

news of engineering forensics

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Understanding and Addressing Microbiologically Influenced Corrosion (MIC) Issues

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MIC is an acronym for microbiologically influenced corrosion, a mode of corrosion involving microbes that react and cause the corrosion or influence other corrosion processes of metallic materials. MIC is caused by bacteria in combination with four other environmental conditions: metals (host location), nutrients, water, and oxygen (although some types of bacteria need only very small amounts of oxygen). When high levels of MIC bacteria exist with all of these environmental conditions, then microbial growth will occur limited only by available nutrients and temperature ranges. MIC starts as a slime growth on the interior surface of metallic objects. The microbes' metabolic processes result in the formation of deposits or tubercles and corrosive waste inside the pipe. MIC results in mechanical blockages of piping and sprinkler heads, as well as pipe wall thinning, pitting and perforations.

Building maintenance personnel may suspect that MIC is present in piping because of observed pinhole leaks, accumulated debris, plugging, coloration or smell of the water and slimes or the presence of tubercles when the liquid is drained from systems and the pipes are inspected. The least intrusive method of determining if MIC is present is to test the liquid within the pipe for the four types of bacteria commonly associated with MIC: sulfur reducing bacteria (SRB), iron related bacteria (IRB), low nutrient bacteria (LNB), and aerobic bacteria (AERO). Based on the types and relative concentrations of each type of bacteria found, the presence of damaging

MIC can be evaluated.

Water sample tests can identify the presence of MIC forming bacteria and the presence of a corrosive environment; however this testing does not reveal the degree of corrosion. The best way to confirm that MIC has degraded piping is to remove sections for evaluation by a microbiologist and metallurgical engineer. Pipe section evaluation has another advantage



in that other types of pipe corrosion can also be found, and the corrosion progression can be determined.

If removal of a pipe section for microscopic analysis is not desired, the level of MIC can be estimated with a combination of bacterial type and relative concentration testing, testing of the water for various chemical and physical properties associated with aggressive microbial growth, plus bore scope evaluations of various sections of the pipe and fittings. While the chemical tests are most accurate if performed on site by qualified individuals, indicators can be obtained from chemical tests performed in the laboratory of samples sent in by clients, and videos of bore scope inspections.

Many industries are now recognizing the potential hazards of MIC and taking action. Namely, the National Fire Protection Association (NFPA) has placed great importance on the testing for and preventative maintenance of MIC in fire sprinkler systems. NFPA 25 requires an obstruction inspection every five years or when there is evidence of rust, foreign debris, untreated water or pinhole leaks among other things. Further, it requires that if any tubercles or slimes are observed, they shall be tested for presence of MIC. (NFPA 25-2002 Section 13.2.1.2) The 1999 edition of NFPA 13—Standard for the Installation of Automatic Sprinkler Systems — includes a new section, 9.1.5, to deal with new sprinkler systems in which the water system is known to be susceptible to MIC development. (NFPA 13-1999 Section 9.1.5) More specific language can be expected in

future editions of these standards for dealing with this evolving problem.

MIC has been found in both "wet" and "dry" fire protection systems. In many cases, MIC has been found to have progressed more rapidly in "dry" systems than in wet systems. After a system is flushed or used, stagnant water can remain in the fitting edges, drops, and in slight dips in horizontal lengths of pipes. MIC bacteria tend to find more favorable growth

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MDE's Educational Speakers

If you are in need of an educational speaker please call MDE today. MDE professionals are scheduled to speak at the following courses / seminars:

- Dale C. Mann - Forensic Evaluation of Clandestine Drug Labs @ the Washington Defenders Association Annual Meeting, Winthrop, WA. April 29, 2005
- Susan Evans, CIH, CSP, PE - The Effect of Disturbing Mold on Airborne Spore Concentrations @ the American Industrial Hygiene Conference and Exposition (AIHCE), Anaheim, CA. May 23, 2005

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Rapid Response Investigations

MDE is able to rapidly respond or schedule investigations 24 hours a day, 365 days a year. During normal office hours, please call our general office number at 206-622-2007. For off-hours and weekends, professionals can be reached at 206-957-2155 to meet your emergency needs.

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conditions in stagnant water.

The key to preventing a catastrophic failure due to MIC is routine inspections and testing of systems exhibiting MIC symptoms. Early detection of MIC bacteria, slimes, or water properties that are conducive to MIC bacterial growth or other general corrosion may provide for timely correction. Inspecting the inside of the pipe with



a video bore scope is helpful in understanding the magnitude of the problem. If this is done, it is recommended that the scope work be video taped so other professionals can later analyze the piping and give appropriate direction. Corrective measures may include chemical treatment of the water, flushing, chemical or mechanical cleaning, and killing of microbes on the pipe interior. Once MIC or other types of corrosion have progressed to the point of leaks and significant pipe wall thinning, the pipes must typically be replaced -- which can be very expensive and disruptive to the building operations. With a new system, the initial fill can be with treated water, biocides and corrosion inhibitors. An existing system may have treated water added when the system is flushed and filled after annual maintenance.

Consultation and utilization of experienced microbiologists, water chemists, metallurgical engineers and fire protection engineers are all

important when trying to analyze and mitigate an active MIC problem in your specific system. MDE's comprehensive service offers each of these professionals all under one roof. MDE provides testing/evaluation for MIC bacteria, water chemistry and metallurgical evaluation of the pipes. MDE also provides consultation for other aspects of the project that may arise. MDE is a forensic engineering and laboratory consultation firm and has no connection or affiliation with any treatment chemicals, treatment methods, or treatment equipment.

What You Don't Know Can Damage Your Case

by Dale C. Mann, Sr. Forensic Chemist

Fire investigators, insurance adjusters, and attorneys may be responsible for selecting a laboratory to perform crucial analyses on samples recovered from a fire scene. However, if an unqualified or inexperienced person is performing the laboratory analysis of the evidence, the viability and credibility of that evidence can be nullified. To prevent this, the laboratory and its' personnel should be assessed prior to sample submission to confirm the quality and integrity of the analytical work to be performed. Answers to a few questions, plus discussions with previous customers of the lab can assist you in making an inference about the quality of the laboratory work product.

Is the chemist experienced in forensic analyses? What is the background of the chemist? What experience does the chemist have in analyzing fire debris?

Does the chemist follow accepted methods in their analysis where appropriate? ASTM and TWGFEX are two of the predominant organizations tasked with formulating methods and

standards for laboratory use in fire investigation. Are NFPA 921 guidelines followed? Is the chemist aware of the recent changes to these guidelines and standards? Ask for references of other fire investigators who utilize the services of the laboratory (you may not want to be one of the first to use a laboratory).

Is the analyst certified? There has been a certification process in place specifically for fire debris analysts since 1996. This process is maintained by the American Board of Criminalistics (ABC). The certification requires the analyst be experienced, be able to demonstrate their expertise through both examination and practical yearly proficiency testing and the analyst is required to maintain a rigorous continuing education routine. Although nothing can guarantee accurate results, this certification process helps assure the analyst continually demonstrates a professional competency.

Is the analyst active in the field of laboratory analysis? By publishing in peer reviewed journals, the analyst is allowing others to evaluate their methods and decision making protocols. Is the analyst active in the standard development process? Analysts who are highly qualified tend to be on the leading edge of new or revised laboratory methods and will use acceptable methodologies.

Is each and every report/conclusion peer reviewed? Peer review is a fundamental tenant of a quality laboratory work product. A knowledgeable and thorough review process can catch mistakes before they get out of the laboratory.

MDE Forensic Laboratories satisfies all the above concerns and has been producing quality laboratory analysis to support fire investigations since 1998. Give Dale Mann a call at 206-957-2145 to discuss your fire investigation or visit mde.com for more information.



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