"IS ESTABLISHING A RESIDENTIAL SPRINKLER ORDINANCE RIGHT FOR THE CITIZENS OF OGDEN CITY?"

EXECUTIVE ANALYSIS OF FIRE SERVICE OPERATIONS
IN EMERGENCY MANAGEMENT

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ABSTRACT

The problem was that Ogden City was growing at an unprecedented rate. Much of that growth had occurred in the outlying areas of Ogden City Fire Department's (OFD) service area. Even though OFD had mutual and automatic aid agreements with the surrounding departments, it still was not able to put two 2-1/2" lines in service within ten minutes of alarm receipt in those outlying areas.

The purpose of the project was to determine if a residential sprinkler system (RSS) ordinance would help Ogden City mitigate the expected increase in life and property loss in the growing areas of their service district. The applied research project utilized the descriptive research methodology to answer the following questions:

1. Does a RSS ordinance significantly impact the loss of life and property?
2. If adopted, should the ordinance require all new construction or limited areas and sizes to install RSS?
3. What are the cost and/or cost savings of installing RSS?
4. What types of systems are available and what are the materials used?

The procedures included a literature review of journals; books, other applied research projects and government reports; and structured interviews with key people in the residential sprinkler and related fields.

The results revealed that Ogden City should adopt an RSS ordinance at some future date. There are many obstacles to overcome and issues that need to be addressed before the community would be ready for an ordinance.

The recommendation was that Ogden City begins the process to adopt a RSS ordinance in the city. A strategic plan marking each step that needs to be addressed will be developed. A task force with representatives from the fire service, building industry,

elected officials and citizens-at-large will ensure that all parties will be informed and their concerns will be addressed in the plan. The number one priority will be to reduce the life and property loss, without putting an undo burden on anyone in the community.

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INTRODUCTION

The problem is Ogden City is growing at an unprecedented rate. Much of that growth is in the outlying areas of Ogden City Fire Departments (OFD) service area. A large number of those homes are quite big, well over 4500 sq/ft. Even though OFD has mutual and automatic aid agreements with all the departments surrounding its service area, they are small, one or two engines and mostly volunteer. The results are that OFD does not have the capability to put two 2-1/2" hand lines in service within 10 minutes of alarm receipt in those areas. Therefore, Ogden City will see an increase in life and property loss in those areas. This is a descriptive research project. Its purpose is to answer the following questions:

1. Does a residential sprinkler ordinance significantly impact the life and property loss in those communities that have adopted such an ordinance?
2. If Ogden City adopts such an ordinance, should it require all new residential construction to install sprinkler systems or only limited areas or sizes, and how would those who need to install be determined?
3. What are the cost and/or cost savings of installing residential sprinkler systems (RSS)?
4. What types of systems are available and what are the materials used in RSS?

BACKGROUND AND SIGNIFICANCE

Ogden City, like many other cities across the nation, has had an unprecedented growth during the last twenty years. During the 1980's Ogden City Fire Department (OFD) was a department where four person engine companies was the standard. OFD staffed six engines and three aerial apparatus along with several other miscellaneous

pieces of equipment daily. OFD personnel were first responders only to any medical incident. The first responder unit was an engine company. In 1986, OFD responded to 2,309 emergency medical service (EMS) calls and 486 fire calls. The total number of calls that year including all other categories i.e. false calls, good intent etc. was 3,407. The total dollar loss to the community was $1,002,605. There were no fire-related deaths in 1986. (The researcher used 1986 because that was the earliest data available from the Utah State Fire Marshal's Office, Appendix A). Even though 67% of the run volume was EMS calls, OFD's emphasis was fighting fire. OFD's largest effort towards a life safety strategy at that time was home inspections. The goal of that program was to visit every home in the city, every two years.

Since that time OFD has cut back to five three-person engines and one two-person tillered aerial truck. However, they have put three ambulances on line and two paramedic squads that run countywide. The total run volume has increased by 322 % for a total of 10,973 in 2001. OFD responded to 9,126 EMS calls, 531 fire calls and 1,316 other aid calls. Fire calls have increased by 9% from 486 in 1986 to 531 in 2001. The total dollar loss for Ogden City in 2001 was $9,618,001, and there was 1 fire-related death (Appendix B).

Ogden City has also grown by 19.9%. 1980 census records show the population of Ogden to be 64,407 and 77,226 in 2000 (Appendix C). It should be noted that the census figures for 2000 are generally considered to be low. The Hispanic population has grown from 12% to just under 24%. City officials suspect a large number of illegal aliens also reside in Ogden City.

Much of the building growth has been, by necessity, in the outlying areas of OFD's response areas. Also, many of these new subdivisions have built up with very large homes, many well over of 4500 sq/ft. This translates into longer responses times to these homes, and more water is needed for the initial attack. Based on the National Fire Academy's recognized formula (L x W divided 3 x % of involvement), the initial attack for a 4500 sq/ft home will require a minimum of two, 2-1/2" hand lines to contain a fire that has involved 25% of the structure. Each 2-1/2" hand line can deliver 200 to 250 gallons per minute (GPM) and it takes one engine company to deploy it. The gallons needed for this scenario is 325 (Managing Company Tactical Operations, *Preparation,* NFA July 1991, SM 5-12).

Another element needs to be added to this scenario. Today's construction materials and techniques have significantly shortened the time a structure can withstand fire impingement. Lightweight rafters and joists can only tolerate about 5 to 8 minutes of direct flame contact before they fail. The results can be catastrophic because there is no warning.

Ogden City is not in a financial position to build and staff more fire stations. The local economy, like the rest of the nation, is declining. The city has had to trim its budget to keep it balanced the last few years. Alternative life safety strategies need to be found to help offset the budget constraints and response time concerns. A residential sprinkler ordinance seems to be a very effective way to address these issues. According to a report by Kimberly D. Rohr, *U.S. Experience With Sprinklers,* (September, 2001), "sprinklers typically reduce the chances of dying in a fire and the average property loss by one-half to two-thirds in any kind of property where they are used" (Rohr, 2001).

The results of this research project will be very important to the future of OFD and the City of Ogden. New paradigms need to be explored, tested and reviewed that will help reduce the impact of budget constraints and increasing demands on not only OFD, but also other fire departments.

In summary, this applied research project illustrates the need for Fire Departments to be vigilant and tenacious when searching for and implementing new life safety strategies to protect the citizens they serve. It is directly related to all four of the United States Fire Administration's (USFA) objectives: a) to reduce life loss in age group 14 years and below, b) to reduce life loss in age group 65 years and above, c) reduce life loss from fire of firefighters, and d) to promote within communities a comprehensive, multi-hazard risk reduction plan led by the fire service. It is also related to Unit 4 and Unit 6 of the *Executive Analysis of Fire Service Operations in Emergency Management,* course of the National Fire Academy (NFA). Unit 4 is the section on community risk assessment. As communities grow and times change, they must constantly re-assess the risk to its citizens. Unit 6 is the section on capability assessment. When communities assess the risk in their jurisdictions, they must decide if they have the capability to mitigate consequences of the perceived risks. One stated objective is, "the student must evaluate current capabilities to meet the critical risks identified in the risk assessment" (Executive Analysis of Fire Service Operations in Emergency Management, NFA March 2001, Pg. SM 6-1).

LITERATURE REVIEW

A literature review was done for the purpose of reviewing the research of different organizations, coalitions and professionals in the field of residential sprinklers. The review included fire service journals, Applied Research Projects (ARP) from the

National Fire Academy (NFA), government documents, surveys, personal conversations with experts in the private sector as well as the fire service, and information from the Internet.

It is generally accepted and well documented that RRS saves lives and property if they are present. The Assistant Fire Chief Jim Ford of the Rural/Metro Fire Department for the City of Scottsdale, Arizona published a report in 1997, *Automatic Sprinklers, A 10 Year Study* (Ford, 1997). It is a detailed history of the effects of the automatic sprinkler code in the City Scottsdale, AZ. Every new building in Scottsdale is required to have an automatic sprinkler system. Of particular interest is the section requiring RSS in every new home, regardless of the size of the structure. The following information is taken directly from the study findings for the time frame of January 1, 1985 through January 1, 1996.

- Average loss per sprinklered incident $1,945
- Average loss per non-sprinklered incident $17,067
- Estimated sprinkler flow per residential incident 209 gallons
- Estimated suppression flow per residential incident 3,290 gallons

The annual structural fire loss dropped from $2,488,586 in 1985/1986 to $1,125,175 in 1994/1995. This represents a 45.2% decrease while the population grew 52% during the same time, 114,993 in 1985 to 174,000 in 1996 (Ford, 1997).

This study included both multi-family and single family residences. However, these figures are in direct support of what the fire service has long since known. Sprinkler systems save lives and property from the effects of fire. They are also in opposition to the myth that sprinkler systems cause more water damage than the fire

causes fire damage. The Scottsdale ordinance was one of the most comprehensive in the United States (U.S.). It paved the way for other communities to follow suit and adopt their versions of an RSS ordinance.

The National Fire Protection Association's (NFPA) recent study, *U.S. Experience With Sprinklers,* published in 2001, is a national study compiling data from the National Fire Incident Reporting System (NFIRS). It is a comprehensive analysis of all of the data collected by the NFPA concerning all occupancies that have a fire incident associated with them. It states, "Automatic sprinklers are highly effective elements of the total system designs for fire protection in buildings. When sprinklers are present, the chances of dying in a fire and the average property loss per fire are both cut by one-half to two-thirds, compared to fires where sprinklers are not present." It also states later in the same section, "The estimated impact of RSS in homes is a 74% reduction in the death rate"(Rohr, 2001). The NFPA also has some interesting facts on its website (NFPA, November).

- NFPA has no record of a fire killing more than two people in a completely sprinklered public assembly, educational, institutional or residential building where the system was working properly.
- In 1998, 31% of the public assembly properties where fires occurred in the U.S. were equipped with sprinklers, compared with 3% of the residential properties.
- In 2000, 85% of the fires occurred in the home, resulting in 3,420 fire deaths.

Two other communities have had their RSS ordinances in place for at least ten years and they have published the results of their evaluations. They are Vancouver,

British Columbia, Canada, and Prince George's County, Maryland. Vancouver instituted an RSS ordinance in 1990 and recently published its report, *10 Year Sprinkler Performance Report of Vancouver, British Columbia, Canada* (Author, 2001). The report evaluates the first ten years of their ordinance, 1990 to 2000. The report states, "The United States has the highest residential fire death rate of any developed country in the world, except Canada" (US Fire Administration, 2000). The following are facts stated in the report:

- The city is located on Canada's West Coast.
- It has had a growth rate of 25% in population in the past ten years.
- The Vancouver Fire Department (VFD) responses to approximately 37,000 calls per year.
- The City has reduced its fire fatalities to an average of 3.33 per year (0.6 per 100,000) from an average of 8.8 per year for the previous decade. This is well below the provincial average and half the Canadian average.
- Property loss a sprinklered home will suffer is approximately $2.22 per $1000 of property at risk, while a non-sprinklered building will suffer approximately $29.69 per $1000 of property at risk. This translates into $666 in damage to a $300,000 home if sprinklered and $8,910 for the same home that is non-sprinklered.
- In Vancouver's experience, the sprinklered home will experience 92.4% less damage than an equivalent non-sprinkler home.
- No fire fatalities have occurred in a residential property protected by a sprinkler system installed to NFPA 13D standards.

- Fire losses have reduced from $30,800,000 per year in 1990 to $15,400,00 in 2000. This represents a 50% reduction despite a 25% population growth.
- Over the last ten year average, the National Fire Sprinkler Association (January, 2002), reports the damage in a sprinklered residential unit was 13 times less than for an equivalent non-sprinklered unit (Author, 2002).

Prince George's County has experienced very similar results as portrayed in an Executive Fire Officer (EFO) Applied Research Project (ARP) authored by Ronald Jon Siarnicki, Fire Chief of Prince George's County Fire/EMS Department (PGFE) in January of 2001. Data from that ARP, *Residential Sprinklers: One Community's Experience Twelve Years After Mandatory Implementation,* states that PGFE reduced the average fire loss from $31,667 in non-sprinklered single family homes to $3,673 in an equivalent sprinklered home. There were no fire related deaths in sprinklered homes and twelve in non-sprinklered homes during the ten year period from April 21,1989 to December 31, 1999. They also stated, "The actual monetary results from initiating residential sprinkler experience in this jurisdiction indicate total property savings of $38,230,000 and, more importantly, 154 lives that were saved as a direct result of the intervention provided by these devices we call residential fire sprinklers" (Siarnicki, 2001).

In an, *Operation Life Safety Newsletter,* (November/December, 1999), Patrick Coughlin notes that 206 cities across the country have adopted a residential sprinkler ordinance of some sort. They all are reporting successes with their program (Coughlin, 1999). The evidence is in and there is no disputing the value of RSS in saving lives and

property. But, savings lives and property, although very important, are not the only issues of concern when a community is deciding if they should initiate such an ordinance.

The most important of these concerns are the lives of those people protecting the lives and property of the citizens. They are the emergency responders, in particular the firefighters. These are the people who are most at risk during fires. Does the adoption of a residential sprinkler system ordinance (RSSO) help reduce the risk to firefighters? The answer is; yes, it does. According to the NFPA Journals, 56 or 50% of the firefighter on-duty deaths were on the fireground in 1999. Of these 56, 11 (19.6%) were in one- and two-family dwellings (Fahy and Leblanc, 2000). In 2000, 39 deaths occurred on the fireground, 46% or 18 of those occurred in residential structures. Of these 18, 11 were in one-and two-family dwellings. 28% of all fire ground deaths occurred in one- and two-family dwellings (Fahy and Leblanc, 2001). In 2001, firefighter deaths on the fireground are distorted because of the assault on the World Trade Center and the ensuing collapse. For the sake of fair comparison, the Fahy and Leblanc of the NFPA Journal did not use the 340 firefighters, who perished on September 11, 2001, in the statistics for 2001. The numbers are very close to the preceding two years. Fahy and Leblanc state, " The largest proportion of fireground deaths occurred in residential structures, where 16, or 42 percent of those who died on the fireground perished. Eleven of the 16 died in one- and two-family dwellings." Ninety-nine firefighters lost their lives while on duty in 2001. Thirty-eight of them were on the fireground. There are many factors and reasons why firefighters die on the fireground. The same article in the NFPA Journal states, "Incident management, personnel accountability systems, sprinkler and smoke alarms, and the use of PASS devices can reduce firefighter's risk of dying on duty" (Fahy and Leblanc,

2002). It stands to reason that if firefighters can catch a fire in the incipient stages more often, then the risk they face will be reduced. Therefore, their chances of surviving another day and going home to their families will be increased. The Scottsdale study reported, " One or two heads control or extinguished the fire 92% of the time, with the majority of the exceptions a result of flammable liquid incidents" (Ford, 1997).

The other issues and concerns about RSS are based on misunderstanding and myth. In a recent article in *Fire Chief Magazine* (August 2000), "Residential sprinkler, up close and personal", Chief Bill Peterson of Plano, Texas said it very well; "The biggest and probably the most difficult obstacles (to RSS) are ignorance and fear. Very few in the homebuilding industry are informed about the fire problem in this country or the benefits of residential sprinklers, benefits that can be enjoyed by everyone, from the homeowner, to the homebuilder, to the fire department and the community at large" (Peterson, 2000). There is a myriad of myths about sprinkler systems in general. Many of them have been propagated by the movie industry. They are absurd and impossible; nevertheless they are still in the minds of the citizens.

Karen Wojcik Berner pointed out seven of the most common myths about RSS in an article in *Fire Chief Magazine*, (March, 1992), "Fast-response residential sprinklers take the fire service into the future." It also addresses the questions the researcher is attempting to answer. The following is a list of those myths and some important facts concerning them.

Myth #1: Fire sprinklers systems increase construction costs excessively**.**

Facts:

- Residential sprinkler systems cost 1% or less of the construction costs. The Scottsdale study stated, "The City has experienced a consistent reduction in the

installation price of RSS. Discussions with members of the sprinkler industry helped identify the primary reasons behind this trend. They are: this is a mandatory requirement for the community; established standards are identified for all builders; increased competition for the available business; better availability of the quality materials; and an increase in the efficiency of those installing the systems, resulting in better and quicker installations." As of January 1996, the average price per square foot (sq/ft) was around $0.59 for production homes and $0.70 for custom homes (Ford, 1997).

- Design flexibility in building codes can partially or totally offset sprinkler installation costs. 17 of 20, or 85% of the Building Officials, Fire Marshals and Fire Chiefs interviewed were in favor of building "trade-offs" for fully sprinklered buildings (Appendix D).
- Insurance cost savings can quickly amortize the cost of sprinklers. Although the researcher found claims of up to 40%, interviews with insurance agents in the area found that 5-10% annual premium discount was the best that could be expected in this region.

Myth #2: Sprinkler heads are ugly and detract from the aesthetics of a home**.**

Facts:

- Through new technology, the size and appearance of sprinkler heads have dramatically improved. According to the Home Fire Sprinkler Coalition (HFSC), "Modern residential sprinklers are inconspicuous and can be mounted flush with walls and ceilings. Some sprinklers can even be concealed. Like regular plumbing, pipes can be hidden behind ceilings and walls" (HFSC, 2000).

- Sprinkler heads can be flush-mounted in ceilings and are available in colors to match your décor.
- Side-wall heads can replace ceiling heads.
- Temperature-sensitive fixtures can conceal heads.

Myth #3: When a fire occurs, every sprinkler head goes off**.**

Facts:

- Sprinkler heads are individually activated by fire.
- Residential fires are usually controlled with just one head. The Scottsdale study states, " 98% of all fires in homes are controlled with the activation of one sprinkler head" (Ford, 1997).

Myth #4: Sprinkler systems cause excessive water damage**.**

Facts:

- "The truth is that sprinkler systems are carefully designed to activate early in a real fire, but not to activate in a non-fire situation. Each sprinkler reacts only to the fire conditions in its area. Water release in a fire is generally much less than would occur if the fire department had to suppress the fire, because later action means more fire, which means more water is needed" (NFPA, 2001).
- The Scottsdale study, the Vancouver study and the Prince George's County study all reported that the water used in a sprinklered building was 10 to 15% of that used in a non-sprinklered building in a similar situation (Ford, 1997, HFSA, 2002 and Siarnicki, 2001)
- The water delivered by a sprinkler head is 10 to 40 gallons per minute (gpm), while the water from a fire hose is 175 to 250 gpm.

- Fire losses in residential occupancies are 85% less when sprinklers are installed. (Many communities are reporting even better loss rates, however those communities are usually high value homes and not within the average range needed for this project.)
- Insurance industry records show a 1000% decrease in the fire losses paid in commercial/industrial occupancies over the past 90 years. Sprinklers are credited for the decrease.

Myth #5: Sprinkler heads frequently become accidentally activated**.**

Fact:

- The accidental operation of a sprinkler head is rare. The Factory Mutual Insurance Company reports the accident rate is one in 16 million sprinkler heads per year.

Myth #6: Insurance rates increase if sprinklers are installed**.**

Facts:

- Based on interviews with area insurance agents, annual insurance premium decrease with most companies 5 to 10% depending on if the home is partially or fully sprinklered (Appendix E).

Myth #7: Sprinklers are designed to protect property, but are not effective for life safety.

Facts:

- Sprinklers provide a high level of life safety. "When it comes to saving lives, nothing can equal or take the place of a sprinkler. There has never been a multi-death fire in a building that was protected by a properly installed, maintained and operating sprinkler system" (Bruno, 1999).
- The Scottsdale study claims 154 lives were saved over a ten-year period and they were a direct result of residential fire sprinklers (Siarnicki, 2001).

- Fire statistics in the United States, Australia and New Zealand demonstrate the life safety effectiveness of residential sprinklers (Berner, 1992).

There has been a concerted effort by the NFPA, local officials and the manufacturers to overcome the cost of installing RSS. The 1994 edition of NFPA 13D, *Standards for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,* several changes were adopted to help. Kenneth E. Isman gives a brief overview of these changes in his article in *Sprinkler Quarterly*, (Spring, 1994), "NFPA 13D – A New Look." He says, "The industry has learned quite a bit since the first edition of NFPA 13D was published 18 years ago, and hopes to translate that knowledge into a more effective marketing program with economic installations and solutions to some of the early problems" (Isman, 1994). At that time, NFPA eliminated all reference to "mobile homes" and replaced them with references to "manufactured homes." It was necessary because the Federal Government no longer refers to them as "mobile homes." This change was important because manufactured housing is a special category of one- and two-family dwellings. Although only 7% of the U.S. population lives in manufactured housing, it has represented a severe fatality problem over the past ten years; nearly double the fatality rate per fire compared to other homes (USFA, 2001). Next he points out that the required water supply has been reduced from 180 to 126 gallons. This reduction is meant to help sprinklers become more economical to those people who live in rural areas that do not have a public water system. It also clarified type of piping material allowed to supply the system. It stated that it could be metal or non-metal.

The most comprehensive change was the addition of a new chapter that applies to small dwellings, 2000 sq/ft or less. It allows even smaller water supplies, 100 gallons, and sprinklers that flow lesser amounts of water.

The 1994 edition of 13D paved the way for the most recent edition published in 1999. This edition went even further by allowing by integrated or multi-purpose systems that are part of the regular plumbing system. They can now be installed using half- inch chloro-polyvinlychloride (CPVC) and polyethylene (PEX) with lowered pressures of 130 psi. The standard before this was 175 psi. Very few homes had that kind of pressure available.

In the simplest sense there are three different types of systems layouts, the tree, the loop and the grid layouts. The tree layout is the traditional type found in most commercial buildings. A riser pipe from the main valve feeds a cross-main line and that line feeds the smaller branch lines. The branch lines are where the sprinkler heads are located. The system is dead-ended and no water circulates, and it is a separate, stand-alone system. The second layout is the loop. It is similar to the tree except that two of the branch lines are connected allowing the water to loop and come from two directions when flowing. When water comes from two directions, smaller pipe can be used and the system will still get the desired flow rates. It is a dead-end and separate layout just like the tree. The third is a grid layout. It is different from the others in that all branch lines are connected to other branch lines and water to any sprinkler head comes from several different directions. This increases the flow to any one head and yet allows the use of less pressure and smaller pipe sizes. It may or may not be a dead-end layout. This is the layout for an integrated or multipurpose system (Coughlin, 2002).

The pressure reduction in 1999 13D allowed the use of integrated systems. In an integrated system, the culinary water system in a home is also used as the sprinkler system. There are several advantages. First, the need for a backflow preventer was eliminated because it is not a separate system where contaminated water or antifreeze could flow back into the public system. This is one of the biggest cost savings to the consumer. Not needing a backflow prevention device reduces the cost of the sprinkler system about $600 (Coughlin, 1998). Second, since this is not a separate system, the cost of having two systems is reduced. Third, the price of half-inch pipe is less than larger sizes. These three items have significantly decreased the cost of RSS (Coughlin, 1998). Interviews with six area fire protection contractors substantiated Coughlin's statement (Appendix G).

There are a lot of choices of materials that can be used today. Anyone can still use metal piping and have separate more expensive systems. However, the intent of the 1999 Edition of NFPA 13D was to allow the use of less expensive materials and make the systems more consumer friendly. One contractor can install the entire plumbing/sprinkler system, instead of having one contractor for the plumbing system and one for the fire protection system. The whole idea is to get the systems into homes where they can do what they were designed to do. Most of the contractors surveyed in this area are using CPVC piping and metal fittings. Some are using smaller half-inch PEX piping and new multi-port fittings approved by NFPA 13D. The cost of these systems is about half the cost of traditional systems and materials (Appendix G).

There are other cost savings that need to be addressed. Chief Ron Coleman wrote an article for *The International Fire Chief,* (September, 1985) called "The Economics of

Residential Fire Sprinkler Systems", where he says "Another aspect of cost avoidance focuses on the manual firefighting resources. Installation of RSS in an entire area often can result in fewer required fire stations and firefighting personnel to protect that area. Such savings can run into the millions of dollars over a decade of service" (Coleman, 1985). Patrick Coughlin's article, "Rethinking Residential Sprinklers", in *Fire Chief,* (September, 1998) restated that same idea, "Fire departments that enacted residential sprinkler ordinances in the mid '80s now have tens of thousands of sprinkler protected homes. Many cities began realizing the benefits long before they had a significant number of systems installed. In some cases the size of the cities has doubled, and the fire departments are still the same size.

Installing sprinkler systems is like having a firefighter in every room. In areas of cities where sprinklers are used, stations can be located in an EMS orientation. This arrangement increases efficiency, but not at the expense of effectiveness" (Couglin, 1998)

Summary

There is certainly enough evidence today to convince anyone that RSS saves and reduce property loss dramatically. The question still remains, "After all the research that has been done, why aren't there more residential sprinkler systems in place?" Chief Bill Peterson says, "The fire service cannot expect to operate in this arena alone. The fire sprinkler industry must take on a much larger role in the future and create the national focus for the further development, on the local level, by a consortium of the community stakeholders" (Peterson, 2000). Most experts in the business agree with Hal Bruno, "When it comes to saving lives, nothing can equal or take the place of a sprinkler"

(Bruno, 1999). But, agreeing with each other is not enough. In *America Burning, Recommissioned,* Finding #2 states, "The most effective fire loss prevention and reduction measure with respect to both life and property is the installation and maintenance of fire sprinklers." One of the recommendations to this finding was "FEMA/USFA should develop a long-term implementation strategy for fire sprinklers and smoke alarms. The plan should include the following implementation aspects: 1. The approach should be community based; 2. No tactic or strategy should detract from the requirement for sprinklers. Smoke alarms and/or other measures should always be the locality's second option as a loss reduction measure"(USFA, 2000). The fire service, as a whole needs to seek new ways and avenues to reach the public. We must prioritize what is important and then develop strategies to market these concepts. Coalitions and alliances with all parties will help build the relationships needed to help us get residential sprinkler systems in our communities.

PROCEDURES

A three-step process was used to obtain the information needed to complete the project. The project was a descriptive research project using a review of current journals, books, government reports, the Internet and structured interviews and conversations with key personnel and experts in the field. The sources used were selected to gather data to answer the following questions: (a) Does a residential sprinkler system ordinance significantly impact the life and property loss in those communities that have adopted such an ordinance? (b) If Ogden City adopts such an ordinance, should it require all new residential construction to install sprinklers or only limited areas or sizes, and how would those who need to install be determined? (c) What are the cost and/or cost savings of

installing RSS? (d) What types of systems are available and what are the materials used in RSS?

The first step was to select a set of journals, books, other applied research projects and government reports based on their relevance to residential sprinkler systems. The list of those journals, books, government reports and applied research projects includes:

NFPA, U.S. Experience With Sprinkler Systems

Automatic Sprinkler, A 10-Year Study

Managing Company Tactical Operations, NFA Student Manual

A Report on Vancouver, British Columbia, Canada, 10 Year Statistics on Residential Fire Sprinklers

Residential Sprinklers: One Community's Experience Twelve Years after Mandatory Implementation, Applied Research Project, NFA

Operation Life Safety Newsletter

Fire in the United States, 1989 – 1998, Twelfth Edition

NFPA Journal

Fire Chief Magazine

Protect What You Value Most, Home Fire Sprinkler Coalition

Sprinkler Quarterly

Firehouse Magazine

America Burning, Recommissioned

The International Fire Chief

Fire in the United States

The second step was structured surveys/interviews with Building Officials (BO), Fire Marshals (FM), Fire Chiefs (FC) and experts in the filed of RSS. The researcher sent out 45 surveys to the BO, FM and FC in fifteen different communities in the area, and received 21 back. This represents a 47% return. The survey asked the twenty-one (21) respondents, a series of fourteen or fifteen questions, depending on the answers. Different questions were asked of the respondents depending upon yes or no answers to some of the questions. A copy of the survey questions is listed in Appendix D of this project on page 47. Interviews with insurance agents, fire protection contractors and real estate appraisers were conducted on the telephone or in-person. Interviewees were selected at random from the telephone book. They represented the major companies in the area. Other conversations with experts were not structured to allow the person to elaborate on any point they felt needed to be brought out. The information derived from this process was included in the literature review of the research and will be discussed further in the results, discussion and recommendations sections of this project. The list of respondents includes:

5 – Building Officials

8 – Fire Marshals

8 – Fire Chiefs

6 – Insurance Agents

6 – Fire Protection Contractors

Frank Richardson, PhD, Associate Professor, Utah Valley State College

Franz Haase, AQUASAFE Sales Manager, inventor of the WIRSBO Multiport Sprinkler Fitting

The third step was a search of the Internet to find pertinent and up-to-date information about RSS. The list of websites is:

www.firechief.com

www.homefiresprinklers.org

Limitations

The surveys were limited to those communities that are of similar size and circumstances along the Wasatch Front in Utah. The Wasatch Front is the common term used in the area for those communities that are situated north and south of Salt Lake City (SLC) along the Wasatch Mountains from Ogden to Provo. The project also included Park City, Utah in the mountains above SLC. The researcher felt that the rest of the country was sufficiently studied through the reports from the NFPA, U.S. Fire Administration (USFA) and the HFSC. The Utah communities that are near Ogden have a much greater effect on this project. The surveys assume that all participants answered the questions truthfully and accurately. The researcher assumes the information gathered from all sources is based on facts and opinions of experts in the field of residential sprinkler systems.

Definition of terms

Aerial Apparatus: Fire trucks that carry large, truck-mounted ladders that are raised by hydraulic systems. They also carry many different sizes of ground ladders and other firefighting equipment.

Ambulance: A vehicle designed and used to transport the sick and injured.

Engine: In this project, refers to a fire engine. Fire engines carry water, a pump, hoses and other firefighting equipment.

First Responders: Units and personnel strategically located to be the first emergency personnel on the scene of an emergency medical incident.

Paramedic squad: A vehicle that transports paramedics to an emergency medical scene, but does not transport patients.

Quick-response sprinkler head: A sprinkler head the uses a more heat sensitive fusible link. It sprays water in a uniform fashion high on the walls instead of the typical "umbrella" pattern.

Tillered Aerial Truck: Aerial apparatus that requires two people to drive it. One person drives the front and the other person steers the rear wheels.

Trade-offs: a term used to explain the practice of allowing homebuilder/homeowners to exchange one form of fire protection for another better form of protection.

RESULTS

A literature review, structured interviews both in person and on the phone, study of Ogden City's demographics, OFD's total call volume statistics from 1986 and 2001 and a search of the Internet were used to determine information relative to the research questions. A copy of OFD's call volume history for 1986 is shown in Appendix A, and the most recent figures for 2001 are shown in Appendix B. Pertinent demographics for Ogden City are shown in Appendix C. The structured interviews are shown in Appendices D, E, F and G.

Answers to Research Questions

Research question #1: Does a residential sprinkler system significantly impact the life and property loss in those communities that have adopted such an ordinance? The answer is yes in both the individual cities sited in this project and the national study done by NFPA, the results for these communities are dramatic. The NFPA study, *U.S.*

Experience with Sprinkler Systems, states, "The estimated impact of residential sprinkler systems in homes (nationwide) is a 74% reduction in the death rate" (Rohr, 2001). The other cities studied showed a dramatic decrease in water damage during a fire and property loss due to fire in sprinklered buildings when compared to equivalent non-sprinklered buildings. Overall property losses decreased in all cases by 40% to 50% even though the communities populations grew anywhere between 25% and 50%.

Research question #2: If Ogden City adopts such an ordinance, should it require all new construction to install sprinkler systems or only limited sizes, and how would those who need to install be determined? The research indicates that size of building is not an indicator of fire occurrence. The research indicates: a) children under the age of 14 and adults over the age of 65 are most at risk. b) low-income families are a high risk (USFA, 2001). This research leads to the conclusion that smaller homes are more likely to have a fire, because low-income and young families do not usually live in large, expensive homes. Also, Fire Marshal Jim Gwynn of Provo Fire Department, pointed out this observation. "People who live in big expensive homes have space and room to neatly and safety store combustibles. It's the people who live in small homes that don't have the space. They are the ones who store all their combustibles in the same space as the water heater and the furnace. Those are the people who should be required to be sprinklered." (Conversation with Fire Marshal Gwynn during his structured interview). If Ogden City did adopt a RSS, it should be in all new construction. Size and location does not offset the need for sprinkler systems. However, the problem would still exist in the outlying areas. If the initiative to get all new construction is not right for this time,

then getting any sprinkler in any residential area would be a great start. It would also address the response time problems for those areas identified as at risk.

Research question #3: What are the cost and/or cost savings of installing residential sprinkler systems? The research found that it ranges with the contractors in the area from $1.30 to $2.50 sq/ft. depending on the type of system installed. The results of the contractor's interviews are located in Appendix G. Only one contractor interviewed installed integrated systems. The contractor installing the integrated system said that he charges $1.30 to $1.50 sq/ft, depending on the requirements of the area. Some jurisdictions require him to provide a backflow prevention device, even though this system is part of a culinary system. The others were installing the more traditional stand-alone systems. Three of the contractors said they are charging between $1.50 and $2.50 sq/ft depending on the area and the job. The other contractor would not give a sq/ft price. He would only say that it would typically cost $4,000 to $5,000 for an average home. The other four contractors pricing is consistent with what was gained from the literature review.

However, there are other cost savings that need to be mentioned. Homeowners insurance premiums can be reduced anywhere from 5% to 10%. The results of interviews with five area insurance agents representing the more established insurance companies in the area are located in Appendix E. Only one of the agents had any real experience with RSS. He represented a company that insures mostly high value homes.

There is also a cost savings to the community that needs to be considered. Many communities are finding that they need less firefighting resources in areas that are entirely sprinklered. This equates to saving millions of dollars over relative short periods

of time (Coleman, 1985). “Installing residential sprinklers is like having a firefighter in every room. In areas of cities where sprinklers are used, stations can be located in an EMS orientation. This arrangement increases efficiency, but not at the expense of effectiveness” (Coughlin, 1998).

Research question #4: What types of systems are available and what are the materials used in RSS? There are three types of system layouts available, the “tree” layout, the “simple-loop” layout and the “grid” layout. Both the tree and the loop are stand-alone systems with dead-end lines. These systems require backflow prevention devices because the water in these lines will sit and become contaminated. The grid layout is used with integrated or multi-purpose systems. This system does not need a backflow preventer because when water is flowing it is moving through the entire system. The results of the interviews with six contractors found that only one was using the integrated system, with PEX piping and new multi-port fittings. The others were using CPVC piping and metal fittings in a tree layout. All systems are required to use residential quick-response sprinkler heads. The configuration of this head directs most of the water along the walls, where the heat plume usually is in residential settings, and as a result stops fire growth more quickly. It keeps the interior tenable longer, so the occupants can escape.

DISCUSSION

In the 1850’s, a North American textile mill owner invented one of the most significant lifesaving devices ever devised. He connected lengths of perforated pipe to a water supply. If a fire occurred, a manually operated valve would supply water to the pipe and the mill would be saved. This was the first attempt at what we call sprinkler systems. In 1874, Henry S. Parmalee, of New Haven, Connecticut, designed the first practical

sprinkler head. That design is still in use today (Siarnicki, 2001). Sprinkler systems have established a record for saving lives and property in commercial and industrial applications that is beyond reproach. All one needs to do is look at the statistics. "Insurance company records show a 1000% decrease in the fire losses paid in commercial/industrial occupancies over the past 90 years. Sprinklers are credited for the decrease" (Berner, 1992). We have been keeping records on the results of sprinkler systems performance for over one hundred years. The results are dramatic and we require them in almost all occupancies. So, why can't the fire service get the public to install such a device in their homes? The research indicates that 0.7% of the one-and two-family dwellings are equipped with residential sprinklers (Rohr, 2001).

The fire service has not done a very good job of getting the information about the fire problem out to the key people in the community. "Fire constitutes a much larger problem than is generally known. Deaths and injuries from all natural disasters combined; floods, hurricanes tornadoes, earthquakes, etc., are just a fraction of the annual casualties from fire. For example, deaths from disasters are on the order of 200 per year versus more than 4,000 deaths from fire" (USFA, 2001). We have all the statistics we need. The fire service has to identify whom the target groups are and create a marketing campaigns to reach them. It needs to step out of the standard paradigms and look at the problem from the view of the homeowners and the developers. The elected officials also need to be convinced that this is the best thing for the community they serve. Most importantly the fire service personnel need to see how important this concept is. Thousands of firefighters across the country have been at the scene of a fire and watched the families despair as their life's work goes up in flames. They have watched while

firefighters search for the loved one that is still unaccounted for. “The typical thinking, be it a fire or accident is, ‘It doesn’t happen to me, it happens to someone else.’ People don’t fully appreciate the devastation fire can cause. It can take away everything you own and your family” (Freestone, 2000). The fire service has this same mentality. Do those same firefighters have sprinklers in their homes? The research interviews tell us they don’t. Only 5% of those interviewed have a RSS in their homes. Is cost a factor? Again, the research tells us no. Why? Because 50% of those same people have will have a jetted tub or hot tub/spa in their homes. They will exchange “creature comforts” for the most effective life saving tool available. Therefore, the credibility of RSS suffers.

When asked who or what is the biggest opposition to an RSS ordinance, the top three answers were builders/developers, politicians and homeowners. “Residential sprinkler systems are among the most controversial and, if you will pardon the pun, the most volatile issues a fire chief can purpose to a community. Taking a new code to the city council or board of supervisors can be risky. Losing not only jeopardizes the level of fire protection available, but also reflects negatively on the fire departments credibility” (Coleman, 1986). In a conversation with Franz Hasse, inventor of the multi-port sprinkler fitting and sprinkler advocate for almost 40 years, he says, “We need to look at this from the point of view of the opposition. This is a cost-benefit issue. Those builders and developers are interested in the bottom line. What is this going to cost and is it worth it? That is what they want to know and the fire service needs to provide the right answers. They are not cold-hearted, unfeeling people. They are business people and they are in business to make money.”

The Building Officials, Fire Marshals and Fire Chiefs instinctively look at creating an ordinance to make people conform. It is almost always fraught with controversy and contention from all those who have to conform.

There is a better way. The interviews showed that all Building Officials, Fire Marshals and Fire Chiefs supported trade-offs of some kind (Appendix D). The "trade-off" strategy has worked well in other parts of the country, when the developers are developing housing tracts. But, it does not address the owner/builder or homeowner who builds his own home.

In the late 1970's and early 1980's the nation was in a deep energy crisis. Homeowners were eligible for a substantial tax credit if they installed energy saving devices such as solar panels to help conserve energy. An article in the *NFPA Journal,* (November/December, 2000) tells how Montgomery County, Maryland has made a law the allows up to a 50%, one-time tax credit on the resident's property taxes when they install a RSS. The only stipulation is the credit cannot exceed the cost of the system. These are great examples of how the government used incentives, instead of ordinance or law to help mitigate a problem. It can also be done with residential sprinklers.

There will always be those who resist, and therefore an ordinance will be needed at some point. The best strategy, however is to get the community to install RSS voluntarily. The best way to get that is to use incentives and education.

The next step is education. The fire service needs to develop strategies to inform all members of the community about the fire problem and how dramatically RSS can affect it. Although this can be done on the local level, there is a need for a national commitment from the USFA. "The estimated impact of residential sprinkler systems in

homes is a 74% reduction in the death rate, therefore proving that a policy of encouraging or requiring greater use of residential sprinklers needs to be adopted nationally (Rohr, 2001). The myths surrounding RSS need to be addressed. Three of the five insurance agents interviewed, made comments about sprinklers causing more water damage than the fire. "The biggest and probably most difficult obstacles (to RSS) are ignorance and fear" (Peterson, 2000).

Karen Wojcik Berner gives some advice for starting a sprinkler ordinance campaign. She says, "According to the Fire Chiefs' Department of the League of California Cities, deciding a community should make sprinkler protection a priority is the initial step in bringing improvements in the life safety and property loss.

The next step is to build a city/community team to help make it a reality. Without proper understanding by everyone affected, particularly developers and homebuyers, the effort could die a premature death." (Berner, 1992). She suggests the following steps:

- **Target the audience.** Determine who will need to be a part of the sprinkler effort.
- **Form a task force.** Getting key individuals and organizations to be a part of the decision-making process will help them support the proposal when it's time for the city council to vote on the issue.
- **Agree on the purpose.** It's important to ensure the task force jointly develops the group's purpose.
- **Communicate the message.** In addition to reaching consensus on the importance of sprinklers, the task force will need to communicate this fact.

- **Draft the ordinance.** Obtain a copy of a model fire sprinkler ordinance to guide the city's efforts in meeting everyone's needs.
- **Review extensively.** This community-wide task force should offer the ordinance for review and input from the entire community.
- **Adopt the ordinance.** The city council vote on the ordinance should be just a formality. The groundwork to gain the citizen and business support will have taken place and the concerns and comments dealt with in the final proposal (Berner, 1992).

In summary there is always a lot of work when something of this magnitude is proposed. The best option is always to get everyone involved, so that all concerns can be addressed and broad-based support can be achieved. It is important to establish priorities. RSS should be the number one priority in our community, because as Hal Bruno said, "When it comes to saving lives, nothing can equal or take the place of a sprinkler" (Bruno, 1999).

RECOMMENDATIONS

The research provided information for Ogden City to make an informed decision about adopting a residential sprinkler system ordinance. The facts presented should bring a heightened awareness about the fire problems facing Ogden City and OFD, and the possible solutions. A RSS ordinance is right for Ogden City. It should be undertaken with a process similar to the steps outlined by Karen Wojcik Berner in her 1992 article. Although it is over ten years old, it very closely mirrors the process taught by the NFA in its course, *Developing Fire and Life Safety Strategies,* (January, 2002). The research has identified the problem and developed a problem statement. The next step will be to target

the population at risk. The USFA has defined the risk population in its recently published objectives. They are: a.) children under age 14; b.) adults over the age of 65; c.) firefighters.

The following step will be to identify all those individuals and organizations that need to be part of the sprinkler effort. A task force will be established for the purpose of adopting a new RSS ordinance. The list of participants should be comprehensive and well thought out. It is especially important to include the developers, homebuyers and elected officials to be part of the task force. The research indicated these are the perceived "biggest" obstacles to adopting the ordinance. Each have a particular point of view that needs to be brought to light and addressed. Understanding everyone's point of view and addressing their concerns is key to this issue. Only by understanding can the entire task force agree on the purpose. The purpose of the group is stated in the mission and vision statements.

The entire group must be involved in the development of a mission and vision statement. This will provide guidance to the group, and allow them to come to consensus regarding the priorities and goals and objectives. Educational experts and marketing specialists should be a part of this task force. The research has made it clear that the message has not reached the public. We are still fighting the same myths and misconceptions about RSS that we were fighting thirty years ago.

The new technologies with these systems such as integrated/multi-purpose systems need to be marketed in the community. A strategic plan for getting plumbers trained and certified to install integrated systems needs to be developed before an ordinance can be adopted.

It is important to seek the advice of other communities, who have adopted this kind of ordinance, in order to gain insight from the lessons they have learned. This was a very effective technique used by the State of Utah to prepare for the 2002 Winter Olympic Games. The personnel brought in from Atlanta, who had the experience of planning for the 1996 Olympic Summer Games in Atlanta, Georgia, were invaluable to the planners of Utah.

A draft ordinance should be drafted and published for comment and feed back. It should be offered for review and input from the entire community. There are several model ordinances available to help the task force develop a draft. This will help generate the feed back needed to make sure that everyone's needs are being met and no one has been forgotten in the process.

If the groundwork is done correctly and each person/entity has a chance to voice his or her concerns and issues, an effective marketing campaign and education plan has been delivered to the target/risk audiences, then the support will be there. The city council vote will only be a formality.

This is a very important undertaking for the community now and for generations to come. The adoption of a residential sprinkler system ordinance will save the community millions of dollars over the course of the next fifty years. This money can better be spent on a myriad of other important matters that our communities will be faced with. Spending the time, effort and money now is one of the best investments this community can make for the present and the future.

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APPENDIX A (results)

NFIRS SELECTED STATISTICS - REPORT 13
SUMMARY OF ALL INCIDENTS BY TYPE SITUATION FOUND

REPORT PERIOD- 01/01/86 THRU 12/31/86 COMPUTER RUN DATE- 09/18/02

STATE- UT COUNTY- WEBER COUNTY FIRE DEPARTMENT- OGDEN CITY FIRE DEPARTMENT FDID 57005

CALLS BY SITUATION FOUND	TOTAL	PERCENT OF TOTAL CALLS	MUTUAL AID GIVEN	MUTUAL AID RECEIVED
FIRES				
BUILDING FIRES	137	4.0	1	0
VEHICLE FIRES	92	2.7	0	0
OTHER FIRES	257	7.5	0	1
TOTAL FIRES	486	14.3	1	1
OVERPRESSURE RUPTURES	3	.1	0	0
RESCUE CALLS				
EMERGENCY MEDICAL TREATMENT	2309	67.8	0	0
ALL OTHERS	2	.1	0	0
TOTAL RESCUE CALLS	2,311	67.8	0	0
HAZARDOUS CONDITION CALLS	157	4.6	0	0
SERVICE CALLS	48	1.4	0	0
GOOD INTENT CALLS	209	6.1	0	0
FALSE CALLS				
MALICIOUS CALLS	41	1.2	0	0
OTHER FALSE CALLS	149	4.4	0	1
TOTAL FALSE CALLS	190	5.6	0	1
ALL OTHER CALLS	3	.1	0	0
TOTAL CALLS	3407	100.0	1	2
TOTAL INCIDENTS WITH EXPOSURE FIRES	9	.3	0	0
TOTAL EXPOSURE FIRES	11	.3	0	0
TOTAL FIRE DOLLAR LOSS	$1,002,605			

CASUALTY SUMMARY

	CIVILIAN	FIRE SERVICE
FIRE RELATED INJURIES	13	0
NON-FIRE INJURIES	3	0
FIRE RELATED DEATHS	0	0
NON-FIRE DEATHS	0	0

NUMBER OF INCIDENT RECORDS SELECTED - 3,409

APPENDIX B (results)

From: Janet Herron
To: Froerer, Marilyn
Date: 9/19/2002 4:17:39 PM
Subject: 2001 reports

Marilyn,
Will you let me know if you get this? I am attaching two reports: the tally report shows you had 10,745 incidents in your jurisdiction, and you gavve mutual aid on 203 incidents. You actually had 10,973 incidents for the year (10,745 + 203 = 10,948) but the system does not count the exposures so I have to hunt for them. They are as follows:

0003834 and 0012330 = 3 exposures each

0000504, 0001906, and 0010585 = 2 exposures each

0000222, 0000814, 0000834, 0000850, 0001246, 0001476, 0003191, 0003612, 0010509, 0010968, 0012478, 0012822, and 0013028 = 1 exposure each.

Exposure fires = 25 incidents.

Totals for 2001: 10,745 + 203 + 25 = 10,973

If you are unable to print these, let me know....janet

APPENDIX B (Continued)

Report Run Date 9/19/2002
Report Start Date
01/01/2001
Report Stop Date
12/31/2001

Tally Report
State: UT

NFIRS 5.0

CODE	DESCRIPTOR	FREQ	FREQ %	CIV DTHS	CIV DTHS %	CIV INJS	CIV INJS %	SERV DTHS	SERV DTHS %	SERV INJS	SERV INJS %	PROP LOSS	PROP LOSS %	CONT LOSS	CONT LOSS %	TOTAL LOSS	TOT LOSS %
100	Fire, other	9	0.1	0	0	0	0	0	0	0	0	17,652	0.2	0	0	17,652	0.2
110	Structure fire, other (conversion only)	73	0.7	1	100	6	37.5	0	0	2	100	9,304,530	94.8	0	0	9,304,530	94.8
130	Mobile property (vehicle) fire, other	65	0.6	0	0	4	25	0	0	0	0	448,300	4.6	0	0	448,300	4.6
140	Natural vegetation fire, other	109	1	0	0	0	0	0	0	0	0	1,026	0	0	0	1,026	0
150	Outside rubbish fire, other	62	0.6	0	0	0	0	0	0	0	0	1,912	0	0	0	1,912	0
160	Special outside fire, other	1	0	0	0	0	0	0	0	0	0	10	0	0	0	10	0
170	Cultivated vegetation, crop fire, other	10	0.1	0	0	0	0	0	0	0	0	42,810	0.4	0	0	42,810	0.4
171	Cultivated grain or crop fire	6	0.1	0	0	0	0	0	0	0	0	1,761	0	0	0	1,761	0
210	Overpressure rupture from steam, other	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
220	Overpressure rupture from air or gas, other	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
251	Excessive heat, scorch burns with no ignition	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	Rescue, emergency medical call (EMS) call, other	110	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
320	Emergency medical service, other (conversion only)	9,126	84.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
331	Lock-in (if lock out , use 511)	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	Extrication, rescue, other	6	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400	Hazardous condition, other	22	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Please note that incident counts do not include associated exposure incidents since only the base incident is counted. Sums on the Tally report do include casualties and dollar losses from exposures.

APPENDIX B (Continued)

Report Run Date 9/19/2002
Report Start Date
01/01/2001
Report Stop Date
12/31/2001

Tally Report
State: UT

NFIRS 5.0

CODE	DESCRIPTOR	FREQ	FREQ %	CIV DTHS	CIV DTHS %	CIV INJS	CIV INJS %	SERV DTHS	SERV DTHS %	SERV INJS	SERV INJS %	PROP LOSS	PROP LOSS %	CONT LOSS	CONT LOSS %	TOTAL LOSS	TOT LOSS %
410	Flammable gas or liquid condition, other	90	0.8	0	0	5	31.2	0	0	0	0	0	0	0	0	0	0
420	Toxic condition, other	5	0	0	0	1	6.2	0	0	0	0	0	0	0	0	0	0
440	Electrical wiring/equipment problem, other	49	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
444	Power line down	28	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
462	Aircraft standby	10	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
471	Explosive, bomb removal (for bomb scare, use 721)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	Service Call, other	17	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	Lock-out	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
521	Water evacuation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
531	Smoke or odor removal	9	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
551	Assist police or other governmental agency	20	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
561	Unauthorized burning	10	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600	Good intent call, other	145	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
621	Wrong location	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
631	Authorized controlled burning	30	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
641	Vicinity alarm (incident in other location)	11	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
651	Smoke scare, odor of smoke	190	1.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
652	Steam, vapor, fog or dust thought to be smoke	12	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Please note that incident counts do not include associated exposure incidents since only the base incident is counted. Sums on the Tally report do include casualties and dollar losses from exposures.

APPENDIX B (Continued)

Report Run Date 9/19/2002
Report Start Date
01/01/2001
Report Stop Date
12/31/2001

Tally Report
State: UT

NFIRS 5.0

CODE	DESCRIPTOR	FREQ	FREQ %	CIV DTHS	CIV DTHS %	CIV INJS	CIV INJS %	SERV DTHS	SERV DTHS %	SERV INJS	SERV INJS %	PROP LOSS	PROP LOSS %	CONT LOSS	CONT LOSS %	TOTAL LOSS	TOT LOSS %
700	False alarm or false call, other	35	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
710	Malicious, mischievous false call, other	17	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
721	Bomb scare - no bomb	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	System malfunction, other	335	3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
740	Unintentional transmission of alarm, other	104	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
900	Special type of incident, other	8	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UUU	Undetermined incident type (conversion only)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		10,745	100	1	100	16	100	0	0	2	100	9,818,001	100	0	0	9,818,001	100

APPENDIX C (results)

Ogden City Profile

January 2002

Ogden City, the Hub of Northern Utah, is the county seat of Weber County, Utah's sixth largest city and home to Weber State University (enrollment - 13,900 students). Ogden City is situated at the base of the Wasatch Mountains and located 35 miles north of Salt Lake City. Ogden is easily accessible via automobile and truck transportation on I-15 and I-84, rail service by Union Pacific, private and chartered service from Ogden-Hinckley Airport, and commercial service from Salt Lake International Airport. The City has a full-time Mayor who exercises executive authority and a seven-member city council that exercises legislative authority. Ogden City has 650 full-time employees.

Size: 27 square miles
Incorporated: 1851

Elevation: 4,300 - 5,200 feet

POPULATION

	1970	1980	1990	2000
Ogden City	69,465	64,407	63,909	77,226
Weber County	126.090	144.616	158,330	182,506
State of Utah	1,066,000	1,474,000	1,722,850	2,233,169

Source: U.S. Census of Population and Governors Office of Planning & Budget, Demographics & Economic Analysis

Age, Sex, and Race

Age	2000	%
0-4	7,586	9.8
5-9	6,052	7.8
10-14	5,310	6.9
15-19	6,207	8.0
20-24	8,327	10.8
25-34	12,242	15.9
35-44	10,172	13.2
45-54	7,835	10.1
55-59	2,595	3.4
60-64	2,173	2.8
65-74	4,104	5.3
75-84	3,441	4.5
85+	1,182	1.5
Total	77,226	100%

One Race	1990	%	2000	%
White	55,885	87.4	61,016	79.0
Black	1,741	2.7	1,785	2.3
American Indian/Native Alaskan	687	1.1	927	1.2
Asian	1,123	1.8	1,105	1.4
Native Hawaiian or other Pacific Islander	Na	Na	133	0.2
Other Race	4,473	7.0	9,997	12.9
Two or more races	na	na	2,263	2.9
Hispanic Origin (of any race)	7,669	12.0	18,253	23.6

Mean Age	28.6

Male	39,050	50.6%
Female	38,176	49.4%

APPENDIX D (results)

Structured Interview/Survey Questionnaire for

Building Officials, Fire Marshals, Fire Chiefs and Experts

1. **Name:** 21 total 5- Building Officials, 8-Fire Marshals, 8- Fire Chiefs
2. **Organization represented:** N/A
3. **Title:** N/A
4. **Number of years in Position:** Average, BO=15 yrs, FM=3.4 yrs, FC=3.3 yrs
5. **Number of years in the Service /Industry:** Average, BO=24.4 yrs, FM= 20.25 yrs, FC= 21.75 yrs.
6. **Does your community have a residential sprinkler system ordinance (RSSO)? Yes** 5 **No** 16
7. **If yes, how long has it been in place?** 2-3yrs., 1-15yrs., 2-not sure
8. **If no, are you in favor of a RSSO in your community? Yes** 18 **No** 3
9. **If yes, has any work been done to initiate such an ordinance?** 5-working on it, 2-happy with current conditions, 2- general discussions,
10. **If no, why?** The general answer here was they are too busy with current projects and no one had made an issue of it
11. **Are you familiar with the studies concerning residential sprinkler systems (RSS) and the outcomes of these studies? Yes** 6 **No** 15
12. **Do you know the approximate cost of RSS in your area for new construction and for retrofit in existing homes?** 1- BO, 3- FC, 8- FM stated $1.00 to $1.50 sq/ft for new construction, none of these knew prices for existing homes, 9- no idea

13. Do you own your own home? Yes 20 (95%) **No** 1

How long have you lived there? average 14.45 yrs

14. Does your home have a RSS? Yes 1 **No** 20

15. Does your home have a hot tub/spa or jetted tub? Yes 11 **No** 11

16. Do you have any data on life and property loss since the adoption of your communities RSS ordinance? No data available

17. What or who has been or will be the biggest opposition to this ordinance?

6- Homeowner (29)%

11- Builder/Developers (52%)

3- Elected officials (14%)

1- very little opposition once people are educated

18. Do you support trade-offs to off set the expense of RSS? Yes 19 **No** 2

Comments: The comments varied widely. Some would trade exterior i.e. hydrant spacing and access, trade-offs but nothing on the inside of the building. Others took the opposite point of view. Several said that are willing to trade passive fire protection for active fire protection.

APPENDIX E (results)

Structured Interview for Insurance Agents

1. **Name:** 5 area agents were interviewed
2. **Date:** August 5, 2002
3. **Company / Companies;** N/A
4. **Does your company offer any discounts for one-and two-family that are partially or fully sprinklered? Yes** 4 **No** 1
5. **If yes, what are the discounts?** 1- 6% for partial and 10% for full 1- 10% with no difference if partially or fully 2- 5% for partial and 10% for full
6. **Approximately, how many homes have you insured with RRS in the last ten years?** 50 or more 2- none 2 less than ten
7. **Have you had any training, seminars or any type of informational meetings covering RSS? Yes_____ No** 5
8. **If yes, please explain** N/A
9. **Do you have any other comments?** 3 mentioned that they thought water damage was greater than the fire damage.

APPENDIX F

Structured Interview with a Real Estate Appraiser

1. **Name:** Allen Packham, Certified Real Estate Appraiser.
2. **Company:** Independent.
3. **Experience:** 11 years working with mostly banks and other lenders.
4. **What area do you work in?** Weber, Davis Salt Lake and Morgan Counties.
5. **How many homes do you think have residential sprinkler systems in these counties?** Less than 5% and that is probably high.
6. **Does a RSS increase or decrease the value of a home in this area?** Neither, because there are not enough homes equipped with RSS to make a market comparison, unless it is in conjunction with a complete security system. Then there is some added value.
7. **Are you in favor of RSS?** No opinion
8. **Would you add this to your own home?** No, the cost-benefit ratio is not adequate. I would be better off adding and hot tub or jetted tub. They will add $500 to $3000 to the value of your home.

APPENDIX G (results)

Interview with Fire Protection Contractors

1. **Name:** 6- contractors interviewed
2. **Title:**
3. **Company Name, Address and Phone:**

4. **Do you install RSS? Yes-** all 6 **No**
5. **Are you familiar with NFPA 13, 13R or 13D? Yes-**all 6 **No**
6. **What type of system do you install in residential construction?**
   a. **Tree system** 5
   b. **Loop System**
   c. **Grid System** 1
7. **What type of materials do you use in RSS and why?** 1- uses PEX piping and new multi-port fittings 5- CPVC piping and metal fittings with backflow preventers.
8. **How much does a typical RSS cost sq/ft in new construction and in existing homes? New** 1 - $1.30 to $1.50 sq/ft 3- $1.50 to $2.50 sq/ft 1- $4,000 to $5000 **Existing** 1- approx $2.50 4- no price given because it varies too much
9. **Are you an advocate of RSS? Yes** all 6 **No**
10. **Do you have a RSS in your home? Yes** 2 **No** 4
11. **Do you have a hot tub/spa or jetted tub? Yes** 3 **No** 3