefits of residential sprinklers

AN IN-DEPTH SERIES of articles in the Boston Globe last April drew nationwide attention to the gaps in adequacy of fire department response. NFPA's needs assessment of the U.S. fire service in 2001 found that most fire departments in all sizes of communities do not have enough fire stations to provide sufficiently rapid response, and a significant fraction of departments in all but the largest cities respond with only one or two firefighters on board.

These results not only spotlighted the threats to firefighters, they reminded residents of the need to protect themselves against serious harm from fire.

NFPA, through its partnership with the Home Fire Sprinkler Coalition (HFSC), recognizes the Boston Globe report as another opportunity to publicize the benefits of an underused, yet highly effective, form of life-safety protection: residential sprinklers. While fire sprinklers have protected many public buildings for more than 100 years, less than 1 percent of U.S. single-family dwellings having fires and only 7 percent to 8 percent of U.S. apartments having fires also have fire sprinkler systems, even though more than 80 percent of all fire deaths occur in homes.

Far from being solely a boon for life safety, residential fire sprinklers are a valuable fire protection tool. According to the HFSC, they save lives, reduce property loss, and can help cut homeowner insurance premiums. The HFSC cites the following statistics:

- * Home fire sprinklers can contain and may even extinguish a fire in its incipient stage, usually in less time than it would take the fire department to arrive on the scene. [This is why knowledgeable fire safety professionals immediately saw the connection between the Boston Globe articles and the value of fire sprinklers.]
- * Installing both smoke alarms and a fire sprinkler system reduces the risk of death in a home by fire by 82 percent, relative to having neither.
- * Only the sprinkler closest to the fire will activate, spraying water directly on the fire. A study in Scottsdale, Arizona, found that 90 percent of fires are contained by the operation of just one sprinkler.
- * Nationally, home fire sprinkler systems add 1 to 1.5 percent, on average, to the total building cost in new construction.
- * Home fire sprinklers use only a fraction of the water used by fire department hoses.
- * Modern residential sprinklers can be mounted inconspicuously, flush with walls or ceilings.
- * The likelihood that a sprinkler will accidentally discharge because of a manufacturing defect is extremely rare. Sprinkler mishaps are generally less likely and less severe than home plumbing system problems.

It is hard to argue against the statistics, the advances in technology, or the life-safety benefits of residential sprinklers.

Fifteen years after Scottsdale, Arizona, began requiring all new homes to have a residential fire sprinkler system, more than 50 percent of the city's homes are now protected with fire sprinkler systems. Data collected by the fire department during that period indicate that 13 lives have been saved and more than \$20 million in property loss has been prevented. During the last three years alone, the average fire loss in homes with sprinklers was \$2,166, compared to \$45,019 for homes without

sprinklers.

While the widespread use of residential sprinklers may still be years away, the effort to expand their use continues.

NFPA is a key player in the promotion of residential sprinklers. It is a founding member of the HFSC and a member of the United States Fire Administration's (USFA) National Residential Fire Sprinkler Initiative, and has strong ties to the National Fire Sprinkler Association and the American Fire Sprinkler Association. First and foremost, however, NFPA is the developer of key sprinkler codes.

The standards

NFPA's sprinkler standards include NFPA 13D, Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes; NFPA 13, Installation of Sprinkler Systems, which governs sprinklers in commercial, industrial, and larger residential buildings; and NFPA 13R, Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.

NFPA 13D was created in response to the landmark report on the nation's fire problem, America Burning, which pointed out that the high number of fatalities in homes had to decrease and that a home fire sprinkler was needed, says Chris Dubay, NFPA's staff liaison to the committees developing the sprinkler standards.

The residential sprinkler itself, introduced in the 1980 edition of NFPA 13D, was developed to address the fire protection needs of small residential compartments with a limited water supply having a primary goal of life safety and to provide adequate time for the occupants to escape from the dwelling.

"Through the years since, the technology of residential sprinklers has developed to allow more economical protection through larger sprinkler protection areas, targeted flow rates, and a wider choice of piping materials," says Russ Fleming, executive vice-president of engineering for the National Fire Sprinkler Association (NFSA). Fleming is also a member of the NFPA Technical Correlating Committee on Automatic Sprinklers.

Sprinkler manufacturers now produce UL-listed residential fire sprinklers that differ from standard types of fire sprinklers in that they spray water higher on the walls to help in maintaining tenability of the room of fire origin. In addition, residential sprinklers incorporate fast response thermal elements, which respond five times faster than standard response sprinklers.

Changes have also been made to NFPA 13D to allow multi-purpose systems that serve both sprinklers and plumbing fixtures through common lines to use 1/2-inch plumbing pipe. Before the change, residential multi-purpose piping had to be at least 3/4-inch and be listed for sprinkler systems.

NFPA 13D is currently in the annual 2006 revision cycle, and further revisions and advancements are expected.

"NFPA 13D has to walk a fine line between minimizing cost while maintaining an acceptable level of protection," says Roland Huggins, vice-president of engineering for the American Fire Sprinkler Association. Huggins is also a member of the NFPA Technical Correlating Committee on Automatic Sprinklers.

"For instance, there was a proposal to provide sprinklers just in the kitchen, since that's where the majority of home fires occur," he says. "This was rejected primarily because the majority of fires resulting in fatalities begin in the living room and bedroom areas. Considering that ease of installation was a driving principle in the development of NFPA 13D, one should expect mainly refinements."

At the recent Report on Proposals meeting, Huggins says, the committee clarified how and where the additional domestic water demand should be applied and clarified that it is acceptable to utilize residential wells as the water supply. At the Report on Comments meeting this fall, the committee is expected to review fire test data that is proposing to provide design basis changes that would allow a single sprinkler flowing 0.07 gpm/sf rather than two sprinklers flowing the equivalent of 0.05

gpm/sf. This would result in a 30 percent reduction in water demand, affecting not only piping choice and size but the size of the water meter, as well. The full fire test report and any received public comments will be reviewed by the committee at their meeting in November.

At the 2005 NFPA World Safety Conference and Exposition® in Las Vegas last June, the NFPA membership upheld the technical committee recommendation that NFPA 101®, Life Safety Code®, and NFPA 5000®, Building Construction and Safety Code®, include a provision requiring residential sprinklers in new home construction.

"Opponents of sprinkler protection in single-family homes argue that only older homes have fire problems, but the proposed requirements in NFPA 101 and NFPA 5000 recognize that we've got to start sometime in bringing the protection of homes up to current technology," says Fleming.

The proposed requirements make absolute sense to Dubai.

"We are promoting fire-safe homes and society is demanding this kind of additional protection. It makes sense to have these provisions in NFPA 101 and NFPA 5000," he says.

"It's huge [adding the residential sprinkler provisions to NFPA 101 and NFPA 5000]," says Huggins. "Consider how much more difficult it is for a local amendment to be added for sprinkler protection when the national model code does not recognize their value."

Dubay, who often speaks about the benefits of residential sprinklers as an NFPA senior fire protection engineer, has found that many fire departments, in particular, want more residential sprinklers installed because of the safety they bring to the homeowner, firefighters, and the entire community. Although sprinklers do not necessarily reduce the number of calls for fires, they do reduce the severity of the fire, thereby reducing danger to firefighters by preventing fires from reaching flashover and reducing the overall size and development of the fire.

Sprinklers also make it possible for the fire service to allocate more resources to emergency medical service and other rescue and emergency situations, Dubai says. Today, fire departments all across the country are being asked to do more with fewer resources. A fire department, responds to a home fire in time to put out the fire, he says. But, they are not there when a fire begins. A fire sprinkler activates and the fire is under control or extinguished sooner than would be the case if extinguishment relied solely on firefighting operations. There is much less fire and water damage, and residents have time to make it out of the house safely.

"When the fire occurs in a sprinklered home, the fire department is ready to response to another emergency that much quicker and available to provide services for the entire community more quickly," Dubai says.

"In addition to the significant reduction to property damage," says Huggins. "let's not forget that residential fire sprinklers also offer a level of protection for firefighters by reducing or eliminating the risk of entering a burning home to rescue the occupants."

Flashover times in residential buildings tend to be very short, even shorter than the best response times. Flashover is the sudden spread of fire to all the combustibles in a room when they reach a temperature high enough to burst into flame at one time.

"There are communities in California, Colorado, and elsewhere that currently mandate residential sprinklers in situations where the homes are built in areas for which fire department response times are considered unacceptably long," says Fleming. "But even the few minutes that constitute a rapid fire department response can be deadly. Hence the title of the well-known home sprinkler advocacy video Less Than Five Minutes."

As one fire chief quoted in the Boston Globe series points out, "We're always going to need firefighter protection. . .but when you really want to talk about saving lives. . .put residential sprinklers in."

Sprinklers and response time

According to NFPA member Ben Klaene, former training chief of Cincinnati, Ohio, Fire Department response time is an often-misunderstood term. Although NFPA 1710, Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, uses this term synonymously with travel time, travel time is actually just one of five components of the overall response time.

Alarm time is the time from ignition to discovery. In a residential building, working smoke alarms shorten alarm times, provided someone in the house calls the fire department. The second component of response time is dispatch time, the time between the call to the dispatcher until the fire department is notified. Dispatch time is usually approximately one minute.

Turnout time, which NFPA 1710 addresses, is the time it takes firefighters to don turnout gear, mount the apparatus, and begin their response. NFPA 1710 sets a target of one minute for turnout time.

Travel time is the elapsed time between leaving the station and arriving at the scene. Most firefighters and NFPA 1710 refer to this as "response time." Finally, set-up time is the time from arrival at the scene until effective actions, such as applying water, are taken.

"In the case of the sprinklered home, the water is already being applied at step one," Klaene says.

The National Research Council of Canada (NRCC) recently studied five new real estate developments with its risk cost assessment model, FIRECAM(TM) (Fire Risk Evaluation and Cost Assessment Model), to assess whether occupants in an apartment building with sprinkler protection but longer fire department response times were as safe as those in a building without sprinkler protection but a faster fire department response time.

Using a three-story apartment building to represent the normal range of buildings in a residential community, the NRCC assessed the expected risk to life to the occupants with and without added sprinkler protection, and with two levels of fire department response. The results showed that sprinkler protection and existing fire department response times provide a better level of fire safety than no sprinkler protection and a shorter fire department response time.

John R. Hall, Jr., NFPA assistant vice-president for Fire Analysis and Research, says NFPA is not aware of any statistics that link the magnitude of damage to people and property to the elapsed time after ignition. However, he notes that "there is slight evidence that higher fire department response times are correlated with higher property damage rates per fire. And there is little question that the critical time for resident survival is before even the fastest, best fire departments can typically respond. The Boston Globe articles indicate that shortening response times would save about 5 percent of home fire victims. Our analysis shows adding fire sprinklers would save 50 to 67 percent. There's really no comparison."

Sprinkler ordinances

Recent product improvements, lower costs, and increased public awareness bode well for fire chiefs looking to gain support for local sprinkler ordinances.

In Davis, California, for example, residential sprinkler systems are mandatory for flag lots within the city limits. Flag lots are lot shapes that limit or prevent fire department access. Residential fire sprinklers are required for all new construction in unincorporated areas of Yolo County, in which Davis is located. Provisions also mandate automatic fire sprinkler systems in residential houses when additions are being made and in houses moved into areas mandating residential fire sprinklers.

The first ordinance mandating sprinklers in new residential construction was adopted in 1978 in San Clemente, California. But most industry watchers consider that the real starting point as 1985, when the fast-growing community of Scottsdale, Arizona, mandated sprinklers for all new residential, industrial, and commercial construction by a vote of 6 to 1. The law went into effect on January 1, 1986.

The idea behind the ordinance was to allow a smaller, better-trained crew of firefighters to do more with less. It was a given that automatic sprinklers were a great benefit in fighting fires in commercial structures, so why not apply them to homes? What's more, commercial sprinklers are geared toward property protection; residential sprinklers are a life-safety matter.

Educating homeowners

One of the major obstacles to the increased use of residential fire sprinklers is homeowners who don't realize that such systems exist. Many homebuyers are not even aware that they can have a fire sprinkler system installed in their homes.

Another obstacle is the mistaken belief that every sprinkler in a house will activate when one goes off. Once homeowners realize that each sprinkler acts individually and that no more than two sprinklers typically activate, their concerns should be lessened.

Still another misconception is that extensive water damage will result when a sprinkler activates. Typically, a sprinkler operates less than 10 minutes before fire department personnel confirm that the fire has been extinguished and shut the system off. During that time, a total of less than 200 gallons (757 liters) of water are used. When firefighters respond to an unsprinklered home, they typically use 200 gallons (757 liters) of water a minute for a significantly longer period of time to extinguish a fire that usually has gone to flashover. Non-fire releases of water are historically quite rare and less common than water damage from other common plumbing mishaps.

One element toward increasing the number of sprinklered homes is a financial incentive, such as discounts on homeowner's insurance. For example, State Farm offers customers with sprinklered homes in the United States and Canada a discount off the premium that ranges from 5 to 10 percent. Most of the major home insurance underwriters are now offering discounts of one form or another.

"From the Coalition's earliest days, our strategic planning process identified the home insurance industry as an important partner for HFSC's work," explains Coalition Chair Gary Keith, NFPA vice-president of regional operations. "By stepping forward to become the first insurance company member of the HFSC Steering Committee, State Farm has made a pioneering move that will help HFSC achieve our public safety mission."

"This is a valuable partnership to help save lives and protect property. It just fits with our Good Neighbor beliefs," says Stephanie Colegrove, vice-president of Operations for State Farm's Property and Casualty. "It is appropriate for State Farm, the largest home insurer in the United States, to take a leadership role in homeowner safety and property protection." The company insures one out of five U.S. homes.

Sprinklers save firefighter lives, too

For the fire service, the message is that fire sprinklers save firefighter lives.

"Fire sprinkler systems can increase that survival window and avoid flashovers by stopping the fire progression," says Azarang (Ozzie) Mirkhah, P.E., EFO, CBO, fire protection engineer for Las Vegas Fire and Rescue. "That would allow the occupants more time to evacuate, which means more time to save their lives and the lives of the responding firefighters."

"If delayed response time is the concern, fire sprinkler system technology could assist us, since their activation and response time in extinguishing the fire could not be matched by any responding units," he says. "The technology is, and has been, available for decades, so why not utilize it to save both the residents and our firefighting comrades?"

"Fire sprinklers will by no means diminish the important role of firefighters. Hazardous material calls, emergency medical calls, planning against potential weapons of mass destruction and terrorism have put plenty on their plates besides fighting fire."

"What residential sprinklers will do is create a safer environment for firefighters engaged in search and rescue operations and in interior fire suppression operations."

As a priority, firefighting has taken a back seat in the Department of Homeland Security's terrorism-focused mission. If the fire service, as a whole, is not considered a high priority, fire prevention usually takes the biggest hit. It's not illogical, then, to reason that a lowering of importance and a lack of funding could mean reversal of the decades-old decline in residential fires. That said, it may only be through the implementation of the available technologies, such as the fire sprinkler systems, that we can hope to reduce residential fire fatalities in the future," he says.

Conclusion

Many fire deaths occur in the home and one of the most effective ways to prevent fire-related deaths is the installation of residential fire sprinklers. Whether mandated or not in communities, fire sprinkler systems are wise investments for all families, especially those with small children and seniors who would need assistance in escaping a home fire.

JOHN NICHOLSON is the managing editor of the NFPA Journal®. He can be reached at jnicholson@nfpa.org.

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