Fire Sprinkler System Reliability, Arguments Regarding the Use of CPVC

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Consult & Design, Inc.

Your speaker today

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Why is this Important?

- If our industry is going to push the value of sprinklers in one- and two-family dwellings, the industry cannot afford to have water loss failures that undermine the value of the protection.
- Many losses I see are preventable.

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CPVC and Non-USP Glycerin

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2012/02/21


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Background

- FFCDI specifying FPE's
- FFCDI investigating losses
- Why is this important?
- Risk and Reliability of the use of nonmetallic piping relative to its increased use for residential (and commercial) sprinkler systems.
- Current FPRF IT&M project

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Background

- NFPA 13 has allowed the use of nonmetallic piping since 1984 – first polybutylene (PB) and then chlorinated polyvinyl chloride (CPVC) in 1986.
- Manufactured to ASTM F442 and specifically listed for use in automatic sprinkler systems.
- NFPA 13 requires the manufacturer's installation requirements be followed.

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VIP

- This presentation is not intended to disparage CPVC! IMO it is a good product when it is properly specified, installed, and maintained.
- **However**, the risk of using the product with environmental and human factors needs to be evaluated thoroughly before it is specified or installed.

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Background

- Some of the listing criteria:
  - Limited use in NFPA 13D, 13R, and 13 (light hazard)
  - Wet and dry systems…
  - Joined with listed fittings or materials

Harvel - 2012

- GF HARVEL CPVC Fire Sprinkler Products are UL Listed and C-UL Listed by Underwriters Laboratories Inc. for use in:
  - Light Hazard occupancies as defined in the Standard for Installation of Sprinkler systems, NFPA 13.
  - Residential occupancies up to and including four stories in height as defined by NFPA 13R.
  - Residential occupancies as defined in the Standard for Sprinkler Systems in One and Two Family Dwellings, NFPA 13D.
  - Installation of private fire service mains and their appurtenances, NFPA 24.

Harvel

- GF Harvel CPVC Fire Sprinkler Products shall be employed in wet pipe systems only (A wet pipe system contains water and is connected to a water supply system so that the water will discharge immediately when the sprinkler is opened.) GF Harvel CPVC fire sprinkler products are not Listed for outdoor use.

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Harvel

- ***AIR OR COMPRESSED GAS MUST NEVER BE USED FOR SYSTEM ACCEPTANCE TESTING (HYDROSTATIC PRESSURE TEST). SYSTEM FAILURE WHEN USING COMPRESSED AIR/ GAS FOR SYSTEM ACCEPTANCE CAN RESULT IN BODILY INJURY, DEATH AND/OR PROPERTY DAMAGE***
- National Fire Protection Association, Standards 13,13D and 13R must be referenced for design and installation requirements in conjunction with these installation instructions.

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Harvel

- *In accordance with the UL® Listing, GF Harvel BlazeMaster® CPVC Fire Sprinkler Products may be used in Low Pressure Dry Pipe and Pre-action System applications in Light Hazard and Residential occupancies in accordance with NFPA 13, 13D and 13R when subject to the following additional limitations: (see the addendum).*

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NFPA 13 - 2013

- 6.3.7.1 Listed nonmetallic pipe shall be installed in accordance with its listing limitations, including installation instructions.
- 6.3.7.2 When nonmetallic pipe is used in combination systems utilizing steel piping/internally coated with corrosion inhibitors and nonmetallic piping, the steel pipe coating shall be investigated for compatibility with the nonmetallic piping by a testing laboratory.

NFPA 13

- A.6.3.7.3 Other construction materials include but are not limited to materials used in fabrication of the sprinkler system, additives to water supplies, cable and wiring, and certain insecticides and fungicides.
- 6.3.7.4 When nonmetallic pipe is used in combination systems utilizing steel pipe, cutting oils and lubricants used for fabrication of the steel piping shall be compatible with the nonmetallic pipe materials.

NFPA 13

- 6.3.7.5 Fire-stopping materials intended for use on nonmetallic piping penetrations shall be investigated for compatibility with the nonmetallic pipe materials.

- Sigh…

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Manufacturer's Information

- Incompatible materials have gone from five somewhat general categories in 1996 for BF Goodrich to forty four in 2013 for BlazeMaster and fifty three for Lubrizol from their websites. Some of the BlazeMaster and Lubrizol are general too, like "Vegetable Oils".

Manufacturer Guidelines

- 2010 Spears Flameguard:
  - Page 6 WARNING DO NOT expose CPVC fire sprinkler products to edible oils, esters, ketones, or petroleum based products such as cutting oils, packing oils, traditional pipe thread paste or dopes, and some lubricants.
  - Do not store or install in direct contact with plasticizer containing materials such as electrical tape or certain wire or cable insulations.
  - Cement may be used for a period of two years from the date stamped on the container.

Manufacturer Cont'd.

- Page 27 WARNING about using only thread sealants recommended by Spears because other joint compounds or pastes (including cutting oils) may contain substances that could cause stress cracks in the CPVC.
- Cutting oils must be removed and the metal pipe thoroughly flushed and degreased prior to assembly with CPVC systems.
- Step 1 for applying sealant states DO NOT use a combination of tape and paste sealants. But, page appears to contradict this with a IF TAPE SEALANT MUST BE USED section.

Manufacturer Cont'd.

- Page 32 indicates that vegetable soap-based lubricant to lubricate gaskets and prelubricated gaskets may be used, but it's the installer's responsibility to determine gasket suitability and chemical compatibility and to consult the gasket and lubricant manufacturer.

Manufacturer Cont'd.

- Page 52 "Do's" include making certain sealants, lubricants and firestop are compatible with CPVC, use the proper solvent cement, flushing the entire system, use only glycerine for freeze protection and to **renew Spears installation training every two years**.

Manufacturer Cont'd.

- Page 52 "Don'ts" include the use of edible oils such as Crisco as a gasket lubricant, use of petroleum or solvent based sealants, lubricants or fire stop materials, use of glycol based solutions as an antifreeze, mixing glycerine and water solutions in contaminated containers, use of solvent cement that exceeds it's shelf life or has become discolored or jellied, and installing tape, insulated wire or cable in direct contact of CPVC.

- What are the points of these last slides?
  - How does installer or owner do all of this?
  - How do they check for compatibility or suitability of gaskets?

Advantages

- Cost (does not mean bad product).
- Lighter weight (saves $ for installer).
- Improved flow characteristics over steel pipe.
- Installation is quicker and easier.
- Changes are made relatively easy.
- The solvent bonding process, if properly done is an excellent joint.

Advantages

- If it is an overpressure event it will expand and will take a lot of expansion.
  - Water expands 7-8% as it freezes and CPVC can withstand that in some circumstances or piping configurations, sometimes better than steel.

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Disadvantages

- All plastics can be attacked by some chemicals.
- Plastics are not as tolerant to chemicals – inside or out!
- Requires additional pipe supports.
- Plastic ingredients, mixing, and process can lead to manufacturing problems.
- Must follow stringent guidelines for installation.

Disadvantages

- Difficulty in making modifications involving the removal or replacement of sprinklers.

- Difficulty in removing dry type sprinklers for 10-year maintenance requirements.

How Do You Avoid?

- Walking on it in an attic.
- Overspray, or just spray from pesticides for example in an attic.
- Overspray, or just spray from pesticides when it is outside before installation.
- Contact with wires, cables, or other incompatible materials over the lifetime of the building or system.

How Do You Avoid?

- Improper installation
  - Incorrect adhesive or too much or too little.
  - Incorrect antifreeze.
  - Incorrect pipe support spacing.
  - No allowance for thermal expansion.
- Incompatible chemicals
- UV exposure

What Else?

- You have fitters used to working with steel pipe and cast iron fittings now using a nonmetallic pipe and fittings with different pipe support, connection, curing time, and keeping it from UV, incompatible materials, and handling carefully.
- That is a considerable learning and re-learning experience.

What Else, cont'd.?

- It is not just the sprinkler contractors, it is:
  - Other trades on new construction sites.
  - Other trades in the area of the installed piping throughout the life of the structure.
  - Contaminants in the water supply.
  - The building owner or occupant sitting, standing, hanging, leaning, or resting anything on the piping.

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Failure Modes

- Softening
- Fracture
  - Environmental Stress Cracking
  - Brittle
  - Ductile
- Impact
- Crush

Freezing

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The Lesson

- The industry is learning from bad experiences by others, but they don't seem to be learning the lesson fast enough.

WARNING: CPVC INSTALLED IN THIS ATTIC

DANGER: DO NOT WALK ON, LEAN ON, OR PUT ANYTHING ON THE ORANGE PIPE IN THIS ATTIC

DO NOT SPRAY PESTICIDES OR FUNGICIDES IN THIS ATTIC

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Conclusion

- The use of CPVC or nonmetallic piping in sprinkler systems requires evaluation of long-term risk and reliability scenarios by the specifier, the installer, and the end-user.

Any Questions?

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Photo courtesy Dave de Vries

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