CITY OF KIRKLAND
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MEMORANDUM

To: Kurt Triplett, City Manager

From: Joe Sanford, Fire Chief
Mark Jung, Fire Marshal

Date: May 19, 2016

Subject: RESIDENTIAL FIRE SPRINKLER SYSTEMS

RECOMMENDATION:

City Council receives an update on residential fire sprinklers systems (RFSS) and gives direction on additional action if desired.

BACKGROUND:

The Public Safety Committee has recently received presentations from the Fire Marshal regarding residential fire sprinkler systems. These presentations have reviewed the history of fire sprinkler regulations in Kirkland, addressed recent changes that have simplified RFSS, included conversations with a representative from the Master Builders Association, and included a brief discussion of insurance premium savings that could offset the cost of a RFSS over time. The Public Safety Committee has requested a presentation to the full council.

Home fires kill more than 2,500 people each year in the United States and cause more than 13,000 civilian injuries[1]. These fires take their toll disproportionally on vulnerable populations[2]. Children, older adults, people living with disabilities, and anyone not able to swiftly respond to the threat of a fire can be quickly be overcome by deadly smoke and heat. When alerted by a smoke alarm, occupants must react quickly to make sure everyone gets out safely. Unfortunately, smoke alarms do not always alert occupants and allow adequate time to escape[3]. Smoke alarms require relatively frequent maintenance and they are easily disabled (and not replaced) in response to nuisance alarms[4]. In contrast, fire sprinklers can contain and often fully extinguish a fire prior to arrival of the fire department. This gives occupants extra time to get out safely, and reduces fire loss by nearly 70%[5]. Home fire sprinklers are virtually maintenance free, impossible to disable without shutting off the water to the entire home, and only activate in response to the extreme heat of a fire. The combination of working smoke detectors and fire sprinklers in homes provides the highest degree of protection for families, their guests, and for firefighters should there be an emergency response.

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1 Characteristics of Home Fie Victims (NFPA 2014)
2 Characteristics of Home Fie Victims (NFPA 2014
3 Seventy percent of people killed in home fires were sleeping or trying to escape. Source: Characteristics of Home Fie Victims (NFPA 2014)
4 Smoke Alarms in U.S. Home Fires (NFPA 2015)
5 US Experience with Fire Sprinklers (NFPA 2013)

In June of 1988 the Kirkland City Council first moved to require installation of fire sprinklers. Chapter 21.33 of the Kirkland Municipal Code was established by ordinance; it required all new buildings greater than 12,000 square feet (SF) to have a fire sprinkler system. The move was made in response to a growing body of evidence that demonstrated sprinkler systems would save lives and reduce property loss. Furthermore, by creating the 12,000 SF threshold, an important community-risk-management boundary was established. Going forward, fire sprinklers would aid firefighters in controlling and extinguishing fires in large structures in Kirkland.

Through the intervening years, requirements in the Municipal Code were adjusted to include a greater number of structures and steps were taken to eliminate barriers to installation of residential fire sprinkler systems (Figure 1.)

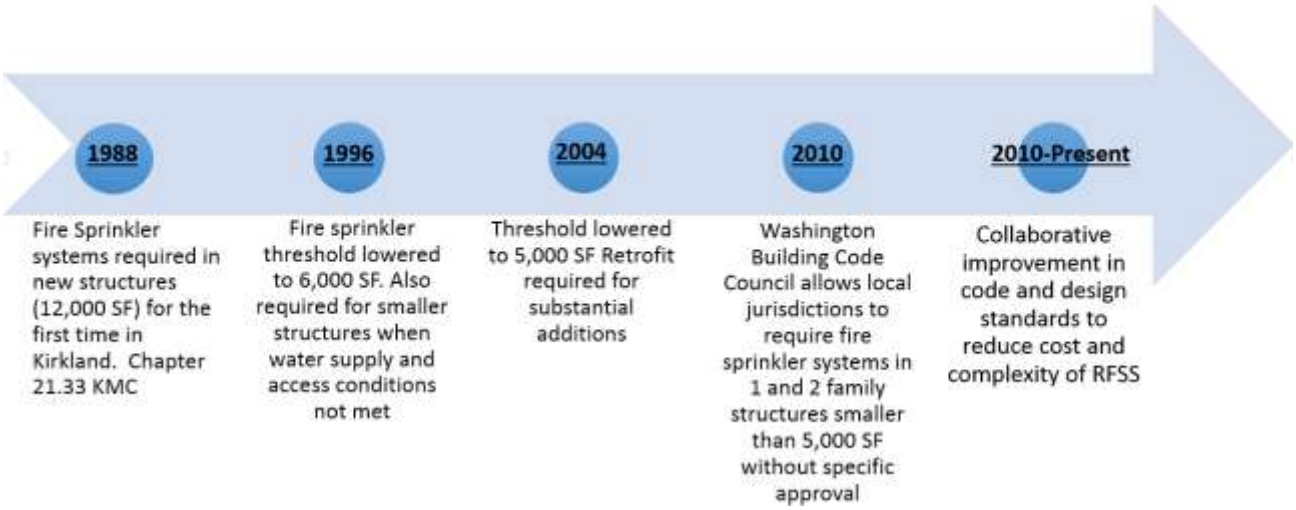


Figure 1.

<u>Current Requirements for Single Family Residential Fire Sprinkler Systems in Kirkland</u>:

- New construction of 5,000 square feet or larger (includes one and two-family houses)
- Limited access including steep slopes and narrow driveways greater than 150 feet
- Fire flow less than 1,000 gallons per minute or hydrant greater than 350 feet away
- Additions to existing structures where the resulting total area is 5,000 square feet or larger

Today, because many homes are being built larger, and because installing RFSS is often less expensive than making water-system or road improvements, a significant number (30%) of single-family residences are being constructed with residential fire sprinkler systems (Table 1.).

Table 1.

Single Family Residential Permits Issued in 2015		
RFSS Not Required		224 (70%)
RFSS Required		97 (30%)
RFSS Required for Size (5,000 SF)	51	
RFSS Required for access	30	
RFSS Required for Required Fire Flow	16	
Total		321

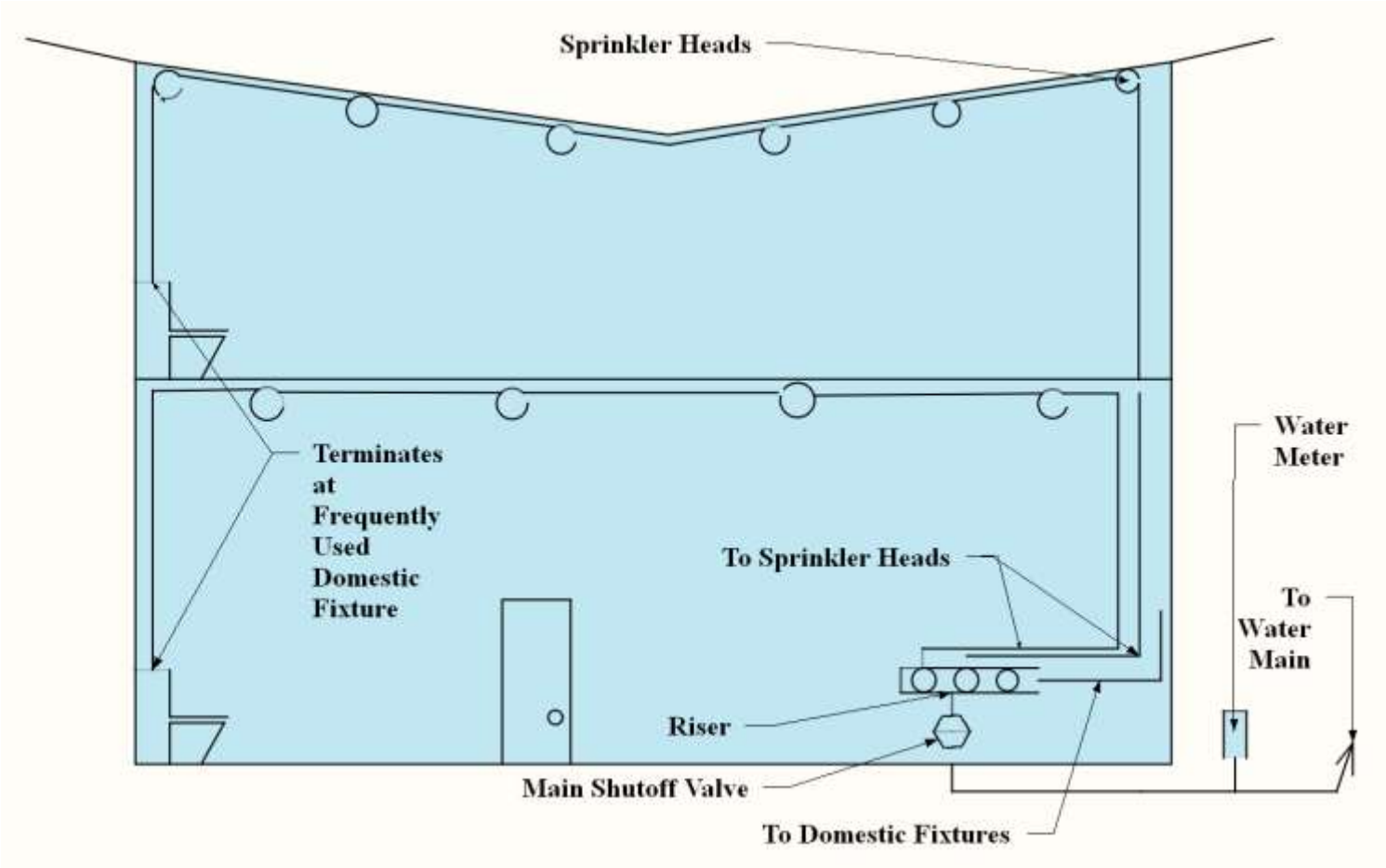
Barriers to acceptance of Residential Fire Sprinkler Systems:

As greater numbers of new one and two family homes were required to be constructed with fire sprinkler systems, cost, complexity, and annual maintenance requirements were quickly identified as barriers to acceptance. Since 2004, Kirkland has worked with the State of Washington, local water purveyors, builders, and other stakeholders to adopt codes and standards that simplify RFSS and address these barriers. A major advance occurred in 2010 when the State allowed local jurisdictions to require simplified systems in structures smaller than 5,000 SF without specific approval by the Building Code Council. These systems are an extension of the domestic plumbing system in a home and they can be installed by plumbers with minimal additional training. The result of these efforts between Kirkland staff and stakeholders is a residential fire sprinkler standard that allows simple reliable, and maintenance free fire sprinkler systems to be installed in Kirkland while eliminating unnecessary cost.

Features of Simplified Residential Fire Sprinkler Systems include:

- Simplified, flow-through or multipurpose, design is an extension of the domestic plumbing system
- Constructed from sprinkler-rated plastic pipe and quick-response residential sprinkler heads that are highly reliable and not expected to require maintenance except after activation due to fire.
- When properly installed these systems are no more subject to freezing or accidental activation than the domestic plumbing system.
- Annual inspection and testing is not required—if the domestic plumbing fixtures are working, the occupants can be reasonably assured that the RFSS will perform as designed in case of a fire.
- No requirement for outside audible and visual notification device (This feature is not required in the National Sprinkler Standard. Stakeholders requested it to be removed to simplify systems and reduce cost).
- No requirement for sprinkler heads in garage and unoccupied spaces (attics and crawl spaces). Also not required in the National Sprinkler Standard. Reduces cost while preserving life safety features of the fire sprinkler system.
- No requirement for connection to a fire alarm system or monitoring (keeps system simple and cost low).
- No requirement for a backflow prevention device (or associated annual testing). Flow-through system keeps water fresh and flowing away from the source.
- Fire department connection to the system is not allowed (Prevents backflow of water into the public water system when backflow prevention device is deleted. Keeps system simple and reduces cost).
- Cost of capital facility charge waived for larger water meter when required for RFSS (These fees eliminated because larger meter is required for RFSS, not domestic use. Lowers cost).

Sketch of Simplified Residential Fire Sprinkler System



While added cost continues to be the biggest barrier in a housing market where even the least expensive housing options are out of reach for many residents to purchase, all indications are that RFSS will continue to be less expensive to install as they become more common and gain acceptance. Simplified RFSS can now be installed, in Kirkland, for less than $1.50 per square foot or about $5,250 for a 3,500 square foot home. In a nationwide survey, the typical cost of installing a RFSS declined from $1.61 in 2008 to $1.35 in 2013[6], and in California, a state were all new homes are required to have RFSS, the typical cost was less than $1.00 per square foot. Further accelerating the return on investment, Kirkland benefits from our neighboring cities Redmond and Kenmore (cities requiring RFSS in all new homes) because they create a larger local market, increasing the supply of qualified residential sprinkler system designers and contractors. When offset by modest fire insurance savings (5% - 15% annually), RFSS may be able to break even over the expected life of a residence.

Reports from Kirkland plan reviewers suggest that an increasing number of developers are choosing to install RFSS rather than building more costly access improvements or investing in upgrades to the local water system. This suggests that the economic feasibility of installing RFSS is improving in some specific cases. Neighboring jurisdictions report similar experience where significant numbers of RFSS are required due to access and water-flow requirements (except in Redmond and Kenmore where all new residential structures are required to have

[6] Fire Protection Research Foundation (2013)

RFSS). Residential fire sprinkler requirements for neighboring jurisdictions are summarized in Table #2 below.

Table 2

Residential Fire Sprinkler Requirements in Neighboring Jurisdictions			
Jurisdiction	Fire Flow	Access	Size Threshold
Kirkland	Yes	Yes	5,000 SF
Bellevue	Yes	Yes	None
Redmond	N/A	N/A	All
Kenmore	N/A	N/A	All
Bothell	Yes	Yes	None
Woodinville	Yes	Yes	None
King County	Yes	Yes	10,000 SF

Range of Options for Changing Residential Fire Sprinkler Requirements

Both the Fire Strategic Plan (2012) and the Standards of Coverage Study (2013) identified expanding the number of residential fire sprinkler systems as an important step to improve the effectiveness of the Fire Department. Staff has identified four possible steps to improve fire safety in new single family homes; education, incentives, lowering the size threshold as opportunities to expand the number of homes covered by RFSS in Kirkland.

Education:
The Fire Department should continue to educate the public about the value of residential fire sprinklers and dispel enduring myths. While evidence overwhelmingly supports choosing fire sprinkler systems, consumers are not generally aware of the added safety offered by a sprinkler system or the advantages over smoke detectors alone. Additional education will increase interest and demand. The fire Department should use public information opportunities to share the message of how simple, reliable, and protective home fire sprinklers have become.

Incentives:
Incentives could be a strong motivator for developers and builders to include RFSS in more homes. For example, incentives like reduced building setbacks, when RFSS are installed, could allow a builder/developer to create additional value in a development project that would offset the cost of the RFSS. If desired by Council, the Fire Department will need to work extensively with the Planning and Building Department to work out a package of possible incentives. Also, reductions in fees could be considered where RFSS are installed. Fee reductions could be partially offset by future savings in protecting a more fire resilient Kirkland. In the future when fire sprinklers protect nearly all structures, fires will frequently be smaller, fewer firefighters will be required to extinguish these smaller fires, and firefighters will be able to return to available status more quickly.

Reducing the Size Threshold:
The size threshold for RFSS has remained at 5,000 SF for more than 10 years. In that time many of the barriers to acceptance have been addressed and the cost of installing RFSS has

been dramatically reduced. However, even at $1.00 per square foot, installation of RFSS represents a significant additional cost with a very long return on investment. Many builders oppose a mandate to install sprinklers in smaller houses, and additional education will be required before consumers will be consistently asking for sprinklers in their homes. Based on an analysis of permits issued in 2015, reducing the square footage threshold to 4,000 square feet would have added an additional 35 houses to those with RFSS. Table 3 shows how lowering the size threshold would have affected RFSS requirements for permits issued in 2015.

Table 3.

Single Family Residential Permits Issued in 2015			
	Size	Fire Flow or Access	Total Required
RFSS Required for Size (5,000 SF)	51 (16%)	46 (14%)	97 (30%)
RFSS Required for Size (4,000 SF)	86 (27%)		132 (68%)
RFSS Required for Size (3,000 SF)	198 (62%)		244 (76%)
Total (321)			

Requiring RSFF in all new Single Family Houses: The Fire Department has recommended this approach in the past and continues to support this change. This change could be coupled with education and incentives as mentioned above and/or be approved with a delayed implementation date (e.g. one year).

Conclusion and Next Steps:

The City of Kirkland has long understood the additional safety provided by fire sprinkler systems, and City leaders have progressively required more new buildings to have fire sprinklers installed. Since the last time the size threshold was reduced, many of the barriers to acceptance of residential fire sprinklers systems have been addressed, increasing the number of RFSS has been recommended in the Fire Department Strategic Plan, and the cost of installing RFSS has come down dramatically.

Staff is requesting direction from the City Council on how to proceed with efforts to increase the number of RFSS installed in new homes in Kirkland:

- Does City Council require additional information?
- Should staff prepare a package of development incentives for consideration?
- Should staff prepare a financial analysis of fee reductions as offsets to the cost of installing RFSS?
- Should staff prepare an ordinance, for consideration, that would reduce the size threshold where RFSS are required or require RFSS in all new single family homes?
- No additional action at this time

Attachments: *Fire Sprinkler Stakeholders Meeting Report, December 2013*
Kirkland City Council Memorandum: Fire Sprinklers, May 18, 2010.

City of Kirkland
Draft Report on the Residential Fire Sprinkler Stakeholders Meeting

December 20, 2013

Background

Since 2004, the Public Safety Committee of the City Council has occasionally discussed how to best prevent residential house fires. Fire and Building staff recommended a residential fire sprinkler ordinance for all new single family homes. The issue was taken to the full Council in 2010 but not approved because the economic downturn was having significant impacts on the home building industry. On May 7th 2013, Council authorized Fire and Building staff to host a stakeholders meeting to discuss the pros and cons of a fire sprinkler ordinance.

Stakeholder Meeting

On September 11, 2013, Fire and Building Department staff hosted a stakeholder meeting to identify the pros and cons of an ordinance requiring the installation for fire sprinklers in all new single family homes. This report documents the issues that were raised in the meeting so the City Council can decide whether it wants to request staff to draft a fire sprinkler ordinance that Council can take action on.

The following stakeholders attended the meeting.

Name	Company	Email	Telephone
Builders			
Josh Lysens	Merit Homes	josh@merithomesinc.com	425-444-4041
Greg Griffis	Merit Homes	greg@merithomesinc.com	425-444-4041
Joe Herr	Burnstead	Joe@burnstead.com	425-818-7467
Aaron Hollingbery	Toll Brothers	ahollingbery@camwest.com	425-825-1955 x125
Tim Winner	West Tier	tim@westtier.com	425-486-9825
David Hoffman	Master Builders	dhoffman@mbaks.com	206-605-3836
Fire Sprinkler Contractors/Suppliers			
Chad Gorney	United Plumbing	chad@unitedplumbing.com	425-877-9701
Kelly Fahey	PacWest Sales Inc.	kelly@pacwestsalesinc	425-493-9680
Water District/Department			
Al Nelson	Northshore Water	anelson@nud.net	425-398-4428
Steve Ensminger	City of Kirkland	sensminger @kirklandwa.gov	425-587-3905
Fire Marshals			
Jeff LaFlam	Northshore Fire	jlaflam@northshorefire.com	425-354-1741
Dave Walker	City of Kirkland	dwalker@kirklandwa.gov	425-587-3623
Building Officials			
Tom Phillips	City of Kirkland	tphillips@kirklandwa.gov	425-587-3604
Bryan Hampson	City of Kenmore	bhampson@kenmorewa.gov	425-398-8900

Pros and Cons of Fire Sprinklers

The stakeholders discussed the pros and cons of residential fire sprinklers, resulting in the following list of pros and cons.

Pros

Saves lives and property. Fire Sprinklers have been shown to extinguish house fires early enough to eliminate the threat to life and minimizing property damage.

Building and Fire Code provisions. There are several current code requirements that are reduced or waived if fire sprinklers are installed:

- Exterior walls must have a one hour fire rating if between five and three feet from a property line. This requirement is waived if the house is equipped with fire sprinklers. This is a common problem where the house is five feet from the property line, but a bay window or other similar bump out is closer to the property line, requiring fire resistive construction.
- If a house is equipped with a residential fire sprinkler the distance to a fire hydrant may be extended from 300 feet to 600 feet. If all houses within a development are sprinklered the need for hydrants is lessened accordingly.
- Access must be provided around roof mounted solar panels to allow firefighters to vent the roof in the event of a fire. This requirement restricts how many panels can be placed on a roof. This requirement is waived if the house has fire sprinklers. This provision is more likely to be used by a homeowner rather than a homebuilder.

Cons

Cost. The installation of a fire sprinkler system in a 2,700 to 3,000 SF house costs $5,200. When overhead and loan interest is added, the cost is $7,200. This additional cost make push a house out of the price range of a perspective buyer.

Other life/safety options. There are numerous other things that can be done to improve life/safety issues in homes that are cheaper and more effective that fire sprinklers.

Unfair to plats currently be developed. There are a number of plats currently under development. It would be unfair to impose an additional cost on property that was purchased prior to the effective date fire sprinkler ordinance.

Other issues raised by stakeholders

At the stakeholders meeting, the following other of issues were raised.

1. Most injuries in homes are not fire related. It would be more cost effective to reduce tripping and falling hazards by requiring safer stairs and guardrails.

2. It would be better to provided incentives to builders for the installation of fire sprinklers and let the builders decide if they want to take advantage of those incentives.

3. Requiring fire sprinklers only in new homes will have little impact in the whole housing stock in Kirkland. There are approximately 20,000 existing houses and in Kirkland and only 150 to 300 new houses are built every year.

4. Kirkland's water department needs to follow the same installation and upsizing policies as the Northshore Utility District (NUD).

5. Question to the Fire and Building staff. How many house fires does Kirkland have each year? How many occur in homes built since 1991 when the current smoke alarms requirements went into effect?

Staff response: In the last year Kirkland has had 42 active structure fires. 21 fires occurred in single family residences, 15 occurred in multifamily residences, 6 occurred in other structures such as schools, hospitals, hotels and restaurants. Total direct dollar loss was 1.1 million in structures. The 21 fires in single family residences showed a structural dollar loss of $841,000. The 15 fires in multifamily residential homes totaled $180,000 in structural losses. In the last year, 2 occupants in single family residences suffered significant injuries from fires. 2 Firefighters also suffered moderate injuries. There have been no recent deaths directly attributable to fires in single family structures. A report that lists the age of buildings involved in fires is not currently available to us.

Financial Mitigation

Fire and Building staff acknowledge the additional cost to the builder and to the consumer for the installation of a fire sprinkler system. During the stakeholders meeting Fire and Building staff suggested several code changes that will save builders money when developing property. Not all of the mitigation items would apply to all houses, but in some cases the savings to the builder will more than off-set the costs of fire sprinklers. Fire and Building staff believe that when the savings are averaged out across the city, it will mitigate the cost of fire sprinklers.

Denser Development Allowed. The development of short plats can be more dense without compromising fire safety when all of the homes are provided with fire sprinklers. The City's Director of Planning and Community Development has agreed to support a change in the Zoning Code that will allow developers to count the access easement as part of each building lot. However, the impervious area of the access road would not count as lot coverage. This could allow for slightly larger houses and in some cases the creation of an additional lot in the short plat.

Reduction in Fire access road width. Fire department access is required for all houses. These roads are currently required to be 20 feet in width. Fire and Building staff will propose an ordinance reducing the width to 16 feet when all houses served by the access road are provided with fire sprinklers.

Eliminate Sprinkler Alarm Bell. Currently City policy requires the installation of an alarm bell mounted outside the house to be activated when a fire sprinkler head is activated. Staff is proposing to eliminate this requirement and make the alarm be optional.

Fire Sprinkle Cost Reductions

Kirkland, like Northshore Utility District has already taken measures to reduce the cost of fire sprinklers, such as:

- Not requiring the sprinkler system to be supplied from a separate water meter.
- Not requiring a backflow preventer when the sprinkler system is combined with the plumbing system.
- Not requiring water meter upsizing charges when the upsizing is only required because of the fire sprinkler system.

Conclusion

The stakeholders meeting provided a good forum for Fire and Building staff to better understand the concerns of the home builders. We all agreed that fire sprinklers save lives and property but there was disagreement whether fires are a significant problem in houses constructed in the last 22 years and whether fire sprinklers are the most cost effective way to reduce safety hazards.

The builders would prefer that fire sprinklers not be required, as it adds more regulation and costs to the house building process. The builders did indicate that if a fire sprinkler ordinance is adopted, there should be provisions to mitigate the installation costs and that any new ordinance should not affect subdivisions that were created prior to the fire sprinkler requirement.

CITY OF KIRKLAND
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MEMORANDUM

To: Marilynne Beard, Interim City Manager

From: Grace Steuart, Fire Marshal
Tom Phillips, Building Services Manager

Date: May 6, 2010

Subject: Possible Adoption of Requirement for Fire Sprinklers in New Single Family Homes

RECOMMENDATION:

That City Council give direction to the Fire/Building Department to move forward with the adoption of Appendix S of the International Residential Code, thus requiring fire sprinklers in all new single family homes effective July 1, 2010.

BACKGROUND:

In July of this year, Kirkland will be adopting the new International Codes with state and local amendments. Since 2007, the Public Safety Committee has discussed whether to require fire sprinklers in all new single family homes. The general consensus has been that requiring sprinklers would provide a high degree of fire safety for our community. This may be accomplished by adopting Appendix S of the International Residential Code, which would become effective on July 1, 2010.

At the Public Safety Committee on February 18, 2010, staff was directed to bring this issue to a regular Council meeting. In March 2010, a memo was placed in the Council's reading file, which provided information regarding the advantages of installing fire sprinklers in all new single family homes. This issue is now on the agenda for May 18, 2010.

Facts about Sprinklers

- **National statistics show that 82 percent of fire deaths occur in homes.** According to the National Fire Protection Association, of the 3,320 civilian fire deaths that occurred in 2008, 2,780 died in residential fires; and of those, 2,365 occurred in one and two-family dwellings. (These statistics have been replicated

in those jurisdictions that have required sprinklers for several years, including Prince George's County, Maryland.)

- **Viable escape times in a typical home fire have dropped from 17 minutes to approximately 3 minutes in the last 30 years**, due to a shift in contents from natural products and fibers to synthetic materials. The primary fuel load available in the early stages of a residential fire is the contents (i.e. furnishings, etc.) inside the house, not the structure of the house itself.

- **A combination of smoke detectors AND residential sprinkler systems doubles residential fire survival rates.** Research indicates that installing smoke detectors alone improves survival rates for residential fires by 50%; however, installing smoke detectors AND a residential fire sprinkler system improves survival rates by **97%**.

- **When fires do occur in homes equipped with automatic fire sprinkler systems, property losses are much lower.** Based on a 15 year study from the City of Scottsdale, Arizona, the average loss for a fire incident in a sprinklered building was over 90% less than the average loss in a structure in which automatic sprinklers were not present.

- **Sprinklers help save firefighters' lives**. According to recent NFPA studies:
    - A great number of residential occupancies are now being built using lightweight construction materials.
    - Although these materials reduce construction costs and have consistently demonstrated equivalent or even superior quality under non-fire conditions, the same cannot be said when these materials are exposed to fire loading during a residential structure fire.
    - The result is progressive structural collapse due to the failure of these lightweight structures, resulting in firefighter injuries and death.

- **Sprinklers are good for the environment.** When a fire occurs in a sprinklered versus a non-sprinklered home:
    - The release of greenhouse gases (CO2) are reduced
    - The amount of water usage is reduced
    - The amount of fire damage is less, resulting in less material being sent to local landfills

- **Sprinklers save City resources by reducing costs associated with fire suppression and investigation activities.** The initial response to any structure fire would be identical, however:
    - The resources dedicated to the unsprinklered structure fire is often hours, taking engines out of service thus extending response times for any other subsequent emergencies

- In the case of a sprinklered structure, all but a single fire engine would be returned to service in a matter of minutes
- Subsequent fire investigation costs in a sprinklered building would be reduced significantly. Since the structure would be less damaged, evidence would be preserved, fires could be investigated more quickly, using fewer investigators, less manpower, and less equipment

- **Other common questions regarding sprinklers**
  - **Won't the presence of automatic fire sprinklers increase the risk of water damage?** When properly installed, the presence of automatic fire sprinklers in a home pose no greater risk than the potable water piping already present in the home. In fact piping for automatic fire sprinkler systems are required to meet a higher standard than conventional potable water piping.
  - **Will I be required to sprinkler the whole house?** The 13D standard specifically allows sprinkler protection to be omitted in non-living areas (garages, attics and crawlspaces)

<u>Facts about Kirkland</u>

- **Flashover often occurs before the Fire Department arrives.** Current average response times in Kirkland are between 5.28 and 5.88 minutes; adding to this the time it takes for a fire to be noticed and an alarm to be called in to 9-1-1, this is well above the 3 minute time frame during which "viable escape" is estimated to be possible from a burning home.

- **Houses are larger and closer together, increasing potential for fire spread**. Land costs in Kirkland continue to increase and lot sizes decrease, so homes are closer together, thus creating a larger potential for a fire spreading to neighboring properties

- **We are approaching this as a life safety issue for residential occupancies only**
  - The threshold for buildings other than residential would remain at 5,000 square feet.
  - Smaller commercial or industrial buildings (such as coffee stands, storage buildings, carports, etc) would not be affected.

- **Cost**
  - **The average cost to sprinkler a home in Kirkland is approximately $2 per square foot** (this figure is based on discussions with local sprinkler contractors for a standard 13D system); the average size of a house in Kirkland (based on 2007-2008 statistics) is 4,300 square feet.

Thus, sprinkler cost for an average new home in Kirkland is approximately $8,600, or about 1% of the purchase price of the home.

- **Kirkland has among the most reasonable permit fees in our area** ($180-$240 depending upon size of house; this fee includes all required inspections)
- **The typical residential system is designed to use the domestic meter**, which is slightly upsized to provide enough capacity for the sprinklers. The customer is not charged for the larger meter if the upsizing is solely for sprinklers.
- **Multi-purpose flow-through type systems are also allowed.** These systems integrate with a home's plumbing system, thus eliminating the need for and added expense of a backflow prevention device.

Summary

Based on the above information, staff recommends that fire sprinklers be required in all new residential construction. We now need the Council's instructions as to whether we should go forward with including residential fire sprinklers during the regular Code adoption process.

Attachments: US Fire Administration pamphlet: *Home Fire Protection – Residential Fire Sprinkler Systems Save Lives*
NFPA Fire Sprinkler Initiative study: *Home Fire Sprinklers - Good for the Environment*
Home Fire Sprinkler Coalition publication: *Benefits of Residential Fire Sprinklers: Prince George's County 15-year History with its Single family Residential Dwelling Fire Sprinkler Ordinance*