Guide to Promoting Automatic Fire Sprinkler Systems

- A Road Map for Advocacy -

International Fire Suppression Alliance, Ltd.

November 2022

The International Fire Suppression Alliance (IFSA) is a not-for-profit association created in 1999 "to globally promote the use of effective water-based fire protection systems." The IFSA's strategic plan is intended to foster the formation and growth of national and regional organizations to promote the fire sprinkler concept around the world. Membership in the IFSA is open to any corporation, partnership, trade association, society or person engaged in the manufacture, sale, installation, design, inspection, testing, maintenance, promotion or regulation of fire sprinkler, water spray or water mist systems. For more details on the IFSA, please visit www.ifsa.global.

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PREFACE

The author is grateful to the Board of Directors of the International Fire Suppression Alliance for encouraging the development of this Guide. The individuals and their companies that make up the IFSA Board have demonstrated a commitment to the cause of fire protection worldwide through the increased use of fire sprinkler systems:

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Although the IFSA has a mission statement that addresses all water-based fire suppression systems, including water mist systems, this document is focused on automatic sprinkler systems due to their longer history of development and greater acceptance as a fire protection technology. Similarly, while efforts have been made to include examples of international experience in fire sprinkler advocacy, much of the material in this Guide is based on the lessons learned in North America, where advocacy for fire sprinkler systems has its longest history.

It is my sincere hope that this guide can serve water-based fire suppression system advocates with a body of historical context, evidence of successful strategies, and lessons learned that can be used and applied to their efforts. It is further hoped that, based on their own experience, those advocates can expand this document to record the history of successes from many other nations around the world.

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July 2022

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INTRODUCTION

At its Annual Meeting on June 14, 2021, the International Fire Suppression Alliance (IFSA) Board of Directors authorized the creation of a fire sprinkler development guide that could be used as a reference by advocates to advance the use of fire sprinkler systems around the world. It was envisioned that such a "road map" could be used to describe the various means by which organizations in countries around the world had been successful in increasing the use of automatic fire sprinkler systems.

It is recognized that all countries and regions are not alike. Building regulatory systems, business methods, and even grassroots advocacy patterns vary considerably. Yet this document was created to allow all readers to benefit from the experience of others, showing efforts that have been fruitful and might have application in their part of the world.

As part of the development process for this document, twelve international fire sprinkler advocates were surveyed and interviewed regarding their experience. These advocates constituted an informal advisory group, and the IFSA thanks them for their contributions:

Alan Brinson*, European Fire Sprinkler Association (EFSN), UK*

Victor Espinola*, Asociación Mexicana de Rociadores Contra Incendios (AMRACI), México*

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Jaime A. Moncada*, International Fire Safety Consulting (IFSC), Latin America*

Mark Whybro*, Home Fire Sprinkler Coalition Australia*

This guide is written with the understanding that, in a perfect world, quality fire protection would be the goal for everyone, and voluntary installation of automatic fire sprinkler systems would be widespread. However, considering the economic pressures facing many building owners and code officials, in combination with the perception that fire is an infrequent and limited severity risk, providing protection against fire often becomes a low priority. When there is a low priority for protection against fire, the risks to life safety become greater for occupants such as residents and workers, for the public as a whole, and for responding firefighters.

Advocates of automatic fire sprinkler systems are aware of the proven effectiveness and reliability of these systems in achieving unmatched success in reducing fire related deaths, injuries, property losses, and related economic/environmental damages and work to convince government regulators of the need to encourage or mandate their installation through regulation. But there is also a critical need to ensure that enforcement officials have the appropriate expertise to confirm compliance with the adopted regulations, and to verify that only properly certified equipment is used. As efforts are made to improve regulations to encourage and require fire sprinkler systems, parallel efforts are needed to identify key enforcers, secure, or develop appropriate training materials, and implement enforcement official training. This is absolutely critical to the goal of achieving effective fire sprinkler protection, both in terms of initial installation, and to the ongoing inspection, testing and maintenance of the systems.

It is the hope of the IFSA that this Guide be translated as necessary to be of use in as many parts of the world as possible. However, in the event of language variations or ambiguities due to translation, the original English version shall be consulted for determination of the original and official intent.

CHAPTER ONE:
IS THERE A "BEST WAY" TO PROMOTE THE USE OF FIRE SPRINKLERS?

At the start of this project, the advisory group of international fire sprinkler advocates were asked to rank ten commonly cited strategies to promote greater use of automatic fire sprinkler systems on a scale from 10 down to 1, where a unanimous vote as the best possible method would be assigned a value of 10.0, and a unanimous vote as the least effective method would have been given a score of only 1.0. The ten methods in order of perceived effectiveness are presented below:

7.3 Convincing code writers to require sprinkler systems for specific occupancies

7.0 Encouraging fire authorities to promote fire sprinklers

6.9 Creating economic incentives in building codes for sprinkler systems

6.5 Proposing legislation to enact fire sprinkler requirements

5.5 Advancing installation standards that lower sprinkler installation costs

5.1 Encouraging property insurance discounts for sprinklers

4.7 Informing public opinion as to the effectiveness of fire sprinklers

4.2 Promoting tax incentives for property owners to install sprinklers

4.0 Urging recognition for fire protection engineering, and

3.8 Educating the public as to how fire sprinkler systems work.

It is clear from the above scoring that the perceived effectiveness of each measure varies considerably. And while it is not clear from these figures, there was also a noticeable variation in opinion among the advocates seemingly dependent upon their global location. What might work best in a country with a well-established system of building regulation is different from what might work best in a country with no such system in place. For that reason, this Guide presents each of these strategies, and notes some of the factors that would make them more or less effective in various situations.

So, this "roadmap" for sprinkler advocacy presents a variety of routes to the destination of increased use of fire sprinkler systems. But the first order of business is the establishment of an advocacy group that can make this journey.

CHAPTER TWO: FORMING AN ADVOCACY GROUP

On May 18, 1999, the inaugural meeting of the International Fire Sprinkler Association (IFSA) was held in Baltimore, Maryland, USA. Representatives from ten companies along with staff from the National Fire Sprinkler Association (USA) agreed to establish a new organization dedicated to increasing global awareness of the effectiveness of automatic sprinkler and other water-based fire suppression systems.

Shortly following its founding, the IFSA adopted a Vision Statement that challenged the organization to become "the worldwide center for information on automatic water-based fire suppression systems and the leader in advancing the widespread use of such systems."

From the start, the IFSA recognized that local groups are in the best position to drive the demand for improvements in building regulation and codes to protect the public, which in turn drives the demand for all types of fire protection systems. So, the first plank in achieving the IFSA vision was identified as "Fostering the development of national and regional organizations with similar objectives." As such, a high priority for the IFSA continues to be finding individuals, groups, and companies in various parts of the world interested in forming national or regional associations, and providing seed money needed to get such organizations up and running.

Over the past twenty-three years the IFSA helped organize and establish organizations that include the European Fire Sprinkler Network (EFSN), the Brazilian Association of Sprinklers (ABSpk), and the National Association of Automatic Fire Sprinkler Systems Colombia (ANRACI). The IFSA has also provided funding in support of the programs and projects of already-existing organizations that shared IFSA priorities, including the British Automatic Fire Sprinkler Association (BAFSA), United Sprinkler Industry (Netherlands), the Mexican Association of Automatic Fire Sprinklers (AMRACI), the National Fire Sprinkler Association (USA), the National Fire Sprinkler Network (UK), Home Fire Sprinkler Coalition Australia and Sprinklerfrämjandet (Sweden).

All these groups have received IFSA support for programs that encourage broader use of automatic fire sprinkler and water mist systems. These programs have included research programs demonstrating the effectiveness of water-based fire protection systems, side-by-side burn demonstrations showing how systems operate in fires, and a variety of training programs aimed at improving the knowledge and abilities of enforcement authorities and others in the building community.

<u>What are the key steps needed to form a local advocacy group and help ensure success?</u>

1. A small number of individuals must first agree that a group focusing on fire suppression will provide the greatest opportunity for success.

Associations dedicated to improved fire protection in general are much more common than organizations focused on automatic water-based fire suppression systems. Such groups often perform a valuable and much needed public service, raising awareness of the dangers of fire and helping to improve public fire safety. However, these organizations are often supported by a broad range of fire protection interests and therefore often have limited ability to effectively promote automatic fire suppression systems, since there may be a desire to balance the demand for the "active" fire protection systems with traditional "passive" approaches to fire protection, such as the use of noncombustible construction and firestopping products. And although the fire alarm and fire sprinkler industries often work hand in hand and have members in common, i.e. companies that provide both types of systems, even the fire detection and alarm interests can hold back movements for greater use of fire sprinkler systems.

The small group of men and women who undertake this task will be rightly considered the "founders" of the advocacy group.

2. An initial decision must be made as to the geographic scope of the proposed new organization.

Advocacy groups, most notably trade associations, are most effective if their intended geographic area of influence matches that of the governmental regulators responsible for creating building safety standards. With regard to the fire sprinkler industry, the regulatory authorities are often national, and it therefore often makes sense to form national advocacy groups. Where regulatory authorities or social norms cross national boundaries and extend into broader regions, then regional groups can also function well. In places like the United States and Canada, where regulations are developed at both the national and state/provincial level, there are often separate state associations that may or may not be affiliated with the national organizations.

In Europe, the original 2002 plans to establish a European Fire Sprinkler Network (EFSN) were developed in a joint effort of the IFSA and the Sprinkler Section of the European Committee of the Manufacturers of Fire Protection Equipment and Fire Fighting Vehicles (EUROFEU). From the start it was recognized that any European entity would also need to work with individual national fire sprinkler organizations where they existed, since there already were such organizations in Germany, Sweden, the United Kingdom and elsewhere. But it was also recognized that the EFSN could help guide efforts in countries where no such associations were yet in place.

3. An initial meeting must be convened to assess the level of interest and commitment on the part of potential members.

The initial meeting is of greatest importance, and it is imperative that a full range of industry partners be invited, including representatives of relevant product manufacturers, installing contractors, specifying design professionals, fire authorities and others known to play a role in or otherwise support the fire sprinkler industry. The larger and broader the base of membership, the greater the likelihood of success. At this initial meeting, the "founders" must lay out their vision for the group, speak of potential achievements, and encourage the participation of all. Success will be evidenced if there is a general agreement that planning should proceed, with a draft membership, dues basis and election of officers to be decided at a follow-up meeting.

4. A follow-up meeting must be held no more than a few months later.

If too much time elapses between the initial meeting and follow up meetings, the momentum achieved from the initial meeting can die. The second meeting is therefore crucial, not only to carry out the tasks of reaching agreement on the organization's name, membership structure and fees, and initial election of officers, but to evaluate the genuine interest of potential members. There are many models for governance of associations, but a governing board consisting of eight to ten individuals representing the interests from several industry partner groups is generally ideal for a new organization: small enough to work together well, but large enough to bring in a wealth of experience and ideas.

If there is a requirement or desire to legally form and register the organization, all decisions needed to complete the process should be discussed and agreed upon at this time. Agreement should also be reached about future meetings.

5. Engaging a staff person may well make the difference between success and failure of the new organization.

It would be a mistake to ignore the fact that the majority of founding members of a local organization are often extremely busy with their own companies, organizations and projects. For this reason, the IFSA has always encouraged organizations to put themselves in a position to hire a staff person as soon as financially possible. In fact, the IFSA has often made hiring a staff person a prerequisite to obtain future funding. Not only will a staff person be able to devote the necessary time but will also have a vested interest in ensuring success for the organization.

If the budget permits, a full-time staff person should be employed since a dedicated effort is expected to result in a greater return on investment. If necessary, however, a part-time staff person can still greatly enhance the image and effectiveness of the new organization. When interviewing

candidates for a staff position, it should be recognized that while experience in fire protection can be an advantage, it is not a necessity. Efforts instead should focus on communication and leadership skills. Writing and public speaking abilities, along with organizational and interpersonal relationship skills, are the keys to success in nonprofit associations.

For multi-national regional Associations, and national associations serving multiple provinces/states that have individual authority for building and fire regulation, it should be a long-term goal to hire regional representatives to serve these individual areas when growth leads to the ability to support a larger staff. Experience in North America and Europe has shown that regional representatives are highly effective in helping to carry out strategy objectives at the regional level.

6. Committees or task groups must be established to reflect priorities.

The organization should discuss and prioritize its goals and assign small groups to move forward in these areas of effort. While participation in the small groups should be open to all members of the organization interested in the subject area, it is most efficient if the chairperson of each committee or task group is a member of the new association's governing board so that the board is integrated into the execution of the various advocacy efforts.

Areas of effort can be as diverse as the various paths for advocacy: promoting code changes, working toward programs for industry competency, or educating the public and/or regulatory authorities. Side-by-side burn demonstrations with otherwise identical sprinklered and non-sprinklered room scenarios have become a popular way of demonstrating the effectiveness of fire sprinkler protection.

The IFSA stands ready to assist all advocacy groups in their efforts to promote the fire sprinkler concept around the world.

CHAPTER THREE: LIMITATIONS OF INSURANCE INCENTIVES FOR SPRINKLER SYSTEMS

Of the ten common strategies used to expand the use of fire sprinkler systems, insurance incentives were the principal motivation during the first century of sprinkler protection. While receiving only a score of 5.1 in the survey, insurance incentives are often the only factor driving the installation of sprinkler systems in some parts of the world today, particularly in areas where there is limited building regulation or a lack of clear mandates or incentives.

Dating back to the industrial revolution, the property insurance industry recognized the ability of fire sprinklers to prevent major losses, and established rate structures that incentivized property owners to protect their buildings. Even before automatic sprinklers were available, insurance companies encouraged the use of noncombustible materials and other building features that could minimize potential losses to fire. The story is told that in 1871, the year prior to the great Chicago fire, Lloyds of London altogether stopped writing fire insurance policies in Chicago out of concern for the local construction methods.

Earlier in that century, a New England textile mill owner named Zachariah Allen was the first business executive to highlight the impact of automatic sprinkler systems and other fire protection features in reducing fire losses. Following improvements he made to his mill to minimize the chance of a fire loss, he asked his insurance company for a reduced premium but was turned down. He then reached out to other mill owners who shared his loss prevention philosophy and formed a mutual property insurance company that would insure only "good risks". By limiting losses, they shared the surplus premiums that remained at the end of a policy term. Allen's efforts led to the formation of the Factory Mutual System, the precursor of FM Global as well as the concept of "highly protected risk (HPR)" properties, which rely heavily on automatic fire sprinkler systems to limit fire losses. As more and more fire sprinkler systems were installed, the cost of insurance in sprinklered HPR properties went from 30 cents per hundred dollars of property value in 1875 to 4 to 5 cents per hundred dollars within thirty years.[1]

However, the extent to which the installation of automatic sprinklers can pay for itself over time depends on the occupancy and other features of a building. In the United States, for example, restaurants of wood frame construction had such a poor fire record at one time that the cost of a installing a fire sprinkler

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1 Rhodes, Jack, "Automatic Sprinklers, the Past, the Present, and a Glimpse Toward the Future," *Fire Journal*, November 1974

system could often be recouped by insurance savings within a matter of three years[2][3].

Property insurance premium savings will tend to be largest for the buildings with the greatest risk to property and content value, but property insurance premiums do not address all the inherent costs and operational risks posed by fire. Property insurance does not address the life safety hazards to occupants or responding firefighters, and most liability insurance policies do not account for the increased risk of non-sprinklered buildings. As a result, while providing sprinkler protection generally reduces property insurance premiums, it is extremely unlikely that insurance incentives alone can be a driving force in creating widespread use of sprinkler systems.

Moreover, because the installation of sprinkler systems for insurance premium savings is largely a commercial transaction between property owner and insurance company, advocacy groups are generally not active in this area. In fact, perhaps the best thing that can be done to promote insurance incentives is to ensure that sprinkler systems are properly designed, installed, and maintained, which has proven benefits to reduced losses. Product certification, along with a system of testing and certifying the competence of individuals involved in system design and installation, is discussed in Section 4.4 of this Guide.

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[2] Fleming, Russell P., "What Cost Sprinkler Protection?", Buildings, Endeavor Business Media, LLC, May 1982

[3] Fleming, Russell P., "What Cost Sprinkler Protection?", Sprinkler Quarterly, National Automatic Sprinkler & Fire Control Association, June 1981

CHAPTER FOUR: FIRE CODES AND FIRE SPRINKLERS

The fire sprinkler advocacy strategy that received the highest level of endorsement (7.3) was "Convincing code writers to require sprinkler systems for specific occupancies", and the second highest (7.0) was "Encouraging fire authorities to promote fire sprinklers", which also could manifest itself through regulatory code changes. But what is a code? And what role do fire sprinklers play?

4.1 The Obligation of Governments to Provide Protection from Fire

Most agree that fire safety is both an individual and a public responsibility. In a workplace, commercial or multi-family residential environment, or non-domestic environment, the person responsible for overall fire safety is generally the person in operational control of the premises. Correspondingly, where there is the possibility of an unsafe environment, governmental authorities are often considered responsible to ensure that proper measures are taken to provide adequate public safety.

Governmental regulations relating to fire safety and protection are generally considered to be a police power. Police power, while difficult to define, is universally conceded to include the inherent power of a government to ensure public safety, health, and morals, and to justify the destruction or abatement, through proper proceedings, of whatever may be regarded as a public nuisance. Examples of police power can include the demolition of a house falling to decay or otherwise endangering the lives of passersby, the slaughter of diseased cattle, the regulation of railways and other means of public conveyance, the compulsory vaccination of children, or the prohibition of gambling. With specific regard to fire protection, police power can range from the demolition of a dangerous or deteriorating building in the path of a fire, to the outright prohibition of wooden buildings in cities, or a ban on consumer fireworks.

In most parts of the world, in order to justify the imposition of governmental authority on behalf of the public, the government must demonstrate that the interests of the general public require such intervention and that the means are reasonably necessary for the accomplishment of the purpose and not unduly oppressive upon individuals. Governmental judicial systems generally supervise the exercise of police power such that there are no unnecessary restrictions or other intervention in business or lawful professions under the guise of protecting the public interests.

4.2 A Brief History of Building and Fire Codes

The earliest known governmental regulation of building safety was part of the Law Code of Hammurabi, the 6th king of Babylon, issued in 1754 BC. The Code contained 282 rules establishing standards for commercial interactions and setting fines and punishments to meet the requirements of justice. It was discovered in 1901, carved onto a massive finger-shaped stone pillar.

The Code contained multiple provisions based on the "eye for an eye" concept of justice:

> 229 If a builder builds a house for someone, and does not construct it properly, and the house which he built falls in and kills its owner, then that builder shall be put to death.
>
> 230 If it kills the son of the owner, the son of that builder shall be put to death.
>
> 231 If it kills a slave of the owner, then he shall pay, slave for slave, to the owner of the house.
>
> 232 If it ruins goods, he shall make compensation for all that has been ruined, and inasmuch as he did not construct properly this house which he built and it fell, he shall re-erect the house from his own means.
>
> 233 If a builder builds a house for someone, even though he has not yet completed it; if then the walls seem toppling, the builder must make the walls solid from his own means.

While this and other early building codes were principally aimed at preventing structural collapse, citywide fires, conflagrations not caused by warfare, were recorded to have taken place in Crete in 1450 BC, Babylon in 538 BC, Carthage in 146 BC, and Rome in AD 64. It was therefore natural that building regulations would eventually address fire hazards as well.

In 871, Alfred the Great of England instituted fire prevention measures, including the covering of cooking fires at night, and in 1189 the Mayor of London proposed party walls of stone to mitigate fire spread, although the rules weren't enforced well enough to prevent the Great London Fire of 1212.

The idea of requiring the use of noncombustible materials to prevent fire spread made its way to the United States. The earliest American cities like New York and Boston required that dwellings be constructed of brick or stone with roofs of slate or tile to restrict the spread of fire.

In 1896, the National Board of Fire Underwriters (NBFU) developed its first model building law and unsuccessfully lobbied to have it adopted by the State of New York. The effort led to the 1905 publication of an NBFU Building Code, considered to be the first "model building code", a full collection of technical

requirements for building construction specifically written in a manner intended to be adopted into law by a government. This NBFU model code was later published under the name National Building Code and was updated periodically until 1967. In total, there were 14 editions of the NBFU's National Building Code, eight of which were complete revisions. This code pioneered the development of fundamental code principles such as building height and area requirements, means of egress, fire resistive construction, shaft enclosure, parapets, fire walls and doors, firestopping, and suppression systems.[4] Cities were responsive to adopting building regulations to avoid major conflagrations that could devastate the local economy through destruction of their industrial infrastructure. Great fires were taking place in almost every city until building codes were developed to address the threat.

The 1905 NBFU model code contained requirements for sprinkler systems in portions of buildings, including the below-grade areas of mercantile and manufacturing occupancies, and for sprinklers throughout the entire stage area of theaters behind the proscenium curtain, including workshops and dressing rooms. While the rationale for the underground requirement was not documented, the requirement for sprinklers in theaters was likely in response to the 1903 Iroquois Theater fire in Chicago that began in the stage area and killed 602 spectators. As such, this was probably the first of many tragedies that resulted in a public outcry for improved protection in the aftermath of a fire tragedy and led to increasing requirements for automatic sprinkler systems in building regulations.

In the United States, large cities like New York and Chicago could afford to write and update their own building codes, but smaller cities and states decided to band together in regional groups to write and regularly update additional model building codes as alternatives to the insurance industry's NBFU National Building Code:

1927 – The *Uniform Building Code*, published by the International Conference of Building Officials (ICBO)

1947 – The *Standard Building Code*, published by the Southern Building Code Congress (SBCCI), and

1950 – The *Basic Building Code*, published by the Building Officials and Code Administrators International (BOCA).

Each of these three model codes was widely adopted in parts of the United States. But deviations in the requirements between them and the manner in which they were adopted at the state or local level often created conflicts that hindered progress in construction means, methods and materials from jurisdiction to jurisdiction. In 1972, in an effort to address and eliminate these

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[4] *BOCA National Building Code*, Tenth Edition, Building Officials and Code Administrators International, Inc., 1986, p. iv.

conflicts, the three model code groups began to collaborate through the creation of a Council of American Building Officials (CABO), and the three groups merged in 1994 to form the International Codes Council (ICC). The ICC today writes a family of coordinated model codes including the International Building Code (IBC), the International Fire Code (IFC), and a number of companion specialty codes for mechanical systems, plumbing, fuel gas, energy efficiency, and other areas of concern to public safety and health. One key item of note is that while the majority of the ICC model documents are intended for application to new construction, the IFC is written in a manner to apply to both new and existing buildings. The document contains fire safety requirements for specific hazards, as well as operational and maintenance requirements for building owners and tenants to ensure that the fire/life safety provisions remain obligatory throughout the life of any building.

It should be noted that while the ICC family of codes has evolved to become the basis for most of the state and municipal building codes across the United States, the ICC has drafted the documents in a manner that allows them to be adopted by any jurisdiction around the world. For example, the current building codes of Saudi Arabia, Abu Dhabi, and Bermuda are all based on editions of the International Building Code. Moreover, because these documents are so detailed and well-coordinated, they are also often used as a key reference for many others around the world.

But the ICC is not the only author of adoptable model codes. The National Fire Protection Association (NFPA) also publishes a model fire code (NFPA 1), a model building code (NFPA 5000), and a "Life Safety Code" (NFPA 101®) that are all widely referenced, adopted, and enforced in the United States and around the world. International users of some of these NFPA codes include Ecuador, Costa Rica, the Dominican Republic, Peru, Kuwait, and the United Arab Emirates.

Some other countries have followed similar code development paths. In Canada, for example, building regulation is the responsibility of the Provinces, Territories and Municipalities. In an effort to coordinate and standardize materials, means and methods of construction nationally the Canadian Federal Government began a program of model code development and maintenance in the 1930s, with first edition of the National Building Code of Canada published in 1941. As in the United States, cities and provinces are permitted to use the model code as the basis of their building regulations without modifications, or they can make local amendments to suit their needs during the adoption process.

Most other countries have developed their own building codes and regulations, but many such codes reference other codes and standards to match product and material requirements in neighboring countries or regions and to significantly reduce the amount of time, effort, and costs required to develop and maintain a full set of building regulations. For example, the European Community has "Eurocodes" that deal with the design of structures of various

materials and wide range of CEN Standards that address particular product or installation requirements, but Europe does not have a comprehensive model building code. This is because building codes are within the legislative competency of individual European countries, each of which has its own history of fires that have led to code changes, while local considerations of climate, preferred materials and styles have also led to code differences.

A common feature within most building codes is a system of occupancy classifications, which is the basis of risk assessment. These classifications acknowledge that the level of risk from fire correlates to how the building or structure is being used, both in terms of the people occupying the structure and the contents of the building. Requirements for minimum levels of inherent fire safety including fire resistance, required means of egress, combustibility of allowable finish materials, alarm and fire sprinkler systems, and other aspects of protection depend on the occupancy classification in conjunction with the area and height of the building. For example, consider the different risks of various occupancy groups:

Assembly – Any fire presents dangers to large numbers of individuals not familiar with exits, and nightclubs involve special hazard of alcoholic beverages impairing judgment

Institutional and Residential – Fire threatens sleeping individuals or those incapable of self-preservation

Mercantile – Large numbers of people and significant stockpiles of combustibles, and

Factory and Storage – Fewer occupants, but hazards to responding firefighters and potential economic damage to the community.

One of the advantages of a building regulatory system based on periodic adoption of model codes is that the model codes are updated on a regular schedule, generally every few years. This allows for the codes to address new techniques and new technologies. It also allows for public input, including that of advocacy groups.

The United States may have the most extensive history of code advocacy from a group focused on fire sprinklers. The National Fire Sprinkler Association (NFSA), which traces its founding to 1905, made a policy decision back in the 1960's to promote greater use of fire sprinklers through building codes. It formed a Building Code Committee and hired staff to participate in the model code development process, leveraging the regional model code development groups against one another in an attempt to accelerate adoption of requirements and incentives for sprinkler systems within their respective code documents. As opposed to simply requesting expanded fire sprinkler mandates within the codes, the sprinkler advocates often worked toward creation of incentives or "trade-offs" that would offset the additional cost of installing sprinklers by reducing costs in other areas of construction, which is addressed

in greater detail in Section 4.5 of this Guide. This approach often meets less resistance from developers and politicians committed not to increase the cost of construction.

The recognition of fire sprinkler systems as key life safety features has increased substantially through the decades since model building codes were first published and adopted in North America. And although cities and provinces/states throughout North America often adopt the model codes with local amendments, fire sprinkler systems are generally required in new construction of these occupancies:

- All new high-rise buildings
- All new large public assembly buildings, including nightclubs
- All new hospitals, nursing homes and other health care facilities
- All new mercantile shops and warehouses over 1200 m^2
- All new hotels and apartment buildings, and
- In two U.S. states (California and Maryland) and the District of Columbia sprinkler systems are required in every new single-family dwelling.

As in North America, code improvements in other parts of the world also tend to follow fire tragedies. In Brazil, where the São Paulo codes and regulations are generally viewed as the model for the rest of the country, many of the code's requirements for fire protection were put in place in response to two high-rise fires that took place in the early 1970s: the Andraus Building fire in 1972 killed 16 people and the Joelma Building fire in 1974 killed 179 others.

However, advocacy organizations can bring about code improvements even without tragic fires. Although the European Fire Sprinkler Network (EFSN) did not exist until 2002, it was able to report by 2006 that many European countries were beginning to recognize the need for sprinkler systems in high-rise buildings. It pointed to a new German requirement for sprinklers in commercial buildings over 30 m in height and in residential buildings over 60 m in height, a Scottish requirement for sprinklers in new residential buildings over 18 m in height, a Catalonian requirement for sprinklers in all new buildings over 50 m in height, and an expected English requirement for sprinklers in new residential buildings over 30 m in height.[5] Since 2006 most European countries have introduced national height thresholds for sprinklers, although these threshold heights still vary considerably.

It should be noted that for the purposes of this Guide, a Building Code is a regulatory document that outlines the minimum requirements for new

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[5] *International Sprinkler Scene*, IFSA, January-April 2006.

construction, alterations, and additions to existing structures. If the alteration or addition is substantial, most building codes require that the entire building be brought up to meet the requirements of the building code currently in effect. Otherwise, existing buildings are not regulated under the current building code, i.e. the provisions of a building code are not retroactive.

A Fire Code, on the other hand, can contain minimum requirements for new construction, but also contains requirements applicable to the use of a building, and can result in the imposition of new or special requirements addressing changes in use or hazards within the building even without a change in the construction features of a building itself. For this reason, a Fire Code often contains provisions that are retroactive in terms of its requirements.

In some countries and jurisdictions, requirements relating to fire protection are excluded from the building code and presented only in the fire code. In other areas, great care is taken to ensure compatibility of the fire code with the building code, so that the fire code requirements don't prevent use of a newly constructed building that meets the requirements of the building code.

4.3 Active vs. Passive Protection

One reason that fire protection requirements are generally included in the building code is that the fire resistance of building materials has traditionally played a large role in the determination of acceptable level of fire risk for various occupancies. In Europe, for example, each of the Eurocodes identified in Section 4.2 contains a section on structural fire design intended to ensure structural integrity.

Standardized time-temperature tests are conducted by materials testing laboratories to assign various building components or assemblies with a fire rating, generally expressed in terms of the maximum time a fire door, a window, or a combination of materials within a sample wall or floor/ceiling assembly can withstand the effects of a test fire without failure. In some cases, the testing laboratories apply a hose stream at the end of the predetermined period to ensure that the component or assembly retains its structural integrity.

Relying on the fire resistance rating of building components to prevent the spread of fire and the damage to property and life associated with that spread has become known as a "passive" approach to fire protection, since the building components are already in place and are presumed to play their role should a fire occur.

The use of automatic sprinkler systems to achieve fire safety is considered the opposite – an "active" approach that requires the system to operate in response to a fire. Fire alarm systems and smoke control systems are likewise considered active systems although, unlike fire sprinkler systems, fire alarm and smoke control systems do not actively attempt to suppress or control the fire.

Proponents of passive protection have historically used the term "fireproof" to describe a building constructed of noncombustible materials to the point where the structure would survive a fire. As far back as 1905, however, the NFPA and others have recommended that use of this term be discontinued in favor of the term "fire-resistive."[6] Since that time it has become more widely appreciated that it is primarily the contents of a building that can burn and result in the destruction of lives and property.

Of the active systems, fire sprinkler systems have a unique advantage over all others. Automatic sprinkler systems are the only broadly applicable and widely used technology that can actively control and often extinguish the fire, thereby eliminating the threat. This can be particularly critical for those who may be hindered or unable to evacuate.

4.4 The Proven Effectiveness of Automatic Fire Sprinkler Systems

Proponents of a passive approach to fire safety often question the reliability of active systems, particularly fire sprinkler systems. But passive systems have failure rates as well, as documented in field surveys and fire loss experience that have revealed breaches of fire-resistive barriers, inadequate firestopping, fire doors and dampers that fail to close, and other deficiencies. For example, one of the first major fire tragedies in the United States in 2022 took place in a non-sprinklered high-rise residential building in the New York City Borough of The Bronx, where the deaths of 17 people, including eight children, were blamed on the failure of two automatically-closing doors to properly function, one being the door to the apartment of fire origin, and the other being a door into the exit stairwell on an upper floor.[7] Failures such as these are unfortunately all too common, yet there are few studies of reliability of passive systems that can be readily compared to the historically excellent performance of automatic fire sprinkler systems.

4.4.1 Studies of System Effectiveness

When the NFSA began advocating for increased recognition of automatic sprinkler systems in United States in the 1960s and 1970s, the NFSA

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[6] Stevens, Richard E. and Cote, Arthur E, "A Brief History of NFPA's Codes and Standards," *Fire Journal*, May 1986.

[7] "Bronx Fire: Mayor Revises Number Killed to 17, Including 8 Children," *New York Times*, January 10, 2022

demonstrated the effectiveness of sprinkler protection in controlling and extinguishing from two primary sources.

The first were the statistics compiled by the NFPA, based on performance of sprinkler systems as reported to its Department of Fire Record[8]. This information was published in the *NFPA Quarterly* as the Automatic Sprinkler Tables and was also made available in pamphlet form for distribution to the public. Records of sprinkler performance had been collected since 1897, and as shown in Table 4.4.1-1 below, no significant changes in the performance of systems appeared to have taken place over time, despite an increase in the types and severity of hazards.[9]

For the purpose of these early statistics, "Satisfactory" performance indicated that the fire sprinkler systems adequately suppressed and controlled the fire. Conversely, "Unsatisfactory" performance included not only poor suppression performance of an operating sprinkler system, but also fires when the water supply had been shut off or was otherwise inadequate at the time of the fire, which accounted for approximately one-third of all "unsatisfactory" incidents.

Table 4.4.1-1: NFPA Summary of Sprinkler System Performance

NFPA Summary of Sprinkler System Performance in the United States 1897-1969				
	Fires 1897-1924		Fires 1925-1969	
	Number	Percent	Number	Percent
Satisfactory	31,388	95.8	78,291	96.2
Unsatisfactory	1,390	4.2	3,134	3.8
Total	32,778	100.0	81,425	100.0

More detailed incident data collection has subsequently been compiled through the use of the National Fire Incident Reporting System (NFIRS) administered by the U.S. Fire Administration starting in the mid-1970s.

The performance of automatic sprinklers in other countries generally matched the performance in North America, and the second source used in NFSA advocacy efforts in the 1970s was from Australia. Sir Harry Marryatt, a founder of the Australian Fire Protection Association, published a book in 1971 that demonstrated an even higher level of sprinkler system performance than in the

[8] "Automatic Sprinkler Performance Tables – 1970 Edition", Fire Journal, Vol 64, No. 4, 1970.

[9] Ault, Wayne E., "Sprinkler Systems" in Fire Protection for the Design Professional (edited by. R. Jensen), Cahners Books, 1973.

NFPA summary.[10] Satisfactory performance was defined as fires in which the building "suffered only minor damage and the loss of contents through fire, water, and smoke is a relatively small proportion (say of the order of not more than 20%) of the total value involved."

Taking advantage of the fact that all fires in Australia and New Zealand were required to be reported to the government by law, he compiled data on 5,734 fires in sprinklered buildings that had taken place in those two countries over 82 years. He later published a second edition expanding the record to a full century of sprinkler system performance that included 9,022 fires in sprinklered buildings as shown in Table 4.4.1-2 below.[11]

The outstanding record achieved by sprinkler systems in Australia and New Zealand over a century of fires has been credited not only to full reporting, but to other factors as well. These include requirements that systems have direct alarm reporting to fire brigades along with excellent programs of system inspection and maintenance.

Table 4.4.1-2: Marryatt Summary of Sprinkler Performance

AFPA Summary of Sprinkler Performance in Australia and New Zealand 1886-1986		
	Number	Percent
Satisfactory	8,973	99.46
Unsatisfactory	49	0.54
Total	9,022	100.0

In recent years the concept of "satisfactory performance" has been further refined to include the concepts of reliability and effectiveness. For example, the NFPA recently analyzed data supplied by U.S. fire departments participating in the National Fire Incident Reporting System (NFIRS), estimating that sprinkler systems were present in ten percent or 51,000 structure fires a year in the U.S. between 2015 and 2019. Overall, they estimated that fire sprinklers operated in 92 percent of the fires considered large enough to activate sprinklers and were

[10] Marryatt, H.W., Fire – Automatic Sprinkler Performance in Australia and New Zealand 1886-1968, Australian Fire Protection Association, 1971.

[11] Marryatt, H.W., Fire – A Century of Automatic Sprinkler Performance in Australia and New Zealand 1886-1986, Australian Fire Protection Association, 1988.

96 percent effective in controlling those fires.[12] The fire was confined to the object or room of origin in 95 percent of the fires in sprinklered structures, and only a single sprinkler operated in 77 percent of the fires in which sprinklers operated. Sprinklers were credited with reducing fire deaths by 89 percent and injuries by 27 percent compared to fires where an extinguishing system was not present.

There have been other recent studies addressing the issue of sprinkler system reliability and effectiveness, including:

- Inspection reports analyzed in Denmark in 2001 showed that 98 percent of the systems were capable of functioning as intended.[13]
- A review of Swedish Rescue Services data from 2004 to 2015 conducted for the Swedish fire sprinkler association Sprinklerfrämjandet showed a reliability of sprinkler systems in excess of 99 percent.[14]
- A 2017 UK Chief Fire Officers Report found sprinkler systems were effective on 99 percent of fires when operating and operated as expected on 94 percent of fires.[15]

Additional reports from France, Germany and Poland also show system reliability of 95-98%[16][17][18]. Ensuring reliability and effectiveness of sprinkler systems requires that the systems be properly designed, installed, and maintained. Standards like NFPA 13[19] address proper design and installation,

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[12] Ahrens, M., *"U.S. Experience with Sprinklers"*, National Fire Protection Association, October 2021, www.nfpa.org.

[13] Reliability of Automatic Water Sprinkler systems (AWS Systems), DBI Report 2008:02, Danish Institute of Fire and Security Technology, 2008.

[14] Melin, Marcus, Reliability of automatic water sprinkler systems, Brandkonsultan AB, 2017

[15] "Efficiency and Effectiveness of Sprinkler Systems in the United Kingdom: An Analysis from Fire Service Data, Optimal Economics for the National Fire Sprinkler Network and the National Fire Chiefs Council, May 2017

[16] "Facteurs d'influence sur la capacite d'une installation sprnkleur a fondtionner correctement", CNPP Report, April 2012

[17] "Special Feature Issue – Risk factor of fire", Schadenspeigel, Muchener Ruckversicherungs-Gesellshaft, 2006

[18] Tofilo, Piotr and MLynarz, Adam, "Reliability and Effectiveness of Sprinkler Systems in Poland", The Main School of Fire Service, 2021

[19] NFPA 13 – *Standard for the Installation of Sprinkler Systems,* National Fire Protection Association, www.nfpa.org

and standards like NFPA 25[20] address system inspection, testing, and maintenance. In Europe, EN 12845[21] includes design, installation, and maintenance in a single document.

4.4.2 Ensuring Effectiveness – System Design and Installation Standards

Traditionally, building and fire codes have regulated "where" sprinkler systems are required to be installed, with published standards, usually adopted by reference, within those codes dictate "how" systems are required to be installed. As such, standards that address the design and installation of fire sprinkler systems play a key role in ensuring the effectiveness of the systems.

Originally both codes and standards were published as "regulations", but in 1940 the National Fire Protection Association changed the word "regulations" in its committee reports to "standards" to make it clear that there was no intent to imply mandatory legal application where none existed.[22] Therefore, a standard has no legal standing until it is adopted or referenced for use by a jurisdiction, in whole or part, through legislative action that makes the standard a legally binding set of rules.

While the code may make a simple reference to requiring a fire sprinkler system, the design and installation standard contains complex rules governing the proper use of sprinklers and other components of the systems. These include rules involving sprinkler spacing, location and positioning with respect to obstructions, minimum water pressures and flow rates needed to address the severity of the hazard being protected, as well as acceptance testing and documentation.

Although building and fire codes occasionally call for the use of partial sprinkler protection to address specific hazards within a building, most code requirements and allowable incentives call for buildings to be "fully sprinklered" in accordance with the referenced design and installation standard. This term is generally interpreted as a requirement to install sprinklers throughout a building except in specific areas permitted to be without sprinklers under the rules of the applicable standard. For example, sprinklers are typically not required to be installed within combustible wall spaces and most

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[20] NFPA 25 – *Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems*, National Fire Protection Association, www.nfpa.org

[21] EN 12845 - *Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance*, European Committee for Standardization (CEN), www.en-standard.eu

[22] Op. Cit., Stevens and Cote 1986.

noncombustible building shafts. In general, sprinklers are not required where there is insufficient space to make the installation of sprinklers practical, or where there will always be an insufficient amount of combustibles to generate enough heat to activate the sprinklers.

Additional information on the role of design and installation standards is provided in Chapter Nine of this Guide.

4.4.3 Ensuring Effectiveness – Certification of Sprinkler Products

A crucial item in fire suppression system reliability is product quality, which is best assured through product standards and certification programs. This would include, but may not be limited to, sprinklers, valves, pipe, fittings, and supports. The IFSA has long recognized that when fire suppression market growth takes place without attention to product quality the demand for water-based fire protection will be filled by suppliers willing to sell substandard products and equipment at lower cost into the international marketplace. As such, the IFSA has made it a priority to stress the need for fire sprinkler advocates to include the promotion of product certification from reputable product testing and certification bodies such as UL, FM, LPCB, and VdS be incorporated as part of their efforts to improve local regulatory code requirements.

In 2018 the IFSA produced a video stressing the need for product quality certification by revealing the potential inadequacies of non-certified sprinklers removed from service in Brazil, which had been hard-hit by low quality products entering their marketplace. The video has been made available in English, Spanish, Portuguese, Chinese, Arabic and Turkish, and viewing is possible through the IFSA website.[23]

Such efforts at ensuring sprinkler product quality are proving successful. At the end of 2018, it was announced that Brazilian sprinkler association ABSpk had won a considerable victory, with legislation passed in the State of São Paulo to require product certification.[24] Due to the fact that most of Brazil tends to follow the leadership of São Paulo State, this victory is having nationwide ramifications.

Because product certification by a recognized testing laboratory is of vital importance for any components whose operation is critical to the success of any fire protection or life safety system, including fire sprinkler systems, government regulators should specify which product standards are to be used and which approval laboratories, foreign or domestic, are acceptable in

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[23] www.ifsa.global

[24] *International Sprinkler Scene*, IFSA, January-March 2019.

verifying compliance with these standards. It should be noted that it will almost always be more cost effective for regulators to adopt existing standards already being applied in other nations, thereby eliminating the costs of creating and maintaining these standards, as well as reducing the costs associated with performing the necessary testing.

4.4.4 Ensuring Effectiveness – Certification Programs for System Technicians

Certification programs for individuals engaged in the design, layout and detailing of fire sprinkler systems help ensure that the individuals preparing design and installation plans are properly qualified. In North America, the NFSA approached the National Institute for Certification in Engineering Technologies (NICET) in 1980 to convince them to begin testing and certifying fire protection technicians, beginning with those active in layout and detailing of fire sprinkler systems and proving the framework for other fields of fire protection industry including fire alarm and non-water suppression systems.[25] The NICET program was later extended to individuals involved in the periodic inspection and testing of systems.

In Mexico, AMRACI has developed a similar Spanish-language certification program through an organization they established with IFSA assistance and known as CETRACI.[26] In several European countries, third-party review of system design and installation by inspection firms is mandated to ensure the quality of installations and systems are periodically inspected by these bodies thereafter. Furthermore, contractors in many countries are assessed and accredited by third-party bodies as well to assure the competency of the company and individuals within it who design and install systems.

4.4.5 Ensuring Effectiveness – Requirements for Inspection and Testing

Although properly certified sprinklers and related products are expected to stand ready to suppress fires over a lengthy service life, sprinkler systems must nevertheless be periodically inspected, tested, and maintained to ensure their proper performance over time. Fire pumps and other mechanical components require regular exercise to assure their full functionality. Above all, valves controlling water supplies must be maintained in the open and ready position,

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[25] www.nicet.org

[26] www.amraci.org/certificacion-cetraci/

which can be best assured through electronic supervision with proper alarms communicating to constantly manned supervising stations.

As mentioned in Section 4.4.1, there are stand-alone industry standards addressing water-based fire protection system inspection, testing and maintenance, and there are standards that include similar requirements within system design and installation rules. Regardless of where these requirements reside, periodic inspection, testing and maintenance must be required, and such requirements are best contained in a fire code, placing the obligation for compliance upon the building owner and giving governmental regulators a means to require and verify that it be performed. In some cases, this responsibility can be transferred to a tenant or other party, but an enforcing authority needs to make sure that the necessary work is accomplished.

In summary, to support a strong role for automatic sprinklers and other water-based systems in building and fire codes, advocacy groups should:

- Understand and appreciate the capabilities of these systems in order to convince authorities of their effectiveness
- Ensure that quality safeguards are in place to maintain system effectiveness and reliability in the jurisdiction by:
    - Requiring products to be tested to specific product standards and that that performance be verified through certification by reputable laboratories
    - Adopting system design and installation standards
    - Implementing programs to ensure the competence of those designing, installing, and maintaining the systems, and
    - Advocating a means to ensure continued system inspection, testing and maintenance.
- Collect evidence of the reliability of the systems and compare that performance to those with similar regulations.

Finally, because cost vs. benefit is always an issue, advocacy groups should seek to maintain current cost data readily available and remember that incentives for architects and builders are often more powerful than mandates, as explained in the next section.

4.5 The Importance of Fire Sprinkler Incentives in Building Codes

"Creating economic incentives in building codes for sprinkler systems", which was rated third most effective strategy to increase the use of sprinklers with a score of 6.9, has been traditionally accomplished by means of what are often

referred to as "sprinkler trade-offs." This refers to permitting design alternatives within building codes that give design professionals options that allow reductions in other fire protection measures if fire sprinklers are installed throughout the building, in recognition of the ability of a fire sprinkler system to provide an equivalent or superior level of protection. These incentives have also been referred to as "fire sprinkler design alternatives" and in some cases "sprinkler trade-ups" depending on local terminology.

The most commonly adopted sprinkler trade-off or incentive is a permitted increase in the height and/or area of a building or fire compartment for that occupancy where the building is sprinklered in accordance with the prevailing national standard. For example, the NBFU model building code published in 1905 and discussed earlier in this chapter granted a 33 to 50 percent increase in the allowable areas between firewalls for buildings equipped with sprinkler systems.

In addition to increased height and area allowances, other commonly adopted sprinkler incentives can include permitting reduced structural fire resistance, longer exit travel distances, fewer restrictions on the range of interior finish materials, and other allowances that can introduce cost savings and economies and help offset the additional cost of installing the sprinkler system.

In the United States, systems of building code incentives were established in each of the regional model building codes prior to when many of the current requirements becoming mandatory code requirements for sprinkler protection, and there is evidence that this was part of a planned long term advocacy strategy. The NFSA worked with the three major model code bodies to pave the way for fire sprinklers by focusing that effort on occupancies where they were most needed, and high-rise buildings were at the top of the list.

4.5.1 Fire Sprinkler Incentive Case Study: U.S. High Rise Building Regulations

In the past, the building codes in the United States permitted the construction of high-rise buildings without sprinklers but with as much as four hours of fire resistance required. To encourage the use of sprinklers the NFSA advocated for code changes that contained incentives for the use of sprinklers as opposed to an imposition of sprinkler requirements in addition to all existing requirements.

On 29-30 November 1972, deadly fires in high-rise buildings took place on successive days in the American cities of New Orleans, Louisiana and Atlanta, Georgia. In the 16-story mixed-use Rault Center in New Orleans, the fire led to four deaths, including four women who jumped from the windows of a top-floor salon. The fire in the 9-story Baptist Towers retirement complex in Atlanta left nine dead and 32 injured. Legislative proposals were quickly introduced in the states of Wisconsin, Illinois, Connecticut, Massachusetts, Indiana, Maine and

Georgia. These efforts were not successful. However, similar efforts did pass into law at the same time in the states of Washington and Minnesota, where the legislation involved adoption of a model building code rather than an explicit requirement for sprinkler systems in high-rise buildings.

In the view of the NFSA at the time, the unsuccessful legislative proposals were hastily drafted and placed for consideration in front of committees not sufficiently familiar with issues of fire safety. More importantly, there was no consideration for the possibility of adding incentives including the relaxing requirements for fire resistive barriers (also called "compartmentation") or other existing fire safety requirements if fire sprinklers were provided. In other words, no trade-offs to help offset the costs of fire sprinkler system installation.

The NFSA's magazine at the time contained this commentary:[27]

> "Four-hour columns, beams, bearing walls and other structural elements may be necessary to protect the structural integrity of a building if it has no built in means of automatically reducing temperatures. To require mausoleum type construction and an automatic means of extinguishing a fire is not only redundant, but places unrealistic cost burdens upon the building owner.
>
> "To pursue the legislative course of mandating automatic sprinklers, without providing for the mitigation of those passive fire protectives, adds needlessly to the cost of both new and existing construction. It imposes severe design limitations upon architects. It can result in the imposition of space limitations by building tenants.
>
> "Realistically, restrictive compartmentalization and automatic sprinklers in combination are unduly restrictive.
>
> "Unfortunately, most legislators are not sufficiently sophisticated in their comprehension of building and fire safety design to provide for what code writers have come to term 'the systems approach.'
>
> "Americans have traditionally resisted arbitrary regulation by the state. When sprinkler protection has been mandated in codes, building owner groups affected by those regulations have banded together and formed restrictive blocs.
>
> "Regulations providing for the free exercise of alternate options have been met with less resistance on the part of owner groups, because the owner or his agent have had a choice. The free exercise of that choice tends to reduce enforcement problems and encourages greater cooperation on the part of the public."

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[27] Reilly, Edward J., "The Legislative Scene," *Sprinkling of News*, National Automatic Sprinkler and Fire Control Association, No. 18, January-April 1973.

By the end of 1973, the NFSA announced that all three of the regional model code groups had adopted new and similar rules for the fire protection of high-rise buildings, which *"brings to a close a major effort on the part of your Association staff to work in cooperation with other members of the fire protection community to bring about uniform code requirements for high rise buildings in the vast majority of U.S. jurisdictions which have adopted the model codes."*[28] These uniform code requirements were not mandatory requirements for sprinkler systems, but rather provisions that allowed building designers to choose to either provide sprinkler protection of the building or:

1. Provide a system of compartmentalization whereby each floor of a high-rise building would be divided into two fire resistive compartments or by subdividing the building into five-story vertical compartments by interrupting stair shafts with smoke barriers every fifth floor or through the use of smoke-proof enclosures for stairways or other approved methods of providing areas of safe refuge, and

2. Prevent vertical communication of fire between vertically-aligned openings in exterior walls by either providing flame barriers between such openings that extended 30 inches (0.76 m) beyond the exterior wall in the plane of the floor or by providing recessed panels between such openings not less than 3 feet (0.9 m) in height.

If the designer elected to provide sprinkler protection for the high-rise building, neither of these two requirements were applicable, and designers could also:

- Reduce the fire resistance requirements by one hour for all internal and external building assemblies, with no assembly being permitted to have less than 1-hour of fire-resistance.
- Increase exit travel distances from 150 feet (45.7 m) to a maximum of 300 feet (91.4 m).
- Eliminate occupant use hose cabinets.
- Eliminate fire department hose racks and hose while maintaining the standpipe system piping and hose outlets for fire department use.
- Eliminate fire alarm manual pull stations.

Within a year, legislation requiring sprinkler protection of new high-rise buildings more than 12 stories or 150 feet (45.7 m) in height had been enacted in multiple states, and the members of the Council of American Building Officials called for model code changes in 1975 to make sprinkler systems

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[28] Reilly, Edward J., "Southern Building Code Congress Adopts New Code Requirements," *Sprinkling of News*, National Automatic Sprinkler and Fire Control Association, No. 20, September-December 1973.

mandatory in all such buildings.[29] The negotiated allowance of design alternatives that permitted reductions in other fire protection requirements had paved the way for code writers to make fire sprinkler systems mandatory for high-rise buildings in all the model codes.

Because building regulation in the United States remained based on one of three regional model building codes rather than a single model, there were some variations between them. In 1977 the NFSA began publishing Guides to sprinkler requirements and trade-offs in the various model codes.[30] The purpose of these documents is to bring the various design alternatives to the attention of building designers, to show them that the cost of fire sprinkler protection could be offset through application of the trade-offs. The NFSA also prepared an article providing technical substantiation for each trade-off that was reprinted in the magazines of several model code organizations and is included in Annex A.1 to this Guide.[31]

As fire sprinkler systems became the norm in new high-rise buildings, it became obvious that existing high-rise buildings remained less safe. This led to numerous requirements for retrofit of existing properties, especially in the 1980s following a series of deadly fires in high-rise hotels, as discussed further in Chapter 12.

4.5.2 Fire Sprinkler Incentive Case Study: Cost Benefit Analysis

In 1980, the United States Fire Administration funded a joint effort by the Council of American Building Officials and the NFSA to both document the basis for the various sprinkler trade-offs in the model building codes and to study their economic impact.[32] Each of the three model code body's technical directors completed fact-finding sheets relative to each code requirement and design alternative granted where fire sprinkler protection was provided. In the Uniform Building Code, for example, the maximum building area was unlimited for one and two-story business and industrial buildings when fire sprinkler systems were provided, and the code's technical director reported that the provision, first appearing in the 1943 edition of that model code, had been justified with this rationale: "The unlimited areas permitted for Groups F and G

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[29] Reilly, Edward J., "High Rise Legislation", *Sprinkling of News*, National Automatic Sprinkler and Fire Control Association, September 1974.

[30] Fleming, Russell P., *Architects' and Engineers' Guide to Automatic Sprinklers in Building Codes*, National Automatic Sprinkler and Fire Control Association, 1977.

[31] Reilly, Edward J. and Fleming, Russell P., "Why Sprinkler Trade-Offs Work," *Sprinkling of News*, National Automatic Sprinkler and Fire Control Association, September 1980.

[32] Fleming, R.P., A Study of the Role and Economic Impact of Automatic Sprinklers in Building Codes, Final report to the U. S. Fire Administration, April 1980.

will meet the modern demand for the assembly line type of factory. Special exit requirements for such buildings appear in the occupancy chapter". Similarly, it was reported that the code's allowance for exit travel increases in sprinklered buildings first appeared in the 1952 edition and that: "The record does not show any reason or basis for the provision, but it does seem reasonable to allow an increase from 150 to 200 feet of travel distance where automatic sprinklers are provided throughout."

The study also included a cost-benefit analysis by a practicing architectural firm to quantify the degree to which trade-offs could offset the additional cost of a fire sprinkler system in three different building types: a small two-story mercantile and office building, a midrise multi-family apartment building, and a high-rise office building. In all three cases, the buildings used as the basis of the analysis were actual buildings that had been designed by the firm and constructed with a fire sprinkler system included. The method used to establish the cost differential between the sprinklered and non-sprinklered designs was to redesign the original sprinklered building as a non-sprinklered building in conformance with the requirements of the model building codes and to estimate the costs accordingly using methods in practice at the time.

Although it was found that there were no major cost saving trade-offs to reduce the economic impact of installing sprinklers in the small mercantile and office building, it was determined that the insurance savings for owner and tenant would effectively repay the cost of the sprinklers in a period of four years. For the midrise apartment building, installation of a sprinkler system allowed the building to be constructed with reduced fire resistance, which alone offset the entire cost of the sprinkler system, and the elimination of occupant use hose cabinets saved thousands of dollars more.

To have been constructed without a fire sprinkler system, the high-rise building would have required more expensive fire doors, more expensive (2-hour rated) fire separation walls, remote control smoke vents, additional fire insulation, fire hose cabinets, additional fire dampers, additional smoke detectors and door releases, and manual fire alarm pull boxes, which in total cost 59 percent more than the fire sprinkler system.

Even where trade-offs are not explicitly detailed within a code, they can often be achieved through equivalency provisions. A recent publication in the Netherlands[33] highlights the benefits of residential sprinklers, and includes a section discussing "compensatory measures" that can be considered under the equivalency section 1.3 of the Netherlands' Building Decree 2012. When

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[33] *Valuation of residential sprinkler installations*, United Residential Sprinkler Installers VWI, September 2021.

residential sprinkler systems are provided, it lists and provides substantiation for the following measures that could be considered:

- Extending travel distance for escape within a residential apartment
- Extending travel distance in the common areas of a residential building (outside the apartment)
- Limiting the number of care providers in care facilities
- Extending of a residential function to a porch
- Omission of a second escape route (protected escape route)
- Reduced resistance to fire penetration between the apartment and common area
- Reduced resistance to fire transfer between residential units
- Enlarging a fire compartment beyond the legal limit, and
- Reducing the fire resistance of a supporting structure.

It may be that the extensive use of sprinkler incentives in the North American model codes has actually diminished the need for performance-based building codes in the United States and Canada. As discussed in Chapter 7 of this Guide, the performance-based codes adopted in some countries essentially give the building design professional in charge of fire safety a similar freedom to allow fire sprinkler systems to substitute for other fire safety features. In that sense, sprinkler trade-offs can be thought of as a form of standardized performance-based design.

CHAPTER FIVE: PURSUING REGULATORY CHANGES IN A CODE ENVIRONMENT

As stated in the previous chapter, countries that have well developed codes and other building regulations that contain enforcement provisions can have unique methods of developing and amending their codes. An advocacy group working to increase the use of fire sprinklers must first evaluate the existing requirements and incentives and consider potential areas of success. The group must then identify the regulatory change process and determine the identity of the key influencers. Planning a code change effort will also require the development of a specific strategy for change, a proposed schedule, and agreement as to the deliverables.

Put into an outline form, an effort would involve these steps:

5.1. Evaluate existing requirements and incentives for automatic sprinklers

- What is the current attitude toward the use of fire sprinklers in the code?
- What incentives/alternatives does the use of sprinklers provide the designer?
- How do the current requirements and incentives compare to those in other countries?
- Has recent fire experience in the country/region provided support for a code change effort favorable to the use of automatic sprinkler systems?

5.2 Identify the regulatory structure

- How is the code developed?
    - Who controls the code development process?
    - Are there any committees or key "influencers" who manage the process?
    - Is there an established review cycle or timeline?
- What political drivers and motivations are available for code changes? (life safety, political decision, political pressure for development, new

data, large fire events, research, cost/ benefit, lobbying from construction/business organization etc.)

- Are there major government policies that will impact building codes in upcoming years?
- Is there any current thinking on the need for change within the code relative to fire safety?
- Are there any influential peer groups/agencies/associations in the country or region that can help motivate changes in the code?
- What is the current state of enforcement of the code?

5.3. Identify the organizations active in influencing the fire safety related aspects of the building code (Note: influencers can be supporters and/or detractors of fire sprinklers)

- Who are the code development influencers based on the type of organization (government, non-profit organizations, fire safety related groups, trade groups, insurance companies and associations, consultants, research bodies, corporations, industries, contractors, architects, building owner associations, fire services, etc.)?
- For each influencer, what is their mission, structure, leadership, decision makers, key people in relation to the code, important memberships, internal committees, level of activity in regulation/code development, etc.?
- For each influencer, what are their economic and political drivers, reputation, product promotion, sector control, membership, finances, etc.?
- For each influencer, are there any friction points, e.g. reducing membership, funding, reputation issues etc.?
- For each influencer, what is their position relative to the use of automatic fire sprinklers in the code (supportive, neutral or detractor)?
- Which of the influencers are potential allies within the process for code changes in favor of automatic fire sprinklers?
- Are there potential opportunities to connect and ally supporting influencers to common themes?

5.4 Develop a specific strategy for code changes

- Which influencers should be the focus within the process?
- What other groups should be contacted as potential allies in the code change process?
- Are there potential in-country consultants that could be retained to assist with bringing about improvements to the code (based on their knowledge, existing relationships, share of voice, position within committees and ability to build consensus)?

5.5 Agree on a schedule and expected deliverables

- Will there be a kick-off meeting for the advocacy effort involving the full advocacy team along with representatives of allies and any involved consultants?
- How often will regular updates be needed to exchange information on progress and review strategies?
- What are the key decision-making dates for those who control the code process?
- Aside from the end goal of the code changes sought, are there interim deliverables that should be scheduled and prepared (white papers, public events, press releases, etc.)?

CHAPTER SIX: DEVELOPING A FIRE CODE WHERE NONE EXISTS

Some countries do not have well developed regulatory processes for a building or fire code in place at the present time. Often, what regulation does exist is limited to specific occupancies or hazard types where prior tragedy or industry specific issues warranted such regulation. For those countries, advocacy groups should consider these "12 Rules for Developing an Effective Fire Code" presented as suggestions to Mexican regulatory authorities by the Mexican sprinkler association AMRACI in November of 2021[34]:

1. A fire code must be mandatory with specific penalties set out for violations that will help ensure compliance.
2. A fire code should be part of the mandatory requirements to be met before a new or extensively renovated building is allowed to be occupied, or before a change of use is permitted in an existing building.
3. The fire code should be freely accessible.
4. The authorities responsible for the various stages of drafting, reviewing, and enforcing the fire code should be fully defined:
    - Authority responsible for preparing the code and reviewing it
    - Authority responsible for the approval and sanction of the code
    - Authority responsible for enforcing the code, and
    - Authority responsible for issuing the authorization to use the property.
5. There should be a code revision process, with defined review and revision cycles, to ensure the code is updated to reflect changes in technology and emerging fire safety risks within the built environment.
6. The code writing and revision process should be open to the general public, who should have the right to propose changes. The process should be transparent, that is, the reason for acceptance or rejection of any proposal should be documented and published.
7. The code should be standardized wherever possible, while also accommodating the particularities of the different regions of the country. A national scope is preferable unless more limited jurisdiction is warranted

[34] Lima, Marcelo, "12 Rules for Developing an Effective Fire Code", personal correspondence 21 October 2021.

due to the large size of the country, dissimilar regions, or a large number of administrative entities (states, provinces, etc).

8. If there are multiple fire codes in a country, efforts should be made to coordinate between then to use similar model criteria, even if they are not identical.

9. A prescriptive fire code is preferred unless the knowledge level of all involved in fire protection in a given country is high and balanced between AHJs, professionals and end-users, in which case a performance-based code could be an option.

10. The fire code should preferably be a stand-alone document whose primary purpose is fire safety. If not possible, an acceptable but less desirable option is to be a sub-section of the building code.

11. The primary objective of a fire code should be life safety, but property protection and environmental protection should be considered as objectives as well.

12. The requirements of the code should be proportionate to the risk - Should be sensitive to the fact that the code should not add unbearable costs to the construction process or ongoing operations, but should also take into account that a higher level of safety usually means additional costs.

When developing proposed code language, consideration should also be given to the inclusion of design alternatives and incentives for fire sprinkler systems, as discussed in Section 4.5 of this Guide.

CHAPTER SEVEN: DEALING WITH A PERFORMANCE-BASED CODE ENVIRONMENT

Performance-based Codes and related design methods are defined as the application of science and engineering in building design to achieve a specified performance objective. In regard to fire protection, performance-based design seeks to take into account the specific characteristics of the building rather than applying generic checklist requirements found in the far more common, traditional "prescriptive" codes that may or may not be appropriate due to a building's unique characteristics.

"Urging recognition for fire protection engineering" was the next to lowest rated advocacy method with a score of 4.0, which may be due to a lack of confidence or understanding in the analytical methods used by fire safety engineers when meeting the provisions of performance-based codes.

It should be noted that even codes thought to be highly prescriptive, such as the IBC, often contain provisions allowing performance based "equivalencies" or "alternates" where the designers are able to demonstrate an equal or better level of safety through well documented analysis that is reviewed and approved by the authority having jurisdiction. However, a true performance-based code would not have prescriptive requirements as a baseline for comparison.

For example, in 1994 the Fire Safety Committee of the Nordic Committee on Building Regulations published a model performance-based code for fire safety in buildings that proposed a general objective as follows:

> *"Every building and structure shall be constructed in such a way and with such materials, and their fittings and furnishings shall be such that, with regard to their use and situation, they afford satisfactory safety with respect to fire for persons who are present in the building, including secure facilities for the rescue of persons and for firefighting, and with respect to the spread of fire to buildings and structures both on the same and adjoining plots. Every building and every structure shall be constructed in such a way that they provide acceptable safety against damage to property and the environment."*[35]

When compared to the specific requirements of prescriptive codes, compliance with performance-based codes and regulations like that above is generally demonstrated either through analysis and/or calculations that demonstrate that a proposed design meets the objectives. However, it is also recognized

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[35] Nordic Committee on Building Regulations (NKB), *Performance Requirements for Fire Safety and Technical Guide for Verification by Calculation*, Report No. 1994:07 E, 1994.

that performing a detailed analysis would be cost prohibitive under many circumstances. Therefore, most performance-based codes also permit the use of pre-accepted solutions, often referred to as “deemed to satisfy” provisions.

Verification of a defined pre-accepted solution is fairly simple, and essentially duplicates the process involved with most standard prescriptive code compliance. But verification of a proposed performance-based solution poses some difficulties. In many countries there is a limited number of fire protection engineers. As a result, fellow fire protection engineers are often called upon to assist local authorities through a design review process. This can create some problems including conflicts of interest, especially when the engineers are placed in reciprocal positions on different projects, and as a result will want to avoid confrontation.

Further, acceptable solutions based on performance-based design tend to vary with cultural norms and experience. Regarding the use of fire sprinklers, this became very apparent in the recurring case studies submitted by different national teams at the biannual International Conferences on Performance-Based Codes conducted by the Society of Fire Protection Engineers (SFPE). Table 7-1 illustrates the use of fire sprinklers by various national teams participating in the conference in their proposals for protection of five unique structures from 1998 to 2006. The five structures included a 40-story high-rise office building, a 28,000 m^2 shopping mall, a 22-story high-rise hotel, a large international transportation center, and 30-story housing for the elderly. Although Australia, Japan and the United States were represented in each case, there were six other countries involved with one or more of the case studies.

As indicated in Table 7-1 below, it appears that practitioners in certain countries (in this case France and Japan), do not rely on automatic sprinklers for building protection as much as practitioners in countries such as Australia, Canada and the United States do. Yet in other occupancy types, such as for fire protection of road tunnels, the Japanese employ sprinkler systems to a far greater extent than their North American counterparts.

In addition to cultural biases, performance-based designs are highly affected by cultural risk tolerance and by the assumptions made regarding fire growth and size, tenability criteria, perceived effectiveness of passive fire protection features, and fire sprinkler system reliability. The lack of professional recognition and standardization internationally in these areas further influences the extent to which fire sprinkler systems are employed as part of a performance-based design.

Table 7-1: Contrasting Election of Fire Sprinkler Use in Performance Based Design for Several Occupancy Types

	1998 Maui, Hawaii 40-story High-rise office	2000 Lund, Sweden 28,000 m^2 Shopping mall	2002 Melbourne 22-story High-rise hotel	2004 Luxembourg International Transportation Center	2006 Tokyo 30-story Elderly housing
Australia	Yes	Yes	Yes	Yes	Yes
Canada	Yes		Yes		
France				No	No
Japan	Yes	No	No	No	No
N. Zealand		Yes	Yes		
Sweden		Yes			
Switzerland					Yes
UK	Yes			Partial	
USA	Yes	Yes	Partial	Yes	Yes

Although the process of using analytical tools in fire protection design has been advanced by organizations such as the SFPE[36] , the British Standards

[36] *SFPE Engineering Guide to Performance-Based Fire Protection*, Society of Fire Protection Engineers, 2007.

Institution[37], and even the International Standards Organization[38], fire protection or fire safety engineering is still a young and developing profession. Advocacy groups in areas where performance-based codes have been adopted or recognized have in some cases resorted to independent studies to demonstrate and encourage reliance on fire sprinkler systems as a principal fire safety design component.

For example, in 2006 Arup Fire conducted a study on behalf of the British Automatic Fire Sprinkler Association (BAFSA) that included examples of trade-offs that could be reasonably taken beyond those recognized by British codes at the time.[39] The published report identified ways in which sprinklers could be taken into consideration for fire engineering analysis in order to achieve the required design goals. The report noted that sprinkler systems have "clear advantages in their use, many of which should either reduce the overall building cost or which allow the approval of a particular design which would otherwise be considered 'unsafe'."

Similarly, in 2010 the IFSA provided partial funding for a study of design alternatives in buildings with fire sprinkler systems conducted by Fredrik Nystedt of the Department of Fire Safety Engineering and Systems Safety at Lund University in Sweden.[40] Intended to form the basis of a Nordic guideline on verification of design alternatives, the report encompassed a review of the effectiveness of fire sprinkler systems and proposed design fires appropriate for use in sprinklered buildings, along with proposed tenability criteria. The study further included guidance on verification methods for sprinkler trade-offs. Nystedt described his work in his abstract:

> *"Three possible verification methods are proposed together with the procedure on how they could be applied in design. The covered methods are both qualitative and quantitative (deterministic as well as probabilistic). In order to get full benefit of a sprinkler system installation, sprinkler performance data is presented together with a new set of tenability criteria in sprinklered buildings and sprinklered design fires. Finally, advice is given on specific design situations where fire sprinklers could allow for trade-offs."*

Performance-based codes have their critics. Following the 2017 Grenfell Tower fire in London that killed 72 there were calls for a major re-examination of the

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[37] *Fire Safety Engineering Principles for the Design of Buildings*, British Standards Institution, 2001.

[38] International Standards Organization. ISO/TC 92/SC4 Fire Safety Engineering

39 Sprinklers for Safety – Use and Benefits of Incorporating Sprinklers in Buildings and Structures, British Automatic Fire Sprinkler Association, 2006.

40 Nystedt, Fredrik, Verifying Design Alternatives in Buildings with Fire Sprinkler Systems, Report 31650 Lund University, 2010.

building codes in use in England. It was noted that, in 1985, 306 pages of building regulations had been replaced with 24 pages of performance-based requirements. Among the groups calling for a review of the regulations in England was the Royal Institute of British Architects, which asked for clearer and more prescriptive requirements, including mandates for fire sprinkler systems in England *"…in all new and converted residential buildings, as currently covered under Regulations 37A and 337B of the Building Regulations for Wales, or at least for residential buildings over three storeys in height".*[41]

In a sense, the sprinkler incentives found in prescriptive codes are very much like "deemed to satisfy" solutions to performance-based codes. Fire sprinkler advocates should urge favorable treatment for active suppression systems in both.

Where performance-based codes contain suggested or required assumed values for sprinkler system reliability, limits of tenability, or maximum fire size, sprinkler advocates should make sure such values are reasonable. Often the most challenging tenability limits are for visual obscuration. Fire testing has demonstrated that sprinkler operation can increase visual obscuration because the combustion cycle is broken, and quantities of unburned particles along with steam generated are put into the air in the vicinity of the fire. But firefighters and researchers have repeatedly testified that all "smoke" is not equal, and the scrubbed smoke from a fire that is being controlled by sprinklers is generally less irritating to the respiratory system and less toxic. The *SFPE Guide to Human Behavior in Fire*[42] contains a discussion of research involving fire escape with compromised visibility and contains this commentary on the lethality of visual obscuration:

> *"…it is clear that a reduction in visibility alone may not prevent escape and in itself does not constitute a visibility endpoint (tenability endpoint); it must be coupled with the potent, harmful effects of heat and toxic gases in cases where visual smoke obscuration inhibits prevents timely escape before conditions become untenable. A primary consideration is, does the inhibition of evacuation, impairment of wayfinding, or reduction in movement speed due to reduced visibility sufficiently lengthen the evacuation and exposure process to a point that incapacitation occurs due to thermal and/or toxic gas exposure or result in occupants becoming trapped in a location where conditions subsequently become lethal due to fire spread or structural collapse."*

Studies of fire events such as the 2003 Station Nightclub Fire in Providence, Rhode Island (USA) have shown that fire sprinklers can reduce or even

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[41] "UK Commission Interim Report Supports Fire Sector Recommendations", *International Sprinkler Scene, IFSA, January-March 2018.*

[42] SFPE Guide to Human Behavior in Fire, 2nd Edition, Society of Fire Protection Engineers, 2018.

eliminate the heat, toxic gasses, and other threats to occupants, even if visibility is compromised during their evacuation. In the aftermath of that fire, the National Institute for Standards and Technology (NIST) conducted an investigation, and recreated the fire scenario with and without automatic fire sprinklers.[43] While the fire without sprinklers was found to quickly exceed lethal limits of temperature, heat flux, oxygen deprivation, carbon monoxide and hydrogen cyanide, giving occupants less than 90 seconds to escape the building, no lethal limits were reached in the corresponding test with sprinklers.

One of the key reasons that fire sprinklers fare so well under performance-based design methodologies is that deterministic approaches to fire protection rely on calculations for which the rate of heat release is the primary driver. Temperatures and the production of smoke and toxic gases are all related to the rate of heat release. It therefore follows that the inherent ability of a sprinkler system to limit and reduce the rate of heat release limits the adverse effects of a fire. In many cases it is impossible to provide adequate designs, such as for smoke control systems, without establishing a maximum size fire, and automatic sprinkler systems are one of the features that make this possible.

[43] *Report of the Technical Investigation of The Station Nightclub Fire (NIST NCSTAR 2), Volumes 1 and 2*, National Institute for Standards and Technology, 2005. Available online at https://www.nist.gov/el/station-nightclub-fire-2003

CHAPTER EIGHT: SPRINKLERS MANDATES OR TAX INCENTIVES THROUGH LEGISLATION

Direct legislation to require sprinklers was rated fourth with a 6.5 in the survey, but tax incentives for property owners, which would also require legislative action, came in eighth with a rating of only 4.2. The difference was explained by one panelist as the fact that the concept and use of tax incentives is unknown in many parts of the world.

8.1 Sprinkler Mandates through Legislation

Fire sprinkler mandates through direct legislative action are most commonly enacted in the aftermath of a severe fire, especially one resulting in large loss of life. Perhaps the most notable recent example is the 2017 Grenfell Tower fire in London that resulted in 72 deaths. There was a tremendous public outcry for action following that fire, and in 2018 the UK government ordered a review of fire safety management in England and Wales, but it took until 2021 for two pieces of legislation to come to fruition and begin implementation: the "Fire Safety Act" and the "Building Safety Bill". Separately, regulatory guidance for fire safety provisions was updated, introducing some important changes, one being a new requirement that sprinkler systems be provided in residential blocks with a floor over 11 m in height in England. Scotland went further, requiring all new residential blocks and all new social housing must now be protected with sprinklers. Wales already required sprinkler systems in all new housing.

Following the Station Nightclub fire in Rhode Island (USA) that killed 100 people, the State of Rhode Island in the United States adopted the "Comprehensive Fire Safety Act of 2003". It was comprehensive in that it required sprinklers to be installed in all existing nightclubs with a maximum occupant load of more than 150, limited the use of pyrotechnics, adopted the National Fire Protection Association's *Uniform Fire Code* (NFPA 1) and *Life Safety Code*® (NFPA 101) into law, repealed previously established exemptions for existing buildings, and empowered fire inspectors to more effectively enforce the adopted regulations.

This Rhode Island legislative action is an example of promoting improved recognition of sprinklers while focusing on an occupancy where public opinion was demanding better protection. The adoption of model codes that include reliance on sprinklers while at the same time lowering the threshold at which fire sprinklers are required can be both an expeditious and a great incremental victory for fire sprinkler advocacy.

States and cities sometimes develop their own laws and ordinances for sprinklers other than through the usual route of strengthening the model fire or building codes. In 1981, the NFSA in the United States published a legislative guide to the development of fire sprinkler laws that included numerous examples of ordinances that had been adopted by individual communities to amend their existing codes or simply create a requirement for comprehensive sprinkler protection.[44] Some of those ordinances are reprinted in Annex A.2 to this Guide. The text noted "most sprinkler ordinances are surprisingly alike…because once one community does the real work on an ordinance there is a tendency not to want to 'reinvent the wheel' and the ordinance is 'borrowed' by surrounding communities."

Due to the efforts of San Clemente, California Fire Chief Ron Coleman, including close to 50 live demonstrations conducted for city officials, that city in 1979 became the first to pass an ordinance requiring residential sprinklers in all new homes. More than 150 other California communities passed similar local ordinances over the next two decades, making the passage of a statewide requirement in 2010 acceptable to both the state's fire service and the local homebuilding association. Countering the popular homebuilder claim that sprinkler requirements will kill future housing development, California built more than 130,000 single-family homes and more than 150,000 multi-family homes in the first three years following 2011, when the statewide requirement for sprinklers took effect.

This has remained true to the present day. In the Chicago area, ordinances requiring that single-family homes be equipped with fire sprinklers have been steadily adopted by one community after another, a process tracked by the Northern Illinois Fire Sprinkler Advisory Board, an affiliate of the NFSA. What started with an ordinance in one community in 1988 grew to three by the turn of the 21st century and stood at 118 communities in 2021.[45]

In some cases, legislative action can be motivated through an appeal to a jurisdiction's pride. No legislative body wants to feel as if they are behind the times. In 1999 for example, representatives of the NFSA in the United States were given the opportunity to testify before the New York City Council about fire sprinklers in high-rise buildings. Although New York City had been at the forefront of encouraging fire sprinkler protection in high-rise office buildings back in the 1970s through its Local Law 5, it was still writing its own building code and that code had not kept up with the increased reliance on automatic fire sprinkler systems in all high-rises, including residential occupancies. The NFSA representatives were able to remind the Council of the historical effectiveness of fire sprinkler systems, but also pointed out that the New York

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[44] Mulrine, Joseph F., *Fire Sprinkler Laws: A Legislative Guide to Their Development*, National Automatic Sprinkler and Fire Control Association, 1981.

[45] https://firesprinklerassoc.org/13d-communities/

City Building Code was lagging most other building codes in the country with regard to protection of residential high-rise buildings. The phrase "New York City is lagging behind" was picked up by the media, and the City Council responded to the testimony from NFSA and other groups by enacting Local Law 10 shortly thereafter, mandating sprinklers throughout all new residential buildings with four or more units. Existing residential buildings were also required to be retrofitted with sprinklers if they underwent major renovations.

As an interesting sidelight, Donald Trump's proposed 72-story Trump World Tower at UN Plaza had already filed plans by the time Local Law 10 was enacted, and was therefore officially exempted from the new sprinkler requirement. However, it was constructed with a fire sprinkler system anyway – the New York Times reported at the time that many buyers wanted the protection and pressured the developer to provide the additional protection.

In addition to ordinances that simply require sprinklers in various occupancies based on building size, use, or occupant load like a model code, there have been some ordinances that focused on community planning and the creation of incentives for sprinkler installation.

8.2 Legislation for Community Planning with Sprinklers

One of the sample ordinances in Annex A.2 to this Guide is from the City of San Buenaventura in California, commonly known as Ventura, from the late 1970s. A report entitled "Controlling the Cost of Fire Protection in the City of San Buenaventura" precedes the wording of the ordinance itself, and was prepared by Fire Chief B.G. Horne as an element of a Community Fire Protection Master Plan in support of the ordinance, which requires sprinkler systems in all buildings with a total floor area exceeding 5,000 square feet (464 m^2). This ordinance provides an excellent example of how proposed sprinkler legislation should be "packaged" for presentation to a local governing body. Chief Horne had determined that most opposition to mandatory sprinkler requirements is based on misinformation, and set out to address the expected concerns head-on.

One of the first communities to use fire sprinklers as a major tool in its master plan was the City of Fresno, California in 1961.[46] A major fire in its downtown area had led the fire chief to propose that all retail stores over 10,000 square feet (929 m^2) in area be protected with automatic sprinkler systems. This original proposal developed into an urban renewal plan for the rehabilitation of the central business district of Fresno, evaluating all retail and wholesale buildings as potentially dangerous buildings. Under Fresno's Building

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46 Goss, William, "Fresno – A Look Ten Years Later," Sprinkling of News, National Automatic Sprinkler and Fire Control Association, June 1981.

Rehabilitation Standards of 1961, buildings were individually inspected to determine if they had at least two-thirds of the fire resistive requirements of the then-current building code for major structural elements and at least one-half of the fire resistance required for non-loadbearing members. If not, it was the owner's option to either retrofit the building with sprinklers or demolish the building. Fire resistive requirements of the building code were based on floor areas within exterior walls – no credit was allowed for interior division walls.

The 1961, Fresno ordinance was further refined in 1974, and again in 1979, ultimately requiring all existing buildings in the central business district over 5,000 square feet (464 m^2) in area to be retrofitted with sprinklers with no exceptions. In one case, a bank modification crossed over the 5,000 square foot threshold simply by adding a drive-through teller window on an exterior wall, triggering the bank to be sprinklered. With all new buildings also required to be sprinklered, 95 percent of the floor area in Fresno's central business district was provided with sprinkler protection by 1981.

And this 20-year investment in automatic sprinkler protection allowed the city to economize elsewhere. The ability of sprinklers to provide built-in protection for the city center allowed the city to better structure its fire department and to reposition its fire stations to better suit its growth and expansion. When the program went into effect in 1961, 69 on-duty firefighters protected a city with an area of 41.8 square miles (108 km^2). By 1981 the same number of on-duty firefighters protected a city with an area exceeding 60 square miles (155 km^2).

It is important to recognize that legislation can also incentivize rather than mandate sprinkler protection. Another example in the United States is the Federal Hotel and Motel Fire Safety Act of 1990. The act required that the individual states submit a list of hotels and motels that met specific fire safety guidelines so that a master list could be published and distributed to Federal agencies. Federal employees were then encouraged to hold meetings and stay only at facilities that met these guidelines, which included the need for an automatic sprinkler system in all hotels and motels over three stories in height.

8.3 Tax Incentives for Sprinklers through Legislation

Another of the sample pieces of legislation reprinted in Annex A.2 of this Guide is Alaska House Bill 648, signed into law by the Governor of Alaska in 1980. This legislation gave tax incentives to property owners who installed approved fire protection systems. The new law allowed a reduction of the assessed value of a structure by 2 percent for tax purposes. The same statute also provided for reduced fees or surcharges for the water used in these systems from public utilities, and provided "tourist attraction" matching funds and loans for system installations.

Perhaps the most significant and well-known legislation with tax incentives for sprinkler system installation in the U.S. was the Fire Sprinkler Incentive

Act (FSIA). The intent of the legislation, originally introduced following the 2003 Station Nightclub fire, was to provide an economic incentive to building owners to retrofit their properties with fire sprinkler systems by providing a significant near-term tax benefit. For U.S. Federal tax purposes, the cost of installing a fire sprinkler system had been treated as a building improvement/ investment and not as a direct operating expense. As a result, the value could only be written off the balance sheet over a long period of time, 39 years for commercial properties and 27.5 years for residential properties. The intent of the bill was met in part 14 years later by the 2017 rewrite of the U.S. Federal tax code, which allowed expenses for fire sprinkler systems, alarm systems, HVAC systems, and roofing in commercial occupancies to be eligible for first year deductions of up to $1 million for small businesses. For larger businesses, the first-year write-off was reduced dollar for dollar for spending over $2.5 million in eligible purchases. A bill drafting error was blamed for not allowing more benefit for larger businesses, which was finally addressed as part of the CARES (Coronavirus Aid, Relief and Economic Security) Act of 2021, which allowed any size business to deduct the full cost of a sprinkler system installation provided the equipment was put into use between September of 2021 and January of 2023.[47]

[47] Fire Sprinkler Tax Incentives – A Guide for the Fire Service, National Fire Sprinkler Association, 2020

CHAPTER NINE: LOWERING SYSTEM COSTS WITH INSTALLATION STANDARDS

The term "regulation" as used in this document covers a broad spectrum of requirements that are otherwise adopted by governments into law. However, proper regulation requires further clarification of the types of regulation that can be adopted. Traditionally, codes regulate "where" sprinkler systems are required to be installed, and standards dictate "how" they are required to be installed. Because the term "regulations" did not make this distinction, In 1940 the National Fire Protection Association changed the word "regulations" in its committee reports to "standards" to make it clear that there was no intent to imply mandatory legal application where none existed.[48] Therefore, a standard has no legal standing until it is adopted or referenced for use by a jurisdiction, in whole or part, through legislative means such as a code adoption action that makes the standard a legally binding set of rules.

"Advancing installation standards that lower sprinkler installation costs" was rated in the top half of advocacy methods with a value of 5.5 because participants recognize that the requirements of a legally adopted or referenced standard play a large role in determining the cost of a system. In turn, cost can play a major role in determining whether owner groups fight a fire sprinkler adoption of a sprinkler mandate, or whether sprinklers are elected for use through the application of other sprinkler incentives or in a performance-based code environment.

One theory as to why sprinkler systems became more prevalent in North America than they are in Europe is that the European sprinkler installation rules, including the current EN 12845, contain some requirements that are more restrictive and therefore more expensive than standards applied in North America. For example, European standards have traditionally required sprinklers in the concealed spaces above ceilings, even when the building is constructed of noncombustible construction. NFPA 13, the predominant installation standard in North America, does not require sprinklers in these spaces unless there are sufficient combustibles to warrant protection.

In 1974, fire protection engineering pioneer Rolf Jensen wrote an article entitled "21 Ways to Better Sprinkler System Design."[49] In that article he discussed changes that had been made over the prior two years to NFPA 13. He predicted that when designers and contractors became aware of these

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48 Op. Cit., Stevens and Cote 1986.

49 Jensen, Rolf, Fire Journal, January 1974.

changes and how to use them, they would be able to reduce sprinkler system costs by as much as 50 percent.

The changes Jensen cited are now commonplace in the fire sprinkler industry:

- Allowance to use hydraulic calculations to size pipe in place of pipe schedules, with design curves leading to reduced overall water demands
- Allowance to provide water only to those sprinklers within a "fire section", defined as a compartment having a fire resistance rating equal to the water supply duration (now known as the "room design method" within NFPA 13)
- Allowance to use the building standpipe (interior hydrant) risers to also serve as risers for sprinklers protecting the floors of a high-rise building
- Allowance to reduce the total water supplies for standpipe systems when the building is fully sprinklered
- Allowance to use copper tube, lightweight steel pipe, or even plastic pipe when tested and found suitable for use by a qualified testing laboratory
- Allowance to install sprinkler piping "dead flat" instead of pitched
- Allowance to eliminate "tie-in" drains for trapped sections of piping with a capacity of 5 gallons (19 liters) or less that could be drained into a bucket
- A requirement that all sprinkler system control valves must be supervised in the open position by one of several means
- Allowance to utilize alternative hanging arrangements if certified by a professional engineer, and elimination of excessive safety factors for common types of hangers
- Allowance to weld steel sprinkler piping
- Allowance to use "special" sprinklers with greater protection areas when tested and approved for use by a qualified testing laboratory
- Allowance to reduce the clearance between sprinklers and the top of storage to 18 inches (0.46 m), and
- Allowance to use nitrogen as the equivalent of an air supply for dry pipe systems.

Jensen was correct that many of these provisions lowered the cost of installing fire sprinkler systems. As a result, opposition to the expanded use of fire sprinkler systems was likewise reduced and many more systems were installed.

Over the years since that 1974 article, the NFPA standard and some of the other sprinkler installation standards around the world have also recognized

new types of sprinklers that have further enhanced economical sprinkler installation, including:

- Extended coverage sprinklers, whereby fewer sprinklers and less piping are needed to protect a given area due to larger protection areas per sprinkler, and
- Early suppression fast response (ESFR) sprinklers which, by faster activation and high-volume water discharge at the roof level, can often result in the elimination of in-rack sprinkler protection within many high rack storage warehouses.

With the publication of *America Burning*[50] in 1973, it became obvious that the United States had a significant fire problem in residential buildings. The report included the statistic that of the 8,000 Americans dying in building fires each year, nine out of ten died at home. Believing that automatic sprinkler systems could provide the solution, the NFPA Committee on Automatic Sprinklers undertook an effort to write a separate installation standard for single-family dwellings, intending to create a more economical standard than NFPA 13 that would still provide a reasonable level of protection for these occupancies at a significantly reduced installation cost. The effort involved a study of fire statistics to determine the areas of a home where deadly fires were most likely to originate, so that the cost of sprinklers in other areas of the home could be eliminated such as small closets, small bathrooms, unoccupied attics and porches.

The publication of the first edition of NFPA 13D[51] in 1975 was based on the sprinkler technology existing at the time. However, it was soon discovered that NFPA 13, the standard for automatic sprinklers whose primary application had been commercial and industrial property protection, was not ideal for the limited water supplies and small rooms associated with smaller residential dwellings. To address this issue, subsequent research funded by the United States Fire Administration led to the creation of a new type of sprinkler better suited to this environment. The "residential sprinkler" has two distinct features. First, the spray pattern was configured to provide high wall-wetting water distribution, ideal for residential rooms in which furniture is typically located along the perimeter of rooms. Second, the new sprinkler was also designed with faster thermal response, which allowed it to use the limited water supplies of dwellings more efficiently, since it was able to activate when the fire was smaller and more easily controlled.

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50 America Burning – The Report of the National Commission on Fire Prevention and Control, 1973.

51 NFPA 13D - Standard for the Installation of Sprinklers in One- and Two-Family Dwellings and Manufactured Homes, National Fire Protection Association, www.nfpa.org

Because the new NFPA 13D reduced or otherwise modified many of the requirements contained within NFPA 13, the NFPA Committee on Automatic Sprinklers classified NFPA 13D as a "life safety" sprinkler standard. It was recognized that the omission of sprinklers from numerous building areas, including combustible concealed spaces, would make it incapable of providing full NFPA 13 levels of property protection.

In the decade following the issuance of NFPA 13D, there was a great deal of interest in developing a standard addressing the middle ground between NFPA 13 and 13D that might lead to increased use of sprinklers in small multi-family residential occupancies. Several cities and states began issuing their own "life safety" standards to fill this gap, which led the NFPA Committee on Automatic Sprinklers to step in and forge a consensus on what that middle ground should look like. The end result was the development of a new standard first issued in 1989, NFPA 13R.[52] In terms of building areas protected by sprinklers it was more restrictive than NFPA 13D, but still considered a standard focused on life safety rather than property protection. For example, like NFPA 13D, NFPA 13R requires the use of residential sprinklers and allows the omission of sprinklers from combustible concealed spaces. In other areas it retains many of the reliability and performance requirements of NFPA 13, such as rules for hydraulic calculations, hanging and bracing, and use of certified pump equipment.

NFPA 13R has become a huge success in the United States where the IBC allowed many of the trade-offs associated with NFPA 13 systems to be used in the construction of multi-family residential occupancies, including an allowance to utilize wood frame construction to four stories instead of three. This gained the support of the multi-family homebuilders' association. Within a few years, NFPA 13R was recognized in all the model codes, and sprinklers became mandatory in all but the smallest multi-family residential occupancies.

A similar strategy for sprinkler protection of residential occupancies was subsequently employed in Australia. Their principal design and installation standard is AS 2118.1 with a companion standard 2118.4 for protecting residential buildings up to four stories in height. But changes to the National Construction Code (2019 NCC)[53] allowed two new types of fire sprinkler system designs as alternates to the regular provisions of their principal fire sprinkler installation standards.[54] One of the new design specifications, FPAA101D, relies on connection to the domestic water supply while the other, FPAA101H, involves connection to the hydrant (standpipe) water supply. The NCC was drafted to include incentives, in this case termed "offsets", to

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52 NFPA 13R - Standard for the Installation of Sprinklers in Low-Rise Residential Occupancies, National Fire Protection Association, www.nfpa.org

53 ncc.abcb.gov.au/

54 "IFSA Supports New Australian Residential Sprinkler Campaign," International Sprinkler Scene, IFSA, July-September 2019.

encourage sprinkler use through the relaxation of other provisions within the NCC to reduce overall construction costs. The offsets include reducing the fire resistance level of non-loadbearing walls around fire-isolated stairs, increasing the distance of travel to exits, and permitting external or "dry" hydrants instead of "wet" risers. The offsets do not apply to residential care facilities, since those occupancies were previously required by code provisions to be protected with fire sprinkler systems.

These changes to the Australian Code were motivated by a fatal fire that took place in 2012 in a building that was purposefully designed to be just under 25 m in effective height, thereby evading the code requirement for an automatic sprinkler system. A coroner's inquest following the fire recommended that a more cost-effective yet "fit for purpose" sprinkler system design be developed so that the threshold for mandatory sprinklers could be lowered. The development of the two new design specifications has in fact led to new sprinkler requirements for all residential buildings more than 4 stories in height rather than the prior height threshold of 25 m. And as of the writing of this guide, sprinkler advocates in Australia are looking to extend sprinkler requirements to all multi-family residential buildings in the next code cycle.

It is important to note that if an effort is made to develop standards intended to make sprinkler system installation more economical, care must be taken that the goal of economy does not result in unforeseen diminished levels of protection, either in reliability or performance. There is ultimately a science behind the extinguishment of fires with water, and some features of reduced requirements can present new and unacceptable risks. Despite the continued successful application of NFPA 13R in the United States and proven benefits for life safety in structures protected with the standard, some states have set additional limits on the size of a building that can be constructed using that standard. One of the key provisions of NFPA 13R that reduces the cost of sprinkler installation is the omission of sprinklers from combustible concealed spaces, including unoccupied attics, an omission that has led to several major losses. While the goal of life safety has been maintained in these fires such that no lives were lost, the destruction of property in some jurisdictions has been subsequently judged to be unacceptable.

Regularly updating the standard references within the adopted code is also a means of producing more economical standards, since newer standards tend to incorporate the latest technology and research. Manufacturers are always striving to develop products that will give them a larger share of the market, and that motivates them to develop products that can result in lower overall system costs as well.

A list of current water-based fire suppression system standards is maintained on the IFSA website.

CHAPTER TEN: EDUCATING AND INFORMING THE PUBLIC

In the list of methods to advocate for fire sprinklers, there were two categories dealing with the public, neither of which was judged to be highly effective by the advisory panel. "Informing Public Opinion as to Fire Sprinkler Effectiveness" scored only a 4.7, while "Educating the Public as to How Sprinklers Work" finished last at 3.8. It is generally believed that this is because it can take vast resources to affect public opinion, as evidenced by the enormous sums spent by major corporations in their advertising budgets.

Yet the idea of swaying public opinion has long been a goal of the fire sprinkler industry and advocates. At the 1970 Fall Meeting of the National Fire Protection Association, an address was presented on behalf of the Executive Director of the NFSA entitled "Convincing Consumers to Install Automatic Sprinklers."[55] The stated definition of "consumer" was broad, and included architects, legislators, building officials, school board members, and hospital administrators. However, it was also noted that "in automatic sprinkler protection, everyone is the consumer; not only the direct buyer of the fire protection system but the tenants and those who work, visit, or live in the sprinklered building".

The basic idea put forth in the address was that the key to promoting the use of sprinklers was twofold: to set forth the advantages provided by automatic sprinkler protection and to dispel the adverse myths and misconceptions about sprinklers. And despite decades of evidence to a great extent, these are the same advantages and misconceptions that persist today, more than half a century later.

10.1 Informing Public Opinion as to Fire Sprinkler Effectiveness

The principal advantages of installing fire sprinklers noted in the 1970 address are still valid, and most have been discussed elsewhere in this Guide:

- Sprinklers offer the highest assurance of safety to life.
- Sprinklers can reduce construction cost when they are installed throughout a building in compliance with most modern building codes.
- Fire insurance premiums can be reduced.

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55 Casey, Raymond J., "Talking Extinguishing Equipment," Fire Journal, March 1971.

- Sprinklers protect “intangible” but vital assets not insurable under any conditions, such as historic artifacts and documents.
- Sprinklers prevent costly “downtime” and assure continuity of business operations.
- Sprinklers protect the jobs of workers.
- Sprinklers safeguard business income.
- Sprinklers prevent loss of customers who might go to another source of supply after a fire.
- Sprinklers permit greater design freedom and building flexibility.
- Sprinklers conserve water.

NFSA had published a pamphlet that same year entitled *25,000 Salesmen*, referencing the estimated 25,000 individuals who worked in the fire sprinkler industry in the U.S. at that time, and the need for each of these individuals to serve as a spokesperson for the fire sprinkler concept. The address concluded by noting that “when sprinklers are installed, everyone benefits, and a product that does so much good for so many people ought not be kept a secret.”

10.2 Educating the Public as to How Sprinklers Work

At the time of the 1970 address mentioned above, it was believed that if the public knew how fire sprinklers worked, it would go a long way toward dispelling the myths. The most common myths at that time were listed as follows:

- When a fire breaks out in a building, all the sprinklers go off and flood the building.
- Fire sprinklers have too much thermal lag and require temperatures that are too high.
- Sprinklers discharge due to mechanical defects, flooding buildings and damaging contents.
- Sprinklers increase the construction cost of buildings.
- “Fireproof” buildings do not need sprinkler protection.

These myths were individually examined and dismissed in the 1970 address, and can be again individually examined in an analysis updated for today’s technology:

All the sprinklers operate in response to the fire and flood the building?

This myth persists. Fire sprinklers have been portrayed inaccurately so much in the media that there is even a website that tracks the movie and television episodes that inaccurately represent fire sprinkler systems.[56] The website notes that the myth of simultaneous activation is only one of five common misconception:

- Pulling a fire alarm activates the fire sprinklers.
- All sprinklers activate simultaneously.
- Lighters/open flames activate the fire sprinklers (often from a distance away and after only a few seconds).
- Fire sprinklers can be activated via the Internet or some other magic button.
- Smoke alone can activate the fire sprinklers.

The taking of artistic license with sprinkler systems by screenwriters as a plot device is a difficult thing to counter, and dates back as far as the 1974 release of the film *Towering Inferno*, depicting a high-rise in which the sprinklers are briefly reported as not working for some unknown reason. To some extent, the depiction of sprinkler systems in media is a valuable sign of growing awareness. Although characterizations of simultaneous activation remain highly objectionable and warrant correction, many advocates have learned to live with depictions of individual sprinkler activations in the presence of heat, even small amounts of heat, and even the figurative "heat" of fast cars or sexual tension.

The NFPA's 2021 report on sprinkler activations in the years 2015 through 2019 indicates than only a single sprinkler activated to control the fire in 77 percent of fires, and that 5 or fewer sprinklers activated in 97 percent of fires.[57]

Fire sprinklers have too much thermal lag and require temperatures that are too high?

This myth had some basis in fact but has been convincingly addressed in the past half century through technological advancements. The development of quick response and residential sprinklers in the 1980s has provided assurance that fire sprinklers are able to respond quickly to fires, maintaining life safety in

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56 www.hollywoodfiresprinklers.com

57 Ahrens, M., U.S. Experience with Sprinklers, National Fire Protection Association, October 2021, www.nfpa.org.

the room of fire origin. Researchers in many countries have demonstrated that residential sprinklers control temperatures and tenability, and the NFPA statistics on reduced fire deaths in sprinklered buildings speak for themselves.

Sprinklers discharge due to mechanical defects, flooding buildings and damaging contents?

To obtain product approval from a certification body like Underwriters Laboratories, sprinkler manufacturers must submit samples to pass dozens of individual tests addressing long-term product integrity, including tests of strength and corrosion resistance. Although the standard pressure rating for sprinklers is 175 psi (1.2 MPa), sprinklers must pass hydrostatic tests at four times their pressure rating, and every sprinkler must be tested to ensure it does not leak at a pressure of at least 500 psi (3.4 MPa) before it leaves the factory[58].

The statistic traditionally cited for the possibility of a sprinkler operating in the absence of heat, freezing or mechanical damage in the field, based on Factory Mutual insurance records, was one per year per 16 million sprinklers in use. With the advent of fast response sprinkler technology in the 1990s there appeared to be an increase in the number of unexplained sprinkler activations or what were termed "pre-ops", especially with fast response sprinklers that utilized 3 mm glass bulbs as the heat-sensing element. In 2004 Underwriters Laboratories began requiring the use of protective covers for these sprinklers, which seemed to eliminate the problem. The protective covers are kept in place during installation but removed prior to the system being placed in service. In retrospect, it is now believed that sprinkler handling methods were the primary cause of the temporary increase in unexplained activations and that greater care is needed during the installation of sprinklers. It is not appropriate, for example, to remove sprinklers from shipping cartons and load them into buckets prior to installation. Doing so could damage the thermal elements, bend the deflectors, or otherwise damage the sprinklers before they are installed.

Sprinklers increase the construction cost of buildings?

As indicated in the chapters discussing sprinkler incentives, the design alternatives that are common in modern building codes, as well as the performance-based designs that are frequently generated by fire protection engineers, often result in less cost for the building design that incorporates a complete fire sprinkler system.

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58 UL 199 – Standard for Automatic Sprinklers for Fire Protection Service, 12th Edition, Underwriters Laboratories, 2020.

“Fireproof” buildings do not need sprinkler protection?

Fortunately, there are fewer references to “fireproof” buildings these days. There is greater recognition that it is building contents that burn and generate toxic smoke. Fire sprinklers react while fires are still small, and control or extinguish them before they can become deadly.

CHAPTER ELEVEN: FIRE SPRINKLERS AND SUSTAINABILITY

The advantages of fire sprinklers noted in the 1970 address discussed in the previous chapter were appropriate to the time and remain largely valid today, but did not include additional areas of concern that have evolved over the past half century. For example, there is widespread agreement that newer combustibles, including the increased use of plastics such as polyurethane foams in furniture, has resulted in faster-developing fires and increased health risks to responding fire brigades. New construction methods, such as lightweight engineered wood trusses, also pose a greater structural collapse hazard as well, risking responding fire fighters and the public.

As the world moves to address the dangers of climate change and other threats to the environment, more recognition is also being given to the role of automatic fire sprinklers in sustainability efforts. Fire sprinklers have historically proven that they prevent large loss fires, thereby eliminating the unmitigated discharge of pollutants and runoff to the air and water. They prevent the need for extensive rebuilding that would require the use of additional resources and energy. At the same time, since sprinkler systems usually utilize plain water as the extinguishing agent, they have never been regarded as an environmental concern in the manner of ozone-reducing chemicals or other potential extinguishing agents.

Unfortunately, some concepts of sustainability in use today utilize fairly narrow definitions, resulting in many advantages of sprinkler systems being overlooked. For example, when the NFSA funded a study in 2010 of how sprinkler systems fit with the 2009 LEED (Leadership in Energy and Environmental Design) building design and construction rating systems, it found that compliance with the building code was a minimum LEED requirement, so that no credit could be given for providing a sprinkler system if one was already required by code, and the LEED program was most likely to be involved with large buildings that were required to be provided with sprinkler protection anyway. As another example, factors such as reused value, recycled content value, the regional content value, and the rapidly renewable content value of fire sprinkler systems were simply not pertinent to the achievement of building credits. While automatic sprinkler and other mechanical systems were exempt from specific requirements for recycled content, many component manufacturers have made this information publicly available, and some of their products, including sprinklers, valves, and fittings, can exceed 90 percent recycled content by weight.

The UK based BREEAM program is similar to LEED but points can be obtained for fire safety, However, it does little to directly incentivize the installation of fire sprinkler systems at present.

The installation cost reductions over the past half century discussed in Chapter Nine have also reduced the environmental impact of sprinkler systems. Based on a survey of industry technical experts in 2008, the widespread use of hydraulic calculations alone was estimated to have reduced the cost of sprinkler systems by 40 percent, with the weight of steel in a steel pipe sprinkler system reduced by as much as 70 percent.[59] This resulted in corresponding reductions in the energy use involved in manufacturing and shipping. This type of change, along with expanded protection areas for sprinklers, elimination of in-rack sprinklers and other developments were primarily aimed at reducing system installation costs, but have also resulted in a steady lessening of the environmental impact of installing a fire sprinkler system.

It is also widely acknowledged that sprinkler systems help reduce water consumption in the event of a fire. A Fire Protection Research Foundation project on residential fire sprinklers measured the total water usage during sprinkler actuation at a fire scene compared with water usage by the fire service and found that the average water usage for firefighting in residences not protected by sprinkler systems could be up to 1200 percent higher than those that are protected by a sprinkler system.[60]

With regard to water usage for system supplies, it should be pointed out that sprinkler standards like NFPA 13 and the European standards have always permitted the use of open water bodies like rivers and lakes to be the source of supply for fire sprinkler systems, and the only concern for reclaimed or recycled water is that it be of sufficient quality to avoid compatibility and corrosion problems. If water is potable then it is certainly adequate for use as a fire sprinkler system supply, and the use of rainwater catchment is common practice throughout the Caribbean and similar areas.

Energy use is also an environmental concern, and there have been major efforts to reduce energy needs, again driven by economic concerns. For example, U.S. codes and standards addressing the installation of standpipe (interior hydrant) systems traditionally required the use of fire pumps to maintain high pressures for mid-rise as well as high-rise buildings. Current codes and standards, however, allow a combined riser to serve both sprinkler systems and standpipe systems, and if the pressures available within the city water main are sufficient to provide water at proper pressures for the sprinklers but not the standpipe outlets, it is permitted to omit the pump and allow the standpipe system to be maintained at the sprinkler system pressure. In the event of a fire, it is reasoned

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[59] Fleming, Russell P., "Fire Sprinklers and Sustainability," Fire Safety Design and Sustainable Building Conference, Fire Protection Research Foundation, November 2008.

[60] Utiskul, Yunyong, and Neil P. Wu, "Residential Fire Sprinklers – Water Usage and Water Meter Performance Study," Fire Protection Research Foundation, February 2011.

that the responding fire department will provide the increased pressures needed for the standpipe outlets using the pump within their apparatus. This eliminates the need to periodically run and test a dedicated fire pump within the building.

The ongoing water and energy demands of sprinkler system maintenance have also been addressed in recent years. As it prepared the 2011 edition of NFPA 25, the technical committee responsible for that standard was made aware of efforts in Australia to substantially curtail the amount of water used in maintaining fire protection systems to help address droughts in that country. The effort included the publication of *Fire Protection Systems Testing – Water Conservation Handbook (HB 233-2008)*, published as a companion guide to the Australian system maintenance standard AS 1851-2005 – *Maintenance of fire protection systems and equipment*. The handbook provides building owners, consultants and system designers with recommendations for ways to reduce, re-use or recycle water used to test sprinkler systems, hydrants, pumps and hose reels.

The Australian effort in turn inspired the NFPA 25 Committee to be more receptive to new technologies that can reduce water and energy demands associated with periodic system testing. For example, beginning with the 2020 edition of NFPA 25, the standard began to allow the use of automated testing equipment that does not discharge water for periodic testing, although actual discharge must be observed at least once every three years to confirm that the testing equipment is functioning properly.

Sustainability guidelines for new construction also neglect the possibility of a building fire and what that means in terms of environmental impact. Research in 2010 by FM Global involving large-scale tests compared the relative impacts of fire in a single-family dwelling that was protected with sprinklers and one that was not.[61] In the home without sprinklers, fire extinguishment was accomplished solely by fire service intervention assuming typical response times. The comparisons showed that having sprinkler protection reduced the quantity of greenhouse gases emitted (by 97.8 percent) and total water used for extinguishment (by 50 to 91 percent). The water runoff from the fire without sprinklers contained more heavy metals and other pollutants, and had a pH value between 11.6 and 12.1 compared to a pH of 7.9 in the sprinkler runoff. The peak heat release rate of the fire was 300 kW with sprinklers, but 13,200 kW without sprinklers. The fraction of available combustible material consumed by the fire was less than 3 percent with sprinklers, but between 62 percent and 95 percent without sprinklers.

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61 Wieczorek, C., Ditch, B., and Bill, R., "Environmental Impact of Automatic Fire Sprinklers," FM Global, 2010.

To be truly sustainable, a building must be protected against destruction by fire, and properly designed, installed, and maintained fire sprinkler systems are the best way to ensure such sustainability.

CHAPTER TWELVE: RESPONDING TO TRAGIC FIRES

It is a sad fact of life that the history of fire protection regulations is often described as being "written in blood", because it seems that only tragedy can create the motivation that results in change. In fact, a "theory of reform following catastrophes" has been advanced to recognize that:

1. The time for reform following a catastrophe is short
2. The scale of the catastrophe is significant in determining the amount of reform possible, and
3. The amount of reform that can be expected depends on proximity to the catastrophe.

Advocates of fire sprinkler systems recognize that large loss fires provide an opportunity for advancing the cause of improved fire protection. However, any advocacy group must address opportunity without appearing opportunistic.

12.1 Seizing the Opportunity

The word "opportunistic" is generally considered to have a negative connotation and is defined as "exploiting chances offered by immediate circumstances without reference to a general plan or moral principle." When a tragic fire takes place, it is easy to see that an industry response calling attention to the difference an automatic fire sprinkler system would have made could be seen as opportunistic. However, if the response is measured and part of a general plan to convince regulators and the public of the need for fire sprinklers to avoid future similar tragedies, then it is not opportunistic but in the public interest.

In fact, it often takes more than one tragedy. Looking back at major advances in the United States, for example, there are notable periods in which regulations appeared following two or more deadly fires in the same type of occupancy in close succession:

- High-rise fires in both the Rault Center in New Orleans (six deaths) and the Baptist Towers in Atlanta, Georgia (10 deaths) on 20 and 30 November of 1972 led to scrutiny of the level of safety in those structures, especially when housing the elderly, leading to a U.S. Senate inquiry.
- Hotel fires in in the MGM Grand Hotel in Las Vegas on 21 November 1980 (85 dead) followed by the Stouffer's Hotel fire in West Harrison, NY on 4 December 1980 (26 dead) and the Las Vegas Hilton fire on 10 February 1981 (seven dead) resulted in a great number of fire sprinkler systems

installed in existing hotels both as a result of regulatory actions (as in Las Vegas) and voluntary actions on the part of major hotel chains.

- Nursing home fires in Hartford, CT on 27 February 2003 (16 dead) and Nashville, TN on 25 September 2003 (16 dead) were the final straws for the U.S. Department of Health and Human Services, leading to a requirement issued in August of 2008 that all long-term care facilities be equipped with an automatic fire sprinkler system within five years in order to continue to be reimbursed by the Federal government for Medicare and Medicaid programs.

Even with performance-based codes, multiple fire tragedies can lead to changes in the acceptable solutions. In New Zealand, for example, the Terwindle Rest Home (aged care residential facility) fire that resulted in seven deaths in 1989 was followed by three fatal fires in rest homes in 1996 and 1997. As a result, the New Zealand Fire Service began to refuse to approve evacuation schemes for these occupancies. The "acceptable solutions" to the New Zealand Building Code now require sprinkler protection for rest homes with five or more beds.

Multiple tragedies in close succession help defeat the attitude that a major fire loss was a "one-off" occurrence, so unusual that it wouldn't be repeated. As such, one lesson in dealing with the aftermath of a major fire loss is to point out that such losses have happened before and will happen again, unless changes are made.

12.2 Principal Considerations

Here are the key considerations for advocates in the aftermath of a major fire tragedy:

1. Advocates should be aware and prepared to reference previous fire tragedies similar to the incident, especially those within the same country or other jurisdiction, to help prevent it from being viewed as a "one-off" incident.
    - Maintain some type of occupancy-based file that will aid in finding similarities to prior fire losses.
2. Advocates should always remember that any fire involving a loss of life is an enormous tragic life-changing event for those who have lost loved ones, and advocates should be clear in expressing genuine sympathy for the families and friends of the victims.
    - In general, the news media will only cover the extent of the tragedy on the first day, then the media will focus on what caused the fire, and it is usually not until the third day or so that the focus shifts to

what could have been done to prevent the tragedy. There is rarely a need for aggressive "waving of the sprinkler flag", and even when the time is appropriate for talking about the value of fire sprinklers there should be a respectful acknowledgement of the lost lives.

3. Advocates should not rush to judgment on the difference an automatic fire sprinkler system would have made until sufficient details have been released by authorities that make it appropriate. Often the cause of the fire and extent of losses are poorly understood in the early stages following a tragedy, and it is not uncommon that early rumors are later corrected, such that advocates should withhold public statements until there are sufficient verified facts to be used as the basis for such statements.

   - The Grenfell Tower fire in London on 14 June 2017 provides an excellent example. Since this was for the most part an exterior fire, it was initially not known whether an automatic fire sprinkler system within the building would have made any difference. It wasn't until 26 June 2017 that the IFSA had sufficient information to issue a press release beginning with this paragraph:

     "Recent reports that detail the origin of the deadly Grenfell Tower fire in London suggest that an automatic fire sprinkler system could have prevented the tragedy. According to the London police, the fire that killed at least 72 individuals on June 14th started in a refrigerator within a 4th story apartment, then spread to the building's combustible exterior cladding. If an automatic fire sprinkler system had been installed in the building, it would have been expected to intervene and prevent the fire from reaching the building exterior."

4. Advocates should be aware of test reports or prior experience that support the opinion that a fire sprinkler system would have been effective under the circumstances that were present in this fire tragedy.

   - In the Grenfell Tower press release cited above, the IFSA was able to cite a report on combustible exterior cladding published in 2014 by the National Fire Protection Research Foundation, which contained the statement "It is concluded that sprinkler systems are likely to have an effect on the risk of interior fires spreading to the external wall to become exterior wall fires."

   - In responding to the March 1990 Happy Land Social Club fire in the Bronx borough of New York City in which 87 people died when a gallon of gasoline was thrown at the base of the exit stairway from the second story assembly occupancy, the NFSA was able to point to a test conducted a few years earlier by Polytechnic University of New York for the New York City Fire Department. In that test, a gallon of gasoline was likewise thrown over bags of combustibles at the base of a stairway. A single overhead fire sprinkler reacted quickly to extinguish the fire before it could involve the combustibles.

5. Advocates need to be aware of the cost of sprinkler system installation as this will invariably be mentioned as a stumbling block, especially for retrofit of existing buildings. Advocates should have up to date information to provide the media and government officials with realistic cost estimates.

    - Key to the effective response of the British Automatic Fire Sprinkler Association (BAFSA) to the 2017 Grenfell Fire disaster was their prior work in producing cost data from the sample sprinkler retrofit of a similar residential tower block. The IFSA assisted in the documentation of this 2012 project, known as the Callow Mount project.[62] In the aftermath of Grenfell, BAFSA was ready to provide hard data, not speculative approximations.

62 Safer High Rise Living… the Callow Mount Sprinkler Retrofit Project, British Automatic Fire Sprinkler Association, 2019. - Available for download at https://www.bafsa.org.uk/wp-content/uploads/bsk-pdf-manager/2017/09/CALLOWMOUNT_web0407LR_lowres.pdf

CHAPTER THIRTEEN: AVAILABLE RESOURCES

Because other fire sprinkler advocacy groups have been at work for decades, there are many resources available that can serve as a source of inspiration or, with proper approval, translation and use.

As noted in many of the preceding chapters, the long history of the NFSA[63] dating back to 1905 has included the development of many materials intended to educate contractors, engineers, architects, authorities having jurisdiction, owners, and layout technicians, because it acknowledged that all of those groups are stakeholders in the codes and standards process affecting the industry. Even though the groups may use codes and standards in different ways, becoming familiar with only specific portions of such publications, they can all become fire sprinkler advocates.

Beginning in 1996, the NFSA joined with the American Fire Sprinkler Association (AFSA)[64] and the NFPA to form the Home Fire Sprinkler Coalition (HFSC), which now has expanded its board to include property insurers, fire service organizations, and others. From the start, HFSC has prided itself on offering free and unbiased educational resources for the fire service, homebuilders, and other stakeholders—all housed on its website[65]. Underscoring the fact that the fire service is a community's most trusted safety source, the fire service has been the biggest promoter of HFSC materials and the home fire sprinkler message. Through HFSC's "Built for Life" program, nearly three thousand U.S. and Canadian fire departments have pledged to make home fire sprinklers a priority of their outreach.

A popular tactic by fire departments to demonstrate the abilities of fire sprinkler systems has been conducting live side-by-side flashover/sprinkler demonstrations for the public and community decision makers. In these demonstrations, two eight-by-eight-foot structures, one equipped with fire sprinklers and one without, are set ablaze as audiences watch and compare the outcome. These side-by-side events display a startling fact: today's home fires can become deadly in as little as two minutes.

The NFPA launched its "fire sprinkler initiative" in 2009, which also focuses on the need for fire sprinklers in all residential properties and which can also be a major resource for fire sprinkler advocates. The Fire Sprinkler Initiative seeks to link advocates with resources to promote fire sprinkler requirements to code-making bodies and legislators. The initiative offers on-the-ground support and

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63 www.nfsa.org

64 www.firesprinkler.org

65 www.homefiresprinkler.org

free resources, including HFSC material, via its website.[66] NFPA research on home fire sprinklers has also furthered the cause; its two landmark reports on sprinkler installation costs place the national average at about one percent of a home's total construction cost.

All of the associations and advocacy groups whose accomplishments are mentioned in this Guide can also serve as resources for new advocacy groups. That is why this Guide includes annex materials such as sample organizational documents from the European Fire Sprinkler Network (EFSN) in Annex A.3 and Asociación Mexicana de Rociadores Contra Incendios (AMRACI) (in Spanish) in Annex A.4. In addition to these sample documents Annex A.5 includes a document created by ANRACI Colombia on conducting side-by-side burn demonstrations (in Spanish).

In closing, it should also be mentioned that the vision of the IFSA is to become *"the recognized worldwide center for information and training aimed at advancing the effective use of water-based fire protection systems."* To the best of its ability, the IFSA stands ready to assist all fire sprinkler advocacy groups around the world in their efforts to encourage the wide use of automatic fire sprinkler systems.

66 www.nfpa.org/firesprinklerinitiative

ANNEX DOCUMENTS

A.1 – Article entitled “Why Sprinkler Trade-offs Work”

Why Sprinkler Trade-Offs Work

by EDWARD J. REILLY, President
and
RUSSELL P. FLEMING, P.E., Vice President of Engineering and Standards
National Automatic Sprinkler and Fire Control Association, Inc.

Several trade associations within the concrete, brick, and masonry industries have undertaken an effort to expand the use of fire-resistive construction through elimination of sprinkler "trade-offs". The concept of trade-offs, permitting automatic sprinkler systems to substitute for other fire protection features, is well established in this nation's building codes. In light of recently-published articles and public presentations attacking the validity of this concept, it is worthwhile to review the background and basis of sprinkler trade-offs, and to see how they are working as part of today's building regulatory system.

Add-Ons

It is sometimes easy to forget how new the science of fire protection is. Proponents of fire-resistive construction give the impression that we've always built our buildings like ovens, and that permitting a "one-hour" wall when an automatic extinguishing system is provided is a new-fangled sacrilege.

The fact is that the concept of fire resistance ratings was introduced with the publication of the first edition of the Uniform Building Code in 1927. By that time, the national installation standard for automatic sprinkler systems had been in existence for over thirty years. Buildings built in the late 1800's and early 1900's were being protected with automatic sprinklers because there was simply no other way of protecting these wood frame buildings. When new fire resistive materials came along, sprinklers were eliminated from many building types. Modern flush, recessed, concealed and decor sprinklers were not available, and building designers were only too happy to do away with the unaesthetic sprinklers.

Common Ground

Both proponents and opponents of sprinkler trade-offs seem to agree that two conditions must be satisfied if building codes are to permit less restrictive fire protection requirements in exchange for the installation of automatic sprinkler systems: capability and dependability. Essentially, capability is the ability to handle the fire and prevent loss of life and property. Dependability is the reliability factor, the assurance that the system will be operable when needed.

The two conditions of capability and dependability are not useful only for determining the validity of sprinkler trade-offs. All fire protection features and schemes should be scrutinized in these two regards.

Capability

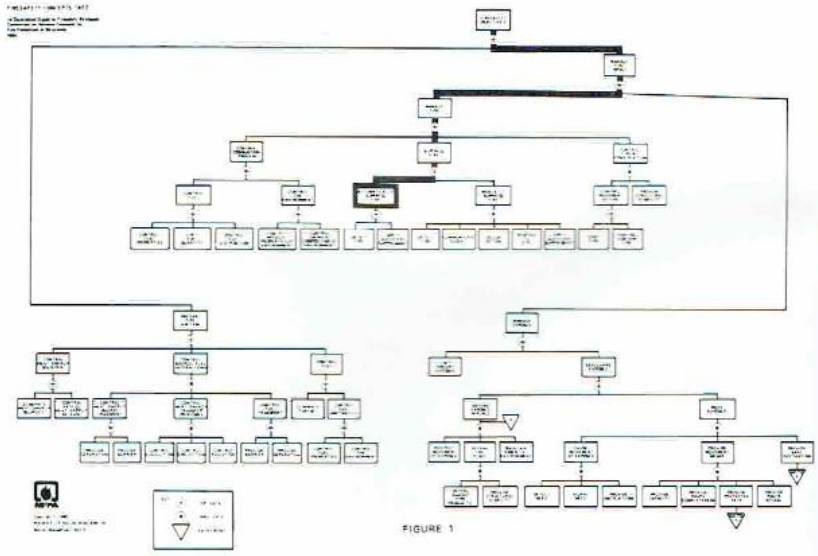
If the factor of dependability is isolated, the capability of a sprinkler system in preventing the loss of life and property can be looked at assuming a 100 percent operable system, i.e. the system will deliver water to the fire.

The water delivery function of a sprinkler system is simple. Minimum densities are established by the national installation standard, NFPA 13, and are matched to the expected loading of combustibles in the occupancy type. Water from a sprinkler immediately reduces the intensity of a fire by cooling the burning surface, preventing the spread of fire to nearby combustibles. The production of steam deprives the fire of needed oxygen, and the wetting of surfaces immediately beyond the fire area prevents flame spread.

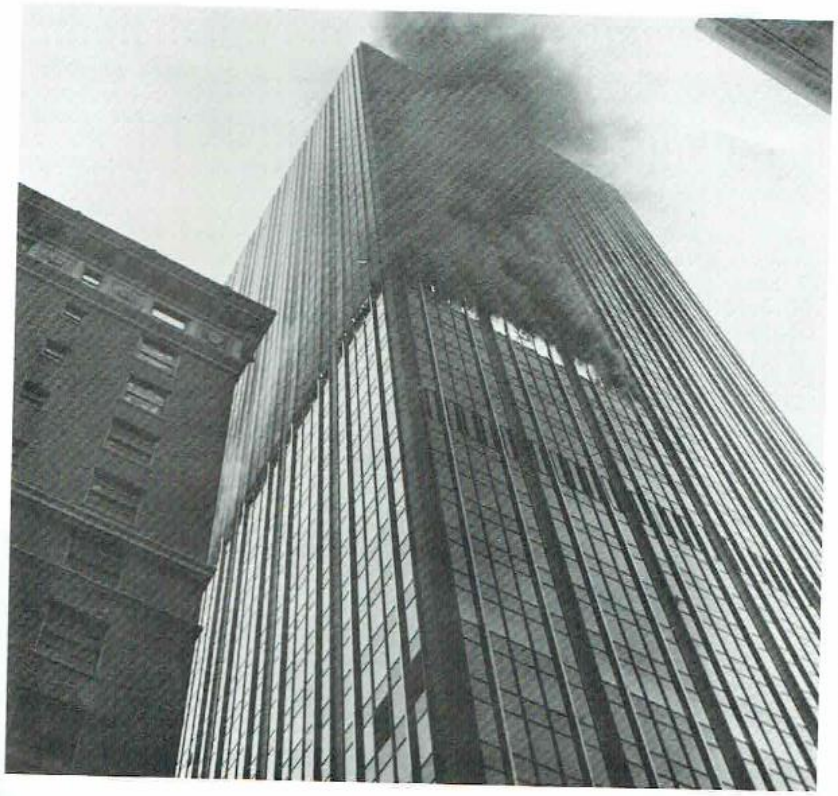
The basic principle of extinguishing a fire while it is still small is practically unbeatable for reducing life and property damage by fire. The NFPA Systems Concept credits an automatic extinguishing system which properly detects and suppresses a fire with having the ability to alone attain the Firesafety Objective. The Firesafety Concepts Tree (Figure 1) contains only "or" gates between the "Automatically Suppress Fire" action and the Firesafety Objective.

The permitting of automatic sprinklers to substitute for other fire protection features of building codes is, to a large extent, based on this judgment that the early application of water to the fire will satisfy the fire safety objective. Such is the case for the elimination of occupant use fire hoses and some automatic and manual alarm systems. In other cases, the judgment is that other fire protection features will not be tested to their fullest.

In any event, the capability of sprinklers to substitute for many



NFPA Fire Safety Concepts Tree



New York Post Staff Photo

ABOUT THE PHOTOS

It's a strange world in a climate of superheated air. Aluminum melts at 1,220°F; steel at 2,600°F. Following the Westvaco Building Fire on June 23, 1980 at 299 Park Avenue in New York City, no traces of aluminum hardware could be found in the debris. This suggests that temperatures ranged above 1,220°F and below 2,600°F.

At 1,100°F, normally considered the critical temperature, steel loses 60% of its strength. Structural steel members expand about 8 inches per 100 lineal feet per 1,000°F rise in temperature above ambient.

These photos tell a story. Clumps of fireproofing fell off. Steel buckled and twisted. That the damage was not worse is a tribute to the gutty performance of one of the world's finest fire departments.

Every sprinkler must be tested to prove its capability to maintain temperatures below 530°F above ambient for 30 consecutive minutes during a brutally harsh fire set in a laboratory under a 350 lb. wood crib. The crib is kept burning by a heptane gas jet as normal sprinkler discharges maintain temperatures well below the failure point of any structural member, fireproofed or not.

other fire protection features has been well established.

Fire Resistance

One of the dozens of individual tests each new sprinkler design must pass, before being listed by Underwriters Laboratories or Factory Mutual Research for commercial distribution, is the standard crib fire test. A 350-pound wood crib is centered under four sprinklers and burned for 30 minutes above a gasoline fire from a continuously-supplied spray nozzle. To pass this severe test, the sprinklers must limit crib weight loss to less than 20 percent, and must reduce ceiling temperatures to some level less than 530°F above ambient within 5 minutes following the start of water discharge.

Figure 2 shows the ceiling temperature profile during the successful performance of a standard sprinkler in the UL crib fire test, charted against the ASTM E-119 Standard Time-Temperature Curve. With the water held back for a full minute, the fire has been permitted to raise ceiling temperatures well above 1000°F. The sprinkler drives down the temperature to levels which would not permit structural failures.

That sprinkler protection is capable of making fire-resistance ratings moot was demonstrated more directly

Photo Courtesy of NYFD

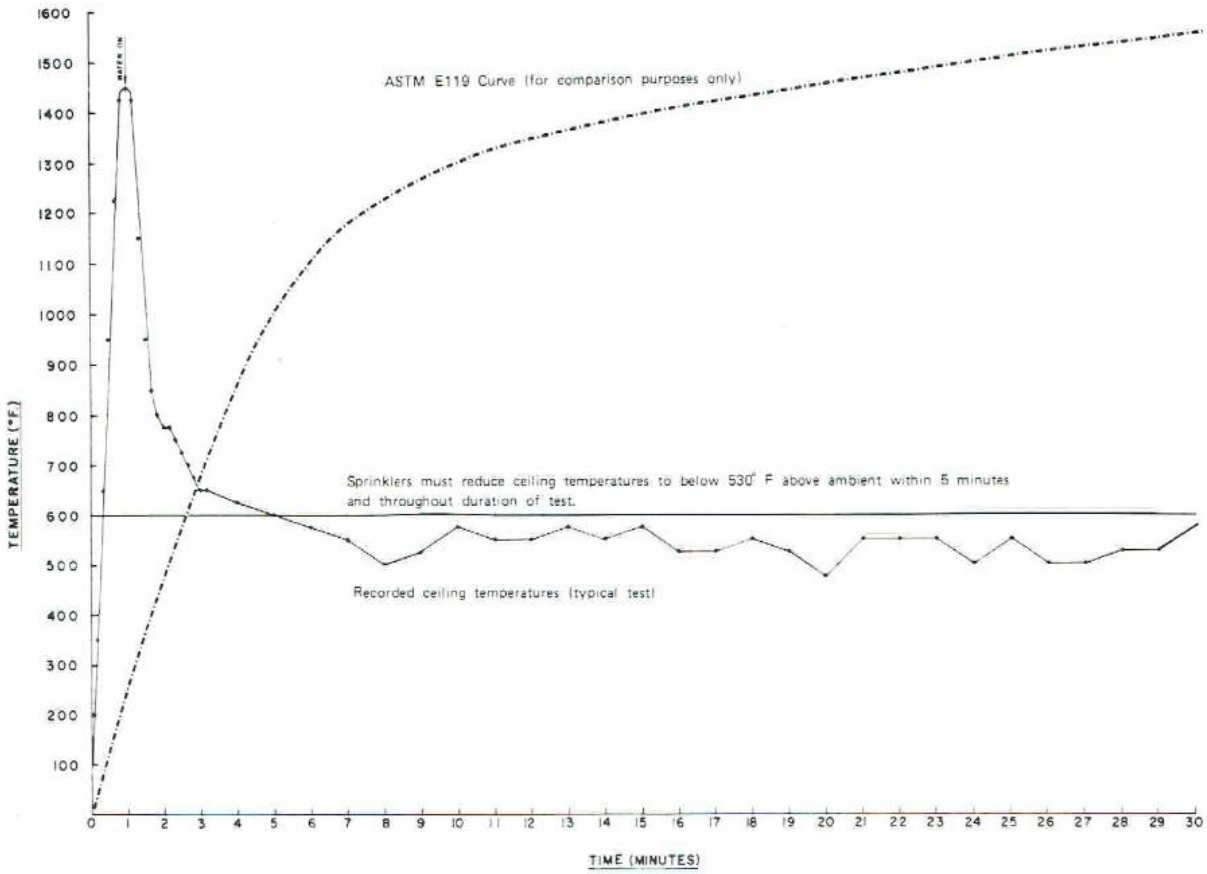


FIGURE 2 - TYPICAL SPRINKLER CRIB FIRE TEST DATA

in 1974 tests conducted by Factory Mutual Research. FM researchers found they were able to simulate, using a gasoline spray, the temperature profile of a bare steel H-column exposed to an ASTM E-119 fire. The gasoline spray of 2.8 gpm was directed upward 1 inch away from the column, and produced a temperature profile for the steel very similar to that recorded in a National Bureau of Standards furnace using the Standard Time-Temperature Curve. With the gasoline spray, however, the FM researchers were able to investigate the effects of automatic sprinklers located 25 feet above. Figure 3 shows that the sprinklers operated about 5 minutes into the test, knocking down the temperature of the steel well before it could reach the expected failure temperatures.

Many other test series have been conducted which demonstrate that sprinklers are capable of providing the equivalent of a fire-resistance rating for the protection of wood, glass, steel, and other combustible and unprotected noncombustible materials.

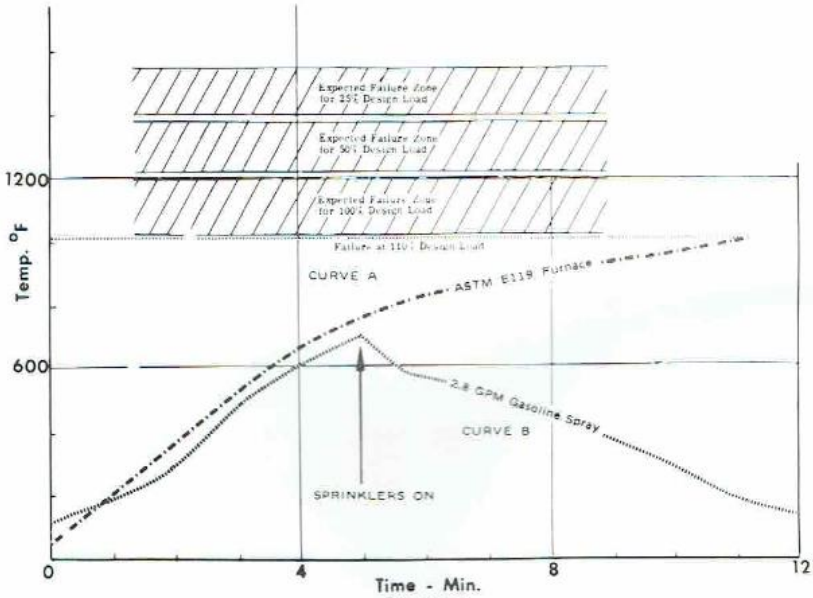


FIGURE 3

FACTORY MUTUAL — Bare Steel H - Columns Temperatures During Exposure to ASTM E-119 Standard Furnace and Simulated Exposure with Sprinkler Protection.

Areas, Heights, and Compartmentation

Building codes almost universally grant greater building heights and areas in recognition of non-combustible and fire-resistive construction. The capability of automatic sprinklers in substituting for the noncombustibility and fire resistance alone justifies area and height increases for sprinklers.

Sprinkler performance statistics show that the large majority of fires in sprinklered buildings are controlled by a very few sprinklers. This ability to confine the fire to a small area of a building eliminates the need for compartmentation.

Research conducted at Factory Mutual, the National Bureau of Standards and elsewhere has given validity to code provisions permitting the elimination of certain horizontal and vertical compartmentation and enclosures in fully sprinklered buildings.

Exit Travel Distance and Capacity

Automatic sprinklers have been permitted to modify the requirements for egress facilities since the 1918 publication of "Safeguarding Factory Workers from Fire" by the National Fire Protection Association. Aimed at eliminating the factory holocausts of the period, the report was a forerunner of the Building Exits Code, now known as the NFPA Life Safety Code. The 1918 report recognized the presence or absence of automatic sprinkler protection as a major factor in determining maximum occupant load for a given floor. With the publication of the Building Exits Code in 1927, a formula was developed to determine a minimum number of exits, with a sprinklered building permitted twice the number of occupants per exit as an unsprinklered building. Today this trade-off has evolved to where the codes permit longer exit travel distances and sometimes lesser exit widths in recognition of sprinkler protection. The basic reasoning has not changed since 1918 — sprinkler protection is capable of eliminating the danger of a fast-developing fire, permitting building occupants more time to escape in an orderly fashion, if escape is necessary at all.

Interior Finish

Tests conducted at Factory Mutual in 1959 and 1960 for the verification of NFPA 13 sprinkler design and installation rules demonstrated that sprinklers are capable of controlling flame spread in rooms with combustible cane fiber board walls and ceilings. Tests conducted by the National Bureau of Standards in 1977 concluded that combustible interior finishes (Class C) did not play any role in fire development when either ceiling mounted or sidewall sprinklers were installed in the room.

Redundancies

Opponents of sprinkler trade-offs create the impression that codewriters are giving away everything else for the benefits of sprinkler protection. In truth, the codes are remarkably conservative. Fire resistance reductions average one hour, and often are accompanied by a requirement that a minimum of one hour passive protection be maintained for key structural assemblies in the unlikely event the automatic sprinkler system would not be operational when needed. Similarly, exit access travel increases for sprinklers are usually held to 50 percent, and increases in allowable flame spread of interior finish materials are limited to the one class higher, i.e. Class I to II or II to III. It is surprising that an unassailable faith in two hours of fire resistance is not carried over into a substantial degree of confidence in one hour of fire resistance accompanied by automatic sprinkler protection.

Dependability

Among the myriad of statistics on automatic sprinkler performance, the Australian statistics remain today the most accurate ever assembled. These statistics, collected in Australia and New Zealand by the Australian Fire Protection Association for the years 1886 through 1968, have withstood more than one "critical evaluation" attempting to invalidate the facts by means of word games and hocus-pocus, such as what might have been stored on which side of a building.

The Australian study indicated a satisfactory performance record of 99.76% (Table 1). The sprinklers successfully controlled the fires in 5,720 of 5,734 cases. The reasons

Table 1

AUTOMATIC SPRINKLER PERFORMANCE
Australia and New Zealand
1886-1969
(Australian Fire Protection Association Records)

Number of Sprinklers Operating	Number of Fires		Percentage Extinguished or Controlled	
	Total	Cumulative	Total	Cumulative
1	3,809	3,809	66.56%	66.56%
2	901	4,710	15.56%	82.12%
3	337	5,047	5.89%	88.01%
4	184	5,231	3.22%	91.23%
5	91	5,322	1.58%	92.81%
6	71	5,393	1.24%	94.05%
7	50	5,443	0.87%	94.92%
8	45	5,488	0.78%	95.70%
9	25	5,513	0.44%	96.14%
10	31	5,544	0.54%	96.68%
10 or more	176	5,720	3.08%	99.76%

TOTAL	NUMBER	PERCENT
Fires Extinguished or Controlled	5,720	99.76%
Unsatisfactory Performance	14	00.24%
TOTAL	5,734	100.00%

for the unsatisfactory performance are shown in Table 2. If the four cases of partial protection are eliminated, since the fire actually started in an unsprinklered area of the building, the successful performance record would go to 99.83%. **At least 83.4 percent of the successful performances were achieved in non-fireresistive buildings.**

Other studies of sprinkler performance have indicated lower degrees of successful performance:

Australia and New Zealand (1886-1968; 5,734 fires)	99.8%
New York City High-Rise (1969-1978; 1,648 fires)	98.4%
New York City Low-Rise (1969-1978; 4,061 fires)	95.8%
Nat. Fire Protection Assoc. (1925-1969; 81,425 fires)	96.2%
US Navy (shore facilities) (1964-1977; 724 fires)	95.7%
Factory Mutual Research (1970-1977; 3,292 fires)	86.1%
Oregon State Fire Marshal (1970-1978; 1,648 fires)	85.8%

The successful performance ratio is directly related to the thoroughness of the reporting system. In Australia and New Zealand, all sprinkler actuations are reported by law. The U.S. Navy and New York City (where the New York Fire Patrol assists the Fire Department in collecting data) are both fairly thorough, resulting in high successful performance ratios. The higher failure rate in New York's low rises was attributed by New York Board of Fire Underwriters Superintendent W. Robert Powers to deteriorating neighborhoods within New York City.

Insurance concerns, and the NFPA as a result in recent years, do not receive reports on a large number of successful one- and two-head sprinkler operations due to the existence of large deductibles on insurance policies, often running into many thousands of dollars. Reporting a successful sprinkler operation would bring no insurance reimbursement, but only a possible rate increase due to observations of poor housekeeping.

NFPA Reporting System

NFPA's reporting system is voluntary. A lack of inducements to fire chiefs, industrial fire protection engineers, plant security officers, custodial personnel or insurance authorities to obtain, complete, and mail NFPA loss report questionnaires has all but dried up sources of data that would upgrade the NFPA's sprinkler performance record to well above the 96% mark.

Often those who complete questionnaires or submit loss reports to NFPA's data bank are motivated by the fact that fires reported are atypical, outside the realm of expected sprinkler behavior. Examples include fires where excessive numbers of sprinklers are opened, or where some unusual event occurred during a fire in a sprinklered building such as an explosion, or a valve ordered closed by a fire chief who misjudged the degree of the fire's control.

NFPA, by its own admission, has vastly understated the record. No motivation exists in the U.S. to induce reporting of small, routine "one-sprinkler" operations. For every reported one-sprinkler fire, it is probable that dozens of these inconspicuous events occur and are buried in oblivion. One fire chief of a midwestern city of 160,000 reported that during his 29 years of service, he had never completed an NFPA loss report questionnaire involving a sprinklered building although thousands of fires were extinguished or controlled during his three decades of service as a fire officer. He could not recall a single case of sprinkler failure, but remembered the largest number of sprinklers that opened during those years occurred when 8 sprinklers brought a fire under control in a multi-story department store four blocks from fire department headquarters.

The lack of one- and two-sprinkler successful reports, even in the NFPA statistics, can be observed by comparing their records of the number of sprinklers operating to control a fire against those of thorough reporting systems such as the Australian and New York statistics. On the basis of simple chance, it can be assumed that the ratio of small controlled fires to large controlled fires would remain fairly constant no matter whose statistics you use. In other words, if one considers only successful performances, the percentage of total fires controlled by one or two sprinklers should hold fairly constant.

Table 3 shows such a correlation holds true between the Australian and New York statistics, but that the NFPA statistics fall very short in the percentage of fires controlled by one or two sprinklers. As a result, the percentage of fires controlled by three or more sprinklers appears much higher than in the other studies.

Interestingly, the total percentage of fires controlled by the different numbers of sprinklers fall neatly in line with other sets of statistics when the NFPA statistics are "modified" by assuming an additional 80,000 unreported fires between the years 1925 and 1969 successfully controlled by one or two sprinklers.

If this is close to the true number of unreported successful performances, the "modified" NFPA overall successful performance ratio for the years 1925-1969 was actually higher than 98 percent. Even this number is conservative in that it assumes no unreported successful performances involving three or more sprinklers.

The Oregon Statistics

Statistics from the Office of the State Fire Marshal of Oregon have been misused for several years in attempts to discredit sprinkler protection. The October, 1973 minutes of the ICBO High Rise Buildings Subcommittee included a reference to Oregon statistics indicating a 76.3% sprinkler performance rating in 1969, a 47.9% rating in 1970, a 40.2% rating

Table 2

AUSTRALIA AND NEW ZEALAND
WHY UNSATISFACTORY PERFORMANCE?

	No. of Fires	Percentage of Unsatisfactory Performance
Severe external exposure	4	28.6%
Partial sprinkler protection	4	28.6%
Explosions		
Systems destroyed by blast	3	21.5%
Fire loading too high for water supply	1	07.1%
Inadequate water supplies	1	0.71%
Roof surface destroyed	1	0.71%
TOTAL	14	100.00%

in 1971, and a 44% rating in 1972. The sprinkler industry was naturally concerned and asked a few questions.

A great many of the sprinkler systems installed in Oregon in the 1960s and early 1970s were substandard systems, not meeting the minimum requirements of the national installation standard NFPA 13. Partial or spot systems were installed in closets and odd corners. It was not uncommon to see 3 or 4 sprinklers fed from a single ¾-inch domestic line. In Oregon, sprinkler branch lines were sometimes fed from 2-inch standpipes that were in turn fed from 2-inch street mains. In one case, 30 sprinklers were permitted in a basement on a 1-inch supply line. Clearly these cases illustrate abuses in the design and installation of sprinkler systems.

The problem of substandard and partial systems was compounded by the problem of a poor reporting system. Oregon is not to be criticized, for it was the only state at the time attempting to keep complete, continuous fire records. Nevertheless, Oregon State Fire Marshal Walt Stickney found it necessary to write to the ICBO High Rise Buildings Subcommittee explaining that:

"there has been confusion for the person making out the fire report, resulting in incomplete information being fed into our data loss system . . . We still find that the person making out the report often puts 'yes' in the category of 'area of origin protected by automatic sprinklers' even though that area is unprotected. For example (copy enclosed): the fire originated on the fifth floor, they have indicated that the area has automatic sprinklers, but the basement is the only part of the building sprinklered . . . Another problem that arises is that all categories may be filled out properly . . . but they then completely omit noting whether the fire was controlled by the sprinkler system or not. This again changes the percentages . . . Another factor over which we have little control is the definition given to "controlled" by the reporting officer, some feel this means completely extinguished."

University of Maryland Study

These same Oregon statistics were dredged up in 1979 for a study the University of Maryland Civil Engineering Department performed on behalf of seven trade associations representing the concrete and masonry industries. Although former Fire Marshal Walt Stickney again warned that the use of the Oregon statistics would mislead them into making false assumptions about sprinkler performance, the Maryland Civil Engineering Department went ahead and, on the basis of 17 incidents among 27,000 fire reports from five states, drew the conclusion that sprinkler systems failed to operate when needed in one out of every seven cases. One wonders what motivated such a total misrepresentation of the facts.

Factory Mutual Statistics

The Factory Mutual System may be the world's largest insurer of highly-protected risks (HPRs). It insures some of the largest, most valuable and best protected properties in the world. Every fire hazard known to man is the object of the protection prescribed by what may be the world's finest staff of professional loss prevention engineers.

Factory Mutual's entire system of engineered loss control is predicated on automatic sprinkler systems, designed and installed by experts and maintained to the Mutuals' high standards. Yet, the Mutuals published record of only 3,292 fires covering a seven year period ending in 1977 seems only slightly better than the discredited Oregon statistics.

Why?

The most obvious reason can be observed in the nature of FM's clients. Deductibles of several hundred thousand to a million dollars are common among the multi-national corporate giants insured by FM. So Factory Mutual loss reports of fires kept small or extinguished by one or two sprinklers must, by the very nature of large deductibles, be minimal. There may be as many as 100 unreported extinguishments for every one that gets into the data bank.

Large, unusual, or dramatic fires do get into the data bank. Closed valve fires are always reported. Maintenance defects on FM inspected sprinkler systems probably escape notice about as often as maintenance defects on DC-10's. And, when they occur, the same kind of flashy headlines and unsavory publicity results. The fiery DC-10 crash at Chicago's O'Hare Airport and the disaster at the Ford Motor Company's Cologne, Germany auto plant in 1978 had something in common: they represent a departure from the norm. But, they are hardly the stuff on which a statistical record of dependability should be based. Just as billions of passenger miles are flown safely each year on DC-10's, so thousands of one- and two-sprinkler extinguishments go unrecorded and unnoticed.

Sprinkler systems are so elementary in design as to be nearly foolproof. They can be relied upon to operate and to extinguish or control fires in nearly 100 percent of the cases.

Building codes have moved in recent years toward making sprinkler systems even more dependable. Most of the model building codes now call for electrical supervision of water flow and valves when the system is required by the code or provided in conjunction with code trade-offs.

Life Safety

All the effort expended railing against sprinkler trade-offs does ensure that if there were horror stories to be told we would have all heard them by now. The only real horror story is that thousands of people die in building fires every year that wouldn't die if those buildings were sprinklered.

In 1975, the National Fire Protection Association produced a staff report listing fatalities from fire in

Table 3

NUMBER OF SPRINKLERS OPERATING ON FIRES AS A PERCENTAGE

Sprinklers	Australia/NZ 1886-1968	New York City 1969-1978	NFPA 1925-1969	Modified NFPA 1925-1969
1 or 2	83%	78%	55%	78%
3-5	11%	15%	18%	10%
6-10	4%	5%	11%	5%
10-15	0%	0%	5%	2%
15	2%	2%	11%	5%
	100%	100%	100%	100%

sprinklered buildings from 1971 through 1975. Table 4 presents the sources of the 99 fatalities. Over two-thirds, 68 of the deaths, resulted from explosions. The sprinkler system was never a factor. Eighteen of the deaths resulted from fires originating in unsprinklered portions of buildings, again the roulette game of partial protection.

The eight fatalities which occurred because the sprinkler system had been shut down and the one which occurred because a gravity tank was not filled with water could have been prevented by mandatory valve and water supply supervision.

One death came while a sprinkler system was under construction in the building, one fatality occurred due to asphyxiation from toxic fumes generated by the especially hazardous contents of a building, and two deaths were reported when the victim became the source of the fire itself, i.e. human torch fires.

Not one fatality could have been averted by decreasing exit travel distance, decreasing the flame spread of interior finish materials, or increasing the fire resistance rating of structural elements.

An automatic sprinkler system is not infallible as a life safety device. The slowly smoldering low-heat fire capable of killing someone in their sleep is always a possibility, and smoke detectors serve a highly useful purpose in this regard. But, sprinklers can prevent fast-developing fires capable of quickly blocking exit routes, trapping and killing dozens. The simple operation and dual detection and control function of the sprinkler make it the most practical fire protection tool ever developed.

The Ultimate Testimony

Since the National Board of Fire Underwriters published its first model building code in America in 1905, a lot of progress has been made in making buildings safer. Massive lofty concrete and steel pillboxes like the Empire State Building are, however, no longer economically feasible. The record of loss of life in large buildings of any and every type of construction points out with infallible emphasis that buildings not equipped with a means of automatically and immediately extinguishing fires continue to become crematories.

While automatic sprinklers have been known to fail to save lives in a few isolated cases, large loss of life in sprinklered buildings is virtually unknown. The record of carnage in unsprinklered buildings, on the other hand, is formidable. It stands as irrefutable testimony to the case for automatic sprinklers. No statistics, however contrived to mislead, however carelessly assembled or even intentionally distorted, can contradict the record that jumps out at any sober observer of this list:

Table 4

SOURCE OF FATALITIES IN SPRINKLERED BUILDINGS 1971-1975

(National Fire Protection Association Records)

Cause	No. of Fatal Incidents	%	Total Lives Lost	%
Explosions	15	50	68	69
Fire In Unsprinklered Portion of Building	8	27	18	18
System Turned Off	2	7	8	8
System Under Construction	1	3	1	1
Insufficient Water Supply	1	3	1	1
Toxic Asphyxiation	1	3	1	1
Torch Fires	2	7	2	2
	30	100%	99	100%

UNSPRINKLERED BUILDING FIRES

		Deaths
Dec. 1, 1958	Our Lady of the Angels School, Chicago, IL	93
Dec. 8, 1961	Hartford Hospital, Hartford, CN	16
Nov. 23, 1963	Golden Age Nursing Home, Fitchville Township, OH	63
Dec. 29, 1963	Roosevelt Hotel, Jacksonville, FL	22
Feb. 7, 1967	Dale's Penthouse Restaurant, Montgomery, AL	25
Feb. 25, 1969	Office Building, New York, NY	11
Jan. 9, 1970	Harmer House Convalescent Home, Marietta, OH	21
Mar. 20, 1970	Ozark Hotel, Seattle, WA	20
Sept. 13, 1970	Ponet Square Hotel, Los Angeles, CA	19
Dec. 20, 1970	Pioneer Hotel, Tuscon, AZ	28
Jan. 14, 1971	Westminster Terrace Presbyterian Home for Senior Citizens, Buechel, KY	9
Oct. 19, 1971	Nursing Home, Honesdale, PA	15
Jan. 16, 1972	Hotel, Tyrone, PA	12
Nov. 30, 1972	Baptist Towers, Atlanta, GA	11
June 24, 1973	Cocktail Lounge, New Orleans, LA	32
Sept. 13, 1973	Washington Hill Nursing Home, Philadelphia, PA	11
Nov. 15, 1973	Stratford Apartments, Los Angeles, CA	24
June 30, 1974	Gulliver's Discotheque, Port Chester, NY	24
June 9, 1975	Seminole County Jail, Sanford, FL	11
Jan. 30, 1976	Blue Angel Night Club, New York, NY	7
Dec. 18, 1975	Wincrest Nursing Home, Chicago, IL	24
Oct. 23, 1976	Puerto Rican Social Club, Bronx, NY	25
May 28, 1977	Beverly Hills Supper Club, Southgate, KY	165
June 26, 1977	Maury County Jail, Columbia, TN	42
Oct. 24, 1977	Cinema Follies, Washington, DC	9
Dec. 13, 1977	Aquinas Hall, Providence College, Providence, RI	10
Jan. 28, 1978	Coates House Hotel, Kansas City, MO	20
July 26, 1980	Brinley Inn, Bradley Beach, NJ	23

The case for sprinklers and "trade-offs" is closed. Sprinkler trade-offs work because sprinklers work . . . to save lives and property.

A.2 - Referenced fire sprinkler ordinances

Section 10: Authority to Enforce

It shall be the duty and responsibility of the Chief of the Morton Grove Fire Department or his duly authorized representative to enforce the provisions of this Ordinance.

Section 11: Conflicting Ordinances

All Ordinances or parts of Ordinances in conflict with this Ordinance are hereby repealed.

Section 12: That this Ordinance shall be published in pamphlet form. Said pamphlet shall be received as evidence of the passage and legal publication of this Ordinance.

Section 13: This Ordinance shall be in full force and effect from and after its passage, approval and publication in pamphlet form according to law.

Controlling The Cost of Fire Protection In The City of San Buenaventura

A basic element of the Community Fire Protection Master Plan

A Study Prepared by B. G. Horne, Fire Chief

Statement of the Problem:

The Fire Department is faced with the task of providing a reasonable degree of fire safety in the city with a minimum budget and reduced equipment manning levels. The growth of the city as it regards fire control is a major area of concern *if* we are to continue the utilization of minimum manning levels.

Numbers of firefighters on-duty relates directly to the number of hose lines and the amounts of water that can be used to fight a fire in the city. At present the 3-man Engine Company manning policy is proving to be cost effective but it is the last notch on the belt as far as reducing manpower.

How do we control the cost of Fire Protection in the city; as it grows; and not force inadequate Fire Protection on the citizenry or force the Fire Chief into the position where his only alternative is to hire more firefighters, build more stations, and purchase more major fire apparatus?—and of course that is based on the premise that monies are available for major fire protection outlays when they most certainly will not.

This study addresses the problem of city growth and the cost of fire control; while offering an alternative approach to the continually growing demand for publicly funded fire protection services.

Criteria for a Solution:

A recent report by the Institute for Local Self-Government entitled; "Alternatives to Traditional Public Safety Delivery Systems," finds that a fire chief must control built-in private fire protection equipment and systems if he is to control the fire department operational budget and the community fire protection problem.

This study, using guidelines from the Institute for Local Self Government and the National Fire Protection Association proposes that the fire department control fires in all new structures built in the city by using an established first alarm assignment that will not create a demand for additional manpower and equipment; or create a deficiency in the fire protection services offered to the already established community.

The designated first alarm assignment would consist of (3) three man companies; (1) two man snorkel truck and (1) one man command vehicle. This assignment of manpower places (3) three man engine companies (9 men) and (1) two man snorkel

truck and (1) one man command vehicle at the scene of an emergency and leaves the remainder of the city with (2) three man engine companies for protection until such time as the emergency is brought under control.

It seems only reasonable that new structures added to our city inventory of buildings to be protected, should provide built-in fire protection systems; and in turn, not demand fire equipment and manpower beyond that available and currently being provided by the city.

Built-In Fire Protection at What Point?

To determine at what point built-in fire protection must be provided we are using two sets of criteria.

The first criteria used was to determine the actual gallons per minute (G.P.M.) of water and hose stream capability of our own pumping engines and existing personnel.

The second criteria used the National Fire Protection Association formula which determines minimum and maximum amounts of gallons of water per minute needed to extinguish a fire based upon increments of 100 cubic feet of involved fire area. The formula denotes 2-GPM as minimum and 4-GPM as maximum. This study uses the mean figure of 3-GPM per 100 cubic feet. The N.F.P.A. formula is described in the NFPA publication *Fire Attack 2*; in chapter thirteen entitled *Estimating Needed Fire Flow*, pages 142–159.

Built in Fire Protection Required at 5,000 Sq. Ft.—Why?

An actual appraisal of the capabilities of the Ventura City Fire Department is graphically shown in the following paragraphs. A first alarm response, utilizing 3 of the 5 engines available plus the snorkel and Platoon Commander can extinguish a fire in a 4,000 Sq. Ft. building without further assistance in most cases. This leaves 2 engines to protect the remainder of the city.

Development of the 5,000 Sq. Ft. Criteria:

Problem: Develop method to allow 3 engine/1 truck response assignment to contain a fire.

Reference: Fire Attack II - NFPA notes a formula of 2–4 gallons of water needed to extinguish a fire for each 100 cubic feet of involved area. This report will use 3 GPM per 100 cubic feet.

Current First Alarm Assignment:

Equipment: 3 Engines (capacity 3,000 GPM), one truck company, and command vehicle.

Personnel: 12 men and officers, 3 on each engine, two on truck, 1 in command vehicle.

GPM Fireground Delivery by Designed Assignment 12 men:

Master Stream	*= 800 G.P.M. (deck gun not for interior attack)*
1–2½" lines	*= 250 G.P.M.*
1–1½" lines	*= 125 G.P.M.*
Total Capability	*= 1,175 GPM (this report will use a figure of 1,200)*

Area GPM Capable of Extinguishing:

1,200 GPM can cover a 4,000 square foot building.

4,000 x H (10)	*= 40,000 cubic feet divided by*
100 x 3 GPM	*= 1,200 GPM*

The above formula is based on a maximum eight to twelve minute response and set-up time for the responding fire equipment. Any delay or response and set-up time of greater duration puts our fire fighting forces on the scene after the flash over of the fire has occurred and presents them with a larger fire that demands more gallons per minute than they are capable. The result is inefficient use of our manpower and equipment coupled with an unacceptable loss of property and possibly lives.

If it is desired to extinguish all fires with a 3 engine–1 truck assignment, all structures 4,000 square feet or larger should be sprinklered.

Alternatives:

A. Increase alarm response. (limited to 2 remaining engines)
B. Find way to increase fire flow capabilities of present response. (limited by current manning levels and current hose sizes)
C. Plan to provide control capability with four engines 15 men as opposed to 12 men.
D. Require buildings more than 4,000 square feet to be sprinklered and plan on the need periodically to find it necessary to rely on mutual aid and callback of personnel to provide control.

Non-Combustible Roofing Credit—1,000 G.P.M.:

Although the study finds that 4,000 Sq. Ft. is the point at which buildings must be provided with built-in fire protection (automatic fire sprinklers) a credit is applied for the non-combustible or fire retardant roofing material applied to the structure. Extreme wind conditions in our city are such that non-combustible roofing be a mandatory item and to such an extent that a 1,000 G.P.M. credit be applied to all structures with the non-combustible roofing.

As the proposed fire protection ordinance will include a non-combustible roofing provision for all new structures—commercial and industrial—the criteria for controlling the cost of fire protection in the city of San Buenaventura is to cause (by ordinance) all new structures 5,000 square feet or over and all new structures above 35 feet in height be equipped with automatic fire sprinklers.

This ordinance will reduce the need for additional publically funded fire protection and allow the city to grow with minimum expansion of the fire department. Without this ordinance the two alternatives are (1) Expand the Fire Department as growth occurs (2) Decrease the current level of service and accept inadequate fire protection and higher insurance premiums.

Data on Automatic Fire Sprinklers:

A summary of data provided by the National Automatic Fire Sprinkler Association.

"Fire Protection Considerations"

Fire protection engineering is a complex subject, starting with the selection of a building site... through the necessity for adequate public firefighting and reliable water supplies... to the design, construction and occupancy of the building itself. And it is growing in complexity every day, as buildings become larger and their occupancies more involved and valuable.

Yet the basic considerations remain the same: Lives, property, and operations must be preserved. Given this complexity, there is no *single* solution. Alarms give warning, but can't fight the fire. Firefighting staffs do their best, but 83% of fires occur during "idle" hours, and humans are unpredictable. Fire-resistant materials won't burn, but building contents will. Insurance can compensate for direct losses, but can't guarantee continued operation or restore lost life.

Only one type of fire protection best meets the basic necessity: automatic sprinklers. According to the National Fire Protection Association, "Sprinklers are the most effective means of automatically controlling fires in buildings". Only automatic sprinklers protect against and fight fire in so many ways—sounding the alarm, reacting immediately, concentrating directly on the fire, and continuing to operate until extinguishment is complete. And no extinguishing agent functions as completely as water—cooling and smothering the blaze, diluting and emulsifying the combustibles.

This combination of the best extinguishing agent known with the best distribution system available is the basis upon which automatic sprinkler systems must be considered. Planned and designed from the beginning with specific reference to the total fire protection requirement, building design and construction, and the hazards of occupancy, they are the single most important element in modern fire protection.

"Do Sprinklers Really Put Out Fires?"

The National Fire Protection Association states that sprinklers are 96.2% effective. This is not a guess. It is the result of analyzing more than 58,000 fires over a 30-year period. (and since many small fires are not reported, it is safe to assume that the degree of effectiveness is even higher.) In addition, records also show that in 6 out of 10 cases, sprinklers extinguish fires without any human assistance. In the other instances they held the fire in check until fire crews arrived.

Do Sprinklers Ever Fail?

In 3.8% of fires recorded, so-called "sprinkler failures" occurred when there was: (1) an improper water supply, or (2) an increased fire hazard. "Improper water supply" means either that there was insufficient water, or that the water was turned off before the sprinklers operated (or before the fire was extinguished). "Increased hazard" refers to those situations in which fire hazards were allowed to flow beyond the original scope of the sprinkler system and without a corresponding modification of the system. Since the first problem could have been solved by simply reinstating the water supply and the second by updating the design of the system, the conclusion is that sprinklers themselves rarely, if ever, "fail".

What are the Functions of Sprinkler Systems?

Sprinkler systems automatically detect fire, immediately sound an alarm, go into fire-fighting operation and remain in operation as long as the fire constitutes a danger. Only automatic sprinkler systems do all four. This is why they are the best single source of fire protection.

Do All Sprinklers Open When Fire Occurs?

No. Only those sprinklers directly over the fire open and discharge water. All others simply remain ready to open in the event the fire spreads or another fire breaks out.

Do Sprinklers Ever Go Off Accidentally?

Odds against accidental discharge are 3,325,000 to 1 (five times the odds against a Royal Flush in poker). Insurance against such a rare occurrence is obtainable at extremely low rates.

Do Sprinklers Use A Large Amount of Water?

A major feature of sprinkler systems is that they use only the amount of water necessary to control the fire. Records show that 37.4% of all fires in which sprinklers operate are controlled by one automatic sprinkler. 73.4% are controlled by 5 or fewer sprinklers and 85% are controlled by 10 or fewer sprinklers.

Do Sprinklers Cause Excessive Water Damage?

Water damage by sprinklers is negligible compared to that caused by fighting the same fire with a hose stream. As an illustration, a standard sprinkler operating at 75 psi delivers about 50 gallons of water per minute. A 2½" hose operating at the same pressure delivers about 400 gallons per minute. And most fires are controlled by a small number of sprinklers, while many hose streams are needed to combat a fire which is out of control. In addition, sprinklers deliver water at the point of the fire. Hose streams may be delivered from outside the building and often cannot reach the fire.

Do Toxic Gases Occur in Fires in Sprinklered Building?

Toxic gases are present wherever there is fire. However, since sprinklers go into operation while the fire is small and generally extinguish it completely, there is very little toxic gas and almost no chance of harmful concentration. As far as it is known, no lives have ever been lost in sprinklered buildings because of toxic gas.

Have Lives Ever Been Lost From Fires in Sprinklered Buildings?

Throughout the history of automatic sprinklers, there have been perhaps a dozen cases in which occupants have been killed by fire in fully sprinklered buildings. In nearly every such case, the individual was the object of the fire, through having his clothes ignite. Never has anyone been "drowned" by a sprinkler system.

Insurance Considerations

Reliance on fire insurance alone to protect against fire loss ignores the fact that 40% of all insured businesses never reopen following a fire. This is a result of skilled personnel moving to other companies, customers being lost to competitors, records being destroyed, or lives being lost... all losses for which insurance cannot compensate.

While widely misunderstood, however, the role of insurance in total fire protection remains one of critical importance. The primary responsibility of fire insurance companies is to evaluate the risk of loss, and based on that evaluation to set a price for insurance. They may recommend additional fire protection measures which can result in a lower insurance rate, but they have neither the time nor the incentive to recommend the best, most economical means of taking such measures. Designing a fire protection system simply to meet the requirements of insurance companies or insurance rating bureaus may result in a system which is either under-designed (in which case there is the risk of major loss), or over-designed (in which case the cost of fire protection is considerably higher than it need be). This is simply because insurance requirements are general, while the needs of individual companies and the hazards of their businesses are specific. Only through the cooperative efforts of management, insurance experts, and fire protection engineers will adequate fire protection be combined with economical insurance premiums for maximum cost efficiency.

1. Who Determines What Fire Insurance Costs?

Fire insurance rates are generally established by state-wide Insurance Rating Bureaus which are privately organized and publicly regulated. They begin with a "Basic Rate" for each city within the state, determined by that city's fire defenses, its conflagration hazard, its local legislation on building construction and hazards, and by the fire loss experience of the entire state. Once the Basic Rate has been established, the rate for individual buildings is determined on the basis of a "Rating Schedule". This includes evaluation of the possibility of exposure fires from adjoining buildings, the type of occupancy, and the type of private fire protection (of which automatic sprinklers were the single most important element). At this point, individual insurance companies take the established rating, and from it compute the rate which they will charge.

2. What Should Fire Insurance Cost?

Fire insurance carriers are interested in reduction of property loss risks. Their rates are negotiable, depending upon many factors influencing the level of risk. One of the most important of these is an automatic sprinkler system. Sprinkler systems typically reduce insurance rates approximately 70%. For example, a rate of $2 per hundred dollars of coverage on unsprinklered property can often be reduced to 60¢ with the installation of sprinklers. Adoption of a full range of fire protection facilities in addition to a sprinkler system may result in still further savings if they qualify the insured for a "HPR" (Highly Protected Risk) rating. Such a rating can reduce insurance premiums to 10¢ per hundred dollars of coverage.

3. Savings May Also Be Secondary

While insurance savings are a primary incentive for the installation of sprinkler systems (which typically pay for themselves through premium reduction over a period of five years or less), it is also true that insurance companies may simply require that sprinklers be installed, or that other fire protection measures be taken, prior to their insuring the property at all. Similarly, insurance companies may agree to insure property only to a fraction of its value unless such measures are taken, and/or may split the coverage between a number of insurance companies. Resulting insurance costs are often extremely high. What ever the particular circumstances, the influence of insurance on fire protection in general and on sprinkler systems in particular (and vice versa) is great... and growing. The modern businessman is well advised to work closely with qualified insurance representatives and fire protection engineers in arriving at the best combination of measures providing maximum fire protection and minimum fire insurance cost.

An Ordinance of The City of San Buenaventura Adding an Article 3 to Chapter 1 of Division 5 of The City of San Buenaventura Ordinance Code Relating to Certain Fire Protection Requirements

The Council of the City of San Buenaventura does ordain as follows:

Section 1. An article 3 is hereby added to Chapter 1 of Division 5 of the City of San Buenaventura Ordinance Code to read as follows:

"Article 3—Fire Protection Requirements—Section 5130

Sec. 5131—Approved Automatic Sprinkler Systems.

(a) Other provisions of this Code or of any other Code of the City of San Buenaventura to the contrary notwithstanding, approved automatic sprinkler systems shall be installed and maintained in those buildings or structures hereafter constructed:

(1) where the total floor area of the building or structure is or will be 5,000 sq. feet or more; or

(2) where the building or structure is four (4) stories or more irrespective of height.

Plans for, installation of, testing of, and maintenance of all such required automatic sprinkler systems shall be to the satisfaction of the Fire Chief.

Data Compiled By The National Automatic Fire Sprinkler Association (19xx)
Typical Case History Savings

Type of Business	Value	Unsprinklered Rate	Sprinklered Rate	Cost of System	Annual Savings	No. of Yrs. to Pay Out
Woodworking Plant	$460,000.00	2.50	.52	$34,498.00	$9,108.00	4½
Meat Packer	$200,000.00	1.59	.55	$ 6,660.00	$2,080.00	3½
Furniture Manuf.	$ 78,000.00	7.00	.74	$ 5,601.00	$4,882.00	1¼
Wholesale Grocer	$ 85,000.00	1.70	.48	$ 4,987.00	$1,037.00	4¾
Bag Manufacturer	$ 40,000.00	5.60	.85	$ 2,900.00	$1,900.00	1½
Wood Working Plant	$250,000.00	3.80	.78	$30,000.00	$7,550.00	4
Department Store	$190,000.00	1.80	.45	$14,132.00	$2,565.00	5½
Garage & Hardware Store	$300,000.00	1.76 bldg 2.79 conts.	.414 B .594 C	$16,000.00	$2,500.00	6½
Tile Board Manuf.	$145,000.00	4.00	2.00	$14,300.00	$2,900.00	5
Retail Furniture Store	$250,000.00	1.02 bldg. 1.44 conts.	.15 B .39 C	$ 9,776.00	$1,300.00	7½
Wooden Coat Hanger Manufacturer	$115,000.00	5.85	.73 B .98 C	$ 6,500.00	$4,458.00	1½
Wholesale Plumbing Supply	$ 90,000.00	1.81 bldg 1.81 conts.	.23 B .47 C	$ 8,946.00	$1,278.00	7
Laundry	$170,000.00	1.08	.11 B .18 C	$ 8,000.00	$1,600.00	5

(b) The term 'automatic sprinkler system' as used herein refers to and shall mean an integrated system of underground and overhead piping including a water supply of a type such as a gravity tank, fire pump, reservoir or pressure tank or a connection, by underground piping, to a City main, which system complies in all respects with the requirements adopted for such systems as described in the National Fire Protection Association, Pamphlet No. 13, as the same now exists or as it may from time to time be amended.

Sec. 5132—Fire Retardant Roofing Materials. All structures built in the City of San Buenaventura after November 1, 1979 shall be required to be constructed with non-combustible or fire retardant roofing materials as approved by the Fire Chief."

Section 2. This ordinance shall take effect on the 31st day following its final passage and adoption.

Alaskan Fire Services Community Fire Protection

I The Problem: Alaska's Expanding and Developing Communities with Underdeveloped Public Services are Particularly Vulnerable to Catastrophic Fire Losses

II The Solution: Maximum Utilization of Private Fire Protection Systems Minimizes Fire Losses and Minimizes Costs of Operating Fire Departments and Water Utilities

III Legislation Creating Incentives for the Installation of Private Fire Protection Systems Will Encourage a Statewide Shift Toward Maximizing Utilization of More Efficient, Less Costly Fire-Fighting Technology, Thereby Holding Down or Reducing Costs of Water Utilities and Fire Departments

IV The Savings in Life, Property, Conservation of Water, and Reduced Cost of Local Government Services from Widespread Installation of Private Fire Protection Systems

V The Size of a Community's Water System can be Reduced by Widespread Installation of Private Fire Protection Systems in the Community

VI Private Fire Protection Reduces the Cost of Other Public Services

VII Tax Credits, Low Interest Loans for Private Fireprotection, Installation, and Elimination of Water Standby Charges will provide the Legislative Incentive to move toward Utilization of the Best and Most Economical Fire Safety Technology—Private Fire Protection
A. Why Legislative Incentives?
B. Low Interest Loans Will Cause Financing to be Available so that Sprinkers can be Installed in Both New and Pre-existing Construction.
C. Tax Credits for Installation of Private Fire Protection Will Encourage, not Penalize, the Owner Who Adopts Better Fire Safety Technology, and Will Not Cause Cities to Lose Tax Revenue
D. Elimination Of Water Standby Charges

VIII Conclusion

I. The Problem: Alaska's Expanding and Developing Communities with Underdeveloped Public Services are Particularly Vulnerable to Catastrophic Fire Losses.

A high fire death rate is peculiarly an American problem. No other industrialized nation comes close to the American fire death rate. Fire deaths and injuries per million population in the United

States are nearly three times that of Sweden which has the next highest death and injury rate by fire.

In 1974 nearly 3 million fires caused nearly $4 billion worth of fire losses. The dollar value of the damage and destruction by fire does not even begin to approximate the actual losses because serious fires create indirect business and community losses such as:

(a) Loss of customers
(b) Loss of profits
(c) Cost of retaining key personnel during shutdown
(d) Loss of taxes on destroyed property.

Finally, there are indirect losses of a personal nature. These may be even more difficult to estimate, yet their importance should not be neglected. In addition to financial losses incurred through temporary unemployment and expenses incurred in finding and moving to new housing, there is the destruction of irreplacable personal belongings.

Consequently, given the compelling social goal of avoiding catastrophic fire losses, together with the absolute necessity to provide water for basic human existence, a community must develop policies which maximize its ability to provide both fire protection and adequate water supplies.

II. The Solution: Maximum Utilization of Private Fire Protection Systems Minimizes Fire Losses and Minimizes Costs of Operating Fire Departments and Water Utilities.

Private fire protection systems (the backbone of which are automatic sprinkler systems) are the most effective means of controlling fires in buildings. Not only do private fire protection systems put out fires, they do not require nearly as much water to extinguish fires as would be required for the Fire Department to put out the same fire. Nor do sprinkler systems require as much or as expensive equipment to fight a given fire as a Fire Department. Where private fire protection systems are deployed the expense and cost of the Fire Department are much less, and the chance for injury to firemen as a result of fire is almost negligible in sprinklered buildings. Sprinkler systems are the most technologically advanced fire fighting weapon, and their use should be maximized to reduce and hold down costs of the Fire Department.

We must accept the fact that public fire departments can control a fire only in its early development stages. For the most part, fire departments can only combat fire by directly overwhelming it with massive amounts of expensive equipment, manpower and water. When the fire is small, the fire department is still on the way. Even with the best response time, it is fact that many small fires are out of control by the time the fire departments arrive.

By contrast, the private fire protection system has no response time. It is on scene before the fire starts, and usually has put out the fire before the fire department even arrives.

III. Legislation Creating Incentives For the Installation of Private Fire Protection Systems Will Encourage a Statewide Shift Toward Maximizing Utilization of More Efficient, Less Costly Firefighting Technology, Thereby Holding Down or Reducing Costs of Water Utilities and Fire Departments.

Private fire protection is an alternative. Its technology is ready to be implemented, and, through legislative incentive, it will reduce the increasing burden of fire protection costs. Within a few short years of implementing legislative incentives, private fire protection systems will become increasingly prevalent in communities statewide. As communities expand and grow, the legislative incentives will alleviate the necessity to expand the manpower, equipment, and water supplies for the fire department as in the past. Fire departments won't need to open as many new stations, buy as much firefighting equipment, or hire as many firefighters to meet the fire protection needs of the state's expanding communities. Costs of water supplies will be reduced as existing supplies go farther as a result of the water conservative propensities of private fire protection systems are realized. By moving now to take advantage of proven fire protection technology huge savings in property loss, jobs, insurance costs, building costs, life, and indeed even entire communities will result and those savings will continue to accrue and continue to accelerate as the incentives prompt more and more property to be protected. (For a hypothetical case study of savings a community can realize as a result of widespread sprinkler installation see, Hackey, Associate Professor, Univ. Maryland, *Built In Fire Protection and Fire Department Manning* (Appendix A).

IV. The Savings in Life, Property, Conservation of Water, and Reduced Cost of Local Government Services from Widespread Installation of Private Fire Protection Systems.

Statistics showing the effectiveness of automatic sprinkler systems are phenomenal. Only in rare instances do automatic sprinkler systems fail to control fires in sprinklered buildings. The failures are seldom due to the sprinklers, but rather, the

lack of water, often because the system has been turned off, either unintentionally, intentionally, or by vandals. A complete record of fires in sprinklered buildings would show that their efficiency probably approaches 100%. National Fire Protection Association, *Fire Protection Handbook*, pp. 14–1 through 14–48, 14th edition, 1976. Given the billions of dollars in fire losses, the potential for savings resulting from widespread installation of sprinklers cannot be ignored. Of all the fires controlled by sprinklers, more than 90% of them are controlled by three or less sprinkler heads. *Fire Protection Handbook*, supra.

The effectiveness of automatic sprinklers stems from their presence at the scene of a potential fire before it starts. They can supply water immediately where it is needed because there are not problems of access to the seat of the fire, or interference with visibility for fire fighting due to smoke. *Fire Protection Handbook, supra*. Sprinklers extinguish fires much earlier than a fire department could ever respond to an alarm. Automatic sprinklers are particularly effective for life safety because they give warning of the existence of fire, and at the same time apply water to the burning area.

> *The only fatalities in fully sprinklered properties reported to the National Fire Protection Association were caused by explosions or flash fires; by ignition of the bedding or clothing of a person who was too young, too old, too intoxicated, or too handicapped in some other way to protect himself properly. . . .*
>
> *In those isolated instances of fatalities to sleeping, handicapped, or intoxicated persons, ignition of clothing or bedding caused fatal burns or asphyxiation either because the small fire did not generate sufficient heat to fuse the sprinkler, or because the victim had suffered fatal injuries before the sprinkler operated. In these later instances, however, the sprinklers protected the lives of persons in adjoining areas. Fire Protection Handbook, supra.*

See, also, Horne, B. G., Fire Chief, *Controlling The Cost of Fire Protection in the City of San Buenaventura*.

Water necessary to put out a fire in its beginning stages is nowhere near the water required for the fire department to put it out after it once gets blazing. Performance characteristics of sprinklers indicate that standard automatic sprinklers discharge anywhere from 18 to 58 gallons of water per minute, depending on the pressure at the sprinkler head. *Fire Protection Handbook, supra*, at pp. 14–42 through 14–48. By comparison, a heavy-attack two and one-half inch mobile fire department hose line in operation can consume as much as 250 gallons of water per minute. If the fire is not put out in its infant stages (as occurs over 90% of the time when automatic sprinklers are deployed), it may take a number of heavy-attack lines hours to control the fire—if the water supply holds out that long.

Sprinklers do not cause excessive water damage. Damage by sprinklers is negligible compared to that caused by fighting the same fire with a hose stream. Most fires are controlled by a small number of sprinklers, while many hose streams are required to combat a fire which is out of control. Sprinklers, in most cases, control the fire immediately. The water damage which does occur is negligible compared to the damage which would have resulted if the building should have been completely or substantially consumed by a fire fought by conventional means. See, Horne, B. G., Fire Chief, *Controlling the Cost of Fire Protection in the City of San Buenaventura*.

V. The Size of a Community's Water System Can be Reduced by Widespread Installation of Private Fire Protection Systems in the Community.

A major part of the cost os the developing community's water supply is the additional reservoir of water which must be on hand for major fires, and the high pressure distribution lines from the reservoir to assure the fire department will have enough water pressure to project many hose streams onto a raging major fire. Nowhere near the same quantity of water or water pressure would be required for automatic sprinklers to do the same job.

The traditional method for estimating the water supply required to serve a community's fire protection needs is by computing fire flow requirements. The criteria to estimate fire flow requirements are found in the *Guide for Determination of Required Fire Flow*, Insurance Service Organization, 1972. The fire flow formula reflects significant water conservation propensities of private fire protection. Depending on the flammability of a given building, the fire flow required is reduced by 25% to 75% when a sprinkler system is present in a building. *Fire Protection Handbook, supra*, at pp. 11–2 through 11–6.

The fire flow formula developed by ISO can be utilized to determine the community-wide fire flow requirements. This procedure is more fully described in ISO's *Municipal Grading Schedule*, copies of which are available in many community Fire Department and Fire Department Protection offices.

Although the methodology in the *Municipal Grading Schedule* does not enable a precise computation of the reduction in community fire flow re-

quirements caused by widespread srpinkler installation, it is significant. Anchorage, Alaska, is a specific case in point, where ISO engineers indicate installation of sprinklers in the Central Business District, alone, made Anchorage a more fireworthy community, and caused a reduction in fire flow requirements.

VI. Private Fire Protection Reduces the Cost of Other Public Services.

In addition to the water conserving properties of automatic sprinkler systems, and the significant savings in life and property, there are other public benefits from widespread installation of private fire protection systems. Among these are:

1. Both the economic and physical burden of the Fire Department are decreased since private fire protection generally puts out the fire before the fire department even arrives. This also decreases the hazards of fighting fire.
2. The cost of manpower and time fighting the fire is reduced and therefore the money necessary to operate the Fire Department can be reduced, stabilized, and diverted to other essential Fire Department or community expenditures.
3. Private fire protection decreases fire insurance costs not only for the person installing it, but also for an entire community where the installations are widespread. Many rural communities have little or no fire protection. These communities may not be able to afford the expensive firefighting equipment more urbanized communities have. Commercial construction moneys are also difficult to obtain because insurance rates are too high. By installing private fire protection, great reductions in insurance premiums can be achieved, which will enable property owners to get reasonable insurance premiums needed to obtain financing for construction.
4. Construction without sprinklers imposes higher insurance costs and imposes on the architect more stringent rules governing compartmentalization, fire proofing, exit distance spacing, travel distance, and exterior design requirements. It costs more to construct without sprinklers. 242 *News Bulletin*, Automatic Sprinkler Fire Control Association, Inc., pp. 1316 (1973). Providing incentives to construct with sprinklers will lower construction costs and then insurance costs, enabling construction to go forward that otherwise would have been too costly. The resulting stabilization and expansion of a community's economic base, not to mention expanded tax base, is obvious.
5. Private fire protection increases municipal tax revenues by encouraging property development.
6. Private fire protection increases a community's total fire protection security, preventing conflagrations and exposure fires.
7. Private fire protection results in lessening the cost of capital improvements to the community's water supply since widespread installation of private fire protection decreases the required fire flow necessary for adequate municipal fire protection.
8. Private fire protection saves billions of gallons of water, which is in chronic short supply in many communities.
9. Encouragement of private fire protection is consistent with the State policy of encouraging installations of fire protection devices (smoke alarms).
10. Since private fire protection can reduce the cost of the Fire Department and the water utility, Municipal tax dollars and State revenue sharing monies can be expended for other essential services, making more efficient use of government dollars.

These benefits are substantial and should be encouraged by the incentive legislative programs hereinafter described.

VII. Tax Credits, Low Interest Loans for Private Fire Protection, Installation, and Elimination of Water Standby Charges will Provide the Legislative Incentive to Move Toward Utilization of the Best and Most Economical Fire Safety Technology—Private Fire Protection.

A. Why Legislative Incentives?

The decision to install or not to install private fire protection hinges on two variables. First, the Uniform Building Code requires building materials with a higher fire rating for higher risk occupancies. If construction is without sprinkler systems the construction costs may be too high, and the increased cost could prevent the decision to construct from even being made. Second, the reduction in insurance rates for buildings with sprinklers will be greater for some kinds of buildings than for others. The size of the reduction is largely determinative of how long it will take the property owner to amortize the cost of the sprinkler system. If the insurance reduction is too small, it will take too long to amortize the cost of installing the system, and the decision to install it may not be made, with the resultant loss in fire safety. Legislative incen-

tives in the form of low interest loans which can be obtained to finance sprinkler installation, additional tax credits to buildings that have sprinklers, and legislative elimination of water standby charges will make the decision to install private protection economical and, thus, voluntary. A significant trend would develop wherein water guzzling fire companies would be replaced by water efficient sprinkler systems, reducing both losses caused by fire and costs to local government.

B. Low Interest Loans Will Cause Financing to be Available so that Sprinklers can be Installed in Both New and Pre-existing Construction.

Funds for low interest loans to finance installation of private fire protection systems should be available in amounts that will allow for a rapid implementation and installation of private fire protection systems by those who qualify for the loans. Many small businesses in our state do not have acess to financing at reasonable rates. The current level of interest rates simply does not make it economical for the property owner to consider the installation of private fire protection. Loan qualifications should be established on the basis of need similar to that required for small business loans. But, in addition, loans should also be made available to property owners who are required to install private fire protection by the community building codes, with some consideration given to those property owners desiring to install a system in a pre-existing structure. Making funds available to owners of pre-existing structures will accelerate the move towards utilizing private fire protection technology instead of the more costly and riskier Fire Department.

C. Tax Credits for Installation of Private Fire Protection Will Encourage, not Penalize the Owner who Adopts Better Fire Safety Technology, and Will Not Cause Cities to Lose Tax Revenue.

Installation of private fire protection systems causes property valuations to increase. Up to now the increase has been included in the property's assessed and the community's mill rate has been applied accordingly, thus raising the owner's taxes. This penalizes the property owner for installing fire protection systems. A property owner who does not install such a system is the one to penalize, because he increases the potential for disastrous fires in the community, and causes escalating costs for the Fire Department and Water System. Enacting State legislation will remove from tax rolls the penalizing assessment against private fire protection systems. This approach does away with counterproductive taxing practices, and maximizes the cost savings of better fire safety technology.

Local governments will not lose tax revenue as a result of the tax credit for fire protection systems. First, as the incentives induce increasing numbers of fire protection systems to be installed, fire departments will save literally millions of dollars because their requirements for manpower, equipment, and additional fire stations will be drastically reduced, to maintain a given level of fire safety. Attached as Appendix II is an actual case study of great savings which resulted in fire department costs in the City of Fresno, California. By inducing widespread installation of private fire protection systems, the City of Fresno's fire department saved literally millions of dollars, according to the study. Reilly and Viniello, Sprinklers Cut Fresno's Fire Losses and Budget, *Fire Journal*, November 1979 (See Appendix II). Appendix I empirically documents the huge savings which will result to the Fire Department from a program of this sort.

Second, the assessed value of a sprinkler system, when compared to the value of the rest of a building, is minimal. Without the sprinkler system a fire will destroy the building, and the corresponding loss from municipal tax rolls of the entire valuation of the building will be manyfold greater than the minimum value of the sprinkler system. The City's tax base will grow more rapidly if it is not being consumed by destructive fires, which will not occur when a City's property tax base is protected by sprinklers. It is a certainty that the loss of tax-assessable property will be many times greater in a community that does not have widespread sprinkler installation.

Third, the major component of a City's water supply cost is the necessity to have water available to combat fire. Widespread installation of private fire protection systems will drastically reduce the fire flow demand, with a correspondent cost reduction to the water utility. In sum, then, the savings to the fire department and the water utility, together with the increased tax base that will result from the increased fire safety, induced by exemption of fire protection systems from the tax base, all culminate to provide increased, rather than decreased, revenue to municipalities. The tax credit incentive in Senate Bill 370 and House Bill 648 will insure this result.

D. Elimination of Water Standby Charges

One of the most invidious disincentives to the installation of private fire protection systems has

been the water standby charge levied by water utilities. The charge is levied when a private fire protection system is connected to the water system, regardless of whether it consumes water or not. The theory of the charge is that the connection of the system creates demand that the Utility must meet. Nothing can be further further from the truth, however. By connection to the water supplies, the required fire flow, and, therefore, demand, is reduced. Sprinklers simply do not demand anywhere near as much water to fight fires as do Fire Departments. *See*, p. 6, *supra; see, also, Fire Protection Handbook, supra*, at 14–42 through 14–48. The cumulative effect of widespread sprinkler installation is reservoir requirements which are stabilized or reduced when compared to the requirements without the sprinklers.

Water demand charges eat up or completely eliminate any insurance savings to the property owner which would otherwise go towards amortizing the cost of installing the system. The demand charge makes it uneconomical to install the sprinklers. The water demand charge eliminates the only source of cost saving to be realized by installation of the sprinkler system. The demand charge should be exposed for what it is—a disincentive to installation of private fire protection that is counter productive to the goal of having adequate water supplies, and to the goal of making our communities safe from destructive fires. In the interests of conserving scarce water resources and maximizing the public fire protection dollar, then, legislation banning imposition of water demand charges on private fire protection systems should be enacted.

VIII. Conclusion

For the foregoing reasons support of this legislative program is urgently solicited. Senators, Representatives, local governments, and the public are urged to support these legislative incentives. It's time to stop utilizing expensive, dangerous, and outmoded fire safety technology to protect our communities. Legislative incentives promote utilization of the best firefighting technology, while at the same time saving money. It will save the public and local government money, and conserve scarce water resources, thereby saving in water supply construction.

State Of Alaska

Alaskan House Bill No. 648

***SECTION 1. AS 18.70 is amended by adding a new section to read:**

Sec. 18.70.081. APPROVAL OF FIRE PROTECTION SYSTEMS. Before October 30 of each year the Department of Public Safety shall prepare and make available a list of approved fire protection systems to the Department of Community and Regional Affairs, the Department of Commerce and Economic Development, and the public.

***SECTION 2. AS 19.53.020(a) is amended by adding a new paragraph to read:**

(7) real property to the extent and subject to the conditions provided in (j) of this section.

***SECTION 3. AS 29.53.020 is amended by adding a new subsection to read:**

(j) Two percent of the assessed value of a structure is exempt from taxation if the structure contains a fire protection system approved under AS 18.70.081, in operating condition, and incorporated as a fixture or part of the structure. The exemption granted by this subsection is limited to

(1) an amount equal to two percent of the value of the structure based on the assessment for 1981, if the fire protection system is a fixture of the structure on January 1, 1981; or

(2) an amount equal to two percent of the value of the structure based on the assessment as of January 1 of the year immediately following the installation of the fire protection system if the fire protection system becomes a fixture of the structure after January 1, 1981.

***SECTION 4. AS 42.05.381 is amended by adding a new subsection to read:**

(d) A utility shall provide for a reduced fee or surcharge for standby water for fire protection systems approved under AS 18.70.081 which use hydraulic sprinklers.

***SECTION 5. AS 44.33.170 is amended by adding a new subsection to read:**

(b) Tourist attraction development matching money may also be obtained for the purpose of purchasing and installing a fire protection system approved under AS 18.70.081 for a building used or to be used for the purposes described in (a) of this section.

***SECTION 6. AS 45.95.020(a) is amended to read:**

(a) The commissioner shall, under regulations and policies adopted by him, make small business

loans to acquire, finance or refinance or equip businesses, including farming equipment, *fire protection systems approved under AS 18.70.081*, mining and fishing, not exceeding $500,000. The loans shall be secured by acceptable collateral and may not exceed 75 percent of the appraised value of the collateral offered as security. The rate of interest may not exceed nine and one-half percent a year on the unpaid balance.

***SECTION 7. AS 45.95.020 is amended by adding a new subsection to read:**

(a) The commissioner may not disqualify an applicant for, or prejudice an applicant's priviledge to receive, a loan to purchase and install a fire protection system solely because of a loan already made to the applicant under this chapter.

State of Connecticut

Sec. 29–44c. Fire extinguishing system required for certain buildings for human occupancy; other occupancies. When any building is to be built having more than **four stories** to be used for human occupancy, such structure shall have an automatic, fire extinguishing system approved by the state fire marshal on each floor. No building inspector shall grant a building permit unless such a fire extinguishing system is included in the final, approved building plans and no fire marshal or building inspector shall permit occupancy of such a building unless and until such fire extinguishing system is installed and operable. The state fire marshal may require fire extinguishing systems approved by him to be installed in other occupancies where they are required in the interest of safety because of special occupancy hazards.

City of White Plains, New York

An Ordinance Amending an Ordinance Entitled, "An Ordinance Adopting a Building Code of the City of White Plains", in Relation to Sprinkler Requirements, Definition of 'Place of Assembly', and Smoke Venting of Interior Exitway Stairways".

The Common Council of The City of White Plains hereby ordains and enacts as follows:

Section 1. Section 1213.1 (and including 1213.1.1 to 1213.1.9, inclusive) of The Building Code of The City of White Plains is hereby amended in its entirety to read as follows:

"1213.1 **BUILDINGS REQUIRING SPRINKLERS.** - Approved automatic sprinkler systems shall be provided in all buildings herein specified and as further required for special uses and occupancies in Article 4:

a.) All new buildings, except as noted in Section 12.13.1.1, for which a building permit is issued on or after the effective date of this Ordinance.
b.) All buildings under construction at the effective date of this Ordinance which are in excess of four stories in height and for which neither a temporary nor final certificate of occupancy has been issued.
c.) Conversion of an existing building or portion therein to a more hazardous use group, and including conversion to a place of assembly or to a public restaurant, eating or drinking establishment, or cabaret use.

1213.1.1 EXCEPTIONS. - The following buildings are not required to have sprinkler systems:

a.) One and Two Family Residences, in detached structures.
b.) Open Parking Garages and Structures, for those stories above grade only.
c.) Detached private parking garages, and public parking garages of one-story in height, conditioned that such structures are used exclusively for parking and contain no cellars nor other uses, including the dispensing of any flammable fuels or liquids.

1213.1.2. **SPRINKLER SYSTEMS DESIGN.** - All sprinkler systems required under Section 1213.0 of this Ordinance shall comply with the following:

a.) Supply shall be from a two-source system, incorporating a dual connection contingency feed piping arrangement, in accordance with the requirements of the White Plains Plumbing Code.

b.) Sprinklers shall be installed within *all* areas and *throughout all portions* of buildings, including, but not limited to, cellars, boiler rooms, storage rooms, closets, attics, hallways, stairwells, lobbies and compactor rooms and shafts.

c.) In buildings containing celium plenums, a two-tier sprinkler system shall be installed with heads mounted at both the finished ceiling level, as well as within and above every ceiling plenum to provide adequate fire suppression coverage therein.

d.) A Central Fire Alarm-Smoke Detection System wired to an A-C primary source of electric power, with emergency power supply backup, as approved by the White Plains Department of Public Safety, shall be installed within and throughout all areas of any building required under this Ordinance to have sprinklers. Additional smoke detectors shall be installed within and above all ceiling plenums to detect any products of combustion or combustible vapors that may accumulate therein.

e.) Sprinkler system design drawings shall be submitted for permit prior to the start of any installation work. Designs shall be in accordance with the requirments of the National Fire Protection Association (NFPA) standards, and of the White Plains Fire Prevention Code."

Section 2. Section 201.0 of Said Ordinance is hereby amended by changing in its entirety the definition of "place of assembly", to read as follows:

"**PLACE OF ASSEMBLY.** A room or space accommodating fifty (50) or more individuals for religious, recreational, educational, political, social or amusement purposes or for the consumption of food and drink, including all connected rooms or spaces with a common means of entrance or egress."

Section 3. Section 618.0 of Said Ordinance is hereby amended by adding to the end thereof a new section 618.10., to read as follows:

"618.10. Smoke Venting of Interior Exitway Stairways. - All new interior exitway stairways shall be equipped with an approved automatic smoke-actuated roof scuttle vent, or other approved automatic smoke purge system located at the uppermost ceiling thereof."

Section 4. This Ordinance shall take effect immediately.

or conductors of mica tape insulation with teflon or equivalent coated glass braid in a metal raceway or equivalent conductors with a maximum operating temperature of 392 degrees fahrenheit approved by the commissioner. Type MI cable terminations in the boxes containing the interlocks shall be sleeved with glass braid fillers or asbestos braid jackets.

(2) In existing office buildings, 100 feet or more in height, as defined in sub-article 210.0 of article 2 of part II, title C, chapter twenty-six of the administrative code, such wiring and sleeving shall be required only for door interlocks on hoistway door frames of elevators kept available for immediate use by the fire department as provided in sub-division (a) of section C26–1800.8 of the administrative code. Installation of such cable or conductors and sleeving shall be completed within one and one-half years of the effective date of this local law.

§8. This local law shall take effect immediately.

THE CITY OF NEW YORK, OFFICE OF THE CITY CLERK, s.s.:

I hereby certify that the foregoing is a true copy of a local law of The City of New York, passed by the Council on November 27, 1979, and approved by the Mayor on December 13, 1979.

DAVID N. DINKINS, City Clerk,
Clerk of the Council.

CERTIFICATION PURSUANT TO MUNICIPAL HOME RULE LAW SECTION 27

Pursuant to the provisions of Municipal Home Rule Law Section 27, I hereby certify that the enclosed local law (Local Law No. 86 of 1979, Council No. Int. 723–A) contains the correct text and received the following vote at the meeting of the New York City Council on November 27, 1979: 42 for, none against.

Was approved by the Mayor on December 13, 1979.

Was returned to the City Clerk on December 14, 1979.

ALLEN G. SCHWARTZ, Corporation Counsel.

Santa Barbara County, California

Ordinance No. 3184

An Ordinance Amending The Santa Barbara County Code to Require Installation of Sprinkler Systems

The Board of Supervisors of the County of Santa Barbara do ordain as follows:

SECTION 1.

The Board of Supervisors of Santa Barbara County hereby find and declare:

(a) The present firefighting resources of Santa Barbara County are hard pressed to handle fires in large unsprinklered buildings.

(b) Geographic conditions in Santa Barbara County result in extended response times for firefighting resources, which contribute to greater life and property loss in large unsprinklered buildings.

(c) Weather conditions and flammable vegetation in Santa Barbara County result in numerous wildland fires, which draw existing resources from their structure protection areas for extended periods of time. This results in extended response time, which contribute to greater life and property loss in large unsprinklered buildings.

(d) Water is in short supply in Santa Barbara County, and fires in unsprinklered buildings typically consume far greater quantities of water to extinguish than do fires in sprinklered buildings.

(e) Fires in large unsprinklered buildings constructed in the future in Santa Barbara County will decrease the availability of firefighting resources and services to other structures.

(f) Built-in fire protection is a universally recognized method of shifting the cost from the public to the private sector.

(g) AUTOMATIC FIRE SPRINKLER SYSTEMS ARE GENERALLY RECOGNIZED AS THE SINGLE GREATEST MITIGATION MEASURE AVAILABLE FOR BUILDING AND CONTENTS FIRE PROTECTION.

(h) Codes and incentives now in effect in Santa Barbara County are insufficient to produce sprinkler protected buildings, as only ten (10) percent of the County's buildings of over 5,000 square feet are so protected.

(i) THE SANTA BARBARA COUNTY MASTER PLAN COMMITTEE HAS RECOGNIZED AUTOMATIC FIRE SPRINKLERS AS THE SINGLE GREATEST IMPROVEMENT AVAILABLE IN STRUCTURAL FIRE SAFETY.

SECTION 2.

Article 1 of Chapter 15 of the Santa Barbara County Code is amended to add thereto Section 15–18, to read as follows:

"SECTION 15-18. AUTOMATIC FIRE SPRINKLER SYSTEMS"

"Notwithstanding any provisions to the contrary in the Uniform Fire Code or in this Code, automatic sprinkler systems shall be installed and maintained in:

"1) New buildings or structures for which application for building permits are officially filed with the Santa Barbara County Building Department after the effective date of this section and WHICH HAVE TOTAL FLOOR AREA OF 5,000 SQUARE FEET OR MORE; and

"2) Existing buildings or structures for which application for modification are officially filed with the Santa Barbara County Building Department after the effective date of this section and WHICH ARE MODIFIED TO INCREASE THE FLOOR SPACE TO 5,000 SQUARE FEET OR MORE.

"The total floor area of such buildings or structures shall be computed without regard to separation walls and floors of less than four hours' fire resistive construction. The total floor area shall be computed, in the case of a single story building, within each separate area surrounded by unpierced separation walls and an unpierced floor of four or more hours' fire resistive construction.

"No automatic sprinkler system required by this section shall be installed without the prior approval of the Fire Chief of the plans for the installation, testing and maintenance of the system.

"The term 'automatic sprinkler system' as used herein means an integrated system of underground and overhead piping, including a water supply such as a gravity tank, fire pump, reservoir, pressure tank, or connection by underground piping to a County main, which system complies in all respects with the requirements for such systems contained in Pamphlet No. 13 issued by the National Fire Protection Association, as such requirements exist as of the effective date of this section or as they may thereafter be amended.

"This section shall not apply to single family dwellings, condominiums, stock cooperatives or any similar residential structures designed and intended at the time of application for a building permit to be occupied by the owner or owners thereof.

"Exemptions from this section may be granted after hearing by the Board of Supervisors on application of the owner of any building or structure wherein installation of an automatic sprinkler system would be inappropriate."

SECTION 3.

The Board of Supervisors direct the Clerk of the Board to file a copy of this ordinance with the California Department of Housing and Community Development.

SECTION 4.

This ordinance shall take effect and be in force thirty (30) days from the date of its passage, and before the expiration of fifteen (15) days after its passage it shall be published once, with the names of the members of the Board of Supervisors voting for and against the same, in the Santa Barbara News-Press, a newspaper of general circulation published in the County of Santa Barbara, State of California.

A.3 – Sample regional advocacy organization bylaws - European Fire Sprinkler Network – EFSN (for more information go to www.eurosprinkler.org)

EUROPEAN FIRE SPRINKLER NETWORK

A COMPANY LIMITED BY GUARANTEE AND NOT HAVING A SHARE CAPITAL

ARTICLES OF ASSOCIATION

of

EUROPEAN FIRE SPRINKLER NETWORK

INTERPRETATION

1.1 In these Articles, unless the context requires otherwise,

"the Act"	means the Companies Act 1985 with any statutory amendment or re-enactment of it for the time being in force and any subordinate legislation made under its authority
"clear days"	in relation to a period of notice means that period excluding the day when the notice is given or deemed to be given and the day for which it is given or on which it is to take effect
"the Council"	means the Council for the time being of the Company
"the Office"	means the registered office for the time being of the Company
"person"	means an individual, a corporation or a firm or other unincorporated association words or expressions bear

the same meanings as in the Act

1.2 the singular includes the plural and the converse applies

1.3 words denoting gender include the other genders.

MEMBERSHIP

2 The subscribers to the memorandum of association of the Company and such other persons as are admitted to membership in accordance with these Articles shall be members of the Company. Every person who wishes to become a member shall make a written application to the Company in such form as the Council requires signed by or on behalf of that person. No person shall be admitted to membership unless his application is approved by the Council.

3 The Council shall admit to membership only persons who are in one of the following categories, namely,

3.1 Insurers, being companies who provide insurance cover for fire risks (the **Insurance Members**),

3.2 Authorities, being bodies with an interest in fire safety and prevention including Government authorities at local, national and European level, Fire Brigades and their representative organisations and other bodies with regulatory functions relating to that interest (the **Authorities Members**),

3.3 Fire Sprinkler Trade Associations, being organisations which operate at National level and which represent the interests of many persons engaged in the manufacture, supply and installation of fire sprinklers (the **FSTA Members**),

3.4 Installers and Manufacturers, being persons or companies who respectively install or manufacture automatic fire sprinklers and associated equipment suitable for controlling and extinguishing fires (the **Installer and Manufacturer Members**),

3.5 Distributors, being persons or companies who supply but do not manufacture automatic fire sprinklers and associated equipment suitable for controlling and extinguishing fires (the **Distribution Members**),

3.6 Professionals and Certification Bodies, being persons or firms who offer independent consultancy services in connection with the use of automatic fire sprinklers to control and extinguish fires or who certify the systems, automatic fire sprinklers or associated equipment (the **Consultancy and Certification Members**).

3.7 Individuals, persons who do not fall into one of the above categories (the **Individual Members**).

4 The register of members shall include an entry for every member of his category of membership. Unincorporated associations shall be represented by their nominees and in each case the name of the association shall be entered in the register of members by the name of the nominee.

ASSOCIATES

5 The Council may admit to associateship of the Company such corporate bodies, unincorporated associations and individuals, who are interested in the fire sprinkler industry but are ineligible for membership, as it thinks fit. Every person who wishes to become an associate shall make a written application to the Company in such form as the Council requires signed by or on behalf of that person. Associates shall have such rights and benefits as the Council shall decide from time to time but-shall not have any of the rights conferred by these Articles specifically on members.

SUBSCRIPTIONS

6 Every member and every associate shall pay to the Company an annual subscription calculated on such formula as the Company in general meeting on the recommendation of the Council decides from time to time. The formula may

vary between members and associates and from one category of members to another. Annual subscriptions shall be paid on the first day of every accounting year of the Company except those of new members and associates which shall be paid within fourteen days after receiving notification of admission or, in any instance of a new or continuing member or associate, as otherwise agreed with him.

7 If the whole or a part of the annual subscription of a member or an associate is more than three months in arrears then on the decision of the Council the Company may give him written notice of the suspension of his rights as a member or an associate, as the case may be, whereupon he shall lose those rights until such time as the arrears have been paid.

8 If the whole or a part of the annual subscription of a member or an associate is more than twelve months in arrears then he shall cease forthwith to be a member or an associate, as the case may be, on the Council passing a resolution to that effect which is notified to him.

LEVIES

9 Members shall pay such levies to the Company as may be approved by special resolution of the Company on a recommendation of the Council made without a dissenting vote.

TERMINATION OF MEMBERSHIP OR ASSOCIATESHIP

10 The membership or associateship of a person shall terminate if:

10.1 he ceases to be a member or associate under Article 8 or

10.2 he is not eligible, under Article 3, for the category of membership specified for him in the register of members or, under Article 5, for associateship or

10.3 he resigns from membership or associateship by giving the Company not less than

six months written notice to that effect or

10.4 he is expelled from membership or associateship under Article 12 or

10.5 being a corporation or an unincorporated association, it is dissolved or

10.6 being an individual, he dies.

11 On the termination of the membership or associateship of a person in any way any subscription or levy due from that person to the Company but unpaid at the date of termination shall remain payable in full.

12 The membership or associateship of a person may be terminated or suspended for a specified period or until certain conditions are met in either case in accordance with the then current procedure approved and promulgated by the Council for dealing with the enforcement of the standards of business and ethics to be maintained by members or with alleged misconduct of members considered to be detrimental to the interests of the Company or of its members and associates. The Procedure may confer on any disciplinary or adjudicatory body such powers as the Council considers to be reasonable.

GENERAL MEETINGS OF MEMBERS

13 The Company shall hold an annual general meeting every year at such time and place as the Council decides but not more than fifteen months shall elapse between one annual general meeting and the next. The first annual general meeting shall be held within eighteen months after the incorporation of the Company but, subject to that, need not be held in the year of incorporation or the next year.

14 All general meetings other than annual general meetings shall be called extraordinary general meetings. An extraordinary general meeting shall be convened at any time the Council so decides or on a members' requisition under section 368 of the Act.

15 Subject to Articles 7 and 12, the persons entitled to attend any general meeting shall be the members for the time being of the Council and members of the Company who may attend, being corporate bodies, through their representatives or, being individuals who are members in their own right or are nominees of unincorporated associations, in person or, in either case, their proxies. The Council may allow any other person to attend and, if invited by the chairman, to take part in the proceedings of a general meeting but no such person shall be entitled to vote.

16 Every member which is a corporate body may by written notification to the Company appoint an individual to act as its representative at general meetings. An appointment may be revoked in the same way. A representative shall be entitled to attend general meetings and to speak and vote in place of the member which appointed him and when present at a meeting shall be treated for all purposes of these Articles as being that member present in person.

NOTICE OF GENERAL MEETINGS

17 Every annual general meeting and every extraordinary general meeting at which a special resolution is to be considered shall be convened by giving every member of the Company (other than a member whose rights are suspended under Article 7 or 12), every Council member and the auditor at least twenty-one clear days written notice specifying the date, time and the venue of the meeting and the general nature of the business to be transacted. Every other extraordinary general meeting shall be convened by giving at least fourteen clear days notice as specified above. A general meeting convened by giving a shorter period of notice than is specified above shall be deemed to have been properly convened in the circumstances provided in section *369* of the Act.

18 The accidental omission to give notice of a general meeting to, or the non-receipt of such notice by, any person entitled to receive the notice shall not invalidate the proceedings at that meeting.

PROCEEDINGS AT GENERAL MEETINGS

19 No business shall be transacted at any general meeting unless a quorum is present. One-tenth of the number of persons entitled to vote on the business to be transacted, each being a member or a proxy for a member or a duty authorised representative of a corporation, shall be a quorum.

20 If such a quorum is not present within half an hour after the time appointed for the meeting, or if during a meeting such a quorum ceases to be present, the meeting shall stand adjourned to the same day in the next week at the same time and place or to such other day and at such other time and place as the Council decides. If such a quorum is not present within half an hour after the time appointed for the adjourned meeting then any two persons entitled to vote shall be a quorum.

21 The Chairman of the Council, or failing him, the Vice-Chairman shall preside at every general meeting but, failing both of them, the persons present and entitled to vote shall choose one of their number to preside.

22 The chairman of a meeting at which a quorum is present may, with the consent of the meeting, and shall if so directed by the meeting, adjourn the meeting from time to time and from place to place but no business shall be transacted at an adjourned meeting other than business which might properly have been transacted at the meeting had the adjournment not taken place. When a meeting is adjourned for fourteen days or more, at least seven clear days notice of the adjourned meeting shall be given as specified in Article 17. Otherwise it shall not be necessary to give such notice.

23 A resolution put to the vote of a meeting shall be decided on a show of hands unless before, or on the declaration of the result of, the show of hands a poll is demanded by the chairman or by at least two persons entitled to vote at the meeting or by a person or persons representing not less than one-tenth of the total voting rights of all the members having the right to vote at the meeting. No poll shall be demanded on the election of the chairman of a meeting or on a question of adjournment. The demand for a poll shall not prevent the continuation of a

meeting for the transaction of any business other than the question on which the poll was demanded.

24 Unless a poll is duly demanded a declaration by the chairman that a resolution has been carried or carried unanimously, or by a particular majority, or lost, or not carried by a particular majority and an entry to that effect in the minutes of the meeting shall be conclusive evidence of the fact without proof of the number or proportion of the votes recorded in favour of or against the resolution.

25 The demand for a poll may, before the poll is taken, be withdrawn with the consent of the chairman, whereupon the result of any show of hands declared before the demand was made shall stand.

26 A poll shall be taken in such manner and at such time and place as the chairman directs and he may appoint scrutineers and fix a time and place for declaring the result, which shall be deemed to be the resolution of the meeting at which the poll was demanded.

27 In the case of an equality of votes, whether on a show of hands or on a poll, the chairman shall be entitled to a casting vote in addition to any other vote he might have.

28 A resolution in writing executed by or on behalf of each member who would have been entitled to vote on it if it had been proposed at a general meeting at which he was entitled to be present shall be as effectual as if it had been passed at a general meeting duly convened and held and may consist of several instruments in the like form each executed by or on behalf of one or more members.

VOTES OF MEMBERS

29 Subject to Articles 7 and 12, on a show of hands every member who, being an individual, is present in person or, being a corporation, is present by a duly authorised representative shall have one vote and on a poll every member so present or present by proxy shall have one vote.

30 No objection shall be raised to the qualification of any person to vote except at the meeting or adjourned meeting at which the vote objected to is tendered and every vote not disallowed at the meeting shall be valid. Any objection made in due time shall be referred to the chairman whose decision shall be final and conclusive.

31 The appointment of a proxy shall be by written instrument which clearly states the names of the Company, the member or representative of a corporation making the appointment and the proxy, the meeting for which the authority applies and any limitation on the authority and which is dated and signed by or on behalf of the appointor. The instrument shall be delivered to the Office not less than forty-eight hours before the meeting for which it applies.

THE COUNCIL

32 The affairs of the Company shall be managed by the Council.

33 Members of the Council are not statutory directors.

34 The Council may pay all expenses incurred in promoting and registering the Company and may exercise all the powers of the Company not required by these Articles or by statutory authority to be exercised by the Company in general meeting. No alteration of the Company's memorandum of association or of these Articles shall invalidate any prior act of the Council which would have been valid if that alteration had not been made. The powers given by this Article shall not be limited by any special power given to the Council by these Articles and a meeting of the Council at which a quorum is present may exercise all powers exercisable by the Council.

APPOINTMENT AND RETIREMENT OF COUNCIL MEMBERS

35 There shall be a maximum of twenty-one Council members; three of whom to be nominated by the International Fire Suppression Alliance ("**IFSA Nominees**"); the remainder to be elected as follows: nine from the Contractor/Manufacturer Members; one from the National Sprinkler Association Members; two from

Insurance Company Members; four from the Consultancy and Certification Body Members; one from the Authorities/Fire Protection Association Members and one from the Distributor Members. Council Candidates may be nominated by any category of member.

36 If they have not already done so, at the first annual general meeting all of the first Council members, with the exception of the IFSA Nominees, shall retire from office.

At every subsequent annual general meeting one third of each category of Council members as defined in article 35 above, with the exception of the IFSA Nominees, shall retire from office but may be re-elected. Any changes to the IFSA Nominees or their alternates shall be notified to the Office at least 30 days before the annual general meeting.

The Council members to retire shall be those who have been in office longest since their last election but, as between persons who have been in office an equal length of time, unless they agree otherwise, those to retire shall be decided by lot.

37 A Council member retiring at an annual general meeting shall be taken to be nominated for re-election unless he clearly indicates his wish not to stand. No other person shall be eligible for election at that meeting unless at least seven days before the meeting there has been delivered to the Office written notice signed by or on behalf of a member in the appropriate category nominating that person which is countersigned by that person to indicate his willingness to stand.

38 Any member of the Council may retire at any time by giving the Company 7 days notice in writing.

At its first meeting after every annual general meeting the Council shall appoint from its members a Chairman, a Vice-Chairman and a Treasurer to hold office until the corresponding meeting in the next year at which they may be reappointed if still Council members.

39 The Council may from time to time co-opt such persons as it thinks fit to serve as

Council members for such period as the Council decides in each case but there shall not at any time be more than two Council members in office co-opted under this Article. On the expiry of his term of office a co-opted Council member may be co-opted for a further term.

40 The Council may appoint any person it considers suitable to fill a casual vacancy occurring in its membership elected by any category of members. A person so appointed shall be treated as having been elected by the members in that category for all purposes of these Articles except that he shall retire at the next annual general meeting at which he may stand for election without express nomination.

DISQUALIFICATION AND REMOVAL OF COUNCIL MEMBERS

41 A person shall cease to be a Council member if:

41.1 he is or becomes an undischarged bankrupt or makes any composition or scheme of arrangement with his creditors;

41.2 he becomes a patient within Part VII of the Mental Health Act 1983;

41.3 he resigns by giving the Company written notice to that effect signed by him or under his authority;

42 The Company may by extraordinary resolution remove any Council member from office. If an elected Council member is so removed then the category of members which elected him may by resolution at the meeting appoint another person to fill the vacancy. A person so appointed shall retire from office under Article 36 at the annual general meeting at which his predecessor would have done.

REMUNERATION OF COUNCIL MEMBERS

43 Council members shall be paid such remuneration (if any) as the Company may by ordinary resolution decide from time to time.

EXPENSES OF COUNCIL MEMBERS

44 Council members may be reimbursed by the Company for any expenses reasonably incurred in carrying out their duties in pursuance of the business of the Company.

COUNCIL MEMBER'S INTERESTS

45 Provided he has disclosed to the Council the nature and extent of any material interest of his, a Council member:

45.1 may be a party to, or otherwise interested in, any transaction or arrangement with the Company or in which the Company is otherwise interested;

45.2 may be a director or other officer of, or employed by, or a party to any transaction or arrangement with, or otherwise interested in, any corporation promoted by the Company or in which the Company is otherwise interested; and

45.3 shall not by reason of his office be accountable to the Company for any benefit which he derives from any such office or employment or from any such transaction or arrangement or from any interest in any such corporation and no such transaction shall be liable to be avoided on the ground of any such interest or benefit.

46 For the purposes of Article 45:

46.1 a general notice given to the Council that a Council member is to be regarded as having an interest of the nature and extent specified in the notice in any transaction or arrangement in which a specified person or class of persons is interested shall be deemed to be a disclosure that the Council member has an interest in any such transaction of that nature and extent; and

46.2 an interest of which a Council member has no knowledge and of which it is unreasonable to expect him to have knowledge shall not be treated as an interest

of his.

PROCEEDINGS OF THE COUNCIL

47 Subject to these Articles, the Council may regulate its proceedings as it thinks fit. Any Council member may call a meeting of the Council. Subject to that, every Council member shall be given at least fourteen clear days' written notice of the time and venue of a Council meeting and the business to be considered unless the circumstances justify otherwise in any respect.

48 The quorum for the transaction of the business of the Council shall be four.

49 Subject to any provision in these Articles to the contrary, any question put to the vote at a Council meeting shall be decided by a simple majority of votes cast. In the event of an equality of votes the chairman shall have a second or casting vote. A Council member shall not be entitled to vote on the question of his own appointment to any office or place of profit in the Company or the terms of it.

50 The Council may from time to time delegate such powers and allocate such duties to one or more of its members and other persons as it thinks fit. If powers are delegated and/or duties allocated to two or more persons jointly then, subject to any directions given by the Council, they shall confer among them, exercise the powers and perform the duties as and when they reasonably decide or a majority of them does.

51 All acts bona fide done by the Council or by any body or person holding powers delegated by it, notwithstanding that it is later discovered that there was some defect in the appointment or qualification of one of its members or, as the case may be, that person, shall be as valid as if the defect had not occurred.

STATUTORY DIRECTORS

52 Daily business of the company shall be managed by an Executive Director, to be appointed by the Council subject to the provisions of the Act, at such remuneration

and on such conditions as the Council may think fit.

53 Unless determined by ordinary resolution there shall be one director and secretary, namely Alan Brinson.

DISQUALIFICATION AND REMOVAL OF DIRECTORS

54 A person shall cease to be a director member if:

54.1 that occurs by virtue of any provision of the Act or he becomes prohibited by law from being a director;

54.2 he is or becomes an undischarged bankrupt or makes any composition or scheme of arrangement with his creditors;

54.3 he becomes a patient within Part VII of the Mental Health Act 1983;

54.4 he resigns by giving the Company written notice to that effect signed by him or under his authority;

54.5 he is removed from office under Article 40;or

54.6 he is removed from office by a resolution passed under section 303 of the Act.

DIRECTORS INTERESTS

55 Subject to the provisions of the Act and provided he has disclosed to the board the nature and extent of any material interest of his, a board member:

55.1 may be a party to, or otherwise interested in, any transaction or arrangement with the Company or in which the Company is otherwise interested;

55.2 may be a director or other officer of, or employed by, or a party to any transaction or arrangement with, or otherwise interested in, any corporation promoted by the Company or in which the Company is otherwise interested; and

55.3 shall not by reason of his office be accountable to the Company for any benefit which he derives from any such office or employment or from any such transaction or arrangement or from any interest in any such corporation and no such transaction shall be liable to be avoided on the ground of any such interest or benefit.

56 For the purposes of Article 55:

56.1 a general notice given to the Council that a Council member is to be regarded as having an interest of the nature and extent specified in the notice in any transaction or arrangement in which a specified person or class of persons is interested shall be deemed to be a disclosure that the Council member has an interest in any such transaction of that nature and extent; and

56.2 an interest of which a Council member has no knowledge and of which it is unreasonable to expect him to have knowledge shall not be treated as an interest of his.

MINUTES

57 The Council shall cause minutes to be made in books kept for the purpose of all appointments of officers made by the Council and of all proceedings at general meetings of the Company and meetings of the Council.

ACCOUNTS

58 No member, as such, shall have any right to inspect any accounting records or other book or document of the Company except as conferred by statute or authorised by the Council or by ordinary resolution of the Company.

NOTICES

59 The Company may give any notice to a member either personally or by sending it by post in a prepaid envelope addressed to the member at his registered address or by leaving it at that address.

60 A member present in person or by proxy at a general meeting shall be deemed to have received notice of the meeting and, where requisite, the purpose for which it was called.

61 Proof that an envelope containing a notice was properly addressed, prepaid and posted shall be conclusive evidence that the notice was given. A notice shall be deemed to have been given forty-eight hours after the envelope containing it was posted.

WINDING UP

62 Clause 8 of the memorandum of association shall have effect as if its provisions were repeated in these Articles.

INDEMNITY

63 Subject to the provisions of the Act but without prejudice to any indemnity to which a Council member may otherwise be entitled, every Council member or other officer or auditor of the Company shall be indemnified out of the assets of the Company against any liability incurred by him in defending any proceedings, whether civil or criminal, in which judgement is given in his favour or in which he is acquitted or in connection with any application in which relief is granted to him by the court from liability for negligence, default, breach of duty or breach of trust in relation to the affairs of the Company.

A.4 – Sample national advocacy organization bylaws - Mexican Association of Automatic Fire Sprinklers, AC – AMRACI (for more information go to www.amraci.org)

"ESTATUTOS DE LA "ASOCIACIÓN MEXICANA DE ROCIADORES AUTOMÁTICOS CONTRA INCENDIOS", ASOCIACIÓN CIVIL.

CAPÍTULO PRIMERO

DENOMINACIÓN, OBJETO, DURACIÓN, DOMICILIO Y CLÁUSULAS DE ADMISIÓN

ARTÍCULO 1.- La asociación se denominará: "ASOCIACIÓN MEXICANA DE ROCIADORES AUTOMÁTICOS CONTRA INCENDIOS", denominación que deberá ir seguida de la expresión "ASOCIACIÓN CIVIL" o de su abreviatura "A.C.".

La asociación podrá utilizar como distintivo el vocablo "AMRACI", seguido de las palabras "ASOCIACIÓN CIVIL" o de su abreviatura "A.C.".

OBJETO

ARTÍCULO 2.- La asociación tendrá por objeto:

I.- Representar a la industria de rociadores automáticos y sistemas contra incendio en México y en el extranjero impulsando su crecimiento y desarrollo, con el objeto de salvaguardar vidas humanas y sus bienes, promoviendo la cultura de prevención y protección a través de normas, códigos, buenas prácticas y la profesionalización del mercado;

II.- Promocionar la implementación de rociadores automáticos y sistemas contra incendio en cualquier edificación pública o privada que lo requiera, buscando prevenir incendios, salvar vidas y propiedades;

III.- Asistir y apoyar con ética profesional la aplicación de los estándares relacionados con la industria de los rociadores automáticos y sistemas contra incendio a los clientes y asociaciones, con el soporte de las normas y reglas que regulan los sistemas contra incendio;

IV.- Proponer, diseñar, actualizar y participar en el proceso de elaboración de normas relacionadas a los rociadores automáticos y sistemas contra incendio; así como ser parte en todo lo que respecta al proceso de cumplimiento de dichas normas;

V.- Proponer códigos y normas dentro de la industria de los rociadores automáticos y sistemas contra incendio en México, que fomenten el profesionalismo, honestidad, prestigio y la sana competencia entre los asociados;

VI.- Desarrollar y promover programas de actualización profesional continua, programas de certificación de personas, empresas y el uso de tecnología que demuestre su cumplimiento con la legislación del país en que se fabricaron o prestan sus servicios;

VII.- Fomentar la cultura de la prevención de incendios y protección contra estos mediante la utilización de rociadores automáticos y sistemas contra incendios;

VIII.- Fomentar la implementación de rociadores automáticos y sistemas contra incendio en los programas de protección civil con empresas privadas y con entes públicos municipales, estatales y federales;

IX.- Coadyuvar en la elaboración y aplicación de los programas de protección civil, con las autoridades municipales, estatales y federales en la prevención de incendios y la protección contra estos;

X.- Participar en las ferias, congresos, seminarios y en general cualquier evento público o privado para difundir los objetivos de la asociación;

XI.- Celebrar acuerdos con instituciones nacionales y extranjeras, para el cumplimiento del objeto de la asociación;

XII.- Unir fuerzas con otras asociaciones y fundaciones que tengan objetivos similares;

XIII.- Proyectar a la asociación y difundir sus objetivos, por medio de publicidad, el intercambio con otras asociaciones y fundaciones, a efecto de lograr la implementación de rociadores automáticos y sistemas contra incendio con las autoridades e instituciones privadas;

XIV.- Tener presencia en los medios de comunicación;

XV.- Proponer la adopción de códigos y normas relacionadas con diseño, instalación y calidad de mano de obra, mantenimiento, control de calidad y prueba de rociadores automáticos y sistemas contra incendio;

XVI.- Ser un órgano de consulta en materia de rociadores automáticos y sistemas contra incendio para las Autoridades Públicas, empresas y Usuarios Finales de los Estados Unidos Mexicanos;

XVII.- Participar en la constitución, operación y actividades de otras Asociaciones Civiles similares en México y en el extranjero;

XVIII.- Coordinarse con las autoridades de protección civil, cuerpo de bomberos, Cruz Roja, policías y demás Entidades Públicas y Privadas que intervengan en la prevención de incendios y protección contra estos; así como la implementación de programas de protección civil, dentro del ámbito municipal, estatal, federal y con empresas privadas;

XIX.- Llevar a cabo cualquier acción que se considere apropiada para alcanzar los fines de la asociación;

XX.- El objeto de la asociación no será de carácter económico, ni político, y

XXI.- Para el cumplimiento de los fines de la asociación, de forma enunciativa más no limitativa, podrá:

a).- Adquirir por cualquier título toda clase de bienes muebles e inmuebles y derechos que sean necesarios para la realización de su objeto social, así como establecer oficinas para prestar los servicios de referencia;

b).- Obtener por cualquier título, concesiones, permisos, autorizaciones o licencias, así como celebrar cualquier clase de contratos con la administración pública sea federal o local, relacionados con su objeto;

c).- Obtener, adquirir, registrar, utilizar o disponer de toda clase de patentes, marcas industriales y de servicios, certificados de invención o nombres comerciales, diseños y dibujos industriales, derechos de autor y cualquier otro tipo de derechos de propiedad industrial, literaria o artística y derecho sobre ellos ya sea en México o en el extranjero;

d).- Emitir, girar, endosar, aceptar, y suscribir toda clase de títulos de crédito sin que constituyan una especulación comercial;

e).- Celebrar toda clase de contratos y convenios, y ejecutar actos u operaciones de cualquier naturaleza, así como otorgar y suscribir cualquier clase de documentos que sean necesarios o convenientes para la realización de su objeto,

f).- Recibir aportaciones económicas y materiales por parte de cualquier nivel de gobierno, así como personas físicas o morales del sector privado, nacionales o extranjeras de procedencia lícita.

DURACIÓN

ARTÍCULO 3.- La duración de la asociación será indefinida.

DOMICILIO

ARTÍCULO 4.- El domicilio de la sede principal de la asociación será en la Ciudad de México, pudiendo establecer sucursales, agencias u oficinas en cualquier otro lugar de la República Mexicana o del extranjero.

CLÁUSULAS DE ADMISIÓN

ARTÍCULO 5.- La nacionalidad de los asociados es Mexicana, Los asociados extranjeros actuales o futuros de la asociación, se obligan ante la Secretaría de Relaciones Exteriores a considerarse como nacionales respecto de:

I.-Las acciones, partes sociales o derechos que adquieran de dicha asociación;

II.- Los bienes, derechos, concesiones, participaciones o intereses de que sea titular la Asociación, y;

III.- Los derechos y obligaciones que deriven de los contratos en que sea parte la propia Asociación;

IV.- A renunciar a invocar la protección de sus gobiernos, bajo la pena, en caso contrario, de perder en beneficio de la Nación, los derechos y bienes que hubiesen adquirido,

CAPÍTULO SEGUNDO

DEL SOCIO FUNDADOR, ASOCIADO, ASOCIADO HONORARIO Y ASOCIADO ESPECIAL, IGUALDAD DE DERECHOS Y OBLIGACIONES DE LOS MISMOS

ARTÍCULO 6.- La asociación será integrada por los siguientes:

a).- SOCIO FUNDADOR: Asociado que firmó el acta constitutiva por la que se creó la asociación;

b).- ASOCIADO: Persona física o moral, nacional o extranjera, que lleva a cabo actividades directamente relacionadas con los rociadores automáticos y sistemas contra incendio.

El Comité de Admisiones determinará su admisión en términos del Reglamento de Admisión.

El asociado activo debe:

(i) participar constantemente en las actividades de la asociación;

(ii) firmar el código de ética; y

(iii) aceptar que su calidad de asociado activo es intransferible;

c).- ASOCIADO HONORARIO: Persona física o moral, nacional o extranjera, reconocida por la asociación que destaque en el desarrollo de actividades encaminadas al crecimiento de actividades relacionadas a los rociadores automáticos y sistemas contra incendio,

d).- ASOCIADO ESPECIAL: Podrán participar en determinadas actividades de la asociación, bajo el carácter de invitados especiales, sin ningún tipo de derecho sobre la misma, dependencias y entidades de la administración pública, personas físicas y morales del sector privado, previa invitación y aprobación de la Asamblea General, siempre y cuando dichas participaciones estén encaminadas exclusivamente a los fines de la asociación.

CLASIFICACIÓN DE ASOCIADOS

ARTÍCULO 7.- Para efectos enunciativos, se entenderá que pertenecen a la industria de los rociadores automáticos y sistemas contra incendio, las siguientes personas:

a).- FABRICANTES: Aquellas personas físicas o morales dedicadas a la manufactura de rociadores automáticos y sistemas contra incendio, así como de todo tipo de componentes que sean necesarios para su implementación y que demuestren que los productos o servicios que prestan cumplen con la legislación del país en que se fabricaron o prestan sus servicios. La asociación, a través de sus órganos valorará la información presentada;

b).- DISTRIBUIDORES: Aquellas personas físicas o morales que tengan como giro la distribución y venta tanto de rociadores automáticos y sistemas contra incendio, así como de todo tipo de componentes que sean necesarios para su implementación y que demuestren que los productos o servicios que prestan cumplen con la legislación del país en que se fabricaron o prestan sus servicios. La asociación, a través de sus órganos valorará la información presentada;

c).- DISEÑADORES: Aquellas personas físicas o morales que tengan como actividad, generar los diseños e ingeniería encaminados al óptimo funcionamiento de rociadores automáticos y sistemas contra incendio;

d).- INSTALADORES: Aquellas personas físicas o morales que se dediquen a instalar los productos para la prevención y protección a base de rociadores automáticos y sistemas contra incendio;

e).- EMPRESAS ASEGURADORAS: Aquellas personas morales que se dediquen a responder por los siniestros ocasionados por incendios, entre otras cosas, y

f).- Las demás personas que tengan deseo de colaborar con los objetivos de la asociación.

ARTÍCULO 8.- Podrá ser ASOCIADO FABRICANTE:

Cualquier persona física o moral, nacional o extranjera dedicada a la manufactura de rociadores automáticos y sistemas contra incendio, así como de todo tipo de componentes que sean necesarios para su implementación, que demuestren que los productos o servicios que prestan cumplen con la legislación del país en que se fabricaron o prestan sus servicios. La asociación, a través de sus órganos valorará la información presentada.

ARTÍCULO 9.- Podrá ser ASOCIADO DISTRIBUIDOR:

Cualquier persona física o moral que tenga como actividad, la distribución y venta tanto de rociadores automáticos y sistemas contra incendio, así como de todo tipo de componentes que sean necesarios para su implementación, que demuestre que los productos o servicios que presta cumplen con la legislación del país en que se fabricaron o presta sus servicios. La asociación, a través de sus órganos valorará la información presentada.

ARTÍCULO 10.- Podrá ser ASOCIADO DISEÑADOR:

Cualquier persona física o moral que tenga como actividad generar los diseños e ingeniería encaminados al óptimo funcionamiento de rociadores automáticos y sistemas contra incendio.

ARTÍCULO 11.- Podrá ser ASOCIADO INSTALADOR:

Cualquier persona física o moral que se dedique a instalar los productos para la prevención y protección de incendios a base rociadores automáticos y sistemas contra incendio.

ARTÍCULO 12.- Podrá ser ASOCIADO DE EMPRESAS ASEGURADORAS:

La persona moral que se dedique a responder por los siniestros ocasionados por incendios entre otras cosas.

ARTÍCULO 13.- Podrá ser ASOCIADO HONORARIO:

Cualquier persona física o moral, nacional o extranjera, reconocida por la asociación, este nombramiento deberá estar firmado por el Consejo Consultivo y se extenderá por el tiempo que se estime conveniente y necesario.

ARTÍCULO 14.- Podrá ser ASOCIADO ESPECIAL:

Cualquier persona moral o física invitada por la asociación a colaborar con los objetivos de la misma.

ARTÍCULO 15.- Los Asociados a excepción de los HONORARIOS y ESPECIALES, tienen los mismos derechos y obligaciones con voz y voto en las Asambleas, así como el derecho de ser elegido por sí o a través de sus delegados, para cargos del Consejo Directivo, ningún Asociado puede tener doble representación.

IGUALDAD DE DERECHOS

ARTÍCULO 16.- Los asociados tendrán derecho a:

a).- Hacer mención de tal calidad en el ejercicio de su actividad industrial;

b).- Participar en las actividades de la asociación;

c).- Ser elegido para cualquier puesto directivo o para integrar cualquiera de las comisiones que se formen;

d).- Ser defendidos en los términos que acuerde la asociación;

e).- Expresar libremente sus ideas;

f).- Asistir a las Asambleas con voz y voto;

g).- Gozar de las demás prerrogativas que estos estatutos conceden, y

h).- Usar la imagen y marca de la asociación, con apego a los lineamientos del Manual de Usuario del Asociado, lo anteriormente citado solo aplicará mientras los asociados sigan siendo reconocidos como tales por la misma.

OBLIGACIONES DE LOS ASOCIADOS

ARTÍCULO 17.- Los asociados tienen obligación de:

a).- Cumplir las disposiciones establecidas por estos estatutos y por la Asamblea, así como adherirse a las normas y prácticas que esta última determine, de acuerdo con sus facultades;

b).- Coadyuvar con la asociación al cumplimiento general de su objeto y fin;

c).- Pagar puntualmente las cuotas ordinarias y extraordinarias:

Cuando exista un incumplimiento de un Asociado por un lapso de 60 días naturales a la fecha de vencimiento de su afiliación, sus derechos serán suspendidos, sin embargo, si el asociado desea reincorporarse a la asociación deberá cubrir las cuotas adeudadas y pagar una cuota de re-inscripción como

si se tratase de un nuevo Asociado, de acuerdo al Reglamento de Admisión, previa autorización del Comité de Admisiones y el Comité de Honor y Justicia.

Para el caso de que el Asociado no regularice la situación descrita en el párrafo que antecede en el término improrrogable de un año será dado de baja;

d).- Desempeñar los cargos y las comisiones que les encomienden los órganos de la asociación;

e).- Asistir puntualmente a las sesiones y Asambleas a las que sean convocados;

f).- Los asociados deberán de asistir como mínimo al 50% de las Asambleas y las sesiones de trabajo de la asociación que se realicen en el año, en caso de incumplimiento perderán su derecho a voto en las Asambleas por celebrarse dentro del primer semestre del año siguiente;

g).- Velar siempre por el prestigio y buen nombre de la asociación para afianzar su engrandecimiento y progreso, y

h).- Comprometerse a asegurar que los recursos que se destinen a la asociación sean de procedencia lícita, responsabilizándose en todo momento de cualquier omisión en la que pudiera incurrir al respecto.

CAPÍTULO TERCERO

DE LA SEPARACIÓN, EXCLUSIÓN, READMISIÓN Y LEVANTAMIENTO DE LA SUSPENSIÓN.

SEPARACIÓN

ARTÍCULO 18.- Los asociados tendrán derecho a separarse de la asociación dando aviso con tres meses de anticipación, sin embargo, no quedarán exentos del pago completo de la cuota anual correspondiente al año en que esta circunstancia deba surtir efecto, así como de cualquier otro adeudo que hubieren generado.

ARTÍCULO 19.- Todo Asociado que deje de cubrir las cuotas establecidas o que incumpla con los requisitos mencionados en los artículos 6 y 17 de estos estatutos, o se haya dictado sentencia condenatoria en materia penal, civil o mercantil incluyendo el concurso mercantil en su contra, será automáticamente suspendido en sus derechos hasta que se resuelva favorablemente la causa de la separación o hasta que se resuelva, en su favor, el juicio o se revoque la sentencia condenatoria, según sea el caso.

EXCLUSIÓN

ARTÍCULO 20.- En términos de lo dispuesto por el Reglamento de Sanciones correspondiente, los asociados podrán ser sujetos de:

I. Amonestación;

II. Suspensión,

III. Expulsión.

Lo anterior se determinará de acuerdo a la gravedad de la falta y de las circunstancias del caso, una vez que sea resuelto por el Comité de Honor y Justicia de la asociación en estricta observancia del derecho de defensa en los términos que establezca el Reglamento de Sanciones.

Serán motivo de exclusión las siguientes conductas:

a).- Observar una conducta contraria a los fines de la asociación.

b).- Observar indiferencia sistemática a los trabajos de la asociación.

c).- Faltar sistemáticamente a las sesiones y Asambleas para las que el Asociado sea citado.

d).- Dejar de pagar la cuota a cargo de los asociados.

e).- Observar conducta desleal y/o comportamientos de falta de ética hacia sus clientes, competidores u otros asociados.

f).- Incumplir deliberadamente con la responsabilidad social a la que se compromete con sus empleados y con la sociedad en general.

ARTÍCULO 21.- El Comité de Honor y Justicia será el órgano facultado para decidir sobre las responsabilidades de cualquier Asociado por incumplimiento de las obligaciones que contrae con la asociación; pero antes de resolver debe dar al Asociado la debida oportunidad para su defensa.

ARTÍCULO 22.- Una vez que el Consejo Directivo se haga sabedor del incumplimiento del Asociado, lo pondrá a consideración del Comité de Honor y Justicia, quien deberá de valorar todas las pruebas aportadas por todos o algunos de los Órganos de la asociación de la AMRACI, quienes valorarán las mismas, a efecto de que en la Asamblea que se levante al respecto, el Comité de Honor y Justicia emita su resolución, decretando la perdida de la condición de Asociado y en consecuencia ordenando su expulsión inmediata, haciéndoselos saber mediante notificación por escrito y con acuse de recibo, acompañando la resolución decretada en la Asamblea.

ARTÍCULO 23.- Cuando la resolución que dicte el Comité de Honor y Justicia en los términos del artículo anterior sea violatorio de lo dispuesto en la Ley o en estos estatutos y cause agravio al interesado, éste podrá recurrir ante la Asamblea, la cual tiene facultades para revocarla o modificarla. La resolución que emita la Asamblea será irrevocable e irrecurrible.

El recurso deberá ser presentado en el término de 15 días naturales, contados a partir del día en que conoció la resolución del Comité de Honor y Justicia y lo hará ante el Comité de Vigilancia, a reserva de presentar sus argumentos en la Asamblea si así lo considera conveniente. El Comité de Vigilancia cuidará que la impugnación se incluya en el orden del día de la siguiente Asamblea.

READMISIÓN Y LEVANTAMIENTO DE LA SUSPENSIÓN

ARTÍCULO 24.- Sobre las solicitudes que los asociados que hayan sido excluidos, que se hayan separado voluntariamente o que hayan sido suspendidos en sus derechos, hagan para ser readmitidos o para que se les levante la suspensión correspondiente, resolverá el Comité de Honor y Justicia; pero su solución será sometida a la consideración de la Asamblea. En todo caso, el levantamiento de la suspensión o la readmisión sólo podrá surtir efectos en el momento en que las personas de que se trate paguen el importe total de las cuotas que dejaron de cubrir durante todo el tiempo de la suspensión, separación o exclusión.

ARTÍCULO 25.- La calidad de asociados se pierde por cualquiera de las siguientes causas:

a).- Actividades contrarias a los intereses de la asociación o de sus miembros, y

b).- Renuncia.

CAPÍTULO CUARTO

PATROCINADORES DE LA asociación

ARTÍCULO 26.- Podrán ser patrocinadores de la asociación, personas físicas o morales, nacionales o extranjeras, dependencias y entidades de cualquiera de los tres niveles de gobierno, previa aprobación del Consejo Directivo de la asociación. Las aportaciones deben ser recursos propios, destinados al cumplimiento del objeto de la asociación. El patrocinador debe estar preferentemente vinculado con el sector de equipos y sistemas contra incendio.

Los patrocinadores podrán participar en las actividades de la asociación, que sean autorizadas por el Consejo Directivo.

ARTÍCULO 27. – El Patrocinador debe:

a).- Pagar o entregar lo que pacte con la asociación;

b).- Evitar utilizar los derechos industriales e intelectuales de la asociación sin la debida licencia jurídica,

c).- Cumplir con obligaciones de ética y combate a la corrupción.

ARTÍCULO 28.- Todo Asociado, Patrocinador o cualquier otra persona que destine recursos a la asociación, se comprometerá a asegurar que los mismos son de procedencia lícita, responsabilizándose en todo momento de cualquier omisión en la que pudiera incurrir al respecto.

CAPÍTULO QUINTO

DE LOS ÓRGANOS DE LA ASOCIACIÓN

ARTÍCULO 29.- La asociación tendrán los siguientes órganos:

I.- Asamblea General;

II.- Consejo Ejecutivo;

III.- Consejo Directivo;

IV.- Consejo Consultivo;

V.- Comités, y

VI.- Director General.

CAPÍTULO SEXTO

DE LA ASAMBLEA GENERAL

ARTÍCULO 30.- El máximo órgano de la asociación es la Asamblea General.

ARTÍCULO 31.- La Asamblea General será presidida por un presidente, quien se auxiliará de los vicepresidentes, tesorero, secretario del Consejo Directivo y del Director General de la asociación.

ARTÍCULO 32.- Las Asambleas Generales, Ordinarias y Extraordinarias se reunirán cuando lo juzgue pertinente el Consejo Directivo, el Comité de Vigilancia o los asociados en los términos de la disposición contenida en el artículo 2675 del Código Civil del Distrito Federal y territorio nacional.

1.- LAS ASAMBLEAS ORDINARIAS, se considerarán legalmente instaladas con el número de asociados que asisten a la Asamblea y sus resoluciones serán válidas con la aprobación del 50% más 1 de los asistentes a la Asamblea Ordinaria.

2.- LAS ASAMBLEAS EXTRAORDINARIAS, se consideran legalmente instaladas cuando la asistencia de los asociados en primera convocatoria sea de por lo menos el 50% mas 1 de los asociados y en segunda convocatoria con los asociados presentes y sus resoluciones serán válidas con la aprobación del 75% de los asistentes a la Asamblea Extraordinaria.

ARTÍCULO 33.- La Asamblea General se reunirá:

I.- En forma ordinaria, dos veces por año, para conocer de los asuntos que le correspondan en los términos del presente estatuto, y

II.- En forma extraordinaria, cuando la convoque cualquiera de las personas al que hace referencia el artículo 42 de los presentes estatutos para decidir sobre cualquiera de los asuntos que conozca la Asamblea Extraordinaria, en los términos de los presentes estatutos.

ARTÍCULO 34.- Las Convocatorias para las asambleas serán únicas, y se harán por correo ordinario o por cualquier medio de comunicación electrónica si el destinatario cuenta con este medio, el lugar indicado por cada uno de los asociados, o por algún periódico de circulación nacional, con anticipación que deberá de ser no menor de diez días naturales, salvo que el Consejo Directivo de la asociación, en atención al punto que fuere a tratarse, redujera dicho término. Las convocatorias podrán ser realizadas por las siguientes personas:

a).- EL presidente del Consejo Directivo;

b).- EL vicepresidente del Consejo Directivo, en suplencia del presidente;

c).- El Coordinador del Comité de Vigilancia;

d).- El tesorero;

e).- El presidente del Comité Consultivo, y

f).- El Director General.

Las convocatorias a Asambleas Generales, deberán contener:

a).- Lugar y fecha de la convocatoria;

b).- Lugar y fecha de celebración de la Asamblea;

c).- Destinatarios;

d).- Objetivo de la convocatoria,

e).- Orden del día.

ARTÍCULO 35.- La Asamblea Ordinaria se ocupará de los siguientes asuntos:

I.- Nombramiento del presidente del Consejo Directivo de la asociación, cada dos años;

II.- Nombramiento del vicepresidente del Consejo Directivo de la asociación, cada dos años;

III.- Creación e Integración de comités;

IV.- Presupuesto de ingresos y egresos;

V.- Cuotas ordinarias y extraordinarias;

VI.- Reglamentos de la asociación;

VII.- Normas de Autorregulación, y

VIII.- Cualquier otro asunto que desee tratar la Asamblea General, sin limitación alguna.

ARTÍCULO 36.- La Asamblea Extraordinaria se ocupará de los siguientes asuntos:

I.- Reformas a los estatutos de la asociación;

II.- Fusión con otra u otras asociaciones;

III.- Disolución y liquidación de la asociación,

IV.- Cualquier otro asunto que no corresponda a la Asamblea Ordinaria.

ARTÍCULO 37.- Los asociados para emitir su voto, podrán acudir a través de su representante legal a la Asamblea General o, en su caso, podrán estar representados por cualquier otra persona que designen, mediante poder simple o notariado en la que se haga constar dicho mandato. Ningún Asociado podrá representar a más de dos asociados. Cada Asociado gozará de un voto en las Asambleas Generales.

ARTÍCULO 38.- Los asociados no podrán votar en la Asamblea General o Extraordinaria cuando no estén al corriente en el pago de sus cuotas y se encuentren en proceso de ser sancionados.

ARTÍCULO 39.- Las resoluciones en la Asamblea se tomarán por la mitad más uno de los asociados presentes o representados. El presidente del Consejo Directivo de la asociación tendrá voto de calidad en caso de empate.

ARTÍCULO 40.- EL Director General llevará un libro de asociados, participantes y patrocinadores, en el cual se inscribirán el nombre con la indicación de sus cuotas pagadas al día de la celebración de la Asamblea General.

ARTÍCULO 41.- La Asamblea General Ordinaria o Extraordinaria, será dirigida por el presidente del Consejo Directivo o por el Director General de la asociación.

ARTÍCULO 42.- Se levantará un acta de la sesión de la Asamblea General Ordinaria o Extraordinaria, que deberá contener la fecha, hora y lugar de reunión, los nombres de los asistentes, el orden del día y el desarrollo del mismo. El acta será firmada por quienes hayan fungido como presidente y secretario de la asamblea.

CAPÍTULO SÉPTIMO

CONSEJO EJECUTIVO

ARTÍCULO 43.- EL Consejo Ejecutivo estará integrado por un presidente, en su caso, vicepresidente, un secretario, un tesorero, el Comité de Vigilancia y el Director General de la asociación.

ARTÍCULO 44.- EL Consejo Ejecutivo tendrá las siguientes facultades:

a).- Dar seguimiento administrativo a las tareas de la asociación;

b).- Reunirse a convocatoria del presidente o Director General;

c).- Asegurar que los recursos aportados a la asociación. se destinen para los fines objeto de la aportación.

d).- Resolver los asuntos urgentes y pedir al Consejo Directivo la ratificación de sus actuaciones, en la junta siguiente.

CAPÍTULO OCTAVO

CONSEJO DIRECTIVO

ARTÍCULO 45.- EL Consejo Directivo estará integrado por un presidente, en su caso, un vicepresidente, un secretario, un tesorero, los coordinadores de los comités y el Director General.

ARTÍCULO 46.- EL Consejo Directivo se reunirá por una vez al mes en la fecha, hora y lugar que determine la convocatoria.

ARTÍCULO 47.- EL Consejo Directivo podrá ser convocado por cualquiera de sus integrantes y sus resoluciones serán válidas con la aprobación de la mayoría de los integrantes del Consejo Directivo.

ARTÍCULO 48.- De cada sesión de Consejo Directivo se dejará constancia de los temas y miembros de dicho Consejo que hayan asistido a la sesión en la que se hará constar los asuntos que tramitaron y el desarrollo de los mismos.

ARTÍCULO 49.- EL Consejo Directivo podrá representar a la asociación ante toda clase de personas físicas, morales y autoridades. EL Consejo Directivo podrá delegar en alguno de sus miembros sus facultades y atribuciones, en forma total o parcial.

CAPÍTULO NOVENO

DEL CONSEJO CONSULTIVO

ARTÍCULO 50.- El Consejo Consultivo estará integrado por las personas físicas que habiendo sido presidentes del Consejo Directivo de la asociación no ejerzan el puesto del presidente del Consejo Directivo en funciones, y sesionarán como mínimo en forma semestral. Tendrán las siguientes facultades y atribuciones:

En atención a lo enunciado en el párrafo anterior, el Consejo Consultivo permanecerá como órgano de consejo y asesoría para la asociación sin que nada pueda determinar su disolución, con excepción hecha de lo que acuerde la Asamblea de asociados sobre este particular.

Si algún expresidente, miembro del Consejo Consultivo llegara en virtud de lo que al respecto mencionan estos estatutos, a convertirse nuevamente en el presidente del Consejo Directivo de la asociación automáticamente dejará de ser miembro del Consejo Consultivo al cual se reintegrará toda vez que haya concluido su mandato.

CAPÍTULO DÉCIMO

DE LOS COMITÉS

ARTÍCULO 51.- La asociación siempre contará con los siguientes comités, independientemente de la creación de nuevos comités con funciones diversas:

I.- Comité de Vigilancia;

II.- Comité de Honor y Justicia;

III.- Comité de Admisiones;

IV.- Comité Técnico.

Aunado a los anteriores Comités, y con el fin de promover e impulsar el desarrollo y cumplimiento del objeto social de la asociación, la Asamblea General, por si, o a propuesta que haga alguno de los asociados, podrá determinar la creación de comités, mismos que deberán integrarse por miembros de la asociación y estarán conformados por un Coordinador, un Sub-coordinador y las personas que estos designen para el desempeño de su encargo.

Los comités podrán tener representantes en algún otro comité y coordinarse con este, cuando sea necesario por la importancia del asunto a tratar; asimismo, podrán celebrarse reuniones conjuntas que involucren a dos o más comités. El número de integrantes y sus funciones se determinará específicamente para cada comité.

ARTÍCULO 52.- Los miembros de los comités durarán dos años en su cargo y podrán ser reelectos por un periodo más en el cargo conferido, previa postulación del presidente del Consejo Directivo de la asociación y aprobación de la Asamblea General, sin que esto sea un obstáculo para que al término de su gestión puedan ocupar otro cargo dentro de la asociación.

Los comités se reunirán mínimo 2 veces del año.

Los integrantes de los comités que tengan un cargo honorifico no recibirán remuneración alguna por el desempeño de su encargo.

ARTÍCULO 53.- Cada comité tendrá un coordinador, el cual será el responsable de:

a) Llevar cabo las convocatorias de las reuniones del comité bajo su coordinación;

b) Llevar control de asistencias;

c) Levantar minutas de las reuniones celebradas;

d) Participar en las sesiones del Consejo Directivo;

e) Dar cumplimiento al mandato que la asamblea le señale al Comité,

f) Hacer cumplir a los integrantes del Comité bajo su coordinación, con el mandato que la asamblea le señaló.

ARTÍCULO 54.- Los comités estarán integrados por mínimo 5 asociados mismos que propondrá el coordinador de cada Comité y se presentarán a la Asamblea General para su aprobación, en caso de empate de las decisiones que deban de tomarse al interior del mismo, el presidente del Consejo Directivo de la Asociación tendrá voto de calidad.

ARTÍCULO 55.- Los comités se consideran legalmente constituidos cuando estén presentes el 50% más 1 de sus integrantes, debiendo tomarse sus decisiones por la votación de la mayoría de los asociados que constituyan legamente el quorum del Comité.

ARTÍCULO 56.- Son facultades y obligaciones del Comité de Vigilancia:

I.- Vigilar, inspeccionar y opinar sobre el manejo de efectivo, valores, cuotas, créditos, utilidades, intereses, rendimientos, concesiones, así como sobre los ingresos ordinarios y extraordinarios de la asociación;

II.- Vigilar el ejercicio del presupuesto anual de ingresos y egresos de la asociación;

III.- Vigilar y supervisar, directamente la cuenta anual y el balance general del mismo que se someterán, a la aprobación de la Asamblea General;

IV.- Inspeccionar y vigilar la contabilidad y el inventario general de la asociación;

V.- Realizar por si a solicitud de la Asamblea General, auditorias y evaluaciones en cualquier tiempo que se requiera;

VI.- Comprobar la correcta aplicación del presupuesto;

VII.- Vetar, por causa grave, alguna decisión financiera del tesorero y someterla a la decisión de la Asamblea General;

VIII.- Presentar ante el Consejo Directivo y en su caso ante la Asamblea General, el informe semestral sobre sus actividades y resultados;

IX.- Denunciar ante el Consejo Directivo cualquier acto u omisión que represente un posible daño al patrimonio de la asociación;

X.- Registrar la integración de los comités vigilando el cabal cumplimiento de sus funciones, y

XI.- Las demás que establezcan el estatuto, Reglamento y los que determine la Asamblea General.

El Comité de Vigilancia deberá reunirse mínimo 2 dos veces por año previo a la reunión de la Asamblea General con la finalidad de conocer y preparar los informes para presentarlos a la reunión anual de la Asamblea General.

ARTÍCULO 57.- Son facultades y obligaciones del Comité de Honor y Justicia:

Desarrollar procedimientos incluyentes, plurales y con equidad para el proceder de la asociación y sus asociados, dictaminar en caso de controversia, las sanciones que por faltas a los estatutos, reglamentos y código de ética infrinja algún asociado, apoyar a los comités de admisiones y vigilancia.

ARTÍCULO 58.- Son facultades y obligaciones del Comité de Admisiones:

Verificar la información, documentación y todos aquellos elementos necesarios, para admitir o rechazar definitivamente a los asociados, participantes y patrocinadores en términos de los estatutos y reglamentos de la asociación.

ARTÍCULO 59.- Son facultades y obligaciones del Comité Técnico:

Determinar sobre la calidad técnica de los estudios, investigación, trabajos, publicaciones, diseño y capacitación de nuevas tecnologías que se realicen en la asociación para la implementación de los rociadores automáticos contra incendios y aquellas obligaciones establecidas en el reglamento del comité.

CAPÍTULO DÉCIMO PRIMERO

INTEGRACIÓN DEL CONSEJO DIRECTIVO

ARTÍCULO 60.- La asociación será administrada por el Consejo Directivo integrado por un presidente, un vicepresidente, un tesorero, un secretario, un Director General y los coordinadores de comités que proponga el Consejo Directivo y apruebe la Asamblea.

ARTÍCULO 61.- EL Consejo Directivo, deberá estar integrado por asociados o por sus representantes, debiendo estos ostentar un cargo de alta dirección en la Empresa o Negocio que van a representar dentro

de la asociación y que, por lo tanto; estén investidos del más amplio poder que en derecho exista para actuar, comprometer a su representada y tomar decisiones dentro de la asociación.

ARTÍCULO 62.- El Consejo Directivo de la asociación se integrará con observación de las siguientes reglas:

a).- Deberán estar integrado por asociados;

b).- Tratándose de personas físicas con actividad empresarial a través de él mismo, tratándose de personas morales a través del presidente del consejo de administración, administrador único o Director General, estos cargos deberán de ejercerse de forma personal y no a través de representante alguno.

c).- Los miembros del Consejo Directivo durarán en su cargo dos años, pero continuarán en el desempeño del mismo hasta que sus sucesores hubieren sido designados y hubieren tomado posesión de sus puestos. En el caso de no haberse designado sucesores o que éstos no hubieren tomado posesión de sus puestos, el Consejo Consultivo, tomará las medidas necesarias que considere pertinentes para la regularización de esta situación;

d).- Los miembros del Consejo Directivo podrán ser reelectos, por un periodo igual al ejercido.

ARTÍCULO 63.- Para ser presidente del Consejo Directivo de la asociación se requiere:

a).- Ser asociado fabricante, distribuidor, diseñador, instalador.

b).- Tratándose de persona física con actividad empresarial a través de él mismo, tratándose de personas morales a través del presidente del consejo de administración, administrador único o director general, estos cargos deberán de ejercerse de forma personal y no a través de representante alguno.

c).- Ser reconocida su solvencia moral y económica.

d).- Conocer los problemas de la asociación y comprometerse a dedicar tiempo de calidad en resolverlos.

e).- Contar con un mínimo de 3 años de pertenecer como asociado activo de la asociación.

ARTÍCULO 64.- La protesta de los miembros del Consejo Directivo se tomará en la asamblea que les haya designado, los que no estén presentes en tal momento, tendrán la protesta en la primera junta del Consejo Directivo a que asistan.

DE LOS PODERES

ARTÍCULO 65.- El presidente, vicepresidente y tesorero del Consejo Directivo de la asociación, tendrán todas las facultades que las leyes otorgan a los de su clase, salvo las limitaciones que más adelante se mencionan, por lo que podrán llevar a cabo todos los actos que no estén reservados por la ley o por estos estatutos a la Asamblea, que sean necesarios o convenientes a su juicio, para la cabal realización de los fines sociales. Gozarán además, de las facultades de un apoderado general para pleitos y cobranzas y para ejecutar actos de administración y representaciones ante particulares, autoridades judiciales y administrativas, civiles, penales y del trabajo, federales o locales, en juicio y fuera de él, con la generalidad que expresan los dos primeros párrafos del artículo 2554 del Código Civil y aún las especiales que requieran mención expresa en los términos del artículo 2587 del Código Civil, así como para promover el juicio de amparo en los términos del artículo 4° de la Ley de Amparo y desistir del referido juicio; así también para presentar denuncias y querellas penales y desistirse de las mismas y para constituirse en coadyuvante del Ministerio Público. Podrán intervenir en la creación, endoso, aval, protesto y pago de toda clase de títulos de crédito, en los términos del artículo 9° de la Ley General de Títulos y Operaciones de Crédito; también podrán sustituirse estas facultades que estimen convenientes, revocar unos y otras y otorgar nuevos, en los términos del artículo 2574 del Código Civil; sin embargo, para ejecutar actos de dominio y para constituir garantías prendarias o hipotecarias y para celebrar contratos de arrendamientos por periodos mayores de un año, se requerirá la aprobación expresa y previa de la Asamblea.

ARTÍCULO 66.- Son funciones del Consejo Directivo las que, en forma enunciativa más no limitativa, se mencionan a continuación:

a).- Representar a la asociación en todos los negocios y actos inherentes a sus actividades y objeto social;

b).- Convocar a Asamblea;

c).- Hacer efectivas las resoluciones tomadas en la Asamblea y en sus propias sesiones;

d).- Informar a la Asamblea sobre la situación y actividades de la asociación y rendirle informes de su propia situación;

e).- Autorizar los gastos ordinarios y extraordinarios de la asociación con base en los presupuestos aprobados por la Asamblea;

f).- Resolver, en principio, en los términos de estos estatutos, sobre la admisión de los asociados;

g).- Conferir comisiones, nombrar comités y delegar facultades;

h).- Promover dinámica y eficazmente la membresía de la asociación, cuidando de su buen prestigio a través de una representación digna y responsable;

i).- Aprobar partidas extraordinarias que consideren necesarias y que no estén previstas en el presupuesto aprobado por la Asamblea, partidas que quedarán sujetas a la justificación ante la Asamblea;

j).- Convocar por cualquiera de sus integrantes, y

k).- Emitir resoluciones mismas que serán válidas con la aprobación de la mayoría de los integrantes del Consejo Directivo.

ARTÍCULO 67.- El presidente del Consejo Directivo de la asociación lo será también del Consejo Directivo y del Consejo Ejecutivo y tendrá las siguientes atribuciones y obligaciones:

a).- Convocar y presidir las Asambleas, las sesiones del Consejo Directivo y las juntas del Consejo Ejecutivo;

b).- Dirigir las actividades de la asociación, procurar su desarrollo y progreso y velar por su prestigio e integridad;

c).- Rendir a la Asamblea un informe anual de su actuación, y

d).- Firmar, en compañía del secretario, las actas de las Asambleas, de las sesiones del Consejo Directivo y de las juntas del Consejo Ejecutivo.

CAPÍTULO DÉCIMO SEGUNDO

EL PRESIDENTE DEL CONSEJO DIRECTIVO

ARTÍCULO 68.- EL presidente del Consejo Directivo de la asociación será electo cada dos años por los miembros de la Asamblea General y su cargo será honorifico, por lo cual no recibirá remuneración alguna y podrá ser reelecto por única vez por un periodo igual.

ARTÍCULO 69.- El presidente nombrará y podrá remover de sus cargos al vicepresidente, tesorero, secretario y coordinadores de comités o grupos de trabajo y dichos nombramientos o destituciones serán aprobados por la Asamblea.

ARTÍCULO 70.- Serán funciones del presidente del Consejo Directivo de la asociación:

I. Representar a la asociación ante todos los niveles de gobierno y empresas públicas y privadas para lograr los fines de la asociación;

II. Mantener siempre en alto en nombre de la asociación, de su Asamblea General y sus comités que lo conforman;

III. Convocar a las reuniones de la Asamblea General;

IV. Presidir la Asamblea General;

V. Firmar con el secretario, las actas de las Asambleas y de las sesiones de la Asamblea General, la correspondencia y todo documento emanado de la asociación;

VI. Firmar los documentos y títulos de crédito que se requieran en forma mancomunada con el tesorero;

VII. Velar por la buena marcha y administración de la asociación, observando y haciendo observar el estatuto y resoluciones de las Asambleas y del Consejo Directivo, y

VIII. Dirigir las discusiones, suspender y levantar las sesiones de la Asamblea General, cuando se altere el orden o falte el debido respeto; y las demás que le confiera el presente estatuto y los reglamentos.

ARTÍCULO 71.- La Asamblea General podrá remover al presidente de su encargo, para lo cual se requiere el voto en ese sentido de por lo menos dos terceras partes de la totalidad de los asociados presentes en dicha Asamblea.

CAPÍTULO DÉCIMO TERCERO

EL VICEPRESIDENTE DEL CONSEJO DIRECTIVO

ARTÍCULO 72.- Serán funciones del vicepresidente del Consejo Directivo de la asociación:

I. Suplir y representar en ausencia del presidente del Consejo Directivo de la asociación ante todos los niveles de gobierno y empresas privadas para lograr los fines de la asociación;

II. Mantener siempre en alto en nombre de la asociación, de su Asamblea General y sus comités que lo conforman;

III. Convocar en ausencia del presidente del Consejo Directivo a las reuniones de la Asamblea General;

IV. Presidir la Asamblea General;

V. Firmar junto con el secretario, las actas de las Asambleas y de las sesiones del Consejo Directivo, la correspondencia y todo documento emanado de la asociación, lo anterior en ausencia del presidente;

VI. Velar por la buena marcha y administración de la asociación, observando y haciendo observar el estatuto y resoluciones de las Asambleas y del Consejo Directivo;

VII. Dirigir las discusiones, suspender y levantar las sesiones de la Asamblea General, cuando se altere el orden o falte el debido respeto; y las demás que le confiera el presente estatuto y los reglamentos;

VIII.- Realizar todas aquellas actividades que el presidente le encomiende.

CAPÍTULO DÉCIMO CUARTO

EL SECRETARIO DEL CONSEJO DIRECTIVO

ARTÍCULO 73.- El secretario del Consejo tendrá las atribuciones y obligaciones siguientes:

a).- Establecer controlar y vigilar los sistemas de información, tanto internos como externos, de la asociación;

b).- Recabar la información que le sea solicitada por el presidente del Consejo Directivo para el desahogo de los diversos asuntos que estén a su cargo, y

c).- Llevar las actas de las Asambleas y de las Sesiones de Consejo Directivo, y firmarlas en compañía del presidente.

CAPÍTULO DÉCIMO QUINTO

DEL TESORERO DEL CONSEJO DIRECTIVO

ARTÍCULO 74.- Corresponde al tesorero:

I.- Llevar a cabo el control y vigilancia de los recursos económicos y materiales, temas fiscales de la asociación;

II.- Contar con poderes de administración y pleitos y cobranzas;

III.- Planificar y controlar el desarrollo financiero de la asociación;

IV.- Elaborar el Presupuesto anual de ingresos y egresos de cada ejercicio social que le corresponda;

V.- Controlar la ejecución y correcta aplicación de los presupuestos;

VI.- Informar, mediante la presentación de estados financieros mensuales, al Consejo Directivo;

VII.- Rendir un informe anual de las finanzas de la asociación a la Asamblea General;

VIII.- Manejar los fondos de la asociación de acuerdo con las autorizaciones de la Asamblea y del Consejo Directivo;

IX.- Para el caso de adjudicaciones, adquisiciones o enajenaciones de bienes inmuebles de la asociación se requerirá forzosamente la firma y autorización mancomunada del presidente, vicepresidente y tesorero del Consejo Directivo;

X.- Solicitar al Comité de Vigilancia que se practique, por lo menos una auditoria cada ejercicio social,

XI.- Controlar y vigilar los sistemas de cobranza.

ARTÍCULO 75.- Considerar y comunicar que los ejercicios sociales correrán del 1° (primero) de enero al 31 (treinta y uno) de diciembre de cada año.

CAPÍTULO DÉCIMO SEXTO

DEL DIRECTOR GENERAL

ARTÍCULO 76.- La dirección de la asociación estará a cargo de un Director General.

ARTÍCULO 77.- Corresponde al Director General:

I. Preparar el informe anual de actividades de la asociación;

II. Ejecutar los acuerdos de la Asamblea General;

III. Vigilar que el archivo, libros y documentos de la asociación se lleven en debido orden y firmar la correspondencia que despache aquella;

IV. Coordinar, previo acuerdo con el presidente del Consejo Directivo de la asociación, las labores de la misma;

V. Representar a la asociación dentro de sus facultades;

VI. Mantener siempre en alto el nombre de la asociación, de su Asamblea General y sus comités que lo conforman;

VII. Realizar las erogaciones que hayan sido autorizadas en el presupuesto de egresos de la Asamblea General;

VIII. Contratar al personal administrativo que laborará en la asociación, de acuerdo con el presupuesto de egresos aprobado por la Asamblea General;

IX. Proponer proyectos al presidente y la Asamblea General de acuerdo al fin de la asociación, y las demás que deriven del presente estatuto, reglamentos o de otras disposiciones jurídicas aplicables.

ARTÍCULO 78.- Por acuerdo del presidente del Consejo Directivo de la asociación, tesorero y coordinadores de los comités de honor y justicia y de vigilancia, se podrá remover al Director General, en los términos de la Ley Federal del Trabajo.

ARTÍCULO 79.- En caso de renuncia del Director General, el presidente del Consejo Directivo de la asociación nombrará a un encargado de la dirección general que se hará cargo de los asuntos administrativos hasta en tanto se reúna la Asamblea General, para elegir a un nuevo Director General.

ARTÍCULO 80.- EL Director General gozará de los siguientes poderes y facultades, los cuales podrán ser limitados por la Asamblea General de asociados:

a).- Poder general para pleitos y cobranzas, incluyendo en materia laboral, con facultades específicas para comparecer ante cualquier autoridad en materia laboral, de trabajo o juntas federales o locales de conciliación y arbitraje, y

b).- Poder actos de administración en forma enunciativa más no limitativas.

ARTÍCULO 81.- El Consejo Directivo determinará la retribución económica que recibirá el Director General, por el desempeño de su encargo.

ARTÍCULO 82.- Limitaciones.

a) El Director General no podrá ser, en caso alguno, ni asociado, ni persona conectada por su actividad o su profesión con las actividades de los asociados.

b) No podrá suscribir en forma personal títulos de crédito a nombre de la asociación, sino mancomunadamente con el presidente o el tesorero del Consejo Directivo de la asociación.

c) El Director General no podrá ser familiar de algún Asociado sin limitación de grado de parentesco.

d) No podrá intervenir en las actividades del Comité Electoral ni ejercer ninguna influencia dentro del proceso electoral.

CAPÍTULO DÉCIMO SÉPTIMO

PATRIMONIO DE LA ASOCIACIÓN Y CUOTAS ORDINARIAS Y EXTRAORDINARIAS

ARTÍCULO 83. Constituye el patrimonio de la asociación:

I.- Los ingresos de cualquier especie, provenientes de los asociados, participantes y patrocinadores y cualquier otro entre público o privado;

II.- Los donativos o subsidios que perciba de sus asociados o de terceros. Tratándose de estos últimos, los donantes podrán ser personas físicas o morales, nacionales o extranjeras, entidades económicas reconocidas por el Derecho con o sin personalidad jurídica, entidades e instituciones de carácter privado o público;

III.- Los apoyos y estímulos públicos que reciba la asociación en termino de los dispuestos por la Ley Federal de Fomento a las Actividades Realizadas por Organizaciones de la Sociedad Civil;

IV.- Cualquier otro bien o derechos que por cualquiera título adquiera;

V.- Los ingresos, apoyos estímulos públicos, que se obtengan se aplicaran en forma exclusiva a realizar el objeto de la asociación; por lo que esta no distribuirá entre sus asociados remanentes de los apoyos y estímulos públicos, que previamente fueren aprobados por la Asamblea General, y

VI.- Los bienes muebles e inmuebles que pertenezcan a la asociación o los que sean adquiridos con posterioridad a la constitución de los presentes estatutos.

ARTÍCULO 84.- Para cubrir los gastos de la asociación, la asamblea podrá seleccionar mecanismos de financiamiento:

ARTÍCULO 85.- El presidente y tesorero del Consejo Directivo de la asociación propondrán las cuotas que deben cubrir los asociados y patrocinadores de la asociación, mismas que deberán ser aceptadas por la asamblea.

ARTÍCULO 86.- Para la realización de eventos especiales, la asociación podrá recurrir al apoyo económico y material de los patrocinadores de la asociación e inclusive de otras instituciones que no lo sean.

ARTÍCULO 87.- En caso del incumplimiento de las aportaciones de las cuotas ordinarias y extraordinarias que establecen los presentes estatutos, se fijará un interés del 9% nueve por ciento anual, hasta en tanto no se liquide lo adeudada a la asociación.

CAPÍTULO DÉCIMO OCTAVO

COMITÉ ELECTORAL

ARTÍCULO 88.- La Asamblea General designará un Comité Electoral que estará constituido por un presidente y secretario y dos escrutadores quienes deberá ser asociados de la asociación.

El Comité Electoral tendrá las funciones y obligaciones siguientes:

a).- Organizar el Proceso Electoral para la renovación de los órganos administrativos de la asociación;

b).- Formular un padrón electoral con los asociados con derecho a voto para efectos del control del proceso electoral y mantener actualizado dicho padrón, mismo que estará disponible para aquellos que aspiren a participar en los procesos electorales de la asociación;

c).- Emitir la convocatoria de registro de planillas con el apoyo del personal administrativo de la Asociación con un mínimo de 60 días naturales previo a la asamblea de elecciones;

d).- Vigilar que las elecciones se verifiquen con estricto apego al Reglamento Electoral que se incluye dentro de éstos mismos estatutos;

e).- Circular entre los Asociados en los medios electrónicos disponibles en la Asociación con 20 días naturales de anticipación a la fecha de las elecciones, las listas de candidatos que reúnen los requisitos para los distintos puestos electivos,

f).- Verificar que los candidatos a puestos electivos, reúnan los requisitos estipulados en los presentes estatutos así como también verificar que dichos candidatos no estén dentro de lo previsto en el Artículo 25.

CAPÍTULO DÉCIMO NOVENO

PROCEDIMIENTO ELECTORAL

ARTÍCULO 89.- Cualquier Asociado, o su representante podrá registrar la plantilla en la que figuren los candidatos a los distintos puestos electivos en el plazo estipulado en la convocatoria respectiva. El registro deberá hacerse en el domicilio social de la Asociación.

ARTÍCULO 90.- Los candidatos deberán reunir los siguientes requisitos:

a).- Todos los asociados aspirantes a integrar una planilla de elección de Consejo Directivo deberán estar al corriente en el pago de cuotas a la asociación;

b).- Presentar la siguiente documentación, copia simple de identificación oficial, curriculum vite y copia de representación legal de la empresa;

c).- El Asociado aspirante a un puesto de elección dentro del Consejo Directivo deberá de cumplir con los requisitos y obligaciones que establecen los presentes estatutos;

d).- Las planillas deberán de integrar a aspirantes a ocupar los cargos de presidente, vicepresidente, secretario, tesorero, y coordinadores de comités, y

e).- El registro de los candidatos o planillas deberán de realizarse durante los 20 días naturales posteriores a la convocatoria de registro de planillas en los formatos que establezca el Comité Electoral y una vez acreditados se entregará un padrón electoral de los asociados con derecho a voto.

ARTÍCULO 91.- El Comité Electoral verificará que los candidatos nombrados en cada planilla hayan cumplido con los requisitos y procederá a convocar a asamblea de elecciones.

a).- Se enviarán a los asociados por los medios electrónicos empleados por la asociación para su difusión la cédula de cada planilla con los candidatos propuestos para cada cargo para su conocimiento y evaluación.

b).- El Comité Electoral cuidará que toda la papelería que se utilice durante el proceso electoral garantice en forma satisfactoria el secreto de la votación.

Quienes no puedan concurrir personalmente a efectuar la entrega de su voto en la Asamblea, lo harán mediante mandatario que se designará por escrito, y debidamente requisitado, cumpliendo con las disposiciones del artículo 45 de estos estatutos.

c).- Dentro del recinto y antes de que se inicie la Asamblea, cualquier asociado que esté registrado en el padrón electoral podrá pedir un juego de cédulas de votación para emitir su voto y éstas le serán entregadas por el Comité Electoral, y se depositará en la urna dispuesta para tal fin.

ARTÍCULO 92.- Al hacer el cómputo de los votos, se seguirá el siguiente procedimiento:

a).- Los escrutadores designados del Comité Electoral abrirán la urna y contabilizaran los votos, mismos que registrará en acta el secretario.

b).- La planilla que obtenga mayor número de votos resultará electa.

c).- El proceso concluirá con la declaración y entrega de la constancia de mayoría triunfadora por parte del Comité Electoral.

d).- Los funcionarios electos tomarán posesión en la última Asamblea Ordinaria del año de la elección.

ARTÍCULO 93.- El Comité Electoral decidirá sobre cualquier asunto que se presente en el proceso electoral y su decisión será inapelable. En caso de empate el que presida el Comité Electoral, tendrá voto de calidad.

CAPÍTULO VIGÉSIMO

DISOLUCIÓN Y LIQUIDACIÓN

ARTÍCULO 94.- La presente asociación se disolverá y liquidará por acuerdo de la Asamblea General o por las causas previstas en el artículo 2685 (dos mil seiscientos ochenta y cinco) del Código Civil para la Ciudad de México que a su letra dice:

"Artículo 2685. Las asociaciones, además de las causas previstas en los estatutos, se extinguen:

I.- Por consentimiento de la asamblea general;

II.- Por haber concluido el término fijado para su duración o por haber conseguido totalmente el objeto de su fundación;

III.- Por haberse vuelto incapaces de realizar el fin para que fueron fundadas;

IV.- Por resolución dictada por autoridad competente."

En caso de disolución la asociación transmitirá los bienes que haya adquirido con apoyos y estímulos públicos a otras u otras organizaciones. La asociación tendrá la facultad de elegir a quien transmitirá dichos bienes, pudiendo en todo momento transmitir sus bienes y donaciones autorizadas en términos de la legislación fiscal.

ARTÍCULO 95.- La liquidación se practicará de acuerdo con las bases siguientes:

a).- Se continuará las operaciones pendientes de la manera más conveniente a la asociación cobrando los créditos y pagando las deudas;

b).- Se formularán el estado financiero de liquidación, el cual deberá ser aprobado por la asamblea, y

c).- Se aplicarán las aportaciones y remanentes a una asociación de objeto similar que determine la asamblea.

CAPÍTULO VIGÉSIMO PRIMERO

REFORMA E INTERPRETACIÓN DE LOS ESTATUTOS

ARTÍCULO 96.- El Consejo Directivo queda facultado para interpretar los presentes estatutos, salvo materia electoral, que corresponderá al Comité Electoral. La Asamblea citada para el efecto, podrá revocar la interpretación del Consejo Directivo a solicitud de 30 asociados cuando menos.

ARTÍCULO 97.- Los asociados podrán solicitar reformas a los estatutos de la asociación en cualquier tiempo, para lo cual se requerirá:

a).- Solicitud por escrito remitida al Comité de Vigilancia y firmada por un mínimo de 30 asociados con su membresía vigente;

b).- EL Comité de Vigilancia enviará la solicitud al Consejo Consultivo quién, en reunión con el presidente del Consejo Directivo de la asociación, estudiará la propuesta de los asociados y decidirá la procedencia de efectuar las modificaciones y reformas solicitudes, y

c).- El Consejo Consultivo solicitará a los asociados la redacción de las modificación es para su presentación a la Asamblea en el momento que se reúna.

TRANSITORIOS

Único. Los presentes estatutos entrarán en vigor el día 30 de Mayo de 2018."

PUNTO DOS.- En desahogo del **segundo** y último punto del Orden del Día la Asamblea adoptó la siguiente:

RESOLUCIÓN

ÚNICA.- Se designa al señor Víctor Daniel Espínola Llaguno como delegado especial de la Asamblea, para que lleven a cabo todos los actos que sean necesarios o convenientes para la ejecución de las resoluciones adoptadas en esta Asamblea, expida las copias que en su caso se requieran de esta acta, acuda ante el notario de su preferencia para su protocolización, en caso que se requiera, y para que realice cualesquiera actos y gestiones necesarias para que las resoluciones de esta asamblea quede debidamente ejecutadas.

No habiendo otro asunto que tratar, se dio por terminada la Asamblea a las 11:00 horas del día de su celebración, levantándose para constancia la presente acta que fue leída, aprobada y firmada por el presidente y la secretario y Escrutador de conformidad con lo dispuesto por los estatutos sociales; así como por los asociados que desearon hacerlo.

FAUSTO LÓPEZ GIL

GABRIEL CONTRERAS ÁLVAREZ

CIRO VALENZUELA PLATA

A.5 – Sample plans and operating instructions for fire sprinkler demonstration unit from ANRACI Colombia

EL PODER DEL FUEGO

PRUEBA SIDE BY SIDE EN COLOMBIA.

Uno de los propósitos de ANRACI COLOMBIA obedece al trabajo constante en erradicar las malas prácticas en cuanto al tema de prevención de incendios y generar una cultura de la prevención en la sociedad colombiana y latinoamericana.

Soportados en nuestro propósito hemos construido dos simuladores en los cuales utilizando muebles, sillas, textiles y demás combustibles normales encontrados en una casa u oficina se generaran dos incendios de idénticas características, uno de los recintos estará dotado con un rociador contra incendios residencial de respuesta rápida el que y controla efectivamente el fuego y los peligros derivados de un incendio; en el otro se demostrara la capacidad del fuego para ocasionar un incendio que puede derivar no solo en la destrucción de todo lo que allí se encuentre, sino también puede llegar a lesiones graves e incluso la muerte.

El enfoque que ANRACI COLOMBIA, da a esta demostración no se constituye en un evento de entretenimiento, por el contrario, lo que busca es educar y generar una cultura de la prevención con base en la recreación de una escena de incendio real.

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“SIDE BY SIDE CON ROCIADORES AUTOMÁTICOS CONTRA INCENDIO”

El Syde by Syde con rociadores automáticos contra incendios, es una prueba que se realiza con fuego vivo en la que mediante la utilización de combustibles sólidos comunes como lo son cada uno de los muebles y enseres que encontramos en las viviendas, oficinas, instituciones educativas, sitios religiosos o de esparcimiento se recrea un incendio que permite observar a los participantes las consecuencias devastadoras del fuego durante un incendio tanto para los bienes como para la salud y la vida. Este tipo de pruebas las realiza ANRACI en búsqueda de generar educación en la prevención y seguridad contra incendios y crear conciencia de las consecuencias devastadoras del fuego; de igual forma la prueba demuestra la eficiencia y eficacia para limitar y controlar un fuego o incendio con rociadores contra incendio de respuesta rápida

GUIA PARA LA REALIZACION DEL EJERCICIO

NECESIDADES DE PERSONAL

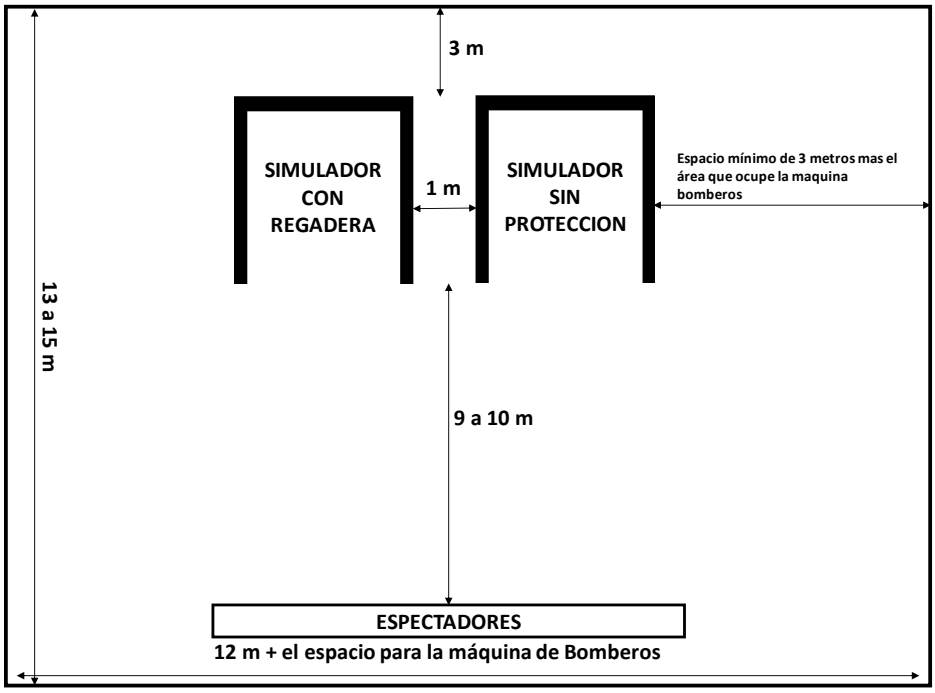
1. Un (1) coordinador general
2. Un (1) encargado de las finanzas
3. Un (1) Presentador - engargado de explicar y describir los hechos que suceden durante el ejercicio
4. Un (1) operativo o encargado del ejercicio – ubicación de los simuladores, supervisa el ensamble de los simuladores, distribución de los muebles en el espacio del simulador, determina el punto o zona de ignición de los incendios, verifica el abastecimiento de agua tanto para el rociador automatrico contra incendios como de la linea de extición.
5. Un (1) encargado de la seguridad (será la persona que estará atenti a que todas las actividades que se realicen en las diferentes fases del ejercicio se realicen con los estandares de seguridad.
6. Un (1) enlace de prensa será la persona encargada y autorizada por ANRACI para dar declaraciones a los medios de prensa tanto hablados como escritos
7. Un (1) bombero maquinista – operador de la bomba
8. Dos (2) bomberos encargados del proceso de igniciín del incendios y luego de la linea de agua de emergencia y del proceso de extinción, la cual debe estar cargada y presurizada durante toda la prueba
9. Personal de logística que apoye los procesos de seguridad.

COORDINACIONES PREVIAS

1. Adelante una reunión con los propietarios o administradores del sitio donde se realizará el ejercicio y con los encargados de la seguridad contra incendios para explicarles de que se trata el ejercicio, como se realizará la prueba y conocer las reglas de seguridad que ellos tienen.
2. Autoridades locales: verifique si para la realización de este tipo de pruebas se requiere un permiso de las autoridades locales (Alcaldía)
3. Cuerpo de Bomberos: Informe y coordine con el Cuerpo de Bomberos los siguientes aspectos:
   - Normas de seguridad que los Bomberos locales tengan previstas.
   - Apoyo con una máquina o camión de bomberos (vehículo de extinción de incendios).
   - Apoyo proceso de ignición de los simuladores
   - Apoyo proceso de extinción del incendio del simulador sin regadera.
4. Convoque los medios de información(prensa).

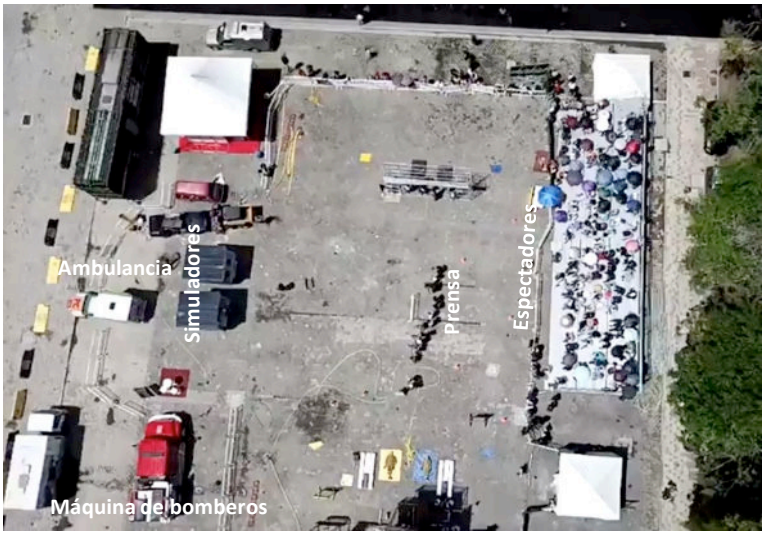
DISTRIBUCION SUGERIDA DE LOS SIMULADORES

Distancias mínimas sugeridas para la ubicación de los simuladores



SEGURIDAD

1. Exija que todo el personal porte sus elelemtos de protección personal y esten cubiertos por Administrador de Riesgos Laborales y servicio de prestación de salud.
2. Realice una inspección al sitios donde se adelantara la demostración para verificar las condiciones de espacio, necesidades, acceso y seguridad.
3. Verifique en el sitio donde se realizará la demostración los siguientes aspectos:
   - Espacio ubicación simuladores: que cuente con el área suficiente que garantice para la realización de la prueba
   - Ubiación espectadores: Se cuenta con espacio para los asistentes o publico garantizandoles la seguridad
4. Analice los siguientes aspectos de seguridad:
   - Tendidos Electricos: Se debe verificar que en el sitio donde se realizará la prueba no hay tendidos electricos cercanos o sobre el lugar donde se ubicaran los simuladores.
   - No hayan almacenamientos de gases o liquidos inflamables o combustibles
   - Que otras exposiciones esten a las distancias minimas para evitar riesgos

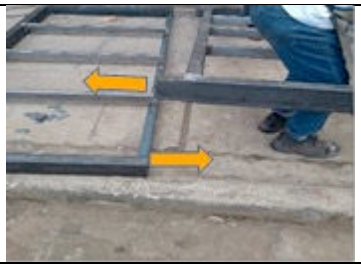


5. Que el área del lugar sea lo suficentemente amplia de moto tal que permita evitar riesgos derivado del ejercicio.
6. Ubique un sitio con piso nivelado o que permita la nivelación de los simuladores.
7. Coordine con la administración del sitio donde se realizará el ejercicio y acuerden las normas de seguridad de cada una de las partes.
8. Coordine con los medios locales el acompañamiento de una ambulancia; de no ser posible contar con este vehículo siempre tenga a la mano un botiquin de primeros auxilios o un encargado de brindar la atención prehospitalaria en caso de ser necesario.
9. Verifique las condicines atmosfericas
   - Dirección del viento.
   - Tormentas electricas.

10. Verifique el centro de atención hospitalaria mas cercano y en lo posible cuente con por lo menos una ambulacia durante la realización del ejercicio.

Ensamble de los simuladores

1. Arme los contenedores en lo posible un día antes de la demostración con fuego vivo.

Ensamblaje de chasis: Los módulos se unen mediante el conector insertándolo dentro de la otra sección	

	Montaje de piso: Se instala los paneles de pisos con tornillo autoperforante dentro del chasis.

Instalación paneles de fachada: a) Se instalan los paneles de fachada empezando por dos esquineros para estabilizar. b) Se pernan a chasis con tornillos autoperforantes en el costado exterior.

	Instalación paneles de fachada: Se instalan el resto de paneles uniéndolos con tornillos pasantes entre si a través de platinas de conexión

Montaje de dintel y viga dintel: a) Se instala la viga dintel tubular y el flanches de cortina. b) Se instalan las correas tubular intermedias con los porta correas c) Montaje de cubierta: Se instala cubierta sobre correas	

- Instale las termocuplas siempre teniendo en cuenta que queden lo mas cerca posible al sitio donde se ubicara el punto de ignición inicial. (esta ubicación permite realizar mediciones de temperatura en tiempo real). De otra parte el control e medición deberá ser ubicado en un sitio que permita realizar las mediciones de temperatura con la mínima exposición al calor radiado.
- Ajuste la instalación de la regadera o rociador automático
- Pinte las paredes
- Instale la alarma sonora por detección de humo
- Instale una o dos cortinas de la pared posterior del simulador sobre una papelera llena de periódico. Donde se dará inicio al fuego al encender la papelera

	Ubique los muebles y enseres dentro de los simuladores con la misma distribución espacial o en forma de espejo.

Suministro de agua para la seguridad de la prueba

Para realizar el ejercicio Side by Side con rociadores contra incendio se debe el suministro de agua suficiente y necesario tanto para el rociador automático ubicado en el simulador de incendio como para el proceso de extinción del incendio.

1. Maquina o Vehículo de extinción de incendios de bomberos con capacidad de tanque de mínimo 750 galones de agua.
2. Hidrante con mangueras cargadas.
3. Sistema fijo de extinción de incendios con linea cargada y activada la bomba contra incendios.
4. Lineas de suministro de agua, debe estar dispuesta así:
   - Si es una máquina extintora de bomberos verifique que la bomba esta funcionando correctamente.
   - Inicie el tendido de mangueras en la salida de 2½ pulgadas utilizando los tramos de manguera necesarios para llegar al sitio del ejercicio y hasta una "Y de bifurcación de 2½*1½*1½ con control de flujo de agua".
   - Desde la "Y de bifurcación de 2½*1½*1½ con control de flujo de agua", realice la bifurcación con tramos de 1½ pulgadas así:
   a. Linea (tendido de mangueras) de abastecimiento del simulador dotado con regaderas automática contra incendio en lo posible por la parte posterior.
   b. Línea de combate o de extinción la cual será utilizada por los bomberos para el control del incendio que se realizará en en simulador que no esta dotado con rociadores automáticos contra incendios. Esta línea deberá estar dotada con una boquilla o pitón estandarizado a 100 PSI y que cuente con contro de flujo y cambio de patrones de agua.

Suministro energía eléctrica para la prueba

Una fuente de suministro de energía eléctrica se requerirá a lo largo de todo el montaje y desarrollo del evento:

1. Fase de armando y desarmado de los simuladores se requiere contar con suministro de energía eléctrica para las herramientas.
2. Fase desarrollo del evento se requiere el suministro para:
   - Sistema de audio y sonido
   - Sistema de video y grabación
   - Sistema de cronómetros o de medición del tiempo

DESARROLLO DE UN INCENDIO.

IGNICIÓN

Como **ignición** puede denominarse tanto la acción de desencadenar la combustión de un cuerpo, como el proceso en el que una sustancia permanece en combustión.

Otra definición de ignición: es el proceso mediante el cual una fuente de energía calorífica afecta un combustible e inicia la combustión.

Fase incipiente

Es la fase durante la cual el combustible primario alcanza temperaturas que permiten llevar la energía calorífica a otros combustibles secundarios e iniciar la fase de crecimiento o de libre combustión.

Fase de crecimiento

Durante esta etapa se presentan columnas de fuego y humos verticales que al alcanzar los techos inicia su desplazamiento en forma horizontal iniciando la transmisión de calor por radiación y convección a los demás elementos que se encuentran en la habitación.

En esta etapa la mayoría de los combustibles alcanzan temperaturas que hace que empiecen la pirolisis que es el cambio del estado sólido al estado gaseoso de tal forma que se produzca la combustión.

El plano neutro generado por los humos no solo irradia los demás combustibles, sino que también inicia un descenso dentro del recinto llevando la energía calorífica a todo el recinto

Flashover o combustión súbita generalizada.

Etapa de transición entre el crecimiento y el desarrollo completo de las fases del incendio Durante esta fase las condiciones en la habitación Cambian rápidamente a medida que el incendio pasa de quemar los materiales que se encienden primero a quemar todas las superficies de combustible expuestas en la habitación.

La capa de gas caliente que se genera en el techo durante la fase de crecimiento causa un calor radiante en los materiales de combustible situados lejos del origen del incendio. Este calor radiante produce la pirolisis en los materiales combustibles. Los gases que se generan se calientan hasta alcanzar la temperatura de ignición por la energía radiante de la capa de gas en el techo.

ANEXO # 1 – PERSONAS PARTICIPANTES			
El personal participante no siempre tendran el mismocargo y sera la misma cantidad, si se reuquiere realice los ajustes necesarios.			
CARGO		NOMBRE	Teléfono
Coordinador general ANRACI			
Coordinador general sitio			
Jefe o encargado Bomberos			
Presentado evento			
Encargado de las finanzas			
Encargado Operativo.			
Encargado de la seguridad			
Enlace de prensa			
Personal de Bomberos	Maquinista		
	Ignición		
	Ignición		
	Extinción		
	Extinción		
Arme y desarme simuladores	Operario 1		
	Operario 2		
	Operario 3		
	Operario 4		
Personal de logística del sitio	Logisitico 1		
	Logisitico 2		
	Logisitico 3		
	Logisitico 4		
Paramedicos	Paramedico 1		
	Paramedico 2		

ANEXO # 2 - LISTA DE MUEBLES Y ENSERES PARA LOS DOS SIMULADORES			
Los muebles, enseres y decoración a utilizar deben ser adquiridos dos (2) de identicas caracteristicas (uno para cada simulador).			
DESCRIPCION	SI	NO	CANT
Laminas de OSB (oriented strand board) de un espesor entre 6 y 10 mm, (se requiere hacer los calculos de cuantas laminas se utilizaran para cubrir las paredes y el techo del simulador.			
Unión doble hembra (1) para conexión de la manguera de bomberos al simulador dotado con rociadores automáticos			
Rociador automático de acción rapida (2)			
Cortinas en algodón de 5 metros de ancho por 2,20 metros de alto			
Soportes tubo de la cortina Cuatro (4)			
Camas			
Mesas			
Sillas			
Sofas			
Puff, entre otras			
Cuadros			
Papelera			
Maniquies			
Revistas como mínimo seis (6) por simulador			
Papel cualquier tipo de papel picado en trozos			
Termocuplas control tmperatura			
Adornos (cualquier tipo de adornos para solocar sobre mesas o escritoriosnen elaborados en materiales combustibles como madera o plásticos)			
Tapetes de 2.20 * 2,20 metros			
Decoración (lamparas, adornos en material combustible)			
Pintura 1 galon de vinilo. (se utilizará si desea tener un acabado de color).			
La cantidad y disposición de los muebles y adaptación de los simuladores depende de los mismos y deben ubicarse de tal forma que se garantice la ignición y desarrollo de los dos incendios en forma similar.			

ANEXO # 3 – HERRAMIENTA BASICAS Y OTROS			
DESCRIPCION	SI	NO	CANT
Taladro			
Alicates			
Destornillador de pala			
Destornillador de estrella			
Martillo			
Cierra circular o de sable con sus respectivos repuestos de corte			
Escalera			
Cinta aislante			
Alambre dulce			
Tornillos autorroscables			
Escoba			
Trapero			
Cinta teflon			

ANEXO # 4 – EQUIPOS PARA EL EVENTO			
DESCRIPCION	SI	NO	CANT
Extensiones Eléctricas			
Cronometro			
Equipo de sonido y audio			
Cámaras de grabanción			
Cámaras fotográficas			
DRON para grabación			
Control de las termocuplas			

ANEXO # 5 – BIENESTAR			
DESCRIPCION	SI	NO	CANT
Agua para hidratación			
Bloqueador solar			
Alimentación para el personal de armado y desarmado del simulador			
Elementos de seguridad de ultimo momento			

ANEXO # 6 – VERIFICACIÓN SUMINISTRO DE AGUA PARA LA PRUEBA			
DESCRIPCION	SI	NO	CANT
Máquina o carro de bomberos para exticicón			
Backup Maquina o carro de bomberos para extinción			
Máquina encendida y engranada la bomba			
Palanca de apertura de la Salida de 2½ en posición abierta			
Revisión toda la linea de manguera desde la maquina hasta el simulador y hasta la boquilla o piton cargada sin presentar fugas			
Verificar que el rociador automético no presente fugas o goteras.			
"Y" de bifucación de 2½*1½*1½ con control de apertura paso de agua en posición abierta.			
Unió doble hembra de 1½ pulgadas conectada a la entrada del simulador			
Presión de la Bomba para el simulador dotado con esprinkler en 50 PSI			
Presión de la bomba para			
Coordinación con el personal de bomberos para la realización de la maniobra de suministro de agua a la entrada del rociador automático			
Coordinación con el personal de bomberos para la realización del proceso de extinción utilizando la menor cantidad de agua.			

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