# The Debate Over Backflow Prevention on Fire Sprinkler Systems

Among water purveyors, state and federal regulators, and the fire protection community there has been a great debate regarding the type and amount of backflow protection needed on fire sprinkler systems. Fire sprinkler systems should be considered non-potable as a result of the poor quality of water found in them.

Existing fire sprinkler systems can and do pose a hazard to the potable water system. For example, "black water" from a fire sprinkler system polluted a major portion of the Santa Rosa Hospital in San Antonio, Texas as a result of backflow. The unsafe quality of the water necessitated procurement of bottled water for drinking and cooking; surgery and other technical activities such as hydrotherapy, dialysis and ex-ray procedures were halted; fouled equipment required cleaning and sanitizing prior to being returned to service; and food service was disrupted.

> When a sprinkler system is charged with fresh water, 2 groups of biological life exist in the system: aerobic and anaerobic – those that need oxygen and those that don't. As the water sits in the iron pipe, oxygen combines with the iron to form rust –the aerobic bugs (those that need oxygen) consume what's left. Then the anaerobic group takes over. They have a gay old time – plenty of food (dead aerobic bugs) and more. The anaerobic bugs eat and drink – and deposit their secretions and other leavings. That's why sprinkler system water smells so bad – it's the anaerobic bug's sewer system.

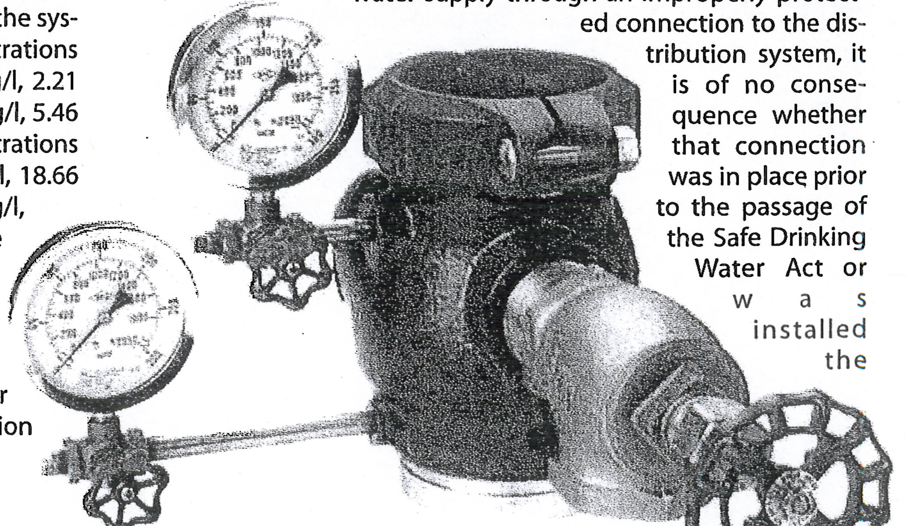
The Atlanta, Georgia, Fire Department conducted a sampling study of water contained in fire sprinkler systems. The Maximum Allowable Concentration (MAC) for lead in potable water is 0.05 mg/l; this study found levels of lead in the following concentrations: 6.66 mg/l, 3.0 mg/l, 12.46 mg/l, 3.40 mg/l in 35% of the systems. The MAC limit for copper is 1.0 mg/l--concentrations detected from these samples were as follows: 0.09 mg/l, 2.21 mg/l, 0.18 mg/l, 0.03 mg/l, 2.82 mg/l, 0.30 mg/l, 1.41 mg/l, 5.46 mg/l, 4.13 mg/l, 3.60 mg/l and 6.0 mg/l. Iron concentrations detected were 4.ll mg/l, 2.12 mg/l, 3.39 mg/l, 1.17 mg/l, 18.66 mg/l, 6.03 mg/l, 10.89 mg/l, 9.99 mg/l, 24.08 mg/l, 72.2 mg/l, and 284.50 mg/l--the MAC level for iron is 1.0 mg/l. Since 1923, 24 documented cases of contamination through backflow from fire sprinkler systems or into distribution mains during firefly conditions are listed by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California in their most recent version of the Manual of Cross-Connection Control.

Backflow of this water into the drinking water supply of a hospital, nursing home, senior citizens center, day care center, nursery or similar facility could have a definite adverse health effect upon those water consumers. The public water supply, by permitting a product which does not meet federal drinking water standards to be distributed to its consumers, is legally liable for any illness or other repercussions of that or any other contamination.

The Knoxville, Tennessee Utilities Board has also completed analyses of several sprinkler system samples. Analyses detected high levels of copper, cadmium, lead, manganese, total solids and levels of thick foul sediment. These levels clearly demonstrate that water from some fire protection systems is non-potable. Coliform bacteria have also been detected in sprinkler systems. Coliform is an indicator that water is not safe for human consumption.

Many states have conducted analyses of water quality within fire safety systems. Leonard Mushin, (now retired from the Los Angeles County Health Department) conducted a water quality study of fire safety system water; results confirmed high metals content, nuisance or opportunistic bacteria, and, in general, poor quality water. Sampling studies of sprinkler systems in Kentucky within the past two years confirm the above data. Kentucky also experienced difficulty in analyzing samples for microbiological contaminants due to the amount of sediment in the water. Illinois has conducted a limited investigation of fire safety systems, and has analyses reflecting similar water quality conditions within fire safety systems.

USEPA regulations make no provision for exceptions to the drinking water standards. If contamination enters a potable water supply through an improperly protected connection to the distribution system, it is of no consequence whether that connection was in place prior to the passage of the Safe Drinking Water Act or was installed the



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day before the contamination occurred. The water supply would be viewed as having violated a drinking water standard(s) and would be responsible for permitting that violation to occur.

Many large buildings or building complexes use supplemental ornamental ponds or fountains as an additional source of water for fire fighting purposes. This practice is common in remote ends of a distribution system, or in areas where water pressure may not always be consistent. Water from lakes, nearby streams, creeks or rivers which are not of acceptable water quality for potable purposes are used when needed and available for fire fighting purposes. Swimming pools have also been used as an alternate source of water during a fire. These alternate sources can easily contaminate or pollute the potable water supply during fire flow conditions. Gravity tanks pose many of the same water quality hazards to the drinking water system, as water is allowed to stagnate within the tanks. Covers or screens loosen over time, allowing rodents, birds and other sources of contamination to enter the tank, and, potentially, the drinking water supply.

A connection which allows any substance to be pumped into the fire safety system from any other source can pose a hazard. Fire department pumpers often haul water to rural or remote fires in tank trucks. Pumpers themselves often contain corrosion inhibiting chemicals to protect the tank in the pumper from corrosion. Even metropolitan pumpers are exposed to water other than that located in the potable water supply distribution system. For example, during the floods in the Chicago area in August of 1987, local news media reported pumpers pumping out basements of city halls, libraries, and other public facilities flooded with storm water and sewage back-up. Few fire departments have disinfection procedures for fire fighting equipment.

There is no doubt that fire safety systems protect property and extinguish fires in their early stages. The fire industry has documented that the majority of fires in buildings equipped with sprinklers are extinguished with flow from three to five sprinkler heads. New technology has produced fire safety systems charged with dry substances for use in computer rooms or other rooms where water would destroy equipment. The systems, however, which are directly connected to the potable water system without proper and approved backflow protection constitute a potential hazard to the safety of the drinking water within that system, just as consumption of water containing levels of contaminants above the standards established by USEPA constitute a potential health hazard to water consumers.

## Concerns from the fire protection industry for retrofitting fire protections systems with backflow prevention devices are:

- Cost
- Size
- Ease of installation
- Pressure drop (loss of water energy or friction loss)
- Reliability and full flow capacity after extended static periods
- Effects of backflow preventers during alarm testing
- Relief valve discharge, both during the static as well as the flowing condition

The biggest concern is the drop in pressure or loss of water energy. Water pressure is energy. The water pressure (energy) inside the sprinkler system is necessary for the sprinkler system to do its job. When water flows through pipes, fittings and valves, it loses energy (friction loss). The energy that is left when the water reaches the open sprinkler (residual pressure) must be sufficient to provide fire control or suppression. Some sprinklers only need 7 psi. Others need 10, 15, 25, 30, 50 or 75 psi. Newer, suppression oriented sprinklers need as much as 90 psi in certain high challenge industrial/storage arrangements.

Many states have enacted laws that require all new fire protection systems to be equipped with approved backflow prevention valves. While that is great in a going forward from here scenario, it's not much help in protecting the old systems of which there are many in use today.

It is very easy to see and understand both sides, we don't want to contaminate our drinking water, and we don't want to hinder our ability to extinguish a burning building.

Clearly both industries must continue to work together, respectful of one another and the ultimate mission of both to keep the public safe.

## The following resources were used for this article.

Illinois Environmental Protection Agency
American Water Works Association
National Fire Protection Association
United States Environmental Protection Agency
American Fire Sprinkler Association

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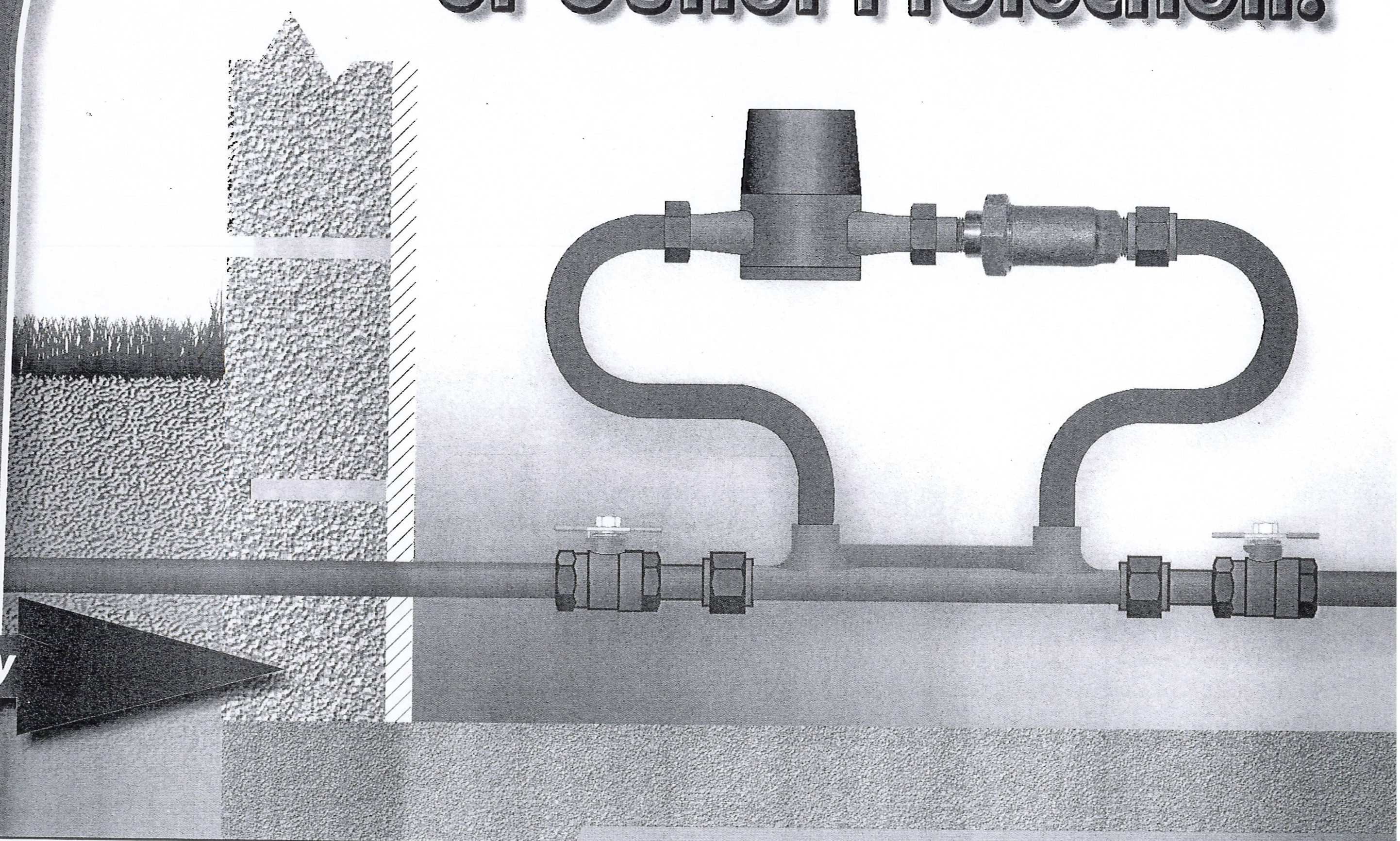
## Containment vs Source or Outlet Protection!




• The Irrigation Connection • The Debate over Backflow Prevention on Fire Sprinkler Systems
• Residential Backflow Prevention • Approved Products not Listed