

Homeowners Guide to Your Residential Sprinkler System

Prepared by the Central Savannah River Area Chapter of the Society of Fire Protection Engineers

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Why Do I need Fire Sprinklers?

Fires kill nearly 4,000 people each year in the United States. Most of these deaths (78.3%) occur in homes.

Fire Sprinklers provide an additional level of protection to increase the safety of your family from the devastating effects of a fire. Some people believe that smoke detectors are enough but smoke detectors coupled with a sprinkler system significantly increase your chances of surviving a fire in your home. (See Myth 3 on page 4) In fact, according to the Home Fire Sprinkler Coalition (HFSC), "installing both smoke alarms and a fire sprinkler system reduces the risk of death in a home fire by 82%, relative to having neither."

Fire in the same room with and without fire sprinklers (photo courtesy of the Home Fire Sprinkler Coalition)

Myths and Facts about Sprinklers

Automatic sprinkler systems have enjoyed an enviable record of protecting life and property for over 100 years. Yet, there are still common misunderstandings about the operation and effectiveness of automatic fire sprinkler systems:

Myth 1: "Water damage from a sprinkler system will be more extensive than fire damage."

Fact: Water damage from a home sprinkler system will be much less severe than the damage caused by water from fire-fighting hose lines or smoke and fire damage if the fire goes unabated. Quick response sprinklers release 8-24 gallons of water per minute compared to 50-125 gallons per minute released by a firehose.

Myth 2: "When a fire occurs, every sprinkler head goes off."

Fact: Sprinkler heads are individually activated by fire. Residential fires are usually controlled with one sprinkler head. 90% of all fires are controlled with six or fewer heads and a study conducted in Australia and New Zealand covering 82 years of automatic sprinkler use found that 82% of the fires which occurred were controlled by two or fewer sprinklers.

Myth 3: "A smoke detector provides enough protection."

Fact: Smoke detectors save lives by providing a warning system but can do nothing to extinguish a growing fire or protect those physically unable to escape on their own, such as the elderly or small children. Too often, battery operated smoke detectors fail to function because the batteries are dead or have been removed. As the percent of homes in America that were "protected" with smoke detectors increased from zero to more than 70%, the number of fire deaths in homes did not significantly decrease.

Myth 4: "Sprinklers are designed to protect property, but are not effective for life safety."

Fact: Sprinklers provide a high level of life safety. Statistics demonstrate that there has never been any multiple loss of life in a fully sprinklered building. Property losses are 85% less in residences with fire sprinklers compared to those without sprinklers. The combination of automatic sprinklers and early warning systems in all buildings and residences could reduce overall injuries, loss of life and property damage by at least 50%.

Courtesy of the American Fire Sprinkler Association (www.sprinklernet.org)

Frequently Asked Questions

How do sprinklers operate?

Fire sprinklers are individually heat-activated and connected to a network of water pipes. When the heat from a fire raises the sprinkler to its operating temperature (usually 68°C or 155 deg. F), only that sprinkler activates delivering water directly to the source of the heat.

Why are sprinklers so effective?

All fires start small and, if detected and tackled early enough, can be controlled with very little water. Residential sprinklers are a special type of fire sprinkler, which respond very quickly and are completely automatic in operation. They can therefore tackle the fire at a very early stage, even if you are not home, releasing water directly over the source of the fire and sounding an alarm.

How reliable are sprinklers?

Records from Australia and New Zealand (where all fire must be reported) between 1886 and 1986 show that sprinklers controlled 99.7% of all fires where they were fitted.

Do sprinklers go off accidentally?

Records in service show that sprinklers are very dependable. The chance of a defective head is less than 1:16,000,000 - less than your chance of winning the Lottery! The chance of an accidental discharge is considerably less.

What about water damage?

Typically a sprinkler discharges 10gal/min. A fireman's hose on the other hand discharges 200+ gallons a minute. In general a sprinkler system will use between 1/100th and 1/1000th of the water used by the Fire Brigade. Even then, most things that get wet can be restored - but a pile of ashes is beyond hope!

(From the Fire Sprinkler Association/Residential Sprinkler Association, <http://www.firesprinklers.info> and <http://www.firesprinklers.org.uk>)

Do's and Don'ts

From the National Fire Sprinkler Association:

Do:

1. Test your system monthly. (If your system is monitored by a fire service agency, be sure to notify them before testing the system. This will prevent sending a false alarm.) Open the test valve and listen for an alarm bell or buzzer. Once the alarm sounds, turn off the valve. If alarm bell or buzzer does not sound, contact a qualified fire sprinkler contractor.
2. Know the location of the system shutoff valve. Be sure all other adult occupants are aware of its location.
3. Make certain the system control valve is open at all times.
4. Have your system extended if your home is enlarged or remodeled. Contact a licensed fire sprinkler contractor. Submit plans to the local fire department or fire prevention division as required to secure a permit.
5. Contact the fire department when any activation occurs, even if the fire has apparently been extinguished.

Don't:

- 1 Don't paint the sprinklers.
2. Don't damage the sprinklers.
3. Don't hang objects from the sprinklers, valves or other components.
4. Don't obstruct the sprinklers.
5. Don't cover the sprinklers.
6. Don't remove the sprinklers.
7. Don't turn off or disconnect the system.
8. Don't shut off the system in the event of a fire.

In the event of a fire, be calm and leave your home immediately. Call the fire department from a neighbor's house.

System Description, Testing and Maintenance

A residential fire sprinkler system is basically maintenance free. The only testing required on a regular basis is opening the drain/test valve to check the alarm operation. The rest of the system is designed to operate properly for 20 years or more without any maintenance. **It is the responsibility of the owner to test and maintain the system.**

Water for your fire sprinkler system is provided from the municipal water supply. Your fire sprinkler system is provided with a backflow preventer to protect the municipal water supply. The details of this component are shown in Figure 1.

Installed above the backflow preventer assembly is the sprinkler riser assembly. This component is shown in Figure 2.

Connected to the riser assembly is the piping which delivers the water to the sprinklers. The sprinklers installed on your system are pendant style sprinklers as shown in Figure 3. An escutcheon plate is provided to give a clean professional appearance. It is important to not hang items from the sprinkler frame or deflector and to use caution so as to prevent damage to the sprinklers.

Per NFPA 13D, Section 4.2.1 "The installer shall provide to the owner/occupant instructions on inspecting, testing, and maintaining the system." This manual serves as that instruction. Other items related to maintenance as described in NFPA 13D are provided below.

4.2 Maintenance.

4.2.1* The installer shall provide to the owner/occupant instructions on inspecting, testing, and maintaining the system.

4.2.2 Operated or damaged sprinklers shall be replaced with sprinklers having the same performance characteristics as the original equipment.

4.2.3 Any sprinklers that have been painted outside of the factory shall be replaced with a new listed sprinkler.

A waterflow switch will activate a buzzer in the event a sprinkler activates or if there is a break in the water line beyond the riser. When the drain valve is opened each month, the buzzer should sound and should reset itself when the valve is returned to the closed position.

Sprinkler piping routed in the attic is covered with insulation. The insulation should not be removed as this could lead to the pipe freezing and bursting during cold weather. Caution should also be used when walking in the attic space as stepping on the pipe could cause leaks or damage.

Additional guidance or instructions are provided in the Appendix.

Test cocks

Control valve Check Module Assembly Control Valve

Figure 1. Double Check Valve (Backflow preventer) Assembly. Installation is vertical

[Note: Control valves shown in "open" position]

Pressure Gauge

Pressure Relief and Drain Valve

Water Flow Switch

Figure 2. Riser Assembly

Figure 3. Fire Sprinkler

Acknowledgements

The CSRA Chapter of the Society of Fire Protection Engineers wishes to acknowledge the following organizations whose publications, websites or involvement in promoting residential fire sprinklers were used in the preparation of this guide.

American Fire Sprinkler Association

The American Fire Sprinkler Association, (AFSA) is a non-profit, international association representing open shop fire sprinkler contractors, dedicated to the educational advancement of its members and promotion of the use of automatic fire sprinkler systems. AFSA was organized in 1981 to provide the open shop fire sprinkler contractor with training, consulting, communication, representation and many more services, all of which have expanded over its existence. Membership is open to contractors, manufacturers, suppliers, designers and Authorities Having Jurisdiction. Currently, AFSA represents approximately 750 companies and individuals in the United States and throughout the world. AFSA believes that the installation of fire sprinklers could save thousands of lives and billions of dollars lost to fire each year. Increasingly, public officials are realizing this.

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Dallas, Texas 75243-8264

Voice: 214.349.5965

www.sprinklernet.org

Home Fire Sprinkler Coalition

The Home Fire Sprinkler Coalition was formed in 1996 in response to the tremendous need to inform the public about the life-saving value of home fire sprinkler protection.

The HFSC has developed educational material with details about automatic home fire sprinkler systems, how they work, why they provide affordable protection and answers to common myths and misconceptions about their operation. These materials are available upon request.

For additional information call 1-888-635-7222 or visit their website at www.homefiresprinkler.org

The National Fire Sprinkler Association

PO Box 1000

Patterson, New York 12563

(845) 878-4200 extension 133

www.NFSA.org

Fire Sprinkler Association/Residential Sprinkler Association, <http://www.firesprinklers.info> and <http://www.firesprinklers.org.uk>

Appendix

Several documents which provide additional information or guidance are provided in this section. The documents are provided here with permission of the organizations identified and are available on the organizations website.

The Case for Residential Sprinklers

(Provided by the National Fire Sprinkler Association)

Residential sprinklers represent a different approach and technology. They add fire suppression to the early warning of smoke detectors. First, a heat sensitive element-called the fusible link-detects the heat from fires. Second, the sprinkler releases water on the fire, extinguishing the fires or confining the fire until the fire department arrives. It is the ability of sprinkler systems to control or extinguish fires in their early stages that makes them such a critical tool in fire protection strategy.

Each sprinkler head responds independently, so that when heat is detected and the sprinkler goes off-which is referred to as "activation"-it puts water only on the affected area and not throughout the rest of the house or building. In roughly 90 percent of all documented sprinkler activations in residences, one sprinkler has been sufficient to control the fire¹⁵.

The Appeal of Sprinkler Systems

The cost of sprinklers is significant compared to smoke detector costs. But the appeal of sprinklers is also significantly geared, for several basic reasons:

Sprinklers offer a package of protection that is far broader than what can be achieved by other interventions. With sprinklers, the homeowners are protecting not only lives, but also the property, the furnishings, and all the intangibles of residential security and peace of mind

Sprinklers achieve these benefits with proven automatic technology. Like other state-of-the-art automatic restraint systems (e.g. airbags), they do not rely on changed human behavior to prevent accidents and loss. The vast majority of all residential fires today are estimated to have behavioral causes-like careless smoking, unattended cooking or children playing with fire. While we cannot design adults to never smoke carelessly or all children to not hide in the closet after they have accidentally set a fire, we can design sprinkler systems to control the results of this behavior.

Sprinklers offer opportunities for more effective use of fire and emergency service resources. Sprinklers systems do not necessarily reduce the number of calls for firefighters, but they do reduce the severity of the fire, thereby reducing danger to firefighters and complexity of response. And because sprinklers could diminish the requirements of fire suppression, they also make it possible for the fire service to allocate more resources to important Emergency Medical Service (EMS) demands, search and rescue needs, etc.¹⁶.

Sprinkler Experience to Date

Ten years ago there was little experience with how sprinklers-if they were installed in significant numbers of residential dwellings-would affect the nationwide fire problem.

Fortunately, we are now beginning to build a significant body of experience in various locations across the country.

Much of this work has been supported by the United States Fire Administration (USFA) as part of a concerted public and private sector effort to determine the appropriate role of residential sprinklers in the country's overall fire suppression and protection strategy. Some of the most extensive experience with residential sprinklers is reflected in the following locations or projects:

San Clemente, California in 1978, was the Nation's first jurisdiction to require residential fire sprinklers in all new properties.

Operation San Francisco, which in the early 1980s served as a national pilot project for residential sprinkler application and testing.

Operation Life Safety, a public/private consortium that, among other activities, monitors residential sprinkler activations all across the country, and tracks the human and property loss statistics for each of those activations.

Cobb County, Georgia, which has tested voluntary incentives, resulting in reduced construction costs, for builders who install sprinklers in new multi-family housing.

Napa, California, where a series of ordinances now require automatic sprinkler protection for a variety of new single and multi-family residences, including all new homes built more than 1.5 miles from a fire station.

Prince George's County, Maryland, which has required automatic fire sprinklers for all new residential construction, including single family dwellings, since 1987.

Scottsdale, Arizona, which passed the nation's most comprehensive sprinkler ordinance in 1985, requiring an automatic sprinkler system in every room of every new industrial, commercial or residential building in the city.

Several "retrofit" demonstration projects, supported by USFA and the National Association of Home Builders Research Center (NAHB-RC), to design and install sprinklers in low income single and multi-family housing units undergoing rehabilitation in a number of U.S. cities.

A self-contained, limited water supply sprinkler research and development project of USFA targeting mobile home fire safety.

Several demonstration projects, supported by USFA and NAHB-RC to identify barriers to residential sprinklers and solutions to these problems.

Port Angeles, Washington has been requiring sprinklers since 1986 in all newly constructed multi-family residential properties. They have also implemented a combination residential sprinkler system program reducing the cost of sprinkler installation by 30%. Subdivisions four minutes from a fire station are required to be sprinklered.

The Major Conclusions for Experience with Sprinklers

It is possible to draw a number of important conclusions about residential sprinklers from the projects and experience just listed. Most Significantly:

1. Residential Sprinklers Save Lives

The evidence on this point is overwhelming. There has not been a single residential fire fatality in a residence with a sprinkler system in either Napa, California or Cobb County, Georgia since the inception of those programs. There has not been a single fire fatality in Prince George's County, Maryland in a building with a sprinkler system. Scottsdale, Arizona credits sprinkler systems with saving up to 52 lives since the ordinance passed in 1985.

A 1984 report by the Bureau of Standards/National Institute of Standards and Technology estimated that the effect of adding fire sprinklers when smoke detectors are already present could reduce the number of fire fatalities by 63 percent.

A NFPA analysis of national data, collected from 1983 to 1992, indicates the number of fire deaths per 1,000 fires was reduced by 57 percent in homes with sprinklers.

2. Residential Sprinklers Reduce Property Loss

Again, the evidence is dramatic. Cobb County, Georgia and Napa, California reported minimal or incidental damage for all of their sprinkler activations, against potential losses extending into the millions, especially for Cobb's multi-family units. Nationally, average property loss in homes with sprinklers is 38% lower than homes without sprinklers, according to a NFPA survey of home fires reported to fire departments from 1983 - 1992.

Where communities have a great deal of experience with residential fire sprinklers the property loss reduction can be much higher. In Scottsdale, fire loss hit a ten-year low in 1992, despite nearly 30 percent population growth in the city in the previous decade. Scottsdale's tracking data show that the average loss in a home with sprinklers in the city, since 1985, has been \$1,382, while the figure for the average loss in a house without sprinklers is \$3,928.

3. Residential Sprinklers Costs Can Be Substantially Reduced and Offset

Builders are understandably reluctant to add to the cost of new construction, especially in a tough economy and at a time when there is already concern that large numbers of Americans are priced out of the new housing market.

Important research is underway to advance the technology, reduce the cost and identify ways to overcome barriers to widespread use. There is increasing evidence that innovations like combining the sprinkler system with the in-home plumbing system, streamlining of the design and permit process, acceptance of building code alternatives and new ideas in site plans for subdivisions can change the economics of sprinkler decisions.

Building code alternatives that communities can consider include: reduction in fire rated gypsum wall board requirements, alterations to attic fire stops, and reduced fire retardant standards for both masonry walls and doors. Cobb County, GA, is a national leader in building code alternatives, particularly for multi-family units.

More widespread is the use of alternatives in site plans for subdivisions that use residential fire sprinklers. Variations in length of set back, density of housing units, street width, turn around radius in cul-de-sacs, water main size and distance between fire hydrants, among others, produce cost savings for builders.

The United States Fire Administration is sponsoring a program with the National Association of Home Builders Research Center and the International City Management Association to identify barriers to residential fire sprinklers and test alternatives. They have developed and are testing a guide to simplify residential fire sprinkler system design and engineering and are working with combined domestic water and sprinkler system installations. In Cedar Rapids, IA, demonstrations, using the guide and a combined system, whole-sale costs have dropped under 50 cents per square foot. In their Prince George's County, MD, work, and in eight other sites, the guide has dropped costs to about 80 cents per square foot. Combined systems are expected to reduce these costs further.

4. Over Time, Residential Sprinklers Will Slow Increases in the Cost of Fire Protection and Allow the Fire Service to Put More Emphasis on Other Pressing Emergency Resource Needs.

Systematic studies of the comparative cost of fire service operation with and without residential sprinklers have not yet been done on a national basis, but individual community experience establishes a clear trend, especially in communities where rapid population growth would otherwise require significant expansion of the fire service. Several high-growth California communities report reduced growth of fire department costs, without any reduction in level of service. Former San Clemente Fire Chief Ron Coleman—who is now the California State Fire Marshal—recently noted how his service "used sprinklers as a means of controlling the fire problem without enormous increases in fire stations, equipment and manpower, as the communities were being built up."

Similar trends are reported for Scottsdale, Arizona, which grew by nearly 30, percent in the seven years after passage of the sprinkler ordinance. Today, Scottsdale citizens pay 30-50 percent less for fire services than residents in surrounding communities. But at the same time, according to Scottsdale officials, the city's Rural/Metro fire service is able to employ more than 50 percent more fire prevention personnel than the regional average.¹⁷ These individuals spend their time in public fire education, building inspection, plan review, arson investigation, and fire prevention administration. This reallocation of available resources, to growing EMS demands or to other basic public services (education or police for example) can be a significant benefit to localities across the country.

5. Residential Sprinklers Have Potential to Reduce Homeowner and Property Insurance Costs

At the present time, insurance reductions are much more common for multi-family units with sprinklers, or for institutional kinds of residential properties—nursing homes, dormitories, etc.—than they are for single family units. Owners of four of the five multi-family units involved in the USFA sprinkler retrofit project received reduction in insurance premiums, for example, after installation of sprinklers. The rate of reduction ranged from 4-40 percent.¹⁸ In the one and two family unit market, reductions occur, but thus far the timetable for action is longer and the percentages of reduction less dramatic. Collectively, more work is necessary to encourage the insurance industry to carry long-standing commercial insurance discounts for sprinkler systems to the residential market.

In general, the Insurance Service Office (ISO) recommends a 13 percent discount for a one or two family residential sprinkler system meeting NFPA 13D standards—with 2 percent more if smoke detectors are also present. This is from the total premium, not just the fire portion.¹⁹

The evidence from communities that have led the way with voluntary sprinkler programs or ordinances suggests that benefits to date are substantial, for both saved lives and saved property. The evidence further suggests that down-the-road benefits, in terms of reduced construction and insurance costs, and greater control of future fire service cost increases, will also be substantial.

Protecting Lives and Property with Residential Sprinklers: Where are We Today?

1. The incidence of residential sprinklers nation-wide is extremely low.

Today, residential sprinklers are probably found in fewer than one percent of all one and two family housing units. The nationwide figure for multi-family units, while believed to be greater, is probably less than 10 percent. Incidence of residential sprinklers in communities with ordinances and voluntary programs ran considerably higher-Prince George's County in Maryland estimates that 20 percent of all multi-family units, and 4 percent of one and two family units, now have sprinkler systems, for example. But nationwide, the penetration numbers are very low, especially if existing housing stock, as opposed to new, is considered.

2. A substantial amount of the research and demonstration work, to develop the technology for quick, reliable, and affordable sprinklers, has been completed.

USFA-supported research in the last 15 years has produced significant technological gain. The basic technology has been made to activate much faster (sprinklers now exist for residential use that have a response time five times faster than commercial sprinklers). Sprinklers have been adapted to meet the particular requirements of virtually every kind of residential housing.

Sprinklers are no longer unattractive (in the sense of being less obtrusive to the homeowner). Sprinklers are increasingly less demanding in terms of water flow-in many instances they operate off the domestic water supply and do not require any special lines or pumps. Low water volume units with self-contained water supplies have been developed to meet the particular requirements of manufactured homes, where fire danger is severe.

High priority research and development over the next few years needs to focus on sprinkler systems that will create the potential to give builders realistic cost saving construction alternatives when installing sprinklers in one and two family units. Especially important are "combined systems" in which the sprinkler system and domestic water supply are merged into a single component. It will also make retrofitting far more feasible economically.

3. The performance standards, covering specifications for sprinkler installation, maintenance and inspection) have been developed.

Sprinkler standards have been promulgated by the National Fire Protection Association (NFPA) for all types of residential dwellings. The NFPA, which represents a broad cross section of the industry-firefighters, architects, engineers, insurance companies, manufacturers, code officials and equipment installers and inspectors-developed the first residential sprinkler standard in 1975 and has updated and extended its work on a regular basis since then.

We now have a Standard (NFPA-13) for large (In most commercial) buildings, Standards (NFPA-13D) for one- and two-family dwellings and manufactured homes, and NFPA-13R for residential occupancies up to and including four-stories in height.

An additional standard - NFPA 25 - (which replaces NFPA-13A/14A)-was added in 1992 and covers the inspection, testing and maintenance of water-based fire protection systems, including sprinkler systems in accordance with NFPA-13. This brings the critical issue of quality control under nationally recognized standards. Periodic inspection of sprinkler systems is important to insure that they perform as intended. Work continues to ensure that simplified methods of design and engineering can be brought to residential systems.

4. There are a number of water, and water-related issues connected to sprinklers that need further resolution.

One issue relates to backflow prevention. Backflow prevention devices, which isolate the water used for sprinkler systems from that used for domestic purpose, are required in many jurisdictions. Various types of devices are available to perform this backflow function, however, in some communities the standards may be more stringent than needed to guarantee drinking water purity. This can adversely affect consumers by pushing up the cost of sprinkler system installation.

Additionally, water authorities in a number of communities around the country have adopted policies of charging fees to homeowners for the initial connection of the sprinkler system to the water supply (connection fee), and for maintaining the availability of water, should it be needed (standby charge).

The amount of the fees varies widely, and in some cases clearly constitutes a pronounced financial disincentive to sprinklers. In nearly 50 California communities surveyed in the first half of 1993, for example, the average residential connection fee is \$1,646 and the average residential standby fee is \$143 annually.²⁰

Sprinkler proponents believe that these fees-especially the standby fees-are questionable policy. There is no charge to homeowners who have not protected their property with sprinklers for the far greater amount of water that is needed to suppress a fire once it occurs. They are working with national water supply organizations to develop a more rational approach.

5. There is increasing Congressional action, and action on the state level, in support of residential sprinklers.

Congress has passed two pieces of legislation in the past three years that puts the leadership of the Federal government to work on behalf of sprinklers. The first, the Hotel and Motel Fire Safety Act of 1990, requires workers on Federal travel to stay only in facilities equipped with smoke detectors and sprinklers that meet the applicable NFPA standards. The second, the Federal Fire Safety Act of 1992, requires the installation of sprinklers in all newly-constructed government-owned high rise buildings, in all newly-leased Federal facilities, and in all multi-family Federally-assisted housing more than four stories in height.

At the state level, there is also action, especially from the National Association of State Fire Marshals which is playing a vigorous role, in cooperation with the United States Fire Administration, to ensure implementation of both of these acts. Some states have, in fact, enacted legislation on these issues.

6. Action in communities to introduce residential sprinklers in new construction is accelerating, and is thus significantly ahead of the code organizations with respect to one and two family dwellings.

Many communities across the country are proceeding with residential fire sprinkler system requirements. Cobb County, Georgia and Napa, California have been extensively profiled-they have been joined by hundreds of other communities. Increasing attention by building code organizations, including NFPA, demonstrate this growth in sprinkler interest. California jurisdictions appear to lead the country in residential fire sprinkler installation. In 1978 there was one community (City of San Clemente-population: 30,000) in California which had the requirement for "all newly constructed single-family dwellings to be equipped with residential fire sprinklers."

7. Homebuilders are offering home buyers options for residential sprinklers in new construction more frequently, as the benefits of sprinklers become better known and as incentives, in the form of construction alternatives, increase.

For the first time in 1993, there was a model house with sprinklers-the Safe and Smart Home-exhibited at the National Association of Homebuilders Annual Convention. The NAHB Research Center is presently working on demonstration projects-funded by the United States Fire Administration and conducted jointly with the International City/County Management Association-to implement construction alternatives that can bring down builders' costs for sprinklers. This project, identifying barriers to residential sprinklers and developing innovative alternatives, is an important initiative.

8. Public awareness of the benefits of sprinklers is low.

Increased public awareness is the critical next step in the drive to sprinkler America's residential housing. There are three avenues for action:

Highlight for all citizens the basic data about the extent to which sprinklers save lives and property. Even in advance of the code changes that will remove barriers to sprinklers nationwide, this can encourage the same consumers who demand airbags in their cars, and who spend several thousand dollars to protect their homes with electronic alarm systems, to demand homes with sprinklers. These consumers will seek to protect their families and seize an opportunity to improve their quality of life.

Educate the public with the facts about residential fire sprinkler technology:

Technology has created attractive, unobtrusive designs of residential fire sprinklers.

Residential fire technology has advanced reliability and responsiveness.

In experience to date, 90 percent of fires are contained with one documented sprinkler operating. Each residential fire sprinkler responds independently, resulting in fires rarely spreading beyond the room of origin.

A community with sprinklers will require significantly less water for fire suppression since a residential sprinkler uses as little as 10 to 18 gallons per minute, as compared to the 150 gallons per minute needed to manually suppress a small house fire.

Reach opinion leaders with information that links sprinklers with several broad and increasingly accepted truths—that the country needs affordable housing; that conservation of natural resources (i.e. water) is a must; and that we must find a way to reduce demand on public sector services. Residential sprinklers fit naturally into the debate around all three of these issues. Each is basically an economic issue, and it will be economic arguments that ultimately will drive the sprinkler issue. The conclusions will be that we cannot afford not to use sprinklers, given the alternatives, and that we must find ways—largely through construction and land use incentives and action on water charges—to bring down the cost of sprinklers. A concerted effort to reach opinion leaders with these economic arguments is a priority next step.

Conclusion

Residential sprinklers have the potential to reduce fire death and property loss attributable to fire. They can do so without jeopardizing the affordability of the housing stock in this country. They can enhance the capacity of public officials to provide for the health and safety of all our citizens—including those most at risk, such as the elderly, the very young, and the disabled.

At the same time, residential sprinklers can help to flatten future expenditures for fire—without diminishing the quality of fire service and protection. This is vital in a time of distressed public sector budgets.

Acknowledgements

The United States Fire Administration gratefully acknowledges the support of a number of individuals and organizations in the preparation of this report. It is impossible to cite the guidance of every individual and organization and we apologize for any omission. In particular we would like to acknowledge the support of the organizations involved in the Partners for Fire Safe Homes.

Bibliography

15. Operation Life Safety. "379 Activations."
16. Institute for Local Self Government. Op. Cit. Page 19
17. Scottsdale Rural/Metro Fire Department "Perspective on Progress." 1993. Page 4.
18. United States Fire Administration. "Residential Fire Sprinkler Retrofit Demonstration Project: Final Report" 1989. Pages 30, 55.
19. National Fire Sprinkler Association. "Homeowner's Guide to Fire Sprinkler Systems." Page 4.
20. Fire Sprinkler Advisory Board of Southern California "1993-Fire Sprinkler Ordinance Survey."

Homeowners Guide to Fire Sprinklers Systems

(Provided by the National Fire Sprinkler Association)

With Residential installation of fire sprinkler systems gaining in popularity and becoming one of the fastest growing segments of the fire sprinkler market, the National Fire Sprinkler Association decided to publish this informational guide to answer many of the questions asked most often by the consumer: It is intended to educate the new homeowner who has purchased a home with an existing fire sprinkler system and those who have built, or are building, a home that will have a new fire sprinkler system installed.

Ø What is a 13D system?

If your new house has a fire sprinkler system installed, chances are it is a 13D type system. 13D is the National Fire Protection Association's (NFPA) standard for the installation of fire sprinkler systems in one and two family dwellings and mobile homes. The standard was adopted by the NFPA in 1975 with periodic reviews and updates to allow for new technological breakthroughs.

To make fire sprinkler systems economically practical for dwellings, NFPA 13D permits omission of sprinklers from certain building areas where NFPA 13 (the standard for commercial occupancies) would require sprinklers. NFPA 13D also permits 2- sprinkler design areas so as to accommodate limited domestic water supplies. This means that the water supply only needs to be able to handle two sprinklers flowing water simultaneously among the total number of sprinklers in the building.

Ø How do sprinklers operate?

Fire sprinklers are individually heat-activated and connected to a network of piping with water under pressure. When the heat of a fire raises the sprinkler to its operating temperature, usually between 165-175°F, a fusible link or glass bulb will activate only that sprinkler over the fire, thereby releasing water only directly over the source of heat.

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Ø Why are sprinklers so effective?

The key to keeping a fire from reaching potentially dangerous and life-threatening proportions is early detection. Fire sprinklers operate automatically over the fire origin, even if you're not home, releasing water directly over the source of heat while simultaneously sounding an alarm.

Fire sprinklers keep fires small. In most cases, fires are controlled with one or two sprinklers.

Ø How reliable will sprinklers be in your home?

Fire sprinklers may be the most reliable fire protection system known. Of course, no one can guarantee you won't have a fire in your home, but if it has a fire sprinkler system installed, we can offer you these facts. In Australia and New Zealand (where fires must be reported) from 1886 to 1986, 99.7% of all fires in sprinklered buildings were controlled by the sprinklers. Although fire records in this country are less dependable, mostly due to the lack of reporting small fires in which sprinklers were successful, the NFPA reports a 96.2% success record for the years 1925 through 1969.

Ø Do sprinklers go off accidentally?

It is possible for a sprinkler to discharge accidentally but it rarely happens. In fact, if a sprinkler is not subjected to freezing, overheating, or mechanical damage, loss records show that only 1 in 16,000,000 sprinklers per year will open accidentally.

Ø What about sprinkler aesthetics?

Sprinklers are no longer the "ugly things hanging from the ceiling." Due to advances in sprinkler technology, sprinklers look better than ever, if you can see them at all. Sprinklers can be concealed in ceilings out of sight until needed to extinguish a fire. They are available in a wide range of sizes and colors to blend into the background of almost any room.

Ø What about water damage?

Water damage due to sprinkler activation is often grossly exaggerated due to comparisons made to small fire losses thanks to the sprinklers.

Actually, the water discharged by the fire department is typically ten to hundreds of times greater than that discharged from the sprinklers. During a fire only the sprinkler(s) closest to the fire are activated limiting the total amount of water needed to suppress a fire.

Ø What are the benefits?

Aside from the obvious property and life saving benefits, many insurance companies offer discounts to homeowners that have homes with fire sprinkler systems installed. The discount recommended by the Insurance Services Offices in most states is 13% for a 13D system, and an additional 2% if smoke detectors are also provided. This discount is from the total homeowners premium, not just the fire portion. Although no specific data is available, a fire sprinkler system should also increase the resale value of your home. At the very least it will be an added benefit to the prospective buyer.

Ø *For More Information, Contact:*

National Fire Sprinkler Association, Inc. Robin Hill Corporate Park - Route 22 P.O. Box 1000 - Patterson, NY 12563 Telephone: (914) 878-4200 Fax: (914) 878-4215

Ø *Do's and Don'ts For Your Residential Fire Sprinkler System*

Do:

1. Test your system monthly. (If your system is monitored by a fire service agency, be sure to notify them before testing the system. This will prevent sending a false alarm.) Open the test valve and listen for an alarm bell. Once the alarm sounds, turn off the valve. If alarm bell does not sound, contact a qualified fire sprinkler contractor.
2. Know the location of the system shutoff valve. Be sure all other adult occupants are aware of its location.
3. Make certain the system control valve is open at all times.
4. Have your system extended if your home is enlarged or remodeled. Contact a licensed fire sprinkler contractor Submit plans to the local fire department or fire prevention division as required to secure a permit.
5. Contact the fire department when any activation occurs, even if the fire has apparently been extinguished.

Don't:

- 1 Don't paint the sprinklers.
2. Don't damage the sprinklers.
3. Don't hang objects from the sprinklers.
4. Don't obstruct the sprinklers.
5. Don't cover the sprinklers.
6. Don't remove the sprinklers.
7. Don't turn off or disconnect the system.
8. Don't shut off the system in the event of a fire.

In the event of a fire, be calm and leave your home immediately. Call the fire department from a neighbor's house.

F.Y.I. - Maintain Your Fire Sprinkler System

(Provided by the National Fire Sprinkler Association)

Ø **How often should my system be inspected?**

The National Fire Protection Association publishes NFPA 25 Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. This document recommends that control valves without electronic supervision be checked on a weekly basis, just to make sure that they are in the open position. Other system components have different requirements. Check with the NFPA 25 or the manufacturers' literature for details.

At least four times each year, a full sprinkler system inspection should be performed by a knowledgeable professional. Some states and cities require more frequent inspections. Most sprinkler contractors offer economical long-term service agreements. These contractors can provide you with the test certificates which will comply with your insurance company and local fire department inspection requirements. _____

Ø **Are there other times when the system should be checked by knowledgeable professionals?**

Yes! Fire Sprinkler systems are designed to the conditions which exist, or are expected to exist, within a building when the sprinkler system is installed. After any changes to the building or the use of the building an analysis should be done to determine if the sprinkler system is adequate. Similarly, even if the building and its use remain the same, changes in the water supply or changes to equipment in the sprinkler system necessitate a reevaluation of the system. Any time a sprinkler system is reviewed for these reasons, it should be done by a fire sprinkler contractor or a registered fire protection engineer. The following is a partial list of situations where a full reevaluation should be performed.

1. Change or addition of backflow preventer or water meter.
2. Change of building occupancy or use.
3. Change in building (walls, partitions, additions).
4. Reduction in public water supplies (sometimes done in areas for water conservation).

Ø **Is there anything building occupants or employees can do?**

Yes! Although members of the general public are generally not knowledgeable enough to inspect, test, or maintain a fire sprinkler system, there are a few simple ways in which they can help:

1. Never paint any fire sprinkler.
2. Never hang anything from any part of a fire sprinkler system.
3. Never stack items close to fire sprinklers. (Tops of storage or furniture should be at least 18 inches below fire sprinklers.)
4. Always report damage to any part of a sprinkler system immediately.
5. Always make sure control valves are in the open position. _____

Ø **How does inspection affect my insurance rate?**

Buildings which are completely sprinklered enjoy special reduced rates. However, if the insurance company does not receive verification of system inspection, penalties in the form of higher insurance rates apply.

The Insurance Services Office (ISO) publishes a Commercial Fire Rating Schedule (CFRS). Section 402 of the CFRS requires building owners to have annual inspections of sprinkler systems to enjoy the "sprinklered" insurance rate.

If an inspection is overdue for up to 12 months, a 5% penalty applies. If the inspection is overdue for 12-24 months a 20% penalty applies. If an inspection is 24-36 months overdue, a 60% penalty applies. If after 36 months an inspection is still not performed, a fully sprinklered building is rated as "Unsprinklered" for the purpose of insurance, with no credit allowed.

Check with your insurance carrier about the rate for your building. Even though it is fully sprinklered you may not be getting as big a discount you're entitled to. Get your sprinkler system inspected and take full financial advantage of your fire sprinkler system.

Ø Are there financial benefits other than insurance for maintaining a sprinkler system?

Yes! Regular inspections of fire sprinkler systems will help reveal problems (if they exist) long before they become major. Sprinkler system repair can then be scheduled for a convenient time, saving you the cost of unnecessary business interruption.

Ø What about liability?

Recent court decisions have held building owners and managers liable because they did not have a fire sprinkler system in a building which had a fire. Even though sprinkler systems were not required in these buildings by fire or building codes, owners still had to pay out millions of dollars. Similarly, an owner or manager of a building with a fire sprinkler system would be held liable if he failed to maintain that system in a working condition.

In addition, owners and managers of commercial and business facilities have an obligation to maintain safe conditions for employees and occupants. By working in a sprinklered building, employees come to expect a certain level of protection. It is incumbent on the owner to maintain this level of protection.

Remember!

Owning a sprinkler system without having it inspected is like owning a car and never changing the oil.

Ø For More Information, Contact:

National Fire Sprinkler Association, Inc. Robin Hill Corporate Park - Route 22 P.O. Box 1000 - Patterson, NY 12563 Telephone: (914) 878-4200 Fax: (914) 878-4215

Automatic Fire Sprinklers: The Facts

(Provided by the American Fire Sprinkler Association)

- Automatic fire sprinklers have been in use in the U.S. since 1874.
- Fire sprinklers are widely recognized as the single most effective method for fighting the spread of fires in their early stages - before they can cause severe injury to people and damage to property.
- When one fire sprinkler head goes off to fight a fire the entire sprinkler system does NOT activate. Sprinklers react to temperatures in individual rooms.
- The chances of a fire sprinkler accidentally going off are extremely remote.
- Installation of fire sprinklers can provide discounts on insurance premiums.
- The costs for installing fire sprinkler systems in buildings 6 to 8 stories high ranges from under a dollar to about \$2.00 per square foot in most new construction and from about \$1.50 to \$2.50 per square foot for retrofitting sprinklers in existing buildings.
- The installation of fire sprinklers in new residential construction is estimated to make up around 1% of the total building cost. (Similar to the cost of new carpet)
- Over 200 U.S. communities have residential sprinkler laws. Roughly 100 of these communities are in California. In downtown Fresno for example, there has been fire damage of only \$42,000 during a 10-year period in which its sprinklering law has been in effect.
- According to the National Fire Protection Association, property damage in hotel fires was 78% less in structures with sprinklers than it was in structures without sprinklers during the years 1983-87. (Average loss per fire was \$2,300 in sprinklered buildings and \$10,300 in unsprinklered buildings.)
- Nearly half of all hotels and motels, according to a 1988 survey by NFPA, have sprinkler systems.
- NFPA has no record of a fire killing more than two people in a completely sprinklered building where the system was properly operating, except in an explosion or flash fire or where industrial fire brigade members or employees were killed during fire suppression operations.

Conclusion

The National Fire Protection Association outlines several major strategies that are key to reductions in fire losses and especially in home fire deaths, which are 78.3% of the total fire deaths. They are:

- More, and more widespread, public fire safety education on how to prevent fires and how to avoid serious injury or death if fire occurs.
- Residential fire safety initiatives remain the key to reductions in the overall fire death toll.
- Wider use and proper maintenance of smoke detectors, coupled with practiced home escape plans.
- Wider use of residential sprinklers.
- Additional efforts to make home products more fire-safe, such as less fire-prone cigarettes and child-resistant lighters.
- Addressing the special protection needs of high-risk groups, such as the young, older adults and the poor.

Fire Sprinkler Facts

(Provided by the Home Fire Sprinkler Coalition)

- Home fire sprinklers can contain and may even extinguish a fire in less time than it would take the fire department to arrive on the scene.
- Nationwide, more than 4,000 people die in fires each year.
Fire sprinklers save lives, reduce property loss and can even help cut homeowner insurance premiums.
- Installing both smoke alarms and a fire sprinkler system reduces the risk of death in a home fire by 82%, relative to having neither.
- Only the sprinkler closest to the fire will activate, spraying water directly on the fire. Ninety percent of fires are contained by the operation of just one sprinkler.
- Nationally, on average, home fire sprinkler systems add 1% to 1.5% of the total building cost in new construction.
- Nationally, on average, home fire sprinkler systems add 1% to 1.5% of the total building cost in new construction.
- Home fire sprinklers use only a fraction of the water used by fire department hoses.
- Home fire sprinkler systems are at least as reliable as home plumbing systems.
- Modern residential sprinklers are inconspicuous and can be mounted flush with walls or ceilings.

For more information on home fire sprinklers, individuals can call 1-888-635-7222.

F.Y.I. - Accidental Discharge of Fire Sprinklers

(Provided by the National Fire Sprinkler Association)

Automatic fire sprinkler systems are widely considered the single most effective tool for protecting life and property from unfriendly fire. There has never been a multiple loss of life from fire among building occupants protected by a properly designed, installed and maintained fire sprinkler system. Having an automatic sprinkler system protecting your home or workplace has been compared to having firefighters at the ready 24 hours a day. Automatic sprinklers respond individually to heat from a fire, distributing water under pressure at the source of a small fire before it can become large and deadly.

The idea of having water at the ready can be a concern to some due to the prospect of water damage. It is increasingly recognized that less water is needed to suppress small fires than large fires, and that a sprinkler system typically uses less than one-tenth the water to control a fire than the fire department would use in a nonsprinklered building. But what happens if there is accidental leakage from the automatic fire sprinkler system?

The fire sprinkler industry takes many precautions to ensure that accidental leakage does not occur. The automatic sprinklers and other system components are tested and listed by Underwriters Laboratories and Factory Mutual Research Corporation to make sure that these devices are not prone to leakage. Component designs are typically tested for integrity at four to five times the maximum water pressures they will see in service, and every single sprinkler is tested at twice its maximum service pressure before it leaves the factory. As a final step in the installation process, the entire sprinkler piping system is also tested under an elevated pressure for a two-hour period, and any leaks must be located and corrected.

There have been some instances where the performance of an automatic fire sprinkler has been so efficient that it is not immediately apparent that a fire took place. But if an automatic sprinkler has discharged water in the clear absence of a fire, an investigation should be undertaken to determine why the sprinkler operated. In almost all cases, a reason can be found. Typically, the reasons include inadvertent overheating, freezing, mechanical damage, corrosion, or deliberate sabotage.

Overheating - Automatic sprinklers respond to heat, and cannot differentiate between "good heat" and "bad heat". Where sprinklers are located very close to unit heaters, under skylights and in other areas exposed to high heat, the applicable rules of NFPA standard 13 - *Installation of Sprinkler Systems* require that higher temperature rated sprinklers be used. This means that the solder elements or glass bulbs used as the operating mechanisms will be designed to activate at temperatures of 200-300oF (93-149oC) instead of the normal 155-165oF (68-74oC). If new sources of heat are added, a qualified contractor should be hired to make the necessary modifications. Temporary heat-producing sources such as construction lighting and television cameras have also been known to activate sprinklers.

Freezing - Although special types of sprinkler systems are available for use in areas subject to freezing, most sprinkler systems are wet pipe systems, meaning that the piping is normally filled with water. If a system or even a small portion of a system is exposed to freezing temperatures, water in the piping can turn to ice, expanding in volume and producing thousands of pounds of pressure. Such pressures can break fittings, but can also force open the valve caps of sprinklers, resulting in apparent accidental discharge or leakage when the system subsequently thaws.

Mechanical Damage - The frame, the seat and the operating mechanism (solder link or glass bulb) of an automatic sprinkler together form a sealed unit that is expected to maintain its integrity, but also to operate efficiently if a fire ever threatens its protected area. The sprinkler parts are joined somewhat like a coiled spring, holding the energy needed to activate when released by heat from a fire. Mechanical impacts to sprinklers can result in damage and separation of parts. Although it is obvious that a large force can immediately open a sprinkler, it is less obvious that a smaller impact can do the same thing over time. For this reason, it is important that sprinklers be carefully handled during the installation process, and that the proper wrenches be used during their installation. Special wrenches are often required by the manufacturers' literature to reduce the possibility of slippage that can damage the sprinkler operating mechanism, potentially resulting in a release of parts weeks or months later. Building renovations can also result in impacts of sprinklers, leading to an inadvertent discharge or leakage at a later date.

Corrosion - Corrosion can result in a weakening of parts, and a subsequent release of water. This can occur among very old sprinklers, or sooner with sprinklers installed in a harsh environment. Many fire codes require enforcement of NFPA 25 - *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*. This standard requires that the building owner replace sprinklers that exhibit corrosion, loading or other damage.

Deliberate Sabotage - Deliberate acts of sabotage must also be considered when investigating the reasons for sprinkler discharge. Vandalism and insurance fraud have been found in the past to be motivations for tampering with sprinklers.

Manufacturing Defect - The likelihood of an automatic sprinkler opening in the absence of the above reasons was historically found to be extremely low - on the order of one per year per sixteen million sprinklers in use. These statistics were based on the use of traditional sprinklers, however, not the more sensitive sprinklers of today that feature lighter operating mechanisms for enhanced fire performance. Although very rare, the possibility of a manufacturing defect can be considered when all other potential reasons for inadvertent operation have been ruled out. This could take the form of a problem in loading or tolerances on the parts. The sprinkler manufacturer should be contacted, and arrangements can be made for professional analysis.

Keys to proper analysis of the reasons for unexpected sprinkler discharge:

1. **Salvage of all sprinkler parts.** Pieces of the sprinkler operating mechanisms can often be located during clean-up activities and, like the sprinkler frame remaining in the piping, are extremely valuable in helping to determine the reason for sprinkler operation.
2. **Complete observation of the surrounding physical environment.** The history of the sprinkler is important. For newer sprinklers, this includes the conditions under which it was shipped to the jobsite, stored and installed. For sprinklers that have been in service for some time, the conditions of use include the possibility of damage from materials handling equipment, the potential exposure to freezing conditions, and the possibility of temporary heat sources.

Following an unexpected operation of a fire sprinkler, prompt and thorough collection of parts and data can mean the difference between an unexplained mystery and a documented problem. Better understanding of the reasons sprinklers operate accidentally will help ensure that fire sprinkler systems are there when needed...to protect lives and property.