

Residential Fire Protection and Life Safety

There are few sights more poignant than a charred and melted smoke detector lying amid the wreckage after a house fire. The firefighters have come and gone, the ambulances have taken away the injured, and nothing is left. There *is* a way to alert you to the presence of fire while protecting you, your loved ones, and valuable property while you escape.

This information has been posted as a public service by First Defence Fire Protection to raise public awareness and appreciation of these effective little devices. Some of these documents may contain copyrighted material, all of which is/are gratefully acknowledged.

Link to [Firebusters](#) in Vancouver!

Now you can get directly to my [home page](#), which was recently named Cool Site of the Week! uploaded by hurricane on May 21, 1997



Some Very Frequently Asked Questions

There is no such thing as a "dumb" question about fire sprinklers. The entire sprinkler trade has remained on the periphery of the construction industry since the beginning, and as a result our work is not well understood. This document is designed to answer several of the most frequently asked questions about sprinklers. An e-mail address at the end of the document will enable you to ask your own questions, or simply comment about what is presented here.

Q: *How do sprinklers work?*

A: Currently there are two major mechanisms on which sprinklers operate: fusible link, and glass bulb. The fusible link has been around practically as long as there have been sprinklers. A solder designed to melt at a certain temperature is used to keep a cap over the orifice of the sprinkler. When the solder absorbs enough heat, it melts, the cap comes off, and water gushes forth.

The glass bulb uses the same principle, except that the bulb shatters instead of melting. The glass bulb has a couple of significant advantages over the solder-type: they can operate much more quickly, and they operate at a much more precise temperature. They are also more aesthetically pleasing.

Q: *Why should I put them in my house?*

A: The majority of fires and fire deaths in this country still occur in a residential setting. According to the Canadian Automatic Sprinkler Association,

"...in 1987 there were 30,735 fires in this category, 46% of the Canadian total. These fires resulted in 439 deaths, or approximately 85% of the nation's fire fatalities, and 2,603 fire injuries, or approximately 68% of the nation's fire injuries..."

That means that 85% of the people who die in fires in Canada die in residential fires.

Part of this figure can be attributed to the fact that we spend more time proportionately at home, but remember that we are many times more likely to have sprinkler protection in our places of work or recreation than we are at home.

Q: *Don't they all go off at once?*

A: No! Because they use a heat-sensitive mechanism, only the sprinklers over a fire will operate. TV and movies are NOT being accurate when they show every sprinkler in the building going off all at once. For you, a homeowner, this means that you will not destroy your house with water damage if a sprinkler goes off.

Q: *How much water damage could there be?*

A: Let's put it this way: when the pumper truck arrives and the firefighters tie a 4-inch line into a hydrant and run a few 2.5-inch lines from the truck to your house, each of those 2.5-inch lines is throwing at least 250 gallons *per minute* onto and into your house. They will do this for at least half an hour, or until the fire is out. They will also spray the houses on either side of your own, to try preventing the spread of the fire.

Sprinklers each throw out a maximum of 20 gallons per minute, and as a rule, only one or two sprinklers will operate, and again as a rule, the fire will be out in ten minutes. The math isn't that hard. Firefighters and 15 000 gallons, or sprinklers and 400 gallons.

Q: *How big a fire can sprinklers put out?*

A: The whole idea is to catch a fire while it is small, before it engulfs the entire house. That's why sprinklers operate so quickly when there is excessive heat in a room. When a sprinkler operates, the sprayed water cools the hot combustible gases which are building up at the ceiling. This prevents a condition called "flashover" when all those gases literally explode and send fire throughout the house. The cooling effect is also discussed in the Life Safety Record document.

Q: *What if they go off accidentally?*

A: That is an extremely unlikely occurrence. The Factory Mutual Research Corporation has compiled data which indicates the failure rate due to manufacturing defect is about 1 in 16 *million* sprinklers per year in service. Obviously, most accidental discharges are due to mechanical damage or freezing damage.

Q: *Aren't the sprinklers themselves rather ugly?*

A: Improvements in technology have allowed sprinklers to become smaller and more effective than ever before. They also come in different finishes to suit your interior. Some sprinklers are completely concealed behind a small metal disc.

Q: *Do the systems require a lot of maintenance?*

A: The recommended maintenance is a monthly test, which is as simple as opening and closing a valve to test the alarm bell. The sprinklers themselves require nothing other than an occasional dusting.

Q: What do I need to put a system in my home?

A: One of the most critical factors in planning a system for your home is having an adequate water supply. If at all possible, we urge that a water supply line of 1.5" be installed from the supply main to the property line. Most new houses are planned with a 3/4" line, but that is simply inadequate because too much pressure is lost through that small pipe. Your system designer will determine if the water pressure is sufficient to complete the design.

Q: How much does a system cost?

A: The cost will vary according to the size of the house, and the presence of unusual architectural features, but a reasonable figure to use for budget purposes is approximately \$1.25 per square foot. Retrofitting an existing house is more costly.



What's In Store For Us?

No one has a crystal ball with which to see into the future, but by looking at current trends and judging the effects of key decisions, we can put together some likely scenarios.

No governing body will be immune to budgetary demands. Municipalities will be forced to make more and more compromises to satisfy everyone, and as a result, resources available to fire departments and emergency services will be reduced. This means fewer firehalls, fewer firefighters, and slower response times. It is then crucial that there be alternate fire suppression and life safety systems in place to fill the gap. This is already occurring around the City of Edmonton where subdivisions may be too far from a firehall for acceptable response times. In these subdivisions sprinklers are a mandatory requirement in homes.

Even in established areas we are seeing response times increase as traffic densities increase. There is no viable alternative at this time that will better protect citizens and reduce costs for governments than sprinkler systems. As buildings age and deteriorate, fire becomes more of a hazard, and sprinklers become more essential as a life safety system. As civic infrastructure deteriorates, the effectiveness of manual firefighting apparatus decreases, and more lives and property are put at risk. It's a sad thing to have to say, but it may take a huge tragic fire for people to realize just how essential sprinklers are now.

More and more constructions not normally associated with fire sprinklers will be protected, partly due to advances in technology, and partly due to the proven record of effectiveness. Tests are underway now to assess installations on passenger aircraft and passenger ships. The aircraft installations will most likely use a sprinkler that produces a fine spray, thus reducing the volume of water needed on board. The ocean-going cruise ships are surrounded by water, and therefore have an infinite supply. These are just some of the directions that fire protection and life safety are going now and in the future.



The Fire Sprinkler Safety Record

The life safety record is absolutely the best evidence we could present to make the case for residential fire sprinkler protection. ***There has never been a multiple loss of life in a fully sprinklered building.*** Consider

the following facts :

- In Canada, between the years 1971-1975, an average of 8000 people annually lost their lives in unsprinklered buildings. In that same period, an average of 20 people annually lost their lives in sprinklered buildings.
- 68% of the lives lost in sprinklered buildings were due to explosions, and an additional 18% were due to the fact that the fire originated in an unsprinklered area of the building.
- In Australia and New Zealand between the years 1886-1968, 99.76% of all fires in sprinklered buildings were controlled or extinguished by the sprinklers.

source: Canadian Automatic Sprinkler Association

One of the first questions to be asked in any discussion about sprinklers is, "I've got a smoke detector, why do I need sprinklers?". Some of the reasons are thus: a smoke detector cannot reduce the temperature of the air around you; it can't put the fire out; and it can't make it safer to escape the building.

When a fire starts, hot combustible gases accumulate at the ceiling. Within two minutes, the temperature can reach 400 degrees Celcius. Very soon after that, those gases will explode spontaneously, throwing a fireball throughout the house. This explosion is called "flashover". Any flammable item within reach will catch fire, and in under ten minutes the entire house will be an inferno.

Residential sprinklers are designed to activate in less than a minute. The cold water being sprayed in the air cools those hot gases dramatically, and douses the fire (residential sprinklers are designed to provide a survivable environment near floor level, which is critical when you consider that most victims of fire die from the heat and smoke inhalation). The whole idea is to catch the fire while it is still small. In those instances where a fire has overwhelmed the sprinklers, an accelerant such as gasoline or kerosene has usually been involved. There is absolutely no doubt at all that fire sprinklers are the most effective form of fire protection.

We in the industry feel that smoke detectors make useful supplements to sprinkler systems, but they in no way can equal the effectiveness of a sprinkler system alone. Here are some figures to mull over:

- Now approximately 11 of 12 homes are equipped with smoke detectors. The death rate in homes with detectors is only 40% lower than in homes without.
- The reduction in death rate associated with sprinkler systems in residential settings is not less than 69%.
- The reduction in death rate associated with both sprinklers and smoke detectors in residential settings is approximately 82%.

Thus far we have looked at residential applications, primarily single-family dwellings. It is important to also look at multi-family and high-rise situations. Because of their height, high-rise buildings present special challenges to fire control. Firstly, the firefighters can't reach up past the sixth or seventh storey on ladder trucks. Secondly, there are far more people to evacuate from a large building, and only a few exits they can use. Thirdly, firefighters inside have to carry heavy gear great distances to fight the fire.

It is for these reasons that fire hose stations have been provided in high-rises for the past several decades. Sprinklers, as we have seen, are the most effective form of fire control and life-safety enhancement available, and more multi-family buildings are being equipped with them. Keep in mind again that there has never been a multiple loss of life from fire in a fully-sprinklered building.



Who Are The People That Do This?

The Designers

Every sprinkler system is designed by a professional designer or engineer. There is a lot of specialized knowledge required to properly plan a layout and correctly perform the calculations. It is for this reason that sprinkler system design is not a do-it-yourself activity.

By consensus, the standard all designers in North America must meet is a document produced by the National Fire Protection Association known as NFPA 13. There are other organizations such as Factory Mutual and Insurer's Advisory Organization who have standards which go beyond NFPA 13, but those are implemented on a case-by-case basis.

Quite often, the local building authority will have local requirements for sprinkler systems and it is up to the designer to be familiar with those particular covenants. This arrangement is called Authority Having Jurisdiction. A system which may be permissible in one city or province may not be in another, for a variety of reasons.

The Installers

As with design, installation is performed by people with specialized training and experience. An installer (or fitter) is not a plumber, and he will become quite indignant if you call him a plumber. There is a specific 4- or 5- year apprenticeship program for sprinkler installation, and while a plumber could handle the work itself, the code standards, the methodology and some of the materials are different. The vast majority of sprinkler installers are men, and this simply reflects the fact that it is hard, heavy, and dirty work.

The Firefighters

As much as sprinklers help the firefighters do their job, many firefighters distrust sprinklers and sprinkler designers. It certainly isn't our goal to put them out of work, or make it more dangerous. In fact, sprinklers make it safer for firefighters by reducing the levels of toxic gases, cooling the building, keeping it structurally safe, and reducing the need to go up on ladders or onto roofs. We do want them to arrive at the scene and be able to make sure the fire is out, determine the cause of the fire, as well as protecting other properties in the area. The biggest advantage sprinklers have is response time, and this is discussed further in the Life Safety Record document.

The Homebuilders

There seems to be great reluctance on the part of homebuilders to include sprinklers in the homes they build, and it is NOT because they doubt the efficiency of sprinklers. They feel the cost is too high to be passed onto the owner, and will make their product non-competitive. However, as stated in the FAQ document, the cost is around \$1.25 per square foot. This a small fraction of what the owner will spend on floor coverings or appliances. This series of documents is designed to help homeowners understand how cost-effective a sprinkler system is, especially if an insurance discount is available.

We in the industry feel that acceptance will gradually increase as awareness increases, and eventually a

sprinkler system will be a standard inclusion in a home contract. After all, fifteen years ago, you couldn't give away a driver's-side airbag, and seatbelts were considered a nuisance.

The Homeowners

There is no "typical" buyer of a sprinkler system. They are from all walks of life and they all have different reasons for investing in a sprinkler system. There are a few common themes, however: they have been through the horror of a house fire; or they haven't, and don't want to go through the horror of a house fire.

Some jurisdictions have a mandatory requirement for sprinklers in all dwellings. The City of Vancouver, for example, has required sprinkler protection in all new dwellings since April of 1990. The track record since the regulation came into effect is brief, but all indications show a significant trend towards a decline in fire-related death (before the issue of real estate values comes up, consider that it costs very little more to physically build the house; it's the *land* which drives the price).

We in the industry feel that we have to reach the homeowners, one at a time if necessary, to demonstrate the advantages of residential sprinkler systems. This isn't an unproven or radical technology, just a lifesaving one.

The Insurance Companies

Just like everyone else, the sprinkler industry has a love-hate relationship with the insurers. They seem more willing to rebuild a house from the footings up rather than replace some carpet and baseboards. Some companies are better than others, and it falls upon the owner to find an insurer who offers discounted premiums for homes equipped with a system. The insurance industry has been strangely silent, considering the reduction in fire deaths and fire damage possible.

Another good source of fire safety information is the United States Fire Administration (USFA).

Where Sprinklers Came From

The whole concept of using a water delivery system to automatically extinguish fire is not a new one. In fact, the earliest recorded application was a barrel of water, a gunpowder charge and a series of fuses. Entertaining, if not effective! Even back in 1723 they were serious about fire control.

The first real ancestor of the sprinkler system was installed in 1852 and it consisted of a series of perforated pipes which dribbled water onto the fire. While an automatic sprinkler was invented in 1864, it wasn't until 1878 that a sprinkler was invented which was used all over the Northeastern US seaboard.

While this new technology was gaining in popularity, it seemed that everyone who designed a system had their own set of rules to work by. Just one hundred miles around Boston, there were nine distinct and different sets of rules by the year 1895. All this variety was just making things more confusing, so in 1895 a group of men met to agree upon a standard set of rules that would be applied to all systems across the US. These people were from both the insurance industry and the sprinkler industry, and in 1896 they created the National Fire Protection Association (NFPA). The rules and standards published that year was known as the Standard for the Installation of Sprinkler Systems, the same name it is known by today.

For a long while the industry was concerned with protecting commercial and industrial buildings, but it soon became apparent that sprinklers could reduce the number of lives lost in residential fires. In 1975 a new standard was published: Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes.

All the standards governing the installation of sprinkler systems have been updated on a regular basis to keep up with advancing technology, and in some cases, they are the incentive which leads to new technology. A system designed to these standards will provide the best possible protection for you and your property.