FPC

Fire Protection Contractor magazine

The Most Widely-Read Sprinkler Industry Publication

October 2006
$7

Pipe & Fittings

also **MIC**

Does MIC or Corrosion Exist Within Fire Sprinkler Systems?

…Are There Initiatives That Protect These Systems?

By Richard O'Leary and Timothy O'Leary

Fire sprinkler systems are vulnerable to attack from microbiological influenced corrosion (MIC) and corrosion. Owners and managers need to take responsibility to learn about MIC and corrosion within systems. Controlling microbiological growth and eliminating corrosion can save dollars and lives. Many fire sprinkler systems are lost each year because of corrosion. This invasion has destroyed both new and old fire sprinkler systems.

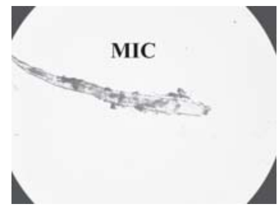
The rusting process within fire sprinkler systems occurs frequently. The water, high in oxygen, reacts with iron. It starts rusting and the pipe becomes damaged. Rust is the start of the problem. Then, chemical acids start either as a by-product of bacteria and/or the by-product of reduced oxygen. Tubercles are formed and "telltale" signs of the impending disaster appear. The deposits formed consist of red-brown ferric hydroxide and greenish black ferrous hydroxide, to include other mineral deposits. These deposits are called tubercles and, at times, are a combination of "microbiological attack" and/or "oxygen cell" corrosion.

Dry systems are especially vulnerable because they operate with a pressurized moist air source. Air with high humidity is trapped within the system. The constant daily temperature variance within these systems causes moisture to condense on the internal portions of the piping. The natural deterioration of metal that occurs within these dry type systems poses an additional problem. The moisture that condenses is very aggressive to the zinc coating, and rapidly dissolves it, producing "white rust," a chemical reaction very similar to iron rusting.

Understanding the corrosion process and microbiological effects on pipes, and aggressively treating fire sprinkler systems, are critical to extending the life span of systems.

What is MIC?

Microbial corrosion, or bacterial corrosion, is corrosion caused or promoted by microorganisms (bacteria). Microbiological influenced corrosion (MIC) refers to corrosion and ensuing loss of metal caused by biological acid producing organisms. Sulfate-reducing bacteria are common in areas where there is a lack of oxygen. Sulfate-reducing bacteria produce a sulfur acid, and that can cause stress cracking.



In the presence of oxygen, some bacteria directly oxidize iron-to-iron oxides and hydroxides, and other bacteria can react with sulfur to produce sulfuric acid. Bacterial cells can form in the deposits of corrosion products, causing and enhancing their rate of destruction.

MIC can occur in any aqueous environments. MIC is a common problem in fire sprinkler systems due to the presence of microbes, water, adequate nutrients, and corrosive by-products. These microorganisms form colonies on the surface of a metal, producing slimes that collect and glue deposits to the metal. They do not form uniform layers, but local "community centers." Once a colony has formed, it tends to attract other biological and non-biological species (metals and chlorides) to the colonization sites. All this leads to the formation of crevices, allowing corrosion to proceed. Ninety percent of MIC is seen as pitting-type corrosion because the site or colonies become "fixed."

Microbiological influenced corrosion, known as MIC, can plug sprinkler heads, and be a cause of tuberculation, resulting in thinning of the metal pipes to include the cause of pinhole leaks. This destruction can lead to ineffective sprinkler operations and losses of goods and services within a building.

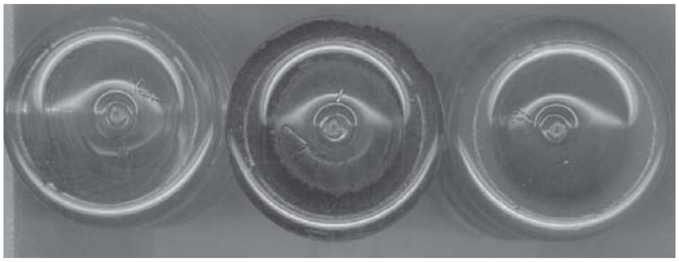
The NFPA Ruling

The National Fire Protection Association (NFPA) requires that systems be tested for MIC and, if it exists, those systems must be treated. Following are significant tests that reveal the presence of corrosion.

Reprinted from FPC/Fire Protection Contractor, October 2006

Water Testing

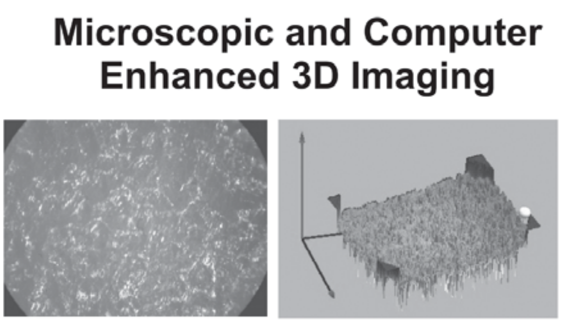
Users of sprinkler systems can be provided with a comprehensive picture of what water is doing within the pipes and sprinkler heads. Water samples need to be taken from the city water system, the riser main drain, and the inspector's port valve at the furthest end of the system.



There are currently over 100 tests performed that assist chemists in determining actual and potential trouble that can lead to oxygen cell corrosion and microbiological influenced corrosion (MIC). It is at this point that the diagnosis is made regarding the extent and the specific type of corrosion of MIC.

Metal Analysis

Besides water testing, metallurgical analysis visibly shows types of tubercles. This analysis becomes an excellent predictor of the extent of corrosion within a system. It allows for a visual identification of pipe wall thickness or damage-causing thinness. Advancements in metallurgical microscopic analysis has allowed Huguenot Laboratories to carefully determine the extent and type of corrosion by using microscopic imaging, which can then be digitally enhanced to show the damage through dimensional imaging software.



Boroscopic Evaluation

Boroscopic evaluation is a simple technique that records, in color, any build-ups or holes in the system and visibly identifies the extent of corrosion within a system.

The Treatment Methodology

Water testing allows chemists to formulate chemicals and products to treat sprinkler systems.

Specific Treatment for the Condition

This analysis leads to specific recommendations for treatment. Experience has demonstrated that various waters throughout the United States have differing characteristics. For example, the northeastern part of the United States has low pH, low hardness, and high iron and manganese, water requiring very different treatment than the hard water of the southeastern United States. Each area and/or environment of the country alters the type of chemicals, the feed rates, and the overall treatment methodology.

Biocides are effective against slime-forming bacteria, sulfate reducing bacteria, and algae. At the same time, inorganic and organic corrosion inhibitors provide protection for ferrous and yellow metals. These products can be applied to stagnant portions of the fire protection systems via specialty designed feed systems. The exact feed rates vary, due to the differing systems conditions and makeup water quality.

Ongoing Monitoring

Once systems are chemically treated, the waters should be re-tested on a three-month to a one-year basis. Installing corrosion coupons is a must, and these coupons can be analyzed quarterly to predict increasing corrosion. On-going monitoring and treatment within systems provide for damage prevention. It is important to note that systems do not remain MIC or corrosion free forever. Chemicals within these systems are lost when water is released from systems during testing. The chemicals, which are the main source of protection for sprinkler systems, gradually become depleted. Eventually, chemicals need to be replaced.

The relationship between plant management, fire sprinkler installers, and engineers committed to treating systems must be maintained on an on-going basis. Utilizing varying treatment options, consisting of automated instrumentation and continued monitoring, can give these individuals and owners the peace of mind that their sprinkler system will perform for a lifetime.

In summary

Using optimum assessment techniques, including water and metal analysis, ultrasound devices, Boroscopic evaluation, and implementing chemical treatment programs that meet corrosion on all levels, will provide owners and managers a level of confidence that their fire sprinkler system will work when needed. Being prepared and learning about MIC and corrosion can change cultural norms, provide insight for owners and managers, and, in the long run, better protect our public.

Reprinted from FPC/Fire Protection Contractor, October 2006

MIC *continued from previous page*

About the Author's:

Richard O. O'Leary is the CEO of Huguenot Laboratories, a fire sprinkler corrosion control specialty company, specializing in internal pipe inspections, corrosion removal, and treatment of fire sprinkler systems. He is the retired chief operating officer of Central Sprinkler Corporation; retired president of Betz Equipment Systems (an internationally known water treatment company), inventor of multiple computerized water processing chemical systems, and a known water treatment doctor. He can be reached at Huguenot Laboratories, 101 Riverdale Road, Port Jervis, NY 12771; 800-228-3793, E-mail: huglabs@hvc.rr.com, Website: www.huguenotlabs.com.

Timothy O'Leary is the executive vice president of Huguenot Laboratories. Tim has 18 years of experience in water treatment management from GE Water Technology. Following an exciting career with this global giant, Tim took on the challenge as vice president of a water purification engineering company. He later was the multi-division manager for a leading regional water treatment company in southern California. Tim joined Huguenot Laboratories last October. His extensive leadership and management in this industry have allowed Huguenot Laboratories to improve its equipment product lines and expand its specialty chemical product lines. Tim O'Leary can be reached at 800-228-3793, E-mail: tim-oleary@huguenotlabs.com.

References:

1. Corrosion. Wikipedia, the free encyclopedia. (http://en.wikipedia.org/wiki/Corrosion.)
2. Corrosion. (http://library.kee.hawaii.edu/external/chemistry/everyday-corrosion.html).