Water Quality in Residential Fire Sprinkler Systems

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Need for Data

- Need for data became apparent when we began implementing the 2011 IRC Residential Sprinkler Requirements
  - Need data from existing FS installations!
- Search for existing data
- To our knowledge, no such data exists for public consumption

Forming the Concept

- TLC Fire, BlazeMaster form the concept of data sampling by June 2011
- Funding obtained from BlazeMaster to proceed
- TLC Fire coordinated testing / sampling program beginning in October 2011

Setting Test Protocol

- What to test for?
- Brought in water purveyors, building & fire officials to assist with chemical contents and contamination vs. natural occurrence in water supply
- Scope of testing established

Water Testing Scope

- Test to drinking water standards
- Use a credible testing laboratory
- We chose: California Laboratory Services located in Rancho Cordova

Test Protocol

- What are we testing for?
  - Metals – EPA 200 Series Methods
  - Purgable Organic Compounds – EPA Method 524.2
  - Bacteria – Total Coliforms
  - Additional VOC's (Volatile Organic Compounds) found in CPVC cement

Water Sampling Method

- Method of sampling established by testing Lab
  - Each sample consists of 5 “vessels” or collection tubes
  - Samplings taken from inspectors test location
  - Clean spigot with household bleach, open spigot at bleed 5 seconds of water out of system – important – only 5 seconds at full flow
  - Fill vials at a low flow rate to prevent air from being trapped upon capping
  - If bubbles are present, uncap vial and add water and recap until no bubbles are present

Bacteriological Sampling

- Medium sized bottle – do not open bottle until ready to fill with sample water
- At a low flow rate, fill the bottle without splashing or spiraling
- Do not set cap down or touch inside of the bottle with fingers or spigot
- Fill to 100 ml line, do not overfill
- Immediately recap the bottle

Bacteriological Sampling

- Large plastic bottle
- Fill at a slow flow rate to just above the top curve of the bottle
- Tag all five bottles with the sample number
- Place all samples in a cooler with an ice pack

Sampling "Focus"

- What is in the water in these systems?
  - Young and Old
  - CPVC Stand Alone, only
- Collection point – Inspectors test to simplify sampling
  - No need to take system out of service to test

“Control” Samples

- No control samples were collected
- At the time of collection, we did not collect samples of the district water supply
- All water districts must publish water supply data…

Where did we obtain Samples?

- Seven (7) samples were collected with the help of industry friends
  - Five (5) in San Diego County
  - Two (2) in Orange County
  - Five (5) new construction tract homes
  - Two (2) retrofits

Age of Systems

- Age of systems are as follows:
  - Sample 1 = 7 years
  - Sample 2 = 12 years
  - Sample 3 = 9 years
  - Sample 4 = 9 years
  - Sample 5 = 18 months
  - Sample 6 = 2 years
  - Sample 7 = 8 years

Systems History

- Hard to determine, but as best as we can tell:
  - Two (2) of the systems had been drained after installation
  - None of the systems have been flushed, to our knowledge

Water Study - Results

- Samples were taken
- Results provided by CA Test Lab
- Results compiled for this presentation by TLC Fire

Results - Bacteria

- ***Total Coliform values are all less than 1.1 MPN (most probable number) and therefore bacteria should be ruled out as a concern.***

Results – Purgable Organic Compounds

- By EPA Method 524.2

Results – Purgable Organic Compounds (1)

	Dakota Ranch	Knightsbridge	El Cajon 1	El Cajon 2	Dana Pt.	Aliso Viejo	4S Ranch
Benzene	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethylbezene	ND	ND	ND	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	5	5.9	6	2	6.9	12	5.8

Results – Purgable Organic Compounds (2)

	Dakota Ranch	Knightsbridge	El Cajon 1	El Cajon 2	Dana Pt.	Aliso Viejo	4S Ranch
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	0.59	0.087	0.087
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	0.8	ND	ND
Trichloroethene	0.62	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND
Total Trihalomethanes (THM)	34	23	8.6	9.6	29	0.51	28

Metals – Results

- We are not sure where the metals are coming from – local water supply perhaps?
- How reliable is online water quality report? Can be used to compare?

Results – Metals (drinking water)

	Dakota Ranch	Knightsbridge	El Cajon 1	El Cajon 2	Dana Pt.	Aliso Viejo	4S Ranch
Metals (Drinking Water) by EPA 200 Series Methods							
Sample #	1	2	3	4	5	6	7
Mercury	ND	ND	ND	ND	ND	ND	ND
Aluminum	ND	ND	ND	170	ND	ND	ND
Barium	110	ND	ND	110	120	ND	ND
Boron	170	140	150	190	140	150	150
Beryllium	ND	ND	ND	3	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND
Copper	190	320	ND	98	220	ND	63
Iron	ND	5700	2600	960	ND	110	3900
Manganese	ND	120	210	150	ND	ND	110
Nickel	19	42	ND	51	56	ND	420
Silver	ND	ND	ND	ND	ND	750	ND
Zinc	17000	6900	ND	6200	16000	ND	9500
Antimony	ND	ND	ND	ND	ND	ND	ND
Arsenic	4	ND	ND	ND	2.9	ND	ND
Cadmium	1.1	1.1	ND	ND	1.7	ND	1.7
Lead	540	510	32	21	480	25	31
Selenium	ND	ND	ND	ND	ND	ND	ND
Vanadium	ND	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND	ND

Solvent Cement

- We added testing protocol for VOC's (volatile organic compounds) to account for the presence of solvent cement used during the installation process

Solvent Cement

- These solvents will flush out permanently after installation
- CA Plumbing – EIR
  - Conducted in the early 2000's, includes a flushing requirement for drinking water

PEX

- It is important to note that we did not test for VOC's (volatile organic compounds) typically found in PEX.
  - Due to the extremely limited number of PEX existing installations

PEX considerations

- What would be expected per the current tests..
  - Look for Methanol (MeOH). PEX elutes considerable methanol, especially the saline cross linking process
  - If used in a stand alone system, we would project to have similar results for coliform bacteria. PEX consumes chlorine, and vice versa.

Conclusions?

- This was not an "official" study,
  - But an attempt to obtain some much needed data
  - Our Conclusion? We need more tests!
  - This is good information to have and our industry will decide if further testing is warranted.

Questions / Discussion

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