

Residential Sprinklers:  
One community's experience twelve years after mandatory  
implementation.

Executive Leadership

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An applied research project submitted to the National Fire Academy as part of the  
Executive Fire Officer Program

January 2001

## **ABSTRACT**

During the 1850's, a North American textile mill owner invented the most significant lifesaving device known to man. Perforated pipe connected to a water supply that would activate when a valve was opened manually. Shortly after that in 1874, Henry S. Parmalee of New Haven, Connecticut, designed the first practical automatic sprinkler head, that is still in use today (NFPA, 1996). Granted, sprinkler system design has gone through change over the years, but the basic concepts still hold firm.

Today, the sprinkler industry has progressed from ordinary plumbing mechanics to sophisticated engineers who are designing specialty systems for all types of buildings and occupancies. The concept of engineered systems has developed into one of the most successful fire suppression methodologies known to man and yet these lifesaving devices continue to be met with great resistance when applied to a residential style development (ICMA, 1988). It baffles the mind that people can be so resistive to the presence of residential sprinklers, even though they are proven lifesaving devices.

The purpose of this research paper is to take a look at one community's experience with the introduction of residential sprinklers into the housing market and, more importantly, what results have been acquired twelve years after a mandatory ordinance was enacted. The community is Prince George's County, Maryland, who has an ordinance requiring that residential sprinkler systems be installed in all new construction. There was a great deal of opposition to this piece of legislation, but through persistence a positive outcome was obtained. The legislation required a phase-in period for residential structures to be sprinklered and, as of January 1, 1992, all new residential structures are required to have these devices (PGFD, 1990).

An evaluative research methodology was used to support this project, and entailed addressing the following research questions: 1. What was the strategy utilized by the Prince

George's County Fire Department (PGFD) to successfully implement a mandatory residential sprinkler ordinance in 1987?; 2. What elements of support were needed to address the plan for implementation of such a controversial, yet lifesaving, initiative?; 3. What was the outcome of the supportive elements and predictions that were used to support the enactment of such legislation?; 4. What results has the Prince George's County community realized twelve years after introduction of this ordinance?; 5. What lessons have been learned from this particular experience?; 6. What is the next step in the process of invoking a fire safe community in Prince George's County, Maryland?

This research includes a literature review, subject matter expert interviews, and eight years of documentation by the PGFD concerning all residential sprinkler activations that had occurred in that time period. Results of the research revealed that the department was able to document reduced fire damage and significant lives saved. The findings of this analysis covered the period of January 1, 1992, through December 31, 1999, as indicated below:

Residential Sprinkler System Reported Incidents	121
Residential Sprinkler System Reported Fire Incidents	117
Residential Sprinkler Activations	143
Total Fire Loss	\$ 401,220.00
Potential Fire loss	\$ 38,230,000.00
Reported Lives Saved	154
Injuries Reported (All minor in nature)	7

Also determined by this research was a correlation between the number of heads that were activated in what would be considered non-intentional types of fire incidents, and the examination of fire spread. This was looked at from the context of the number of heads that were activated and the actual containment of the fire to the room of origin. In all of the 121

incidents reported, only eleven had more than one head activated. Of those eleven, seven had more than two heads activated. A review of those seven cases revealed that some type of extenuating circumstance, such as the use of an accelerant or human intervention, contributed directly to the involvement of the other sprinkler heads. Only four cases reported some type of accidental activation or water flow from reasons other than a fire occurrence.

As a result of this research project, several recommendations are put forth as important steps needing to be taken by both the research community and the nation at large. Suggested recommendations for the County include an assessment of all current sprinkler technology to determine application in the County, more research for the continuation of reducing installation costs, and to determine if residential sprinkler systems improve the resale values of homes. An effort must be initiated to educate the public about the relative worth of these devices and to encourage more people to install them in their homes. Finally, the County recommendation is to explore avenues of pursuing retrofitting of sprinklers into existing residences.

Several recommendations have also been determined for other jurisdictions. These recommendations include the following five points. First, before starting any public activities related to mandatory sprinkler requirements, make sure that the entire process is well thought out using a strategic planning process to develop an action plan that addressed all of the needed resources to accomplish the task. Second, that enactment of the legislation is based upon good solid facts and obtainable predictions. Third, that a united front is provided to support the decision making process. Fourth, that the future needs of the community are well established and lastly, that the legislation is drafted in such a way that all parties of interest have been involved in a consensus building process.

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## INTRODUCTION

Fire, a problem that has continued to plague man since the beginning of his existence. How does one go about reducing the occurrence of fire? When it does occur, how does one go about suppressing it in the most expeditious manner, with the least amount of damage resulting from both the fire itself and the means utilized to control it? Man has continued to try and answer this question. Since the time of the early cave dwellers, which used open flames for heat and cooking, to the modern day fire service organizations that experiment with innovations such as quints and high-powered water blasters. In this author's opinion, however, man knows the answer today, but in some situations will not readily accept sprinkler systems as the solution.

Fire sprinklers have been in existence since the 1800s when business owners first recognized the potential risk that a fire might have had upon their establishments. This is an interesting point because even back then, the concept of loss and monetary value drove the human thinking process to a point that the loss of life, due to fire, took second priority to the loss of livelihood through employment opportunities. As time marched on, discussions began to develop about the need to apply fire sprinkler technology into the residential setting. Thus, came the creation of residential fire suppression systems (NOVA, 1999). Based upon the idea that if these products could detect fire early enough in its incipient stage, then it could be extinguished, or at least held in check with a minimal amount of water and thus keep the damages limited to minor amounts. A transformation from the business community of protecting ones livelihood, to the residential community and protecting ones life began to occur.

The battle then ensued. Everyone seemed to have an opinion about the worth and cost of these known lifesaving devices. The fire service pushed forward with proposed acts of legislation to require sprinkler systems to be installed in all residential structures, and the building industry fought back. They used reasons such as; the cost would be too much for an

average homeowner, the water damage would be too great due to their activation, and what if they discharged accidentally or a water pipe broke. The devastation from free flowing water would be astronomical. Well, as the battle raged on, certain communities around the country continued to push for the acceptance of this position and hence a handful of laws were adopted bringing about a transformation into how that community deals with the present threat of a fire.

One such community, who successfully implemented this type of legislation, was Prince George's County, Maryland. A cosmopolitan jurisdiction that borders the District of Columbia to the East, managed under a charter form of government, is considered to be one of the true melting pots of the East Coast. Having over 127 different languages spoken by its residents and a wide range of housing units, it has many things to offer in both employment and living arrangements (Prince George's County Government, 1998). But one factor is common to Prince George's County. Like so many other East Coast communities, the occurrence of fire presents an ever-present danger to its citizenry and economic base. After nearly three years of extensive preparation and research, the Prince George's County Fire/EMS Department embarked upon a process of legislating a mandatory residential sprinkler ordinance that would require these lifesaving devices to be installed in every home built after a certain date.

The Prince George's County experience with its Residential Sprinkler Legislation is the focus of this research project. In that, since its enactment over twelve years ago, the County Fire/EMS Department has been tracking the number and types of fire related incidents that have occurred in structures that have residential sprinklers installed. In addition, the research will include a review of similar fire occurrences that have taken place in like structures that do not have residential sprinkler systems installed. The purpose of this research paper is to show the effects residential sprinkler systems have had on the quality of life through the mitigation of fire in Prince George's County, Maryland. It is also the intent of this research project to show the

direct correlation to fire occurrence, fire spread and property loss that have occurred in both sprinklered and non-sprinklered buildings of similar construction design and similar fire origins.

The research questions answered by this project are:

1. What was the strategy utilized by the Prince George's County Fire Department to successfully implement a mandatory residential sprinkler ordinance in 1987?
2. What elements of support were needed to address the plan for implementation of such a controversial, yet lifesaving, initiative?
3. What was the outcome of the supportive elements and predictions that were used to support the enactment of such legislation?
4. What results has the Prince George's County community realized 12 years after introduction of this ordinance?
5. What lessons have been learned from this particular experience?
6. What is the next step in the process of invoking a fire safe community in Prince George's County, Maryland?

## **BACKGROUND AND SIGNIFICANCE**

In completing this research project, it was intended to utilize a great deal of research that was acquired through the case study organization, the Prince George's County Fire/EMS Department, over the past 12 years relevant to the implementation of a Countywide residential sprinkler ordinance. The information was secured as a direct result of this research project from various organizational sections and parts of the County government. Today, the Prince George's County Fire/EMS Department is a career/volunteer combination system that consists of 47 fire/rescue facilities. Currently, the authorized strength of the career force is 800 employees and a total volunteer force of 2,000, of which about 1,200 participate in emergency response

activities. The operating budget for the Department is 67 million dollars, which includes fringe benefit packages for both career and volunteer members. The Department is responsible for all suppression activities, both Advanced Life Support and Basic Life Support delivery systems, and fire prevention and investigation activities (PGFD, 2000).

Prince George's County, Maryland, has a population in excess of 830,000 residents who live predominantly in the northern two-thirds of the 500 square miles that make up this land mass. The southern one-third portion of the County is predominantly rural. However, large tracts of land are currently undergoing development with a ground swell of housing units being built. Prince George's County is most noted as a residential community, providing affordable living arrangements for many people who work within the jurisdictional boundaries of the District of Columbia. It was built up heavily in the 50's, 60's and 70's with large amounts of residential units, both single-family and multi-family, to provide residences for the many federal workers in the area (Virta, 1991).

Prince George's County has developed significantly since 1970 when its citizenry elected to adopt a charter form of government to administer to its greater needs. This included the creation of a fire service that overnight came under the auspicious of a County Fire Chief, which had been comprised of 37 separate volunteer fire service corporations that operated within separate tax districts managed by individual County commissioners. With the advent of the Prince George's County Fire/Emergency Medical Services Department, came the push for a stronger uniform fire prevention code and ordinance, known as Subtitle 11 of the Prince George's County Government. A document that has played a significant role in this jurisdiction's transition to "One of the First Counties in the Nation to Require Residential Sprinklers in all Dwellings (Bosanko, 1990)."

The 80's brought with it a great deal of expansion to the construction potentials in Prince George's County Maryland. Development was abounding throughout the County. With this large influx of, specifically, new housing units, a concern began to arise over the need for adequate public facilities in the County to address this ever-growing population of residential structures. At that time, fire loss statistics indicated a sustained trend similar to other communities in the nation, specifically those on the East Coast, in that, fire deaths in residential structures continue to be truly significant and the occurrence of fire was only reducing slightly. According to the United States Fire Administration, in 1985, 6,000 fire deaths were occurring annually in the United States, and 80% of them had occurred in residential structures, with 50% of those individuals killed being the elderly, handicapped, intoxicated individuals, and children. Fire statistics for Prince George's County, at the time, supported similar findings with an average of 14 fire deaths a year and 104 fire injuries occurring in the County annually. Reporting 89% of the fire deaths occurring in residential properties, and structural fire losses amounting in excess of \$13,800,000 annually (Prince George's County Government, 1987).

In an effort to reduce these staggering statistics and to meet the fire suppression obligations of the government, a plan of action was developed to introduce legislation requiring the installation of residential fire sprinkler systems throughout the County. After a considerable amount of work, spearheaded by the Prince George's County fire service, the legislation was approved by the Prince George's County Council and signed into law in 1987, by the County Executive. The law allowed for a phase-in of these lifesaving devices. One and two family model homes had to feature sprinkler systems on February 1, 1988. All multi-family residences were affected on June 30, 1988, with all townhouses starting on January 1, 1989. On January 1, 1992, the final stage of the law went into effect stating that from that point on all residential

structures, including single-family homes, must be fully protected by a NFPA Approved 13-D residential sprinkler system (PGFD, 1990).

This research project is directly relevant and related to the National Fire Academy (NFA) Course “Executive Leadership.” Due to the definitive nature, it provides for the evaluation of a community-based initiative in addressing a significant global management problem. Directly supported by the fact that the process utilized in Prince George’s County for addressing its community fire problem involved many executive-level competencies that were initiated successfully. This research paper will serve as a tool to evaluate the implementation process used by that county’s leadership and the related skills and attributes that can be used by others. Examining this initiative of implementing a countywide mandatory sprinkler ordinance provides a far-reaching opportunity to evaluate and assess leadership strategies, multiple role utilizations, decision-making skills and processes to influence change in one’s community. Overall, providing a methodology to assess survey instruments, experiential activities, creation of desirable goals and personal effectiveness.

## **LITERATURE REVIEW**

The literature review conducted to support this research project included numerous texts and written materials that discuss many of the issues surrounding the need for residential sprinkler systems both abroad and here in the United States. The majority of the materials found, provided more references toward the positive benefits of these known lifesaving devices than actual long-term experiences of their performance after implementation in a community setting. This is due in part to the newness of the technology being utilized in this scope of construction and the limited amount of communities here in the United States who have successfully implemented such mandatory legislation as was done in Prince George’s County.

Most all of the literature reviewed made some reference, in one form or another, to a national program entitled “Operation Life Safety” (OLS). “A partnership of the International Association of Fire Chiefs (IAFC), the United States Fire Administration (USFA), and the private sector, whose goal it was to significantly reduce residential fire deaths, injuries, and property losses through the use of public awareness and education programs, and the promotion of early warning detection, alarm, and fast-response sprinkler technology” (OLS, 1996). As this organization developed, its primary function developed into a system that would monitor sprinkler activations all across the country and track the human and property loss statistics for each of those activations. The materials made available through “Operation Life Safety” carried the sprinkler message for several years; however, support of this program has changed when it reorganized into the flagship program of the Residential Fire Safety Institute in June of 1999.

The first municipality in the United States, 1978, to require residential fire sprinklers in all new properties was San Clemente, California. This community, in essence, started the country down the path of mandating residential sprinkler systems that was soon followed by several other progressive and innovative governments. “Operation San Francisco,” that community’s plan for utilization of these devices served as a national pilot project for residential sprinkler application and testing in October of 1983. It was determined from that project that “Their tests along with others across the country, contributed to the realization that fire deaths could be substantially reduced through the increased application of quick-response sprinkler technology used in conjunction with early warning detection and alarm systems.” Major conclusions from all of this research, conducted at that time, were found to determine that: a) residential sprinklers save lives; b) residential sprinklers reduce property loss; c) residential sprinkler costs can be substantially reduced or offset; d) that over time sprinklers will reduce fire service needs; and e) offer a potential to reduce insurance costs (Partners for Fire Safe Homes,

1995). The research of the time, 1978 – 1987, went on to support that; “Studies by the Federal Emergency Management Agency through the United States Fire Administration indicate that the installation of home quick response fire sprinkler systems could have saved thousands of lives, prevented a large portion of those injuries, and eliminated hundreds of millions of dollars in property losses,” as reported in 1986 (USFA). The problem was getting the public to accept this fact and install them.

The literature review also indicated, at that time, that benefits to both homebuilders and buyers were identified and marketed as positive aspects of these systems. Benefits to builders having these devices installed in their construction projects included: offering a low cost reliable safety option that would attract many buyers and trade-off's between sprinklers and code requirements that can result in lower construction costs and more units per area of land mass developed. Benefits offered to home buyers included: a superior degree of life safety for families, home and contents will be safe from serious fire damage, and probable increases in the resale value of the home (Ruppert Brothers, 1987).

Unfortunately, several common myths were also associated with residential sprinkler systems and because of anti-support groups, such as builders and developers propagating in such myths, communities had to prepare to address each item as it is presented to them. These myths included: the cost these systems add to the construction project, overall appearance of the sprinkler heads in the living area, the potential of accidental activations of the heads, the potential of excessive water damage during normal activation, the overall effectiveness of sprinklers, and the need for sprinklers when smoke detectors are already in the home (Wilk, 1999). Truth be it known, these two different types of safety items, sprinklers and smoke alarms, actually work hand in hand towards making a residential structure safe from the ravages and destructive force of fire. This point has been made time and time again, but not to the level that

it should be publicized. But due to initiatives by well-established information sources, such as Popular Mechanics, the steady fight to win people over continues (2000).

All in all, these issues began to settle and until 1998, the residential sprinkler battle facing most of America had seemed to quiet down. Communities that had made the bold step to implement mandatory legislation were actually becoming accustomed to these devices and acceptance seemed more tolerant in other communities. Then, one of the most disastrous blows to the efforts of legislating the installation of residential sprinklers occurred. The Omega Fire Sprinkler Head Recall. A national recall of 8.4 million defective sprinkler heads because of the use of a synthetic elastomer O-ring that swelled or degraded to a point that the head would be rendered inoperable (UL, 1996). This defective design feature, which was known to prevent activation of the head when a fire actually did occur, sent a shock wave through the sprinkler community. Providing unwarranted opportunities to spread misinformation by those individuals that wished to refute the importance and significance that residential sprinklers had added to the safety elements of a home. This one single event, in this author's opinion, caused an expressive destructive blow to the positive residential sprinkler efforts by so very many and that the need is again present for a national effort to restart the residential sprinkler installation efforts that were unprecedented in the 1980's. That too is another purpose of this research project, to show that even though the installation of residential sprinkler systems have been faced with a mired of issues, the basic principles put forth by this technology are, in fact, the right thing to do, and, more importantly, can be one of the most critical single beneficial actions a homeowner can take to ensure that their place of residence does not succumb to fire. A recent article that appeared in a newspaper's home report section earlier this year stated, "A sprinkler system, combined with smoke detectors, provides the most reliable form of residential fire protection for you and your family" (Popular Mechanics, 2000).

## **PROCEDURES**

### Research

The desired outcome of this applied research project was to determine the level of success that resulted from the adoption of a residential sprinkler ordinance in Prince George's County and to see if, in fact, the life and property savings' predictions made 12 years ago were accurate. In addition, to determine if the amount of effort, resources utilized, and the costs expended, at that time, were actually worth the amount of return that the community has seen on its original investment. It is also the desired outcome of this project to determine what steps can be successfully utilized by other fire service organizations to revitalize any aspects of implementing residential sprinkler legislation in their community. In addition, it is a purpose of this project to actually justify, 12 years later, this government's expenditure of funds, resources, and time to institute this legislation. And, to assess the value added benefit provided the county by taking on such an extensive initiative, such as changing the fire safety laws of the community.

The research methodology used for this project was evaluative in nature and includes a literature review, subject matter expert interviews, and an analysis of eight years of sprinkler activations resulting from fires in residential structures here in Prince George's County, Maryland. The analysis was designed to evaluate the specific circumstances surrounding each fire incident and the resultant sprinkler activation while looking at nine separate documentation items. The areas of documentation involving this review included: date of incident, type of structure, fire origin, fire cause, number of fused heads, actual fire loss, potential fire loss, lives saved, and resulting injuries. The main emphasis of this analysis was to determine the facts that surrounded the fire occurrence, what activated the sprinkler head, how many heads were fused (fire spread), and the amount of damages or lack there of that occurred from an incident.

The eight years of sprinkler activation reports were completed by on-duty fire inspectors with the Prince George's County Fire/EMS Department, who responded at the time that the emergency incident and/or activation was reported. The reports were completed on-scene via first hand inspection of the structure and within 24 hours, forwarded to the Department's Fire Prevention office for analysis and storage. For some time, the reports had not been utilized to any great extent or potential use as a means of supporting or providing fire data analysis and only through the interests of this author were the reports located and assessed for use in this research project. Part of the reason for the lack of utilization of these reports by the Department, was directly related to the mass amounts of transition and turmoil the Department has seen in the past 11 years. During that time, the Department faced significant budget reductions, reductions in staff and sworn positions, and had been commanded by five different fire chiefs (Siarnicki, 1999).

As part of the research methodology utilized in this report, the types of incidents reported on the fire sprinkler activations forms were analyzed for key points related to occupancy and fire location. With this data, a second search of the entire fire service archives was conducted in order to locate similar fire occurrences in non-sprinklered buildings over a similar period of time. There is no specific significance to the time period used, other than it was after the mandatory legislation was enacted in the County and covers a span of time that includes all of the phased-in requirements of the law. The purpose of this second data search was to have comparable incidents that occurred in non-sprinklered structures with similar construction features and designs. Thus, providing a reference point as to what could have occurred in the non-sprinklered buildings, had these devices been there, and what could have occurred in the sprinklered buildings had this lifesaving device not been installed.

## RESULTS

The fire problem in Prince George's County is very similar to many other urban/suburban communities in the United States. The leading cause of fire is unattended food on the stove, which accounts for over 26% of all fires reported in the County on an annual basis. In 1999, the Department responded to approximately 110,000 calls for service annually of which 85,000 of those incidents are EMS in nature. As was mentioned earlier, the purpose of this research project was to examine the process that was utilized by this agency to address its fire occurrences and, more importantly, prevent future fire related deaths and injuries.

The overall strategy undertaken by the Prince George's County Fire/EMS Department at the time that its residential sprinkler legislation was being proposed was to take a multi-aspect strategic approach to the various groups and entities that would be involved with this initiative. The three main groups who possessed the most opposition to this new law, that had to be dealt with, were the building community, real estate community, and the development community. Only when all three of these groups were addressed, would it then be felt that the outcome of this endeavor could be successful. The plan was to find specific elements that would appeal to each of these groups and combine them with very specific facts and figures concerning residential sprinklers and to make individualized presentations to each of these groups, so as to hit their issues head on. Ultimately, to win their support. For the building community, the issues were simple: establish alternative ways to offset the anticipated costs of the sprinkler systems and to provide a marketing package for them that would increase system purchases by perspective home buyers. To address the concerns of the development community, it was proposed that these systems would allow for more dense population, due to built-in protection and thus allow for more occupancies to be constructed on smaller amounts of land mass; therefore, increasing profits and total units per acre of developable land. And finally, with the real estate community,

the main point for this group was the potential increase in value these systems would add to a home, the potential for decreased insurance premiums and, more importantly, the increased demand by the buying population for homes that were more safe (SMBIA, 1988).

Granted, this may seem like a very basic approach to the problem of gaining support of these groups, and in reality it was. However, it must be noted, for the purpose of this research paper, that this process of winning over the opposition in the County took almost two years to complete and stresses one of the key points determined by this research project. No successful outcome of any type dealing with the implementation of a residential sprinkler ordinance will come to fruition without the commitment, drive, and most of all, homework being completed by the sponsoring fire service organization. As mentioned earlier, a costly endeavor.

Critical to winning the support of these groups and others involved in this legislation was determining what elements would be needed to address the plan for implementation of such a controversial and yet lifesaving initiative. First and foremost was the need for accurate information and facts concerning other community's experiences with residential sprinklers. It was critical to use facts that were hard to dispute and hit home on making the County safer.

The second element of support utilized in this process was a consolidated tactical front line by all of County government with a well-versed strategic action plan that met all of the goals and objectives that needed to be accomplished through a holistic approach of solving this problem. This involved addressing all of the structural and construction needs of the community by laying out a 10-point program as part of the proposed legislation. These ten points were: 1) All new multi-family dwellings shall be fully sprinklered in accordance with NFPA 13. A list of acceptable building construction cost savings alternatives has been established and are permitted for sprinklered apartments; 2) All existing multi-family dwellings for which a voluntary sprinkler system is installed in accordance with NFPA 13, shall not be taxed upon the increased

appraised value added by the sprinkler system improvement until the building is sold to a new owner; 3) All new townhouses must be fully sprinklered in accordance with NFPA 13-D. A list of acceptable building construction cost saving alternatives has been established and are permitted for sprinklered townhouses; 4) All existing townhouse dwellings for which a voluntary sprinkler system is installed in accordance with NFPA 13-D, shall not be taxed upon the increased appraised value added by the sprinkler system improvement until the building is sold to a new owner; 5) All new model homes constructed on a specific date shall be fully sprinklered in accordance with NFPA 13-D. The builder shall be required to furnish a sprinkler option for review by potential buyers prior to obtaining a building permit; 6) All existing single-family dwellings shall be entitled to the same tax deferment as existing townhouses and multi-family dwellings; 7) All new hotels, motels, and dormitories shall be required to have complete sprinkler protection in accordance with NFPA 13; 8) All existing hotels, motels and dormitories shall be required to have complete sprinkler protection in accordance with NFPA 13; 9) All sprinkler systems shall incorporate quick-response sprinkler heads in residential areas in accordance with the conditions of their listing; 10) The requirements for sprinklers shall in no way cause a reduction in existing requirements for smoke detection in current laws and regulations (OLS, 1987).

The third element of support that was critical to success was understanding the need for requirements of this law to be phased into existence so that no one building group or development company would feel an immediate overwhelming impact or burden from the legislation. The implementation schedules that were proposed and later adopted were as follows: one and two family model homes had to feature sprinkler systems on February 1, 1988, all multi-family residences were affected on June 30, 1988, with all townhouses starting on January 1, 1989, and on January 1, 1992, the final stage of the law went into effect, stating that from that

point on, all residential structures, including single-family homes must be fully protected (Prince George's County Government, 1987).

The fourth and final element of support for this process was the establishment of a Countywide task force made up of a broad range of individuals who each represented some group or faction that had a vested interest in the law. The task force met on a monthly basis to address the issues at hand and concerns as they arose. A copy of the final Task Force Report is listed in Appendix A. The task force organizational structure was decentralized enough to allow for the creation of several subcommittees to address specific elements of the proposed legislation and its ultimate implementation. One such subcommittee was the group assigned with developing alternative ways to offset the cost of these sprinkler systems here in Prince George's County. The subcommittee was comprised of twelve individuals representing the fire service, the building community, the development community, the design community, the County Council, fire service labor groups, County planning officials and the County Attorney's Office (Sandul, 1987). This group continued to meet until it had developed a series of construction alternatives that were presented to the entire task force, subsequently approved and enacted upon as part of the legislation when it became law. A listing of these alternatives can be found in Appendix B.

Each of these supportive elements resulted in specific outcomes that were, at the time, based upon predictions made by both the County fire service and those that were proponents of the legislation. These predictions were utilized as part of the justification as to why this new law was not only necessary, but also critical to maintaining an expected way of life here in the County. The predictions that were made 12 years ago were as follows; the cost for having a residential sprinkler system installed in a new home during construction would be approximately \$2,500 to \$3,500 per dwelling. Installations may be done by a sprinkler contractor, plumber,

homeowner, or subcontractor, provided that the system design is in accordance with required code standards. The installation of a residential sprinkler system will in some cases, reduce home insurance premiums. Residential sprinkler heads are not unattractive to the homes aesthetics features, and residential sprinklers will extinguish a typical room fire prior to sufficient accumulations of toxic fire gases or heat development. Most fires will be extinguished by one or two sprinkler heads. Minimal amounts of water will be utilized to extinguish the fire. Minimal amounts of water damage will occur since these heads only utilize 13 gallons of water per minute each. The resale value of your home will increase, and these systems do not experience accidental activations with any regularity (PGFD, 1987).

And as to be expected, the implementation of this new law was not as smooth as its originators would have liked it to be. Problems related to its early enforcement plagued the process for the first couple of years, but over time the process continued to improve and work much better. Early problems with implementation included little or no experienced individuals who truly understood these systems, who could ensure that they were both designed properly and installed properly. This point affected both the building and inspectional sides of the coin. Contractors were suddenly faced with a mandate of including a new life safety system that many, if any, had little or no experience with. Also, plaguing this problem was the lack of experienced building inspectors who were now being required to go out, on-site, and guide these contractors through the tough questions of how these systems work and, more importantly, how do they comply with the County's codes and ordinances relative to proper installation of the systems.

To address that problem, the County fire service began to offer a series of training programs for any and all interested parties who wished to learn proper techniques concerning the various aspects of the new law (SMBIA, 1988). The courses were met with great appreciation and appeal from all parties involved. Information on the scope and program outline of the course

can be found in Appendix C. In all instances throughout the County, only licensed and registered plumbers and sprinkler contractors initiated actions associated with installing these systems. Installation has become too involved and technical for homeowners or non-certified persons to undertake.

Even with these training courses, problems continued to persist. Problems such as shoddy workmanship by system installers and inferior products being used to cut cost corners by builders. Poorly designed systems that did not adequately protect all aspects of the structure and most of all, a general lack of proper insulation techniques that lead to a rash of sprinkler pipe breaks in unheated portions of these structures. It took a few years, but these issues seem to have been mitigated, in most cases, through formal education, sharing of information, and improved inspection services.

Two separate data searches were conducted for this project involving the official fire incident records of the Prince George's County Fire/EMS Department. These searches were designed to look at reported fire incidents in two specific types of residences, sprinklered and non-sprinklered buildings. The first search involved all reported incidents in the County involving residential sprinkler activations in fully sprinklered buildings starting on April 21, 1989, through December 31, 1999. These dates were chosen because on April 21, 1989, the first reported sprinkler activation in the County occurred since the implementation of County Council Bill 145-1987 and on December 31, 1999, came an end to a significant point in time that can be referenced easily, the end of a millennium. During this time frame, 121 sprinkler system service calls for release of water were made to the Fire/EMS Department with 117 actual sprinkler activation incidents having been reported in Prince George's County, Maryland. Of these incidents, 143 heads were activated for various reported reasons and those that were the result of an actual fire occurrence, were most often extinguished prior to the arrival of the responding

emergency personnel and units. One incident was reported because a ceiling fan was misaligned and struck a head, and three incidents were reported as sprinkler activations, but were actually frozen water pipes that had broken due to poor insulation techniques.

It has been identified through these incident reports that 154 lives have been saved from potential fire related deaths and that only seven injuries were reported, all of which were minor in nature. Determining the actual or potential number of lives saved was a very difficult item to verify from this researchers' point of view; however, this information was reported on each activation document as a separate point, and, therefore, becomes a part of the significant and critical elements of this research. The criteria utilized by the Department, at the time of completing this activation report, was based upon the numbers of people that were in close proximity of the fire's origin or were in the immediate areas of the living unit where the fire occurred. This research did not look at persons in other living units (attached or semi-attached residences) immediately adjoining the unit of origin, such as adjoining apartments or townhouses in multi-family dwellings. Trying to estimate the level and scope of that type of data would be purely speculative and not very beneficial based upon any potential challenge of its validity.

Also included as assessment items in this research were information about monetary losses related to the amount of damage that was incurred as a result of the incident. Actual loss was listed as a separate item covering the amount of damage that was physically viewed by the fire inspector, immediately following the reported occurrence. This damage figure was limited to the fire damage and water damage caused by the sprinkler activation. The potential loss listed, in comparison to the actual loss, is the amount that the entire structure was estimated to be worth at the time the incident occurred. This would be equivalent to the amount that would have been listed if the entire structure were categorized as a total loss.

In discussing the various types of structures referenced in this report, it is important to note the different meanings that would apply to the various residences that are listed on the following tables. There are eight different structural categories used in this research project and they are directly related to terminology utilized by the Prince George's County Fire/EMS Department as the types of structures that experienced the sprinkler activations. Multi-family structures refer to multiple occupancy buildings that would have more than one family living on the same floor of the building within the global unit of construction, that are usually not owned by the specific tenant or residence, but are owned by a rental company or real estate conglomerate. This would be illustrated best as a garden apartment style building. A townhouse is a structure usually two or three stories in height with one family unit of living space on all the floors. These units are attached to other occupied structures, with usually five to eight units in a row. Structures classified as motels serve as temporary living facilities, one to three stories in height. A dormitory is a multi-person living facility associated with a school, college, university or institutional function. Hotels are rental units designed for short stays that are usually five or more stories in height. Single-family residences are stand-alone structures not attached to any other buildings or dwellings. A condo (condominium) fits the same construction criteria as a multi-family dwelling, except that an individual or a tenant of the unit privately owns the area of residence. A day-care structure is a daily care facility that attends to the needs of small children, usually under school attending age. The other points of reference on the following tables are self-explanatory and provide a broad view of the overall circumstances of each reported incident.

The following table is the information that was gathered as a result of the research that was conducted concerning fire occurrences in fully sprinklered residential structures in Prince George's County, Maryland, from April 21, 1989, to December 31, 1999.

### Fires Reported in Sprinklered Structures 1989 to 1999

Date	Structure	Origin	Cause	Fused Heads	Actual Loss	Potential Loss	Lives Saved	Injuries Reported
04/21/89	Multi-family	Kitchen	Grease	1	\$ 8,500.00	\$ 960,000.00	2	0
11/04/89	Multi-family	Living Rm.	Fireplace	1	\$ 800.00	\$ 80,000.00	0	0
11/07/89	Townhouse	Bedroom	Heated light bulb	1	\$ 1,500.00	\$ 80,000.00	2	0
12/06/89	Multi-family	Kitchen	Grease	1	\$ 4,300.00	\$ 250,000.00	2	0
12/06/89	Motel	Bedroom	Set Fire	1	\$ 3,000.00	\$1,000,000.00	0	0
12/24/89	Townhouse	Kitchen	Grease	1	\$ 100.00	\$ 110,000.00	2	0
12/30/89	Multi-family	Living Rm.	Food on Stove	2	\$ 2,600.00	\$ 960,000.00	0	0
10/23/90	Townhouse	Kitchen	Grease	1	\$ 1,800.00	\$ 110,000.00	3	0
12/20/90	Dormitory	Kitchen	Grease	1	\$ 1,000.00	\$1,000,000.00	2	0
04/05/91	Multi-family	Kitchen	Grease	3	\$10,000.00	\$1,000,000.00	8	0
05/02/91	Multi-family	Kitchen	Microwave	1	\$ 350.00	\$1,000,000.00	8	0
05/04/91	Townhouse	Kitchen	Grease	1	\$ 2,500.00	\$ 110,000.00	0	0
07/11/91	Multi-family	Bedroom	Intentional	1	\$ 4,600.00	\$ 250,000.00	1	0
07/25/91	Multi-family	Bedroom	Candle	1	\$ 6,000.00	\$1,000,000.00	1	0
11/13/91	Townhouse	Kitchen	Grease	1	\$ 200.00	\$ 110,000.00	0	0
11/14/91	Townhouse	Kitchen	Grease	2	\$ 4,000.00	\$ 110,000.00	0	0
11/23/91	Multi-family	Kitchen	Grease	1	\$ 2,500.00	\$ 110,000.00	0	0
11/24/91	Townhouse	Garage	Fireplace ashes	1	\$ 200.00	\$ 110,000.00	0	0
11/24/91	Townhouse	Kitchen	Grease	1	\$ 2,050.00	\$ 100,000.00	0	0
12/22/91	Townhouse	Basement	Hydro-carbon fuel	7	\$ 5,000.00	\$ 100,000.00	0	0
06/26/92	Multi-family	Kitchen	Unattended food	1	\$ 6,000.00	\$ 150,000.00	1	0
08/28/92	Townhouse	Bedroom	Overheated Iron	1	\$ 7,000.00	\$ 90,000.00	0	0
09/08/92	Townhouse	Bedroom	Candle	1	\$ 5,000.00	\$ 100,000.00	0	0
11/29/92	Multi-family	Kitchen	Grease	1	\$ 1,000.00	\$1,000,000.00	0	1 Burned Hand
12/23/92	Multi-family	Kitchen	Food on stove	1	\$ 300.00	\$ 120,000.00	0	0
02/19/93	Townhouse	Kitchen	Grease	1	\$ 4,500.00	\$ 110,000.00	1	1 Burned Hand
04/08/93	Hotel	Bedroom	Electrical Cord	1	\$10,000.00	\$1,000,000.00	0	0
05/08/93	Townhouse	Kitchen	Grease	1	\$ 1,000.00	\$ 110,000.00	0	0
05/09/93	Single-family	Family Rm.	Electrical Cord	4	\$15,000.00	\$ 125,000.00	0	0
06/16/93	Single-family	Kitchen	Unattended Food	1	\$ 300.00	\$ 125,000.00	0	0
08/01/93	Townhouse	Kitchen	Food on Stove	1	\$10,000.00	\$ 110,000.00	0	0
08/06/93	Townhouse	Laundry Rm.	Dryer Vent	1	\$ 5,000.00	\$ 110,000.00	0	0
12/06/93	Multi-family	Kitchen	Grease	1	\$ 600.00	\$ 250,000.00	2	0
03/07/94	Condo	Kitchen	Food on Stove	1	\$ 400.00	\$ 120,000.00	0	0
04/25/94	Multi-family	Kitchen	Food on Stove	1	\$ 3,700.00	\$ 200,000.00	1	0
06/20/94	Condo	Kitchen	Grease	1	\$ 600.00	\$ 120,000.00	1	1 Burned Hand
06/23/94	Condo	Kitchen	Food on Stove	1	\$ 500.00	\$ 90,000.00	2	0
09/03/94	Townhouse	Kitchen	Food on Stove	1	\$ 1,500.00	\$ 126,000.00	2	0
09/03/94	Condo	Kitchen	Food on Stove	1	\$ 2,500.00	\$ 150,000.00	1	0
09/13/94	Townhouse	Kitchen	Food on Stove	1	\$ 1,500.00	\$ 120,000.00	2	0
09/14/94	Townhouse	Bedroom	Fan hit head	1	\$ 600.00	\$ 130,000.00	0	0
09/19/94	Single-family	Kitchen	Food on Stove	1	\$ 1,600.00	\$ 195,000.00	1	0
09/23/94	Multi-family	Bedroom	Unknown	1	\$ 200.00	\$7,000,000.00	1	0
09/28/94	Townhouse	Kitchen	Unattended Food	1	\$ 3,500.00	\$ 110,000.00	3	0
10/29/94	Townhouse	Kitchen	Grease	1	\$ 550.00	\$ 110,000.00	3	0
11/05/94	Townhouse	Basement	Clothes Dryer	1	\$ 1,100.00	\$ 80,000.00	1	0
11/07/94	Single-family	Basement	Water Heater	3	\$ 300.00	\$ 250,000.00	4	1 Burned Hand
12/11/94	Townhouse	Garage	Fireplace ashes	1	\$ 200.00	\$ 150,000.00	1	0
12/20/94	Townhouse	Kitchen	Food on Stove	1	\$ 1,100.00	\$ 115,000.00	1	0
01/01/95	Townhouse	Kitchen	Food on Stove	1	\$ 700.00	\$ 115,000.00	3	1

Date	Structure	Origin	Cause	Fused Heads	Actual Loss	Potential Loss	Lives Saved	Injuries Reported
02/06/95	Multi-family	Closet	Frozen Pipe	0	\$ 3,500.00	Unreported	0	0
02/06/95	Day Care	Attic	Frozen Pipe	0	\$ 7,000.00	Unreported	0	0
02/06/95	Condo	Garage	Frozen Pipe	0	\$ 3,000.00	Unreported	0	0
02/08/95	Single-family	Bedroom	Unknown	1	\$ 1,500.00	\$ 200,000.00	3	0
02/20/95	Townhouse	Kitchen	Food on Stove	1	\$ 3,500.00	\$ 115,000.00	8	0
04/06/95	Single-family	Kitchen	Food on Stove	1	\$ 300.00	\$ 174,000.00	4	0
06/02/95	Single-family	Kitchen	Food on Stove	1	\$ 700.00	\$ 164,000.00	2	0
07/12/95	Condo	Kitchen	Food on Stove	1	\$ 1,600.00	\$ 115,000.00	1	0
07/15/95	Condo	Kitchen	Food on Stove	1	\$ 500.00	\$ 115,000.00	1	0
07/30/95	Single-family	Kitchen	Deep Fat Fryer	1	\$15,000.00	\$ 200,000.00	1	0
07/31/95	Single-family	Kitchen	Grease	1	\$ 4,000.00	\$ 275,000.00	2	0
09/14/95	Townhouse	Corridor	Trash Can	1	\$ 2,000.00	\$ 100,000.00	0	0
09/19/95	Single-family	Kitchen	Food on Stove	1	\$ 1,600.00	\$ 195,000.00	1	0
12/05/95	Townhouse	Family Rm.	Electrical Cord	2	\$ 1,600.00	\$ 120,000.00	1	0
10/23/96	Townhouse	Bathroom	Candle	1	\$ 4,000.00	\$ 125,000.00	1	0
11/13/96	Condo	Kitchen	Clothes Dryer	1	\$ 7,000.00	\$ 80,000.00	1	0
11/19/96	Single-family	Kitchen	Food on Stove	1	\$ 2,800.00	\$ 136,000.00	1	0
11/24/96	Townhouse	Kitchen	Food on Stove	1	\$ 2,000.00	\$ 130,000.00	0	0
02/18/97	Single-family	Kitchen	Grease	1	\$ 1,000.00	\$ 135,000.00	1	0
03/03/97	Condo	Kitchen	Food on Stove	1	\$ 1,900.00	\$ 100,000.00	1	0
03/21/97	Townhouse	Kitchen	Grease	3	\$10,000.00	\$ 110,000.00	2	0
05/13/97	Condo	Kitchen	Food on Stove	1	\$11,000.00	\$ 92,000.00	1	0
05/24/97	Multi-family	Laundry Rm.	Set fire, trash can	1	\$ 20.00	\$1,000,000.00	1	0
05/28/97	Multi-family	Kitchen	Grease	1	\$ 0.00	\$ 600,000.00	1	0
06/06/97	Townhouse	Kitchen	Cooking	1	\$ 3,000.00	\$ 80,000.00	1	0
06/30/97	Single-family	Kitchen	Grease	2	\$ 6,000.00	\$ 220,000.00	2	0
07/03/97	Condo	Kitchen	Grease	1	\$ 700.00	\$ 116,000.00	1	0
07/10/97	Single-family	Kitchen	Grease	1	\$ 700.00	\$ 155,000.00	1	0
09/02/97	Townhouse	Kitchen	Food on Stove	1	\$ 2,700.00	\$ 110,000.00	1	0
09/07/97	Single-family	Kitchen	Food on Stove	1	\$ 1,000.00	\$ 80,000.00	0	0
10/16/97	Single-family	Kitchen	Unattended Pot	1	\$ 400.00	\$ 148,000.00	0	0
10/30/97	Townhouse	Kitchen	Food on Stove	1	\$ 1,000.00	\$ 147,000.00	1	0
12/21/97	Townhouse	Basement	Clothes Dryer	1	\$ 5,000.00	\$ 115,000.00	1	0
12/21/97	Single-family	Kitchen	Food on Stove	1	\$ 2,000.00	\$ 70,000.00	1	0
12/22/97	Single-family	Bedroom	Unknown	1	\$ 2,000.00	\$ 170,000.00	0	0
01/04/98	Single-family	Kitchen	Food on Stove	1	\$ 1,000.00	\$ 145,000.00	1	0
01/06/98	Single-family	Kitchen	Unattended Food	1	\$ 500.00	\$ 215,000.00	1	0
01/13/98	Townhouse	Kitchen	Food on Stove	1	\$ 1,000.00	\$ 98,000.00	1	0
01/13/98	Townhouse	Kitchen	Food on Stove	1	\$ 1,000.00	\$ 118,000.00	1	0
01/27/98	Single-family	Kitchen	Food on Stove	1	\$ 6,000.00	\$ 217,000.00	1	0
04/20/98	Multi-family	Kitchen	Grease	1	\$ 400.00	\$ 250,000.00	1	0
04/27/98	Multi-family	Kitchen	Unattended Food	1	\$ 1,300.00	\$1,000,000.00	2	0
05/01/98	Condo	Kitchen	Food on Stove	1	\$12,000.00	\$ 119,000.00	0	0
06/10/98	Multi-family	Kitchen	Food on Stove	1	\$ 1,500.00	\$ 121,000.00	1	0
06/16/98	Multi-family	Kitchen	Food on Stove	1	\$ 3,000.00	\$1,000,000.00	1	0
06/24/98	Townhouse	Kitchen	Food on Stove	1	\$ 3,500.00	\$ 107,000.00	1	0
07/20/98	Single-family	Kitchen	Food on Stove	5	\$13,000.00	\$ 160,000.00	1	1 Burned Hand
07/22/98	Townhouse	Kitchen	Food on Stove	1	\$ 750.00	\$ 124,000.00	1	0
08/05/98	Townhouse	Kitchen	Food on Stove	1	\$13,000.00	\$ 132,000.00	3	0
02/03/99	Multi-family	Kitchen	Food on Stove	1	\$ 2,000.00	\$ 500,000.00	1	0
02/24/99	Single-family	Kitchen	Food on Stove	1	\$ 2,000.00	\$ 244,000.00	1	0
04/10/99	Single-family	Kitchen	Food on Stove	1	\$10,500.00	\$ 208,000.00	1	0
06/19/99	Multi-family	Bedroom	Mattress	1	\$ 3,500.00	\$1,000,000.00	2	0

Date	Structure	Origin	Cause	Fused Heads	Actual Loss	Potential Loss	Lives Saved	Injuries Reported
07/27/99	Single-family	Kitchen	Food on Stove	1	\$ 2,000.00	\$ 185,000.00	0	0
07/29/99	Single-family	Bedroom	Set Fire	1	\$ 1,100.00	\$ 236,000.00	1	0
08/04/99	Multi-family	Kitchen	Food on Stove	1	\$ 2,000.00	\$1,000,000.00	1	0
08/07/99	Single-family	Living Rm.	Incense burning	1	\$ 2,000.00	\$ 129,000.00	0	0
08/10/99	Townhouse	Kitchen	Unattended Food	1	\$ 1,500.00	\$ 149,000.00	1	0
08/12/99	Townhouse	Kitchen	Grease	1	\$13,000.00	\$ 144,000.00	1	0
08/14/99	Single-family	Kitchen	Grease	1	\$13,000.00	\$ 136,000.00	1	0
08/19/99	Townhouse	Living Rm.	Electrical	1	\$ 5,200.00	\$ 125,000.00	0	0
08/27/99	Multi-family	Storage	Trash	1	\$ 500.00	\$1,000,000.00	0	0
09/19/99	Multi-family	Bedroom	Mattress	1	\$ 3,500.00	\$ 500,000.00	2	0
10/07/99	Townhouse	Basement	Appliance	1	\$ 1,000.00	\$ 145,000.00	0	0
10/07/99	Multi-family	Kitchen	Food on Stove	1	\$ 5,000.00	\$ 147,000.00	1	0
10/22/99	Townhouse	Kitchen	Food on Stove	1	\$ 3,000.00	\$ 100,000.00	2	0
10/31/99	Single-family	Kitchen	Food on Stove	1	\$ 1,000.00	\$ 160,000.00	4	0
11/13/99	Multi-family	Kitchen	Food on Stove	1	\$10,000.00	\$1,000,000.00	0	0
12/23/99	Single-family	Basement	Child & Matches	1	\$ 1,500.00	\$ 215,000.00	7	0
12/26/99	Townhouse	Kitchen	Food on Stove	1	\$ 300.00	\$ 135,000.00	5	0
12/31/99	Single-family	Kitchen	Grease	3	\$ 2,000.00	\$ 188,000.00	2	2 hand/arm/leg
Totals	121 Incidents			143	\$401,220.00	\$38,230,000.00	154	7 Burn Injuries

The following table is the information that was gathered as a result of the research that was conducted concerning fire occurrences for four years in non-sprinklered residential structures from January 12, 1990, to December 24, 1993, in Prince George's County, Maryland. These cases were pulled from the Department's fire investigations files, using a random search of incidents based upon having a completed investigators report from which this data could be gleaned. Cases that involved structures that were not protected by residential sprinkler systems were utilized for this data with a clear understanding that a case involving a structure that was not covered by the County sprinkler laws at the time the fire occurred was not eligible for inspection. This was done so that the data would not be skewed based upon assessing a structure that would not have been sprinklered, had it been built at the time the fire occurred. An example of this would be that there are no single-family dwellings that were examined in this table until after January 1, 1992, which is the date that the legislation came into effect concerning these types of structures. A total of 50 incidents are listed on the following table and reflect a cross

sectional view of the types of fire occurrences that did occur in Prince George's County during this four year period. Only seven examination fields were noted on these incidents because there would be no need to acknowledge the number of sprinkler heads that activated upon detection of the fire because as has been laid out in the parameters of this research, these structures were not protected by residential sprinkler systems.

### Fires Reported in Non-sprinklered Buildings 1990 to 1993

Date	Structure	Origin	Cause	Loss	Deaths	Injuries
01/12/90	Multi-family	Bedroom	Accidental	\$ 185,000.00		6 Burn/Smoke
01/26/90	Townhouse	Garage	Electrical	\$ 80,000.00		
02/14/90	Multi-family	Bedroom	Child, Matches	\$ 200,000.00	2	4 Smoke
04/13/90	Multi-family	Basement	Plumbers	\$ 400,000.00		
04/18/90	Motel	Bedroom	Arson/Suicide	\$ 90,000.00	1	3 Burn/Smoke
04/22/90	Multi-family	Living Room	Smoking	\$ 37,500.00		
06/02/90	Multi-family	Bedroom	Electrical	\$ 65,000.00		3 Burn/Smoke
06/27/90	Townhouse	Bedroom	Candle	\$ 15,000.00		
07/15/90	Multi-family	Bedroom	Child, Matches	\$ 6,000.00		1 Smoke
07/23/90	Multi-family	Kitchen	Grease	\$ 25,000.00		1 Smoke
08/07/90	Multi-family	Kitchen	Food on Stove	\$ 50,000.00		1 Smoke
10/02/90	Multi-family	Bedroom	Electrical	\$ 6,000.00		
10/22/90	Multi-family	Living Room	Child, Matches	\$ 13,000.00	1	1 Burn
01/22/91	Townhouse	Bedroom	Smoking	\$ 62,000.00		
01/27/91	Townhouse	Bedroom	Child, Matches	\$ 20,000.00		2 Smoke
04/03/91	Multi-family	Kitchen	Food on Stove	\$ 130,000.00		
04/22/91	Multi-family	Kitchen	Food on Stove	\$ 300,000.00	1	8 Burn/Smoke
05/07/91	Townhouse	Water Heater	Accidental	\$ 50,000.00		1 Burn
06/27/91	Multi-family	Basement	Sump pump	\$ 60,000.00		
07/21/91	Multi-family	Living Room	Electrical	\$ 454,000.00		4 Smoke
09/22/91	Townhouse	Dryer	Electrical	\$ 25,000.00		
10/03/91	Townhouse	Kitchen	Grease	\$ 150,000.00		1 Burn
11/02/91	Townhouse	Bedroom	Electrical	\$ 125,000.00		
11/27/91	Townhouse	Bedroom	Child, Matches	\$ 20,000.00		1 Smoke
01/12/92	Single-family	Bedroom	Smoking	\$ 60,000.00	1	
02/13/92	Multi-family	Bedroom	Child, Matches	\$ 6,000.00		1 Smoke
02/17/92	Multi-family	Kitchen	Accidental	\$ 55,000.00		
02/29/92	Townhouse	Garage	Electrical	\$ 30,000.00		
04/26/92	Multi-family	Kitchen	Food on Stove	\$ 40,000.00	4	
05/09/92	Single-family	Bedroom	Smoking	\$ 35,000.00	1	
05/16/92	Townhouse	Bedroom	Candle	\$ 45,000.00	1	
06/18/92	Townhouse	Kitchen	Food on Stove	\$ 130,000.00		1 Smoke
08/27/92	Single-family	Bedroom	Smoking	\$ 25,000.00	1	

Date	Structure	Origin	Cause	Loss	Deaths	Injuries
09/30/92	Multi-family	Furnace	Electrical	\$ 110,000.00		
09/30/92	Single-family	Bedroom	Child, Matches	\$ 20,000.00	2	
10/18/92	Multi-family	Bedroom	Electrical	\$ 50,000.00		1 Smoke
10/24/92	Townhouse	Exterior	Lightening	\$ 150,000.00		
12/19/92	Single-family	Kitchen	Grease	\$ 35,000.00		2 Smoke
12/27/92	Townhouse	Kitchen	Food on Stove	\$ 30,000.00		1 Burn
01/10/93	Single-family	Living Room	Smoking	\$ 40,000.00	1	
01/20/93	Multi-family	Living Room	Smoking	\$ 90,000.00		1 Smoke
02/04/93	Multi-family	Bedroom	Child, Matches	\$ 30,000.00		
02/07/93	Townhouse	Kitchen	Accidental	\$ 30,000.00		
04/09/93	Multi-family	Bedroom	Undetermined	\$ 25,000.00		1 Smoke
05/12/93	Multi-family	Bedroom	Candle	\$ 40,000.00		1 Smoke
06/12/93	Single-family	Living Room	Smoking	\$ 20,000.00	1	
08/28/93	Multi-family	Kitchen	Accidental	\$ 100,000.00		
10/05 93	Townhouse	Living Room	Undetermined	\$ 150,000.00		1 Smoke/Burn
11/28/93	Single-family	Bedroom	Light Fixture	\$ 35,000.00	4	
12/24/93	Single-family	Kitchen	Food on Stove	\$ 15,000.00	1	
Total	50 incidents			\$ 3,964,500.00	22	46

In all of the data analyzed, it was learned that there was not one accidental activation of a sprinkler head reported; however, there were reports of broken water pipes that did result in some damage to the residences. One incident was reported because a ceiling fan was misaligned and struck a head, and three incidents were reported as sprinkler activation's, but were actually frozen water pipes that had broken due to poor insulation techniques. For all of these types of occurrences, it was determined that installation problems involving improper insulation techniques, faulty water pipe materials and construction work caused by the installing contractors was the cause. These water discharges were not as a result of a defective residential fire sprinkler system or accidental activation of a sprinkler head.

As suspected, and as can be seen from the data below, the fire incidents that occurred in sprinklered buildings over the eight years studied had much less resultant fire and water damage than those incidents that were assessed from incidents reported over only four years of time in non-sprinklered buildings

### Comparison of Total Dollar Loss in Sprinklered and Non-sprinklered Structures

Reported Occupancy Having an incident	Sprinklered Structure		Non-Sprinklered Structure	
	Incidents	Dollar Loss	Incidents	Dollar Loss
Townhouse	44 1 water damage	\$ 138,050.00 \$ 600.00	16	\$ 1,112,000.00
Multi-Family	28 1 water damage	\$ 84,170.00 \$ 3,500.00	24	\$ 2,477,500.00
Condo	12 1 water damage	\$ 40,700.00 \$ 3,000.00	0	\$ 0.00
Motel	1	\$ 3,000.00	1	\$ 90,000.00
Hotel	1	\$ 10,000.00	0	\$ 0.00
Single-family	30	\$ 110,200.00	9	\$ 285,000.00
Dormitory	1	\$ 1,000.00	0	\$ 0.00
Day Care	1 water damage	\$ 7,000.00	0	\$ 0.00
<b>Total</b>	121	\$ 401,220.00	50	\$ 3,964,500.00

From this data, one can determine that the average amount of fire loss in sprinklered dwellings is around \$3,300.00 per incident and in non-sprinklered structures \$80,000.00 per incident. As can be expected though, due to the different types of structures and their relative worth, the amount of loss for non-sprinklered buildings is some what skewed, so the information has been broken down by building type so that a better comparison can be made.

### Comparison of Average Dollar Loss in Sprinklered and Non-sprinklered Structures

Structure	Average Loss Sprinklered Building	Average Loss Non-Sprinklered Building
Townhouse	\$ 3,138.00	\$ 69,500.00
One water damage report	\$ 600.00	
Multi-family	\$ 3,006.00	\$ 103,230.00
One water damage report	\$ 3,500.00	
Condo	\$ 3,392.00	None reported
One water damage report	\$ 3,000.00	
Motel	\$ 3,000.00	\$ 90,000.00
Hotel	\$ 10,000.00	None reported
Single-family	\$ 3,673.00	\$ 31,667.00
Dormitory	\$ 1,000.00	None reported
Day Care (water damage only)	\$ 7,000.00	None reported

And as suspected, and as can be seen from the data below, the fire incidents that occurred in sprinklered buildings over the eight reported years had much less resultant fire related deaths and injuries to the civilian population than those incidents that were assessed from only four years of history incidents in non-sprinklered buildings. Eight years of non-sprinklered fire statistics would surely support a doubled increase to the deaths and injuries reported.

### **Comparison of Injuries and Deaths in Sprinklered and Non-sprinklered Structures**

Reported Occupancy	Sprinklered Structure		Non-Sprinklered Structure		
	Injuries	Deaths	Injuries	Deaths	
Townhouse	44	1	0	8	0
Multi-Family	28	1	0	34	9
Condo	12	1	0	0	0
Motel	1	0	0	3	1
Hotel	1	0	0	0	0
Single-family	30	4	0	1	12
Dormitory	1	0	0	0	0
Day Care	0	0	0	0	0
<b>Total</b>	<b>117</b>	<b>7</b>	<b>0</b>	<b>46</b>	<b>22</b>

For Prince George's County, many of its major assumptions that were made 12 years ago, can no longer be categorized as projections, instead, very convincing and supportive facts that are difficult to discredit or prove to be flawed in any way. The numbers speak for themselves and, more importantly, tell a story about how easy it is to improve a way of life by ensuring that a community is safe from the ravages of fire. The actual monetary results from initiating the residential sprinkler experience in this jurisdiction indicate total property savings of \$38,230,000.00 and, most importantly, 154 lives that were saved as a direct result of the intervention provided by these devices we call residential fire sprinklers. Offsetting any costs that may have been expended over the years by the Prince George's County Fire/EMS Department and the Prince George's County Government in bringing about this proven life and property saving legislation. What also needs to be noted is that during this eight-year time frame,

numerous lives were lost in structures that could have been sprinklered had a retrofit clause been added to the original legislation. Listed below is a brief notation of the fire fatalities that occurred in structures over the past eleven and a half years that, if built today, would have to have a residential sprinkler system installed based upon the phase in requirements of the County law.

### **All Fire Fatalities Reported in Prince George's County from 1988 to 1999**

1988	1	1 multi-family dwelling fatality occurred.
1989	4	3 multi-family and 1 townhouse dwelling fatalities occurred.
1990	3	1 multi-family and 2 townhouse dwelling fatalities occurred.
1991	2	2 multi-family fatalities occurred.
1992	11	4 multi-family, 2 townhouse, and 5 single-family dwelling fatalities occurred.
1993	8	1 multi-family and 7 single-family dwelling fatalities occurred.
1994	13	5 multi-family and 8 single-family dwelling fatalities occurred.
1995	8	8 single-family dwelling fatalities occurred.
1996	3	1 multi-family and 3 single-family dwelling fatalities occurred.
1997	7	2 multi-family, 2 townhouse, and 3 single-family dwelling fatalities occurred.
1998	6	1 multi-family, 1 townhouse and 4 single-family dwelling fatalities occurred.
1999	6	2 multi-family, 1 townhouse and 3 single-family dwelling fatalities occurred.
11.5 years	72	Total number of fatalities that could have been prevented if sprinklers were present.

Leading to the ultimate question to be addressed, considering all that was learned from this experience, “What can be done with this information and what are the next steps in the process of invoking a fire safe community in Prince George’s County, Maryland?” The answer is obvious, due to the overwhelming success that was experienced by the County through this initiative. Develop a process whereby the number of residential sprinkler systems in the County is increased through an effort to place these devices in existing structures through retrofitting.

## **DISCUSSION**

The Department, organized in 1970 under a charter form of government, is comprised of 47 community based fire/rescue facilities operating a fleet of 544 vehicles staffed by nearly 800

career personnel and 1,200 active volunteers (PGFD, 2000). For the first 10 or so years after being created, the Department spent most of its effort organizing and formulating itself into one of the most progressive combination (career/volunteer) Department's in the nation. It was not until the mid 80's that the agency, under the leadership of the Fire Chief, was finally able to begin undertaking a very aggressive life safety code initiative that included looking at the need for a Countywide, mandatory residential sprinkler ordinance (Bosanko, 1990).

In 1987, the County was experiencing fire statistics that averaged 14 fire deaths annually of which 89% of the fire deaths occurred in residential properties. In 1984, structural losses due to fire in the County exceeded \$10,700,000 and in 1986, structural losses escalated to \$13,800,000 of which 8 million dollars in loss were to residential structures alone. The County was averaging 109 serious injuries due to fire on an annual basis, as well. Taking these statistics back just 10 years to 1976, one can see that 88 single-family residential fire deaths had occurred, representing 64% of the total amount, 10 townhouse related fatalities occurred, representing 7%, and 39 fatalities occurred in multi-family dwellings comprising the remaining 29% of the 10 year annual fire death totals (Prince George's County Government, 1987). These numbers were staggering and compelling enough to cause the County to take a bold step and do something different towards addressing this problem.

In that same year, the Prince George's County Council passed legislation Council Bill -145, 1987, which required residential sprinkler systems in all single-family dwellings by January 1, 1992. As of June 30, 1998, all multi-family residences were to be fully sprinklered, and effective February 1, 1988, one and two-family model homes must have had a sprinkler system installed for viewing availability by prospective homebuyers (SMBIA, 1988). The passing of this legislation was a landmark turning point for this government's commitment to the safety and well-being of the citizens it represented. The action steps that had to be taken to

prepare this government to take these steps were not only intense, but involved a continual uphill fight with many different and yet varied interest groups associated with the legislation.

Considerable time, money and resources were expended to undertake this initiative. It is estimated that over \$100,000 was spent by the Department and the County government, as a whole, to bring this legislation to fruition (PGFD, 1988). Not an inexpensive effort to say the least.

From 1987 to 2000, Prince George's County, Maryland, has seen both boom and bust in its economic development and residential construction experiences. However, constant throughout this time has been the requirement that any new home, no matter what the occupancy, be constructed with a full automatic residential sprinkler system so as to deal with the potential of fire occurrence in the home. During this time frame, nearly 30,000 residential fire sprinkler systems have been installed in Prince George's County, Maryland (Department of Environmental Resources, 2000).

Prince George's County was not the first jurisdiction to look at these devices, but ended up being the first County in the nation to require them in all residential structures (Bosanko, 1990). Information acquired from Operation San Francisco and Operation Life Safety assisted greatly at the time. Not to mention facts provided by the Bureau of Standards, National Institute of Standards and Technology, which estimated in a 1984 report that "the effect of adding fire sprinklers when smoke detectors are already present in the home could reduce the number of fire fatalities in this country by 63%" (Partners for Fire Safe Homes, 1995.)

Even though 12 years have passed since this legislation was first introduced, the expected outcomes predicted all those years ago have mostly been accomplished and, in this author's opinion, has been surpassed in several specific instances. The overall success of this legislation cannot only be measured by the amount of fire and water related damage that has been avoided,

or the aesthetic nature of which sprinkler designers have adapted their overall look, but more importantly, the number of times human lives have been spared the tragic and painful encounter that persists when exposed to heat, smoke, and fire. Sprinklers do extinguish fires very effectively, with a minimal amount of water, often times cutting off the spread of fire and the products of combustion from the rest of the living area in the residence where the fire has originated.

It is now a proven fact, through the Prince George's County experience, that in all 117 fire related cases, as part of this research, the buildup and accumulation of toxic fire gases and heat was prevented by the activation of either one or two residential sprinkler heads. This is supported by the fact that no one individual, out of the 154 that were present at the time of these reported fire occurrences or seven that were injured in these 117 fire cases, was overcome by smoke or, more tragically, succumbed to the devastating effects of the fire. Compared to the obvious number of injuries, both smoke inhalation and burns that resulted to the group of citizens that resided in non-sprinklered structures, 22 reported deaths and 46 significant burns and smoke related injuries that occurred in just four short years. The numbers clearly support the early results projected by the County to support the original legislation. In addition, with the heads only being designed to flow at maximum 13 gallons of water per minute, the fires were quickly extinguished often prior to the arrival of fire and rescue personnel and with minimal amounts of water, which resulted in smaller amounts of water damage to the home and less need for extensive clean-up efforts and restoration.

Also, determined by this research methodology was a correlation between the number of heads that were activated, in what would be considered non-intentional types of fire incidents, and the examination of fire spread. This was looked at from the context of the number of heads that were activated and the actual containment of the fire to the room of origin. In all of the 121

incidents that were reported in the eight years of data collected, only 11 of them reported more than one head activated. Of those 11, seven had more than two heads activated. A review of those seven cases revealed that some type of extenuating circumstance, such as the use of an accelerant or human intervention, contributed directly to the involvement of the other sprinkler heads, and only four cases reported some type of accidental activation or water flow from reasons other than a fire occurrence.

One can only imagine that eight years of reported data of similar occurrences in non-sprinklered buildings would statistically result in over \$8,000,000.00 of fire and water related damage reports. Showing even more strength to the fact that comparing more incidents in sprinklered buildings to less incidents in non-sprinklered structures, resulted in an opposite correlation of less damage in sprinklered structures to more damage in non-sprinklered residences. Further justifying and supporting the overall net worth of these systems and the importance of their presence in dwellings of all types and occupancies.

At the time that this legislation was adopted, the expected cost for installation of such a residential sprinkler system was estimated to be approximately \$1.50 per square foot. Today, in new construction, the cost does vary according to the specific geographical area the home is being built in, due mostly to the specific code being enforced in that area, but averages are still between \$1.00 to \$1.50 per square foot (Wilk, 1999). Very similar to, but slightly less than the costs that were identified 12 years ago. With the advent of new technologies and the current use of domesticated water piping systems, no longer separated from fire suppression piping, the costs will be driven down more. In addition, as more of these systems are installed and as more contractors and plumbers enter into the installation arena, competition will also reduce the cost. Newer less expensive sprinkler designs have all but neutralized the cost issue, but getting people to understand that it is the right thing to do is still the task at hand. The reduction of installation

cost has been a slow process but positive in nature, assisting in the discussions of cost savings to the homeowner has been the limited reductions to insurance premiums that have been offered by some insurance carriers. Not all companies offer reduced rates and so consumers are encouraged to check several price quotes before signing a contractual agreement.

The key to being successful as a fire service professional is to take any situation that you or your organization is faced with and turn it into an opportunity for the betterment of your internal and external customers, the citizens of that jurisdiction, and the emergency service providers who have taken an oath to assist them. Making sure that there is a clear message that the Department is really and truly committed to the betterment of life in the community and serving each and every citizen whom makes up the population. The situation from information learned through this research project is no different, in that, it is critical to take the lessons learned from this particular experience and make a positive contribution to the community on its behalf. Not only does this research indicate dollars saved and loss of life prevented, but it also demonstrates that the fire service knows what is needed to make our communities safer and have a duty and obligation to ensure that they stand up for the right thing to do. More importantly, they support, enhance, and embrace the right thing to do. That, a public policy, can be an effective tool in reducing the occurrence of fire and that the efforts put forward and the fights to support it, are worth the expenditure of resources, because in this situation, the end does justify the means.

Organizational implications from this research project clearly lead Prince George's County into the investigative fields of implementing a Countywide Retrofit Policy concerning residential sprinklers. Retrofitting of structures involves a specialized installation of sprinkler systems that allow for adequate protection methodologies to be adapted to existing buildings. Thus, making the sprinkler system conform to the construction techniques that were used years

ago. One key point in doing retrofitting projects, is to ensure that the sprinkler system is fully functional and yet not very visible to the home occupants (USFA, 1989). Having piping and sprinkler heads exposed throughout the structure will surely be met with great resistance, because there is a need to assess the aesthetic value of these systems, as well. The trick to this process is to utilize existing void and passage spaces to snake piping systems throughout the house and still keep the overall cost for installations at a minimal price. Current cost estimates for retrofitting an average single-family dwelling is between \$2.00 and \$4.00 per square foot (Zimmerman and Hopkins, 1998). An expensive proposition from any point of view and a real challenge that must be worked out.

In order to be successful at increasing the number of systems being installed in a community, a significant amount of information exchange will have to be initiated. A full fledged marketing campaign will have to be undertaken in order to get the word out to the public in masses. Only through information exchange and education will the public be more receptive to endure the costs associated with these lifesaving devices. This responsibility will fall directly upon the governmental entity representing the jurisdiction where the systems need to be installed. By spearheading an awareness campaign through the use of media outlets, a fire service organization can get their message across; however, there still continues to be a need at the national level for support of this type of activity. As was mentioned before, the national push for residential sprinklers has somewhat slowed and it is time for the United States Fire Administration to step up its involvement in this process.

Probably one of the most influential documents ever published in this country concerning our national fire problem was "America Burning." This report of the National Commission on Fire Prevention and Control (1973) identified 90 recommendations that would assist America in becoming more fire safe than it was in the early 70's. A second look at the nations fire problem

was conducted in 1987 when a conference was held in Tyson's Corner, Virginia, to re-examine the progress that had been made since the original report was published (USFA). And in 1999, a third panel of "America Burning" was recommissioned to look at the overall success of the original report from its inception. This panel, made up of 24 individuals who had vast experiences and expertise within their own professional field and direct ties to the American fire service, were charged by FEMA Director James Lee Witt to reassess the role of the national fire service in the prevention and control of risks in America. This new report entitled "America at Risk" assessed the progress made to date on the original 90 recommendations of the first report and identified 12 new and specific findings that need to be addressed at the national level to reduce death, injury, and property loss in this country (USFA, 2000).

In support of this very research project and a need for enhanced awareness to the positive effects residential sprinklers have on the American way of life, Finding #2 from "America at Risk" addresses the sprinkler issue. This finding was centered on the application and use of sprinkler technology to make our communities safer. As a result of this finding, the panel recommended that the "USFA should develop a long-term implementation strategy for fire sprinklers and smoke alarms." This statement is truly in support of the very recommendation that this research project has identified as a needed course of action that we as a nation must undertake. We have been sitting idle too long, and have seen too many Americans die due to fire. It is time we act positively and directly at mitigating the risks associated with fire occurrence in our country, especially since America has one of the worst fire experience records of the industrialized world (USFA, 1987).

## RECOMMENDATIONS

As a result of this research project, several recommendations are put forth as important steps needing to be taken to improve upon the already established successes from the mandatory establishment of a residential sprinkler ordinance in Prince George's County, Maryland. And, several recommendations have been determined for other jurisdictions that may wish to utilize this research project to assist them in their own endeavors of acquiring and strengthening support for some form of residential sprinkler legislation. These recommendations facilitate the necessary guidelines that are needed for a community to evoke the proper steps of preparing itself for such an occurrence.

Pertaining to Prince George's County, suggested recommendations include an assessment of all current sprinkler technology available today to determine if any advances in fire sprinkler technology could be applied in the County, so as to increase efficiency of the systems and to continue to reduce the overall installation costs. Examples of new technologies that should be investigated by the County are mist sprinkler systems, networked piping systems, and combination systems that fully integrate the fire sprinklers with domestic water system configurations. Also, more research is needed to actually determine if residential sprinkler systems improve resale values. There were not enough research materials available to determine the actual outcome of this one County presumption.

And finally, as it pertains to the County, specifically, and the nation as well, an effort must be taken to educate the public about the relative worth of these devices and to encourage more people to install them in their homes. This final County recommendation establishes a real need for the County government to explore available avenues to pursue a process of invoking the retrofitting of these known lifesaving devices. With the advent of Smart Growth strategies being entertained in many communities around the nation, now would be a great opportunity to

introduce a process by which additional construction cost reductions and tax incentives can be offered in exchange for having sprinkler components included in any redevelopment or remodeling project. The long-term benefits, relative to life and property savings would far outweigh the \$2.00 to \$4.00 per square foot cost that would have to be expended.

This research project also described the planning process that was used by the Prince George's County Fire/EMS Department to justify the resources expended in their effort to enact their progressive legislation. Several recommendations for other communities were gleaned from this experience. First, before starting any public activity related to mandatory sprinkler requirements, make sure that the entire process is well thought out, a strategic planning process is applied to developing the action plan and, most of all, that the resources are available which will be needed to win such a battle. Second, that the justification for the enactment of the legislation is based upon good solid facts and that the predictions used to gain support of this initiative are, in fact, achievable. Next, that a united front is provided for the process that will be utilized to gain support for the legislation and that inclusion of all parties of interest is used as a key point of the decision making process. Fourth, that a definitive communications effort is put forth to ensue that the facts, utilized in support of these laws, are representative of the future needs of the community through public education initiatives and marketing campaigns. And lastly, that adequate research is done so that the best possible composites of the legislation are adapted to the specific needs of the community and that the appropriate trade-offs and adjustments to the building and life safety code are made in a positive way to support enactment of the law. Remember, no successful outcome of any type dealing with the implementation of a residential sprinkler ordinance will come to fruition without the commitment, drive and, most of all, completion of homework by the sponsoring fire service organization.

## **Appendix A**

**Report to the Prince George's County Fire Chief**

**Task Force Studying Residential Sprinkler Applications**

**Appendix B**

**Building Trade-Off's**

**And**

**Construction Alternatives**

## **Appendix C**

### **Residential Fire Sprinkler Seminar**

### **Training Classes on Sprinkler Systems**

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