An Overview of AWWA's Guidance Report on Managing the Implementation of Residential Fire Sprinklers in Community Water Systems

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WATER EFFICIENCY CONSULTING

AWWA Technical & Educational Council Project

Guidance for Water Utilities on Managing the Implementation of Residential Fire Sprinkler Systems in Community Water Systems

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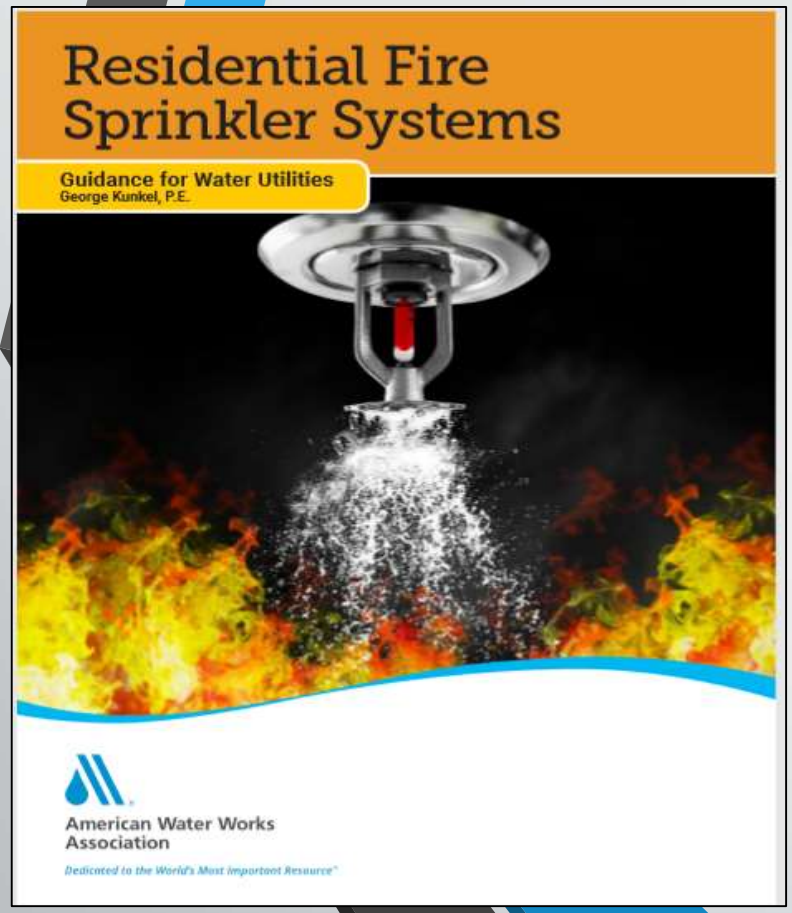
The Report –access it for free



Purpose: provide water utilities with information on residential fire sprinkler systems (RFSS) and guide them in setting their own policies and procedures for the design, installation, and operation of their water distribution system supporting RFSS use.

Google "AWWA Fire Sprinkler Report"

https://www.awwa.org/AWWA-Articles/managing-the-growing-use-of-residential-fire-sprinkler-systems

Fire Protection History: a Public or Private Service?

- Benjamin Franklin founded the Union Fire Company in Philadelphia in 1736
- Many fire companies existed and aligned with insurance companies; giving preference for fire extinguishing to ***subscribers*** of the insurance company
- The "fire mark" was mounted to the building so fire fighters would know who subscribed to the insurance company

Source: HankeringforHistory.com

Benjamin Franklin: Firefighter
Source: thehistoryblog.com

Water was carried by hand from supplies from private wells or from Philadelphia's two major rivers

"Fire Mark" for the Philadelphia Contributionship
Source: philly.curbed.com

Community Water Systems and Fire Protection

- Needed to protect against great conflagrations
- Water inundation: primary form of fire suppression; water systems were designed with fire flow capacity

Great Chicago Fire of 1871
Source: Wikipedia

First Fire Sprinkler Systems

- First system: Theatre Royal, London, 1812.
- First automatic sprinkler system: Phillip Pratt, 1870's
- Standard design by Henry Parmalee and Frederick Grinnell by the 1890's.

  Source: Koorsen

For many years fire sprinklers existed primarily in industrial, commercial and multi-family buildings

Fire sprinkler control valve assembly
Source: Wikipedia

Fire Protection in the Residential Sector

- "Residential" is the leading property type for fire deaths, fire injuries, and fire dollar loss.
- National Fire Protection Association's (NFPA) *Home Structures Fire Report* (2017): an estimated 358,500 home fires per year from 2011-2015

Average annual fire statistics of:

- **2,510 civilian fire deaths, or 93% of all civilian structure fire deaths,**
- **12,300 civilian fire injuries, or 87% of all civilian structure fire injuries, and**
- **$6.7 billion in direct damage, or 68% of total direct damage in structure fires.**

Disposition of Residential Fire Sprinklers by US State

National·Fire·Protection·Association—Fire·Sprinkler·Initiative¤	
States·prohibiting·statewide·and·new,·local·adoptions·of·fire·sprinkler·requirements·(31)¶ *(*Note:·In·MA·and·NY,·homes·of·a·certain·size·must·be·sprinklered)¤*	AK,·AL,·AZ,·CT,·DE,·GA,·HI,·ID,·IN,·KS,·KY,·LA,·MA,·MI,·MN,·MS,·MO,·NH,·NJ,·NY,·NC,·ND,·OH,·PA,·SC,·SD,·TX,·UT,·VA,·WV,·WI¤
States·allowing·local·adoptions·of·sprinkler·requirements·for·new·homes·(17)¤	AR,·CO,·FL,·IL,·IA,·ME,·MT,·NE,·NV,·NM,·OK,·OR,·RI,·TN,·VT,·WA,·WY¤
States/regions·requiring·fire·sprinklers·in·new,·one-·and·two-family·homes·(2·states·and·District·of·Columbia)¤	CA,·MD,·Washington,·D.C.¤
http://www.firesprinklerinitiative.org/legislation/·sprinkler-requirements-by-state.aspx[3]¶ Accessed·September·12,·2017¤	

- Promoting RFSS: fire safety and protection community
- Challenging RFSS: home building community

Scottsdale, AZ
the Longest Running RFSS Community in the USA

- Over 50,000 residential buildings are now sprinklered
- Only one fire death in RFSS property in +30 years (Over one dozen deaths in non-RFSS buildings)
- Registered $2,166 average property loss per fire incident in sprinklered properties, compared to $45,000 average loss per non-sprinkled building fire
- Property damage of $7.31 per capita vs. $27 per capita for US properties
- Fire hydrant spacing increased from 660 feet to 1,200 feet
- Removed requirement for 360-degree access to allow more developed property. Increased building development density by 4%

RFSS Guidance to Water Utilities:

- Codes, Manuals, Standards
- Service Line configuration and sizing
- Metering
- Water quality assurance
- Permitting
- Water Rates and Charges
- *Stakeholder Coordination is Key! Water utility, fire, code, fire system designers, customers, elected officials, media, insurers*

AWWA Policy Statement on Residential Fire Sprinklers

Residential·Fire·Sprinklers¶

AWWA·recognizes·the·increasing·use·of·residential·fire·sprinkler·systems·and·recommends·that·they·be·designed·by·licensed·or·accredited·professionals;·approved·by·the·appropriate·local·agencies·(water·utility,·fire·department·and/or·other·approval·agency)·to·ensure·adequate·flow,·pressure,·and·backflow·protection;·and·installed·by·licensed·fire·sprinkler·contractors·or·properly·trained·personnel.¶

Adopted·by·the·Board·of·Directors·February·4,·1996,·reaffirmed·June·13,·2004,·revised·January·17,·2010.·Revised·June·8,·2014.¶

Codes, Standards, Manuals

International Codes: International Code Council (ICC) adopted amendment to 2009 International Residential Code (IRC), mandating all new 1- and 2-family residential dwellings be equipped with RFSS. The International Fire Code (IFC) also requires sprinkler protection for all residential occupancies.

Uniform Construction Codes within the USA: CA, MD and DC maintain a uniform construction code based upon the IRC and have a RFSS requirement.

Individual Jurisdictions within the USA: Many individual jurisdictions (cities, towns, municipalities) have adopted local RFSS ordinances. But a majority of states prohibit local jurisdictions from adopting RFSS ordinances. NY, MA have RFSS requirements for certain buildings.

National Fire Protection Association (NFPA) Sprinkler System Design Standards

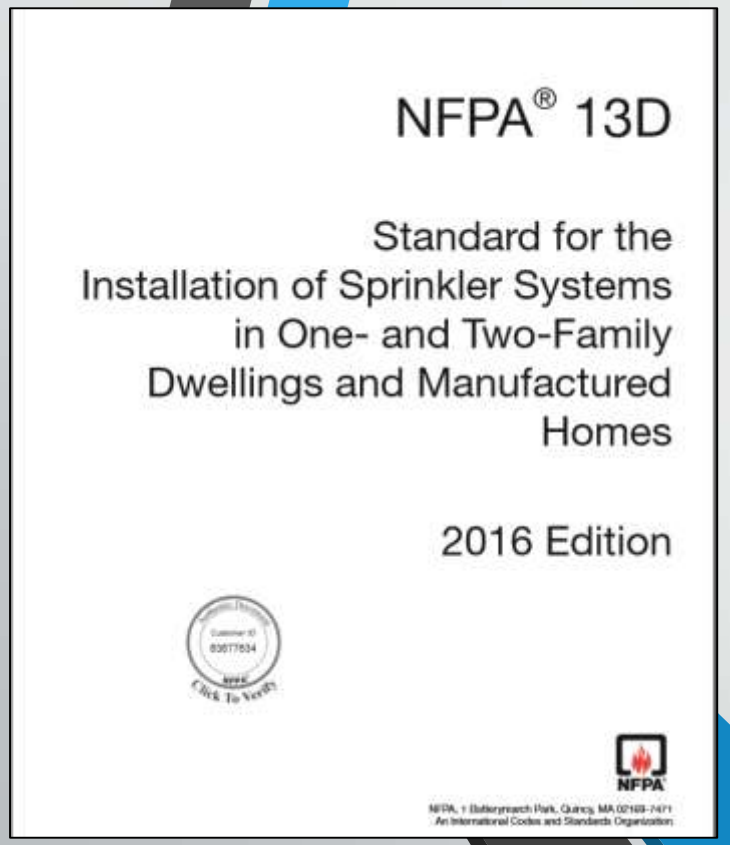
NFPA 13 Standard: ***Standard for the Installation of Sprinkler Systems.*** Life safety and protection to the facility and assets. Fire protection throughout the entire building, including unoccupied spaces.

NFPA 13R Standard: ***Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies.*** Life safety and moderate building protection. Allows occupants to escape in event of fire. Sprinkler not needed for concealed spaces. Applies to a building of no more than four stories in height.

NFPA 13D Standard: ***Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*****.** Minimum requirements standard to provide ***life safety protection, <u>not</u> property protection***. Certain building spaces can go un-sprinklered. Needed water discharge is least of all standards: 13 gpm per sprinkler head; available for min 7-10 minutes at a minimum of 7 psi.

NFPA also publishes several other codes that comment on fire sprinkler use.

NFPA 13D Standard – Distinction Among the 3 Standards



- Annual sprinkler system certification is <u>not</u> required
- Audible alarm is <u>not</u> required (if home is equipped with smoke detectors)
- Occurs as separate fire and domestic lines in some jurisdictions, or as a single line supplying both fire and domestic flows in others (NFPA 13 and 13R systems are always separate lines)
- Backflow protection typically need <u>not</u> be required on domestic lines and lines supplying both fire and domestic flow, particularly those with a *passive purge (fire line connection to a toilet tank)* configuration.
- Backflow protection of separate fire lines <u>is</u> typically required

In the NFPA 13D environment for RFSS, a burden falls upon the homeowner to ensure systems (fire, backflow protection) are in working order. Annual system inspections and fees may be required.

AWWA Guidance for Water Supply and Fire Protection

Manual M31 – *Distribution System Requirements for Fire Protection*: guidance on traditional water utility fire protection, and a chapter on RFSS.

Manual M22 – *Sizing Water Service Lines and Meters*: guidance on determining expected water demands in customer buildings that are used to properly size and specify water service lines and water meters. Brief discussion on RFSS.

Manual M14 - *Recommended Practice for Backflow Prevention and Cross Connection Control*: information on backflow prevention, with recommended backflow prevention practice for residential, one- and two-family dwelling fire protection systems. Defines different levels of building hazards that may exist.

Manual M1 – *Principles of Water Rates, Fees, and Charges*. guidance on setting fees and charges for service lines providing fire protection service. Current edition includes specific guidance on setting rates for sprinklered buildings, including those designed under the NFPA 13D Standard.

AWWA Guidance for Water Meters in the RFSS Environment

AWWA Standard C714-13 – *Cold-Water Meters for Residential Fire Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*: sets minimum manufacturing and performance requirements for water meters used for RFSS. Not prescriptive in defining the use of water meters on fire supply lines.

Note: The fire protection community prefers no meter on the fire sprinkler supply line.

It is up to the utility to determine:

1. if a water meter is required on the fire supply line
2. the specific features and specifications of the water meter.

AWWA Guidance for Water Meters in the RFSS Environment

- Consider requiring an affidavit be provided by the meter manufacturer confirming that their water meter will continue to deliver water under a **"locked measuring element"** condition.
- The NFPA 13D Standard does not require that water meters used in RFSS applications be listed under the provisions of Underwriters Laboratories, Inc. (UL), Factory Mutual Company (FM), or other insurance underwriting agency. **This is a utility-specific decision.**
- **Per NFPA 13D and AWWA M22, standard water meters used in domestic water supply applications are acceptable for use in RFSS applications. It is up to the water utility to require, or not require, that any of the provisions of the AWWA C714-13 be used.**

Flowrate limits of the recommended flow ranges of positive displacement meters*

Size	Low Flow, gal/min	High Flow, gal/min
5/8-inch	0.5	20.0
¾-inch	0.75	30.0
1-inch	1.0	50.0

*Gathered from standard manufacturer product literature

(solid state meters are also used in RFSS applications)

Some recent research suggests that water meters can sustain a brief period of flow higher than the rated max

Customer Service Line Configurations

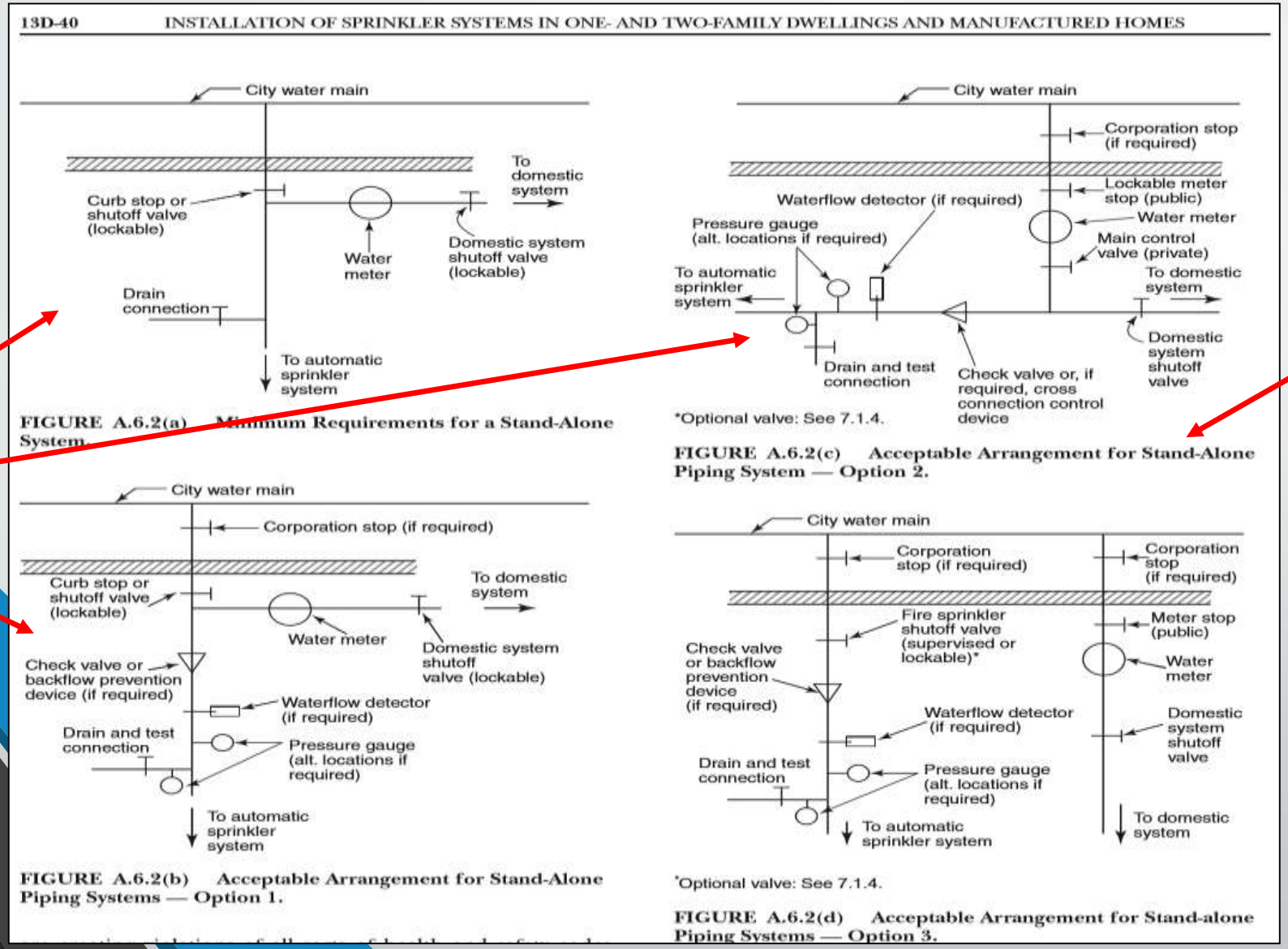
Historically for Water Utilities:

- Domestic water supply – separately tapped line from the water main supplying domestic use fixtures in the building with distinct rates/charges
- Fire supply – larger connections that are separately tapped and supply fire sprinkler heads usually with a fixed, or standby, charge

Now:

- RFSS – can be a “hybrid” of the above two conditions – this challenges existing policy structures for many utilities

Stand Alone Service Line Configurations



Stand-alone – dedicated fire line to sprinkler heads

Three options include a single tapping into the water main for a line that provides both domestic and fire supply.

A fourth option features separate lines: one for domestic service and one for fire

Source: NFPA 13D Standard

Multi-purpose Service Line Configurations

Multi-purpose – simultaneously supplies both domestic fixtures and fire sprinkler heads from the same piping.

The multipurpose configuration has an advantage of better maintaining water quality by avoiding stagnation

Tree – domestic supply lines branch off of single primary supply line from water main. The primary supply extends into the building to supply sprinkler heads from dead-ended branch piping off of the primary supply pipe

Looped – domestic supply lines branch off of single primary supply line from water main. The primary supply extends into the building and forms a loop of piping that supplies sprinkler heads.

Network – a unique design where each sprinkler head can be supplied water from a minimum of three different paths. (Now uncommon because the fittings needed to establish three paths to sprinklers are no longer being manufactured.)

Passive purge: includes piping that serves a single, remote toilet in addition to the fire sprinklers.

Maintaining Water Quality

Water quality can deteriorate in stagnant fire lines

Two controls can be considered:

1) select a piping configuration that minimizes the stagnation of water: multi-purpose, passive purge
2) provide acceptable backflow protection if the piping configuration results in stagnant water
   - Need to factor backflow installation/maintenance into the decision
   - ***Hundreds or thousands of backflow devices will exist in the residential sector, and must be maintained by homeowners***

This is a foremost and highly important consideration in the RFSS design

Service Discontinuance

- In typical RFSS designs, halting water service also halts supply to the RFSS. This can be acceptable because:
  - Most buildings need water service to maintain the Certificate of Occupancy. Buildings with discontinued water service should be vacated.
  - RFSS exist for life safety; these systems are not required to function in unoccupied buildings.
- Realistically, discontinuance to fire lines generates concern with fire/code officials.
- Be proactive in coordinating service discontinuance policy with fire/code officials

AWWA Policy Statement

Discontinuance of Water Service for Nonpayment

AWWA realizes the importance of the nondiscriminatory billing and collection procedures to ensure that each customer pays for the services rendered by the utility under its rates and tariffs. Failure on the part of the customer to pay a water bill necessitates that other customers bear the burden of paying for the service.

AWWA recognizes that certain circumstances may require some flexibility because water service is a necessity in maintaining sanitary conditions in the home and may be required for life-sustaining equipment. It may also be a vital part of industrial and commercial operations. Discontinuance of water service for nonpayment is considered a final phase of a collection procedure and should be instituted with sufficient notification when all other reasonable alternatives have been exhausted.

Adopted by the Board of Directors Jan. 28, 1978, revised Jan. 31, 1982, reaffirmed on Jan. 27, 1991, and revised June 17, 2001, revised Jan. 16, 2005, reaffirmed by the Board of Directors Jan. 20, 2013.

Hydraulic Requirements and Line Sizing

- NFPA 13D: minimum operating pressure of 7 psi at sprinkler heads. Sprinkler designers should obtain the static pressure from the utility water distribution system.
- Typical demand per sprinkler is 13 gpm. Design assumes 2 sprinklers activated simultaneously. **Typical max flow is 26-35 gpm**. For homes with landscape irrigation, max flow may be up to 40 gpm.
- NFPA 13D: min water main size of 4-inch diameter. Service line size depends on the specified flowrate, available pressure, & expected head loss, <u>but must be at least ¾-inch diameter</u>.

Piping Materials

PEX in manifold

Copper - Traditional

CPVC – common with RFSS

(Chlorinated Polyvinyl Chloride)

PEX – very common with RFSS

(Cross-linked Polyethylene)

Typical Stand-alone configuration

Rates and Charges

Philadelphia Water Department

Established a intermediate fixed rate for RFSS

Service: Monthly Charges

METER SIZE (INCHES)	METER CODE	MONTHLY WATER CHARGE	MONTHLY SEWER CHARGE*	COMBINED MONTHLY CHARGE*
5/8	R	$6.58	$7.17	$13.75
3/4	Z	$7.54	$8.76	$16.30
1	Q	$9.90	$12.34	$22.24
1 - 1/2	P	$15.13	$20.68	$35.81
2	X	$22.25	$31.41	$53.66
3	O	$37.91	$55.65	$93.56
4	W	$66.31	$95.42	$161.73
6	N	$127.93	$186.85	$314.78
8	V	$199.07	$294.17	$493.24
10	E	$289.09	$425.36	$714.45
12	T	$502.82	$763.12	$1,265.94

*Does not include stormwater charges.

Service

Information for homes with residential fire sprinkler systems

Water service charges for customers with residential fire services are $2.18 higher for all meter sizes although the sewer service charges are the same as a residential customer with a 5/8 inch meter without a fire service. Please see the chart below if you have a residential fire service.

METER SIZE (INCHES)	METER CODE	MONTHLY WATER CHARGE	MONTHLY SEWER CHARGE	COMBINED MONTHLY CHARGE
3/4	Z	$9.71	$7.17	$16.88
1	Q	$12.07	$7.17	$19.24
1 - 1/2	P	$17.30	$7.17	$24.47
2	X	$24.42	$7.17	$31.59

Considerations include:

- Connection charges
- Meter sizing costs
- Fixed charges – often based upon meter size, may take into account sewer/other charges also
- Other charges
- **Concern**: RFSS may be a "hybrid" and need a new class of service in your rate structure.

Coordination is Key

The Implementation of RFSS impacts multiple stakeholders:

- ***Water utility staff***
- ***Fire Departments***
- ***Code Officials***
- ***Fire Protection System Designers & Installers***
- ***Contractors: Builders, Plumbing***
- ***Customers***
- ***Insurers***
- ***Elected officials***
- ***Media***

Additional Resource - videos

Home Fire Sprinkler Coalition

- Guide
- Videos (available online and via YouTube©)

https://homefiresprinkler.org/water-supply-video/

Summary

Water utilities can obtain valuable guidance in the AWWA Report:

Guidance for Water Utilities on Managing the Implementation of Residential Fire Sprinkler Systems in Community Water Systems

Google "AWWA Fire Sprinkler Report"

For a copy of this presentation, email me at:

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