

# Minnesota State Fire Chiefs Association

## White Paper on Residential Sprinkler Systems

### **Background:**

At the September, 2008 International Code Council hearings conducted in Minneapolis, Minnesota, a proposal to require residential fire sprinklers for one and two family homes was approved (see below) for homes built under the 2009 version of the International Residential Code (IRC).

### ***SECTION R313***

### ***FIRE SPRINKLER SYSTEMS***

*R313.1 General. Effective January 1, 2011, an approved automatic fire sprinkler system shall be installed in new one-and two-family dwellings and townhouses in accordance with NFPA 13D.*

The IRC is a model code that each state, or in some cases, local jurisdictions, can adopt as their model building code. Minnesota has historically adopted the International Building Code, International Fire Code, and the International Residential Code on a state-wide basis and there is currently no effort underway to change this.

The Department of Labor and Industry (DOLI) is tasked with adoption of the model codes and has issued a letter on June 1, 2009 stating the adoption of all codes; Building, Fire and Residential would be temporarily placed on hold due to the combination of economic conditions and lack of any significant changes in any of the model codes.

The letter states DOLI's intention of beginning the adoption process with the formation of advisory committees to begin sometime in 2010 or at the latest, the early part of 2011.

### **Effective Date:**

The IRC provision calls for an effective date of no sooner than January 1, 2011. If the state adopts the IRC by January 1 the provision will apply. If adoption occurs after January 1, 2011 then only those homes built after adoption will be required to comply. There is no retroactive provision in the code.

### **NFPA 13D:**

The National Fire Protection Association is a non-profit 100+ year old organization specializing in fire related issues. Amongst their many activities are the development of education materials, standards, and codes. The "13" series of their product line are specific to automatic sprinkler systems with the NFPA 13<sup>1</sup> standard for

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<sup>1</sup> National Fire Protection Association, *Standard for the Installation of Sprinkler Systems*

commercial applications, 13R<sup>2</sup> applicable to multi-family structures such as apartments and town homes, and the 13D<sup>3</sup> applicable to one and two family residences.

NFPA 13D standard is the least prescriptive, thus, the most economical. The following table illustrates some of the differences:

Item	13 System	13D System
Pipe	Steel Pipe 1” to 8” diameter	Plastic typically 1” diameter
Coverage	100% of building	Small closets, bathrooms, storage areas exempted if under 55 sq. ft.
Pressure Test	Required	Not Required
Fire Department Connection	Required	Not Required
Alarm	Required	Not Required

There are numerous myths and inaccurate statements about the requirements of 13D, many of these surround water supply and electrical power. The facts are 13D is a performance standard in which the installer must calculate flow requirements based upon the water supply. Your certified system designer will obtain water supply information and calculate supply needs and possible pump requirements based upon the structure.

FACT – 13D has no requirement for a water reservoir or pump unless the water supply is inadequate. In most municipal cases the water supply should be adequate; however, in rural areas with wells, a slightly larger pump (1/4 to 1/3 more horsepower) will adequately supply a single family system. New sprinkler head technology specific for 13D systems allow operation at flows as low as 8 gallons per minute. NFPA requires a minimum supply of at least two heads, thus 16 gallons per minute. For comparison, a 5/8” garden hose flows at 17 gallons per minute.

FACT – 13D has no requirement for back-up electrical power of the pump. If there is a power failure at the same time a fire occurs there is a greater likelihood of significant fire damage.

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<sup>2</sup> National Fire Protection Association, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*

<sup>3</sup> National Fire Protection Association, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*

**Cost:**

A recent report issued by the Fire Protection Research Foundation<sup>4</sup> which is comprised of fire groups, home builders, and water supply agencies details the cost to install a NFPA 13D compliant system ranges from \$.38 per square foot to \$3.66 per square foot. The average cost was \$1.61 per square foot. The Report determined this number by selecting ten representative cities from around the nation and soliciting and acquiring three bids.

Minnesota, with its cold winter climate eliminates certain efficiencies in installation as few circumstances allow any pipe in the attic area. Cities such as Blaine, Plymouth and Maple Grove have thousands of systems installed in town homes and close to a hundred one and two single family homes.

Their experience reflects the Minnesota Fire Chiefs member's average of \$1.61 for the townhomes and approximately \$1.80 for one and two single family homes.

**Reductions/Insurance Savings/Financing Costs:**

Depending upon the community, there may be certain trade-off or alternatives to other building code requirements if sprinklers are installed. These are more typical for town homes where street width can be narrowed, lot size reduces, and hydrant spacing increased. However, these same trade-offs can and have been used in single family housing developments.

Additionally, most community building and fire officials will accept a sprinkler system as an alternate to egress windows from basement locations. Depending upon your situation, the installation of a sprinkler system would partially or wholly offset the cost of egress window installation.

At least thirteen insurance companies now provide a discount on their homeowner policy ranging from 5% to 15%. While this is becoming more widely known, the consumer still must shop on the open market to achieve the greatest savings<sup>5</sup>.

If one were to finance a \$3,500 system (average cost for a 2,000 sq. ft. home); at a 6.5% interest rate the additionally monthly cost in your mortgage would be just under \$5 per month.

**Operation:**

All sprinkler heads including residential sprinkler heads are activated by heat. Meaning that only those heads closest to the fire will activate. Most residential heads are designed to activate at 155 degrees. In close to 90% of fires in which a sprinkler head activates, a single head will control or extinguish the fire<sup>6</sup>.

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<sup>4</sup> Fire Protection Research Foundation, *Home Fire Sprinkler Cost Assessment*, 2008, <http://www.nfpa.org/assets/files/PDF/Research/FireSprinklerCostAssessment.pdf>

<sup>5</sup> Insurance Services Office, Inc., *Residential Sprinklers ISO Fact Sheet*, [www.isomitigation.com](http://www.isomitigation.com)

<sup>6</sup> NFPA, *Fast Facts About Home Fire Sprinklers*

Accidental discharge of sprinkler heads is rare. Factory Mutual, a nationally recognized testing laboratory reports the chance of an accidental discharge from a sprinkler is “the odds that rival winning the California State Lottery.” Water filled sprinkler heads and pipes are subject to freezing, however, no more or less than your domestic water supply. No evidence or data exists indicating more water damage due to frozen sprinkler pipes versus frozen water pipes.

Water damage from sprinklers is minimal given that one to two sprinklers typically control the fire. This equate to 15 to 20 gallons per minute. Comparatively, upon arrival the fire department will employ a minimum of two firefighting lines discharging 150 to 200 gallons per minute each or a total of 300 to 400 gallons of water per minute.

Unlike most other systems in your home; lawn sprinklers, heating and cooling and plumbing; there is virtually no maintenance for residential systems. A periodic check of the pressure gauge and ensuring the main valve is never turned off is typically all that is required.

In their 100+ year history, sprinklers have proven to be extremely effective in controlling and extinguishing fire. There are few other examples of technologies more effective in minimizing death and destruction as sprinklers.

Comparatively, traditional fire suppression is the least effective method of controlling fire and the United States, despite having some of the best training, equipment, and technology, ranks amongst the worst when compared to the world in fire property and death statistics.

#### **Fire Facts:**

According to the United States Fire Administration for the calendar year 2007;

- There were 399,000 structure fires in the United States
- 2,865 civilians were killed, a disproportionate number of them young children and elderly people.
- There were 13,600 civilian injuries.
- Over \$7.4 billion worth of property was destroyed.
- Over 100 firefighters were killed.
- According to a National Institute of Standards and Technology study, a family had 17 minutes to escape a residential fire in the 1970's<sup>7</sup>. Today, due to changes in construction, finishing materials, and the large amount of synthetics and plastics in the contents of the home, that time has been reduced to as few as 3 minutes<sup>8</sup>!

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<sup>7</sup> NIST, *Technical Note 1455*

<sup>8</sup> NIST, *Technical Note 1455*

**Policy Issues:**

Communities can significantly reduce their overall fire protection costs through the adoption and use of codes requiring the use of automatic sprinkler systems. A community using this approach transfers the responsibility directly to the property owner who receives the benefits of reduced insurance costs, a vastly improved response in the event of a fire, significantly reduced loss of personal property, and reduced infrastructure costs (taxes). In communities where sprinklers are an integral part of the overall fire protection plan, it is possible to save millions of dollars per year of property tax dollars via the use of a combination, volunteer, or smaller career department. Minnesota cities such as Bloomington, Plymouth, Woodbury Eden Prairie, and Maple Grove are just a few of many examples of cities who have been able to maintain predominantly volunteer departments at significant cost savings in large part due to sprinkler requirements.

Lightweight construction, specifically the dominate use of trusses and floor trusses are emerging as a firefighters greatest threat. First introduced about twenty years ago, they are almost exclusively used in all new home construction. Any fire that penetrates and impinges on the truss assembly almost immediately weakens the assembly and has resulted in a greater frequency of firefighter injuries and fatalities as they have fallen through the floor.

Numerous scientific studies have been completed on this issue with two of the more recent ones being; National Institute of Standards and Technology in January of 2007 and Uderwriters Laboratories in conjunction with Michigan State University in November of 2008. Both studies reported results of significant failure of the truss assembly when exposed to fire, sometimes within minutes of the fire starting<sup>9</sup>.

Opponents argue that smoke detectors are more than sufficient to protect a family in a residential occupancy. However, statistics again reveal that while smoke detectors have a marvelous record in having helped to reduce the number of deaths over the years, they simply are not adequate or effective in all cases. Disabled, disconnected and poorly maintained detectors are present in over 25% of residential structures. Furthermore, as mentioned earlier, the young and old are especially vulnerable and given the speed at which fire grows, smoke detector activation has proven to be inadequate.

Finally, the Insurance Services Office (ISO) just released a Residential Sprinkler ISO Fact Sheet stating:

- Premium credit of 13% for fully sprinklered homes and 8% for partial
- Leakage coverage is included in the basic policy, there is no extra charge.
- If the requirement of the International Residential Code (2009) for automatic sprinkler protection is removed by legislative or local ordinance the ISO Building Code Effectiveness Grading Schedule would not provide full recognition for adoption of the code.

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<sup>9</sup> NIST, *A Study of Metal Truss Plate Connectors When Exposed to Fire*  
UL, *Fire Test Report: Wood Truss Members with Steel Plate Connectors Used in Floor-Ceiling Assemblies*

**Summary:**

Installing residential sprinklers in newly constructed one and two family homes will have a profound impact on the fire service, local governments, and society.

An average homeowner will pay less than \$4,000 for the installation of the system and will, in most cases, recoup that investment through the combination of insurance savings, possible construction trade offs, and reduced property taxes.

The same homeowner will enjoy an immeasurably greater level of safety, with respect to fire, as compared to reliance on traditional fire suppression response which has proven time and time again to be woefully inadequate due to the speed at which fire grows.