Second Edition

Bridging the Gap

A Guide to Implementing a Residential Sprinkler Requirement

By Jim Tidwell, Ken Kraus and Michael Love

Bridging the Gap–
A Guide to Implementing a Residential Sprinkler Requirement

By Jim Tidwell, Ken Kraus and Michael Love

January 2013

About the Authors

Jim Tidwell

Jim served in the Fort Worth, Texas, Fire Department for 30 years, serving in every rank, including Fire Marshal, Executive Deputy Chief and Chief of Department (interim). After leaving the department, he led the Fire Service Activities Team for the International Code Council, where he spearheaded efforts to provide opportunities for fire service input and influence in the ICC Code Development Process. Jim has actively promoted fire service issues on a local, state, and national level for many years. Some of his activities include service on ICC and NFPA code development committees, working with legislative and executive branches of government to ensure fire service issues are recognized, and volunteering for the National Fallen Firefighters' Foundation on a number of projects.

Ken Kraus

Ken was promoted to the rank of Fire Inspector in 1983 after six years as a Firefighter III with the Los Angeles City Fire Department. After several years Ken became responsible for new construction projects and high-rise buildings for roughly one-third of the city. Ken was an original appointment to the NFPA Regional Code Development Committee in 1996 and remained an engaged member until his retirement from the LAFD in 2011. Ken was selected the ICC "Fire Official of the Year" in 2011, is a member of the ICC Fire Code Action Committee and currently holds the position of Vice Chair of the ICC Codes and Standards Council. Ken served on the Executive Board of the California Fire Chiefs Association, Fire Prevention Officers Section, Southern Division, holding the office of President in 2008. Ken is currently representing the International Association of Fire Chiefs on various U.S. EPA flame

retardant alternatives assessments and serves on the Board of Directors of the IAFC Fire and Life Safety Section.

Michael Love

Mike worked as a firefighter for Montgomery County, Maryland, for more than 33 years. He served in a diverse range of positions that included extensive experience as an operational company officer and firefighter in some of the busiest companies; Field Battalion Chief; Assistant Chief commanding one of three shifts of county-wide operations; Chief of Emergency Medical Services; Special Operations Chief, Supervisor of Dispatch; and most recently commanded a division that included the Fire Marshal's Office, Public Information, Community Outreach, Recruiting and Planning and Research. As Division Chief, Love served as the Montgomery County Fire Marshal. Love is a graduate of the University of Maryland with a bachelor's degree in Fire Science, is a graduate of the United States Fire Administration Executive Fire Officer Program and is a Certified Public Manager. Love is currently a freelance consultant and technical writer and is a member of the Maryland Fire and Burn Safety Coalition.

Acknowledgments

We'd like to acknowledge the many individuals and organizations that supported the development of this Guide. In particular, we want to recognize the members of the Advisory Committee for this project. Without their leadership, guidance, and expertise in the subject matter, this project would not have been possible. The steering committee includes:

Tony Apfelbeck	Altamonte Springs, FL
Jeff Feid	State Farm Insurance
Jim Ford	Fire Marshal, Scottsdale, AZ
Jeff Hugo	National Fire Sprinkler Association
Bruce Johnson	International Code Council
Tom Lia	Northern Illinois Fire Sprinkler Advisory Board
Sandy Mills-Alford	AliveTek
Phil Oakes	National Association of State Fire Marshals
Vickie Pritchett	Fire Team USA
Tim Travers	National Fire Protection Association
Sara Yerkes	International Code Council

Table of Contents

Introduction

The fire problem in America is our homes. According to two NFPA studies for the year 2011, more than 90 percent of civilian structure fire deaths and 40 percent of firefighter fireground deaths occur in house fires. This is in spite of the tremendous benefit afforded by smoke alarms. Residential sprinklers are widely recognized as the next revolution in reducing our nation's losses due to fire. While minimizing unwanted fires is a primary life safety objective, once a fire starts, the earliest intervention possible leads to the best outcome. Several studies verify the fact that the vast majority of fires are extinguished before they grow large enough to be of consequence;[1] however, the small percentage of fires that grow beyond the control of building occupants cause the vast majority of deaths, injuries, and damage to property. Residential sprinkler systems present the most effective system response to these fires in homes. The installation of residential sprinklers will significantly reduce injuries, deaths, and property loss, safeguarding both our families and our communities. The national regulatory community has embraced this technology by including requirements for sprinkler systems in one- and two-family dwellings in every model code developed in the United States.

Because residential sprinkler requirements are relatively new to most jurisdictions, there is an overall lack of guidance about their implementation. This guide is intended to provide a roadmap for jurisdictions that have adopted residential sprinkler system requirements to help implement the regulation in a logical, business-like manner. This information is based upon

[1] *National Fire Protection Association "U.S. Experience With Sprinklers": 65 percent of fires in buildings equipped with sprinklers were too small to activate the sprinkler system. Consumer Product Safety Commission "Residential Fire Survey, 2004-2005": Only 3.4 percent of all fires are reported to fire departments.*

successes (and failures) of other jurisdictions that have completed the adoption and initial implementation in the last few years. Realizing that every jurisdiction is different, we have taken into account resource allocation issues, technical barriers, and other concerns that will necessitate different approaches by various jurisdictions. In addition to the direct implementation information, we attempt to provide information and statistics to demonstrate the value of residential sprinklers. Demonstrating the value of residential sprinklers is important to a successful implementation, and to the long-term viability of such a requirement.

Included in this guide are sample policies, procedures, and checklists to assist jurisdictions in formulating their own best practices. These samples are a compilation of those from successful implementations across the country, and are considered "open source" so that anyone can copy, modify, and use them as they see fit. The guide is organized into sections that provide a series of decision points that should be considered as a jurisdiction moves forward with implementation.

This guide is not all-inclusive of the best practices, but is a starting point for collecting and providing access to the many successful efforts of jurisdictions throughout the United States that have residential sprinkler ordinances and mandates. It is arranged using four major topics:

1. Addressing Policy Issues
2. Organizing a Stakeholder Group
3. Considerations for Key Decision Points
4. Background, Models, Best Practices and Examples

Each major subject is discussed through sub-topics that provide guidance on related issues. The sub-topic areas contain best practices gathered from

throughout the United States that provide a model for managing the business side of a residential fire sprinkler requirement. To enhance visual presentation, this guide provides flow charts, matrixes and other visual means to help the reader make decisions or see how a process works.

Trends, Technology, and Modern Living

While progress and innovation by their nature facilitate change, a seemingly infinite number of variables have impacted one- and two-family home construction over the past 30 years. Examples of these changes include:

- Evolving design toward larger, more open structures
- Technological changes in construction techniques and materials, including engineered building systems
- Reduction in availability of natural resources
- Desire for more sustainable communities

These and other issues have driven changes that have had a negative impact on services delivered by fire departments across the country. Because building regulations haven't kept pace with the changes in construction, residential fire sprinklers now provide the most cost-effective mitigation measure to address these challenges.

Let's consider some of the major changes to the built environment.

PLANNED UNIT DEVELOPMENTS

Planned Unit Developments (PUD) and other innovative residential planning concepts represent a relatively new philosophy that redefines the traditional residential neighborhood. PUDs emphasize the sense of community and maximize land use while affording the jurisdiction planning flexibility through increased population densities.

These communities are composed of one- and two-family dwellings, condominiums and townhouses; they incorporate open spaces and common areas to enhance the neighborhood experience. They may also have access to nearby transportation and retail conveniences.

Contrary to traditional neighborhood planning, PUDs attempt to minimize property frontage in relation to lot size and seek to discourage vehicular traffic flow.

While PUDs may enrich the residential living experience, they present some challenges to the delivery of emergency services.

Densities

Dwellings or other residential buildings within PUDs are spaced much closer than in a conventional neighborhood. Setbacks are reduced, with some structures sharing party walls and yards. Clustering or grouping buildings is also used to increase the size and usability of common areas. These traits inhibit traditional fire response strategies in a number of ways, such as limiting access.

Access

Street widths vary depending on their distance from main thoroughfares and proximity to the dwellings. Most "streets" that provide direct access to homes either limit or prohibit street parking because of reduced width. Any breach of ideal compliance with the prescribed parking policies can delay response times for emergency medical or suppression resources.

Since PUDs begin as what is essentially a rezoning exercise, they afford to the jurisdiction a tremendous amount of influence over the design. Initial PUD submittals can challenge a jurisdiction's general safety plan and force officials to consider extraordinary alternatives to traditional fire safety designs. These alternative strategies, paired with pre-incident planning, can offset many of the challenges of

PUDs; the most critical component is the requirement for an automatic sprinkler system throughout the development.

MODERN HOMES

Residential building construction and interior furnishings have changed radically over the past 30 years. In many instances, materials and practices previously reserved for commercial projects have been incorporated into common residential construction.

While these innovations in home construction were evolving, the fire service was focused on other issues. The result is that firefighter safety and public safety have been affected, and the fire service is now reacting to the challenges through changes in fireground tactics and strategies. This is not the most effective solution, but until residential sprinkler regulations are in place, it may be the only one available.

Let's start from the ground up and consider how home construction has evolved over the second half of the 20th Century.

1940–1960

Balloon construction, characterized by dimensional lumber studs that extend from the bottom plate to the top plate, lacked fire-stopping capability and was common through the mid-1950s. This technique created small vertical concealed spaces that promoted rapid fire spread. The only saving grace with regard to single-family dwellings is that throughout that period most homes were one story.

1960–1980

Residential construction evolved through the 1960s and ’70s to include conventional combustible (platform) construction. Homes constructed during this period typically used dimensional lumber and extensive fire-blocking. This period also saw a shift toward two-story homes and a steady increase in the average square footage.

1980–2010

U.S. Census data indicates that average home size has increased by about 65 percent from the mid-1970s to today with new single-story homes representing less than 15 percent of the market. More important is how these homes are constructed and how design trends have created structures that, under fire conditions, behave more like commercial occupancies than homes.

The advent of lightweight engineered wood products in single-family home construction has changed dramatically how modern homes behave during fires. The use of wooden “I” beams and open web trusses for floor, ceiling and roof assemblies is a key change that drives many other factors.

Construction Features

Wooden I-joists, nearly twice as stiff as comparable dimensional lumber, can cover immense spans with standard lengths ranging from 24-48 feet. Many products are manufactured with scored knockouts for mechanical penetrations. Vertical, structural sheathing (plywood or oriented strand board) used in wooden I beams can be as thin as 3/8-inch.

Wooden I-Joists with cutouts for piping and other system components.

Open web trusses are used for longer spans and create additional concealed spaces with their cross bracing members, negating the need for solid vertical sheathing between the top and bottom chord. This lack of lateral compartmentation creates a full-length/full-width concealed space. Thin metal gusset plates, with a penetration depth of 3/8-inch, join the elements together.

Top and bottom flanges or chords range from 1 3/4-inch to 2 5/16-inch wide for standard applications and are manufactured using solid sawn or laminated veneer lumber.

The hazard created with these lightweight engineered products is that they collapse far more quickly under fire conditions than traditional sawn lumber assemblies.

Wooden I-Joists after the fire. Oriented Strand Board (OSB) webbing has burned through, weakening the member substantially.

Design Features

Lightweight engineered wood assemblies offer architects a host of structural and design alternatives. This is due primarily to their inherent rigidity and load- carrying capacities.

These structural features allow builders to design much larger spans than with dimensional lumber. Larger spans equate to larger rooms, more open areas and fewer walls or "compartments." These large open areas also create large concealed spaces as previously discussed. In direct contrast to legacy designs, modern assembly failures are larger and more catastrophic.

In many cases, this design flexibility has led to homes of 10,000- to 20,000-square-feet and larger. Some jurisdictions have raised concerns about the efficacy of NFPA 13D [life safety] systems to adequately mitigate the multiple hazards associated with these "McMansions." Several jurisdictions have set thresholds that if exceeded would

require a full NFPA 13 system in order to address the additional hazards of these large buildings.

It's not just about larger homes and bigger rooms. Ceiling heights have also increased and modern houses tend to be taller. Eight-foot legacy ceilings have been replaced by 10-foot to 13-foot heights on the ground floor and 9- to 10-foot heights on upper levels. Roof truss assemblies require taller geometries to carry loads over larger spans. This in turn renders much larger attic spaces than legacy construction. The net effect on building height can raise ridegepole heights to 30 feet or more. It may be counter intuitive, but increased interior volumes can lead to larger fires. (See "Fire Behavior" below.)

Let's look at the pros and cons of lightweight engineered wood trusses.

ADVANTAGES

- Availability
- Longer spans
- Larger load capacity
- Quieter floors
- Smoother finished ceilings
- Lighter, faster installation
- Increased rigidity

DANGERS

- Less mass – rapid failures
- Large horizontal concealed spaces
- Failure even with minimal deflection
- Few warning signs before failure
- Larger spans allow larger open areas….less compartmentation
- More dependent on bracing (sheathing, rim joist, hangers, blocking)

PRACTICAL CHALLENGES OF MODERN LIVING

- Homes located closer together
- More two-story homes – emergency egress more difficult
- Higher occupancy densities due to family members moving back home
- Aging populations requiring full-time care at home
- Increased flammability of interior furnishings

MODERN FURNISHINGS

There has been much written about the evolution of home furnishings' combustibility over the past few decades. One common theme centers on how materials used in residential furniture have gradually changed from using natural materials to incorporating more synthetics into finished fabrics and padding materials. Some have questioned the ability of certain types of smoke alarms to effectively respond to this shift in materials. This is due in part to studies conducted at the National Institute for Standards and Technology that involved an investigation that considered a 30-year period. The primary conclusion of this research was that occupants in homes today have less time to escape before a fire makes the space untenable, in spite of the prevalent and increasing use of smoke alarms.

Here are some of the key differences in traditional and modern upholstered furniture.

TRADITIONAL FURNITURE MATERIALS	
	Cellulosic based – cotton, linen, jute Animal based – wool, silk, feathers Most used for covering and cushioning
	CHARACTERISTICS
	Simple Designs Smaller Pieces

MODERN FURNITURE MATERIALS	Polyester Olefin Polyurethane (varying densities, primarily used in cushions) Polyamides (Nylon)
	CHARACTERISTICS
	Larger (often overstuffed appearance) Complex Designs (more folds and tucks) More Transitions from Vertical to Horizontal

Cost

Never underestimate the importance of manufacturing costs and profit margins. With natural materials becoming more scarce and expensive, the opportunity exists for new materials, manufacturing techniques, and products to gain market share. Add to this the incessant consumer demand for "new and improved," and you create a model that ensures high product innovation and turnover. This constant influx of new materials and designs represents a significant challenge for regulators attempting to maintain the safety of residential occupancies.

Smoke Production and Toxicity

In addition to being more easily ignited, modern furniture generally emits more smoke with higher toxicity levels than legacy pieces. Combustion by-products emitted by synthetic-based furniture render toxicants like hydrogen cyanide and hydrogen bromide at much higher levels than natural materials.

The toxicity equation is complicated by the inclusion of halogenated flame retardant compounds during manufacturing. Many furniture manufacturers make furniture for

the entire U.S. market that meets the flammability requirements known as California Technical Bulletin 117, which is most often met with the use of halogenated flame retardants. Combustion of these organic halogens generates high levels of dioxins, furans, and carbon monoxide, further compromising tenability. Additional environmental and end-of-life concerns further cloud the use of these chemicals.

Fire Behavior

While ignitability, toxicity and smoke production are all-important assessment factors, most of the upholstered furniture research focuses on peak heat release as the single most important variable. Both the heat release rate and total heat release are monitored and recorded in most studies. Legacy furniture using natural finish fabrics and padding materials demonstrate significantly slower fire growth and lower heat release rates than modern pieces using synthetic (thermoplastic) fabrics and polyurethane or polyolefin padding.

A UL research project determined that a single piece of upholstered furniture has enough combustion potential to cause a room to flashover.[1] This scenario was actually less likely in a legacy room where the lower ceilings, compartmentation and lower volume limited combustion due to oxygen depletion. Conversely, modern homes with large rooms and taller ceilings provide more oxygen and more heat release that can precipitate flashover.

INSURANCE SERVICES OFFICE (ISO)

ISO is a leading source of property insurance and risk information. Data collected include evaluations of public fire protection, flood risk, and the adoption and enforcement of building codes in individual communities. This information can help communities manage and mitigate their risk. A primary tool of this effort is the Building Code Effectiveness Grading Schedule (BCEGS) program. This program

[2] *Analysis of Changing Fire Dynamics, Stephen Kerber, UL*

currently evaluates more than 25,000 communities. Communities that do not adopt a residential code that mandates fire sprinklers in one- and two-family dwellings will not receive full credit per the BCEGS Code Adoption Table. This reduced credit has caused some jurisdictions' classifications to be reduced by a full grade.

ISO has stated that adopting the most recent model codes is an important element of a community's overall risk-reduction strategy. A recent study has detailed how many jurisdictions are delaying the adoption of the current codes in an effort to reduce adoption and ordinance costs. The study indicates that "Economic issues still threaten code adoption and enforcement progress in many areas of the country." This is important because, according to ISO, "municipalities with well-enforced, up-to-date codes should demonstrate better loss experience."

Delaying the adoption of the most recent model codes that mandate residential fire sprinklers will impact risk assessment ratings. More important, this intentional action will compromise the safety of residents and emergency responders.

- The complete report ("Is the Economy Threatening Building-Code Effectiveness?") is available at: **www.isomitigation.com**.

WATER MIST FIRE PROTECTION SYSTEMS

The next evolution in water-based fire protection may be just around the bend. Water Mist systems as defined and addressed by NFPA 750 are surging as a result of the evolution in theory and materials. These systems have been around since the 1940s, but have been limited in their application to a very select group of projects because of cost and their limited applicability.

Water mist fire protection systems use a propellant, usually compressed gas, at pressures ranging from less than 175 psi to more than 500 psi. The propellant

ensures that water, in the form of a fine mist, and in some cases an atomizing media, are expelled through the heads (or nozzles) at a sufficient rate to ensure complete dispersal. The effectiveness of these systems is due primarily to the exponentially increased surface area of mist-sized droplets.

Recent advancements in low pressure (under 175 psi) water mist technologies have enhanced their effectiveness and reduced system costs significantly. This should lead to wider application.

Multi-purpose Sprinkler Systems

Multi-purpose systems combine the home's domestic plumbing system with the fire sprinkler system, affording several benefits. Since the fire protection system shares a common supply with the regular plumbing, it's constantly apparent if water is available each time a cold-water plumbing fixture is used. This verifies that the sprinkler system is operational and may preclude the need for check valves and backflow preventers. Sprinkler heads can either be branched directly off domestic lines or supplied from various sources from multiple directions. In either case, systems are designed to provide sufficient coverage and pressure to provide the desired life safety benefit of one- and two-family dwelling sprinkler systems.

TRENDS AND TECHNOLOGY SUMMARY

Building materials, construction design and interior furnishings used in one- and two-family dwellings have evolved tremendously over the past 30 years. These changes have created unintended consequences that exponentially increased the hazards associated with fighting fires in dwellings. The National Institute for Occupational Safety and Health (NIOSH) has documented 32 firefighter deaths and injuries over a five year period that were directly attributed to fire or collapse of

lightweight wood construction[1]. (NIOSH Alert April, 2005 http://www.cdc.gov/niosh/docs/2005-132/pdfs/2005-132.pdf.)

UL, in conjunction with the International Association of Fire Chiefs, the Chicago Fire Department, and Michigan State University, and through a Department of Homeland Security Fire Prevention and Safety Grant, studied the structural stability of engineered lumber under fire conditions. The findings of this comprehensive, full-scale research were sobering. Unprotected (no drywall or fire sprinklers) floor assemblies constructed of legacy dimensional lumber withstood the test fire (ASTM E-119) for 18 minutes before it failed. Similarly installed engineered "I" joists failed in just four minutes. While these tests did use a full fire exposure, it's clear that, depending on how long the fire has been burning and the fire department's response time, the structural integrity of engineered floor and ceiling assemblies can be compromised upon the fire department's arrival on scene.

The transition to synthetic finish fabrics and padding materials in home furnishings has added significantly to the residential fire challenge. Rooms that are more susceptible to flashover are constructed in a manner that is prone to early catastrophic failure of structural components. These failures many times involve large areas and occur with little or no warning.

Residential fire sprinklers are widely recognized as being extraordinarily effective in mitigating these hazards. Fire sprinklers provide escape time for occupants and buy back precious firefighting minutes that have eroded through transition to modern homes with contemporary furnishings. Effective implementation of a residential fire sprinkler requirement is one of the greatest community risk reduction strategies a jurisdiction can enact. In addition to community risk, fire sprinklers address the fire problem in America by minimizing injuries and deaths to civilians and firefighters in residential fires.

1 NIOSH Alert, April 2005

Addressing Policy Issues

In order to best manage the development and implementation of a residential sprinkler regulation, it's important to understand the legal basis for the authority to do so. A discussion of the U. S. legal process can be found in **Appendix D**.

THE MOST COMMON TYPES OF RESIDENTIAL SPRINKLER LEGISLATION

- **Stand-alone ordinances (municipal, county, fire district/authority).** These are the most common type of regulation at the time of publication. A stand-alone ordinance has the benefit of providing significant opportunity for input and influence by local stakeholders. Issues of interest to any stakeholder can be vetted through a comprehensive, collaborative process. Concerns of contractors, water purveyors, and citizens will be considered during the development of the legislation, assuring that all points of view are taken into account. This process usually includes internal development, stakeholder input, and public hearings.

- **Model Code Adoption (municipal, county, fire district/authority).** Recently the International Residential Code followed NFPA 101 and NFPA 5000 in placing a requirement in the model code for one- and two-family residences to be equipped with residential sprinkler systems.

- State adoption of minimum code requirements (usually based upon model codes).[2]

[2] *Statewide minimum codes allow local jurisdictions to adopt more restrictive requirements than the state code.*

- State adoption of mini-maxi code requirements (usually based upon model codes).[3]

Stand-alone ordinances were adopted in many jurisdictions prior to the inclusion of residential sprinkler requirements in the model codes. These ordinances were typically initiated by the fire service, with support from various community leaders, industries, and trades, depending upon the politics of the jurisdiction. The goal of these efforts was to achieve a higher level of fire safety in the community and to address the overall cost of fire protection. A stand-alone ordinance has the advantage of being considered separately from a larger code adoption action. This allows stakeholders the ability to focus on this single issue rather than getting caught up in all of the issues complicit in a major code update. Homebuilders, water purveyors, fire protection professionals and others have ample opportunity for input, discussion, and collaboration. While it's probably more difficult from a political perspective to adopt a stand-alone ordinance, it's possible that because of the added focus, it will be more readily accepted.

The primary advantage of adopting a model code rather than a stand-alone ordinance is that the model code provides a wide range of fire and life safety requirements in a single document. In addition, the model codes take great care to assure the provisions are coordinated to avoid conflicting requirements. The code has been through a national consensus process, and may have greater legal standing than a regulation produced locally. In addition, once the code is adopted, the sprinkler requirement becomes one of many contained in the regulation, making it a less likely target than if it were a stand-alone document. Once adopted, the sprinkler requirement may be easier to defend and justify as a part of the overall regulation.

[3] *Statewide mini-maxi codes seldom allow any local changes to the state code and then only under rare and unusual circumstances.*

Most jurisdictions that adopt model codes as the basis for their building and fire regulations go through an amendment process to maintain unique administrative provisions and address issues important to the individual community. These may be related to climate, topography, or other criteria identified by the community leaders. The requirement for residential sprinklers is likely to be hotly debated at the local level, with proposals that attempt to delete the requirement entirely or to provide additional tradeoffs or incentives. Individuals or organizations that weigh in on both sides of the issue are great candidates for membership on the stakeholder group when it is time to implement the requirement.

A number of states adopt statewide minimum standards for construction and water supplies. Many states that omit the residential sprinkler requirement from the model code allow local jurisdictions to introduce such a requirement on a local level. This will be similar to passing a local ordinance, or simply amending the state regulation locally.

In "mini-maxi" states, construction regulations are promulgated at the state level, and local jurisdictions aren't authorized to amend them. In some of these states, local jurisdictions are charged with the responsibility of enforcing the state standards, but have no authority to change them. Local jurisdictions in states that adopt regulations requiring sprinklers in one- and two-family dwellings may find themselves in a situation whereby they must develop a process for enforcing this new regulation over a short period of time with little room for negotiation with stakeholders.

Regardless of the type of legislation, it is important to pursue a collaborative approach to implementation. Identifying stakeholders and an appropriate organizational approach will form the foundation of your implementation effort. This activity will be addressed in the next section of this guide.

In jurisdictions with a building code that doesn't have a residential sprinkler requirement, it is still possible to pursue other avenues to achieve sprinkler protection in homes. By building alliances and promoting the inclusion of residential fire sprinklers in homes, you can encourage voluntary installations. Promoting residential fire sprinklers to developers and builders is often accomplished by offering incentives that reduce the cost of construction projects and enable streamlined business processes that can save time on the project. **Appendix A** of this guide provides considerations for voluntary inclusion of residential fire sprinklers.

OTHER POLICY AREAS TO CONSIDER

If your jurisdiction has adopted a code or regulation requiring residential fire sprinklers, there may be other policy areas that need to be considered during the implementation phase. While assuring code compliance may not require changes to your business process, there may be opportunities for policy changes that will streamline the enforcement and make the regulation more palatable to those in opposition. Remember the benefit that sprinklers provide to your department and the community and think outside the box. Some of these policy considerations include:

- Financial impacts: Building permit fees are normally based upon the estimated cost of construction. This cost includes all components and systems, including sprinklers. If additional fees are required to review and inspect residential sprinkler systems, the building community may object to what it perceives as paying twice for the same service.
- Incentives for installing sprinklers are contained in the model codes; however, if the jurisdiction determines that its citizens will enjoy additional financial benefits, it is appropriate to consider reductions in some of the fees associated with permits, inspections, and approvals for these systems.

- New licensing and certification for trades associated with fire sprinklers may be considered where licensing is currently based upon the requirements for designing and installing commercial fire sprinkler systems. Residential systems are, by design, less complicated than their commercial cousins, and the same level of expertise may not be required for installers. However, it is important that jurisdictions establish competency standards for residential sprinkler installers. Where designs are provided by factory or proprietary system engineers, local engineering criteria may require less scrutiny. Some states have implemented separate, less restrictive criteria for the licensing of persons who design and/or install residential sprinkler systems.

Another policy decision is whether the jurisdiction will accept the model code or standard intact, or will make local changes to accommodate some perceived weakness in the requirements. It is within the purview of the jurisdiction to modify the national standards to provide the level of safety desired by the community. A note of caution here: Changes to the national standards to make them more restrictive that increase costs will almost certainly have a negative impact on the overall program. Some of the more stringent requirements that have been adopted in jurisdictions include:

- Requiring sprinklers in garage areas
- Requiring sprinklers in attics
- Requiring sprinklers in small bathrooms and closets
- Requirements for material-specific piping (for example, copper piping)
- Prohibitions against some materials (for example, PEX piping)
- Increasing water supply requirements
- Requiring other than 13D systems in very large homes

Prior to the residential sprinkler standards being developed (NFPA 13R and NFPA 13D), the only national sprinkler standard was intended for the protection of

commercial property (NFPA 13). The commercial standard requires virtually all spaces to be sprinklered, and includes robust water supply requirements based upon commercial fire loads. To address the residential fire problem, new standards were developed for the specific purpose of providing an increased level of life safety in residential applications. These standards accept a certain level of risk to the property in return for a lower overall cost of the system. The national consensus processes used to develop these standards provide a significant amount of credibility when they're adopted. Local changes to these standards may not enjoy that same level of credibility. Any changes to the national standards should be well thought out and fully vetted with all stakeholders if possible.

Organizing a Stakeholder Group

It's likely that a stakeholder group was assembled to pass the legislation leading to a residential sprinkler requirement. It's also likely that a stakeholder group was assembled to oppose the requirement. If so, the members of both groups should be invited to serve on the stakeholder committee to develop the implementation criteria. Having the right players, both supporters and opponents, at the table when discussing all the decision points will provide the greatest opportunity to resolve any controversial issues prior to finalizing the implementation policies.

Implementing a residential fire sprinkler requirement impacts many people in the community. No matter how the regulation came about, involvement by people that will be most affected is a necessary part of the implementation process. People buy into change more readily when they are able to communicate their concerns and help to resolve problems and overcome barriers. Affording ownership to those affected is the best way to minimize resolute resistance. California's effort is a great example of giving partners a voice.

This section of the guide assists in identifying stakeholders and presents some best practices to optimize their involvement. While two of the best practices offered represent very formal techniques, they are not the only way to approach this helpful step in the implementation. Any methodology that provides for robust communication and is acceptable and viable for the community involved will serve to promote a smooth implementation. The objective is to emphasize the importance of collaboration with all interested parties to identify issues that may affect the success of the implementation.

WHY STAKEHOLDER SUPPORT IS NEEDED

Having stakeholder support is a significant benefit to implementing a residential sprinkler requirement without major setbacks or unnecessary delays. A move to residential fire sprinkler systems in one- and two-family dwellings is a complex process that impacts a wide range of stakeholders. These stakeholders probably already have a position on residential sprinklers and can be supportive or resistant, and may range from lackadaisical to extreme in their respective positions. Others may be completely unaware of the technology, or otherwise indifferent. If all the groups participate sincerely and understand the simplicity and effectiveness of automatic fire protection, many positive benefits will accrue.

Involving stakeholders in a change process is a positive strategic approach. In the book *Managing at the Speed of Change*, author Daryl Conner describes the benefits of active involvement of those who are subjected to change and asserts that this positive involvement can create synergy, defined as a result that is greater than the sum of its parts. The members still may not be positive supporters of residential sprinklers, but they may become a positive supporter of you as the implementer.

The main goal of this phase is to identify any problems or issues that will arise and start to gather information to develop solutions. Stakeholder involvement not only helps to build consensus but it increases the knowledge needed to accomplish the little-known areas of the process that are sometimes referred to as the "devil in the details." By assembling and managing the stakeholder group, you will create a mechanism and forum for sharing technical input as well as addressing any misinformation or misunderstandings that may exist.

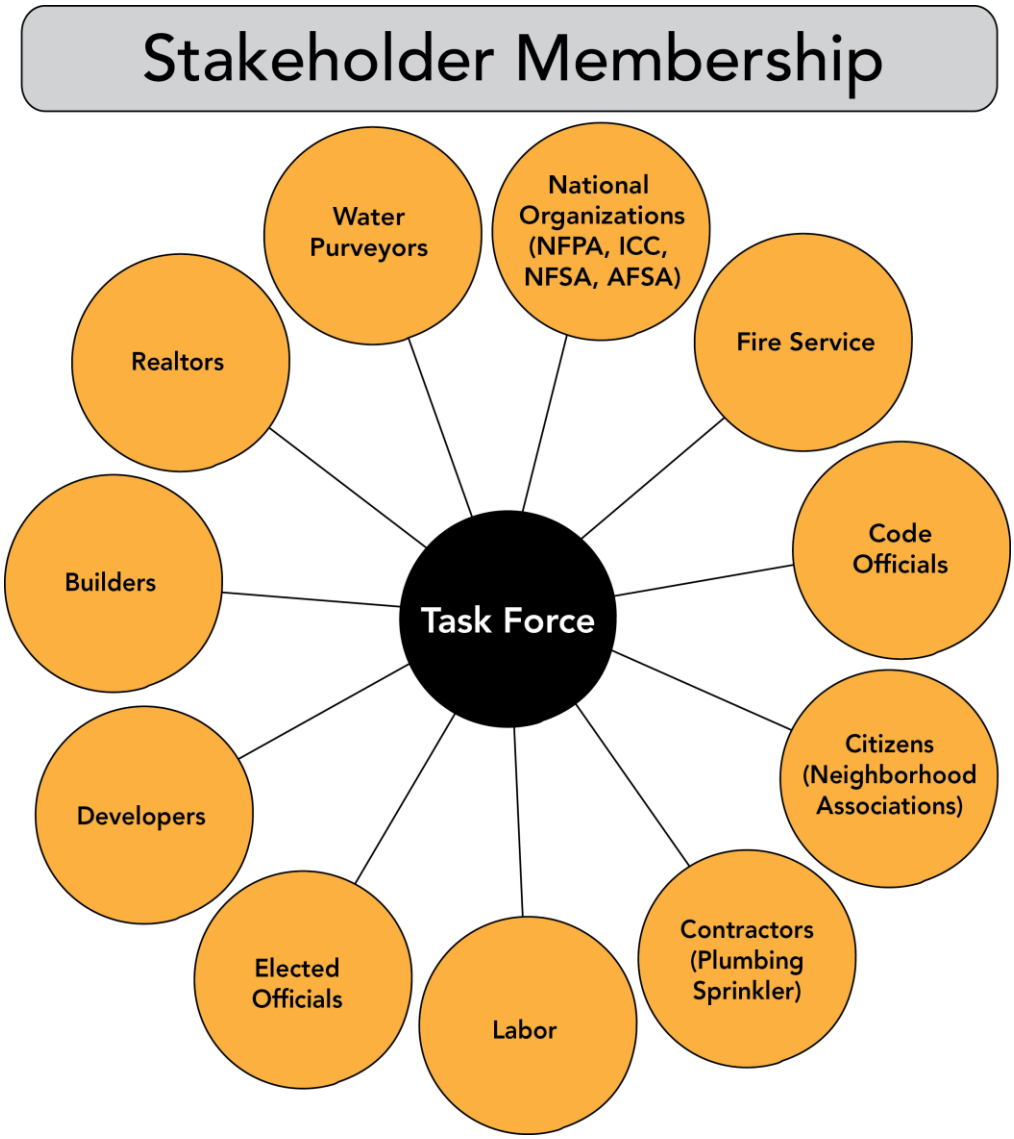
WHAT TO CALL THE STAKEHOLDER GROUP

There are many ways to gather the input needed for the implementation. The name of the group assembled is less important than the makeup and the outcomes, but some of the more common names include task forces, committees, and work groups. For the purposes of this guide, we'll use the term "task force" to identify the core stakeholder group. Task forces have become a popular way to organize around problem solving or information gathering and lend themselves to a diverse range of people and issues.

A task force is a group that is formed to work through a specific short-term issue. Generally, task forces are defined by a purpose – in this case to identify all areas of concern and issues involving the implementation of a residential fire sprinkler requirement. A task force should have a specific starting point and ending point. This range from start to finish doesn't necessarily need to be based upon a specific time frame, but could be goal based, or the group could meet until there is consensus of the issues identified. Using a task force process allows you to meet on a regular basis with stakeholders, identify key areas of concern, and produce a documented end product. Since it's likely that a number of functions will be undertaken simultaneously to speed up the process, it will be helpful to have subgroups to accomplish work on some of the more specific issues.

Best practices for stakeholder involvement can be found in **Appendix B**.

DO YOU HAVE THE RIGHT MEMBERS IN YOUR STAKEHOLDER GROUP?



For purposes of this discussion, a stakeholder can be described as a person or organization concerned about or affected by a change, has a vested interest in the change, or is assigned regulatory oversight. A new residential sprinkler requirement is an important community enhancement that affects many people. A small planning group may be assembled to identify the potential stakeholders and answer some key questions, such as:

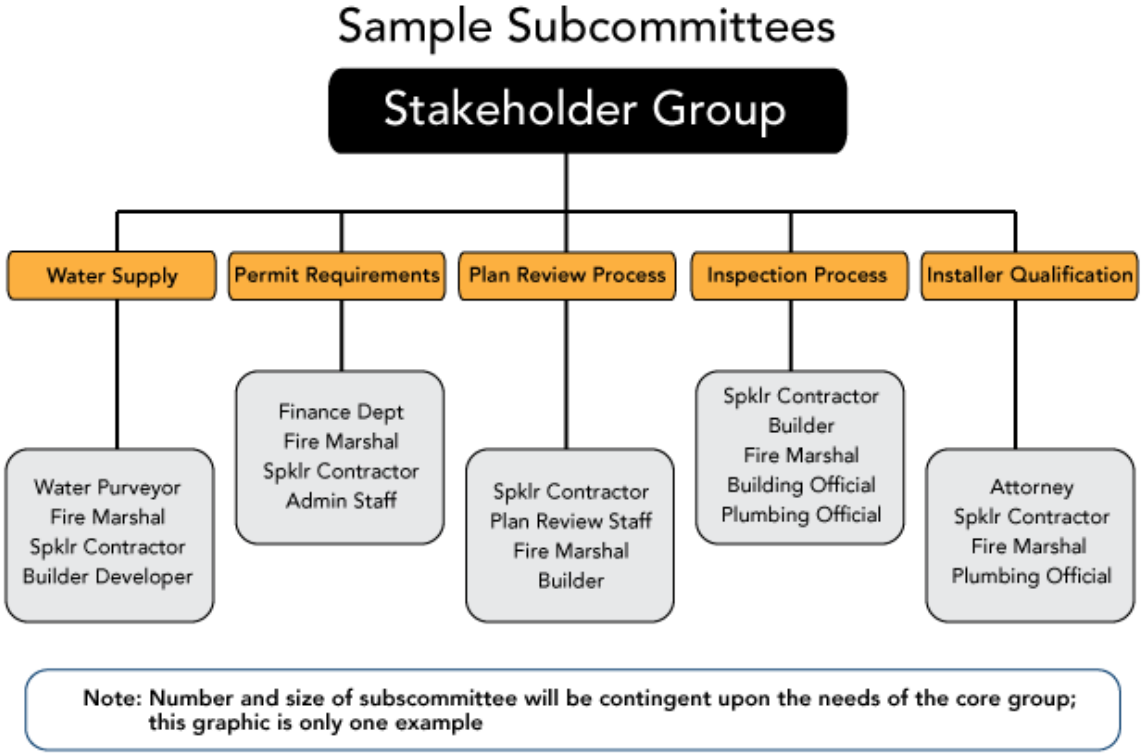
- Who has a stake in the requirement for residential fire sprinkler systems?
- Who is most affected by the problems or issues created by the requirement?
- Who has concerns?
- Who might have a different view?
- Who is best able to solve problems that may come up in discussions?
- Who might have a positive opinion or could be a champion for the effort?
- Who has expressed opposition?
- Who is impacted by the increased costs of the sprinkler systems?
- Who receives the benefit of the sprinkler systems?
- What are the most likely impediments to successful implementation?

The various stakeholders chosen to participate in a 2009 task force on residential fire sprinkler system requirements in California included representatives from the following:

- California Fire Service
- Building Industry
- Building Officials
- Public Health Officials
- State Agencies
- National Fire Protection Association
- National Fire Sprinkler Association
- League of California Cities
- Manufactured Housing Institute
- Design Professionals
- Water Purveyors
- American Water Works Association

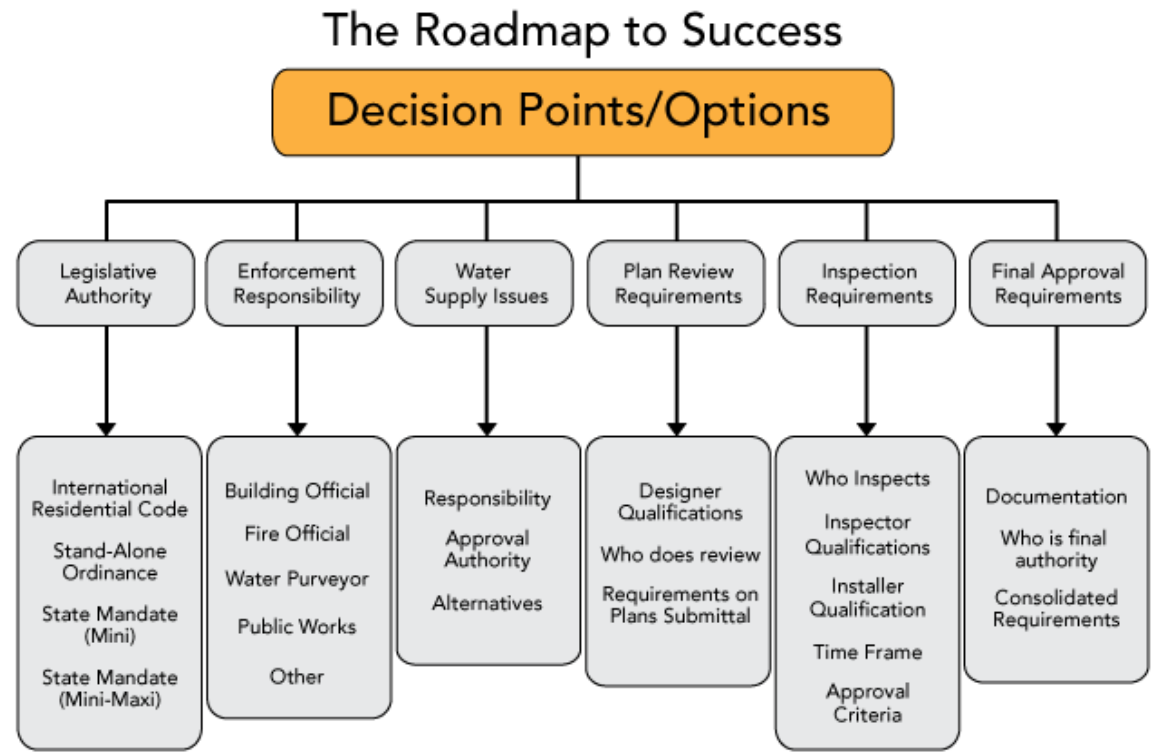
In 1986, Prince George's County, Maryland, identified similar groups but also included representatives from the Board of Trade, insurance industry, and elected officials.

If you compile a list similar to the examples above and consider staff involvement, the number of people and interests becomes significant. There may be some people who will have limited specific roles and others whose involvement falls across the entire scope of the sprinkler implementation. Formalizing a viable stakeholder group will provide a good starting point for input and discussion. This group will provide important information and will be a resource for implementing all the other aspects of the ordinance. Each person and organization should be acknowledged in any report or document that results from the effort. Including their contact information (with permission) is also a good idea, as others may have specific issues they wish to submit directly to one of the members.


Sample Subcommittees
Stakeholder Group
Water Supply
Permit Requirements
Plan Review Process
Inspection Process
Installer Qualification
Water Purveyor
Fire Marshal
Spklr Contractor
Builder Developer
Finance Dept
Fire Marshal
Spklr Contractor
Admin Staff
Spklr Contractor
Plan Review Staff
Fire Marshal
Builder
Spklr Contractor
Builder
Fire Marshal
Building Official
Plumbing Official
Attorney
Spklr Contractor
Fire Marshal
Plumbing Official
Note: Number and size of subscommittee will be contingent upon the needs of the core group; this graphic is only one example

Considerations for Key Decision Points

Ultimately, a stakeholder group is needed to identify contentious issues, arrive at consensus solutions and develop support for the decisions of the group. Identifying as many of these decision points in advance of meeting with the stakeholders will help illustrate the kinds of issues to be addressed. Some of those decisions may have already been made during the legislative process, and should be clearly identified as to what the decision was, why it was made, and how it affects the implementation. The graphic below shows many of the typical decisions involved in the implementation process.



DECISION POINT: WHAT IS THE LEGISLATIVE AUTHORITY FOR THE RESIDENTIAL SPRINKLER REQUIREMENT?

The decision to require residential sprinklers is typically made as a part of the legislative process. It can be important to identify the source of the regulation, and any impacts it may have on other issues. For instance, if the International Residential Code (IRC) was adopted, it contains optional design criteria (IRC P2904) to the other national standard, NFPA 13D. However, if a stand-alone ordinance was adopted, this option may not be legislated, but could be part of the discussion as an alternative means of compliance. The IRC provisions contained in P2904 have been deemed equivalent to NFPA 13D by jurisdictions adopting the IRC. The difference is that the IRC approach is more prescriptive in nature, and doesn't require the level of engineering that may be necessary under the NFPA standard. Homebuilders, plumbers, and others who aren't as familiar with the engineering aspect of sprinklers seem to prefer the prescriptive approach. (Many of the prescriptive criteria in the IRC have been incorporated into the latest version of NFPA 13D.)

If a statewide mini-maxi code has been adopted, it's likely that any alternatives are off the table for the task force. In this case, an explanation of the legal requirements will be helpful to avoid spending time and resources debating issues that are beyond the control of the group. The attorney for the jurisdiction will probably be in the best position to provide this explanation. Whether the attorney is a member of the task force or not is a decision for the task force leadership. At a minimum, the jurisdiction's attorney should be available to the task force to answer any questions that might arise during discussions.

The following model codes include requirements for residential fire sprinkler systems:

CODE	
International Residential Code 2012 Edition	IRC: R313 Automatic Fire Sprinkler Systems
International Building Code 2012 Edition	903.2.8: Sprinkler Systems in Residential Buildings
NFPA 5000 Building Construction and Safety Code 2012 Edition	22.3.4.1 Extinguishment Requirements
NFPA 1 Fire Code 2012 Edition	13.3.2.20.1 One- and Two-Family Dwellings
NFPA 101 Life Safety Code 2012 Edition	24.3.5.1 Extinguishment Requirements

The following reference standards are frequently identified for specific information about installations and equipment involving fire sprinkler systems:

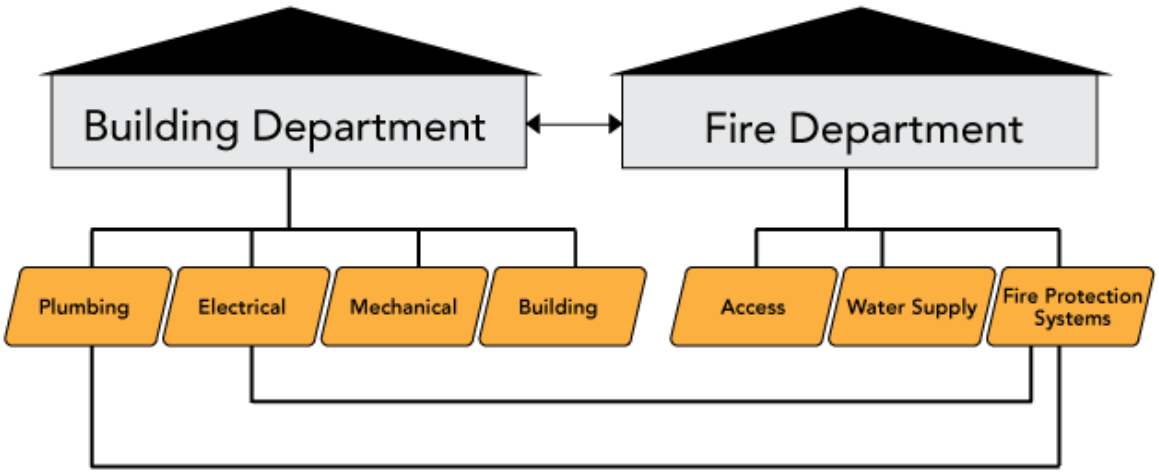
REFERENCE	
NFPA 13 Standard for the Installation of Sprinkler Systems	This standard is for commercial buildings, and doesn't apply to one- and two-family dwellings; however, it contains substantial information that may be helpful.
NFPA 13D Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	This standard is specific to one- and two-family dwellings
NFPA 13R Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and including four stories in height	This standard is for multi-family structures, including apartment buildings.
IRC 2904	This portion of the IRC has installation requirements for residential sprinkler systems in one- and two-family dwellings.

More background on the legal authority for code compliance can be found in **Appendix D**.

DECISION POINT: WHO HAS ENFORCEMENT RESPONSIBILITY?

The authority for enforcement will normally fall upon an existing agency within the jurisdiction. Depending upon the characteristics of the jurisdiction, this responsibility might fall to the fire department's fire prevention office, the building official, or the plumbing official. Other options would include the water purveyor or public works, if they have the technical expertise and other resources to manage the process.

If no existing agency has the resources to enforce the new provision, consideration may be given to dividing the work among agencies. For example, the fire department might conduct plan review, and the plumbing inspectors might inspect the sprinkler system while on site as they are conducting the plumbing inspection.



If work is to be shared between departments, close coordination and communication is critical to a successful outcome. A jurisdiction's building department is often the responsible agency for all one- and two-family dwellings, even if the fire department is involved in commercial construction. In these communities, a case can be made that the building department should have overall enforcement authority for all work involved, including sprinklers in one- and two-family dwellings. If more than one department is involved, it is imperative that they coordinate their efforts and coordinate their respective responsibilities. The level of public acceptance will be higher where two departments are effectively implementing the regulations.

In jurisdictions with little or no existing resources to undertake enforcement activities, or when the existing resources are not sufficient to do so, consideration of using outside organizations to conduct the plan review and inspections may be necessary. This could be as simple as requiring a certification from a qualified third party that the system is designed and installed in accordance with the regulation, or it could involve considerable qualifications criteria, quality control checks, and oversight by the jurisdiction.

There are two common methods for jurisdictions to utilize third-party plan review and inspection agencies. Probably the most predominant method is to identify the necessary qualifications for the third-party firms, and allow the third parties to contract directly with the developer/builder. This is the simplest and most straight-forward way for a jurisdiction to avoid the cost of enforcement activities while maintaining some regulatory oversight. The other common method is for a jurisdiction to contract directly with one or more third-party agencies to conduct plan reviews and inspections in the jurisdiction. The jurisdiction collects fees for permits to cover the cost of the third-party work. This arrangement provides somewhat more oversight by the jurisdiction, and still provides significant flexibility in allocating resources. The costs of the third-party activities are directly tied to their production, so that when development slows down, with a correlating reduction in

permit fees, the costs of the third party also go down. In this case, the private sector is responsible for down-staffing or otherwise cutting costs to meet demand.

DECISION POINT: WILL PERMITS BE REQUIRED, AND WHAT WILL THE PERMIT REQUIREMENTS BE?

There are several reasons to require permits as one component of the regulation. Permits allow a jurisdiction to open a dialogue with the installer, communicate expectations, and scrutinize the installer's qualifications. Permitting can also be a mechanism to recover part or all of the cost of implementing the requirement. If a jurisdiction elects not to have a formal permit process, other means to trigger plan reviews, inspections, and other enforcement actions must be made.

Some jurisdictions include the residential sprinkler system in the overall building permit, and treat it like any other system in the building. This may be an effective and appropriate process if the components of a separate permitting system are added to the over-arching building permit. If a permitting process is not established, oversight of the program will be severely constrained.

There are several pieces of the permit issue that the task force should consider:

IDENTIFICATION OF FUNDING SOURCES

Most jurisdictions today are underfunded, and will be reluctant to embark upon any new programs without identifying funding sources. Permit fees can underwrite whatever portion of the program's cost the task force deems appropriate.

When considering cost recovery, one formula is to identify the comparative benefit of the installation to the individual homeowner and the community at large. Because a residential sprinkler requirement will reduce the community's overall exposure to losses due to fire, everyone receives a benefit. However, the homeowner receives the most direct benefit, enjoys any incentives the jurisdiction offers, as well as reduced insurance costs, and a higher level of safety.

Under this scenario, the task force should determine the percentage of benefit to the homeowner and the community. If the program costs $100,000 to implement, and the task force determines that the homeowner gains 75 percent of the benefit, then permit fees should generate $75,000, and the balance should come from the general tax base. The actual process to make this determination is significantly more complicated, but the outcome should be similar.

In order to calculate the actual cost of implementation, (permitting, plan review, inspection services, and data collection), the jurisdiction's finance group should be called upon for assistance. Identifying all activities and their costs will provide a clear indication to policy makers that the task force is competent and serious about its work. Salaries and benefits of employees, vehicle and other equipment costs, overhead, including building rent, utilities, etc., and any maintenance costs should be included. It's likely that some personnel costs will be for persons who have responsibilities beyond the residential sprinkler project. Permit technicians, inspectors, and plan reviewers are likely to spend a portion of their time on residential sprinkler installations, so only a percentage of each will be used to calculate the actual cost of the program.

This cost recovery assessment is also helpful to determine whether the regulatory activities will be conducted in-house by existing or new

employees, or by qualified third-party contractors. The cost of each, along with an assessment of the benefits and barriers of each, should be considered to reach the best decision for the jurisdiction.

Some jurisdictions will need 100 percent cost recovery to implement the program; this is more straightforward than attempting to spread the costs. The permit fees may be based upon the size of the system or they may be a flat fee for each installation. Either way, the full cost of implementing the regulation will be reflected in the permit fees.

QUALIFICATIONS OF THE PERMIT APPLICANT

The permit applicant should be the person or company that will actually submit plans and install the system. It's appropriate to evaluate the qualifications of the applicant to ensure that he or she is competent to do the job. Allowing people who may not have the qualifications to obtain a permit may lead to misunderstandings and damage the credibility of the program. Some jurisdictions allow homeowners to obtain a permit for their own home. In these cases, jurisdictions need to clearly communicate the requirements for plan submittals, installation criteria, etc., so that the homeowner fully understands the complexities of the job. The jurisdiction should anticipate providing significantly more feedback to a homeowner than is normally required for contractors. Sample permit applications and checklists can be found in **Appendix C**.

Another consideration here is state licensing requirements. Many states require the design and installation of sprinkler systems to be performed by a licensed contractor. These requirements normally specify the required training, certification, experience, and other requisites for license holders. In these cases, the person or company applying for the permit should adhere to the state requirements.

It's probably a good idea to be sure that all stakeholders are aware of the difference between a license and a certification. A license is issued by a governmental agency, and is normally required for conducting certain activities (driving, cutting hair, designing fire protection systems). Licensing requirements routinely include training, experience, and insurance as minimum qualifications, and a fee is paid to the agency to cover the costs of the licensing process. A licensee is typically accountable to an oversight body (state agency) that is authorized to enforce the licensing regulation and to ensure adherence to industry standards. Violators can be disciplined through a number of actions, up to and including revocation of their license.

A certification is normally considered evidence of knowledge or competence to conduct certain activities. Certifying agencies are normally private-sector organizations that have developed training, testing, or other methods to determine an applicant's knowledge or ability to engage in the work described. Some manufacturers certify their technicians (GM-certified mechanics), but there are also organizations that exist solely for the purpose of certifying individuals engaged in certain activities (accounting, building inspection). Some of these private-sector organizations have more credibility than others; when determining qualifications for fire protection activities, investigation and analysis of the certifying organization is prudent.

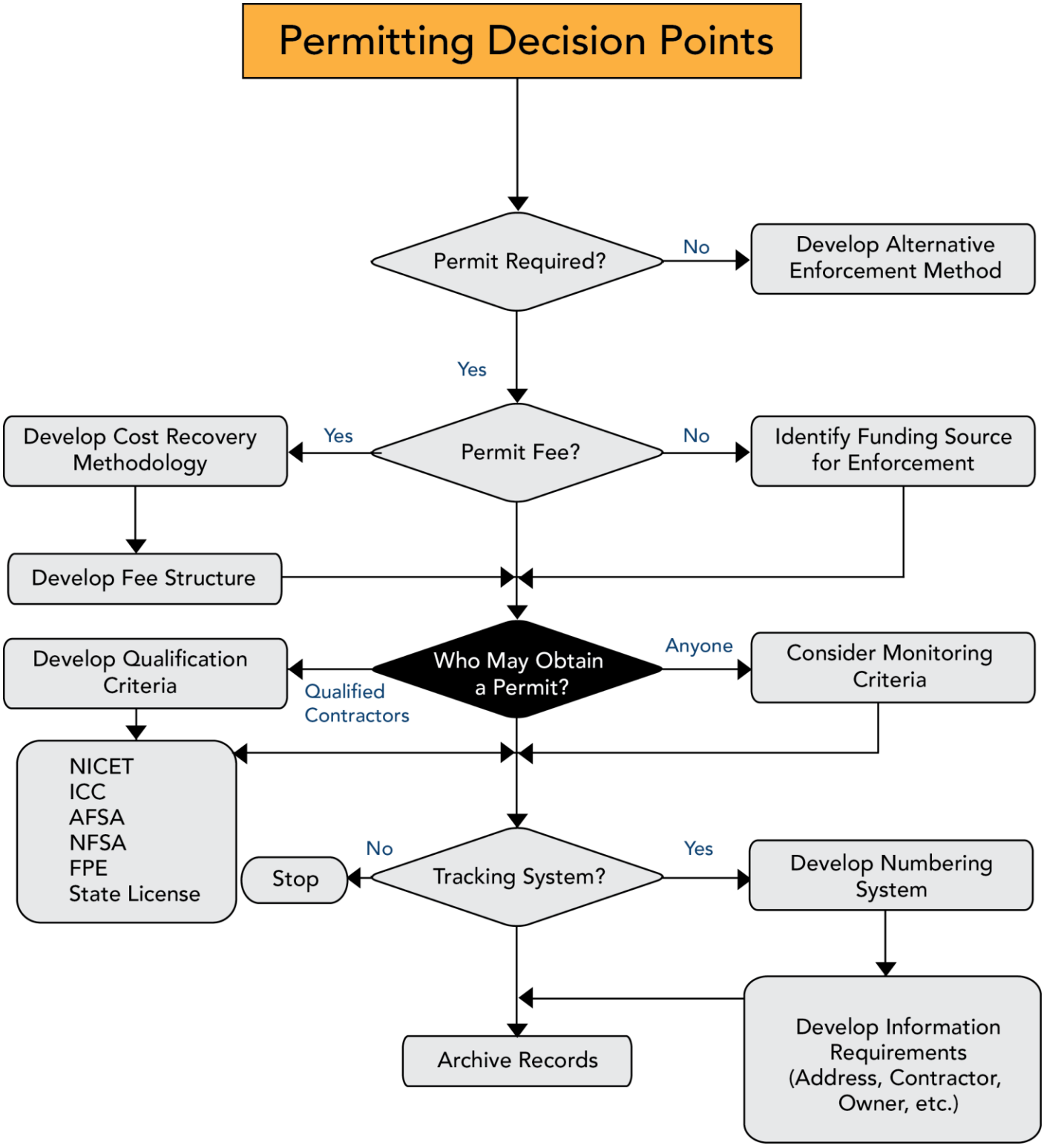
The Center for Public Safety Excellence (CPSE) is a nonprofit organization that has, for more than a decade, helped local public safety agencies around the world streamline and improve their service delivery. Through its individual commissions, CPSE provides a host of programs, including accreditation for fire and emergency service agencies and professional designations for senior-level fire and emergency service officers. The CPSE also offers a variety of workshops designed specifically for fire and emergency service agencies that are geared to aid emergency personnel in their quest for continuous quality improvement.

Beginning in November 2010, CPSE partnered with American Fire Sprinkler Association (AFSA), National Fire Sprinkler Association (NFSA), and International Code Council (ICC) to bring experts together from interested stakeholders to develop an accreditation program for contractors that install residential fire sprinklers in one- and two-family dwellings. From its inception, there was participation from ISO, the International City/County Management Association (ICMA), NFSA, ICC, AFSA, the National Association of State Fire Marshals (NASFM), the Plumbing-Heating-Cooling Contractors Association (PHCC), the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada (UAPPF), and the Plastic Pipe and Fittings Association (PPFA).

The CPSE has recently completed the beta testing of the newly developed accreditation program. The nationally recognized accreditation is for contractors engaged in design/layout, installation, and maintenance of residential sprinklers in one- and two-family dwellings and manufactured homes.

The accreditation process involves a three- to six-month (depending on the size of the contractor) self-assessment of the core competencies and performance indicators, a peer review process, and a recommendation to the accrediting authority. The accreditation, assigned to companies, not individuals, assures state/local officials and residential consumers that qualified, competent contractors perform their sprinkler installations. At publication, two companies have been accredited, with additional parties in process.

Best Practices for permitting systems may be found in **Appendix B**.


Permitting Decision Points
Permit Required?
No
Develop Alternative Enforcement Method
Yes
Permit Fee?
Yes
Develop Cost Recovery Methodology
No
Identify Funding Source for Enforcement
Develop Fee Structure
Who May Obtain a Permit?
Anyone
Consider Monitoring Criteria
Develop Qualification Criteria
Qualified Contractors
NICET
ICC
AFSA
NFSA
FPE
State License
Tracking System?
No
Stop
Yes
Develop Numbering System
Develop Information Requirements (Address, Contractor, Owner, etc.)
Archive Records

DECISION POINT: HOW ARE WATER SUPPLY ISSUES TO BE ADDRESSED?

This is an important and sometimes difficult discussion that takes place wherever residential sprinkler systems are mandated. A dependable, adequate water supply is an essential ingredient of the residential fire sprinkler system and can often be the critical path issue in the implementation of a requirement. Water supply, fees, and meter sizes have been some of the more difficult issues, and in some cases barriers, to a successful implementation. It is critical that the water purveyor, as a key stakeholder, be involved as early as possible.

In order to best engage the water suppliers, it's important to understand the philosophy that is used in their pricing of meters, water, wastewater, and pumping capacity (impact fees). With water shortages occurring in many parts of the United States and a continuing decline in fresh water supplies across the globe, these organizations are under pressure to control water consumption and recoup virtually all their costs in the acquisition, treatment, and distribution of that commodity. Different utilities use different models to accomplish these goals. The most common method to correlate the supply requirements to the demand is the size of the water meter.

Many water suppliers use meter size to gauge the potential water use at a facility (residential or commercial). The theory is that larger meters will be used to consume larger amounts of water. Because the supplier must construct pumping stations, piping networks, etc., in advance of development, they charge the consumer for that infrastructure at the time of the building's construction based upon meter size.

Increasing the size of a meter for built-in fire suppression systems may result in significant increases in the cost – sometimes thousands of dollars. Many suppliers don't realize that the fire suppression system actually reduces their overall supply requirements. Others recognize this fact, but are reluctant to take it into consideration because once the meter is in place, there is no way to control the potential increased water use by the building owner. Where entire subdivisions are being sprinklered, it's possible to show the water supplier that, because of the reduced fire flow requirement, they can actually reduce the water main sizes and pumping capacity for that subdivision. This is probably the strongest argument against increasing the cost of larger meters for fire protection use.

For example, in the city of Bremerton, Washington, the fire department worked closely with the water department to determine the impact that residential sprinklers would have on their water system. The outcome was that the water department now offers a larger meter for dwellings installing residential sprinkler systems at no additional cost. This particular example illustrates the value of a close working relationship between the fire department and the water department.

Another option is to connect the fire sprinkler system ahead of the water meter. From a fire protection perspective, this is an acceptable arrangement, although it will require separate backflow prevention and does not allow the plumbing and fire protection systems to be combined.

One example of a jurisdiction that is working proactively to balance the public safety interests with the water supply interests is California. Phase I of the California residential fire sprinkler task force focused on building a relationship with the state's water purveyors and identifying any issues that are currently barriers to a residential fire sprinkler requirement.

The California task force identified a number of topic areas for discussion, including:

These sub-groups within the California Task Force are all areas that have received national attention when implementing residential fire sprinkler programs. Working to solve these issues so they do not become barriers is a positive benefit of working with a task force.

- The California report ***Residential Fire Sprinkler/Water Purveyor Task Force: Final Report/Recommendations (click here)***, describes how California worked through its water supply issues and contains many best-practice examples that can be useful to any jurisdiction.

- The Home Fire Sprinkler Coalition has information for water purveyors, including a video on their website at **www.homefiresprinkler.org**.

DECISION POINT: HOW WILL PLAN REVIEW REQUIREMENTS BE ADDRESSED?

Both the International Residential Code and NFPA 13D specify the information required on plans that are to be submitted for approval. These requirements should be part of the consideration of the task force, and may be modified to the jurisdiction's needs.

Additional questions to be discussed by the task force include:

DESIGNER QUALIFICATIONS

Some states license sprinkler designers; in that case, a minimum requirement would be for the person to possess the appropriate state license. In the absence of a state license requirement, consideration should be given to professional qualifications such as the National Institute for Certification in Engineering Technologies (**NICET**), International Code Council (**ICC**) certification, or trade association credentials (**NFSA**, **AFSA**). Each of these qualifying criteria should be compared with the community's expectations, and one or more could be deemed acceptable by the task force. At the time of publication, there were other efforts underway to create new certification and accreditation programs. Research and consideration of all available programs will best serve the community.

NICET is probably the most widely used and accepted qualifying organization for fire protection system designers. NICET utilizes a four-level program to certify individuals who plan, organize, and design fire sprinkler systems. The NICET certification requires work experience and successful completion of knowledge-based tests to determine the competency level of technicians.

The International Code Council has certifications for several disciplines, including residential sprinkler installers. The ICC certifications are granted upon completion of knowledge-based examinations and are considered to be valid in most states. The advantage of this certification is that it's based solely on the requirements necessary for residential sprinkler installation. Other certifications may be offered for inspectors, plan reviewers, and designers.

The National Fire Sprinkler Association (NFSA) and the American Fire Sprinkler Association (AFSA) have ongoing programs to train and certify

individuals in the various disciplines associated with fire sprinkler installation, and may develop specific programs for residential sprinkler systems as well.

COMPLIANCE ISSUES

Will plans be reviewed for compliance with statutes and regulations? If there is no current plan review capacity within the jurisdiction, the decision may be to forgo plan review entirely. In this case, consideration for the designer qualifications becomes paramount. The jurisdiction should consider mandating the qualifications of the designers and require a signed, stamped (where appropriate) statement that the plans meet the regulatory requirements of the jurisdiction. Appropriate credentials for designers include NICET-certified engineering technicians, professional engineers in the appropriate discipline (usually fire protection), and individuals licensed by a state agency for this purpose.

Most design professionals are competent and ethical; however, it's important to remain vigilant to assure the reviews are comprehensive. This should be part of any program's quality control process.

THIRD-PARTY PLAN REVIEWERS

Third-party plan review is gaining in popularity across the United States. One reason is that the use of third-party contractors reduces a jurisdiction's personnel costs, and as the economy cycles, they aren't faced with decisions about reducing staff. In addition, managing contractors is considered far less complicated than managing full-time staff, where payroll, benefits, and other issues consume considerable time and resources.

A jurisdiction may decide to contract with a third party directly or to accept third-party plan reviews from qualified individuals who are paid by the

developer or builder. Either way, the qualifications of the person conducting plan reviews should be scrutinized to assure a level of competency acceptable to the jurisdiction.

The use of third-party contractors may not provide the most control over the quality of inspections and the level of customer service. For purposes of this discussion, the highest level of control would be to hire full-time staff for the jurisdiction to conduct plan reviews and inspections. The next highest level of control would be for the jurisdiction to contract directly with the third party. The least amount of control would be to permit the installers or builders to contract directly with the third parties and provide reports to the jurisdiction. Jurisdictions should determine the level of customer service, the credibility desired, and the overall level of safety that can be delivered under each type of system and make the best decision for the community.

REVIEWING AGENCY

If a jurisdiction decides to conduct plan reviews internally, it must decide which agency conducts the reviews. They should determine who has the technical expertise and staffing to conduct competent plan reviews in a timely manner. If the resource is not in place within the jurisdiction, identify the most effective manner to acquire such expertise. This expertise can be acquired by training current employees or hiring qualified individuals. Compare these internal costs and expected effectiveness, both short term and long term, with the potential to contract with qualified individuals or firms. Some jurisdictions have cost-sharing arrangements whereby each jurisdiction assumes responsibilities for specific code enforcement activities across jurisdictional boundaries. Innovation is sometimes the key to success, especially in times of scarce resources.

IDENTIFYING REQUIRED INFORMATION

Information necessary for the review of plans is outlined in the codes; however, if there is a need for additional information, the task force should identify the items needed, and justify the need as a part of its discussions. Samples of checklists for required information can be found in **Appendix C**.

TURN-AROUND TIME

The task force should determine turn-around time (the time from when plans are submitted to completion of review). This has become a very controversial issue in many jurisdictions, as contractors need approved plans to begin work, and extended turn-around times can have a severe negative impact on the entire construction project. The performance expectation for plan review of one- and two-family homes may be significantly shorter than it is for commercial projects. The current level of plan review service must be quantified, and the proposed level of service under the residential sprinkler requirement should not cause a reduction in this level of service. The turn-around time will depend upon the level of resources available, the technical expertise of the reviewers, the quality/intensity of the review, and the volume of plans. If a jurisdiction is conducting plan reviews in-house, consideration should be given to a method of handling spikes in the workload. One way to do so is to have a standing contract with a third party, and when the turn-around time reaches the critical point, begin sending plans to the third party.

REPLICABLE COMPONENTS AND SYSTEMS

Any discussion about plan review for residential sprinkler systems wouldn't be complete without a mention of replicable building components and systems. Most large developments are built by single entities, usually large developer/homebuilders. Typically, the number of floor plans is limited,

although the elevations of the homes may be different. In some cases, a subdivision of several hundred homes may have only five or six floor plans. In these cases, it's likely that one comprehensive plan review for each floor plan will suffice, assuming the same piping and head layout will be used throughout the subdivision. A quick study of the hydraulic characteristics may be necessary for each home, especially if the subdivision is in terrain with significant deviations in elevation. When attempting to identify necessary resources for plan review, it's good to consider the fact that many tract home developments will not require full plan reviews of each home.

DECISION POINT: WHAT WILL THE INSPECTION REQUIREMENTS BE?

Residential sprinkler systems are life safety systems and, as such, demand a high level of oversight. Some items the task force should consider for the inspection process and requirements include:

QUALIFICATIONS

What are the necessary qualifications for the inspector and the installer? If there are state licensing requirements, these may be the only necessary requirements. Absent these mandates, national certifications for installers and inspectors should be considered. These include ICC, CPSE, NICET, and trade associations' certification programs. Evaluating the available certifications and accreditations in view of the jurisdiction's culture will provide the best fit.

REQUIRED INSPECTIONS

A comprehensive inspection program will help ensure the effectiveness of the system. Some of the questions jurisdictions need to address are listed here.

What inspections are necessary? Does the water supply connection need to be verified for compliance with plans? Should a rough-in inspection be conducted to assure piping is properly attached to the structure and complies with the plans? Is a final inspection necessary to verify the piping is insulated, and heads are properly located? Each of these questions must be answered with consideration for the necessary resources, cost, and benefit to the community. It is imperative that departments that inspect different portions or stages of the project communicate efficiently.

DISAPPROVALS AND RE-INSPECTIONS

What is the jurisdiction's policy regarding the disapproval of a system based upon an inspection? What is the policy regarding re-inspections? Timing? Costs? The more detail the task force can generate on these issues, the smoother the implementation will be.

TURN-AROUND TIME

What is the expected time frame for inspections? Homebuilders have become accustomed to same-day or next-day service after a request. It would be detrimental to the implementation process to reduce the current level of service.

INSPECTORS

Who will conduct the inspection? If current resources exist with the necessary expertise, this is a non-issue. If resources need to be added, where should they reside? If a plumbing inspector is already going to be on the site conducting a plumbing inspection, can he or she be trained to conduct the

sprinkler inspection? Is there a need for another inspector on the site? If the jurisdiction doesn't have the funding to obtain the necessary resources, one solution might be to require certification of the system installation by an approved contractor (third party). While this may not be a jurisdiction's first choice, it may provide a level of safety consistent with the community's expectations.

Inspection best practices can be found in **Appendix B**. A sample inspection checklist can be found in **Appendix C**.

DECISION POINT: WHAT ARE THE REQUIREMENTS FOR FINAL APPROVAL?

The decisions made regarding permitting, plan review, and inspection will drive the final approval criteria. In order to gain final approval of the sprinkler system, a permit will be required, plans must be approved in accordance with the plan review process, and any inspections will need to be completed satisfactorily. These are basic issues; some of the decisions that need consideration at this point include:

- What is the process for final approval? Typically, if plans have been approved, then whoever completes the final inspection will grant final approval of the system. However, if the final inspection is by a third-party inspector, it's advisable to consider an additional step in the process to allow an employee of the jurisdiction to actually grant the approval. This could be the building official or the fire marshal, depending upon who is best situated to do so.
- Documentation of final approval must be established. In most jurisdictions, the building official issues a Certificate of Occupancy (CO) when a building has been approved for occupancy. This CO is issued only after all plans for the building (structural, electrical, mechanical, etc.) have been approved and all

final inspections completed. The sprinkler system should be included in this process; a CO should never be issued, thus the building should not be occupied, until the sprinkler system is approved.

Again, collaboration is the key to success. Communication between the building official, the fire department, the sprinkler contractors and any third parties doing plan review or inspection is critical to successful completion of a project. Failure to communicate will result in confusion and finger-pointing, which is in no one's best interest.

DECISION POINT: HOW WILL YOU DEFINE AND MEASURE EFFECTIVE CUSTOMER SERVICE?

This entire guide is intended to provide insight into how to manage the implementation of a residential fire sprinkler requirement with a customer service approach. The first priority, then, is to identify your customer. In the case of implementing a residential sprinkler requirement, it's important to recognize that your customers are varied, and may have competing interests. Consider the following (partial) list of customers:

- Firefighters depend upon the residential sprinklers to provide an enhanced level of safety in their "workplace"
- Homeowners depend upon the residential sprinklers to protect their families and their largest investment
- Homebuilders need timely response to inspection requests, etc.
- Sprinkler installers need a balanced regulatory system to assure they and their competitors are held to a consistent standard
- Members of the community

- Developers
- Water purveyors
- Building design community
- Political leaders

By listening to and understanding the customers' concerns, issues, and needs throughout implementation and beyond, you will establish an intuitive and transparent process. Add to this the clear, well-described expectations, checklists for plan review and inspections, interpretations of how you will apply the code and your accessibility to your customers, and you are ensuring an effective customer service approach.

Let us emphasize that customer service is not a one-time task, but rather an overall orientation. For it to be of value, it needs to be the way business is done in every part of every service delivered. Work to embed it naturally into your business process. This will help you eliminate conflicts that take time and energy away from your main job of ensuring that residential fire sprinklers are installed according to your code.

DECISION POINT: HOW WILL YOU COLLECT DATA ON INSTALLED SPRINKLER SYSTEMS?

At some point in the future of your residential fire sprinkler requirement, you may need to be able to retrieve information about the community's sprinkler experience to solve a problem or reflect on a positive story. The fire and life safety community has promoted residential fire sprinklers for more than 30 years as critical technology to reduce residential fire risk. Implementing a sprinkler requirement offers the opportunity to create a data collection process that will provide information on sprinkler performance and their life-saving capabilities. Once you have begun finalizing inspections and people begin to move in to completed homes, you will

move on to the next construction project. During implementation is the best time to create a data collection tool and process.

Your data collection process does not need to be complex as long as there is a way to link it to other data that will be collected and retained. Usually information about home construction is kept for many years, and electronic recordkeeping simplifies this because you do not need to consider physical space. Make sure that the electronic file for the sprinkler design and associated material information sheets are combined with the construction plans. Be aware that often the work plans for construction of the structure precede design plans for the fire sprinkler system, so you need to ensure the records are combined in the long-term file archive with the building official. The fire authority with jurisdiction may not be the same as the building official, so there needs to be coordination and collaboration on this detail. Future issues involving the sprinkler system that may require local research include identifying the sprinkler installer, or information such as the lot number or individual serial numbers of the sprinkler heads or other components.

The best opportunity to enter information that creates a record about the sprinkler system is when the permit is initiated. Many communities have computerized systems that integrate functions electronically, including processing the permit, fees, billing, and accounts payable. It may be possible to include a data subset for information about the sprinkler system or the ability to export data from this system to a spreadsheet or separate data base. An integrated system can minimize efforts documenting your data. If there is no such central ability to track data about the sprinkler system, then it will be necessary to create a system.

In creating a data system, a table format is all that is needed and can be created in a spreadsheet. The advantage of a spreadsheet is that there are functions that facilitate sorting, and completing mathematical formulas that would be helpful in telling a

story about the data. It also helps you locate specific information without manually looking through every item of data.

Databases can provide a simple process with some up-front formatting. The power of databases is that you can create entry forms that allow you to input one record at a time without looking at the rest of the data, such as in a spreadsheet. Databases also have the ability to accept ancillary files such as photos and scanned images, which could be helpful in saving space that is required when keeping hard-copy files.

When planning what data will be collected, consider brainstorming some of the areas for which you can envision using the data. Some examples may include: the need to track the inspection of back flow preventers, or the manufacturer of the sprinkler, including serial numbers. This would allow you to annotate any activation of a sprinkler and any pertinent details. While it may not be necessary to include all the details of the activation, a summary or comment area can allow an opportunity to include brief information and include any fire record identification number, or incident number. Some of the essential fields needed for your data collection tool may include:

- Fire protection permit number
- Modification of existing fire protection system – Yes or No
- If modified, what is the original permit number?
- Date of final permit approval
- Building permit number
- Full Address where system was installed
- Installer (Company)
- Installer contact information
- Record of sprinkler activation
- System design criteria (IRC 2904, 13D, etc.)

- Type of system (combination, stand alone, grid, tree)
- Information regarding antifreeze in system
- Component description (type/make of heads, piping, backflow preventer, etc.)
- Comments

If the database is driven by the permit number as the key field, when there is work in the future it can be linked to any previous permits and provide an explanation why an address is repeated. These are just examples of what may be considered; it is up to the individual jurisdiction to determine what information they would like to capture for future use.

Case Studies – A Tale of Three Cities

To illustrate the philosophies contained in this guide, we will observe three different mythical cities. These could easily be fire districts, counties, fire authorities, or any other unit of local government; however, we'll use cities for purposes of illustration.

CASHVILLE, ARKLAHOMA

The first city is Cashville, Arklahoma. Cashville is an affluent suburb of a large city. In Cashville, the citizens expect their government to provide a high level of service at a reasonable cost. They are progressive, and believe that public safety is one of the core services their local government should provide.

Recently, Arklahoma adopted the International Residential Code statewide, including a requirement for residential sprinkler systems in all homes to be constructed after January 1, 2012. The mayor has tasked the Fire Department with developing the implementation plan for the residential sprinkler requirement.

Chief Nar, the chief of the department, meets with his senior leadership team to craft a strategy to assure a successful implementation. During this meeting, he appoints his fire marshal, Chief Doit, as the lead Fire Department person for the project, and encourages his other senior leaders to support the fire marshal in any way they can.

Chief Doit begins by identifying every group that he believes will have an interest in the process relating to the implementation. After compiling his list, he contacts a person in each group, and asks for a volunteer to serve on a steering committee to develop the implementation plans for the residential sprinkler regulation. In addition to inviting someone from each group, he also shares his list and asks for input as to any additional groups or people who should be included in the effort.

This process takes about three weeks, as some of the groups need to discuss the project and identify their best representative. The result of this effort is a large, diverse group of stakeholders, all with an interest in the residential sprinkler project and a commitment to work together to achieve the best outcome for Cashville. The first steering committee meeting is one month after the initial meeting with Chief Nar.

Prior to the initial steering committee meeting, Chief Doit assembles an information package for each member. In the package are examples of other programs around the state and the country. In addition, he identifies a series of discussions that need to take place, realizing that it will take time for the committee members to become familiar with each other, and for the committee as a whole to become fully functional.

Chief Doit makes a presentation to the committee at its first meeting to outline the process and some of the issues in need of resolution. The committee takes time to discuss each issue, and some of the members have other issues they want to consider. After a series of meetings, the steering committee decides that permitting, plan review, and inspection are needed. Also, because of recent water shortages and the implementation of significant fees for water usage, the committee identifies water supply issues as critical to the success of the implementation.

Subcommittees are appointed to work on each of these issues. In addition to the mechanical processes for implementation, the committee determines there is a need for significantly enhanced communication to all affected parties, and methods to get the information to contractors, builders, citizens, and other stakeholders should be considered. Additional subcommittees are appointed to develop communication projects for the implementation plan. The steering committee recognizes that, as additional issues arise in the subcommittee meetings, more decisions will need to be made.

Permitting/Plan Review Subcommittee

The permitting subcommittee is made up of a homebuilder, the building official, Chief Doit, a person from the city's finance department, a sprinkler contractor, and a representative from Cashville's League of Neighborhoods. The industry representatives would like to keep the cost of permits as low as possible, maintaining that the residential sprinkler systems benefit all citizens, so the cost of implementing the system should be borne by all taxpayers, and not be a burden to the construction industry. The League of Neighborhoods representative argues that the sprinklers do little, if anything, to lessen the burden on existing homeowners, who already pay taxes for fire response, and won't enjoy the benefits of added protection to their homes. Therefore, the League believes that the entire burden of implementation should be borne by the construction industry and passed on to the purchasers of the homes. After much debate, the subcommittee agrees that a reasonable cost sharing is 75/25, with the permits providing 75 percent of the cost of implementation, and the city's general fund covering the balance.

At this point, the committee tasks the finance department with determining the actual cost of implementation. They advise that both hard costs and soft costs be included, i.e., not only the actual cost of new employees, overtime, and new equipment, but also overhead such as office space, a portion of management, human resources department, etc.

The building official and the homebuilders association are tasked with projecting the number of homes that will be constructed during the first year. This will identify the workload and resources needed to meet the demand. During this discussion, other decision points are identified:

> *Will the sprinkler permit be a stand-alone permit, or will it be combined with the construction permit?*

What department will be responsible for plan review; what is the cost of the personnel?

What department will be responsible for inspection; what are the personnel costs?

Because the steering committee has decided that the program should recover 75 percent of the cost through permit fees, the subcommittee determines that it would be problematic to try to adjust building permit fees to accomplish this. It would be much easier to create a stand-alone permit, with associated fees clearly identified for cost recovery.

The Building Department doesn't have anyone on staff with the expertise to review fire protection drawings; they regularly review plumbing systems, but these reviews don't normally consider the details of the hydraulic characteristics of the system. The Fire Department has been conducting reviews of commercial sprinkler systems, so the committee decides that they should also conduct the review of residential sprinkler systems.

The salary range for the fire protection specialist who conducts system plan reviews is $40,000 to $60,000 per year, so the committee uses the assumption of a $50,000 salary for purposes of cost recovery. The Human Resources Department has furnished the committee with a multiplier of .32 for the cost of benefits to add to the salary number. This represents the average cost to the city of all benefits, including insurance, vacation, sick leave, etc.

The Finance Department has studied the city's support functions as a fraction of the city's overall budget. The support functions include the operation of the City Manager's Office, Human Resources, Budget & Finance, Purchasing, and other departments that don't directly serve the public, but are critical to the city's operation. These functions represent 16 percent of the city's budget.

The group then determines the cost of office space, furniture, utilities, automobiles, uniforms, and other items necessary for the plan reviewer to function. Using normal amortization criteria and actual cost of goods, along with market rent costs applied to the square footage of the reviewer's office, the group calculates the value of these items at $28,000 per year. The committee then went through the same exercise for the person who would actually take the permit application and issue the permit.

Once the gross costs were developed for all personnel involved in the permitting and plan review process, the steering committee needed to know how much time each person involved would actually dedicate to this program – it was likely that no one would work on it full time, but some kind of reasonable calculation was necessary.

The homebuilder and the building official, along with the city's planning director, projected the number of homes that would be constructed during the next 12-month period. They divided the gross number of homes into categories according to size, type (condominium, townhome, one- and two-family) and whether the homes would be tract homes with a limited number of floor plans, or custom homes in need of individual reviews for each. The outcome was that a total of 1,750 homes would be constructed – 250 townhomes with 10 different floor plans, no condominiums, 1,250 tract homes, and 250 custom homes. Of the 1,250 tract homes, it was estimated that there would be 50 different floor plans. The average size townhome would be 1,500 square feet, the average tract home would be 2,800 square feet, and the average custom home would be 3,500 square feet.

Using these projections, it was determined that it would require approximately 583 hours of administrative time to issue the permits (20 minutes for each). When calculating the amount of time for plan reviews, it was estimated that a custom home would require 2.5 hours to review the initial drawings; for townhomes, 1.5 hours for each floor plan, plus 20 minutes to verify water supply, elevation changes, and other variables for each additional town home; and for tract homes, it was estimated that

each floor plan would require two hours to review, and each additional home with the same floor plan would require an additional half-hour to verify water supply and other variables.

The calculations can be illustrated as follows:

RESIDENTIAL PLAN REVIEW TIMES			
Type Structure	**Initial Review**	**Additional Floor Plans**	**Total Time**
Townhomes	10	240	(10*1.5)+(240*.33) = 94.2 Hours
Tract Homes	50	1200	(50*2)+(1200*.5) = 700 Hours
Custom Homes	250	0	250*2.5 = 625 hours
Total	**310**	**1,440**	**1,419.2 Hours**

Using the total of 1,419 hours, we can see that this is approximately 68 percent of a full-time employee's time. And, using 583 hours for an administrative person to issue permits, this is about 28 percent of a full-time employee's time. Using these figures, we can calculate the estimated cost of permitting and reviewing plans for residential sprinkler installations:

TOTAL COST OF PERSONNEL		
Plan Review Specialist		
Salary	$ 50,000	
Benefits	$ 16,000	($50,000*.32)
Support Functions	$ 8,000	($50,000*.16)
Misc. (auto, furn., etc.)	$ 28,000	
Total	$102,000	
Amount for Project	**$ 69,360**	**($102,000*.68)**
Administrative Assistant (Permit Clerk)		
Salary	$ 30,000	
Benefits	$ 9,600	($30,000*.32)
Support Functions	$ 4,800	($30,000*.16)
Misc.	$ 3,000	
Total	$ 47,400	

Amount for Project	**$ 13,272**	(47,400*.28)

According to this calculation, the total cost of issuing the permit and reviewing sprinkler plans is $82,632. While this is good information to have, it's of limited value when determining a reasonable permit fee. Using the cost of personnel, taxpayers are funding the plan review specialist at almost $50 per hour, and the administrative assistant at about $20 per hour. Based upon these figures, the cost to conduct plan reviews and issue permits is as follows:

PLAN REVIEW COSTS, INCLUDING PERMITTING				
Type Structure	**Initial Floor Plan**		**Additional Floor Plans**	
Townhome	$95	($50*1.5)+$20	$36.50	($50*.33)+$20
Tract Home	$120	($50*2)+$20	$45	($50*.5)+$20
Custom Home	$145	($50*2.5)+$20	n/a	n/a

Inspection Subcommittee

A separate subcommittee was appointed to assess the options available for conducting onsite inspections. This committee was made up of a homebuilder, the building official, a plumbing inspector, a fire inspector, and a neighborhood representative.

After considerable discussion, it was determined that, to be able to assure a high level of compliance, two inspections would be necessary for each system: a "rough-in" inspection to check the piping assembly, and a final inspection to see that the system is finished properly, escutcheons in place, no painted heads, etc. The subcommittee decided to leave the actual inspection criteria up to the staff, but in order to evaluate the costs of the program, the amount of time and the number of inspections had to be determined.

The subcommittee evaluated the advantages of inspections conducted by the fire department and by plumbing inspectors. It was perceived that the fire inspectors had a higher level of competence in the fire protection system arena. However, they would probably not be able to meet the expectations of the homebuilders and contractors regarding response time for inspections without adding personnel. The normal response for the fire inspectors to a request for inspection was 48-72 hours, but the plumbers responded with next-day service.

The subcommittee advised the steering committee that, with relatively little training, plumbing inspectors could become very competent to conduct the fire sprinkler inspections in dwellings, and could perform the inspections in conjunction with their plumbing inspections. This would result in a significant savings to the jurisdiction, while the quality of the program would remain intact. The decision was made to place inspection responsibility with the plumbing inspection staff.

After consultation with plumbing and fire inspectors, the subcommittee estimated that the additional time for the sprinkler inspection would be approximately 30 minutes per system. Using a similar formula to determine the actual cost of personnel and equipment used for plan review and permitting, it was determined that the city's cost to conduct an on-site inspection of a sprinkler system would be $35; two inspections for each system would add $70 to the city's cost.

Cost Summary

Based upon the data and the assumptions by the experts on the committees, the cost of administering the program was estimated to be between 4 and 11 cents per square foot, depending upon the size and type of unit. To simplify the overall permitting system, it was determined that full cost recovery could be achieved by charging $200 for a permit for an original floor plan up to 2,000 square feet. An additional charge of $50 for each additional 1,000 square feet was deemed appropriate and would recover all costs for larger projects. For replicated floor plans, the committee agreed that actual costs are significantly lower. The plan review time would be about 25 percent, but the inspection time would remain the same. The result is that the actual cost would be about half for duplicate floor plans. Furthermore, it was determined that the difference in cost between townhomes, custom homes, and tract homes wasn't enough to justify creating three permit fee schedules and creating additional confusion. Using the recovery rate agreed upon (75 percent), the following fee schedule was developed:

	First 2,000 Sq. Ft.	Additional 1,000 Sq. Ft.
Original Floor Plan	$150	$50
Duplicate Floor Plans	$100	$35

The logic behind the fees for duplicate floor plans is that, upon examination, the cost to conduct a cursory plan review and two inspections was about 65 percent of the cost of the original floor plan.

Water Supply

The city of Cashville owned the water utility, and the relationships between city departments was excellent. The water department's fees included an impact fee based upon the meter size. This was a logical policy, as larger meters typically indicate higher water use, so charging higher impact fees for higher water users met the goal of the city. However, the steering committee determined that, if homes were equipped with a meter one size larger than standard, extended coverage sprinklers could be used in most areas of the city. This would significantly reduce the cost of each system, but not enough to offset the increased impact fee.

After considerable discussion, the water department agreed that residential sprinklers, if installed in all homes in the city, would, in fact, reduce the overall demand on the water system. Based upon that consideration, the water department agreed to forgo the additional impact fee for the larger meter as long as all homes were being sprinklered.

Communications Plan

A critical component of the stakeholders' recommendations was the communications plan. In order to avoid misunderstandings and miscommunications, and to assure everyone with an interest had the opportunity to participate and ask questions, the steering committee devised a communications plan. They determined that different audiences would be interested in different components of the implementation, so the recommendation was to develop three different programs.

For those contractors planning and installing residential sprinklers, a seminar was developed to provide information about permit application procedures, requirements for drawings and submittal details. Also covered would be how to request an inspection, and what would constitute failure. A team of city representatives, including the fire department and the plumbing inspection agency,

would deliver these seminars. In addition, the regional fire sprinkler association partnered with the local chapter of the Plumbing & Mechanical Contractors' Association to offer classes on the actual planning and installation of residential fire sprinkler systems.

For homebuilders and general contractors, a presentation was developed that could be delivered at luncheons or other meetings. This presentation included information on how the plan review would be conducted and how this could impact the turn-around times. This presentation pointed out ways that homebuilders and general contractors could avoid delays by making sure the plans submitted had all of the necessary information, and that they were fully compliant with the new sprinkler requirements.

Also covered in this presentation was the inspection process, assuring the homebuilders that, because the sprinkler inspection was simply an extension of the plumbing inspection, the only delay should be the amount of time to actually conduct the inspection.

It was reiterated that the way to avoid delays due to disapproval of a system is the same as any other system installation (electrical, HVAC, etc.), and that is to be sure the system is code compliant. While every new program will need some time to iron out any wrinkles, every effort has been made to avoid a negative impact on the homebuilders. Someone on the steering committee or city staff familiar with the program would give this presentation.

For neighborhoods, business groups, civic clubs, and similar organizations, a third presentation was developed. This presentation would speak to the enhanced safety that the residential sprinklers would bring to the community, and then speak to the actual implementation process. This presentation would highlight the collaboration between the various organizations, and compliment the leadership of each of the

organizations that participated. A practical description of the implementation would be presented, ending with a question-and-answer session.

These three presentations, delivered to as many audiences as possible, were critical to the success of the program. Including representation from all the stakeholders in the development of the implementation was essential for success.

In Cashville, residential sprinkler systems are being installed in all new homes, they are recovering much of the cost of implementation through permit fees, and the process is running very smoothly. The steering committee now meets quarterly to review any complaints or problems with the process and to offer suggested revisions for improvement.

MODERATION CITY, MICHILVANIA

Moderation City, or "MC" as it's known, is a medium-size city with all the normal attributes, services, and issues. In MC, the citizens expect a robust fire response, but don't fully understand the value of fire prevention efforts, including residential sprinklers. However, two years ago, after a hard-fought campaign by the fire department, city leaders, and the sprinkler industry, MC citizens voted to require residential sprinklers in all newly constructed homes.

To allow for a transition period in which to build the necessary infrastructure, the requirement didn't go into effect for two years. They believed this would allow ample time for the government, contractors, and homebuilders to prepare for implementation. During the campaign for sprinklers, the proponents committed to implementing a regulatory scheme that would be low cost, but effective. One specific commitment was to avoid hiring additional city staff.

The mayor of MC appointed a team of city staff to develop the implementation strategy. The staff members included the fire chief, a building official, and a person from the city administrator's office.

After meeting several times to identify issues in need of attention, the staff decided that the best approach was to assemble a group of stakeholders to collaborate on the various implementation challenges. Because of time constraints, the stakeholder group was kept relatively small, with only participants representing industries that would be directly impacted by the implementation. The stakeholders group was made up of representatives from the homebuilders, sprinkler contractors, and plumbers associations.

As the meetings with the stakeholders progressed, they identified a major cost issue. They saw water impact fees for larger water meters as a potential impediment. The group agreed to invite the local water provider to the meetings. Because the water providers weren't initially involved, and the project was well underway, they felt overlooked and under-appreciated. The discussions with the water provider were less than successful. The group was able to achieve only minor concessions to offset some fairly significant impact (meter size and infrastructure) fees.

The stakeholders agreed that permits were needed to be able to track the plans and installations, and permit fees became a controversial issue. The homebuilders argued that the building permit was based upon the value of the structure, including sprinklers, so they didn't want to be charged an additional fee. The fire sprinkler companies were accustomed to paying permit fees and agreed that the additional service required some kind of revenue source for funding. The plumbers stayed neutral, although they tended to side with the homebuilders as they were not accustomed to acquiring a separate permit. The outcome of the initial discussions about permit fees was to put it on hold and move to a discussion about plan review and inspection to determine the actual cost of the program.

Due to the commitment to avoid hiring additional city staff, the stakeholders agreed that third-party contractors would be utilized for plan review and inspection. The sprinkler contractors wanted recognition for their state license and professional qualifications in lieu of having their plans reviewed. Others in the group disagreed, and it was decided that, regardless of a person's qualifications, plans would be reviewed and inspections would be conducted. This was deemed necessary to assure that systems being installed met the standards adopted by MC.

The group next considered the advantages and disadvantages of the different business arrangements available to them. Should MC contract directly with the plan review and inspection companies? Or should the homebuilders or installers be required to engage these companies and report to MC? The city representatives believed they could better manage the process if the plan reviewers and inspectors contracted directly with the city. The homebuilders and installers agreed, as that was one less process they would have to manage.

This brought the group back to the funding issue. The city had not budgeted any additional money to implement the program, so the city representatives believed the permit fees should cover the entire cost of the program. The homebuilders didn't want to saddle the homeowner with that additional cost along with the cost of the sprinkler installation.

The stakeholders were at impasse. The mayor and city council would have to make the decision. It was presented as an "either/or" situation. Either they could add funding to the departments issuing permits and overseeing the process, or they could direct staff to create a fee structure that would recover the entire cost of implementation.

The elected leadership decided that, because existing city staff would be used to issue permits and oversee the system, the city would absorb that cost. Permit fees should fund the actual work (plan review and inspection) of the third parties.

The group then set about the task of determining the cost of reviewing plans and conducting inspections by third parties. The group developed two different Requests for Proposals, one for plan review, and one for inspection. During the discussion, the group decided that, while one company might possess the qualifications to do both, it was likely that a better price and potentially better service could be achieved if at least two companies were involved. There was no reason that one company couldn't submit proposals on both components of the project.

The qualification criteria were determined through researching other communities' policies, considering the current policies for commercial sprinkler systems, and reviewing the positions of several trade associations. The group decided that, in order to qualify to conduct plan review, the person doing the work would need to possess a Level III certificate from the National Institute for Certification in Engineering Technologies, or be a licensed professional engineer in the discipline of fire protection, or equivalent. To be considered qualified to conduct sprinkler inspections, a person would need to possess a Level II certificate from the National Institute for Certification in Engineering Technologies, or an appropriate certification from the International Code Council, the National Fire Sprinkler Association, American Fire Sprinkler Association, or equivalent.

After receiving the RFP responses and a selection process, MC signed contracts with an engineering firm for plan review and a third-party inspection firm for the sprinkler inspections. The engineering firm will charge a flat fee of $175 for each residential sprinkler system plan review of a dwelling up to 2,500 square feet. For units larger than 2,500 square feet, an additional charge of $50 per 1,000 square feet or portion thereof will be charged. Should plans be rejected, a re-review fee of one

half the original fee will be charged. The inspection firm will charge $85 per dwelling unit for each inspection, including any required re-inspection.

Therefore, a single-family dwelling of less than 2,500 square feet will generate a cost of $345 ($175 for plan review, plus two inspections, rough-in and final, at $85 each). This assumes the plans are approved on the initial submittal, and the system passes both inspections. Based upon the direct cost to the city, MC adopted a permit fee structure identical to the charges from the third-party contractors. A basic permit fee is $345 plus $50 per 1,000 square feet or portion thereof beyond 2,500 square feet. If a plan is rejected, an additional fee is required with the re-submittal equal to the original fee, minus $170 (the inspection fee), times one half [for a unit under 2,500 square feet, the re-submittal fee would be ($345−$170) ×.5 = $87.50].

If, upon inspection, the system is found deficient and an additional inspection is required, the inspection fee must be paid upon request for the re-inspection. To allow for flexibility in scheduling and for the convenience of the installing contractors, MC decided to allow contractors to establish escrow accounts with the city. Contractors could deposit funds into the accounts that would be drawn upon by the city for permit fees and inspections.

Oversight of the program, including issuing permits and collecting fees, was assigned to the fire department. This was primarily because of the prior discussions about the building permit and what it did and did not include. The stakeholders decided that the building department was overseeing the overall building permitting and inspection system, and it would be most appropriate for the fire department to oversee this specific component of the construction project. It was further determined that the fire department would manage the third-party plan review contract, and the building department would manage the third-party inspection project. In this way, communication would be ongoing between the departments, and each would have a role in the final approval process.

In Moderation City, sprinkler systems are being installed in new homes, and the city leadership is satisfied that an appropriate amount of oversight is being provided by the third-party contractors. The commitment to avoid hiring additional city staff has been kept, and city staff has absorbed the additional workload, albeit with some deterioration in overall service.

Both the fire chief and the building official believe they could improve on the quality of service if they had additional staff to oversee the third-party contractors, but they don't have budget authority to hire new personnel. Overall, the system seems to be working well, but it's difficult to be sure, as the stakeholder group is no longer meeting.

PFRUGALTON, FLORIZONA

The final city in this study is Pfrugalton, Florizona. The state of Florizona is a "mini-maxi" state, and adopted the 2009 International Residential Code with the requirement for residential sprinklers intact. The regulations go into effect 90 days after adoption, and local jurisdictions are required to apply the state regulations as written.

Pfrugalton is a small but growing jurisdiction of about 12,000 people. They have a volunteer fire department with no fire prevention division, and one building inspector for new construction and renovations.

Pfrugalton requires builders to have their plans reviewed by a qualified third-party plan reviewer, and submit a letter from the reviewer with their plans in order to obtain a building permit. The building inspector then inspects the construction as it progresses.

The mayor of Pfrugalton, upon learning of the new code requirements, decided to have lunch with the local homebuilders association president and the building official. They discussed the new residential sprinkler requirement and explored a few options about its implementation.

After considering his options, the mayor decided to continue with the current system, which has served his community well over the years. The building official will develop reasonable qualifications for third-party reviewers of residential sprinkler systems, and will secure adequate training so he can become competent in inspecting them.

After talking with the fire chief and several of his peers in neighboring jurisdictions, the building official decides that the reviewer will need to be either a NICET Level III technician or a registered fire protection engineer. The reviewers will be required to submit a letter stating the findings of their review and any deficiencies in the plans. If the reviewer is substandard or is found to be overlooking deficiencies, the building official is authorized to refuse future submittals from them.

The building official decides to take a course offered by the U.S. Fire Sprinkler Association for Authorities Having Jurisdiction. Upon completion of the course, he is able to assess the plan reviews that come into his office, and to inspect installations for compliance with NFPA 13D and the International Residential Code.

Initially, the system instituted seemed to work smoothly, although many objected to the process. Homebuilders didn't like the additional cost of plan review, and the plumbers and sprinkler contractors felt left out of the discussion. Homebuyers and citizens were confused about when sprinklers were required in dwellings, what they cost, and how they worked. Overall, the implementation in Pfrugalton worked, but much improvement could have been made.

Appendix A: Incentivizing the Installation of Residential Sprinklers

Some jurisdictions don't have the authority to require sprinkler systems in dwellings. This may be due to a legislative prohibition, recognition that the community isn't ready to impose the requirement, or some other reason.

There are, however, developments where the installation of residential sprinkler systems would greatly enhance the community's safety and reduce the need for reactive fire response, even without a regulatory requirement. In these cases, some code officials or other public safety officials will develop a package of incentives to offset the cost of the sprinkler installation. This enhances community safety and creates a "win-win" for the community and the developer.

When identifying appropriate incentives for residential sprinklers offsets, it's necessary to review the benefits (and weaknesses) of these systems. The residential sprinkler standard (NFPA 13D) was developed to provide a solution to the residential death and injury problem at a lower cost than a typical commercial sprinkler system. From NFPA 13D:

> ***"Recognizing the need to reduce the annual life loss from fire in residential occupancies (about 50 percent of total loss of life by fire), the Committee on Automatic Sprinklers appointed a subcommittee in May 1973 to prepare the* Standard on the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes.***"***

Although these systems have a very positive impact on property loss, they are primarily intended to reduce the loss of life from fire; therefore, the standard doesn't require many spaces in a home to be covered by the sprinkler system. Areas that do

not require coverage include attics, closets, most bathrooms, and some under-floor areas. Additionally, the required duration of the water supply to the system is seven to 10 minutes, depending upon the supply arrangement.

Highlighting these issues is not intended to discourage incentivization for developers and builders to install sprinklers, and it is not intended to promote modifications to the national standard to make it more restrictive. It is simply to provide some balance to the thought processes necessary for reasonable, appropriate incentives.

According to the latest report from Scottsdale, Arizona, where about half the homes are sprinklered, the property loss from fire is about a third of the national average, and life loss is nonexistent in sprinklered homes. These data appear to be consistent with information available from other sources. Based upon this, it is clear that residential sprinkler installations will improve a community's fire safety environment, so finding the appropriate incentives to offset the cost of their installation could be a net benefit to the citizens served.

The Fire Protection Research Foundation (FPRF) completed a study in 2010 of incentives offered in 16 jurisdictions. The purpose of the study was to identify "common" incentives being offered, and to quantify their value. This was a follow-up report to their study of the cost of installing residential sprinkler systems.[1]

In the latest study, it is reported that the average value of an incentive package of the 16 jurisdictions studied is $3,365. This includes $145 for the first year's value of homeowner incentives (reduced property tax, special financing options, etc.); $1,945 for builder-oriented incentives (reduced fees, reduced fire ratings, etc.); and $1,271 for developer-oriented incentives (increased hydrant spacing, reduced fire flows, etc.). Based upon this report, it's likely that an incentive program can offset most, if not all, of sprinkler installation costs. The following discussion of common incentives

[4] *Incentives For The Use of Residential Fire Sprinkler Systems in U.S. Communities, October 2010.*

should provide for a reasonably complete discussion about the efficacy of each incentive based upon the conditions in a specific community.

INCENTIVES FOR HOMEOWNERS

PROPERTY TAX REDUCTION

The portion of property taxes (or other funding methods) that are used for fire protection can be identified in any jurisdiction's budget. Developing a formula that can be used to provide for a reduction in taxes paid for fire response will be logical in many communities. If a community expects the fire response need to be reduced by some percentage by installing residential sprinklers, the amount of taxes that go to fire response activities might be reduced by a like amount.

FINANCING INCENTIVES

At least one state has instituted a grant program whereby individual grants are made available to those who install residential sprinkler systems. This is an innovative concept that essentially rebates a portion of property taxes, an amount determined by the local fire commission or fire district.

INSURANCE COST REDUCTION

While not technically an incentive that a jurisdiction can offer, homeowners should know that they may enjoy fire insurance savings of up to 12 percent of their premium. The FPRF study indicates that the average is about 7 percent in the communities they studied. This incentive will recur every year for the life of the home, and can be shown to be very valuable over time.

EASE OF MAINTENANCE

For homeowners, maintaining your sprinkler system will be very close to what you're doing now to monitor your regular plumbing. In other words … not much. It is worth mentioning that materials used in sprinkler systems are designed and tested to higher standards than your domestic plumbing components.

INCENTIVES FOR HOMEBUILDERS

REDUCED WATER SERVICE IMPACT FEE

This incentive is based upon the philosophy that less water will be necessary for fire suppression when a sprinkler system is present. If an entire subdivision is sprinklered, distribution system pipe sizes and pumping capacities can be reduced, and the overall cost to the community for water service is less. This savings can be passed along to the builder by reducing the impact fees associated with service.

REDUCED FIRE IMPACT FEE

Similar to the reduction in water impact fee discussion, this incentive is based upon the philosophy that residential sprinklers will significantly reduce (but not eliminate) the need for manual fire suppression, thus a reduction in the impact fee is logical.

REDUCED BUILDING PERMIT FEES

At least one jurisdiction provides for a substantial (40 percent) reduction in building permit fees for homes built with sprinkler systems. While it's difficult to tie this reduction to a specific savings to the jurisdiction, the

theory is that the installation of sprinkler systems will result in a safer community, and fire will be less of a financial burden on the community. Reduced fire ratings for building assemblies: Because there are very few requirements for passive fire protection in one- and two-family dwellings, the only significant savings available is in the rated separation between the garage and the living space and, where required, exterior wall ratings. The value of the separation between the garage and the living space isn't significant, but it may add enough to the overall incentive package to make it worthwhile. Some jurisdictions allow this incentive only if the garage is also sprinklered. In some cases, the offsetting costs are comparable, thus it loses its effectiveness as an incentive for installing the basic residential system. Exterior wall ratings will be addressed under "Developer Incentives."

ELIMINATE THE REQUIREMENT FOR RESCUE/EGRESS WINDOWS

This has become an item of much debate in the fire service community. When attempting to provide incentives for residential sprinklers, one thought is that the systems are specifically intended to provide enough time for occupants to escape in case of fire. Many agree that this negates the need for rescue/escape windows in sleeping rooms and other habitable spaces. While this argument is logical, many in the fire service find it difficult to agree to such an incentive because of the inherent feeling that people need a way out, and firefighters need a means to rescue fire victims. It's a very emotional argument, one that should be vetted with all involved before including it in a package.

INCENTIVES FOR DEVELOPERS

INCREASED SPACING OF FIRE HYDRANTS

Typical current policies require hydrants to be spaced 300 to 500 feet apart. A common incentive is to allow an increase of 50 to 100 percent, reducing the number of required hydrants by up to half. In the majority of cases where a fire grows out of control in a sprinklered home, there will be no need for fire hydrants. Occasionally, tank water will be needed to complete extinguishment, but most of the time the fire department activities will be limited to overhaul and cleanup. When a fire does grow beyond the capability of a sprinkler system (attic fire, exterior fire), the time to establish a water supply from a hydrant that is 500 more feet from the fire would amount to the time it takes to drive the apparatus an additional 500 feet; the time to hook up, etc., should be the same.

DECREASED FIRE FLOW REQUIREMENTS

Historically, commercial occupancies have enjoyed a reduction in required fire flow of up to 50 percent when equipped with sprinkler systems. This seems logical, as those systems are full coverage systems. When applying this logic to residential sprinkler systems, consideration should be given to the fact that they are partial coverage systems with limited water supply requirements. It may be appropriate to provide for some reduction in fire flow, but how much depends upon the response capability of the fire department, the ability to provide water volume from other sources, and the separation distances between homes. Both the International Fire Code and NFPA-1 Fire Code permit a reduction of 50 percent in the required fire flow for sprinklered residences.

REDUCTION IN BUILDING SETBACKS

Reducing the exterior wall ratings for homes located in close proximity can result in fairly substantial savings. This incentive should be considered in light of the fact that wall ratings are required only when the structures are built closer than five feet to a property line. Eliminating the fire resistance requirement would allow homes to be constructed closer than 10 feet apart, possibly abutting each other (zero lot line developments) if they were equipped with residential sprinklers. Granting relief from the setback requirements is very attractive to developers, as they can develop more lots from the same acreage; however, consideration must be given to the fact that these sprinkler systems are not full coverage systems, and any decisions should weigh all the information appropriately.

INCREASED ZONING DENSITIES

Where zoning ordinances restrict the number of homes per acre or other unit of measurement, the density may be increased if all homes in the subdivision are sprinklered. This will allow more lots per acre, providing similar, and possibly superior, advantages to the developer as reducing building setbacks.

REDUCTION IN REQUIRED ROAD WIDTH

Streets and roads are some of the most expensive components of most developments. A reduction in width of only a foot or two will result in substantial savings for the developer. The Fire Protection Research Foundation report states that the average savings in the jurisdictions in their survey was more than $1,000 per lot.[1] When considering an allowance for reducing road width, however, other issues need to be contemplated. How is parking to be managed? If homes are constructed very close to the street, with little room for parking in the driveway, we should assume automobiles

[5] *Incentives For The Use of Residential Fire Sprinkler Systems in U.S. Communities, October 2010.*

will be parked on both sides of the street. What is the available width under that scenario? How will garbage trucks, snow removal equipment, and other heavy machinery access the area? All these issues can be resolved, but a comprehensive solution should be developed.

For any incentive being considered, a long-term, innovative outlook should be used. Installation, maintenance, upkeep, and enforcement are all considerations for many of the incentives mentioned. Fire department considerations will include apparatus size and configuration, staffing, response times, and overall response capability. Residential sprinklers are the next revolution in fire safety, but we must not overlook the need for a level of redundancy in our community fire protection strategy.

As new developments are built, new, innovative incentives will be developed. The key to success is to be sure that a diverse stakeholder group weighs in on any incentive under consideration. Homeowners, elected and appointed leaders, homebuilders, developers, and fire service representatives must all have a voice in the process.

INCENTIVES FOR COMMUNITIES

REDUCED FIRE LOSSES

Sprinklers confine fires to smaller portions of the building. Fires in sprinklered residences impact 30 percent of the area compared with nonsprinklered spaces.[1] This reduced impact minimizes relocation and construction timeframes.

REDUCED INJURIES AND FATALITIES

There is a lot more to residential sprinklers than keeping fires small. Because fires are held in check, occupants can escape and firefighters are afforded a

[1] *U.S. Experience with Sprinklers, NFPA, March 2012*

less challenging working environment. Based on a five-year study, a recent NFPA report documents an 83 percent reduction in civilian deaths and a 65 percent reduction in firefighter injuries in residential fires where sprinklers were present.[1]

COST REDUCTIONS

The cost of residential sprinkler systems will continue to decrease as they become more common. Both materials and labor costs will shrink in a competitive environment. As home sprinklers become more common, communities will be able to claim that "Sprinklered Communities are Safer Communities."

ADDITIONAL EMPLOYMENT

An important benefit to the community will be the addition of jobs. Both professional and skilled workers will be needed as sprinkler mandates hit the street. Positions added will range from technical and engineering to transportation, installation, and inspecting.

The Scottsdale, Arizona Fire Department has compiled two reports that provide a clear view of the benefits of residential sprinklers. These reports cover decades of data, and can be downloaded at:

http://www.homefiresprinkler.org/index.php/fire-department-scottsdale-report **and** http://www.homefiresprinkler.org/index.php/fire-department-15-year-data

[6] *Impact of Home Sprinklers on Firefighter Injuries, John Hall, NFPA, 2012*

Appendix B: Best Practices

Success in implementing a residential fire sprinkler requirement will depend on many areas of preparation. Considerable amounts of detailed background work must be completed to ensure success. One important area that cannot be over emphasized is communication and information.

Today, when people need information the first place they look is the Internet. A good website that is easy to navigate and provides current and comprehensive information is a tremendous asset. A good portal will help designers, installers and builders process compliant plans that meet the specifications of the jurisdiction. These professionals need to keep their work on schedule. Having clear and thorough details available ahead of time will help them achieve their goals as well as reduce plan corrections and re-inspections.

Clearly articulating your specific requirements in an accessible fashion will increase consistency. Carefully designed charts, text explanations and diagrams can reduce mistakes and define expectations. The following section highlights some best practices in accessible requirements.

NOTE: For url's (web addresses) in this section, go to www.firemarshals.org to access this guide electronically.

POLICY ISSUES

Interpretations and Applications *(click here)* Scottsdale, Arizona

This is a comprehensive document presenting how the city of Scottsdale interprets the NFPA sprinkler standards. This best practice should be strongly considered for any implementation plan. Recognize however, that these are policy statements and the Interpretations & Applications document evolved over many years of managing a residential fire sprinkler requirement. Developing this document was an arduous process incorporating collaboration, planning and problem solving. Jurisdictions implementing a requirement should review this document and use the interpretations that are appropriate for their community. The Scottsdale document is arranged following the NFPA 13D and 13R sections, which can serve as an effective outline.

STAKEHOLDER INVOLVEMENT

The California State Fire Marshal involved stakeholders in a series of task forces designed to include participation from all those affected by a residential fire sprinkler requirement. The California implementation is on-going, with January 1, 2011, as the original implementation date. California's reports offer an excellent model to others who are implementing a residential sprinkler requirement.

California's task force process is a best practice example for implementing complex change. It is a powerful strategic approach to a successful residential fire sprinkler requirement. State officials have provided a good example of documenting their work, including conclusions and recommendations resulting from their meetings. The task force reports are available for use by other jurisdictions and are available on the State Fire Marshal's website.

- **California Residential Fire Sprinkler Installation Task Force Final Report and Recommendations *(click here)***

- **California Residential Fire Sprinkler/Training and Education Task Force Final Report and Recommendations (*click here)***

- **California Residential Fire Sprinkler/Water Purveyor Task Force Final Report and Recommendations *(click here)***

The International Association of Fire Chiefs with the National Fire Sprinkler Association produced an excellent resource titled:

- **Residential Fire Sprinklers: A Step-By-Step Approach for Communities, Second Edition *(click here)***

This guide focuses on organizing the stakeholder group to get the ordinance passed. It also provides superb guidance that can be used at any step of the process, including activities after passage of the ordinance.

PLAN REVIEW AND INSPECTION

- **Common Plan Check Notes and Requirements *(click here)***
  Napa, California

Plan check notes are a way to communicate to the permit holder specific and additional detail that will be required of the AHJ. In this case from Napa, California, anyone who is considering installing a residential fire sprinkler system is provided with a compilation of potential requirements so they can be considered ahead of time. This is similar to the Scottsdale use of documented interpretations.

- **Express Residential Fire Sprinkler Design Guide *(click here)*** Prince George's County, Maryland

Prince George's County, Maryland, worked with the U.S. Fire Administration and the National Association of Home Builders to create a design guide that would provide a simplified method for designing residential fire sprinkler systems. Simplification has been achieved by pre-engineering key features of the design.

The guide includes a preliminary discussion of sprinkler coverage area, water flow, and water pressure. After this overview of the essentials, the guide is divided into two sections: Hydraulic Worksheet – where calculations account for pressure losses in the system and ensure that adequate flow and pressure are available at the most remote sprinkler; and Sprinkler Target Zones – which eliminate the need to determine precise locations for sprinklers and substitute "target zones" where sprinklers can be placed to provide adequate coverage.

Another example of using a task force to build consensus can be found in the experience of Prince George's County, Maryland. Prince George's County identified residential fire sprinklers as a method to reduce risk to their residents.

In October 1986, Fire Chief M.H. "Jim" Estepp established a task force of key stakeholders with the mission to determine current risk and whether a residential fire sprinkler requirement was right for Prince George's County. The task force agenda established a very aggressive work approach that produced a report by February 1987.

The task force report led to legislation that amended the Prince George's County Building Code requiring "Quick Activation Sprinkler Systems" in all newly constructed residential dwelling units, motels, and hotels. The legislation phased in a fire sprinkler requirement, with the final phase requiring fire sprinklers in new one-

and two-family dwellings by January 1, 1992. The following quotation from the report speaks to the benefit of participation by stakeholders, which resulted in a safer outcome for future residents.

"It was evident and heartening throughout this endeavor that a common interest in the safety of the citizens of Prince George's County was of mutual concern to private and public sector representation alike. At the same time, every avenue of potential cost reductions associated with any potential sprinkler legislation was examined for possible application in an effort to develop realistic and equitable standards."

- **Residential Fire Sprinkler Systems: Plan Submittal and Inspection Requirements *(click here)*** Warrington Township

This document posted on the Warrington Township, Pennsylvania, website offers a best practice for what is expected beyond the NFPA 13D standard for residential fire sprinkler systems. This is a good start for any jurisdiction needing a model for describing its internal requirements.

- **Residential Fire Sprinkler Plan Review Checklist *(click here)*** Encinitas, California

This best practice from Encinitas, California, takes a fill-in-the-information approach.

- **Residential Fire Sprinkler Plan Review Checklist *(click here)*** Henderson, Nevada

Similar to the Encinitas checklist, Henderson, Nevada, adds some introductory comments and explanations on what to expect.

- **Plan Submittal And Inspection Requirements – San Mateo, California *(click here)***

- **Inspections of Residential Fire Sprinkler Systems – Maine State Fire Marshal *(click here)***
- **Residential Fire Sprinkler Systems – Warrington Township, Pennsylvania *(click here)***
- **Installation of Residential Fire Sprinkler Systems – Pioneer Fire Protection Standard *(click here)***

This guideline specifically describes the elements that will be evaluated during an inspection. This is a very thorough document that goes into detail of the NFPA 13D Standard.

- **Residential Inspections – Montgomery County, Maryland *(click here)***

PERMITTING

- **Fire Service Fee Schedule *(click here)*** City of San Bernardino, California

The City of San Bernardino, California, like many communities, has provided specific information on its website to identify fees and costs associated with residential fire sprinkler systems. As with other items identified previously, it is helpful to provide as much information as possible to increase the potential for a successful project. Many of the design and engineering professionals deal with different jurisdictions and as they are anticipating expenditures when planning work, they need readily accessible reference sources to identify their costs. The easier they can find information the better. The San Bernardino fee schedule is very straightforward in its approach.

Permit Application – Altamonte Springs, Florida *(click here)*

FEES

- **Ordinance Establishing A Schedule Of Fees For Fire Prevention Inspections And Reviews Within The Boundaries Of The Oswego Fire Protection District *(click here)*** Oswego, Illinois

This document from Oswego, Illinois, provides the legislative approach to establishing the fee schedule. This is accomplished through the jurisdiction's legislative process. Note that in this ordinance it provides for the AHJ to waive a fee where appropriate. This is an important consideration in planning your business process because at some point the need to waive a fee will occur. If the process is not clearly identified, then you may be required by law to require a fee from someone who would otherwise be exempt. You will need to have assistance in this area of planning from the legal or finance staff within the government.

FM Fee Schedule *(click here)* Fairfax County, Virginia

This website from Fairfax County, Virginia, provides an explanation for fees as well as links to the authority to charge the fees. The Fairfax County Fire Marshal's Office website is a best practice for transparency and the priority of information to residents and businesses in the county. It is simple and straightforward, but has many links to information and an intuitive format.

- **Building Permit Fee Changes Explanation *(click here)*** Aurora, Colorado

This explanation shows how officials in Aurora, Colorado, explain their reason for implementing a fee structure. If it is necessary to establish fees or other authorization and must be done through the jurisdiction's legislative process, consider this in planning the implementation. These are critical path considerations that may be out of your control and may take considerable time to complete.

Appendix C: Sample Checklists

Note: To download checklists in Word, **click here** or go to **www.firemarshals.org**.

Jurisdiction Name Here

Residential Sprinkler System Plan Review Checklist

Applicant: _____ *Phone:* _____

Project Address: _____ *File/Permit#* _____

Approved	Approved With Comments	Not Approved	***Required Information:***	***Comments:***
			Identification and contact information of designer, owner, contractor	
			Location, including street address	
			Scale of plan, legibility	
			Complete floor plan showing all walls, partitions, and potential obstructions	
			Full height building section	
			Elevation at point of water connection and changes between connection and discharge point(s)	
			Dimensioned site plan with water supply, structure location, etc.	
			Water supply specifications (volume, pressure, flow characteristics)	
			Alternative water supply components, if provided. (Well pump, gravity or pressure tank, calculations for size, etc.)	
			Location and arrangement of all devices (meters, backflow preventers, etc.)	
			Basis of design (13-D, P2904)	
			Type of piping and materials (steel, CPVC, PEX, etc.)	
			Make, model, type of sprinklers	
			Location of all valves and fittings	
			Antifreeze specifications and locations, if provided	
			Insulation specifications (where provided to prevent freezing)	
			Location and spacing criteria for all sprinklers	
			Hydraulic calculations (computer generated or prescriptive method)	
			Piping supports	
			Reference nodes matching hydraulic calculations	
			Flow test/pressure data used for hydraulic calculations	

Reviewer: _____ *Date:* _____

Jurisdiction Name Here

Residential Sprinkler System Inspection Checklist

Applicant: _____ *Phone:* _____

Project Address: _____ *File/Permit#* _____

Approved	Approved With Comments	Not Approved	*Rough-in Inspection* ☐	*Final Inspection* ☐	*Comments:*
			Meter size matches plans	Owner's Instructions Present	
			Underground piping matches plans (size, length, material)	All heads located according to plans, no obstructions	
			Piping supports adequate & in accordance with listings	No Leaks	
				All valves open	
				Monitoring in place (if required by 7.1.2)	
				Escutcheon plates in place	
				Insulation in accordance with plans to prevent freezing	
				Antifreeze solution is factory mixed, adequate for installation	
				Type of sprinklers match plans	
				Notification sign at water supply shut-off	

Inspector: _____ *Date:* _____

Revised 12/12/10

Jurisdiction Name Here

Residential Sprinkler System Permit Application

Permit Number: _____ Date: _____

Site Address: _____ Tenant/Building Name _____

Applicant is: ☐ Architect/Engineer ☐ Contractor ☐ Owner ☐ Other (Describe) _____

Property Owner

Name _____ Phone: _____

Address: _____ City _____ State ___ Zip _____

Contractor

Name _____ Phone: _____ License Number: _____

Address: _____ City _____ State ___ Zip _____

Architect/Engineer

Name _____ Phone: _____ Registration Number: _____

Address: _____ City _____ State ___ Zip _____

Type of Work

Check only one: ☐ New ☐ Addition ☐ Alteration/Remodel ☐ Repair/Maintenance

Permit Fee: $_____

Applicant Signature: _____

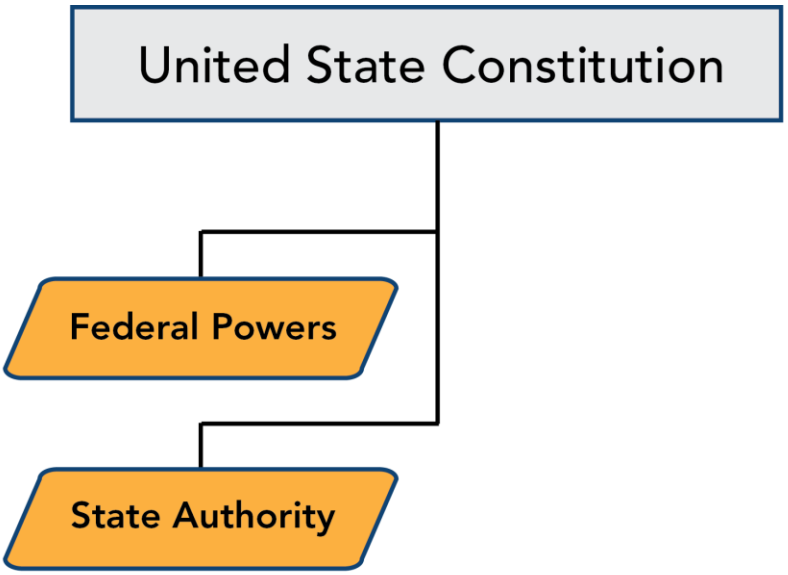
Approved by: _____

Conditions of permit: _____

Appendix D: Legal Authority for Code Compliance

In the United States, model codes are developed through a consensus process and are typically used as a basis for local or state adoption. These model regulations include building codes, fire codes, electrical codes, plumbing codes, and a myriad of other codes intended for adoption. The two primary model code organizations are the International Code Council® and the National Fire Protection Association.® These organizations utilize volunteer experts to develop rational, cost-effective regulations to ensure a reasonable level of safety in the built environment.

However, none of these model codes can be enforced without government action. The responsible governmental jurisdiction (municipality, county, state or agency) must go through the legislative and rulemaking process before they become enforceable. The benefits of using model codes as the basis for regulations include a consistency for designers, engineers, builders, regulators, and decreased costs of building materials and equipment. In addition, the use of model codes provides an opportunity for uniform training programs for regulators at all levels. So how do these model regulations become enforceable, and what is the legal basis for your authority?



The U.S. Constitution grants certain powers to the Federal Government; however, it also reserves all rights to states that are not specifically granted to the federal government. This is a general statement, and there are exceptions; however, construction codes, fire codes, and similar regulations have historically been relegated to the states.

State laws tell us who is authorized to enforce code compliance. The state governments are constitutionally the ultimate authorities having jurisdiction. The legal basis originates in the ***Tenth Amendment to the United States Constitution:*** **"**The powers not delegated to the United States by the Constitution, nor prohibited by it to states, are reserved to the states exclusively, or to the people." The Tenth Amendment made no mention of the constitutional standing of cities or counties – because they have no constitutional standing. Powers of local governments are only those powers delegated by the states. State constitutions and statutes define the relationship among the state, counties, and municipalities through their respective constitutions and statutes.

Typically, a state will provide for one of three types of regulatory systems:

1. Statewide adoption of minimum code requirements. In these states, no local government may adopt regulations that are less restrictive than the state minimum; however, they are authorized to adopt more restrictive regulations based upon the community's needs.
2. Statewide adoption of code requirements and a prohibition of any local amendments. In these states, there is no authority for any local jurisdiction to amend the state regulations in any way. These states are often referred to as "mini-maxi" states. Another form of this type of system is one where local jurisdictions can petition the state for permission to amend the code based upon specific attributes of the community.
3. Home Rule states, whereby the state doesn't adopt any codes, but permits local jurisdictions to adopt regulations appropriate for their community. In some states this authority is given to municipalities but not counties. In others, counties may adopt regulations for unincorporated areas. A third derivative is where the counties' authority may supersede the municipalities' authority. In one state, fire districts are given overriding authority to adopt and enforce building and fire regulations, superseding the authority of municipalities and counties.

The adopting jurisdiction (state, county, fire district/authority or municipality) will provide for administrative authority to the code official who will manage compliance. In the International Residential Code this authority resides in Chapter 1 Administration; Section R104 Duties and Powers of the Building Official.

The Administration chapter also will provide for the establishment of a building safety department and specifically identifies some of its necessary functions. Principal among these is the appointment of a building official and staff deputized to perform the duties described in the code. Model fire codes such as NFPA 1 and the

International Fire Code provide similar authorities in their Administration Chapter. The administrative chapters of the model codes are the most amended sections; states and local jurisdictions have various methodologies relating to the granting of authority to carry out regulatory activities.

Appendix E: Relevant Links

California – Office of the State Fire Marshal

Residential Fire Sprinklers in the California Codes.
osfm.fire.ca.gov/codedevelopment/residentialsprinklerandcacodes.php

Antifreeze Informational Bulletin
osfm.fire.ca.gov/informationbulletin/pdf/2010/IBantifreezeinressprinklers09-08-2010.pdf

Center for Public Safety Excellence

Accreditation Program for Residential Sprinkler Installers

www.Publicsafetyexcellence.org

Factory Mutual

Environmental Impact of Automatic Fire Sprinklers
www.firemarshals.org/pdf/FM_Global_report_sprinklers.pdf

Home Fire Sprinkler Coalition

www.homefiresprinkler.org/fire-service

Why Home Fire Sprinklers Are Needed
www.homefiresprinkler.org/home-sprinkler-systems-are-needed

Fire Team USA

Public Service Announcements, Current Information on Residential Sprinklers
www.fireteamusa.com

International Code Council – ICC

Coalition For Current Safety Codes

www.coalition4safety.org

Resources for Implementation Activities

www.iccsafe.org/rfswww.iccsafe.org/rfs

Institute for Business And Home Safety – IBHS

www.disastersafety.org/disastersafety/perspectives-of-ibhs-on-the-residential-fire-sprinkler-study-by-the-vermont-department-of-public-safety/

www.disastersafety.org/building_codes/rating-the-states_ibhs/

www.disastersafety.org/public-policy/residential-fire-sprinklers/

Insurance Services Office （ISO）

Building Code Effectiveness Grading Schedule and Public Protection Classification System

www.ISOMitigation.com

IRC Fire Sprinkler Coalition

Resources

www.ircfiresprinkler.org/resources.aspx

Instructional Videos

www.ircfiresprinkler.org/webcast.aspx

Johns Hopkins University

Residential Sprinkler System Issue Brief
www.networkforphl.org/_asset/ry7nj9/Residential-Sprinkler-Systems.pdf

Overview
www.networkforphl.org/the_network_blog/2011/12/14/76/sprinklers_for_residential_fire_protection

National Institute of Standards and Technology – NIST

Cost Benefit Study
www.nist.gov/el/sprinklers-101107.cfm

Online Tools
www.nist.gov/el/fire-041211.cfm

National Fire Protection Association – NFPA

Coalition For Current Safety Codes
www.coalition4safety.org

Firefighter Fatalities
www.nfpa.org/categoryList.asp?categoryID=955&URL=Research/Fire%20statistics/The%20U.S.%20fire%20service

The Impact of Home Sprinklers on Firefighter Injuries

www.nfpa.org/assets/files//PDF/SprinklerImpactFFInjuries.pdf

The U.S. Fire Problem – (Civilian Injuries)
www.nfpa.org/itemDetail.asp?categoryID=953&itemID=23071&URL=Research/Fire%20statistics/The%20U.S.%20fire%20problem

Sprinkler Successes
www.nfpa.org/assets/files//pdf/sprinklersuccessesselectedproperties.pdf

Facts and Myths
firesprinklerinitiative.org/resources/fact-sheets/myths-vs-facts.aspx

U.S. Experience With Sprinklers
www.nfpa.org/itemDetail.asp?categoryID=2466&itemID=55726&URL=Research/Statistical%20reports/Fire%20protection%20systems/

Fire Sprinkler Initiative
www.firesprinklerinitiative.org

Antifreeze in Sprinkler Systems
www.nfpa.org/itemDetail.asp?categoryID=2064&itemID=48038

NFPA Fire Protection Research Foundation

Impact of Home Fire Sprinklers in Reducing Fire Injuries
www.nfpa.org/assets/files//PDF/SprinklerImpactFFInjuries.pdf

Cost Analysis – 2008
www.firesprinklerinitiative.org/Research-Reports/~/media/Fire%20Sprinkler%20Initiative/Files/Reports/FireSprinklerCostAssessment.pdf

Impact of Sprinklers on Fire Flow
www.nfpa.org/assets/files/Research%20Foundation/RFFireFlowWaterConsumption.pdf

State Farm Insurance

Video of side by side demonstration of sprinklered vs. non-sprinklered room fires:

http://learningcenter.statefarm.com/residence/safety-1/burning-down-the-house/

Insurance industry information for homeowner insurance discounts, available promotional materials, general information:

http://www.statefarm.com/insurance/homeowners/homeowners.asp?WT.svl=4

http://www.statefarm.com/aboutus/community/safety/home_and_recreation.asp

UL

Ventilation – Legacy and Modern Furniture
www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/fireservice/ventilation/

Structural Stability of Engineered Lumber under Fire Conditions
www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/fireservice/lightweight/

Upholstered Furniture Flammability
www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/fireservice/upholstered/

Analysis of Changing Residential Fire Dynamics

www.ul.com/global/documents/newscience/whitepapers/firesafety/FS_Analysis%20of%20Changing%20Residential%20Fire%20Dynamics%20and%20Its%20Implications_10-12.pdf

National Institute for Occupational Safety and Health

NIOSH Alert April, 2005

www.cdc.gov/niosh/docs/2005-132.pdf