The Evolution in Residential Fire Protection

by Ronny J. Coleman
December 18, 2008

A note to readers:

Time stands still for no person. In no place else is this truer than in the field of fire protection. The technology of this industry has undergone significant change in the last century, but more importantly each of those changes has been based upon the efforts of a small number of people to become reality.

When Alpha to Omega was originally written, the history of the automatic sprinkler system was 100 years old. A few dedicated and similar thinking individuals made a choice to add a new chapter to the moldy textbooks on fire protection by adding the dimension of residential sprinklers. Margaret Meade once stated that “you should never underestimate what a small group of people can do in changing the world – in fact, that is all that ever has”.

Since this book was distributed, the number of individuals who have joined in the journey of making sprinklers in homes a reality has grown by leaps and bounds. If this book were to be updated today, it would contain the names of many fire- and life-safety advocates who are truly committed to the elimination of America’s fire problem.

I hope you enjoy reading Alpha to Omega. Just remember that history is being made every day. Remember, what occurred a long time ago is just a memory. What is most important is what you and countless others can do to advance the state of the art. History might be made tomorrow.
ALPHA TO OMEGA

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by Ronny J. Coleman

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>xi</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>xiii</td>
</tr>
<tr>
<td>CHAPTER ONE</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>History of Fire</td>
<td></td>
</tr>
<tr>
<td>CHAPTER TWO</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Magic of Combustion</td>
<td></td>
</tr>
<tr>
<td>CHAPTER THREE</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Evolution of an Idea</td>
<td></td>
</tr>
<tr>
<td>CHAPTER FOUR</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>The Orange County Experience</td>
<td></td>
</tr>
<tr>
<td>CHAPTER FIVE</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>An Overnight Success</td>
<td></td>
</tr>
<tr>
<td>CHAPTER SIX</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Bill Meyer</td>
<td></td>
</tr>
<tr>
<td>CHAPTER SEVEN</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Sprinkler Corporation Gets Involved</td>
<td></td>
</tr>
<tr>
<td>CHAPTER EIGHT</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>The Marriott Experience</td>
<td></td>
</tr>
<tr>
<td>CHAPTER NINE</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobb County, Georgia</td>
<td></td>
</tr>
<tr>
<td>CHAPTER TEN</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>The Scottsdale Plan</td>
<td></td>
</tr>
<tr>
<td>CHAPTER ELEVEN</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>When is a Sprinkler Head Not a Sprinkler Head</td>
<td></td>
</tr>
<tr>
<td>CHAPTER TWELVE</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>When Will There Be Enough Evidence?</td>
<td></td>
</tr>
<tr>
<td>SUMMARY</td>
<td>153</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>155</td>
</tr>
<tr>
<td>ABOUT THE AUTHOR</td>
<td>169</td>
</tr>
</tbody>
</table>
Anytime a text is prepared involving history and human factors, one is highly dependent upon memory and cooperation. This book began as a series of conversations and slowly but surely has evolved into a manuscript. There are hundreds of people who have been involved in the development of material contained in this book. Unfortunately, most of them will remain anonymous. They know who they are because they were students in the “Fire-Stop-B” program in San Clemente or they were in the many audiences at the Federal Conferences on Sprinkler Concepts, at the ISFSI Conferences or at the NFPA programs. I apologize for not remembering all in the book, but in a sense, you are all remembered because you prompted the development of the material.

Specifically, I must recognize the cooperation and patience of my wife, Marie, the moral support of my fellow fire officers, and the commitment of Central Sprinkler Systems in allowing me to put these words into print.

All of the people interviewed in the preparation of this text contributed both time and material, but further, they contributed insight.

Lastly, but certainly not least, my thanks to both Kara and Heidi for converting my dictation into a finished product.
Residence of Mr. Gene Kelly, Beverly Hills, California, 1:25 a.m., December 22, 1983. Defective decorative lights in Christmas Tree.
Someone once said that every story has three main elements—the beginning, the middle and the end. In preparing to write this book about the history of the residential-sprinkler concept, the title was selected because it reflects the beginning and the current state of the art: The Omega sprinkler head. The end is far from being written.

In fact, the quest for the ultimate means of fire protection will probably never be over. It has gone on since man first discovered that fire, the servant of man, is also the enemy of man.

The movie QUEST FOR FIRE heralded the dim beginnings of man's understanding of what fire was capable of producing. Another movie, THE TOWERING INFERNO, graphically spelled out how malevolent fire can be. Unfortunately, there never has been a popular movie made about the ultimate in fire control—the fire that never happened or the one that remained small and under man's control.

And so it is with the history of the residential fire sprinkler. It is not, nor will it ever be, a front page headline. Sprinkling buildings will never be a very popular cause.

None of this, however, should distract from the importance of the concept. Decades from now, there will be people who
are alive and contributing to society who may have been lost if their houses, apartments, hotels or motels had not been sprinkled.

Our Alpha to Omega title uses the letters of the Greek alphabet to signify many things at once. Alpha means "the beginning." It is the starting point from which all other things are measured. In the field of residential sprinklers, Alpha stands for an idea—the protection of life and property. Omega was selected because it is the name of the state-of-the-art sprinkler head at the time of the writing of this text. It is the last letter in the Greek alphabet and represents a position along a line that promises more to come.

The people, organizations, stories and ideas contained within the pages of this book are like building blocks. Taken separately, they may not appear to be all that important, but viewed collectively they represent the frontier in modern fire protection.

Throughout this book you will read about successes in the evolution of the historical development of the residential-sprinkler concept. Yet inherent in that discussion is the fact that many of the people and organizations involved in this process realize the quest is far from over. Most of them recognize that many more have yet to join the battle. Hopefully, those who are reading this book will be able to "read between the lines" as well as understand the motives of those who were involved. Perhaps you, too, can be enlisted in the army of advocates for residential fire safety. Perhaps you, too, by reading of the past and present events will be stimulated to make your contribution to advance this state-of-the-art in life safety.

Central Sprinkler Corporation, under the guidance of Mr. Bill Meyer, has made a commitment. Through the insight of this company, we have now achieved the level of "Omega." What letter of the alphabet will we be seeing within the next year, the next decade and by the turn of the century?

Ω
ALPHA TO OMEGA
History of Fire

No one will ever know who was the first human being to "use" fire. Probably there were thousands of humans who confronted fire at the dawn of humanity. Some may have even died from the effects of brush fires in the early days of mankind's awakening. But that one, singularly-brave person who deliberately used fire for his own purposes is memorialized primarily because of his anonymity. Maybe it's best that we will never know because this preserves the mystery and the majesty of fire.

BORN IN FIRE

Scientists tell us that our universe was born in fire. The big bang theory is basically an explosion on a cosmic scale. According to this theory, a fireball in the vacuum and coldness of space gave birth to our solar system. It is a phenomenon we are now able to describe, but may never understand why it happened.

Fire is the stuff of stars. Fire was one of the most basic chemical processes that started our solar system on its way to the creation of life. No doubt, far out on the fringes of the universe, there are stars—the Alpha Centaurus of other solar systems that are blazing forth in the genesis of new planets and new life. Most likely, fire will be there too!
Let's get back to those pre-historic figures who evolved to mental state of trying to control, tame and use fire. Archeologists cannot give us their name, but they can give us a scenario. Most likely, the event occurred somewhere in the African savannah.uddled together for warmth, as often a victim as a hunter, early Ian probably thought of fire as a spiritual force of doom. olcanoes, in pyrotechnic displays, spewed fire that later turned stone. Violence and death were the results of man's first encounters with fire. Instead of warmth, it usually delivered death. Instead of a tool, fire was a weapon that could not be created except by the magic of nature. It could not be controlled except by time. It could not be outrun by human beings and it certainly could not be held to the naked flesh.

So it was natural for man to fear fire. Imagine, then, what courage it took to even begin to think it could be used for mankind's purposes! Perhaps one of those cold, terrified people came across a smoldering mass of coals, conveniently banked against a creek bed or lying on a pile of rocks. Feeling the radiant heat remove the pain of cold from their naked flesh, perhaps they slept beside it. They probably felt the need to repeat the experience. Slowly, early man approached the idea of "feeding fire" to keep it "alive." It is not inconceivable that humanity spent a millennium in awe of fire before realizing it could be harnessed and created.

**SERS OF FIRE**

It is highly likely that the first "user of fire" was a woman. Early man was a hunter. His task was to forage, attack and kill for the survival of the species. Females, while not exactly sedentary, were expected to remain relatively stationary.

Others have suggested that perhaps fire was tamed when one of those hungry, foraging, early examples of humanity came across a burned carcass of an animal that had been overcome by a rapidly spreading brush fire. The cooked flesh may have st fallen off the bones instead of having to be hacked and chewed from the carcass. The earliest gourmet may just have been someone who decided to deliberately burn the carcass of prey instead of succumbing to the desire to "eat it right away."

The really interesting part of mankind's decision to use fire
Soon came the idea of pottery, then weapons made of fire, the melting of metals, and so on and so on. Man not only discovered fire but also began the process of trying to convert its magic into mankind's quest for immortality and control of his destiny.

The transition process, however, has been a tough one. For every advance in the use of fire there has been a corollary danger to its aspiring masters. Probably the only reason mankind has survived its early encounters with fire is that the steppes of the African plain were so vast that a tribe could easily escape its early mistakes. Quite possibly, the fact that caves were noncombustible prevented their ancestors from burning down their homes through poor fire protection practices. Nonetheless, mankind survived. Tenuously, we have maintained a love affair with fire that has often been tainted by fear and anger.

For example, it is well known among archeologists that many of man's early attempts at structures were literally burned to the ground. As a matter of fact, the burning of these structures actually assured their immortality since the resulting carbon created by the fire was more durable than the rotted wood. Carbon dating techniques of burned structures have helped fix the time of certain civilizations. In essence, fire has destroyed and has perpetuated man's quest for a quality of life.

The movie, QUEST FOR FIRE, was an excellent representation of those dawning years. If you saw it, you may recall the reverence people gave to fire; how they cradled it, sustained it and were totally devastated by its loss. The movie also gave us some clues as to how the use of fire and civilization grew as parallel concepts.

Most notably in this film, the quest for fire was likened to a pilgrimage of almost spiritual significance. It is no wonder that many of our Paleolithic predecessors drew a relationship between the "keeper of the flame" and the "keeper of the faith." It is even conceivable that religion, which still honors flames in rituals and ceremonies, started in the minds of those that drew a correlation between the power of fire, a force of nature and the existence of a Supreme Being.

Some of the earliest legends of mankind equate fire with the power of a god. The Romans, the Polynesians and many other cultures established a god in charge of fire. In the Greek version, it was Haphaestus; the Romans had Vulcan; the Hawaiians had Pele. All represented a power, a force in nature that was
both benevolent and malevolent.

**COMBUSTIBLE CLICHES**

Not surprisingly, we still make comparisons of love and hate by cliches that contain references to the use of fire. For example, we commonly say we are “carrying a torch” for an old lover. A former heartthrob is referred to as an “old flame.” A person who gets real mad is said to be “really burned up.”

According to some legends, mankind did not always have the use of fire, and the ancients sought a way of explaining how it was that man enlisted fire. Early storytellers were looking for something to explain fire spiritually and mysteriously.

The Greeks believed that only the gods had the possession of fire. Zeus had proclaimed that fire must be confined to the heavens and ordained that men were not worthy of its use. Prometheus, brother of Pandora and Epimetheus, thought differently. According to myth, he gave a burning brand to the human race, and the wrath of the gods came down on him like the proverbial “ton of bricks.” He was condemned to be chained to a mountaintop and have buzzards eat his liver while he remained alive and alert. Some reward!

Unfortunately, the human race has spent little time mourning this fallen god. Instead we embarked on a race to find how many ways fire could act as servant and slave. And just as quickly, mankind found out that the servant could be spiteful and the slave could revolt.

**BURNING OF THE CITIES**

Perhaps the first documented tragedy from uncontrolled fire was the burning of the Library at Alexandria. The collected works of mankind’s intelligencia to that date were reduced to ash and rubble as fire swept through the Library. No doubt there were witnesses who realized they were watching the destruction of irreplaceable assets. Perhaps some felt sufficient remorse to swear they would try to prevent a similar recurrence.

From that point on, the burning of major cities became a frequent occurrence. Almost every major city on the face of the earth has its “fire story.” One of the great metropolises of the world was completely burned out in 1200 BC. The city of Carthage, one of the first cities to reach a population of one million, was
completely burned to the ground in the year 146 B.C. Babylon, Baghdad, Constantinople and most other ancient cities were reduced to ashes time and time again.

I am sure that almost everyone has heard the story of Nero fiddling while Rome burned. Few realize, however, that the Holy Roman Empire was among the first civilizations to have a regularly constituted firefighting agency. Created during the reign of Augustus, there was a Corps of Vigiles (Cohortes Vigiles). It began with slaves, evolved into freemen and ultimately ended up as a military group set aside to protect the city from the ravages of fire.

The history of cities and the frequency with which fire has been man's adversary is a real saga. Time after time after time, the major cities have been destroyed. None have been exempt. Moscow, Frankfurt, Paris, London and most of the other capitals of the Old World were systematically devastated. Some of these major fires were caused by military action, but most were just sheer carelessness; most were downright preventable.

**PUDDING LANE**

The classic example was the great London fire of 1066. It started on Pudding Lane, not far from the Windsor castle, right on the edge of the Thames. This fire was caused by a baker's apprentice who failed to properly operate a stove. The resulting fire destroyed thousands of homes, businesses and places of worship. It was so severe that even the King took part in the firefighting operations. Prudently stationing himself on a boat in the center of the Thames, he shouted orders to “pull down” the house of London's Lord Mayor. In that particular fire, firefighting forces were so primitive as to be totally ineffective. The fire ran on and on until it depleted its fuel. It could not be checked.

A huge statue on Pudding Lane in London commemorates the event. The statue, designed by the famous architect Christopher Wren, stands 366 feet high to mark the spot where the great conflagration started.

And so the story has gone in Europe and across Asia. Society has advanced and fire was used as a tool and a friend. But every once in awhile, the relationship changed and all of man's treasures, achievements and accomplishments were vulnerable to the all-
consuming wrath of uncontrolled fire.

In the New World, fire was in use too. New World inhabitants did not seem to have the desire to create monumental cities. Native Americans were much more in touch with the mysteries of fire than the white explorers. The Indians believed in making small fires and getting very close for warmth all over while claiming the white man built big fires and stood far back so that he was baked on one side and froze on the other.

It is doubtful that many Indian villages burned down in comparison to the number of European cities which have been leveled by fire. Archeologists have unearthed evidence that Indians used to burn each other's villages as an act of war, but accidental fires were few and far between. There is also evidence, however, that some tribes deliberately set brush fires in a forest to perform the job of clearing underbrush and thereby make these lands more conducive to animals' survival. California Indians were known to have set controlled fires in the chaparral where forage was dependent on new growth and reduced underbrush. Perhaps Indians were simple in lifestyle, but they were sophisticated in their understanding of fire.

When the Europeans landed on this continent, they brought with them pride and prejudice regarding fire. In FIRES AND FIREFIGHTERS by John V. Morris, a history of fire in America, the author states that the two primary fears of colonial Americans were Indian attacks and fires. Both were frequent events. It is hard for us to relate to this today, but a structure fire in colonial America in the dead of winter was almost a death sentence. Time after time small colonies were destroyed by Indian attacks accompanied by deliberately-set fires.

Nonetheless, on both sides of the Atlantic, society continued to blend fire's benefits and liabilities. In the years following the discovery of America, many lives were lost and much property destroyed due to fire. Not too surprisingly, people began asking "why?" Answer: we have let fire get out of control too often. Question: What should we do about it? Answer: Prevent fires from starting in the first place.

ORGANIZED FIRE PREVENTION

The first organized efforts at controlling fire were fire prevention measures. It has often been said that the greatest
number of building laws, codes and ordinances that started in this country had their genesis as fire codes in early European cities. Property set-backs, for example, are nothing more than an attempt to control exposure fires.

Among the first laws ever to see paper in this country were fire laws restricting the manner in which buildings were constructed. It is not hard to visualize that the crude thatched huts of the settlers were dangerous, both inside and out. Even the first log cabins built on the edges of our ocean and rivers by the early settlers had wooden chimneys which caught fire easily. In addition, most of the buildings were built close together so fire could leap quickly from one to another with small chance of being controlled.

**FIRE LAWS**

Peter Stuyvesant in New Amsterdam generated an ordinance about roof coverings back in the 1600s and helped create one of the first fire departments in the New World, according to Morris. One of their duties was to inspect every chimney in New Amsterdam and to appropriate funds for new ladders, hooks and buckets. Ordinances about candlemakers had already been on the books in London. (Maybe these were the first hazardous materials occupancy permits.) Other ordinances had been devised to deal with the problems of wooden chimneys, excessive piles of twigs and kindling against walls and fences. Unfortunately, fire defense laws and fire losses continued to mount despite these fire prevention measures.

Most major American cities have been burned severely at some point in their history. Boston has burned. So has New York, New Orleans, Philadelphia, and Charleston. In Europe the fire record paralleled this country's through the 1600 and 1700s, as major fires continued to spring up in densely populated communities.

**FIRE SUPPRESSION**

The earlier concept of the Roman Cohortes Vigiles was forgotten for centuries. After the Dark Ages, the idea was renewed along with the concept of prevention. The idea of fire suppression, i.e., controlling fires after they start, took literally centuries to catch on. Like all of the technological advances that man has
embraced, it got off to a slow start. It has often been stated that the earliest form of fire pump was invented by Ctesbius in early Greece. This concept was lost and not renewed, however, until the 1600s and 1700s.

THE CATASTROPHIC THEORY OF REFORM

Interestingly enough, man’s relationship to fire has also resulted in the development of a concept called “the catastrophic theory of reform.” What this basically means is that we, as a society, will allow a condition to exist until such time that it becomes so critical and the losses so severe that we pass a law to make sure the condition never happens again.

Our history books are checkered by such events. One classic example occurred at the Triangle Shirtworks Factory in New York City in 1911. This particular fire brought about major industrial reform. After the flames, by-products of combustion and acrid smoke took the lives of 164 young working women, fire prevention codes began addressing the issue of adequate exits and fire protection for industrial complexes.

Another fire occurred in 1903 in the Iriquois Theatre in Chicago. This was not an old, ramshackle structure, but rather a newly-constructed building, probably constructed exactly to the fire codes at the time. It was packed with people celebrating prior to the Christmas holidays. A fire occurred when the asbestos curtain, which was supposed to keep the fire contained behind the stage, didn’t function. Whatever lighting was in the building failed and the fire led to panic. The subsequent fire death exceeded 600. This tragedy led to codes concerning emergency lighting and flame retardency for theatres and other public-assembly buildings.

Even earlier we had the classic fire of the 1870s—the Great Chicago Fire. Supposedly starting in Mrs. O’Leary’s barn, it devastated Chicago and literally cast a pall of gloom over the country. This fire was not the only one that occurred in the year 1872; a tremendously large brush fire sweeping through the forests of Peshtigo, Wisconsin, killed hundreds of people and devastated many homes and cities.

As we progress chronologically, it’s interesting to note that, decade after decade, we have fire problems that take years for the solutions to become apparent. For example, in Boston in
1942, a fire occurred in The Coconut Grove Restaurant. This overcrowded, poorly-designed building had revolving doors that would not allow people to exit quickly. Combustible decorations were installed in the building with little or no concern with what they would do during a fire. The subsequent fire killed 492 people. That tragedy aroused the public and brought about the first of what are now referred to as “cabaret laws.”

**INVENTION OF THE SPRINKLER HEAD**

A device, called the automatic fire sprinkler head, was developed in the late 1800s by Henry Parmalee. It was initially developed to protect the interests of the textile industry which had suffered many major-loss fires.

The above development was just a footnote of history at this point because for literally generations the only buildings which reaped the benefits of built-in fire protection were those of the textile industry. Otherwise, the nation’s fire problems continued to march on to the steady drumbeat of death and destruction.

Every decade has had its conflagration to put on the books. Making a quantum leap from the 1940s up to the most current time, we realize that nothing much has really changed.

**MODERN DAY DISASTERS**

For example, on the afternoon of July 31, 1979, the City Council of Houston, Texas, conducted a serious debate about whether they should have an ordinance to regulate the use of wood shingle roofs. This ordinance was being debated some 300 years after Peter Stuyvesant had decided that thatched roofs were a fire hazard in New Amsterdam. While the Council debate raged back and forth, the decision was ultimately made to postpone the action on the ordinance.

According to a National Fire Protection Association's FIRE JOURNAL article published in January 1980, shortly after that event, at approximately the same time that the postponement vote was being taken, a fire was starting. Reportedly a Houston businessman, looking out his office window in a high-rise building, saw the fire starting on the roof of a building several miles away. Through his telescope, the man saw that the wood shingle roof of a single
building was on fire. The fire eventually spread to 26 separate apartment buildings all with wood shingle roofs, totally destroying 22 and damaging the others. While no lives were lost, it was a conflagration of devastating proportions. Ironically, the day after the conflagration, the Houston City Council re-convened and unanimously passed the ordinance regulating wood shingle roofs. Another example of the catastrophic theory of reform.

Time and time again, man has attempted to escape the phenomena of fire by assuring himself that things have been taken care of for him. For example, when you check in at a motel, you expect that if you place your life in the hands of the innkeeper, your safety should be assured. It is quite possible that many people who entered the MGM Grand Hotel in Las Vegas, Nevada, in February, 1981 felt they were removed from the pressures and strains of modern life as they rested and played in the glitter and glamour of Las Vegas. A rapidly spreading fire on the main floor of the MGM Grand converted that vacation into a nightmare.

The same thing has applied in places of worship, restaurants and hospitals. Every conceivable place where man has sought safety and security and has taken fire with him, there has been a disaster. Indeed, the most dangerous place for fire is right in the home. Since the NFPA has been keeping records, the single-family dwelling has outstripped all others when it comes to fire losses and fire deaths. The most frequent type of fatal fire responded to by the modern fire department is the structure fire. The fire most often resulting in death and/or serious injury is the single-family dwelling.

If we could go back for just a few moments into that scenario of early humans on the plains of Africa and put ourselves into their place for a few seconds, we realize that, while civilization has changed a lot, man and fire have not. When fire is under control, comfort, enjoyment, and security have resulted. When it got out of control of early man, he was terrorized, panic-stricken and totally incapable of coping. He probably fled in fear of an uncontrolled fire. Now in the Twentieth Century we face the same phenomena that can occur right in the confines of our own homes.
THE MYTH OF FIRE

For those who have never experienced a fire, the movie version is a myth. Movies such as THE TOWERING INFERNO have painted the picture that fire can be dealt with in a very simplistic manner. On television you have probably seen at least one scene where an individual puts a handkerchief over his nose or a wet blanket over his shoulders and dashes through a burning building to safety. No way!

In reality, the inside of a burning building is like the bowels of hell. Professionally-trained firefighters equipped with the most modern equipment still find themselves face to face with the most violent, naturally occurring force on the surface of the earth. Surviving an encounter with an uncontrolled fire is a traumatic experience.

For those who have faced a fire, the previous paragraph is redundant and in fact is probably a mere smattering of the emotional terror that you experienced.

Mankind’s march to the goal of controlling his life and destiny has had many stumbling points, and fire is only one of these. War, famine, pestilence and plague have brought their own forms of destruction, but over the centuries none have been so systematically devastating as fire.

Throughout this book, bear in mind that one of the potential solutions for America’s fire problem—in fact, the fire problem of the world—was discovered over one hundred years ago for the express purpose of limiting fire in a place of business in order to protect an investment. That same invention and the evolution of technology to support that invention are now one hundred years old. There is one mechanism, one technology, that offers us the potential of ultimate control over “uncontrollable” fire—the automatic fire sprinkler head!
CHAPTER TWO

The Magic of Combustion

Just how is it that a small match can initiate a sequence of events that could literally destroy an entire city? How does this powerful natural force come into being? The answers to these questions have mystified both ancient and modern men. Granted, science gradually formulated laws of combustion which describe the phenomenon of fire and suggest some ways of controlling it. Nevertheless, the means by which a fire starts, grows and consumes is still a matter of myth and much confusion to the ordinary human being.

NO TWO FIRES BURN ALIKE

In the fire service we have the saying, “No two fires burn alike!” Actually, that’s not true. Fire hasn’t changed one iota since two sticks were rubbed together or since flint was used as an ignition source.

Fire is actually quite well defined in the scientific vocabulary. Fires start, they grow, and they eventually destroy all fuel that is directly introduced into their paths by following an evolutionary path of events.

Understanding that evolution and comparing it to the structural fire problem is the essence of modern fire protection. Controlling fire means controlling that process. It follows that the more a
person understands about the phenomenon of a fire's growth, he more likely he will be able to make strategic interventions in that process. For a full understanding of the concepts explored in the remainder of this book, a brief discussion of dwelling fires is necessary at this point. This information will clarify the rationale and methodology of those devoted to the use of automatic fire protection in limiting the growth of fires.

**POINT OF ORIGIN**

Apart from violent explosions or deliberately set arson fires using flammable liquids, most residential fires start very small. In the jargon of the fire profession, the place where a fire starts is referred to as its "point of origin." This is the location within the structural geometry where something, i.e., a heat source or a series of circumstances, allows a fuel and a heat source to come together. Very common "sources of ignition" of fires are matches and electrical or heating appliances.

Most everyone has heard of the "fire triangle." The point of origin is where all points of this triangle come together to create a fire. The three legs of the fire triangle are fuel, heat and oxygen. All three elements must be present in order for fire to start, however, in about 95 per cent of the cases, the amount of heat, fuel, and oxygen are very small in volume and low in quality. In other words, a very high percentage of fires start off with minimum heat source involving a highly susceptible fuel source such as paper, textiles or linens. The point of origin is almost literally that—a small point source where these three elements are brought together to start the chain of events.

The point of origin in most fire scenarios is almost invariably down low to the floor or resting upon a piece of furniture. The classic situation in many cases is that the point of origin is adjacent to fuel groupings such as sofas, beds, wastebaskets or other furnishings. In other scenarios the fuel source may be part of the appliance that started the fire, e.g., a television set or coffee machine. Invariably, however, the point of origin seldom takes up an area in the total geometry of the exposed building of more than six to eight square inches or—at the maximum—twelve inches in diameter.
starts. In some cases, the process is very, very slow. This is often the result of a fuel being exposed to a heat source over a long period of time in which the fuel deteriorates very slowly. You have probably seen this where newsprint or textiles have been exposed to a heat source. The paper has turned brown, curled on the edges and gives every indication of being ready to break into flames but has not. These types of fire scenarios are referred to as “smoldering starts.” They are often prevented at the onset because they are so slow in starting and give off clues. Most likely everyone has experienced the acrid odor of an over-heated electrical appliance. Others have perhaps been startled to smell the odor given off by textiles and clothing placed too close to a heating device for drying. This is not an uncommon situation when individuals are coming in from snow or rain and attempt to dry clothing by hanging it on the back of a chair adjacent to a heating appliance.

OPEN FLAME PRODUCTION

The second stage of combustion after the point of origin is an “open flame ignition.” This occurs when a fuel progresses from the smoldering stage to actually produce an open flame. Visualize someone tossing a match into a trash basket. For a few moments, the trash basket may only smolder, giving off that distinctive burnt-paper odor and then, suddenly, a flame will be seen to flicker along the edge of the kindling fuel, followed by a noticable open flame. As soon as an open flame is present in a fire scenario, a sequence of events unravel that could conceivably destroy an entire structure. For that matter, the sequence of events could continue to grow to destroy an entire city, such as occurred in The Great Chicago Fire in the 1870s and The Chelsea Conflagration of the 1960s.

A fire in the point-of-origin stage is most vulnerable to extinguishment. In many cases, the fire can be extinguished by simply removing the fuel from the heat source and allowing it to go out. In other cases, a cup of water cast into a wastebasket or, in some cases, a person literally taking the fuel and stepping on it with his foot is sufficient to extinguish the fire. The mechanism of extinguishment when a fire is at this level of involvement requires a very small amount of energy because the fire itself is producing so little energy. Fires caught when
they are at the point-of-origin stage in hundreds of thousands of cases around the country go unreported to local firefighting agencies. They are often considered "accidents" and unless there is some additional complication, such as a small child being involved or the possibility of a rekindle occurring, many people consider these types of incidents mere nuisances, hardly cause for alarm.

**AREA OF ORIGIN**

If only all fires would stay at their point of origin! Life would sure be a lot simpler; a lot of property would still be in existence; many people whose lives were abruptly ended by fire would still be alive and contributing to society; and the insurance industry and the fire profession could be devoting time and attention to other matters. But that's not what happens.

Once a fire has progressed to the open-flame stage in the area of point of origin, it has the possibility of growing in two distinct ways.

First, it can migrate to additional fuels and enlarge the point to the stage where more energy is being pumped into the process. The term for this migration is "extension." When a fire begins to extend beyond its point of origin, it is searching for a fuel that will be susceptible to the heat being produced by the point of origin. In many cases, fires have actually gone out because there were no immediately and readily available fuels for extending the point of origin. Visualize, for example, a wastebasket in an empty basketball court. A fire may occur, but by the time it has consumed the fuel in the wastebasket, it is highly unlikely that it has extended to any remaining portions of the building. If you take that same wastebasket and place it beside a sofabeed or master bedroom suite and allow the same fire to occur, the radiant heat being emitted by the initial source of ignition may well start consuming additional fuels.

As each of these fuels become involved, there is an extremely significant increase in the amount of heat being generated. For every minute a fire is allowed to grow, it will continue to gain in dominance on a geometric scale. What this means is that if a fire burns for one minute and consumes a certain amount of fuel, in the following minute it will double in the amount of fuel it consumes. The following minute after that it will double
its fuel consumption again. At the end of a four-or five-minute scenario, the fire may be consuming hundreds of times more fuel than it did in the first sixty seconds. The phenomena of the "area of origin" is that a fire will almost always attempt to extend to the next closest available fuel source unless the distances are so great or the fuels are so resistive that they are not capable of reaching a kindling temperature.

**THE PLUME**

There is an interesting event that takes place at the point of origin when a fire starts creating an "area of origin." The heat being generated by the fire and the other products of combustion have the potential of doing two things. First, the products of combustion, i.e., smoke, fire gases and the heated air effected by the fire, will tend to rise directly above the fire source itself. This is referred to as a "plume." The very fact that this plume exists is the reason we place mantels over candles and lanterns. A plume relates to how a chimney or stovepipe works to channel the products of combustion and "convected heat" away from the heat source.

*Fire plume that is created above a fire. This is the stage of fire just before flashover occurs.*
You probably have seen a fire start and have noticed that, at the very beginning, the plume rising above the fire appears almost lethargic. The gases moving up that column are moving very slowly; there is not a lot of energy there. This phenomena is referred to as a “plume velocity.” What a plume velocity consists of is the speed (in feet per second) that the fire gases are being projected away from the burning material.

**RADIANT HEAT**

The second form of heat transfer at an area of origin is “radiant heat.” Radiant heat is what makes our fireplaces and stoves work. It is the transmission of heat energy across vertical and horizontal planes like light waves. If you have ever found yourself in front of a fireplace and felt the warm, rosy glow that comes from the fire, you have experienced radiant heat. Radiant heat tends to travel in straight lines and is governed by the “inverse square law.” Basically, every time you double the distance that radiant heat must travel from its source, the intensity of the heat falling on a new surface is reduced by one quarter of its former value.

Now back to our fire. If the fire at the point of origin is now beginning to attack the fuels in the immediate area, a fairly predictable series of events will begin to unfold. As we have indicated earlier, fires start relatively slowly. As the plume begins to build and discharges products of combustion into the overhead, it propels smoke and fire gases to remote parts of the building.

If this event does not occur, there is a good possibility smoke detectors would not work. A low plume velocity, which creates a cold smoke, often results in the smoke not being propelled high enough for the fire to ever generate enough smoke to activate smoke detectors. It is not uncommon for fires to have been discovered in this stage by people who have “smelled smoke” drifting throughout a building because the plume had never generated enough velocity to put the smoke into the overhead.

It is axiomatic, however, that as a fire adds fuel and generates more heat energy, the plume velocity will continue to accelerate. In addition, the plume which is going up to the ceiling line carries with it convected heat generated by the fire in the area
the nature of the material involved. For example, a fire starting in a stack of newspapers is going to burn somewhat differently than a fire starting in a stack of logs. Generally speaking, fires that have a "kindling" effect of having small, highly-divided and susceptible fuel sources tend to grow faster in the earlier stages.

The fire becomes a sort of heat pump. It is pumping heat into the atmosphere and several things are going to occur. First, the heat will travel to the highest point in the room and, in some cases, will immediately be cooled off because it is absorbed by the material of the room. For example, if a fire was burning in a room lined with wallpaper or paneling, the paneling would begin to absorb the heat from the convected plume until it could no longer absorb any more. Then this convected heat would begin to break down the fuel. It's conceivable that a fire would continue to spread by involving the remaining combustibles in the rest of the room.

**ROOM OF ORIGIN**

Once a fire in the area of origin has reached a flame height of approximately three feet and starts increasing its plume velocity to about forty to forty-five feet per second, the fire has now become an imminent threat to life and property in the building. In the two previous sections, we referred to the point of origin and the area of origin as relatively vulnerable fire scenarios. These are commonly referred to as "low-challenge" fires. This means that the fire is capable of being extinguished relatively easily and, in many cases, does not necessitate extensive fire-extinguishing equipment. Once the fire has reached the high-challenge state, however, such as the fire that is beginning to consume the room of origin, it is beyond the coping capabilities of the average citizen. It must now be turned over to professional firefighters.

An event that can occur at this time is called "flashover." Flashover occurs when convected and radiant heat warm all of the combustible materials inside the room of origin to their ignition temperatures. At this point, the fire will accelerate ten to twenty times faster than it had at any previous stage in its development. The flashover stage is by far the most lethal of the entire sequence. Once a fire has progressed to this point, it is impossible for anyone to escape alive from the room of origin.
Believe it or not, this same admonition actually applies to the professional firefighter. Even firefighters with all their protective equipment can't enter that kind of environment. Firefighters can only enter a room that has entered the flashover stage by penetrating the room with a firestream first and cooling the atmosphere to the point where it is safe for them to enter.

**THE BUILDING OF ORIGIN**

Once a fire goes to flashover, the migration of heat and products of combustion is so rapid and so violent that only two things will prevent the fire from destroying the entire building: (1) If the building is compartmentalized so that the fire cannot migrate into hallways, out windows and into other portions of the same building from the room of origin; and (2) if the building has such a limited fuel supply that the fire burns itself out in the room of origin and does not migrate into other areas.

A totally involved structure. This is what flashover does to a house.

A fire will attempt to move from the room of origin to the remaining portions of the building by any and all means available to it. The convected heat produced by flashover has a tendency to migrate upwards and outwards. In fact, the term used by professional firefighters to describe this condition is "mushrooming."
This means the fire will move up until it reaches a horizontal barrier and then it will begin to spread out equally in all directions as rapidly as possible. Fire will move from room to room; through windows, doors, transoms and openings in walls; and, in some cases, by actually burning its way through the material applied to the walls.

Firefighters call this particular kind of emergency a “totally involved” structure. This means that the building, its contents and any occupants are dominated by the fire spread. Chances of survival or reduction of loss of property are practically nil.

EXTENSION BEYOND THE BUILDING OF ORIGIN

Probably the most dramatic and, in some cases, terrorizing fire behavior phenomena is when a structure has become so heavily involved that it begins to extend to the structures standing closest to it. That’s what happened in Mrs. O’Leary’s barn in Chicago. The building generated so much radiant heat that it began to attack the fuel on the exterior of surrounding buildings. The fire then began to migrate horizontally.

There are numerous dangers when a fire reaches this particular point. First, and most obvious, is that when a fire is creating this volume of heat, it becomes increasingly difficult for the firefighting forces to do anything to stay the speed at which the fire consumes other combustibles. If wind or closely-compacted, densely-constructed buildings are factored into this fire equation, one can readily calculate that a conflagration will soon result. In some cases, the fire will spread from building to building even faster because burning brands become secondary points of origin, thus creating their own areas of origin and subsequent involvement of additional structures.

When a fire reaches total involvement, it is not inconceivable, even with a relatively small building, that it may be producing millions and millions of heat units called “BTUs.” This stands for “British Thermal Unit” and is a measure of the amount of heat generated by a burning product. The only means of combating the millions of BTUs produced in a fire is to attack with sufficient water to reduce the heat. If unchecked, the heat produced from the fuel source will ignite surrounding materials, thus producing more heat and thereby furthering the fire’s geometric progression.
Well, there you have it, in terms of the areas a structural fire can go through, up to and including the point where it can endanger the lives and property of an entire community. Starting with that almost insignificant point of origin and migrating up to and including the potential for involving multiple structures, a fire is relentless, unemotional, and highly predictable. There is a rule of thumb that once a fire has started in an uncontrolled environment, it will continue to consume and destroy until it either runs out of fuel, runs out of air or there is some form of intervening strategy to keep the fire from reaching the next level.

And of course, that is what structural fire protection is all about. For the last several hundred years, there has been one attempt after another to find ways to keep a fire from migrating from one stage to the next. Some of the strategies we have employed to date are classified as “passive” strategies. That is to say we have done things to buildings to protect them from fire which are passive in nature, e.g., fire walls and fire stops. These resist a fire spread but they do absolutely nothing to reduce the impact if the fire is not held in check. The smoke detector is another passive form since a detector will almost always activate at a point when the fire is transitioning from the point of origin to the area of origin. If someone is there to hear the smoke detector, there is a good possibility the fire will be held in check because it is at a vulnerable stage, at a low-challenge situation where it can be controlled.

All the events we have described thus far in this chapter take place in chronological order. Fires simply do not go from a point of origin directly to total involvement. There is an orderly, almost methodical sequence of events that the fire will follow. As a matter of fact, this sequence is so predictable that it is used as a basis for fire-investigation work to reconstruct how and where a fire started. Many times professional firefighters can locate a characteristic burn pattern in structures shaped like a large “V.” This “V” pattern is a manifestation of the chronology of events we have described. The point of origin becomes the bottom
pattern until it reaches the ceiling line. The sequence then proceeds from the areas previously described.

Most firefighters are familiar with this time element, but most non-fire professionals have a limited grasp of it. There are a number of myths associated with the ignition and spread of fires. Some of these myths have been perpetuated by the movie and television industry which has led people to believe that, when a building is fully involved, all they have to do is to wrap a handkerchief around their noses, wet down their shirt, and they are capable of running through a room that has gone to flashover. Don’t try it! It may look good on TV, but in reality, it’s an instant trip to the morgue.

THE SMELL OF FIRE

A dangerous myth is that you can always smell a fire when you are asleep. People often don’t believe it’s necessary to have smoke detectors or any other form of alarm device because they staunchly maintain that they will be able to detect the presence of fire using their own sense of smell. Unfortunately, the olfactory nerves are among those that are deadened during sleep. This fatal myth has been debunked by the thousands of people who have died while sound asleep in the comfort of their own beds. Another myth is that if a fire starts, a garden hose will do the job for you. Or maybe that fire extinguisher in the kitchen is going to hold the fire in check. If the fire is in the low-challenge stage, that may be true. While statistics are not available on the subject of fire control by first-aid firefighting appliances, it is obvious that they are desirable or we wouldn’t have a fire-extinguisher industry.

However it must be pointed out that when a fire goes into the high-challenge period, fire extinguishing capabilities of first-aid appliances drop off dramatically. Many firefighters have conducted experimental burns to evaluate this sequence. The author has personally burned about 500 buildings over the last ten years in a wide variety of scenarios to test some of these time elements. Unfortunately, the wide variety of fuels and structures makes it almost impossible to come up with a fixed time schedule of how each and every fire is going to burn. However, there are some observations about fire behavior that even non-science oriented people will appreciate.
The first of these is that a fire will remain at its point of origin until the stage at which an open flame is produced. Once an open flame has been produced and you have a flame height of six to eight inches, a sequence of events starts; i.e., a virtually unstoppable clock begins ticking. If an adequate fuel supply exists and there is sufficient oxygen available, a fire will create an area of origin in four to six minutes. This means that wherever the fire started, it will begin to extend to nearby fuel sources within that four-to-six minute time frame.

Once a fire has created an area of origin and continues to build an open flame, the time frame once again goes into a holding pattern, provided the area of origin does not develop a plume velocity of more than fifteen to twenty feet per second and does not develop a flame height of over three feet. If the flame height exceeds three feet and the plume velocity approaches twenty-five to forty feet per second, you have approximately four to six minutes from that point in time until the room begins to enter a potential flashover stage.

After the fire reaches three feet off the floor and the plume velocity begins to accelerate, the fire will typically develop a plume that eventually hits the ceiling and begins to “roll over.” Anyone who has ever witnessed this event in a controlled burn will testify to the fact that the plume appears to be a “pedestal” of fire. Once a fire has achieved that degree of heat production and is generating heated gases in a rapid manner, it reaches a point of high challenge and cannot be effectively dealt with by most civilians, and even by most household-brand type fire extinguishers. The only successful deterrent at that point is either a built-in fire sprinkler system or the application of a fire stream by firefighters in adequate amounts of water to limit the heat production.

**MUSHROOMING**

If the fire plume hits the ceiling and begins to “mushroom” out from the plume, the room is ripe for flashover. Typically, this stage is never seen by the layman and, as a matter of fact, has not been seen by many professional firefighters.

Most of the experience individual firefighters have in assessing this stage of fire behavior has been in controlled burns, primarily because the transition stage from a pre-flashover to a flashover
condition is such a short time that it occurs prior to the arrival of a fire-suppression company.

**FLASHOVER**

When the plume reaches the point where the fire begins to migrate across the ceiling, conditions occur in the room of origin. If the flame-propagation zone and the heated air are confined to an average-sized room, it does not take very long for this situation to result in radiant and convected heat being transmitted to almost all the combustibles in the room. Once again, this condition is very seldom witnessed except in experimental fires, where it's possible to watch the area-of-origin plume radiate and roll across the ceiling like waves in water. The sound level of the fire will actually increase in volume. Those who have experienced flashover often draw an analogy between a flashover and someone throwing a can of gasoline into the room. There is a point at which the room seemingly “bursts into flame” from the sheer volume of heat being trapped there. The thermal balance of the fire instantly results in heated gases and even flame being taken clear down to the floor level in the room of origin. Any occupant will be mortally injured, and every piece of property in that room will be badly damaged, even if fire suppression were to take place immediately.

Next, the fire migrates from the room of origin and attempts to dominate the entire structure. The manner in which a fire spreads inside a structure is directly related to its design, the quality of the construction and the volume of fire load in the room of origin.

**TOTAL INVOLVEMENT**

Fire moves upward and outward; therefore, the time from flashover to total involvement of the building is directly related to the size of the building and the opportunity for that migration to occur. Typically, in a single-family dwelling a room fire can move to a total involvement in as little as fifteen to twenty minutes from the time of flashover. In larger structures, total involvement may take as long as two or three hours, if the building is multi-storied or multi-compartmentalized.

Well, that's how fire goes from that little tiny, insignificant
flicker of flame at the head of a match to a totally devastating and awesome force of nature that can destroy life and property.

**SUMMARY**

In summation, this chronology of events and the particulars of what occurs are highly quantifiable and amazingly predictable. This does not mean they are scientifically reproducible in all cases. Structural geometry, the fuel array and a variety of other conditions often create fires which are extremely difficult to control. It is important to note that in the vast majority of cases, these trying conditions do not exist until the fire attains the high challenge state and goes to flashover in the room of origin. Fires that never get large are not very difficult to control.

Over the last few decades there has been a tremendous emphasis on reducing the response time of the manual firefighting forces. This has been accomplished primarily through smoke detectors and the installation of fire alarms connected to local fire agencies. These passive means of fire control, however, do not in any way restrict the growth of a fire once the chain of events has been started by ignition at the point of origin.

It now appears logical that if built-in fire protection were to be available in order to intervene in a fire's growth between the area of origin and the point of flashover while the fire remains in a low-challenge situation, fire losses would be significantly reduced and the impact on local fire fighting resources would be eased. We will now direct our attentions to the topic of this entire book, which is the instrument in that intervention—the residential fire sprinkler. To learn more about how this amazingly simple piece of technology introduced into an amazingly simple fire scenario can just possibly hold the answer to the residential fire problem in the United States continue reading the rest of his book!
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The Evolution of an Idea

SUCCESS?

Someone once said “Success has many fathers—but Failure is an orphan.” And so it is with the adoption of any new concept. If it is tried and it fails, no one wants to take the blame. But, on the other hand, if it becomes a success, over a period of years it becomes very difficult to distinguish the paternity of the idea. According to Peter Drucker in his book “Innovations and Entrepreneurship”, any revolutionary idea that expands the horizons of technology normally takes twenty to twenty-five years to be adopted, lots of time for the originator of the idea to be obscured.

In the field of residential sprinkler technology, this evolution can not only be witnessed but can be actually measured. It has literally taken decades for the concept to take hold. The only true “father” of the residential sprinkler system is the inventor of the automatic sprinkler himself—Henry Parmalee; the rest of the fire profession have only served as “uncles” to the idea.

The automatic fire sprinkler system is not exactly a modern invention. It has been around, in one form or another, for well over a hundred years. Like many other inventions, it was born out of necessity in the latter half of the 1860s and early 1870s when the textile mill industry was facing catastrophic fire losses. In an attempt to prevent small fires from turning into major conflagrations the quest began to invent a means by which water
could be applied to fires while they were still in the incipient stage.

Parmalee was credited with creating the first fusible link sprinkler head which was patented in September, 1872. Prior to his invention, there were some rather bizarre proposals, one of which included kegs of water mounted on rafters and surrounded with fusible explosives so that, should a fire start, the fuses would ignite, blow the barrels apart, and water would discharge on the fire.

A modern-day sprinkler head, put alongside some of the very first head developed shows an amazing similarity. The basic concept in those days was to have some form of nozzle attached to a pipe that holds water back. This nozzle was controlled by a type of fusible link. Sound familiar? If that sounds like a description of a common industrial or commercial sprinkler head, it is because it was a good idea in the 1870s and it is still a good idea in the 1980s.

The automatic sprinkler system, once proven as a means of controlling fires in textile mills, spread rapidly throughout the industrial community. It soon became readily apparent to those who had the most to lose, the insurance industry and major manufacturers, that the installation of automatic fire systems were an extremely cost effective way to protect their risks.

It took decades for the major insurance companies to fully realize the impact of this innovation. Many years after the installation of the original systems, the insurance industry recognized the sprinklers' value and started to give credit to sprinklered risks. Over a period of several decades, this credit for sprinklered occupancies has come to more and more of an economic implication. Premiums for sprinklered buildings continue to drop. After many years of actuarial study, a sprinklered risk may now often be insured for approximately 50% of the same area without sprinklers.

Today, fire insurance in certain sprinklered risks can often be demonstrated as having "paid for the sprinkler system" within five years of its installation with the premium savings.

It would be difficult, if not impossible, to estimate the total number of automatic fire sprinkler systems installed in industrial,
have been manufactured and installed with the specific purpose of limiting fire growth and the protection of property. These systems have been eminently successful.

Numerous references have been made in fire protection literature to the fact that occupancies protected by automatic sprinklers have had a 98% success rate. That means that for every occupancy fitted with sprinklers, approximately 98% of the fires have been controlled or growth of the fire has been limited until the arrival of professional firefighters.

So what about residences? One might ask the rhetorical question why wasn’t this marvelous technology installed in the dwelling occupancy to save lives if it is that good? Why has it taken one hundred years for the automatic fire sprinkler system to be brought to bear on our nation’s most significant fire problem, the loss of life in the residential occupancy? The answer is both simple and complex!

The most simple reason is that no one really has been a firm advocate of such installations. The fire service initially did not take a position in favor of automatic fire sprinkler systems. As a matter of record, when automatic sprinklers were first installed (back in the 1870s) firefighters were not convinced that this device was going to do anything it was reported to do. It took the professional fire service over twenty years to accept the basic premise that a fire department should pump water into a fire department connection to support the water supply of automatic sprinklers.

The sprinkler industry itself never advocated the use of these systems in dwelling occupancies. In the first place, putting sprinklers in homes represented a very fragmented market. The basic engineering that went into sprinkler systems for large textile plants involved the use of large amounts of water, large valves, specialized hydraulic calculations, and so forth. For a sprinkler company to gear up to provide the installation of such a system would require a group of very skilled and talented people accustomed to working in one type of construction environment, that of major construction.

Not only that, but back in the 1800s, homes were not built in “tracts.” As practically every residence was constructed as a “custom home” there was literally no market for a residential sprinkler industry to identify.
50 YEARS AGO

This doesn't mean, however, that the concept was totally ignored. Grinnell Corporation in the 1930s actually advertised the development of a "Junior" sprinkler system in some of the major magazines of that era. The system was advertised for installation in basements of large apartment complexes and in situations where it was recognized that automatic sprinkler systems could protect the structure. The concept, however, died of benign neglect. The fire service at that point did not see fit to support the idea and did not advocate it. The automatic fire sprinkler industry did not see a sufficient market to continue advertising and marketing efforts, and therefore discontinued their pursuit.

In the ensuing fifty years between 1930 and the late 1950s there were installations of automatic sprinkler systems in dwellings, however. Intermittently, throughout the entire United States, individuals (some with fire service and some with engineering backgrounds) made installations of automatic fire sprinkler systems in their own residences. Each of these dwellings was designed and installed under a different set of criteria. There simply were no standards, primarily because there was no way of scaling down the engineering criteria in use with the major systems.

During that fifty year evolution, there was development of
standards for the installation of large scale sprinkler systems. The document well-known by most fire departments, Pamphlet 13, was generated by a need of the automatic sprinkler industry to set engineering standards. Unfortunately, in the development of these standards, there was major emphasis on large scale installations resulting in development of technology not appropriate for single family dwellings, or even for apartment houses.

The National Fire Protection Association had its origin in the development of automatic fire sprinkler standards. The automatic sprinkler standards was the NFPA's first published work and was developed as a joint effort of those in the sprinkler manufacturing and insurance industries in an effort to create uniformity of installation. While this document has undergone many, many revisions since its inception in 1896, the basic concept of Standard 13 has not changed since its creation.

SO WHO IS THE FATHER!

The point of this discussion is that residential fire sprinkler systems were never actually invented. They evolved from a technology which has matured over nearly a full century. There have been numerous individuals who have asked questioned why the systems have not been installed in dwellings, and each of these individuals have also contributed in some way toward the evolution of the idea.

To use an analogy, the development of residential sprinklers has taken on the connotation of a painting being developed by a committee of painters. Each contributor has added a brush stroke to the overall background, and the details have been filled in by those individuals who have been successful in actually getting those systems installed.

RICHARD PATTON

In the late 1950s and early 1960s a set of circumstances occurred that started raising questions about automatic sprinkler systems for dwellings. Richard Patton, a fire protection engineer, had been studying standards in England, New Zealand and Australia. Patton questioned why a scaled-down version of Standard 13 could not be developed in order to attack the rising loss of life and property in single family dwellings. He questioned why it was necessary to have large volumes of water to operate
these systems when a small amount of water, applied in an early stage of the fire, could limit most fires to the area of origin.

**13-D BEGINS**

Concurrent with that inquiry, the National Fire Protection Association Standard 13 Committee began discussions on the formulation of a standard to apply to occupancies other than industry in an attempt by the committee to set standards to be used in single family dwellings and mobile homes. It was labeled Standard 13-D. In this era, the 1950s and 1960s, a rapid growth process was occurring in many areas of the United States, with a logical concern regarding the possibility of limiting fire problems with relationship to water supply, access, fire department operational problems, and the rising cost of fire protection. It soon became obvious to many other individuals who were also studying Patton’s work that automatic fire sprinklers could be used as a form of alternative fire protection in dwelling occupancies.

The original Standard 13-D as published by the NFPA encompassed design criteria based on the use of existing sprinkler head technology, which used the commercial and industrial head. Further, this 13-D system was based on an only slightly scaled down version of the water supply requirements. Initially 13-D was based on a series of fire tests conducted at Underwriter’s Laboratory using existing technology. Among the requirements for that original system was that there be a ten minute water supply be available. If you look at the volumes of water required for sprinkler heads of that era, this imposes quite an engineering requirement. These heads were discharging relatively large amounts of water at relatively large pressures. Multiplying these numbers out over a ten minute period often resorted in a storage requirement of thousands of gallons of water. The reason for the ten minute water supply was to allow reasonable time for evacuation of the occupants from the dwelling.

Essentially, the initial 13-D concept was to classify a dwelling as a life hazard and assume that in most fires one or two sprinkler heads would operate. While there was information in 13-D on head spacing, density and other factors for dwellings, there really was no body of knowledge to support how this concept would actually work in a single family dwelling.
WILLOWS PROJECT

But there were those who were raising questions. In the Willows Project, a major controlled-burn operated by the California State Fire Training Division in Willows, California, a suggestion was made by Don and Bob Shaw to build a sprinkler system out of plastic pipe for dwellings. Further, the Shaws, who were a father and son firefighter combination, suggested that maybe sprinkler heads could even be made from plastic. The tests, which were run in 1972, were certainly not on the scale of UL lab tests, but they were provocative. In test after test, it was determined that the plastic pipe did serve as a viable conveyance. As a matter of fact, the tests were run with exposed plastic pipe that not only extinguished the fires but did not fail when exposed to direct flame.

The firm of R.G. Sloane contributed a great deal of material to these experimental tests, and a report published by Don and Bob Shaw was distributed to fire departments throughout the west coast.

Simultaneously with this effort, a study was being conducted by some fire protection engineering students at the University of Maryland, who then published the results. Not unlike many other innovations, the idea of using a different form of technology to deliver water did not spring full-blown from the idea of one individual. Instead, the innovators were looking outside their own realm and discovering similar ideas from other professionals all over the country.

BYRON CHANEY

One of the earliest pioneers advocating this concept was Chief Byron Chaney, then of Mountain View, California, who instituted the Master Planning process placing a strong emphasis on use of built-in fire protection as an alternative to manual firefighting forces.

In 1960, when the residential concept was first advocated, there were fewer than several hundred of these systems throughout the entire United States. Interestingly enough, some of the earliest examples of residential fire sprinkler systems were found in the most remote parts of the country, such as Massachusetts and Alaska. However, in the time between 1960 and the latter part
of the 1970s this number doubled.

Simultaneously with this effort, a study was being conducted by some fire protection engineering students at the University of Maryland, who then published the results. Not unlike many other innovations, the idea of using a different form of technology to deliver water did not spring full-blown from the idea of one individual. Instead, the innovators were looking outside their own realm and discovering similar ideas from other professionals all over the country.

**FORMATION OF THE NFPCA**

When President Nixon empowered the Presidential Commission on Fire Prevention and Control, one of his charges to the committee was to develop recommendations to attack the residential fire problem. Shortly after the formation of the National Fire Protection Control Administration, it was formed under the direction of Howard Tipton. One of the tasks of the NFPCA was to research the residential fire protection problem.

Bob Hennessey, recently from the Insurance Standards Office, became a fire protection analyst in the County of Orange, California. Knowing full well the track record of the automatic fire sprinkler system in industrial occupancies, he began research on the use of this new technology in solving some of the land use problems in Orange County. The Orange County Story is told elsewhere in this book, as are each of the major incidents to date.

**ONE HUNDRED YEAR OLD TECHNOLOGY AND THE NETWORK**

A one-hundred-year-old technology was about to go through a renaissance. The evolution of the idea was not unlike how a spider begins to spin a web. First there was an anchor point. One or two individuals were agitating on a local level for the use of the concept. The federal government formed a focal point with the US Fire Administration. Clear across the country channels of communication began to build between the individuals who were advocates of the system.

Perhaps the most important thing to recognize as far as the historical aspects were concerned was the development of the communications network. Like a spider web, lines began to build
back and forth across the country. Individuals who were advocates and who knew of someone else also interested picked up the telephone, made a phone call, made a contact. And so it went. In short order, the author of this book came in contact with Bob Hennessey, and then Dick Patton, then soon with Harry Shaw of the National Fire Protection and Control Administration, and Dave Hilton of Cobb County, Georgia.

SAN CLEMENTE

Approximately 1976 the City of San Clemente initiated its research project as a result of studies done at the “Elmore Ranch” fire. From 1976 through 1978 intensive research was done by Fire Marshal Don Hodgson, Captain G. L. Carmichael, Fire Protection Specialist Jim Pengelly, Ray Russell of the State Fire Marshal’s office and other members of the San Clemente Fire Department staff.

The plastic sprinkler system installed at the Elmore Ranch in San Clemente. Designed by Firefighter Jim Pengelly.

U.S. FIRE ADMINISTRATION

However, the strongest influence came from work done by the U. S. Fire Administration. Under the direction of the National Fire Protection and Control Administration, Harry Shaw had become involved with the NFPAs 13-D Committee. The USFA had recently completed a series of tests regarding smoke detectors
in cooperation with the Los Angeles Fire Department, and was vitally interested in pursuing research and development of the residential sprinkler system concept.

In addition, many communities at that time were beginning to view built-in automatic fire protection technology as an alternative form of fire protection as part of the Master Planning process. As a result of increasing demands on land use in some rapidly growing communities such as Orange County, California and Cobb County, Georgia, the impetus was there to develop this technology.

**THE JOHN HOPKINS STUDY**

While the NFPA Pamphlet 13-D Committee was debating the new standard for single and two-family dwellings, John Hopkins University was working on a research project regarding the impact of built-in fire protection technology on life loss. This study was done by Rolf Jensen Associates and Schirmer Engineering and was funded by the United States government to determine if a reduced amount of loss of life and property had occurred in a given set of scenarios when smoke detectors or automatic fire protection mechanisms had been used and, if so, how much. This study, referenced in the Bibliography of this book, established that, in some scenarios, a combination of smoke detectors and built-in fire protection could reduce loss of life and property by as much as 97%.

The USFA fully realized the importance of this statement and accepted the possibility of two facts. First, an increase in the interest of installation of automatic residential fire protection and the potential for reducing loss of life and property. The research project for the development of residential sprinkler technology was therefore granted. A joint group consisting of the NFPA, the USFA, the Los Angeles City Fire Department and several private enterprises conducted research to evaluate smoke detectors and automatic fire sprinkler systems.

The Jensen/Schirmer Study established user requirements for residential sprinkler systems and created some of the initial interest in the design techniques applicable to residential systems. This study provided an outline for the development of standard hardware terminology and incentives for the implementation of residential sprinklers.
As a result of some of these initial studies, it also became apparent that time was of the essence in protecting the dwelling occupant. While time is not necessarily a constraint in the protection of industrial occupancies, it becomes very important when establishing minimum protection for occupants in smaller and more personal living conditions.

The reason is relatively simple: When a sprinkler system is engineered for a large, open area such as a gymnasium or an industrial complex, it is designed to keep the fire from taking over the entire space. The products of combustion prior to the initiation of the sprinkler head are not really an important issue. The products of combustion will be diluted in the larger areas of these industrial and commercial occupancies and occupants are generally not present to experience hazards. In addition, the temperature build-up in these very large rooms will be slower due to the dissipation of the convected heat. Therefore, flashover and life-safety conditions in occupancies protected by commercial sprinkler heads is not really much of an issue.

However the USFA, under the direction of Mr. Shaw at that time, did recognize that when providing protection in a dwelling occupancy, these factors must be considered.

Early experiments with commercial sprinkler heads revealed that the response time of conventional sprinkler heads were satisfactory to control fires in rooms of origin but that they did not eliminate the production of carbon monoxide and smoke density that could possibly jeopardize life safety.

Many communities were engaging in fire behavior tests at this time. Notably fire experiments conducted in San Clemente and Cobb County, Georgia were based on the use of the conventional and standard sprinkler head. In many cases, these fires generated a sufficient amount of heavy smoke and carbon monoxide before sprinkler activation as to render the room untenable by anyone other than a trained firefighter.

**FACTORY MUTUAL TESTS**

At that time the research project funded by the USFA was expanded to include the evaluation of sprinkler heads being developed by manufacturers in cooperation with Factory Mutual Research Corporation. Both Central Sprinkler and Grinnell were
extensively involved in creating a new head which would be more responsive to the conditions required to keep a dwelling safe from the products of combustion. This sprinkler head was utilized at the test site in Marina Del Rey, California under the supervision of Division Chief Don Manning of the Los Angeles City Fire Department. The results of these tests were instrumental in moving the development of new sprinkler standards for dwelling occupancies another step along.

Other tests were conducted on mobile homes in North Carolina in cooperation with the Neely Insurance Agency and the Charlotte Fire Department.

Upon complete evaluation of the research results, the NFPA 13-D Committee reconvened. After considerable discussions, and not without debate, it was advised that the new standards incorporate a new term “Quick Response Residential Sprinkler.” As a result of this development, there have been significant changes in the design criteria for sprinkler systems in dwelling occupancies, such as sprinkler spacing, distance from walls, height on the walls that the water must strike, water density, limitations of water supply, and the new plumbing configurations. Central Sprinkler Corporation was among the pioneers in developing
These new designs are radically different from concepts of the original NFPA 13.

Because of the nature of the standard setting process, there was a considerable amount of time spent on the scientific justification for changing criteria. Many communities facing rapid growth were dealing with alternatives to manual fire protection forces and were either evaluating or writing similar standards to deal with local problems.

**THE MARRIOTT COMMITMENT**

Many of these applications were for specific purposes such as hotels, motels, and dwelling occupancies under the supervision of large corporations such as the Marriott Corporation. Sonny Scarff, an early pioneer in the use of sprinkler systems, became instrumental in sprinkler installation in a significant number of hotels around the country.

**NITINOL**

Studies began to proliferate regarding new possibilities. One project was conducted with Quick Response Sprinklers and involved the use of the metal nitinol.

A study was performed by the Battelle Corporation under a USFA grant in 1979. The purpose of the grant was to explore the feasibility of a sprinkler head using a "memory metal." Most standard sprinklers are activated by the fusing of a low temperature solder link or the expansion of an encapsulated liquid. When the systems activate, they release seals over the water openings, thereby initiating water flow. The nitinol sprinkler, on the other hand, is a fast acting "on-off" sprinkler. The final report on the nitinol head was produced in September 1982 and demonstrates that nitinol metal has the ability to actuate a residential sprinkler head with a sufficiently fast response time to meet the special requirements of a residential occupancy. Unfortunately, the nitinol material has not been adequately introduced, at the time of this writing, into the sprinkler industry and is not a viable product at this time.
CONTINUING THE EVOLUTION

Another of the early pioneers, Fire Marshal Jerry Lambert of the Dallas, Texas, Fire Department, was extensively involved in the development of a residential tract located in downtown Dallas which allowed specific construction trade-offs for the installation of sprinklers, probably one of the first tracts in the country intentionally developed with that concept. It was known as the Fox and Jacobs Project.

Like the proverbial tom-tom drums of the Indians, the beat of increased emphasis on residential sprinklers continued through the late 1970s and into the early 1980s.

CONFERENCES AND SEMINARS

The USFA sponsored numerous conferences on the technology and invited individuals from all around our country and the world to exchange information. These conferences were instrumental in forming many of the links as the spider web of communication and information networks continued from coast to coast. Many of the individuals involved, advocates of the system, became close personal friends during that time and began to exchange information on a more systematic, frequent basis.

One of the most important aspects evolving from these networks of information exchanges was the development of support materials and libraries of information compiled by communities attempting to advocate residential life safety systems. One of the ideas taking off at this time was the development of “residential sprinkler trailers,” mobile homes equipped with residential sprinklers, designed as demonstration devices to show “experimental fires” which could be taken to specific locations to be shown to legislators, politicians, and building officials.

Subsequently, a sprinklered trailer was shown on nationwide television with celebrity Jack Palance sitting in it when the scenario fire was set alight. These trailers, funded by the USFA, have been distributed throughout the entire country and have served as the models for development of many training trailers built by local communities.
information exchange network of the late 1970s began to develop a trailer funded by his department in cooperation with the private sector. Central Sprinkler Company was among those who paid for portions of the materials for the construction of this demonstration. Literally hundreds, if not thousands, of individuals have subsequently witnessed fire demonstrations in these trailers.

The concept has grown to the point where many communities, instead of waiting for federal trailers to come to them on a rotational basis, have opted to build their own.

*The residential fire sprinkler trailer designed and built by the Salinas Fire Department.*

**PORT ANGELES, WASHINGTON**

Fire Chief Larry Glenn of Port Angeles, Washington, for example, built a trailer in cooperation with the private sector and has engaged in burn exercises involving everyone from State Senator to insurance commissioners to local politicians in the state of Washington.

**HOME IMPROVEMENT MAGAZINES**

Sunset Magazine in 1984 produced one of the first major magazine articles on the subject of residential sprinklers. Writer Channing Dawson of that publication participated in an actual retrofit of a home in San Clemente which was subsequently
printed in that magazine. Both Popular Mechanics and Popular
Science have published articles on residential sprinkler technology.

STATE GOVERNMENT

State government has not been lacking in focus of interest on the residential sprinkler concept either. In the state of Alaska legislation has been advocated that improves upon the economic condition of sprinkler systems. In the state of California, legislation was introduced and passed which actually removes the cost of built-in fire protection from the assessed valuation of the building, thereby making the building more inexpensive with relationship to taxes.

PTI

Public Technology, Incorporated, a private non-profit corporation in conjunction with the USFA, co-hosted a residential sprinkler installation workshop at the National Fire Academy in Emmitsburg, Maryland. At this workshop most of the roleplayers who have been mentioned earlier were invited to participate in a brainstorming session of how to get residential sprinklers into the marketplace. This workshop, which was subsequently documented in the International Association of Fire Chiefs’ Magazine, developed a flow chart and established some criteria that many communities have since utilized in the development of local residential sprinkler systems ordinances.

THE COALITION

In approximately 1982 Tom Kelly, representative of the Society of Plastics industry, participated in a residential sprinkler program. Upon completion of that program and while engaging in conversation with the participants, Tom produced The Coalition for Home Fire Sprinklers. The group has enlisted the cooperation of such luminaries as Shirley Jones, Marty Ingels, Kareem Abdul Jabbar, Steve Allen and a host of fire chiefs. The Coalition’s role is primarily that of spreading information and improving public awareness.

OPERATION SAN FRANCISCO

Sonny Scarff, Harry Shaw, Jerry Lambert and many others involved in the discussion of sprinkler systems in high rise buildings had an opportunity to burn a building in Ft. Lauderdale.
Florida. This experimental fire, hosted by the Marriott Corporation, was conducted in order to study justification of retrofitted sprinkler systems in high-rise hotels. The burn, attended by several hundred fire officials from all over the United States, was a tremendous success. In fire after fire, sprinkler systems utilizing plastic pipe and the new fast-response sprinkler heads controlled fires to the smallest possible areas.

The success of the Ft. Lauderdale program gave birth to "Operation San Francisco." Sonny Scarff, working in cooperation with many other organizations including the International Association of Fire Chiefs, headed a major project conducted in San Francisco, California. Using methodology derived from the Ft. Lauderdale burns, Scarff and hundreds of other fire officials converged on a large condemned building in downtown San Francisco at the same time the California League of Cities was hosting its annual conference. Fire after fire was built in the building to demonstrate the effectiveness of this new technology. Further, these fires showed the relative effectiveness of such devices as smoke detectors and smoke removal systems.

Operation San Francisco was attended by thousands of fire officials, many there at the invitation of the Marriott Corporation, some from the League of Cities, others piqued by professional curiosity. Here and there, all over the country, people began to focus on this concept. There was a significant increase in the technology.

**SCOTTSDALE AND COBB COUNTY**

Experiments are one thing, reality another. As brush stroke upon brush stroke was applied to the canvas of the residential sprinkler picture, it became apparent that this was no fly-by-night concept.

While all of these experiments were going on around the country, several communities had already moved ahead with implementation of ordinances. San Clemente, California adopted the sprinkler ordinance in 1978. Chief David Hilton of Cobb County, Georgia, moved ahead with the development of the concept of trade-offs or "building design freedom" in exchange for automatic sprinkler systems.

Scottsdale, Arizona, a community protected by one of the largest private fire departments in the country, expressed interest
n this technology. Chief Lou Witzeman and Chief Bob Edwards began experiments including everything up to the point where they actually set fire to a live building which had been sprinklered by the building developer.

The spider web-like communications network was in place as these communities began to feed from the other's information sources. For example, when San Clemente instituted its ordinance in 1978, Chief Lou Witzeman flew to San Clemente to serve as an expert witness. Conversely, when Scottsdale was to hear its ordinance in 1985, this author reciprocated with a trip to that City to testify.

STUDIES AND RESEARCH

Study after study has been instituted by various agencies at the federal level with regard to residential sprinklers. For example, the Consumer Products Safety Commission has produced a document, "Cost Benefit Study of Residential sprinklers." In the state of New York there was an economic analysis written dealing with the issue of retrofitting sprinkler systems into businesses.

A bibliography found at the back of this book cites most of the references giving basis to this historical perspective. Ten years ago a bibliography would have fit on one page. Today it is a dynamic and living document changing almost daily.

SUMMARY

Since the "modern" beginning of this concept in 1934, no one can actually claim to be the father, not unless that one is willing to accept multiple parentage. The interest in residential sprinkler technology has evolved over a considerable number of years and has been radically influenced by the actions of many individuals.

As recently as the writing of this chapter, communities are still conducting experiments into residential sprinkler concepts. The City of Anaheim, California, under the direction of Chief Bob Simpson, executed an experimental burn attended by several hundred fire officials from all over Southern California. The major sprinkler companies on an almost daily basis are interacting with communities around the country in an attempt to improve the performance of these systems.
The automatic sprinkler system has traveled a tremendous distance from the original idea of perforated pipes. The modern systems are hydraulically calculated, aesthetically pleasing, and scientifically valid. It is a form of technology evolved through the three basic stages of change.

The first stage of any new technology is always met with resistance; the second, or validation stage, is when that technology proves to the professional community the concept is valid. Automatic fire protection is now a fact of life in many communities. It is both cost-effective and has a measurable effect on those communities. In a recent issue of the ICBO’s Building Official magazine, reviews a study done in the city of Fresno. Authored by Joe Randall, this study firmly established that over a sixty year period a retrofitted sprinkler ordinance for downtown Fresno had a direct and measurable effect on fire losses. During the first thirty years without sprinkler systems a certain number of fires and a specific amount of loss occurred. In the next thirty years, with the area completely retrofitted with sprinkler systems, there was a ten percent increase in fires and a ninety-three percent reduction in fire loss.

Residential sprinkler technology is moving to the third stage of development, that of acceptance. It is rapidly becoming a necessity in many communities.

It is entirely conceivable that twenty or thirty years in the future that a person would no more think of building a home without automatic fire sprinklers than they would of constructing that same edifice without electrical outlets and solar panels to provide electricity. The idea of built-in fire protection can justifiably be viewed as an idea whose time has come.
If this Contractor mailed out 500 contract forms supplied by us—
he would be BUSY

An Installation Agency for the Grinnell "Junior" Sprinkler System will earn
$5,000 a year, if it keeps
only one workman busy
on an average.
And one workman can do
a job with no helper.

A "Junior" Sprinkler System in the
basement here required
8 Speedex Heads
$25.00 PROFIT

A "Junior" Screen in the
basement here required
12 Speedex Heads
$35.00 PROFIT

WHAT THE GRINNELL
"JUNIOR" SPRINKLER SYSTEM
IS AND HOW IT WORKS

The only thing you can count on in fire is
heat. No matter where, when or how for
starts it will generate heat. This is the
first fundamental a fire

"The warning in your water will put out any.
If the heat can be made to turn on the
water—fire danger would be gone.

With the Grinnell "Junior" System, that is
exactly what happens. There is nothing
different to the system except an automatic alarm
which tells you that there is a fire and that
the system is putting it out.

With the Grinnell "Junior" System flexible
sprinkler tubing is connected to the domestic
water supply and water flows through the System
without the usual fastening and nuisance at regular
intervals Grinnell Sprinkler heads. These heads are held tightly shut by a
special contrivance which will open only
when subjected to a temperature of 135
degrees. When a sufficient water issue from
the tubing and is broken up by the heads
into a pressure driven rain. When the fire
starts—the head starts—a fast the head starts
the water starts. When the water starts
the fire goes out.

As soon as water flows through the tubing
to an open head an alarm is automatically
sent to the alarm company.

YES, WE HAVE THE AUTHORIZED
AGENCY FOR THE GRINNELL
"JUNIOR" SPRINKLER SYSTEM.

A SELLING AS THE BILLS GETS
BACK, I WILL TELL HIM TO
GO RIGHT OVER AND GIVE
YOU AN ESTIMATE.

MRS. SMITH'S BASEMENT
WAS DONE FOR $5.00.

DETAILS AND GENERAL INFORMATION
GRINNELL "JUNIOR" SPRINKLER SYSTEM

The Grinnell "Junior" Sprinkler System is unique in the simplicity of
its design. By referring to the
illustration of a typical installation

GRINNELL SPEEDEX SPRINKLER HEAD
(Patented)

This provides for more even distribution of water and
pressure, no matter where the operating sprinkler may
be. The sprinkler heads on this system are installed in
a permanent position which greatly
facilitates erection of the tubing as
the same can be attached directly to the
ceiling by means of clip hangers. The
sprinkler heads are spaced ten to twelve
feet apart and due to the special de-

GRINNELL SPEEDEX ALARM VALVE
(Patented Patented)

"Long" of the sprinkler
valve proper. Ordinarily
the check in the valve is
closed in the water main.
Bob Hennessy was born in Boston, Massachusetts, practically within the shadow of the NFPA building. However, for the first three decades of his life, his interest in the fire service was not any more nor any less than any other civilian. In fact, Bob's primary interest was in geology. Graduating from Rutgers University with a bachelor's degree in geology, he was offered a commission in the United States Marine Corps and accepted.

Like hundreds of thousands of other young men, Bob found himself stationed in Southern California at Camp Pendleton in the early 1960s. The Korean War was over and the Viet Nam War had not yet started. There he served as a member of the Pioneer Battalion, a Marine Corps outfit devoted to construction and improvising engineering solutions near the front lines. During his tenure as a Marine Corps officer, his interest in fire was limited to the brush fires which swept over the hills and down into Camp Christianito each and every summer.

Upon leaving the Marines, Bob found himself part of the burgeoning work force in Southern California. Answering a newspaper ad, Bob was interviewed by the Pacific Fire Rating Bureau in 1962. Many Southern California communities had experienced very rapid growth after the close of the Korean War, and the Pacific Fire Rating Bureau was struggling to keep up
with the demand for insurance ratings. While Bob did not have an engineering degree in fire protection, he did have the technical skills and background to handle complex ISO formulas, so he was hired.

From 1962 until 1967, Bob gained a broad, technical background in fire protection. Making up for the lack of his exposure to it in his younger years, he participated in the Insurance Standard Office grading of many of the communities in Orange County and developed a considerable background in the use of the grading schedule. During his time with the Pacific Fire Rating Bureau, that organization underwent transition and was renamed the Insurance Services Office.

**THE ORANGE COUNTY FIRE DEPARTMENT**

There was a lot of expansion going on in the Orange County Fire Department at the same time. In 1967, Orange County was protected by the California Department of Forestry (CDF) under the direction of Chief Elmer Osterman. The Fire Protection Division, which did most of the fire combat work, was manned by CDF firefighters, however, the Fire Prevention functions were handled by some county employees who did not work for the CDF. The head of the Fire Protection and Prevention Division at that time was a gentleman by the name of Ray Suess. Many of the more experienced fire officers in Southern California recall Ray’s extensive involvement in arson investigations.

Like Ray, Elmer Osterman was also a man who believed in looking forward. Under Elmer’s direction, both the fire combat and the fire prevention divisions began to wrestle with the development processes of Orange County. One of their decisions early on, was to build a fire prevention staff with substantial technical background.

In 1967 Bob resigned from ISO and became one of the first fire prevention officers for Orange County. From 1967 until 1974, Bob performed many of the routine tasks of fire inspectors around the country. He conducted plan checks, worked with developers and contractors, and attempted to marry the problems of fire code enforcement with the complexities of land use and development. During this same period, Bob gained an appreciation for built-in fire protection’s minimization of risks.

His background in engineering at the ISO, coupled with
his experience in innovating and improvising as a member of the Pioneer Battalion encouraged a sense of professional curiosity regarding the possibility of building fire protection into structures. Early in the 1970s Bob wondered if some of the risks that he was asked to protect would be better served if they were equipped with automatic sprinkler systems. Like many other people, however, he was unable to find the right combination of circumstances and technology to implement this concept.

With the reorganization of the Orange County Fire Department in 1974, Bob was promoted to the position of Fire Protection Analyst. Ray Suess had retired from the Department and Elmer Osterman had also moved on. The new Chief was Carl Downs. Without hesitating, Bob placed his emphasis on planning the future of Orange County instead of concentrating strictly on routine fire inspection matters.

**EARLY INFLUENCES**

Simultaneous to his growth and development as a Fire Protection Analyst, Bob was also teaching the ISO grading schedule at California State University at Long Beach. Teaching a course at Santa Ana College during this time, he frequently got into discussions with his students and other professional fire officers about the use of built-in fire protection. This curiosity was further promoted by the fact that the United States Fire Administration conducted one of its pilot courses on Master Planning at this time. Bob was one of the twenty-five or so selected individuals who participated in that program at Asilomar. During those discussions questions were again raised as to whether sprinkler systems might be a viable means of protecting certain tract developments.

Bob was an innovator, but he was never far away from his engineering background. After all, he had served under John Colton and Lauren Marks in the ISO and knew the value of doing his homework before he made any rash judgments.

When pressed to describe exactly what it was that swayed his interest in the favor of residential sprinklers, Bob will readily admit that he is not really sure. Reflecting back upon the exposure he had with the wide variety of individuals, he indicates that some of the writings of Dick Patton, a fire protection engineer from Sacramento, raised many questions in his mind that prompted
his curiosity. Further, he was involved in a growing network of people interested in sprinkler technology at that time.

Between 1974 and 1975, there was a lot of interaction between the fire prevention office and those participating in residential sprinkler development, including this author and several others such as Lane Adams from the Copper Development Corporation and John Viniello from Grinnell.

**UNIQUE PROBLEMS**

Around 1976 the Orange County Fire Department faced a rather unique problem. Initially, the idea that Bob had been working on was the development of sprinkler systems for housing tracts. As Orange County began to grow up out of the flatlands and into the foothills, property owners began to develop areas that were extremely difficult to serve with conventional fire protection. These included homes sitting in areas of very, very rough terrain and elevated high up on sides of hills for scenic views. All this necessitated the development of custom-made fire protection for rural estates.

Quite frequently, access to these properties was severely limited. In many cases, it consisted of private, narrow, very steep driveways that were anywhere from 500 to 1000 feet in length from the closest public street. In many cases, the roads were one way. In a large number of cases, the buildings were sufficiently large to generate significant fire flow.

According to Bob Hennessey, it just did not make sense to require that a standard fire hydrant served by a minimum of a six inch main be installed for each and every one of these custom homes. In the first place, this would be extremely difficult to achieve technically, and in the second place it would be extremely expensive.

Engaging in discussions with property owners, Bob raised the question of the cost of residential sprinkler systems compared to the cost of installing a fire hydrant and a six inch main. In many cases owners selected the built-in fire protection system strictly because of economic reasons.

Relying extensively upon his fire protection engineering background, Bob opted to use a totally different approach to providing residential sprinklers. In the first place, there was no viable standard published in 1978 for these types of installations.
The 13D system that was in the document stage at that time was uneconomical and extremely difficult to construct. Therefore, he took what was among the first risk taken by professional fire officers in advancing the state of the art. He opted to install residential sprinklers off the domestic water system.

The first few systems he installed consisted primarily of standard one-half inch commercial sprinkler heads. These were supplied by one-half, three-quarter, and one inch copper piping connected to the domestic water supply. These copper systems did not have some of the more conventional devices. For example, they did not have bells, alarm valves or drain valves. However, the systems were very carefully calculated in accordance with NFPA 13D, which was in effect at that time.

**EARLY PROBLEMS**

There was a lot of criticism of these initial systems. Bob experienced a great deal of animosity from many quarters. For example, plumbers were unfamiliar with what he was asking and insisted that it couldn't be done. Members of the building industry opposed the program regardless of the cost, merely because they felt this was one step in the direction of mandating sprinkler systems. True to the Marine Corps slogan that the Corps is always looking for a few good men, Bob pursued his planned course of action despite the criticism. Hundreds, if not thousands, of hours were consumed in working with various craftsmen during these initial installations. Many of the custom home builders, while they opted for the sprinkler systems to avoid the cost of supplying water, still were anxious concerning such things as malfunctioning or aesthetically unpleasing heads. But Bob hung in there.

In 1978, the Orange County Fire Department was faced with something more complicated. Two apartment complexes were proposed in Orange County. These complexes would create a total of approximately 32 new units in an unincorporated County area and would be served by a water company with an extremely limited water supply.

The conventional means of dealing with this construction dictated that water main extensions from adjacent agencies would have been required. This was an extremely costly proposition and would require upgrading of mains, tearing up and reasphalting
This sprinkler head controlled the fire at the Cypress Motel.

the streets, and a wide variety of accompanying problems, all of which had a dollar sign attached.

Instead, Bob Hennessey and his staff proposed that residential sprinkler systems be installed in these complexes. Once again, the initial response was negative, however, by engaging the educational processes with both the developer and the water agencies, it was soon agreed that the residential sprinkler system was by far the most cost effective means of building the complex and keeping it within reasonable financial restraints.

Interestingly enough, this particular occupancy utilized an extension of the same technology that Bob had used in the custom homes. This apartment complex was protected by standard copper plumbing that came right off the domestic water supply, allowing for the relatively inexpensive installation of the system.

During these first few years, there were a lot of problems. In the first place, there was learning experience for members of the Fire Prevention Bureau under Bob's direction. There were frequent consultations with all parties involved. Notably, the proposed systems were being installed by plumbers and not by sprinkler contractors. This meant considerable installation time was wasted because the plumbers had virtually no experience with these systems. In addition, the coordination with the other trades, such as dry wallers, was difficult because residential fire
extinguishing systems were new elements. They had to be planned, coordinated and controlled in relationship to the other disciplines, and there were not a lot of experience in this area.

Bob's convictions continued to be reinforced throughout these first few years by the fact that other communities such as San Clemente, California, Dallas, Texas, and Cobb County, Georgia were enacting sprinkler ordinances at the same time. According to Bob, "As I kept looking at what the real problem was—the residential fire—I knew that we had to stick to the concept."

THE BIA

Reflecting back upon Bob's courage in the early years, he took it upon himself to "beard the lion" in his own den by taking the issue of residential sprinklers right to the Building Industry's Action committee. Approaching Phil Bettencourt of the Orange County BIA Bob requested that the BIA take a look at building trade-offs and attempt to resolve some of the conflicts inherent in this technology. Unfortunately, Bob was not successful at this particular time because of the fact that many of the building trades and associations were unaware of what sprinkler technology was all about. Consequently, they opposed it.

When Hennessey took on the BIA the net result was the production of a document on the whole concept of residential fire sprinkler systems. There was not a lot of encouragement given by the trade at that time, however, he did win one very important concession that has had a marked influence on the growth of residential sprinklers ever since. The BIA did not take an active role in attempting to discourage the installation of the systems. Instead, it preferred to see the installation of these systems on a voluntary or specific circumstance basis instead of mandating community wide.

Bob indicates that if he had known how things were going to go with the process, he really would have taken the issue to the decision makers directly instead of going through the agony of working with the BIA. He feels that he would have "probably pushed a whole lot harder," but he has no reason for regrets.
THE CYPRESS MOTEL

In 1980, a 102-unit hotel was proposed for the City of Cypress. Once again, the development was sited on a parcel of land that provided a limited access to emergency vehicles. Additionally, as in the previous circumstance, this was in an area where the local water company could not deliver the required fire flow. During the plan approval process, the developer was given the option of either sprinklering all the units or making a 35 foot radius cul-de-sac for fire apparatus in the turning area of the driveway. In addition, he was requested to make an expensive water main extension that would result in a significant cost to relocation and street repairs.

Working closely with the property owner, Bob developed a proposed fire sprinkler system that was hydraulically calculated in accordance with 13-D at that time. This system consisted of one-half inch copper pipe installed alongside the domestic system utilizing pendant heads with cover plates. The heads were supplied by three-quarter inch and one inch copper plumbing systems.

Rapid growth and development created the need for residential sprinklers in Orange County.
This was among the first fires in a sprinklered building occurring in Orange County. An arsonist set fire to the second floor in a bathroom where there were no sprinkler heads. This fire spread to the dining and living room area of the upper unit where two heads were immediately activated and they extinguished and controlled the fire. In actuality, no suppression effort was even undertaken as the emergency was originally reported as a “water vacuum” incident by a Cypress Police Officer. The owner/developer of the Cypress motel was so pleased with the minimal loss this fire presented that he stated “Every future complex I build will be protected with sprinkler systems.”

So Bob’s decision to deal with the BIA may have been a temporary stumbling block. However, by using the tract approval process he has been successful in development of the sprinkler concept in Orange County.

DEMAND FOR HOUSING

In the late 1970s the demand for housing, particularly affordable housing, became a major concern of the Orange County Board of Supervisors. Ordinances were passed and housing density bonuses considered that required developers to provide affordable housing.

These projects were very high-density, two to three story townhouses or condominiums. Almost all were served by private streets with roadway widths less than that of public streets, and it was not uncommon to have a single access to a public street. The Orange County Fire Department recognized that a recommendation of denial for such projects would not carry because of the sensitivity of the affordable housing issue. Residential sprinkler systems were required for such projects and this action would eventually result in approximately 2000 protected dwelling units. These systems consisted of standard 1/2 inch pendant heads with 165°F links supplied by 3/4, 1, and 1 1/2-inch copper piping extended from the domestic cold water system. The systems were hydraulically calculated with a demand factor for consumption added.

RESIDENTIAL DEVELOPMENT PERMIT PROCESS

The City of Irvine, one of ten cities that contracts with the Orange County Fire Department, initiated a process within the
Orange County has its first fire in a motel in Cypress California. The damage is insignificant.
zoning code intended to ensure that the quality of services (police, fire, roads, water, sewer, parks, etc.) will be available to residential projects. The fire department feature of this process requires 80% of the future dwelling units to be within a five minute response distance from the nearest fire station. A number of residential development permit applications were filed for projects in north Irvine. These projects did not meet the requirements for the fire department feature and were required to build in additional protection with sprinkler systems. Approximately 1000 dwelling units were partially sprinklered as a result of this process. These homes were protected by small orifice (7/16-inch) heads with 135°F fusible links. Piping was copper connected to the domestic underground service before the main shut-off. All heads were served by a completely separate overhead piping system.

One of these new homes had a fire in a clothes dryer in an attached garage which was extinguished by a single head. Fire and water damage—minimal.

Another fire has occurred in an apartment complex protected with a residential fire extinguishing system at the time this book was being written. The tenants were melting wax for candles in a kitchen oven and left to go to the store. The wax ignited and the fire extended to the kitchen. This residential extinguishing system had small orifice sprinklers supplied by 3/4 and 1-inch copper piping normally extended from the closest cold water fixture unit. Two sprinklers operated and confined the fire to the kitchen. Fire and water damage—light to moderate.

Although jurisdictions served by the Orange County Fire Department do not have a specific fire protection ordinance, the Department has been very successful in offering residential fire extinguishing systems to compensate for a number of fire protection deficiencies. Examples of these deficiencies are:

1. Dwelling units set back further than 150 feet from vehicular access.
2. Sub-standard or no turn-arounds for dead-end streets greater than 150 feet in length.
3. Response from the closest fire station is in excess of five minutes for urban areas and eight minutes for rural areas.
4. The water agency unable to deliver full required fire flow.
5. The water agency able to deliver required fire flow but not for the required duration.
6. An excessive number of dwelling units are served by a single street for ingress and egress.

7. Streets or driveways exceed a 15% grade.

In 1980 the Orange County Fire and Building Departments and several Building Industry Association (BIA) members agreed to a study by a civil engineering firm. This study would evaluate the cost differential for an extensive residential project in South County which was near completion. The cost differential would compare existing water system improvements that were installed (these costs were known) with the cost of fire sprinklers in every dwelling unit plus the cost of water system improvements based on the following criteria:

1. A reduction in fire flow of 50% with a minimum water main size of not less than 6-inch.
2. Hydrant spacing can be increased to 1,000 feet for multiple-family and detached single family residences.
3. Main line valve installations be such that up to four hydrants cannot be removed from service in the event of a break. (Current guidelines suggest two fire hydrants).

Study results indicated that residential fire extinguishing systems were more expensive than the reduction in cost for water system improvements. The principal reason for this was that a master planned pipeline designed to serve other vacant properties and improve the reliability to existing built-up areas could not be reduced in size.

SUMMARY

At the time I am writing this book, the foresight of Bob Hennessey can be credited for several accomplishments:

The Orange County Fire Department has utilized residential fire extinguishing systems to mitigate other fire protection deficiencies and found such systems to be acceptable to developers as an alternative fire protection measure.

The Orange County Fire Department has kept the residential fire extinguishing systems simple and economical to gain acceptance.

Early systems were installed by plumbers who used normal 1/2-inch commercial heads supplied by 3/4 and 1-inch copper piping extended from the domestic cold water system. Subsequent
systems were required to utilize small orifice heads as it was felt that better results could be achieved, particularly with multiple-family projects, because of the relatively small room size.

There have been three actual fires in dwelling units protected by these residential fire extinguishing systems. In two cases the system confined the fire to the room of origin. In the case where the fire was purposely set in a non-sprinklered bathroom, the fire extended to an adjacent sprinklered area and was extinguished. Two of these fires were in dwelling units that used the 1/2-inch commercial head supplied as an extension of the domestic water system. The third fire, in an attached garage, was protected by small orifice heads supplied from a separate piping system.

There have been no reported cases of accidental or malicious activation of residential fire extinguishing systems.

The Orange County Fire Department currently requires the quick-response residential head and also accepts approved non-metallic piping. It is estimated that approximately 7,000 to 8,000 dwelling units in jurisdictions protected by the Orange County Fire Department have residential extinguishing systems installed.

Because of Bob Hennessey’s idea, many Orange County, California residents are living and working in safer buildings with a higher standard for quality of life.
There is actually a lot of controversy about the significance of one of San Clemente’s greatest achievements. It was the adoption of the first mandatory residential sprinkler ordinance in the entire world. That sounds kind of heavy! In the entire world! In actuality, the City of San Clemente was the first to ever adopt a residential sprinkler ordinance that was an across-the-board requirement for all occupancies. The reason it is controversial is that not everyone agreed with it at the time, and it may be years before the jury returns the final verdict on the effectiveness of the decision.

It was not a decision achieved easily nor was the decision taken lightly. As a matter of fact, it was a combination of economics, philosophy, technology and professionalism all had to come together at one point to even begin to create an environment where the decision could be made.

PRIOR EXPERIENCES

Earlier in my career, as a member of the Costa Mesa Fire Department, I worked very closely with Fire Chief John Marshall and Fire Marshal Robert Beauchamp in the formulation of a commercial sprinkler ordinance. The purpose behind that ordinance was to do something about the devastating losses in the fiberglass
industry. During that research, one thing became evident: automatic fire-protection devices such as the automatic sprinkler system, were extremely useful in restricting fire spread. Their effectiveness was beyond reproach.

Therefore, after assuming responsibility as Fire Chief in San Clemente, I began to ponder the relationship between sprinklers and fire protection. If automatic sprinklers can be so effective in reducing fire losses in industrial occupancies, why couldn't they be used to do likewise in the residential occupancy? It was a matter of public record in the late Sixties and early Seventies that the single-family dwelling occupancy was, by far, the most frequent scene of major-loss fires. On national and state levels, the statistics were staggering. On the local level, they were no less significant. Year in and year out, in the majority of fires in Orange County—and even in San Clemente—where there was loss of life and significant losses in property, the dwelling occupancy was usually involved.

**SOURCES OF INFORMATION**

I would like to say that we invented the concept, but we didn't. Instead, we borrowed it from a gentleman by the name of Richard Patton. Dick is sometimes referred to as the Father of the Residential Sprinkler Concept. As a young Fire Protection Engineer in the Fifties, he began touting the idea that five gallons of water put on a fire when it was still the size of a wastebasket made a lot more sense than 5,000 gallons a minute put on a burning building that was rapidly turning into a parking lot and memorial to ineffective building codes.

Fortunately, for the City of San Clemente, the United States Fire Administration had started conducting research on a similar concept. The United States Fire Administration had been funding several projects for the testing of smoke detectors and built-in fire protection devices. The Los Angeles City Fire Department, under the supervision of Chief Jack Gerard, had entered into a project called the “Marina Del Rey Experiment.” Fire Marshal Don Hodgson and I began to gather a library of all of this research.

**GROWTH PROBLEMS & PROPOSITION 13**

Concurrent with this good fortune, the City of San Clemente was facing some severe concerns. The first of these was the
immminent passage of Proposition 13. For those that will be reading this sometime in the distant future, it should be pointed out that Proposition 13 was the Twentieth Century’s version of the Boston Tea Party. Instead of throwing the English tea into Boston Harbor, however, the taxpayers in the state of California threw the revenue-producing side of government into a complete tailspin. Under the guidance of Howard Jarvis and Paul Gann, an initiative was prepared which basically emasculated property tax provisions for the generating of revenues. Proposition 13 curtailed services of such essential government functions as police and fire protection in many communities. Proposition 13 also had the effect of reconstituting the way in which local governments were funded.

Another issue that the City of San Clemente was facing at that time was one of eminent growth—not just planned, controlled growth, but significant, conspicuous growth. In the 1970s the City of San Clemente was divided into two areas; the Old City, which was predominately on the western side of the interstate freeway, and three large ranches, sprawling like three fingers in front of the freeway, over the ridge lines and down into the back country. These three ranches were owned by major land owners, and all indications were that the owners were going to build housing communities almost concurrently, and in a very short period of time.

The net result of this development would have been a huge increase in fire protection costs for the community at large and a potential threat to the part-paid/part-volunteer fire personnel principle by which we had operated our department since the late 1960s.

After many discussions with department staff, it was decided that we should look at the idea of residential fire protection systems as a means of doing two things. The first of these was to deal with the growth problem. By installing these sprinkler systems as the occupancies moved further and further away from existing fire stations, the fire department would be given another edge in responding to fires that were under control. The second aspect of this decision was that the residential sprinkler system was viewed as a means of cost avoidance. Even though the community would be vastly expanding, the increased potential for fire problems could still be handled by a part-paid/part-
Historically, in Orange County, most communities had attempted to get rid of their volunteer firemen as soon as the community had started to grow. The argument had always been that volunteers were just not satisfactory for fully developed communities. We maintained that homes protected by built-in fire protection systems could not only be dealt with on the attack pumper principle, but would create a fire problem far less difficult to deal with if we continued with our paid and volunteer firefighter concept.

**RESEARCH FOR A SOLUTION**

Our research was both internal and external to the San Clemente Fire Department. Starting in 1974 the Department began to conduct control burns. Every time we obtained a building that had to be destroyed for either redevelopment or for open space, the Fire Department staff took some time to conduct experimental fires using the residential sprinkler concept. Among the first of these fires where these principles were tested was the Resort Motel burn near the Pier and the Elmore Ranch “Hell Week Operation.”

Another thing that became obvious to those of us working on the experiment was that, besides being able to put out the fire, these installations had to meet several other criteria. Among the most critical of these was that the systems had to be aesthetically pleasing and relatively economical to install. This led us in the direction of experimenting with such things as plastic pipe and redesigning sprinkler systems to use components that were considerably smaller than the system components used for commercial applications.

**EXPERIMENTS IN FIRE**

The experimental fires went on for several years. Thirteen separate sets of experimental fires were conducted, using almost every conceivable equipment configuration. Fire Protection Specialist Jim Pengelly, Operations Chief Bill Bundy, Captain G. L. Carmichael (who later became Fire Marshal) and the rest of the Department staff participated in the development of scenarios and experiments to test the system under a wide variety of conditions.
A communications network was set up among all of the other fire protection people experimenting with similar concepts. Among these were members of the Los Angeles City and other Fire Departments who were working on residential sprinklers, including Chief David Hilton of Cobb County, Georgia, John Viniello of Grinnell Corporation, Kathy Vernot of Central Sprinkler Corporation and Jerry Lambert of the Dallas Fire Department.

**US FIRE ADMINISTRATION ASSISTANCE**

The project immediately started attracting the attention of the outside world. Harry Shaw of the United States Fire Administration requested that the City of San Clemente submit a request for a grant. The purpose of this grant was to do two things. First it would allow for the development of an inspection methodology for the installation of these sprinklers. The second purpose of the grant was to write a manual that could be distributed to other fire departments. About this same time, Fire Marshal Don Hodgson was chosen as Fire Chief of California City. When Don accepted the position, Captain G. L. Carmichael was immediately assigned as San Clemente City Fire Marshal and picked up the reins of the residential sprinkler system program.

**ORDINANCE ADOPTION**

The ordinance was actually adopted just prior to Proposition 13 becoming law in California. According to Council Actions records, the ordinance was originally adopted in April 1978, but not without a fight. At that time the City Council was going through a great deal of turmoil. One Council voted for the adoption of the ordinance and it was passed. In a very short time, there was a recall of the Council members for other reasons. The ordinance was immediately brought back up on the floor by the newly-constituted Council as a result of requests by the developers of the ranches.

The night the ordinance was re-evaluated by the Council, the chambers were packed from door to door; there were no empty seats in the house. Because of the importance of this ordinance, not only to the City of San Clemente, but also to the fire service profession at large, several influential individuals were requested to attend the meeting as "defense witnesses" for the staff. Among these were Mr. Bill Goss of the National
Automatic Sprinkler and Fire Control Association; Lou Witzeman of the Rural-Metro Fire Department of Scottsdale, Arizona; John Viniello from Grinnell Corporation; and Russell Henderson from Costa Mesa Fire Department, a Fire Protection Analyst.

My presentation to the City Council that night was almost forty-five minutes long. The staff, which had been very successful in documenting all of our experimental fires, worked long hours preparing a dual screen, 35 mm slide projection program that told the whole story. Fortunately, the Mayor (who was fairly objective about the whole thing) had agreed to let the Fire Department put its presentation on first, before all the criticism was brought to bear by those who opposed the ordinance. That’s probably what made the difference between its passage and failure. By the time the presentation was finished, almost everyone in the audience had been well-versed in fire behavior, automatic fire protection, manual fire protection and the discrepancy between the two.

It didn’t take long for the developers and real estate people to voice their objections. Interestingly enough, there were large numbers of them yet few had much to say. Most of their objections were non-technical in nature, and were founded on the assumption that People should be allowed to burn themselves up in their own homes if that’s what they want to do.

The action taken by the Council next almost caused a collective coronary among the Staff. One of the Council members, who had just recently been elected, was not quite sure of how to handle the vote. Councilman Ed Kalsched moved to table the ordinance. Unbeknownst to Ed, the motion to table actually was a motion to kill the ordinance. What he was really trying to do was to keep the ordinance as it was and to make no changes in it. It didn’t come off that way! His motion to table the ordinance was seconded by another Councilperson. The Mayor, thinking he had correctly read the signals as to what was going on, called for the question. The motion was voted on and the vote was 5-0.

I could almost feel my heart come up from the depths of my chest cavity to lodge sideways with my tonsils. Years and years of work seemingly went out the window with that motion. The developers and those who had voiced their objections, feeling very proud of themselves at this point, got up and noisily left
the Council Chambers. Chief Carmichael and myself and those who had come to support the Sprinkler Ordinance remained sitting in the audience, stunned. The Mayor, sensing the buildup of all this pressure, called for an immediate recess of the Council. With the crack of the gavel the five Councilpeople stood up and moved towards the exits to get some coffee.

I couldn’t really believe that what had happened had really happened! I left my seat, went to the back, walked up to Councilman Kalsched and those standing around him and asked him why he had voted to kill the ordinance. The question was not threatening, but rather was directed to see where I had gone wrong. Ed’s answer was even more startling: “Why, Ron! I didn’t vote to kill the ordinance. I voted to put it back on the table, leave it alone, let it stay the way it is.”

The Mayor had an almost panicky look in his eyes. The City Clerk immediately gave the Councilman a brief lesson in ROBERT’S RULES OF ORDER, and a silence came over the coffee room like none I had ever witnessed before.

The Mayor, who felt the responsibility for this situation, asked Ed if that is really what he wanted to do. The answer was: “No. I feel that the ordinance is good for the City in the long run and that it should be continued.”

After the recess, the Mayor banged his gavel down. The first order of business was that the previous motion be returned to the Agenda. The now-deserted Council Chamber was witness to Ed’s confession that his motion was out of order and that it was not his intent. A substitute motion was made or some other such parliamentary procedure, and Councilman Kalsched’s original motion withdrawn. The motion was restated to retain the ordinance as written and the vote was then taken.

The vote was again 5-0. A slight misunderstanding that had significant impact had been reversed in a matter of ten minutes.

Frankly, I have never figured out why the developers didn’t have a tremendous upheaval after the news was made available to them. They had walked out of the Council Chambers thinking they were winners and awoke the next morning to read a newspaper headline stating that the ordinance had been retained. It was very interesting that they did not only not react, but almost shrugged their shoulders and said, “Well, if that’s the way it’s going to be, that’s the way it’s going to be.” Even those who
were the most bitterly opposed to the ordinance seemingly accepted the Council's ultimate decision.

That doesn't mean that they weren't upset and to this day, some of them still bear grudges about it, but, in the final analysis, they effectively did nothing about the Council's decision.

Someone once said that timing is everything. As I indicated earlier in this chapter, someone once asked us how we got to be an overnight success without residential sprinkler ordinance. It had nothing to do with our knowledge on the subject. Instead, the City of San Clemente became the leader in the world in residential sprinkler technology because of the convergence of a wide variety of circumstances that ALLOWED us to be the first. The deterioration of the tax base, the impact of rapid residential growth, the political upheaval of the community, our preparation with having the right answers at the right time and the naivete of politicians and practitioners all served to create a tiny window through which the residential sprinkler ordinance slipped into the fire profession.

SUMMARY

Since that date, of course, others have adopted the concept and used it for other purposes and have been even more successful in getting specific applications on a voluntary basis. But the fact of the matter is that San Clemente could have been just another notch on the loss ledger except for that conversation in the coffee room. A brief clarification of a motion, a man who was willing to admit that he had made a mistake, a Council that was willing to take the risk—all helped to put San Clemente on the map as one of the most progressive fire protection agencies in the country.

The legacy of that decision will, hopefully, be felt decades from today when other communities or even the citizens of San Clemente see the reduction in loss of life and property because of the installation of these life-saving devices. It's really doubtful that those who will enjoy that protection decades from today will ever remember the names of those who helped shaped the fire protection environment, but it should be written somewhere that Richard Patton thought it up; City Manager Gerald Weeks had the confidence to let us move forward with it; that my staff—Don Hodgson, Gary Carmichael and Inspector Ed Harrod—had
the technical capacity to make it work; that the young inquisitive minds of our firefighters—such as Bill Bundy, Jim Pengelly and Dave Cisar—helped shape experiments to justify it; and that Councilman Ed Kalsched and Mayor Roy Hamm had the courage to support the decision.

In my own opinion, fewer programs have ever been proposed that have had as significant an impact on the American fire problem as the residential sprinkler system concept.

There is an old saying in this business: "Don’t reinvent the wheel.” We didn’t invent residential sprinkler systems. We were merely the first city to accept the fact that they were as much of our fire protection delivery system as any other element. We made them work. And that is something for which every San Clemente firefighter should be proud.

Byron Chaney said it best: “Manual Firefighting is antiquated and dangerous.” Automatic sprinklers can save lives, property and provide for a better quality of life.
There are a lot of stories about the man. It was once told that he incited his installation crews to hold road races to see who could get to the scene of a contract job first. He has the reputation of being for the underdog.

He is a fighter, an innovator, a family man, and a leader.

It is no surprise that Bill Meyer has found himself on the leading edge of the sprinkler market—and he has been there for the last thirty years. The development of the Omega line of residential fire sprinklers is a natural extension of Meyers' commitment and involvement in the development of modern fire protection.

Bill was born in Chicago, Illinois, December 23, 1920. When World War II broke out, Bill found himself attending the University of Notre Dame. He graduated from there in 1943 with a bachelor's degree. From 1945 to 1947 he was busily occupied with two major projects. The first of these was studying law at the University of Notre Dame. The second was conducting the courtship of Mary Kathleen Hampsh.

In 1947 these two activities underwent a coalition that were to ever affect the quality of Bill Meyers' life. In the first case, he completed his study of law and became a pipe fitter with the Automatic Sprinkler Corporation of America. In the second,
he asked Mary Kathleen to become his wife.

Bill's love affair with Mary Kathleen has produced a family of eight children and ten grandchildren. His love affair with the sprinkler industry has produced a family of sprinkler device products that are affecting the lives of literally millions of people daily.

It certainly wasn't easy at the outset. When Bill started with Automatic Sprinkler Corporation, the job required that he travel and from 1947 to 1949 he traveled constantly, taking Mary Kaye and the children with him.

In the short period of two years, Bill developed quite a reputation. In 1949 he was given the opportunity to enter the company sales program, on the condition he move to Youngstown, Ohio. He immediately saw that this sales program had a future to it and started taking engineering courses at night at Youngstown State University. In 1951, he became a contract engineer. The job was demanding and required, once again, that he pull up his roots and move to another part of the country. So, the entire Meyer family, bag and baggage, moved to Richmond, Virginia.

Then he was named Regional Sales Manager for Automatic Sprinkler for the Milwaukee Region which included Chicago, where he again re-located his family.

Life certainly couldn't have been boring for the Meyers family as it continued to grow. According to his son Steve, the Meyers were a good Catholic couple and practiced "Catholic Roulette" resulting in the proliferation of other Meyers who would subsequently become involved in the sprinkler business.

Seemingly every two years there was change in the family home place. In 1954, Bill and family were moved back to Youngstown where he became the Assistant Sales Manager for Automatic Sprinkler Corporation of America. Then, in 1956, he was appointed as the Manager of the East and Southern Sales Regions of that company. Obviously, Bill had a talent that could not be suppressed and was promoted in 1964 to National Sales Manager working out of Youngstown, Ohio.

Bill had eyes on a different kind of future. As his family grew in size, he realized that if we was going to be able to control that future he needed to be his own boss. By this time there were eight children (Bill, George, Steven, Mariah, Martha, Annie, Marilyn, and Johnny.)
Over the years, Bill had developed a close personal relationship with T. Seddon "Sed" Duke, who had started a company called Star Sprinkler, in Philadelphia. Sed looked upon Bill Meyer as a son. Sed had never had any sons of his own, though he had a daughter. In 1964, Sed Duke decided it was time for him to relax a little, and he put his company up for sale. Honeywell had made an offer for the company, but because Sed liked Bill, he offered to sell Star Sprinkler to Bill for less money than Honeywell had bid.

When the opportunity came to buy Star Sprinkler it took every ounce of inventiveness and innovation on the part of the Meyers to scrounge up the funding to purchase the company, but that purchase allowed Bill to move into another area of fire protection, that of design.

Sed Duke remained happily with Star Sprinkler as Chairman of the Board until his death in 1968.

When Bill purchased Star, which required a move to Philadelphia, the gross sales were about 1.2 million dollars a year. Utilizing some innovative and most creative sales techniques, Bill took Star Sprinkler's sales to nearly nine million dollars in the short period of two and a half years.

The way he accomplished this was indicative of the Meyer style. Star was not a large part of the market at that time, so he went to all the managers of sprinkler installation companies whom he knew and trusted, sat down with them and talked straight. According to Steve, Bill convinced these individuals to become sales managers for him. He said "I'll give you instant credit and I'll give you all the education on sprinkler devices I can, and I'll give you as much time as you need to pay me off because I need someone out there to sell devices!" He hired people as salesmen and made them their own bosses. He motivated them to go out and install sprinklers, at the same time making sure they were Star sprinklers.

Another of his innovations while Bill was President of Star was a concept called "Scholar Stamps." When a contractor bought sprinkler heads from Star he was given the opportunity to receive a discount on the price if he paid on time. If the contractor did pay on time, Bill would take a percentage of the purchase and put it into a fund that that company could use for any employee to go to college. Further, Bill agreed that, over a period
of time, he would match any funds that accumulated in that account. Obviously, if a contractor bought consistently over four or five years they could have had several thousand dollars in such a scholarship fund. The Scholar Stamp program was innovative and creative; however, like so many other projects, it was highly dependent upon the leadership of the organization to sustain it. Once Bill left Star, the company discontinued the program. To this day, though, Bill Meyer is still honoring some of those Scholar Stamps at Central.

During this same time, the entire built-in fire protection area was changing. Back in the early 1950s there were fewer than 300 national contractors. Today there are probably over 3,000. After taking Star from $1.2 million to $9 million in sales, Bill started looking out over the horizon and seeking new challenges. In 1968 Bill sold Star Sprinkler to the Insurance Company of North America Corporation (INA), and became the Vice-President of the Manufacturing Division of that company. In that capacity he simultaneously controlled three manufacturing companies: Star Sprinkler, Safety First, and Air Valves.

While Bill continued to exercise his leadership role at INA, one particular event among the vast array of his accomplishments may have started the entire residential sprinkler system movement. That event was the invention of the “Unspoiler”—a sprinkler head designed to be concealed.

Originally, it was designed for Disneyworld in Orlando, Florida. According to Steve, Bill sat down one evening with his brother-in-law, Bob Anderson, and designed a cover and can that would conceal a regular sprinkler head. This design proved to be very popular, selling over 150,000 heads the first year of its manufacture.

Most communities really serious about use of sprinkler systems in residential occupancies started developing their research and ordinances about that same time. The Unspoiler was a key role-player as it dealt with the most serious problem facing the residential application—aesthetics.

Restless as ever, Bill continued to serve as Vice-President of INA until it became apparent that it was time to move on again. By that time he was managing several different kinds of companies, some of which had nothing to do with sprinklers, and, according to his family, “His whole love IS sprinklers! He
really didn't want to bother with the other things—he was strictly a sprinkler guy."

So, in 1973, Bill left INA and purchased a small, relatively unknown company called "Central Automatic Sprinkler."

The year that he became President of Central, annual sales were $350,000, most (probably 50%) overseas. The reason for this was that Central's products were not state of the art. They were selling at low prices as, in many cases, the product didn't have proper approvals in this country. And, at the same time, Central was also in the business of installing sprinklers.

The first thing Bill did when he brought Central was to get out of the construction business. It was his desire that Central Sprinkler become strictly a manufacturing company. He brought along Bob Anderson, his brother-in-law, who at that time had been Vice President of Engineering at Star Sprinkler. The first thing that Bob and Bill did was to redesign every product that Central was manufacturing.

The proof of the pudding, of course, is in the results. Today, Central Sprinkler has sales of approximately $35 million—in eleven years the $350,000 has become $35,000,000.

Bill Meyer at the scene of the Retrofit test in San Clemente.
Throughout his career, Bill has continued to provide leadership in areas dealing with motivation and education. For example, he started the first national seminars and conventions for sprinkler contractors while he was at Star. He continued that by becoming the first chairman and last non-paid president of the National Automatic Sprinkler Association (NSFCA).

He was among the first to start educating his sales force in the design and engineering concepts of sprinkler systems. He set up courses on hydraulic calculations. He went to the contractors and set up courses of instruction, gave them inexpensive computers, and then educated them in engineering concepts using those computers.

He conceived the idea that limited area sprinkler systems could be doing some good for some sprinklered risks. By using on-off heads and calculating the system very carefully, he was able to go to buildings that were not required to be sprinklered, and, by working with an insurance company (Scottish and York), was able to get the insurance company to give them a partial sprinkler rate. Subsequently, many buildings which would otherwise not have been sprinklered were fitted with partial systems.

Long the champion of private enterprise and the capitalistic system, Bill was asked to serve as co-chairman with Sylvia Porter on President Ford's Committee to Control Inflation in 1975. The "WIN" Project was his idea. Deeply committed to the idea that the way to deal with economic ills was to be more productive, the Meyer family under Bill's tutelage continued to branch out, taking on more and more projects. Among these, in 1979, was Meyertech Corporation which manufactured quick connect sprinkler fittings for cast iron and steel pipe. At that time it was quite revolutionary. Subsequently that company was sold to ITT Grinnell, which still handles the manufacturing of that project.

Bill Meyer is that rare blend of family-man and fighter who believes in making things happen rather than talking about them. He tends to see solutions instead of obstacles. He is a motivator, and a mentor to many in the industry. He donated time and personnel to start another organization significantly adding to the American fire protection scene, the American Fire Sprinkler Association. Recently in San Antonio, Texas, the AFSA awarded Bill Meyer the Henry Parmalee Award, one of numerous awards that have been bestowed upon Bill over the years for his
contributions to the industry.

Bill’s involvement in the Omega project, therefore, was not surprising. Responding to the proposal put out in 1980 by Harry Shaw of the USFA, Bill jumped into the mainstream of residential fire protection with enthusiasm. That enthusiasm to date has seen a commitment of almost $2.5 million in research, resulting in a state of the art residential sprinkler head. Through his efforts, residential sprinklers have now been placed in some of the most important residences in this country—including those homes having historical and political importance to our country. Central Sprinkler Corporation has been intimately involved in providing a high level of fire protection for America’s Attic—The Smithsonian Institute.

All this time, while Bill was forging his way through the wilderness of fire protection, Mary Kathleen continued working at his side, raising a family that has become a large part of Central. In 1984, Bill Meyer turned over the presidency of Central to his second son, George, retaining the position of Chairman of the Board and Chief Executive Officer for himself. Steve is a Vice-President of Central and runs the warehouse in Anaheim, California. Bill Pardue, Mariah’s husband, is a Vice-President, Annie’s husband runs the Dallas operation, and Marilyn is the Vice-President of Distribution located in Philadelphia. The oldest son, Bill, is now a doctor and Martha is married to an hotel manager. The youngest child, Johnny, is completing his education with the goal of becoming a rock star.

The present Meyer home in Wayne, Pennsylvania, is often the scene of gatherings that could best be referred to as “the gathering of a clan.” Thanksgiving, Christmas and other major holidays are often seen, according to Steve, as a combination of board meetings, office parties, and family get-togethers. Before Central Sprinkler went public, the entire corporation was owned by family.

Bill’s family goes far beyond those who are directly related. Early in Bill’s career, for example, he had a very close friend who died at an early age and left a son—Buck Buchanan. Now Buck is every bit as much a part of the family as any member of the Meyer clan. And so it is with Kathy Vernot, who is considered to be somewhat of a “half-sister.”

Bill, in addition to the reputation he enjoys of being a leader
in sprinklers, is a personable and exciting person to know. He forms very loyal friendships. When someone is his friend, they are his friend forever. Probably a major contributing factor to his success is the fact that he trusts people and people can trust him. His humanism and enthusiasm, coupled with his wry and unusual sense of humor, is the stuff from which his legend has grown.

There are many stories about Bill Meyer. In one story related to me by Steve while I was researching this book, Bill was having some problems with a group of labor people one day. George and Steve were both in high school at that time and George was working in assembly. George hated assembly work. He had threatened to quit and go put roofs on or do something else during the summer. Bill didn’t want to see George “waste” his summer doing that so he took him off the assembly line and wrote him into an engineering class. Later that day, the employees were having a big meeting and Bill was talking to the people out in the plant, trying to talk them out of going union.

“I hear you guys say that there have been no promotions,” Bill told the group. “You guys are arguing about the fact that people are not getting promoted...Just today, some gentleman came in who was making heads out here on the assembly line, and by afternoon he was in an engineering course.” Everybody sitting in the room was wondering who it was.

Steve, sitting in the audience and unaware of the circumstances, raised his hand and said “What’s this guy’s name, anyway?” The next day, Steve was out on the shipping dock. But nobody could get mad at Bill, even when he was in the process of conning them.

As of the writing of this book, Bill is 64 years old. Some people, by the age of 64, are looking for rocking chairs and retirement. Bill Meyer is looking for new challenges and new horizons. Almost daily, he can be heard talking about new projects, new concepts, and new directions.

The Greek alphabet, which is symbolized in the Omega line, is as timeless as the stars. Despite the fact that we do not use the Greek alphabet to write letters today, we use it as symbols of things that last. Bill Meyer has become a symbol himself.
Bill Meyer is a big man. His is big in body; he has a big family; he has a big spirit. He is also very big in fire protection. For decades Bill Meyer's involvement in the American fire protection scene has been well known.

It is fitting, then, that Central Sprinkler Corporation be part of the movement towards the residential sprinkler market. And it took a man with a lot of courage to get involved in that movement. In addition, it took a company with strong resources to make that commitment work. Fortunately for the sprinkler movement, both qualities were present in Bill Meyer and Central Sprinkler.

As was noted in other chapters, almost all the initial work being done in residential sprinklers utilized conventional light hazard or ordinary hazard sprinkler heads. Meyer's original work involved the development of the Star concealed-head sprinkler. In many applications proposed by fire departments in the 1970s, the concealed Star and Gem heads were selected for residential application because of their aesthetic appeal.

According to Central, the sprinkler movement first gained their attention in 1976. At that time, systems proponents confronted the suggestion that sprinkler heads were not as responsive to fire behavior as they should be for residential safety. Many of the early tests conducted by Factory Mutual and studied by the
United States Fire Administration indicated that a new type of technology was needed. The primary difference between the residential sprinkler technology and its predecessors was its quick-responding sprinkler head. This concept is further explored in the chapter “When Is a Sprinkler Head Not a Sprinkler Head?”

**OBSERVATION AND INVOLVEMENT**

For the first couple of years, Bill was an observer, despite the fact that he had been at the forefront of many technological advances in the fire service. Central Sprinkler Corporation carefully monitored test results and listened to company advisors. Central wanted to make sure they thoroughly understood the problem and then, if they decided to become involved, they could make a serious commitment. Harry Shaw from the United States Fire Administration had numerous meetings with Ms. Kathy Vernot, who was then involved in Central’s Sales Division, to discuss the possibility of Central’s involvement.

It did not happen overnight. It was readily apparent the work required to make these sprinkler heads function properly necessitated a considerable amount of research time between idea conception and implementation. Kathy continued to work with Harry Shaw to determine the practical value of the idea. The life-safety implications intrigued Central.

According to Kathy, the original thought on Central’s part was that a quick-responding type head might be marketed to libraries since Central was then heavily involved with the United States government, determining ways to protect official documents. The original proposal of a sprinkler head that would go off quickly, thereby extinguishing fires when they were small, was an appealing one to government authorities.

As the studies began to cross both Bill and Kathy’s desks, the life-safety issues were seen as critical. Study after study revealed that the ceiling and eye-level temperatures and the amount of gases generated by fires which were ultimately controlled by ordinary sprinkler heads, were nonetheless excessive in life-safety situations. As the evidence mounted, Bill’s enthusiasm, prompted by Kathy’s continued monitoring of the situation, began to grow.
THE COMMITMENT

In October 1978, a meeting occurred between Harry Shaw and representatives of Central Sprinkler. It was decided that Central Sprinkler would make the commitment to initiate research. Kathy, whose title at that time was Director of Life Safety, began to work with members of the Central Sprinkler staff to start forming parameters for the new head. Bob Anderson and George Pieczykolan of the Central engineering staff spent hours pouring over diagrams and illustrations, trying to come up with a schematic that would meet the new life-safety requirements.

As everyone knows, research of this nature is very expensive. Research expenses began to mount. At the onset, Central’s original estimate of monthly expenses was $50,000. In the final analysis, however, it has been estimated that, since the start of the initial project, Central spent approximately $2.5 million on the development of the Omega line of sprinkler heads.

Initially, the engineering department, Bill Meyer and several other members of the staff had been a little reluctant. However, as the engineers began to realize the significance of what was happening with the new, quick-response technology, their enthusiasm and commitment grew. After tests conducted at Central’s laboratories were reviewed, it was easy to see this new technology had the potential to revolutionize fire protection. Because these sprinkler heads would go off when the fire was smaller and producing less heat, less water would be required for its extinguishment. By the sprinkler head activating more rapidly, it was possible that this type of technology might resolve other problems of installation.

The task of obtaining sprinkler head approval was anything but easy. Bill was totally unwilling to give up until the product or the process had either failed or was completed. Bill’s gregarious personality belies the fact that he likes to fight for the underdog. Everywhere that Central turned in the industry at that time, there were people saying that the fast-response residential sprinkler was unnecessary, unneeded and unwanted.

Kathy’s convictions were equally as strong as Bill’s. Traveling from one part of the country to another, talking to fire officials and discussing the possibilities of this concept, she became more and more convinced that residential sprinkler technology was
on the leading edge of the future of fire protection. Collectively, the two of them continued providing the moral, emotional, and financial support to keep this project moving forward.

Obstacle after obstacle had to be overcome. For example, the original prototype heads were tested time and time again. Each time they failed. According to Kathy's records, the original Omega head was tested 52 times in their own laboratories and failed each time. Instead of viewing these disappointments as failures, Central accepted them as challenges. Central was convinced a solution lay ahead.

The testing got even more expensive as they proceeded to take their technology to the official testing labs. Every time a sprinkler head is tested by Factory Mutual (or Underwriters Laboratory), the estimated cost to the manufacturer is approximately $9,000. Over the several years Central was involved in developing this technology, they had sprinkler heads tested 47 separate times. It doesn't take long to realize that 9,000 multiplied by 47 amounts to a hefty financial commitment to the worthiness of a product.

The field of residential sprinklers at that particular time was hardly crowded with other companies jumping on the bandwagon. In fact, there were only two companies interested enough in
the technology to continue investing the time, effort and money in their prototypes—Central and Grinnell.

To make matters worse, development of a prototype was like trying to hit a moving target. As research moved forward in the area of temperature ranges and toxicity levels, old standards used to evaluate heads had to be re-evaluated. Therefore, despite the fact that many of the heads had performance ranges within the old standards, they had to be redesigned and more finely tuned in order to meet the new standards.

Bill Meyer's enthusiasm for the product never wavered following his initial commitment. Time after time, when experimental fires or demonstration burns were conducted, Central participated by donating its expertise and products. Fire departments which were proponents of the technology found Central more than willing to put its products on the line for testing and comparison.

![A test fire utilizing one of the Central Sprinkler residential heads.](image)

About this same time, many of the large hotel and motel owners began to realize the importance of residential sprinkler protection. Central became involved in developing that market also. As the pace quickened with the adoption of the concept, pressures on the company to produce its head increased.

It is very difficult to assess the concept in terms of emotional
and financial commitment during that period. The entire company, in fact, became more and more involved in the process. Steven Meyer, working on the West Coast, George Meyer at the main office in Pennsylvania, and Buck Buchanan, serving in the Southern United States, received more and more requests to participate with local agencies and authorities.

Like so many other fields of research, such as a sprinkler having residential sensitivity, the Quick Response Sprinkler (QRS) head was developed, it began to open other doors and raise other questions. For example, the initial research indicated that coverage for the sprinkler heads was an extremely critical economic issue. Central devoted more and more time to the development of the extended coverage heads, making it less costly to protect individual rooms. The reason this worked was the extended coverage sprinkler head often had to protect a single room. Whereas the other designs quite frequently had required two, and as many as four heads.

Another spin-off of this research was the continued emphasis toward life safety. During the developmental phase of the residential sprinkler concept, there were several disastrous jail fires. One of these, set in a Mississippi prison by inmates as a diversionary action, resulted in the deaths of a large number of prisoners. Utilizing the residential sprinkler technology, Central developed a sprinkler head that could be installed inside a jail cell. These sprinkler heads not only provided protection against fire, but also were so smooth and obscure when properly installed in the ceiling that an inmate could not use the sprinkler head for hanging himself in a suicide attempt.

As the wheel of progress kept grinding out, research indicated that cost and aesthetics were serious considerations. A research spin-off was the Ident-I-Fire sprinkler head, which is equipped with a micro switch so that an entire sprinkler system need not be activated. Each individual head can be wired so, if activated, it will set off an alarm. This particular concept was extremely beneficial in retrofit applications, allowing sprinkler heads to be supplied over domestic water systems and other variations which would be all but impossible if conventional plumbing methods were utilized.
THE “FIRE BALL” EXPERIMENT

One experiment Bill identified as part of the research format involved a most interesting and innovative use of chemical fire control. A neighboring community to the Central offices in Lansdale, Pennsylvania, had been experimenting with a new type of halogen that was mixed with dry chemicals. This particular combination could be installed inside a spherical ball with a sprinkler head installed on the bottom side of the ball. In demonstration fires at the laboratory, it was firmly established that this type of mixture of sprinkler technology and chemical application provided an insight into another avenue for change in modern fire protection. Bill enthusiastically embraced the concept and supported research into the product. It has still not made it to the marketplace, but it has not disappeared either.

If you go back to Day One of the development of this sprinkler head, it could have very easily died on the drawing board. The residential sprinkler market in 1978 was so infinitesimal that the major manufacturers had absolutely no interest in it. At the time of writing of this book in 1985, there are still not a tremendous
number of companies involved in the residential market, but momentum is gaining daily. At the onset of this revolution in sprinkler heads, Central committed almost $2.5 million to residential sprinkler development with absolutely no guarantee of ever recouping those costs. According to Steven Meyer, Central's West Coast representative, two years ago they were selling approximately 1,500 sprinkler heads a month. At the time of the preparation of this book, that number had leaped to nearly 30,000 per month in the Western United States ALONE!

No one will ever know just exactly what would have happened to the residential sprinkler movement if Central had not been committed to the concept. It may not have died, but would have continued with a lesser degree of success in obtaining public and professional support.

One thing is certain: Bill Meyer's faith in the concept of this project, and his willingness to risk his professional reputation in fire protection to develop it, did much to foster and maintain the residential sprinkler movement.

TO OMEGA—ONLY THE MIDDLE

The name of this book is ALPHA TO OMEGA. In the preparation of the material and the research with the various individuals, Kathy was interviewed and asked why “Omega” was selected for the sprinkler head. Her answer was simple: "It's the final letter of the Greek alphabet. It sounded good." But further, it seemed to contain just the right number of letters from "omen" to be portentous of those things that were due to come in the future.

The Greek letter “Omega” has a sense of finality to it, however, Kathy states the Omega head is not the final step in the evolution of this technology. In the few short years from 1978 to 1984, the Omega has contributed to a quantum leap forward in residential fire protection. At the start of the 1970s, one would have had to look very long and hard to have found a half dozen communities with sprinklered residential occupancies.
SUMMARY

As a direct result of the Omega's contribution to the state of the art, today hundreds of communities nationwide are using residential sprinklers as an adjunct to manual fire protection. While no hard and fast figures are there to test, it is estimated that by 1985 there will probably be several hundred thousand people living under the protection of the residential sprinkler. A significant number, if not a major portion, of the dwellings that are sprinklered are living under the protection of the Omega head.

It has often been stated that despite the fact that this movement has gained a considerable amount of momentum, a major portion of the American housing stock has already been built upon the land. By the year 2000, approximately 80% of the dwellings that we will be using at that time will be properties currently in existence. On the other hand, this means there are two decades for communities to go to work and attempt to use this technology to upgrade protection through retrofitting and community building code trade-offs.

It is not inconceivable that by the turn of the century, a million people could be able to go to bed at night trusting that a silent sentinel is standing guard over their families and their property. Like a warrior from a Greek myth, the Omega head is part of a legend that was born in truth. All legends have an element of truth.

The Greeks prized wisdom above all things. It is not unlikely that if the technology for sprinkler systems had been around for the scholars of that era to evaluate, they would have embraced the concept with open arms. Instead, it took several thousand years for the President of a major corporation, such as Bill Meyer, a Vice-President of Marketing such as Kathy Vemot, and the engineering staff of a company like Central Sprinkler Corporation to create the Omega.

Omega is change. Omega will make a difference.
CHAPTER EIGHT

The Marriott Experience

When you think of firefighters, you think of strong, rugged individuals who are willing to risk their lives to save lives and property. The image that is often conjured up is of an individual that faces the adversary, fire, in a physical sense—broad back, strong arms, sturdy build. That description fits one of the most unusual firefighters in America—Sonny Scarff, Director of Fire Protection for the Marriott Corporation.

Sonny is all of those things. He ought to be since he spent many years as a professional firefighter in the capacity of both a tailboard firefighter and a fire officer. On the surface, he was an unlikely candidate to be responsible for the creation of Marriott Corporation’s entry into the life safety arena.

He began his career as a firefighter in Washington, D.C., after growing up in the Maryland area and serving as a member of volunteer fire departments. In 1968, he left the Washington, D.C., department and went to Prince George’s County where he served as the Station Officer for the Chillum-Adelphi Fire Department.

The Chillum-Adelphi Fire Department protected 120,000 people. There were two stations, not unlike many fire departments in the Maryland area. His tasks as firefighter ran the gamut from the simplest of trash can responses to the complex problems
of hazardous materials and high-rises. Like hundreds of thousands of other firefighters across the nation, now-Captain Scarff often faced life or death circumstances. One such operation was the recovering of casualties from a below-grade manhole. Sonny faced this and other threats with the type of courage we expect of the professional fire officer.

In 1974, the Prince George's County went through a consolidation that resulted in reorganization of many fire departments in that area. Suddenly, there was a threat more ominous than all the fires Sonny had had to face—a reorganizational scheme that threatened Sonny's position as a fire officer.

**BEGINNING AT MARRIOTT**

At that time, however, several events were flowing together that would make a significant change to Sonny's contribution to the American fire scene. The first was that the Marriott Corporation was looking for a Fire Protection Director. They didn't have to look far after Sonny filed his application. He had all the credentials the hotel chain was looking for, including a most important personality, the Las Vegas Hilton and the Westchase in Houston.

Bill Marriott, President of the Marriott Corporation, called Sonny into his office and stated: "Sonny, I don't ever want to have to stand in front of a bunch of news reporters and answer the question of why someone had to die in a fire in a building that I own."

Sonny took Bill Marriott at his word. At that point, the Marriott Corporation was undergoing a great deal of change. The entire chain was beginning an expansion that was to result in more than 120 new hotels and more than 750 new restaurants over the next ten years.

The previous fire protection administrator for Marriott, Jay Livingston, had been successful in getting the new hotels sprinklered. Most of the new restaurants and hotels were going to be sprinklered. But what about those built prior to the expansion?

Sonny's job description included responsibility for "all of the fire protection" in the Marriott chain, not just the new sprinklered buildings. Previously it had been under his area of jurisdiction to negotiate permits and occupancy requirements for local authorities as new hotels and restaurants were built. Now
he began to focus on an entirely new problem—how to get sprinkler protection into all the older buildings under a retrofit mode.

There are 165 hotels in the Marriott chain. By 1990, Marriott Corporation stands to be the fifth largest hotel chain in the entire world. Neither the task nor the solution were going to be easy.

**FIRST STEPS**

In 1977 the United States Fire Administration Office in Washington, D.C., was beginning to share information in the entire concept of residential sprinklers. Sonny had attended a conference held in Washington, D.C., and had begun to exchange information with those who had practical experience with sprinkler systems. He flew to Scottsdale, Arizona, and began to exchange information with that community which had installed residential sprinklers. Soon he focused on the thought of retrofitting the old Marriott hotels with the use of new plastic pipe and the quick response sprinkler head.

Sonny met Harry Shaw of the United States Fire Administration at a party and began to talk about the possibility of retrofitting. As is so often the case in the fire service, this brief conversation turned into a lifetime commitment. Harry encouraged Sonny to try plastic pipe as a retrofit possibility. The die was cast.

**PLASTIC PIPE IN HOTELS?**

To say the Marriott's commitment to plastic pipe was controversial is an understatement. Sonny soon found himself in an arena of controversy and, at the same time, a bellweather for the innkeeping industry. From the onset, there were a considerable number of people who swore that plastic pipe retrofit was an impossibility and were openly opposed to it. Many of the sprinkler contractors and some of the major automatic sprinkler companies in this country opposed Sonny's position.

But Bill Marriott, the man who worried about having his name attached to a serious fire, never lost faith in Sonny's decision. While the rest of the industry slept and refused to deal with the concept of plastic pipe, the Marriott Corporation began to unveil a plan to completely retrofit all their hotels, making them among the safest places in the world to reside for the night.

Since the start of the program, the Marriott Corporation has
retrofitted eighteen of their high-rise hotels. Seven more have been placed on a contract bid list for the year 1985. Another thirty have been scheduled for retrofitting by the end of 1990. By the turn of the century, the Marriott hotels will be among the most well-protected public assembly structures in the industry.

But the project has not been without its obstacles.

At the very start, when Sonny and the Marriott Corporation went out to bid, the automatic sprinkler contractors opposed the use of plastic pipe. The majority of the industry simply did not want to talk about it. In addition, there were serious problems with local fire officials resisting the use of plastic pipe. In several cases, the only way Sonny was able to get the material installed was to actually take his case to the Board of Appeals and prove to the local authorities that this concept could and would work.

Commitment was the watchword of the process. Sonny never doubted it was the right thing to do. He was responsible for fire protection for these facilities, and right or wrong, he intended to see automatic fire protection installed. Bill Marriott supported the concept thoroughly; the President of the corporation was a "Partner in Progress" regarding the entire issue. Bill's attitude was that the key issue was to significantly improve the level of protection and, at the same time, meet deadlines and keep as many hotels open for use as much as possible.

**RETRO-FIT COMPARISONS**

The battle was joined! There were several key issues regarding installation that had to be dealt with. Among these was the goal of keeping as many rooms available for service as possible. Every minute of every day that a room cannot be rented represents a negative on the cash flow side of the industry. For the most part, Sonny's use of polybutylene avoided that particular problem because poly is a "clean" installation.

To further prove this point, there were several tests of the concept used to evaluate criteria for the use of plastic pipe. The City of Chicago refused to allow polybutylene; the City of New Orleans would allow it.

Sonny did some comparisons: In Chicago, a floor was out of service for approximately 14 days so that steel could be installed. In New Orleans, however, work on a floor was completed in
only 4 days, and THE ROOMS WHERE THE POLYBUTYLENE WAS BEING INSTALLED WERE SOLD EVERY NIGHT!!

Sonny and the Marriott Corporation were convinced this concept worked but it remained to be seen whether the remainder of the profession, i.e., the fire officials, were convinced. It seemed appropriate that along the line somewhere they needed to conduct tests and demonstrations for fire officials to witness the effectiveness of this material.

FT. LAUDERDALE DEMONSTRATIONS

Sonny got the idea to conduct a demonstration in Ft. Lauderdale, Florida. Marriott had an old piece of property due to be torn down there to be replaced with a new hotel. Working closely with Harry Shaw, then recently retired from the U. S. Fire Administration, they set up a test burn and invited fire officials from all over the United States to observe. The Fort Lauderdale tests, conducted in 1982, were attended by well over 250 fire officials. In scenario after scenario, the fires were extinguished and controlled with polybutylene pipe sprinkler systems. Unfortunately, at this time, polybutylene had not been “approved” by any of the appropriate testing agencies. There was still skepticism in the profession.

Nothing, however, deterred Sonny’s commitment to the concept. Right on the heels of the Ft. Lauderdale test, another opportunity to validate the concept presented itself. This was a series of test fires conducted in San Francisco dubbed Operation San Francisco and, later, Operation Life Safety, that resulted in a long range commitment to life safety in the hotel industry by the International Association of Fire Chiefs.

OPERATION SAN FRANCISCO

A General Services Administration building owned by the City of San Francisco had been turned over to the Marriott Corporation to be torn down as part of a redevelopment project. Sonny contacted approximately 44 people in the hotel industry and fire service profession and began putting together what was later called Operation San Francisco. This project became a catalyst in the sequence of significant events in the development of life safety systems criteria in this country.

Operation San Francisco also happened to be conducted
during the annual convention of the California League of Cities and was attended by hundreds of local government and fire officials. Bottom line was: Residential sprinkler systems can and will save lives if installed in hotel and motel occupancies.

The data generated by Operation San Francisco was voluminous. It was the seminal project for the formation of Operation Life Safety, sponsored by the International Association of Fire Chiefs that has spread the word to communities all around the country. More importantly, its message rang like a clear bell throughout the fire service: polybutylene can be installed in these kinds of occupancies and resolve life safety problems.

**OBSTACLES AND DISAGREEMENTS**

Not everyone agrees that polybutylene is a good idea. Some communities were more receptive to Sonny's efforts than others. Some were outright hostile because they either lacked the level of expertise in dealing with the material or the material was totally unknown to them. But persistence paid off.

In the words of Sonny Scarff, “Plastic pipe is the ultimate solution to the design problems in retrofit applications.” Polybutylene and CPVC can surmount construction problems with a minimum of effort. They are easy to work with, inexpensive in comparison to all other types of application, and can be installed without radically altering the occupancy level of the building.

According to Sonny, in 1984 he was putting polybutylene retrofits into the hotels for approximately $1,000 per room. As indicated above, this was accomplished without taking the rooms out of service. The installations were aesthetically pleasing, operational in a short period of time and—they work!

A fire actually occurred in a sprinklered hotel in Newton, Massachusetts. In a letter to the Marriott Corporation, Newton’s Fire Chief wrote: “Without the sprinkler system, we would have lost the wing. We would have lost some lives.” The systems do work.

**CONTINUED COMMITMENT**

Sonny has taken Bill Marriott at his word and has been working toward the installation of systems that will keep the Marriott Corporation out of the headlines. By looking at the past one can readily see that this is not only a moral issue but an
economic one as well. The lawsuits that were settled out of court regarding the MGM Grand could have paid for the original installation of a sprinkler system in that occupancy many times over. And that doesn't even begin to assess the philosophical and emotional aspects of what those victims were worth to society.

At the time of this writing, there are some 56,000 hotels and motels in the United States. It is estimated that only 2% are completely protected by sprinkler systems. It is estimated that another 20% have some form of sprinkler protection in the hallways, corridors and certain high-risk areas such as laundry rooms.

It is interesting to note that the travel agencies who booked visitors into the MGM Grand and the Hilton Hotel were subsequently made party to the lawsuit regarding the loss of life in those fires. This whole question of joint and several liability implies that travel agents booking clients into a place of public assembly lacking adequate fire protection may be found partially responsible for any adverse consequences of a fire.

As a result, travel agencies are becoming more sensitive to the liability issue. Notably, the Automobile Club is now starting to provide information in their catalogs regarding fully-sprinklered building. Meeting planners and professional tour groups are now starting to ask questions about fire safety installations in hotels and motels. It may not be too long before people begin to ask the question: Is this building sprinklered? before they make their reservation.

SUMMARY

Sonny knows what it's like to answer the clang of an alarm bell. He spent his time on the tailboard and he knows that sometimes when you arrive at the scene of a fire all the damage has been done before the fire engine pulls up in front of the fire scene.

Installing sprinkler systems using polybutylene pipe was not the first battle Sonny Scarff fought and it probably won't be the last. (He was among those who took on the issue of 5 inch hose. At the time, it looked like a radical idea and caused great concern. Now many fire departments wonder how they got along without it!)

Sonny is a man who fits the image of the fire service. He
is no prima donna who talks in terms of esoteric theory. He is a man who has been there. He's felt the sting of fire and he's put his life on the line many times. But, more importantly, he put his reputation on the line and committed himself to the concept that automatic fire sprinklers can and will save lives in the hotel industry.

He rose to the challenge. His commitment and focus is on changing the system so that it is better, not just bigger. His accomplishments in the hotel industry are not based upon authority but rather upon his abilities to convince the Marriott Corporation that sprinklers were the right way to go.

Standing with Sonny in the lower floors of the Marriott Corporation Headquarters in Washington, D.C., I asked him “If you had it to do all over again, would you do it the same way?” His response was typical—neither flamboyant nor verbose, just a straightforward “Yes!”

Looking around the room it is highly visible that fire protection is part of the team committed to excellence. In office after office as we walked through the Corporate construction offices, there were little reminders that Sonny Scarff has left his impressions upon those responsible for planning the future of Marriott Inns.

As Director of Fire Protection, Sonny might not have bright red fire trucks responding under his direction. Instead, he has helped to shape an environment that probably does more to protect the traveling public than the actions of any other single individual in the fire profession to date.
Probably one of the most famous movie scenes of all time was in the epic GONE WITH THE WIND. The burning of Atlanta was a historical and traumatic event. If Chief David Hilton of Cobb County, Georgia has his way about it, there never will be another conflagration in the state of Georgia.

THE SOUTHERN GENTLEMAN

Chief Dave Hilton is the epitome of a Southern gentleman. Soft southern drawl, impeccable manners, and a gentlemanly decor that belies the fact that he has led a very rapidly paced life-style.

Chief Hilton was born in Hayleyville, Alabama, but according to Dave “Every time the rent came due, we moved.” Moving from Hayleyville, he lived in Jasper and Birmingham, Alabama and several other locations, not as noteworthy. In 1950 while Dave was still in the eighth grade, his family moved to Cobb County, Georgia. There Dave had the opportunity to become one of the “good ole boys” in that area. He went to high school there and, in 1955, took two steps that were to provide direction to his life.

The first was that he got married and the second was that he joined the Atlanta Fire Department.
From 1955 until 1965 Dave served as a firefighter on the Atlanta Fire Department doing what is typical—he fought structure and grass fires, and responded alongside his brother firefighters in attempting to save lives and property. During his nine years and nine months as an Atlanta firefighter, he was promoted to the rank of Fire Sergeant.

In 1961, while he was still part of the Atlanta Fire Department, he was asked to become a part-time chief for a city called Powder Springs, located in Cobb County. This was a volunteer fire department that needed some assistance and direction. An interesting concept was used at that time to provide that leadership. Dave and a friend of his, Don Poole, were asked to serve as "joint chiefs."

In 1964 the area around Atlanta was growing so rapidly that it was obvious that the Powder Springs Fire Department must go full time. Dave was offered the job of Fire Chief in 1964 and Don Poole was offered that of Assistant Chief. Several years later Don would become chief in Seminole Springs, Florida.

At that time, however, the Powder Springs Fire Department consisted of two paid personnel—the Chief and the Assistant Chief. The rest were volunteers.

Dave made an amazing transition. He had been a firefighter in Atlanta and had instantly become Fire Chief. He never served in any other ranks in between. Powder Springs was one of eight fire departments in Cobb County, all of which had separate tax bases and operated independent from one another.

At that time Cobb County had a Fire Marshal's office that consisted of one Fire Marshal and one Inspector who were not part of any of the individual fire departments. There were eight separate fire chiefs and over fifty separate telephone numbers that people had to call in Cobb County if they wanted to talk to someone about fire protection. It was obvious this was not effective or efficient. In 1969 the Board of Fire Masters approved the concept of combining all of these individual fire departments into one contingent, and in 1971 they voted to dissolve all eight fire departments and merge them into one.

Dave was appointed as chief of this organization, despite the fact that he was the youngest. As a matter of fact, when he was first offered the Chief's position, he declined. They came back with an additional offer and Dave stepped forward to take
the position only under the condition that the position not be allowed to be looked at from a political point of view. His stipulation was that he would not be asked to support anybody in a political sense to remain as members of the Board of Fire Masters.

**COBB COUNTY**

The combination of all these entities into the Cobb County Fire Department was also in direct response to the fact that the Cobb County area was rapidly being impacted by the urbanization of the Atlanta area. In 1971 when the Department was first organized, there were 120 personnel and the budget was approximately $1 million. Today, 1985, the organization has grown to 361 full-time employees with an annual budget of $15.5 million.

Cobb County had been primarily a rural area. In 1967 the rural character of that county had begun to change as the urban sprawl from Atlanta migrated outward, first slowly and then more rapidly. Cobb County became sprinkled with new construction. Unfortunately, these new developments were not sprinklered.

According to Dave, he was “a typical fire chief—I was asittin' around awaitin' for the next fire to occur, drinking coffee, and visiting the fire house!”

**CODE ENFORCEMENT INSTEAD OF CODE THREE**

One of the first things that Dave instituted was a strong code enforcement program. Dave’s soft, Southern drawl masked a very solid commitment for enforcing the codes, despite the fact that there were firefighting agencies in neighboring counties that were not doing so. At the outset this was difficult. However, developers soon found while Dave was tough, he was also fair.

Despite the fact that he had spent most of his time on the tailboard of a fire truck before he came to this position as Chief, Dave had a strong background in the philosophy of fire protection. He realized that Cobb County, which at that time was the 7th fastest growing county in the country, would have a tremendous fire problem unless a planning program was developed that would result in fire-safe construction. When Dave began his research he ran into considerable resistance. The builders’ favorite question to him was “Why here?” His response was “I don’t know what others do in other places, but here we’re going to build them right!”
There was tremendous pressure on the fire department to deal with this growth. Back in the early 1970s Dave witnessed fire after fire in apartment complexes as they sprung up around the county. Dave’s desire for a good code enforcement program was also tempered by his common sense approach to provide a delivery system that made sense to both the fire department and the developers.

FIRST STEP TO ACCEPTANCE

According to Dave, his first exposure to the residential sprinkler concept did not start by studying residential sprinklers. In 1975 there was a seminar conducted at the University of Georgia. The main speakers at that particular seminar were Laura Buchbinder and Howard Tipton. The focus of the meetings was on public education.

Dave’s attendance at this seminar was prefixed by the fact that five people had died in a fire just prior to his leaving for the workshop. Driving to the seminar he reflected upon the fact that coping with the influx of people on a one-to-one ratio was just almost impossible. At one time he had been told that his county was increasing in population by 10,000 new souls a month. It didn’t take long for Dave to come to the conclusion that a conventional means of dealing with this kind of a problem would mean a conventional fire problem down the road.

As a result of his attendance at the seminar at the University of Georgia, Dave took his first major step in producing an unconventional fire protection delivery system. Returning home, he shifted his focus from the combat role to the public education role. Shortly thereafter, the Department added nine full-time public education positions to the Cobb County Fire Department.

Repeatedly he asked his staff members Why, Why, Why. Why are we doing things this way? Why can’t we do it better? Dave had actually charged his Bureau with developing a system of sprinklering all of their commercial and industrial occupancies. At the outset, there was not even any talk of construction trade-offs. Built-in fire protection was an obvious solution to deal with this rapid growth.
POST PROPERTIES

Attempts at providing sprinklers in commercial-industrial occupancies was relatively easy, in one sense, because most of the major codes did have sprinkler requirements after a certain size. However, in 1979, Jim Bechtel and John Williams of Post Properties brought a major, multiple-family development into Cobb County’s Fire Prevention office and laid the plans on the table. Post Properties were quality builders, constructing only projects of which they could be proud.

Dave remembers that in conversation with the staff, they were very impressed with fire walls. Most of the discussion concerning fire protection centered on the idea of isolating portions of the building. Dave startled them all by saying "That’s okay. I can still burn ‘em down."

The time was right for Dave to make the offer. He did. He requested Post Properties to sprinkle their property. The response was what could be expected—they said they couldn’t afford to sprinkle, either NFPA pamphlet 13 or NFPA pamphlet 13D. Not so typical was Dave’s response to their rejection. He stated "What if I were to design a system that is acceptable, based on Pamphlet 13D, that we could build together and I would be willing to trade-off some of the construction features. What if I were able to prove to you that you could sprinkle your properties at no cost?"

The remainder of all the typical myths then were discussed. "The heads are too ugly." "The heads are all going to go off at the same time." "There’s going to be excessive water damage."

The discussions, while they never became heated, did become rather complicated because Post wanted to move ahead with their development and Dave was dedicated to the idea of reducing the fire problem.

COMPROMISE AND COOPERATION

The compromise was simple. A decision was made to run a survey of existing buildings asking some questions about the properties. The survey was unique in that it had only two questions. "Would the property owners be willing to pay for a private police force if it were offered?" and "Would you like to have a residential fire protection system for life safety?" The
response was overwhelmingly in favor of the residential sprinkler system. Dave recalls the ratio was 85%-15% in favor of the concept.

THE CONSORTIUM

At the time Dave was not aware of all the things going on with regard to the United States Fire Administration and its efforts in the field of residential sprinklers. Totally independently, he, Fire Marshal Nathan Wilson and Lieutenant Jerry Grier started to develop a concept to get residential sprinkler systems installed in multiple family dwellings by utilizing a “Consortium.” This Consortium was a problem solving group whose job it was to come up with ways of installing sprinkler systems without a mandatory ordinance.

Dave talked to several local sprinkler contractors about his idea and was rebuffed. Most of the sprinkler contractors in that part of the country at that time were very much unaware of the residential concept and did not perceive it as a viable part of their market. They weren’t much help.


Later, the Consortium would include Harvey Paschal, a Fire Commissioner, an American Water Works Association (AWWA) representative, and Bob Sutton of the Cobb County Water System.

The goal of the Consortium was simple: To sprinkler apartment houses and multiple family dwellings to protect people by building a modified 13D system. Everything had a dollar sign. The biggest issues always centered around economics. While it is known that it will cost to put in a sprinkler system, it was unknown at that time what the dollar and cent value of other building requirements that could be traded off in return for installation of that sprinkler system. The key focus in the Consortium was on identifying trade-offs that could be used that did not contribute to life safety during a fire.

A typical example was the requirement of one hour construction between apartments. According to most of those who worked
COBB COUNTY, GEORGIA  /  105

on the Consortium, it is almost impossible to maintain the one hour integrity for a variety of reasons. Therefore, the question became—is it required? Could it be traded off? Could residential sprinklers allow for these types of reductions in fire resistance and compartmentalization concepts by using sprinklers to confine fires?

The research went on for months. The Consortium identified those areas that cost a lot of money. It was rapidly discovered by Dave and the others that there was a lot of "code hypocrisy." For example, we often find in codes a requirement that a building have a door that is able to withstand fire for one hour, and then we allow it to be installed in a frame capable of resisting fire for only twenty minutes!

Initially, the Consortium met on a weekly basis. As the months progressed, it became obvious the meetings needed to be more frequent and ultimately, they met almost daily. For a period of four to six months, the Consortium discussions ranged all over the field of construction tradeoffs. Obviously, the biggest adversarial relationship in the group was between Post Properties, as the developer, and the Fire Department.

THE TURNING POINT

About three months into the process, there was an event that, according to Dave, really indicated that the process was working. Dave states "I was already to agree to giving a trade-off of a certain construction feature. I was interrupted by Bechtel who stated 'The hell you will.'" Dave states at that moment he realized the developers were truly helping to build a code. They were no longer adversaries, but were part of a team. Post Properties, with their reputation as quality builders, were not willing to go along with any trade-offs that would reduce that quality. They were only interested in producing trade-offs that would increase the level of protection. The adversary relationship melded into a partnership.

As the Consortium continued developing trade-off concepts, others joined the team. Norm Koplan, an Atlanta building official, and Ronald Wright of the Fulton County Fire Department took part.

While the Consortium was making progress, it was not without some struggles. Every product they wanted to test to
get into the systems had to go through a rigorous scrutiny of the group. Initially Dave had wanted to use CPVC. W. T. Anderson unequivocally stated “No!” at the outset. Then he took samples of CPVC, filled it full of water, froze it in his home freezer, microwaved it to boiling, froze it again and repeated the process until he was completely satisfied the material would do what was claimed.

In retrospect, Dave says the most important element to the success of the Cobb County program was the relationship established between the building official and the fire official. In his personal opinion, if that relationship had not developed, the Cobb County program would have struck out long before it was sprinklering buildings.

**THE PORTER CAMPBELL BURN**

In November 1980 a developer by the name of Porter Campbell had a five room frame house which was offered to the fire department to test Dave Hilton’s concept. Meeting on a muddy hillside, they agreed that they were going to “rebuild” the house far enough to be able to test sprinkler heads in it. The developers and the fire department joined in the process of experimentation, an essential part of validating the entire work.

By 1980 the residential sprinkler concept had been growing by leaps and bounds and Harry Shaw of USFA heard about Dave Hilton’s potential experiment through the grapevine. He called Chief Hilton and said “We want to be a part of those tests.” At that time, Harry Shaw was trying hard to keep manufacturers motivated towards the residential sprinkler market by getting them involved in these experimental burns. Expedited by Harry, a contract was let with Factory Mutual Research Center, and John Viniello of Grinnell Corporation offered to provide resources and materials for the Porter Campbell burn.

Kathy Vernot of Central Sprinkler was asked to participate in the burn also. According to Dave, her arrival was heralded by the fact that she showed up on the burn with a Crown Royal bag. Dave and Kathy had never met until the moment she walked up to him at the site and introduced herself. The black Crown Royal bag contained the newest prototypes of the Central Sprinkler Omega line, heretofore not seen publically, and not even completely tested.
Others participating in the test were Bob Spaulding, Dr. Kung, and Eddie Hill, all from Factory Mutual. Representatives from Georgia State government were invited to participate. Bob Edwards from Scottsdale, Arizona, conducting research at that time for the Scottsdale ordinance, also attended.

The purpose of the burn was simple—to justify in the minds of all those concerned that sprinklers would do what they said they would do. The burn was a pivotal point in the development of the Cobb County system. If the fires had been a failure, there was a high degree of possibility that the voluntary aspects of the trade-offs would never have become reality.

Up to this point, Dave had felt that the majority of his work had been in isolation. Even though Chief Hilton had also reviewed some of the material coming out of San Clemente, California, he did not feel confident that the documentation at that point was adequate for his decision to allow trade-offs. It had been frustrating trying to solve the trade-off problem with the vacuum for information. The night before the burn started, Dave, John Vinniello, and Harry Shaw were relaxing over a cocktail when Dave blurted out “Where in the hell have you people been?” Very quietly, John responded “Waiting on you, Chief.”

ADVOCATES OR OBSTACLES

What John was saying was a simple statement of fact—the entire residential sprinkler movement in this country is highly dependent upon the actions of local fire authorities and their becoming advocates. Without the local fire chief advocating these installations, there is no justification for the industry to continue to produce the product. A product that costs millions of dollars to develop with no market, doesn’t have much opportunity to ever come into existence.

The tests went on for three days. One room which was 12’x12’6” caused some concern. Factory Mutual, for example, wanted to install a six inch wall to reduce the room to a 12’x12’. Dave resisted that. He wanted to do the tests the way the building was originally constructed. He wanted to test sidewalls. He wanted to test heads under conditions that were extremely difficult, including the use of Molotov cocktails.

Throughout the preliminary discussion of the tests, the statement was repeated over and over again: “Commercial heads
won't do it!" Dave stated "I never could figure that out. When some truck rookie has to carry a wedge to shut off a commercial head, comes out looking like a drowned rat, you couldn't tell me that those heads won't put out a fire."

The tests were successful. They were so successful that Dave decided the next thing to do was to construct a test building. This building, which was 16'x16' was constructed to test all the unique features that crop up in a residential application. The materials were totally donated by the local construction industry. It was designed with five head locations. Experiments were run to test such unique things as ceiling fans, the updraft and downdraft problems, problems of false beams and what happens with different kinds of wall coverings.

Communications had opened considerably by this time. Bob Edwards continued to communicate with Dave as a result of his testing conducted in April 1981. Further, Dave by this time was part of the speakers' network working in Washington D.C. with the International Society of Fire Instructors.

By this time also, Post Properties were convinced the idea was viable. They had constructed an eight unit fully sprinklered apartment complex.

**SPRINKLER INSPECTION DIVISION**

The Cobb County Fire Department moved ahead with the concept by establishing a Sprinkler Inspection Division. Initially, this consisted of Lieutenant Jerry Grier and Don Hester. Today this division has grown to seven full-time people. Initially, all the people who went into this program were volunteers, because of the importance with which it is recognized within the organization. Dave believes morale is very high in the Sprinkler Inspection Division because it is considered to be a most important program to Cobb County, and the individuals receive recognition for their participation. Besides that, there's a lot of excitement because of the constant changes occurring.

Like every other advocate of residential sprinklers, Dave has had to deal with his share of skeptics. While conversing with fellow fire chiefs at a conference, one of the individuals chastised Dave for taking people off the floor and putting them into fire prevention. They stated "You should never rob manpower from combat to serve in the bureau." Dave did not agree. He felt
COBB COUNTY, GEORGIA

he should put his personnel where they would do the most good. And in the case of Cobb County, Georgia, he felt they were doing the most good by creating the Sprinkler Inspection Division.

Chief Hilton believes that many fire officers are afraid of dealing with the residential sprinkler concept because it will, in effect, reduce fire loss. By reducing fire loss there is the concern that there will be a subsequent reduction in resources. Dave believes this is not what happens. He feels that support increases with very aggressive public education regarding built-in fire protection programs.

One of Dave’s favorite expressions is “I’m here to he’p ya!” Dave doesn’t use the L in HELP. But it doesn’t bother him to give ...L to other people! It doesn’t bother him to upset people. His personal philosophy is that you have to work to communicate your ideas to people; you cannot assume they know what you know, or care as much as you care. You gott “he’p them” learn.

At one time, there was a move in the legislature in Georgia to kill Dave’s ordinance. A bill was introduced to require all residential sprinkler systems to be installed only by sprinkler contractors, contrary to the fact that most residential applications are being done by plumbers. The sprinkler contractors introduced a bill (Bill 441) that was approved by the Fire Marshal’s office and was almost ready to be passed.

The attitude seemed to be at that point that the major sprinkler contractors really weren’t that interested in the residential sprinkler market, but they also didn’t want anyone else to be doing it, either. To paraphrase Dave’s expression, “This sort of reminded me of the case of a divorced wife—when a guy divorces someone, he doesn’t want his old lady, but on the other hand, he doesn’t want anyone else to have her either.”

A meeting was held and a bargain struck that the bill would be pulled and Dave would be allowed to continue.

A second set of tests, held in July 1981, was covered by three television networks. Four of the Commissioners from Cobb County, Ernest W. Barrett, Harvey Pascal, “Butch” Thompson and Witt Carson, volunteered to sit in the experimental building while the fires were being set. As the chairman emerged from the building after the fire, he was heard to say “Anybody that would vote against this kind of an idea has to be nuts!” The following
Tuesday night Chief Hilton received permission from the Cobb County Fire Commission to make these systems viable by offering construction trade-offs.

**SUCCESS!**

The night the ordinance was heard, there were over two hundred people in the audience. There was no long-winded debate or discussion. As Dave recalls, the entire ordinance was heard in forty-five seconds, the motion made to pass it as a matter of course. (Certainly a better track record than what had we experienced in San Clemente!)

In Dave’s opinion, there were three people who were absolutely essential to the success of the ordinance adoption. The first of these was the developer, John Bechtel. He is recognized as a quality builder but he is also an innovator—someone who is willing to make things happen by looking at his business in a creative and knowledgable way. The second person Dave has highlighted as contributing to the success of the program was Ed Ingram. Ed was not only knowledgable, but was extremely flexible and was willing to work out problems as they occurred. Thirdly, Lieutenant Jerry Grier of the Cobb County Fire Department, whose enthusiasm was unbounded, contributed a great deal to the success of the program. It was Lt. Grier who would mysteriously “happen to have” any resource needed.

There had been several critical events in this program. Some have been favorable, some not. For example, at the time this book is being written, there have been four real fires. These fires have been discussed in another chapter of this book. There have also been four accidental discharges—two of these were in occupied buildings and two in vacant homes.

In a system of checks and balances, the four real fires have had more impact than the four accidental discharges, of course. Nonetheless, the accidental discharges have been a subject of concern. Working closely with companies in the area, such as Earl Summerville of Marrietta Sprinkler Company, Dick Gust of Shell Chemical, and Rusty Kingman of General Fire Supply, Chief Hilton feels he has solved most of the problems associated with the accidental discharges.
The Consortium which facilitated this entire process still exists. The focus of the group is now shifting from the multiple family to the single family fire problem. Current projections for Cobb County indicate that somewhere between twelve and fifteen thousand single family dwellings will be constructed in the area during the next decade. Therefore, trade-offs in this area are being considered.

When Dave was asked “Would you do it all over again?” he responded by stating “Yes—but I would do it a lot faster, I would do it much earlier in time. And, I would make sure I had minutes of the Consortium meetings. There were a lot of things that happened in those meetings that I wish I had been able to capture.”

SUMMARY

At the time this book is being compiled, it is estimated that Dave Hilton’s Cobb County program has resulted in the installation of sprinklers in well over twelve thousand dwelling units. It is known that at least two lives, possibly three, have

Jennifer Collum, one of the first lives saved by residential sprinklers. May 2, 1985.
been saved as a result of these systems. Chief Hilton is firmly committed to the concept of providing residential fire safety to the highest degree. And, as he once stated, he has all the reason in the world to be concerned. For one thing, his own brother died fighting a dwelling fire in Cobb County that could have been prevented.

Dave is a man who is not afraid to talk nose to nose with the top pros. He believes in using the most common-sense approach to the resolution of problems.

If someone had told him twenty years ago that he would be one of the leaders in residential fire protection, he probably would have been startled. One of his favorite jokes could characteristically describe it. Dave often asks how you can tell the difference between a fairy tale and a red-necked fairy tale? According to him, the fairy tale starts off with "Once upon a time..." A red-necked fairy tale goes "Y'll ain't going to believe this..."

Well, y'll aren't going to believe that Dave Hilton is far from being through with built-in fire protection in Cobb County, Georgia. With his focus now shifting from multiple family occupancy to the single family dwelling, y'll aren't going to believe what he will do when he puts his mind to it!
CHAPTER TEN

The Scottsdale Plan

The Scottsdale Fire Department is no stranger to controversy. At one time all you had to do was mention "The Scottsdale Plan" and a Fire Chief would begin gnashing his teeth, the firefighters would get agitated, and an argument was sure to ensue. The reason: Scottsdale, Arizona has one of the first "private" fire departments in the entire United States.

PRIVATE FIRE PROTECTION

Many are aware of the existence of the Scottsdale Private Fire Department but very few are actually aware of how it got started and the reasons behind it. It is important to understand those historical facts because they were the basis for the Department’s business-like and innovative approach to providing fire protection. The founder of the Scottsdale Fire Department, Mr. Lou Witzeman, created the organization out of necessity. Its survival has always depended upon its early adoption of technology and its use of methodologies that allowed a "lean and mean" firefighting agency.

In 1948 Lou Witzeman was working for The Arizona Republic. This newspaper had a small circulation in the vicinity of Phoenix and Scottsdale. Unfortunately, Lou lived in an area that had absolutely no fire protection. Like the weather, a lot of people
talk about fire protection but don’t do much about it. Lou and one of his neighbors were an exception to this rule; they opted to buy their own fire truck to protect their homes.

**SUBSCRIPTION FOR SERVICE**

The basic idea was to purchase the fire apparatus and share the cost with a few neighbors. Unfortunately, once the truck had been ordered and just prior to its delivery, the neighbor reneged on the idea. The neighbor’s cold feet gave Lou a hot problem. Now he owned a fire truck, which obviously is an expensive way to protect your own home.

The obvious solution was to try to get other people involved in the cost of the equipment. Always the maverick, Lou went door to door with his other neighbors and started to sell “subscriptions” to the use of the truck. To say that this concept created a controversy is a huge understatement. Grumbling neighbors referred to Lou’s efforts as being “mercenary”. Resentful neighboring fire departments attacked Lou’s approach as being inefficient and “immoral”; attempts were even made to make it illegal.

Nonetheless, Lou persisted. From 1948 to 1952, Lou struggled with his embryonic concept of private fire protection. During that six year period, he pioneered many concepts that were later to be severely criticized, then evaluated, and ultimately adopted by other firefighting agencies. These included the concepts of mini-pumpers, firefighting agencies developing their own equipment, robots in fire protection, and the two-man attack pumper principle.

**SCOTTSDALE IS BORN**

In 1952, Scottsdale, a City which had sprung up out of the dry desert landscape, incorporated. By that time, the Rural-Metro Fire Department had developed from Lou’s single fire truck to a viable firefighting agency. The City of Scottsdale opted to hire Rural-Metro to provide fire protection.

From 1952 through the 1980s, the Rural-Metro Fire Department has grown. Currently it provides fire protection in several other states and consists of a firefighting agency of over 1000 personnel. Once considered the black sheep of the fire protection industry, Lou evolved from a newspaper reporter to a controversial fire
chief to a nationally-known speaker and contributor to national firefighting organizations.

Instead of remaining an ugly stepchild, the Rural-Metro Fire Department continued to mature into an organization that is a leader in adopting new technologies and methodologies. For example, Lou’s department was among the first to use computers. Lou’s point of view was that his fire protection was a business. Businesses were using computers. Fire departments should use computers. Experimentation, innovation and early adoption became the watchwords of the Rural-Metro Fire Department.

BOB EDWARDS

Lou’s philosophy was carried out in other fashions, also. For example, Chief Witzeman did not only always select personnel using conventional and traditional methods. One day during the “halycon days” of OSHA, someone, anonymously, filed a complaint against the Rural-Metro. A bright, young OSHA inspector, Bob Edwards, who had just recently moved to Phoenix from the Washington D.C. area, was sent to investigate. Typical of Lou, he met with Bob nose to nose and defended the Rural-Metro Fire Department from the accusation.

Never one to back away from controversy or responsibility, Bob thoroughly investigated the incident. He found that the accusation was unfounded. In the process he made a friend of Lou. The two men had a lot in common. They both were doers. They both were opinionated. And they shared a common interest in safety.

Bob was born in Washington D.C. Both his father and his grandfather had been Chiefs of Police of The District of Columbia Police Department, however, his interests had taken him in a slightly different direction than law enforcement. He attended George Washington University and later took courses at the University of Maryland in engineering. His real interests lay in the field of technology.

After graduation from college, Bob never even considered either law enforcement or fire protection. He became a Masters Licensed electrical contractor. His tendency to speak his mind and to become involved as an advocate soon gained him the position of a legislative consultant for the Occupational Safety and Health Agency. As many will recall, the acronym “OSHA”
at one point in time, really struck fear in the hearts of many people.

Bob had decided he wanted to change locations. Moving to the Phoenix area in the 1970s, he was functioning as an OSHA inspector when the complaint against Lou was filed. As he recalls, when he arrived at Lou’s office in the early part of 1977, his first impression of his meeting with Lou was that he was cordial, but firmly convinced that the complaint against Rural-Metro was unfounded. Lou wasn’t about to back away. Bob recognized the challenge right there. Not too surprisingly, he discovered that the primary reason for the complaints against Lou was that he was doing things “in a different way.” There is nothing in federal law that states that innovation is inherently unsafe. Bob found that the complaint was unfounded and, at the same time, developed considerable respect for the man who had created the first successful, private fire department in the Twentieth Century.

**BOB COMES ON BOARD**

Lou recognized Bob’s talents also and offered him a job. Bob had never once stood on the tailboard of a fire truck but he had the savvy of a good code enforcer, a legislative advocate and a businessman. Bob respected Lou but really wasn’t quite sure if he could work for the man. Therefore, in order to “save face” for both, they arrived at a tacit agreement. Bob would go to work for Rural-Metro for a ninety-day period to see if it was going to work out. His job: the head of the Rural-Metro Fire Prevention Bureau. Bob’s predecessor, Melvin Paxton, had recently moved on to other ventures, and Lou needed someone in charge of the Bureau who would take a firm but fair hand on fire prevention matters.

The ninety days passed and Bob became a fixture of the Rural-Metro organizational structure. Lou, never one for mincing words, told everybody he was looking to retire and began to groom Bob to become the future chief of the Scottsdale operations. Another member of the Rural-Metro organization, Ron Butler, was ultimately promoted to President. From 1977 to 1983, Bob Edwards moved from being employed as an OSHA inspector to Fire Chief of one of the most creative and innovative fire departments in the country.
Currently, the nation-wide Rural-Metro operation is a $30,000,000 fire department. It provides services in the states of Arizona, New Mexico, Texas, Florida and Georgia. It is also a leader in the adoption of residential fire sprinkler technology.

**SPRINKLER ORDINANCE RESEARCH**

In 1977 when the San Clemente ordinance was being considered for adoption, Lou was among the first to hop on an airplane and fly to the aid of the San Clemente Fire Department. He was there the night the ordinance was debated in front of the building and development industry. For many years prior, Lou had been the staunch advocate of sprinklering commercial occupancies and was well aware of the advantages and disadvantages of built-in fire protection. Sitting in the Council Chambers of the City of San Clemente, Lou was flanked by Bill Goss from the National Automatic Sprinkler Fire Control Association, and Fire Marshals from many neighboring communities. Upon his return to Scottsdale, instead of putting the information into a file drawer and forgetting it, he passed it on to Bob Edwards with the characteristic flair of a maverick by stating “This looks like a good idea. Let’s check it out.”

And check it out they did. Bob immediately started making contact with all of those who were involved in the early development of residential sprinkler technology. In the matter of a few short months he had contacted Sonny Scarff of the Marriott Corporation, Harry Shaw of the United States Fire Administration, Kathy Vernot of Central Sprinkler Corporation, Shell Chemical, R.G. Sloane (a plastic pipe manufacturer), and all of the other pioneer organizations and individuals, including myself in San Clemente.

The 1970s had already seen a large number of “experimental fires” wherein local fire departments would retrofit old buildings and conduct demonstration burns. Typically, Rural-Metro decided to take another look at this. According to Bob Edwards, “It just didn’t make any sense to keep on burning old houses.” It was not unusual, for example, upon completion of the retrofits, that the local fire departments did what they do a lot of: burn the building the rest of the way to the ground, thereby removing the evidence of the fire from the surface of the earth.

An idea was spawned, either by Lou or by Bob, that made
a significant contribution to the whole idea. They decided to actually set fire to a new home. Now THAT was revolutionary!

**WOMACK HOMES**

As head of the fire prevention bureau Bob had been in contact with a development company, Womack. Womack was in the process of building triplexes and duplexes in the Scottsdale area. He was developing models when Bob met him and the suggestion was made to Womack: “How about sprinklering a few of these models so we can do some tests?”

Talk about a rapid, radical departure from the norm! These homes were not going to be merely retrofitted, set fire to, and allowed to burn to destruction. What Bob was suggesting was that the homes be fitted with sprinkler systems, fires deliberately set in them, then the homes restored to service and THEN sold! If there was anything that could prove the fact that residential fire systems are a viable part of community fire protection, it would be the Scottsdale experiments.

Harry Shaw, at that time in charge of the United States Fire Administration’s program on residential fire technology, provided the funds for a complete testing facility to be set up. Factory Mutual was brought on site and performed all the telemetry necessary to verify the tests. Sentry Insurance provided a group of independent adjusters to make sure that the loss figures reflected in the tests were reasonable and accurate. Don Weiner, the Sentry Loss Control Manager, involved himself in the early planning stages to make sure the information was usable by the insurance industry.

The Rural-Metro Fire Department provided two things for the test: Leadership and Logistics. On April 19, 20 and 21, 1982, the tests were set in the Womack Homes. Invitations were sent to a wide variety of individuals who had expressed interest in residential fire systems. Over 250 observers arrived to look at the fires over the three days. There were even individuals from as far away as Great Britain, Canada and Italy. State Department Fire Protection Specialist Dennis Lundstedt and Secret Service Fire Protection Specialist Dean Rudge were also observers of this landmark experiment.

Central Sprinkler Corporation was there. Kathy Vernot, who at that time was extensively involved in the development of the
new residential sprinkler head, offered to allow the use of the Central heads in the experiment, despite the fact that at that time they were not listed. It was going to be a true “trial by fire” because these particular experimental fires were not going to be done under the same kind of laboratory conditions one would experience in Underwriter's Laboratories or Factory Mutual. Kathy was not concerned, however, because she was convinced the Central head could do the job.

Grinnell was also involved. John Viniello, who at that time was working for Grinnell, offered the use of that company’s product in one of the experimental fires.

NEGOTIATION FOR THE DEMONSTRATION

One cannot assume that this experimental fire was easy to achieve merely because of Bob’s strong convictions and the resources being made available by the industry. A sixty-day negotiation process began between Womack Homes and all other parties. As a result, a simple bargain was struck between Rural-Metro, the vendors and Womack Homes.

Two homes were going to be outfitted with residential sprinklers. In one, the system would be plumbed with a combination of black iron and polybutelyne. The other would be plumbed with copper. One residence would be equipped with Central sprinkler heads, the other would be equipped with Grinnell.

Rural-Metro promised Womack builders that, as a result of the fire and upon completion of the experimental fires, the buildings would be restored to service and the sprinkler systems put back into condition. (Talk about confidence!) Sonny Scarff from Marriott Corporation contributed a large amount of furniture that was coming out of a remodel of a Marriott hotel in Houston, Texas. Much of the system components were donated by both Central and Grinnell. Grantham Fire Protection, operating in the Phoenix-Scottsdale area, offered to put in the copper system.

PUTTING THE REPUTATION ON THE LINE

Rural-Metro had opted to get into residential sprinklers and was about to put its professional reputation on the line by setting fire to two buildings with considerable true value, buildings which were not destined for destruction and would, thereby, stand as mute evidence of the effectiveness—or failure—of residential fire systems.
Underwriter's Laboratories representatives visited the site. At that time they, too, were relatively new in the field of evaluating residential sprinklers. According to the UL rep, the firm was interested in observing the test because it could provide the impetus for cutting days—maybe months—off the testing process for the acceptance of residential sprinklers.

The tests went off without a hitch. Lou was there, and in his usual style, volunteered to sit in the room when the fires were set. A lot of people have claimed over the thirty-five or forty years of Rural-Metro's existence that Lou Witzeman was all wet. He was about to prove it and to prove his point at the same time. The living room, kitchen and bedroom scenarios went off without incident. The results of these experimental fires were thoroughly documented and slides and video tapes were made.

**CONVINCING EVIDENCE**

When asked what the effect was of the experimental fires, Bob Edwards responded, "The effect that it had on me and Lou and Ron (Butler) was to prove to us that this is the thing of the future." It was not that Bob needed a lot of convincing. According to him, his initial involvement in residential sprinklers was because "I have had a totally different viewpoint on this issue. I kept looking at the statistics. The fire losses were in the dwellings. This simply had to be a tool that we had to explore."

Upon completion of the experimental burns, however, there was even a more "burning issue": how to use residential sprinklers as part of the Rural-Metro operation. Immediately upon completion of the Womack burn, Bob Edwards embarked on a project of writing a sprinkler ordinance for the Rural-Metro Fire Department. As with many other communities that have faced a similar set of circumstances, Bob soon realized that this was not going to be an overnight task. It would take over three years from the date of inception for the actual adoption of the Scottsdale ordinance.

**HARBOR POINT**

Utilizing the resources of all of those who participated in the Womack burn, Bob expanded his network to include those communities with voluntary standards. These included locations such as Cobb County, Georgia, where Chief Dave Hilton had
been so successful getting residential sprinklers installed. It soon became evident to Bob that the concept of “trade-offs” was an essential element to selling sprinkler systems to builders and developers. Bob began to focus on this approach in planning for Harbor Point, a new high-density development to be constructed in Scottsdale.

Bob’s point of view on the expansion of sprinkler technology in Scottsdale was that it had to be “cost-effective. It had to make sense to everyone.” This “everyone” implied involving developers, politicians, construction personnel, firefighters, water supply and financial people. Utilizing a “systems management concept,” Bob began to apply his code enforcing expertise to utilizing trade-offs as incentives for the installation of systems.

The Harbor Point development was a perfect example. The Harbor Point facility consisted of 206 units in an apartment complex that was three stories high. As these types of developments go, Harbor Point was not unusual, but it did have some very unusual problems. There were problems of water supply (fire flow), access, and the usual concerns associated with high-density housing.

**DESIGN FREEDOM AS A CONCEPT**

At that point, Bob began to develop a concept that was dubbed “a design freedom concept.” The design freedom approach was to look at a matrix of alternatives so builders and developers would have the choice of different options to achieve the same overall objectives. For example, water supply could be delivered in many different fashions. It either can be stored on-site or provided by large diameter mains or distributed through sprinkler systems. Of course, each of these “freedom” packages had a price tag associated with it, of course.

This approach was used in the Harbor Point development. Cost factors were associated with every alternative. Had the developer opted to follow all the conventional approaches to solving the problems, it would have cost an additional $276,000 for the upgrades. Instead, the Harbor Point developer opted to install the residential sprinkler system at a cost of $176,000. This meant that there was an actual benefit to the developer of $100,000 in “up-front money” that the developer did not have to pay interest on during the construction loan.
MORE INCENTIVES

The Rural-Metro Fire Department was not satisfied with only one experiment in financial incentives. The next was conducted on The Paseo Del Norte Nursing Home. Like Harbor Point, there were water supply problems, access problems and the normal garden-variety limitations on the development. While information is not readily available on the cost impact of the sprinkler systems at Paseo Del Norte, the fact remains that the developers voluntarily chose to sprinkle the building in order to avoid the other problems. In rapid succession over the period of the next year to eighteen months, six other major developments in the Scottsdale area opted to use residential sprinklers as a financially sound method of fire protection.

THE BOULDERS PROJECT

The real proof of the pudding for Bob Edwards’ Design Freedom Concept came into focus with the development of The Boulders project. The Boulders was a resort, owned by the Rockefeller Institute, that was to be built in the Scottsdale area. A very sophisticated, very expensive facility was planned with 120 casitas, small townhouses consisting of 500 to 550 square
feet, designed to be spread out across the desert and incorporated as closely as possible with the landscape.

The Boulders was to consist of a major golf course, tennis clubs and two major restaurants. It was obvious from the outset that this project would present unique fire protection problems because the Rockefeller people wanted to preserve the integrity of the environment and that would conflict with Rural-Metro's Mission to protect life and property.

Bob stated: "The challenge to the builders was that they wanted to be unique; they wanted to use golf cart-type access. They didn't want large thoroughfares, fire lanes and so forth. Building The Boulders project would have probably been impossible with a conventional approach."

Of course, the other problem was the lack of an adequate water supply. There was one 6-inch water main servicing the area which was provided by a private water company. While fire flow was available, it certainly was limited. It was also obvious that extensive expansion of the water supply was going to be very expensive.

This time, Bob and the Rural-Metro Fire Prevention Bureau were conversant with the concept of trade-offs and worked closely with the builders. A wide array of ideas were proposed as to how this project could be built with the minimum ecological impact on the area. A lake was being utilized to provide a water supply for irrigating the golf course. Water was pumped into holding ponds and was readily accessible on-site, although it was not stored in underground pipes. The Boulders had over 3,000,000 gallons of water stored on-site. This grey water system was plumbed to provide water to some of the sprinkler systems.

was the idea of attaching a strobe light to the smoke detector and alarm device so that, when an alarm tripped, the strobe light was activated. As a result, whenever one of the casitas, inconspicuously snuggled down among the cactus and boulders, was suffering some type of an emergency, the flashing strobe light would instantaneously draw emergency personnel to the scene. Like moths to a flame, the strobe light was an innovative—and at the same time—most effective addition.

Upon completion of The Boulders project, the Rockefeller people were extremely pleased. They had their resort. It was cost-effective, aesthetically pleasing and as safe as any resort of
its type in the country. In view of the fact that the casitas rented for over $300 per day, the grey-water sprinkler systems were not only cost effective but prudent protection of the lives of some very important people.

![One of the Casistas at the Boulders. Protected by the Central Residential Sprinkler Head.](image)

Bob indicated that his research in residential fire sprinklers is not going to stop with the development of these concepts. One of his more recent concepts was the development of "A community sprinkler system." This is one in which a given area runs a single water supply line (such as down an alley) and laterals are fed off that system to provide sprinkler protection to specific occupants. It doesn't take much to figure out that, with the grey-water concept becoming more of an issue in other communities, it is conceivable that reclaimed water may someday serve as part of the fire protection delivery system.

When questioned about Scottsdale's approach to residential sprinkler technology, Bob Edwards replied: "Research and development is what has kept Rural-Metro alive. Someone has always been waiting in the wings for us in private fire protection to fail. They want to be able to say 'See, I told you so!' Yet, we know that this is the way things are going." Bob is convinced that residential fire protection technology is every bit as much a part of his inventory and arsenal as nozzles, hose and fire trucks.
CALL FOR THE QUESTION

Bob got his final test of fire on the evening of June 4, 1985. The ordinance, which was years in development, was offered to the City of Scottsdale. During the four and one half hour Council hearing, a wide variety of opinions were heard. The Mayor calmly and humorously presided over testimony from both opponents and proponents of the system. Question after question was fielded by Chief Edwards. Testimony was given by chief Dave Hilton, Kathy Vernot, several local developers and myself.

As usual, there were questions raised about costs, the “myths” of sprinkler-caused water damage, excessive costs, insurance problems and so forth. The discussion, which was video-taped, played itself out to a packed house. No one left the room until after the Mayor asked for a motion to accept the ordinance as written. Each Council member gave a short speech outlining their reasons for voting as they did. The vote was cast. It was 6 to 1 in favor of adoption.

Scottsdale, at that moment, had the most comprehensive sprinkler ordinance on the books of any city in the entire country—perhaps the entire world!

Later, relaxing over a cold beer, Bob admitted that he was greatly relieved and at the same time anxious. The big task of getting the ordinance was over. The larger task of implementing it has just begun.

SUMMARY

The philosophy of the Rural-Metro Fire Department—instituted initially by Lou Witzeman, carried on by the likes of Bob Edwards and Ron Butler, is that fire protection is a business, a business of saving lives and property, but a business nonetheless. Bob recognizes that the residential sprinkler systems approach helps deal with the problem of having to maintain a standing army to respond to emergencies.

Rural-Metro was willing to experiment and did so successfully during the Womack burns. More importantly, however, they were willing to act by developing the design freedom concept and by promoting the installation of sprinklers on a volunteer basis. If track records are to be believed, Rural-Metro is on the leading edge of residential fire protection systems development and will most likely stay in that position for some time to come.
Bob's philosophy, while it was not finely tuned on the tailboard of a fire truck, is very important for the fire service of today. Bob believes that "I would be doing a disservice to myself if I see a way of doing something better and fail to do so. I wouldn't want to say 'Well, I had the idea, but I didn't pursue it'."

No one will ever be able to accuse Rural-Metro of failing to pursue an idea!
When Is a Sprinkler Head Not a Sprinkler Head?

When the very first sprinkler heads were invented back in the late 1800s they were extremely simple devices. Essentially, they were nothing more than short pieces of pipe plugged with a material that would melt when the fire reached a certain temperature, thereby releasing the water to spray on the fire. Because the majority of the sprinkler technology initially was designed for mercantile and heavy industrial applications, the only real criteria for an operating sprinkler head in those days was that it work.

In those days, there were no laboratories to generate experiments to prove whether sprinkler heads worked within a certain time frame or performed before the fire reached a certain level. In view of the fact that the sprinkler head came from an industrial background, it was not unreasonable to anticipate that it would be bulky, ugly and designed to take the wear and tear of the industrial environment. And, that is exactly what the first sprinkler heads looked like. They were bulky and ugly, but they worked.

BIZARRE HEADS

From the late 1800s until the early 1970s there were literally hundreds, if not thousands, of different types of sprinkler heads
designed to meet different kinds of applications. Industrial Risk Insurers has published a very nice little booklet illustrating some unique and, in some cases, almost bizarre sprinkler heads which were designed in response to various sprinkler problems.

A wide variety of techniques was used to hold the water pressure back and to speed up the manner in which the sprinkler responded to fire conditions. For example, there were chemical balls designed to rupture at certain temperatures; there were pellets made of chemical compounds designed to melt at relatively low temperatures. However, one problem remained with the industrial and commercial sprinkler head—it was slow to operate.

Actually, no one really cared! The track record of the sprinkler head in achieving the mission it was assigned, i.e., to control fires, was impeccable. In almost one hundred years of providing performance, the sprinkler head functioned to control fires to the areas of origin approximately 96% of the time. There are probably very few technological devices ever introduced that can claim a similar success rate.

USFA

In 1976 the United States Fire Administration (USFA) was created under the Federal Emergency Management Agency (FEMA). The mission of the USFA was to reduce the loss of life in America's homes by 50% in one generation. At the time, 80% of all fire deaths occurred in the home. This record stood despite the increased use of smoke detectors. The most obvious solution to a problem which was rapidly growing out of proportion, was to develop a sprinkler system for the home which could function off the domestic water supply and also be affordable.

However, when the USFA started demonstrating interest in sprinklers for possible use in a residential application, there appeared to be a problem generated by the basic difference in achieving the goals of protecting property and life. During the initial testing phase of sprinkler systems for residential applications the tests were heavily instrumented and the results extensively analyzed after each demonstration fire.

A grant was awarded from the USFA to Factory Mutual Research Systems for the purpose of studying the problem and developing design criteria for the listing and possible development of a residential sprinkler as well as the system concept. This
group, under the direction of Dr. H. C. Kung spent countless hours testing and observing sprinkler responses to fire.

In fire test after fire test, the fire would reach a proportion in the test room that was just on the verge of flashover before the sprinkler heads would function. The reason for this was the "thermal mass" of the activation mechanism for the sprinkler head. That is to say, the sprinkler head could be designed to go off at a certain temperature, but the speed with which the link absorbed enough heat to manifest that temperature was a variable. In the simplest terms, the melting temperature of the solder in most sprinkler links and the speed with which it responded were independent variables.

For those conducting some of the early experiments, it became quite obvious that a fire could reach a relatively good level of proportion before a standard commercial sprinkler head would activate. Because of this, it was common for these fires to be generating a considerable amount of toxic gases including carbon monoxide and hydrocyanic acid. In many of these cases, the sprinkler head would ultimately activate and control the fire, but not before there was a threshold achieved in the fire area that endangered the occupants of the room. The need to develop a faster reacting sprinkler was made clear at this time. Based upon preliminary tests, it also became quite apparent that it really didn't matter how much water was discharged on the fire, but rather how fast it got there.

**TAU VALUE**

This phenomena of time response was even given a name—the "Tau value." Tau is a Greek letter standing for the element of time. Sprinkler head after sprinkler head was tested to determine what its Tau value was. Very quickly, it was determined that there was a wide variety of Tau values for sprinkler heads having similar temperature ratings. For example, a sprinkler head with 165 degree rating, manufactured by one company, would respond within so many seconds of achieving heat levels, while a similar sprinkler head with an almost identical temperature rating would take two to two and a half times longer.

This represented a problem for the USFA with respect to continuing its support the concept that sprinkler systems could be a life safety device in residential occupancies. The reasoning
was if sprinkler heads could not keep the poisonous gases below the minimum threshold level, it was possible for a person remaining in the room of origin to become a casualty even if the sprinkler head activated.

As a result of these observations, the USFA requested proposals from companies interested in researching this and developing a sprinkler head with a faster response time. Two of the major manufacturers that stepped forward were Central Sprinkler Corporation and Grinnell Systems. Both companies started research projects to shorten response time. It is an old axiom in firefighting that a small amount of water put on a fire when it is relatively small is worth gallons of water put on a fire after it has an opportunity to become large.

$2,000,000 HEAD

Central’s program resulted in expenditures of over $2 million and four years of stringent testing to develop such a head. The result was a group of residential sprinklers which also have commercial listings, better known as the Omega Life-Safety Sprinkler Collection—the Omega in the title of this book.

Based on these two observations, Harry Shaw of the USFA also began to generate other criteria for the residential head. If a head could be designed to go off quickly when the fire was still relatively small, this head might also get by with less water and lower pressure.

Such observations and many others were continually offered to the manufacturers with the idea that they develop a new type of sprinkler head—the residential life safety head.

A new test criteria needed to be developed for these heads. Previously all commercial heads were tested to UL199, which includes commercial and industrial sprinklers. It requires a sprinkler to react in 6 minutes and 30 seconds in an air atmosphere where heated gases are not circulating. The criteria used to design a residential sprinkler was UL1626. When placed in a circulating air atmosphere, a head tested to UL1626 requires response in 8 1/2 seconds! A minimum of 6 seconds and a maximum of 13 seconds qualifies the sprinkler as having residential sensitivity.

The earliest models designed to fit this criteria were based on another simple premise: If the thermal mass of the solder link was sufficient to slow down a sprinkler head, it made sense
that the thermal mass reduction would increase the speed of response. Therefore, most of the initial research in the concept of residential sprinklers was aimed at the idea of reducing the size of the link.

**RESPONSE TIME INDEX**

Continued research led to the conclusion that each type of sprinkler head would have a response time that was predictable and measurable in accordance with the technology used. This was soon dubbed the "Response Time Index" or "RTL." An entirely different technique for testing these types of sprinklers was also developed. What was important with a sprinkler head of low thermal mass and quick sensitivity was that there be some means of measuring the response time that was easy to predict and to control under laboratory conditions. A decision was made to limit the testing of residential sprinkler heads to exposure to a rapidly moving column of fire gas that was reaching a certain minimum temperature level.

The quick response category was developed out of the need to offer the benefits of life-safety residential sprinklers to the light and ordinary hazard commercial occupancy. Grinnell used an approach which incorporated the residential sprinkler sensing element in a standard commercial frame. Central, on the other hand, developed three different residential pendants and a horizontal sidewall, which bear dual listings. The difference is that the effective residential water spray pattern is provided in addition to the residential sensitivity.

The initial testing done with this concept proved the merit of the idea. The first fast response or quick responding sprinkler heads were tested at Marina Del Rey by the Los Angeles City Fire Department. These prototype heads began to validate the whole idea of sprinkler heads being life safety devices. In test after test, the sprinkler heads designed to meet this criteria were successful in preventing fires from generating poisonous gases that exceeded human tolerances.

As mentioned earlier, most fire deaths are associated with products of combustion and heated, toxic gases. It was therefore necessary for Factory Mutual to select criteria for the design of the sprinkler to control hazardous gases.

The adequacy of the occupants' protection provided by
sprinklers is evaluated from measurements of carbon monoxide concentration and gas temperature at eye level in the room of fire origin. The actual effects of carbon monoxide on humans depend on its concentration and the duration of the exposure. Estimates of what constitutes a hazardous level are 3000 ppm (parts per million) of carbon monoxide for a few minutes and 1600 ppm for half an hour. Exposure to 1600 ppm for 20 minutes will cause headache and dizziness whereas exposure to 1600 ppm for half an hour will result in death.

**SETTING THE CRITERIA**

The criterion adapted for evaluating the heat hazard was that the gas temperature at eye level should be less than 225 degrees F. Measurements of ceiling surface temperature above the fire were used to assess the ability of residential sprinklers to provide property protection. For adequate property protection, the ceiling temperature should not exceed 600 degrees F. It is at this temperature that cellulosic and plastic material begin to vigorously decompose.

We have already learned that the criterion adopted for evaluating the heat hazard is that the gas temperature at eye level should be less than 225 degrees F. Excess exposure to temperature levels in excess of this results in loss of consciousness and death within several minutes.

Therefore, the criteria selected for the development of the residential sprinkler required that in a fire condition a residential sprinkler not allow eye level temperatures to exceed 225 degrees F, while the ceiling level temperature gas to be controlled at 600 degrees F or less. Carbon Monoxide saturation was restricted to 3000 ppm or less.

This is not to say that the road was smooth and easy once criteria was selected. Quite the contrary, because sprinkler heads were more sensitive to the velocity of gases passing them, a whole new problem became associated with sprinkler system design. A rapidly spreading fire had the possibility of sending a stream of gases throughout an entire area and subsequently causing the activation of more than one sprinkler head simultaneously. The concept of RTI, however, was valid and the technology continued to move in that direction.
OTHER CONCEPTS

Other concepts fostered by research in the residential field were “RDD” and ‘ADD.” RDD stands for “Required Delivered Density.” ADD stands for “Actual Delivered Density.” Stated simply, Required Delivered Density is the theoretical amount of water required to come out of a sprinkler head to deal with a specific fire problem. Actual Delivered Density is the actual amount of water delivered on the fire when the head activates at a given point in the fire behavior scenario.

The RTI concept relates these two principles because the residential sprinkler head is designed to activate at a point in the fire behavior scenario where the Actual Delivered Density is less than the Required Delivered Density.

The purpose of these engineering criteria was to make sure that the residential sprinkler head is putting water on the fire before the fire has reached the point of maximizing the extinguishment potential of each sprinkler head. The purpose of this is to keep the fire well below the thresholds with regard to production of toxic gases, heat, smoke, and other harmful by-products of combustion.

CONCEPT HAS MERIT

As soon as the technology began to take hold and subsequent tests were run, it was obvious the concept had merit. In parallel testing scenarios where commercial and industrial sprinkler heads were used with residential sprinkler heads, the time of extinguishment was cut drastically. While the track record of the “normal” sprinkler head was admirable under most conditions, it was also noticeably longer with response times. It was not uncommon in some scenarios for heads to take up to two and a half minutes to activate.

This was to be contrasted rather dramatically with the results of residential sprinkler technology. It was not uncommon for sprinkler heads with a similar temperature rating (i.e., 165 degrees) to respond in a matter of 30 to 45 seconds after the fire had reached the open flame production phase. In many cases, the fire never even got beyond the point of origin when the sprinkler head activated.

Earlier sprinkler heads were bulky, heavily-engineered and designed to be as rugged as the girders they were attempting
to protect. This was contrasted with the residential sprinkler heads which were aesthetically appealing, even delicate, but durable. In the process of reducing the thermal mass of the link, there was also a move to make the residential sprinkler head more aesthetically compatible with the residential environment with which it was going to serve.

As each generation comes along with a design of new residential heads characteristics will probably become more and more important, especially as architects, building designers, developers, home owners and consumers at large begin to realize the importance of the residential head. There will be more financial incentive for making these heads less expensive and less obtrusive.

One of the early cliches used to describe the residential sprinkler was that they are “silent sentinels.” With the movement toward making them more aesthetically pleasing, it is possible that the phrase someday may be “The Invisible Sentinels.”

**OMEGA**

The Omega, a leader in the residential sprinkler market, is on the leading edge of economics, aesthetics and safety. It is not only capable of meeting the criteria for response time but is also aesthetically pleasing. The engineering that went into the Omega configuration was considerably different than that of other research projects. In essence, most of the other companies attempted to take a conventional sprinkler head and “put it on a diet.” The Omega, on the other hand, was based on a totally different premise. The struts were eliminated and the mechanism which held back the water pressure was pushed behind a relatively flat and unobtrusive sprinkler head. The heat collectors on the exposed portion of the sprinkler head were not designed to melt but rather to instantaneously transfer heat to the interior of the head and subsequently to the activation device which would release the water pressure.

Basically, increased sprinkler sensitivity is achieved by reducing the mass of the sensing element. A row of pellets are the actual alloys utilized for the respective sprinkler heads. The difference is in overall size between those alloy pellets utilized in the Omega Life-Safety sprinkler as opposed to those used in the standard commercial Model E Pendent. The sensitivity of the sprinkler
The Omega Sidewall Sprinkler Head.

The Omega Sprinkler Head.
is related to the size and mass of the sprinkler link itself. Thus, the response time of a sprinkler in a fire depends on the gas velocity and gas temperatures adjacent to the sprinkler, and the sprinkler link sensitivity and its temperature rating (the link sensitivity is expressed by its time constant).

As a result of this shift in focus, the Omega head easily reengineered for side-wall applications. Additionally, the sprinkler head was aesthetically pleasing in a wide variety of architectural environments.

In addition to sprinkler link sensitivity, it was also determined that a special method of water distribution was necessary for life safety heads. Commercial heads create an umbrella type pattern that does not put water very high on the walls. The residential or UL1626 water pattern is high, flat and wide, distributing water droplets into corners and adjacent wall areas where heated gases collect and become significantly dangerous.

...AND RESEARCH GOES ON!

Currently, many other companies are researching the concept of residential heads, due to the fact that this technology has now been found acceptable for applications for other types of environments such as motels, hotels and boarding homes. A whole new generation of built-in fire protection devices is being spawned by research in this area. Notably, the design emphasis is no longer on property protection but instead is focused on life safety and the element of time. This new generation of sprinkler heads is following in the footsteps of a concept basic to the idea of firefighting, namely, that the element of time may be either an enemy or an asset in the control of fire.

Interestingly enough, the idea that residential sprinklers must be made more sensitive and thereby more responsive to fire behavior is directly in concert with the concepts of early warning detection and alarm systems. It is almost axiomatic that if fires are detected, occupants are warned and fires are controlled when still relatively small, the whole idea of loss of life from fire becomes a moot point. Small fires simply do not kill people. Residential sprinkler heads are a life saving device and perform this task in the most simple of fashions. They keep fires under control while they are still confined to the area of origin.

It appears that the technology which had its genesis in life
safety may once again provide assistance to overall of fire protection. A research project was being administered at the time this book was being prepared called the "ESFR." This acronym stands for "Early Suppression Fast Response," and is an entirely new field of research aimed at keeping fires small in high-rack storage in commercial warehouses.

Students of fire protection realize that if a faster responding sprinkler head is going to do a better job of controlling fires in residences, then it is possible it will do a better job of controlling fires in other occupancies. On the surface, that sounds like a fairly straightforward and easily acceptable comment but, to the contrary, it is very controversial and is not universally accepted by those who are in the business of engineering sprinkler systems.

The NFPA Foundation is presently conducting tests in conjunction with Factory Mutual to determine the value of using a faster responding sprinkler head to control fires in high-rack storage.

**SUMMARY**

No one knows what the future holds. One of the more interesting proposals has to do with a sprinkler head that has an explosive device in the head designed to activate almost instantaneously when the fire reaches a certain temperature level. This is a case of history repeating itself. One of the earliest attempts at fire suppression in factories was to take barrels of water and put them on the beams in buildings and surround them with blasting cord. The idea was that when the fire got big enough to ignite the blasting cord, the barrel would be destroyed and the water would be released onto the fire.

Let's hope new explosives technology will be a trifle more sophisticated than that. But the principle remains the same—the whole idea is to put water on the fire as quickly as possible. Instantaneous is just about as good as you are ever going to get.

Another design experiment involves Nitinol, a specialized metallic material with "thermal memory," the expansion or contraction of the material in accordance with heat levels. Nitinol head research was undertaken to find a head that not only responds quickly to various temperature levels but also with capability of shutting that head off when the temperature lowers.
This is the panacea many fire department personnel are looking for in order to justify sprinklers on the basis of reduced fire damage and minimal water damage.

In designing the new sprinklers, Central has incorporated a micro-switch concept into any Omega sprinkler for the purpose of electronically monitoring sprinkler flow. This modification, which they call the Ident-a-fire, is a simple concept. A normally open or closed electronic switch with a resistive rating of 125 volts AC and 28 volts DC is installed between the deflector and the sprinkler body. Since the switch is energized by the current passing through high temperature (200 degrees C) teflon fire alarm cable (600V), the circuit is opened or closed when the link fuses and the deflector “kicks out” to discharge water. Wired to an annunciator or fire alarm panel, sprinkler activation interrupts or completes the switch circuit and causes a signal at the panel, indicating exactly which sprinkler has activated.

Another embellishment to the Life-Safety sprinklers was a suicide-deterrent feature which Central calls The Prohibitor. It is designed for use in applications where there is a concern that sprinkler hardware may be used for self-destruction. The Prohibitor features a non-removable escutcheon by virtue of tamper-proof screws with one-way threads, and a breakaway of less than eighty pounds. The combination of the Prohibitor and the Ident-A-Fire concepts are quite commonly used in prison installations to illustrate a new dimension in life-safety fire protection and electronic monitoring of sprinkler flow.

It was recently reported the Japanese have developed a jelling substance, which is put into fire streams and discharged on the base of a fire. If it does not get converted to steam instantly, within a matter of seconds, the water forms a jelly-like substance that can be scooped up instead of running over and damaging everything.

Personally, when I heard about the Japanese concept, I was reminded of an early 1950s movie entitled THE BLOB. Somehow or other it seems to take all the glamour out of firefighting when you think of a firefighter carrying a quivering mass of Jello out of a structure in the aftermath of a fire. Hopefully this Jello will not have the malicious intent of Steve McQueen’s adversary.

Gertrude Stein once wrote “A rose is a rose is a rose.” In the future, a sprinkler head may not just be a sprinkler head.
This research has given genesis to the idea that sprinkler heads may be designed for occupancy and life safety instead of merely to limit the spread of fire. The designation of a sprinkler head as a "residential head" is like the Good Housekeeping Seal of Approval. It means the sprinkler head has a slightly different mission in life than its commercial counterpart. It was designed as a life-safety device and must be used accordingly.
When Will We Have Enough Evidence?

One of the most serious problems facing the entire life safety movement in the United States is the question of validation. Is the concept valid? Of course, everyone wonders whether the insurance industry will support the concept of residential sprinklers by giving a rate break in those occupancies protected by residential sprinklers.

Therein lies Catch 22. The insurance industry has been hesitant to progress quickly with the concept of residential sprinklers because it is waiting to “collect enough evidence” that these systems work as they should. Many communities are therefore reluctant to start urging or mandating the use of residential sprinklers because they’re waiting for the insurance breaks to come first. That’s the Catch 22. No evidence, no systems; no systems, no evidence.

But to thoroughly mix my metaphors, the proof of the pudding is when we have a fire! Those communities that have moved ahead with the concept of residential sprinklers have had fires, and the systems have proven valid. The purpose of this chapter is to give a brief overview of some actual fire scenarios which occurred in communities with residential sprinklers. In several cases, the information may sound almost too bizarre to
be true, but all the fires discussed in this chapter are documented by the agencies that experienced them.

**FAIRBORN, OHIO**

Probably two of the first people to recognize the value of residential sprinkler systems are John and Myrtle Turner of Fairborn, Ohio. In April, 1974, a sprinkler system activated in their apartment which probably saved their lives. In a report filed by Pete Fusco in the Dayton Daily News on Sunday, August 25, 1974, the following scenario was described: “It was about midnight and I heard some funny noises out in the living room. I got up and the noise turned out to be water coming from the sprinkler’ said Turner. The sprinkler had been activated by a fiercely burning couch in the living room which was extinguished by the system in the living room while the turners walked safely out of the house.”

The sprinkler system had been installed as a result of ground work done by Fire Chief Charlie Rule who had taken over the Fairborn department a year previously. The fire sprinklers were not originally required in the Hawthorne Apartments. The builder, Greene Metropolitan Housing Authority, had made the decision to install sprinklers, choosing between a fire sprinkler system and a recreation room. Mrs. turner was quoted as saying “I’m sure glad he chose not to build the recreation room!”

**THE ORANGE COUNTY EXPERIENCE**

Bob Hennessy, Fire Protection Analyst for the Orange County Fire Department, was one of the first individuals to support the concept of residential sprinklers. Early in the 1970s, Bob adopted the view that many occupancies could be better protected by sprinklers than they could be by upgrading water systems and other manual firefighting methods.

This line of logic was used in the development of a hotel in Cypress, California. The hotel complex, which was to be constructed on a site in an existing neighborhood, was surrounded by inadequate water lines. After evaluating the situation, Bob offered the property owner the alternative of upgrading the water system or installing residential sprinklers.

The building owner chose the latter. The systems he installed were of copper tubing, installed right off the hotel’s plumbing
supply. In this particular case, the owner didn't have long to wait to prove his decision was not only a wise one, but also timely. The building developer either had some sort of labor problems or was under the scrutiny of neighborhood vandals who deemed the hotel unsuitable for the area and decided to set fire to it. Early one morning, a police officer on routine patrol drove down the street in front of the hotel just prior to its being opened for occupancy and was startled to see a stream of water running out the front door into the street. The police officer, unaware that the building was sprinklered, thought that someone had turned a garden hose in the occupancy.

Instead of notifying the fire department, the police officer left the vehicle to investigate. The officer was startled upon entering the hallway to the occupancy, to find a veritable waterfall cascading down the stairwell. Still unaware that the building was sprinklered, the officer called for fire department assistance because he thought they had a water vac problem.

Upon arrival at the scene, firefighters turned off the water system and entered the building. They were amazed to find it had been set afire by an errant arsonist who had piled debris in a second floor bathroom. The bathroom itself was not sprinklered, but the room immediately adjacent to it was. As the fire rose in the bathroom and reached a flame height of 3 or 4 feet (according to the fire marks on the walls) the sprinkler heads activated in the adjacent room. Two heads, in this particular case, were activated because of the volume of fire and its shielding by virtue of its location inside the bathroom. The fire was controlled and extinguished. It had been confined to the bathroom.

With very minor work on the part of the developer, the drywall was replaced, the sprinkler heads were screwed back into the ceiling and the motel was readied for opening. If the building had not been sprinklered, there is a very good possibility that major damage would have occurred.

Months after that, Orange County had a second fire, also successfully controlled by a sprinkler head. In this particular case, the homeowner had been embarrassed by the fire and, instead of notifying the fire department, he merely replaced the sprinkler head and went about his business as usual. Several months later, the fire department learned of the fire through conversations
with the man’s neighbors. When asked what had happened, the occupant was sheepish but admitted that the sprinkler head controlled the fire so successfully that he did not feel it necessary to call the fire department.

COBB COUNTY

Dave Hilton, one of the early risk takers in the area of residential sprinklers, once said he was one of the few fire chiefs in the world who was “settin’ around waitin’ for a fire to happen.” At this time, he was sprinklering apartment houses at a very rapid rate and was continually questioned by developers “Do these things really work?”

Fire scenario during the Fort Lauderdale Tests, Fort Lauderdale, Florida. This test led many to the conclusion that plastic pipe was viable.

Dave had to wait longer than Bob Hennessy. After several years of installing systems in apartment houses, his department had not experienced a single fire. Then, in a very rapid succession, three fires occurred. In all of three cases, sprinklers were directly responsible for saving lives and property.

The first fire was “typical” of life-loss fires. A gentleman who had spent the major portion of the evening participating in the process of getting intoxicated, came home in the early morning hours. Not unlike many other individuals under the influence of alcohol, he decided he needed something to eat
before going to bed. He put a pot on the stove to heat some food. He was going to lie down, "just to rest my eyes." Of course, the same thing that has happened thousands of times before and has resulted in either death or injury: the occupant fell asleep and the fire on the stove continued until the food was on fire and so were the kitchen cabinets.

Under normal circumstances, the outcome could have been disastrous, but this apartment was sprinklered, according to Chief Dave Hilton's criteria, and the "silent sentinel" was ready to act. The occupant, who was carrying a pretty heavy load of intoxication was totally unaware of what happened next. As a matter of fact, if you listen to the tape recordings of him in an interview shortly after the fire, he was still unaware of what had happened. All he knew was that he had been suddenly awakened by a blast of cold water in his face. He was convinced that somebody had stuck a garden hose in the window and was hosing him down, trying to awaken him.

That wasn't at all what happened. The fire on the stove had reached open flame production and sent a plume of fire into the kitchen cabinets. A sprinkler head located about eight and a half feet away from the stovetop reached its operating temperature quickly because it was a residential life safety head. The popping of the link sent a fine spray into the room and immediately extinguished the fire, at the same time providing a wake-up call.

The most telling part of this tale was the fact that the intoxicated gentleman, after he found out what had happened, was quoted as saying "I'm just really glad to be alive!"

Dave Hilton's second fire was even more dramatic, and it involved an individual you would think would be much more aware of fire safety—a practicing attorney. This twenty-six year old woman, was heating oil on a stovetop one day and failed to monitor the temperature level. The oil caught fire.

What happened in the next thirty seconds has often had disastrous outcomes. Despite the fact the woman knew it was against her best interest to do so, she grabbed the pot off the stove. She intended to "run and throw the pot outside." Professional firefighters know this particular reaction has often resulted in serious burns to the person trying to carry the pot and, worse yet, has often resulted in burns to other people who have had the hot oil spilled on them. Nonetheless, this learned young
lady exhibited the type of behavior which usually results in a casualty or property loss.

Fortunately, her apartment was protected by one of Dave’s “instant firefighters.” As she grabbed the pot and turned, she walked directly under a sprinkler head. The plume of fire was so tall that it reached the point of operating the link within the milliseconds it took her to walk past the sprinkler head. Later she was quoted as saying “I thought something had broken. I couldn’t believe that much water could come out of my ceiling!” The instant firefighter controlled the fire in a millisecond.

The third fire took on an even more bizarre twist. Chief Hilton likes to refer to this fire as the “smart water fire.” Firefighters know we have wet water, and rapid water, but in this particular case, Chief Hilton called the water “smart.”

In this scenario, an individual was cooking steaks on an outdoor barbecue. Not unlike hundreds of other people, when he finished using the barbecue, he failed to extinguish the coals. Rather he put a lid on them and moved the barbecue next to the exterior wall of his home. This is a common practice because most people feel confident the barbecue is safe as it made of metal. Little did this man know that in the early morning hours the radiant heat still emitting from the barbecue would set fire to the shake shingles on the exterior of his house. Unseen, the fire began to develop very rapidly on the outside of the house. The fire spread up the wall and consumed the wood sheathing and 2x4s supporting the exterior wall. Finally, a sufficient amount of heat penetrated the inside of the tool shed to activate a sprinkler head. To that point, the drywall had held the fire in check but was nearly ready to ignite. The sprinkler head went on and extinguished the fire as it penetrated the interior wall and generated enough steam to put out the fire on the building’s exterior. The “instant firefighter” had done it again!

SAN CLEMENTE, CALIFORNIA

Not unlike Chief Hilton, the San Clemente Fire Department had waited with bated breath for its first fire experience. After sprinklering over 2,000 single family dwellings and conducting hundreds of experimental fires, the question still remained: will the systems perform as claimed in a real fire?

San Clemente got its answer at two o’clock in the morning
on Cazador Lane. A large condominium complex there was in the most vulnerable stage of construction. The building had been completely framed and wrapped with tarpaper, but the exterior had not been stuccoed. The drywall on the interior of the building had not been completely installed.

San Clemente has its first fire in a building under construction. The system was just placed in service a few days before the fire.

The San Clemente sprinkler ordinance required all systems to be installed and operational during the drywalling phase of construction in order to make certain that the carpenters did not drive nails through the plumbing, thereby rupturing the system. So this system was operational even though the building was far from occupancy.

The fire department received its first notification that a fire was in progress from the occupants of the single family dwelling immediately adjacent to the construction site. The person who dialed 911 reported "I just heard a loud pop. I can see smoke coming out of the second floor, and I think there is a fire in the condominiums next door."

This particular fire could have been disastrous under normal circumstances. Cazador Lane is a very narrow, one-way street that runs adjacent to a bluff overlooking the Pacific Ocean. If the building had not been sprinklered, it would never have been
allowed in the area in the first place. A very limited water supply was available and, at the time of the fire, the building was surrounded by scaffolding and construction vehicles. As an unsprinklered occupancy, this fire would have been a candidate for disaster.

Instead, upon arrival of the first due company, white smoke was seen coming from the rear of the second floor. No bell was ringing because the alarm bells were not required at that point. The first due officer, however, could clearly hear the sound of rushing water and water was seen issuing from the front door of the complex. The captain, following good fireground procedures treated the fire as though it still had potential and laid lines, advancing the inch and a half to the front door of the structure from where the smoke was emitting.

From the volume of water coming from the front of the building, it was evident that more than one sprinkler head had fused. An order was issued to secondary companies to shut off the water system. The inch and a half was advanced to the stairwell to see what remained to be accomplished. After the water had been shut off and lights established in the area, firefighters were faced with a fire approximately three feet square, sitting right at the top of a stairwell. Construction materials piled in the general vicinity had been burning for so long that they had actually burned a hole through the floor joists.

Directly above the fire was an atrium that had not been drywalled yet. If the fire had been allowed to continue, it would have gone into the atrium and subsequently into an open attic space encompassing several thousand square feet above the condominium units.

Three sprinkler heads had fused—one directly over the fire and two more in a small kitchen and atrium area to the side adjacent to the fire. There was some damage to drywall, and some floor joists would had to be totally replaced. But the building was totally intact. Under other circumstances, a fire occurring in an occupancy of this type, at that time of night, would have been disastrous.

Interestingly enough, this particular building was owned by a developer who had adamantly opposed the sprinkler ordinance at its outset. To this gentleman’s credit, after viewing the fire and the results, he stated “I still don’t like the fact that this sprinkler
WHEN WILL WE HAVE ENOUGH EVIDENCE?

system was mandated, but I have to admit that this building wouldn't be standing without it."

SANTA BARBARA FIRE

Probably one of the most unusual fires ever in residential occupancies is one in which a life was saved under the most adverse of circumstances.

In the early 1970s there was a fire in Santa Barbara, California. An individual had gone to a bar, met some other people during the evening, and took them to his home as a gesture of friendship. The individual was aghast to discover, upon arrival at his residence, that they intended to rob him. The victim was badly beaten and tied to a chair in the middle of the room. After stealing everything they could carry out to the car, they came back in and set fire to the room. The victim, who was already crippled and tied to the chair, believed he about to meet his maker.

Fortunately for the victim, unfortunately for the assailants, they were totally unaware the victim's building was a fully sprinklered occupancy. Soon after the criminals set fire to the room and exited, the sprinkler system was activated and the fire controlled. Upon arrival, firefighters found one irate, thoroughly wet, very happy-to-be alive individual.

WET BABY

The latest, and perhaps the most dramatic, case of a residential sprinkler activation occurred in Cobb County, Georgia. Thursday morning, May 2, 1985 at 6:15 a.m., a window fan short-circuited in the bedroom of a 20 month old girl. Young Jennifer Collum may not appreciate it for years but she probably owes her life to a Central Sprinkler head that had been installed in her apartment.

According to Chief Dave Hilton, young Jennifer lived in Smyrna. Her room, adjacent to her mothers, was windowless. Christina, Jennifer's mother, awoke to hear her baby crying in the next room. Christina said "I went in the hall and saw the fire." Christina opened the door and went in to pick up her baby. she could have taken her time because Jennifer was being showered by the activated sprinkler head—and not very happy about it at the time. But the fire in her room was controlled.

The smoke alarm did not activate. It had been disabled when
the fan's short circuit had blown the same circuit that powered the detector. The alarm never did activate.

Christina said that "The only thing on my mind was my baby. I couldn't see her through all that smoke." She continued "The sprinkler system saved my daughter's life. There's no question in my mind. I'm glad to know that they work. They are really great!"

Chief Hilton estimates that the total fire loss was less than $100.00 But, more importantly, he states "We could have lost at least four lives in this apartment."

**SUMMARY**

So there is the evidence. While this information has not been incorporated into actuarial tables of insurance companies, the fact is that residential sprinkler systems have and will continue to save lives and property. The insurance industry is reluctant to accept these incidents because they are somewhat isolated at this time. They are, however, direct indicators of the potential of the residential life safety system.

*The area of ignition in the San Clemente Fire. The loss was very minor compared to what it would have been in an unsprinklered building.*
As mentioned in another chapter, the Fire Chief of Newton, Massachusetts, had a fire in a hotel protected by one of Marriott Corporation's retrofits. He was convinced that an entire wing was saved and knew for a fact that human lives had been protected due to Marriott's sprinkler system.

How long is it going to take the insurance industry to recognize this evidence? How much longer can we afford to let them take for their evaluations?

Throughout the other sections of this book we have discussed the thorough testing and documentation of residential sprinklers by authorized laboratories. The work of Factory Mutual and Underwriters' Labs is completely documented. The history of the Los Angeles Fire Tests has been completely documented. Operation Life Safety, Operation San Francisco, the Cobb County fires, the San Clemente Fire Stop B Tests and literally hundreds of other experimental and demonstrational fires have proven that the residential fire safety system is a viable part of the arsenal of a fire department's operation.

What remains is for the American insurance industry to take stock of these facts and begin offering assistance in providing the financial incentives to encourage installation of these systems in each and every structure that is possible.

Recently, Sentry Insurance, a company in Phoenix, Arizona, made some major strides forward in this area. Sentry has posted a premium schedule that offers up to a 50% discount on homes protected by these systems. With a 50% discount in a home with a $400 a year premium, amortization of the cost of a residential sprinkler system doesn’t take long. Over the next few years we should see more and more companies offering similar discounts.

In the book MEGATRENDS, author John Nesbitt makes an appropriate statement. He indicates that in an era of high tech, it is crucial that we also have high touch. Instead of entrapping and dehumanizing life, technology has the potential of significantly improving the quality of life. Such is the phenomena of the residential life safety system. It is high tech but it is also "high touch." It has the potential of converting plastic, titanium and water into a formula spelling Life, Safety, and the Pursuit of the Quality of Life.
One of the really neat things about going to old Western movies was that they all had happy endings. The good guy always got the girl, the bad guy always got it in the end, and as the sun set, the viewers were reasonably assured that the world would be better tomorrow than it had been that day.

Unfortunately, such is not the case with residential fire safety. This field of endeavor requires constant contribution and attention to detail if things are going to proceed favorably. This book was written as a historical perspective of the concept of residential life safety, but it was written as a device for you, the reader, to use in assessing your own thoughts about the concept.

The final chapter in this book is not going to contain any rosy predictions about how things will be 10, 15 or 20 years from now. Hopefully, the evolution of this concept will continue, and enlightened individuals across the land will choose this means of modern fire protection to keep their communities safe. As I stated at an International Fire Service Instructor’s Conference in Washington, D.C., there is “no future for residential fire safety—there are only futures!” Any number of things can happen to this concept now that it has undergone exposure to public scrutiny and criticism.

To some, the concept of built-in residential fire protection
is an idea whose time has come; they will take this information and put it to good use. To others, the entire idea is like waving a red flag of controversy. In some cases, it has polarized communities, generated mistrust and raised the ire of developers, contractors and citizens.

The future of this concept is in your hands—the hands of the reader of this book. We recognize that, in a few cases, the book will be given to individuals who will never even open the cover. It is not uncommon for a gift of knowledge to be placed on a bookshelf to be admired and never used.

However, I want to share this information and knowledge gleaned from my own and other people's experiences. This knowledge is intended to serve as a launching pad for those who want to carry this concept to greater heights and to new arenas.

The writing of a book from this perspective is not unlike firing a shot into a dark room. You have no idea what you are shooting at and no idea whatsoever of the impact your shooting may have on any of the potential targets hidden and obscured by the darkness.

We hope that you have been convinced by the weight of evidence and the persuasiveness of argument that residential fire sprinklers should be part of your future. The only way we have of measuring that is to come back at sometime in the future and determine that the state of the art has advanced beyond the point described here. By sheer momentum, this concept is bound to be carried in some direction. You have an important part in determining that direction and, at the same time, determining the speed with which the concept is carried forward.

It is fashionable in some management circles today to talk of searches for excellence and megatrends. Adoption and implementation of the residential sprinkler concept is a choice for excellence as well as a megatrend.

If you have embraced the concepts explored in this book and have prepared to make the commitment to making residential sprinklers a part of everyone's future, then the time preparing this book will have been rewarded many times over. Please accept the literary version of a congratulatory handshake!
A


Alaska, Legislation and Model Resolution. Malone and Duncan.


Angus, Rodney D. "Evaluation of Residential Fire Risk as a Basis for Planning of Automatic Fire Protection Systems."

An Ounce of Prevention. FEMA, U.S. Fire Administration.

Answers to the Sbingle and Shake Roof Problem. NFPA. M p 66-1.


Belzak, Byron T. Built Not to Burn, the Residential Fire Sprinkler Resource Book. Atlanta, Georgia 30339.


Britton, S. "Fire Sprinkler at Home." Sacramento Union.


C


Central Residential Fire Sprinkler Home Case Study... Cobb County, Georgia, 1983.
BIBLIOGRAPHY / 157


Charlotte Test Series, Draft Summary. NFPA.

Chaney, Byron. "Manual Fire Combat Antiquated, Dangerous and Expensive.”


*Design for Disaster.* Burbank Fire Department, November 1970.

*Development of an Experimental Prototype Low-Cost Electronic Sensor/Actuator for a Residential Automatic Sprinkler Head.* FEMA Grant #80009.


"Drive to Cut the Cost of Home Fire Sprinklers." Business Week, July 16, 1979.


Fire Hazard/Fire Protection Study. Huntington Beach Fire Department, Huntington Beach Planning Department, July 1974.


Fire Protection Software, Incorporated, 1411 E. Will Rogers Avenue, Stillwater, Oklahoma 74074.


Fully Involved. FEMA. U.S. Fire Administration.

Friedman, Dr. Raymond. "Sprinkler Technology: Research on Sensitivity." Record, Fall 1983.

G


*General Safety Bulletins on Solvent Cement and Primer for Plastic Pipe*. Industrial Polychemical Service, 17109 S. Main St., Gardena, California 90247.

Geoghan, Marchall, Jackson and Harris, *Development of a Nitinol-Actuated Fire Sprinkler*, U.S.F.A. Grant #80124, Battelle Laboratories, Columbus, Ohio 43201, September 15, 1982.


Grinnell Residential Fire Sprinkler. Test Case Study...Cobb County, Georgia, 1982.


H


*Handbook of Steel Pipe*. American Iron and Steel Institute.


Highlights of the National Household Fire Survey. U.S. Department of Commerce. NFPCA. No Number—Black Cover.

Home Fire Viewed as a Scientific System. Technical Report 77-5, SFPE, 60 Batterymarch Street, Boston, Massachusetts 02110.

House Resolution #7, California House of Representatives, Relative to Automatic Sprinkler Systems.


How to Use Statistics, NFPA, 470 Atlantic Avenue, Boston, Massachusetts 02210.

I


Impact of the Use of Smoke Detectors. U.S. Department of Commerce. PTI, Urban Consortium, NFPCA Grant 77075.


Investigation on Retroactive Smoke Detectors, Extinguishing Systems. Orange County Fire Department, September 1980.

J


Johnson, Emerson. "Firemen Want to go to Blazes Less."


K


Major Findings of the National Fire Data Center, October 17, 1977.


Management and Enforcement of Fire Codes. FEMA, U.S. Fire Administration, November 1979. USFA Grant 79002.


Murphy, K. “County May Require Sprinklers in New Homes.” Register, September 1981.


Operation San Francisco Sprinkler Demo, 1/2" VHS Video Tape Grinnell Fire Protection Systems, October 1983.


*Polybutylene in Depth*. Shell Chemical Company.


Q


R


Reilly, Edward J. “Residential Sprinklers Systems—Where Do We Go From Here?”


Residential Fire Sprinklers: A Builder’s Perspective. Byron Belzak...Wordsmith (Cobb County).


Residential Fire Sprinkler Protection, Technology Update. National Fire Data Center FEMA.


Sentinels of Survival. Area 16 Productions, 917 North Highland Avenue, Hollywood, California 90038.


Society of Fire Protection Engineers. 60 Batterymarch Street, Boston, Massachusetts 02110.


Sprinkler Requirements in the National Building Code of Canada, Canadian Automatic Sprinkler Association. CASA-6-C.


Sprinkler System Guide. V. King, September 1978.


Solvent Cementing PVC, Plastic Pipe Fitting with Weld on Solvent Cements. Industrial Polychemical Service, Box 471, 17109 South Main, Gardena, California 90247.


Summary Investigation Report, Successful Sprinkler Activation, Cobb Country, Georgia, May 2, 1985, NFPA.


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Ron Coleman is currently the Fire Chief of the City of Fullerton, California, and was previously the Fire Chief of the City of San Clemente, California. He has been involved in the development of automatic fire protection systems for over 25 years. He is a consulting editor for Fire Chief Magazine and has authored numerous articles and textbooks.

The writing of this book is also dedicated to the memory of Fire Marshal Don Hodgson.