# Frequently Asked Questions About Microbiologically Influenced Corrosion (MIC)

### *1. What is "MIC"?*

MIC is an acronym for microbiologically influenced corrosion, a mode of corrosion incorporating microbes that react and cause the corrosion or influence other corrosion processes of metallic materials.

### *2. What causes MIC?*

MIC is caused by bacterial microbes 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). These bacteria are ubiquitous in the environment and piping materials. When all of these environmental conditions are present, then microbial growth will occur. When the nutrients in the system are consumed, the microbes may become dormant. When the environmental conditions, i.e. nutrients or oxygen, are replenished, the microbial growth resumes. Examples of this replenishment include: flow testing, draining and refilling of systems, addition of water to replenish losses from leaks or maintenance, or the periodic filling of dry fire sprinkler systems. Microbial reactions, depending on the type, will only occur at certain temperature ranges.

### *3. What happens if MIC is present in pipes?*

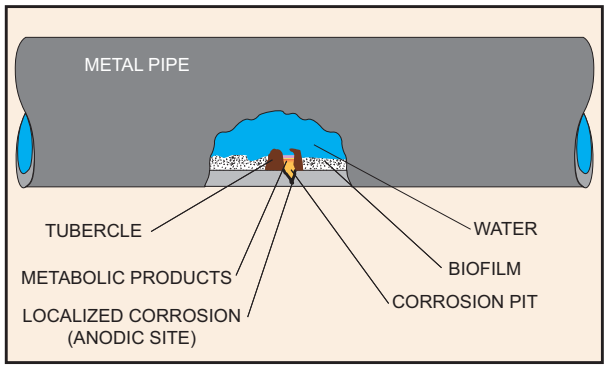
As MIC bacteria grows, consumption of the metal in the pipe occurs and sometimes tubercles are formed. Pitting is a likely effect and the walls of the pipe may be penetrated but the flow characteristics of the pipes are degraded and the loose scale or rust can plug sprinklers and valves.

### *4. How is MIC detected?*

Building maintenance personnel may suspect that MIC is present because of observed pinhole leaks in pipes, the amount of debris, plugging, coloration or smell of the water and slimes or the presence of tubercles when the liquid is drained from systems when the pipes are inspected. The least intrusive method to ascertain whether the bacteria associated with MIC are present is for the liquid within the pipe to be tested for the four types of bacteria commonly associated with MIC: sulfur reducing bacteria, iron related bacteria, low nutrient bacteria, and aerobic bacteria. However, the best way to confirm that MIC has degraded piping is to remove sections and have them evaluated by a microbiologist and metallurgical engineer. Another advantage to this analysis is that other types of pipe corrosion can also be found. Based on the types and relative concentrations of each type of bacteria found, the presence of damaging MIC can be evaluated.

### *5. Is there a way to test how far MIC has advanced without the removal of sections of pipe?*

The progressive degradation of pipe walls by MIC bacteria can generally be determined through the microscopic evaluation of sections of the pipe. Pipe degradation may have occurred due to MIC or due to other forms of corrosion. The effectiveness of the inspection does require that the pipe section evaluated be a section of pipe that has degradation. A prediction of the progression of MIC can be done with a combination of bacterial type and relative concentration testing, plus testing of the water for various chemical and physical properties associated with aggressive microbial growth. 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, if the samples are collected and shipped with proper care.




*Simplified diagram showing MIC corrosion site*

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### *6. Why should testing for MIC be done?*

NFPA 25 requires an obstruction inspection every 5 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 indications of MIC. (NFPA 25-2002 Section 13.2.1.2)

### *7. If the building has a dry sprinkler system, can there be a problem with MIC?*

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 remains in the fitting edges, drops, and in slight dips in horizontal lengths of pipes. MIC bacteria tend to find more favorable growth conditions in oxygenated stagnant water.

### *8. What can be done if MIC is found in testing?*

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 of the condition. Corrective measures may include chemical treatment of the water, flushing, chemical and/or mechanical cleaning, and killing of microbes on the pipe interior, followed by a dwell time prior to reactivating the system, all depending on the conditions found. Once MIC or other types of corrosion have progressed to the point of leaks and significant pipe wall thinning, typically the pipes must be replaced -- which can be very expensive and disruptive to the building operations. Inspecting the inside of the pipe with a video bore scope is helpful in order to understand 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.

### *9. What is suggested if a proactive approach to minimizing MIC is desired?*

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. Testing of the supply water for MIC bacteria and general chemistries, as well as physically observing the growths and surface conditions will determine the aggressiveness of the environment for MIC bacteria growth and the proper treatment. Utilizing the microbiologist, water chemist, metallurgical engineer and fire protection engineer are all important to consult with when trying to minimize or mitigate an active MIC problem in your specific system. MDE has these professionals available.

### *10. What are the many benefits of utilizing MDE Inc. for MIC testing?*

- Experienced metallurgical engineers, fire protection engineers, forensic chemists, water chemists, mechanical and civil engineers, and microbiologists are available to address all aspects of a project.
- 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.
- **Independent** forensic engineering and professional services. MDE has no connection or affiliation with any treatment chemicals, treatment methods, or treatment equipment. MDE is an engineering and laboratory consultation firm.
- On-site engineers and testing consultation, as needed.

## *- MDE's Ancillary Services:*

- Metallurgical Engineering
- Materials Engineering
- Civil Engineering
- Industrial Hygiene
- Mechanical Engineering
- Fire Protection Engineering
- Forensic Chemistry
- Accident Reconstruction

*MDE Inc. is a multi-discipline forensic engineering and laboratory firm. Based in Seattle, Washington we have served clients both nationally and internationally for over twenty years.*

*NOTE that MDE is not associated with any water chemical treatment products or providers, pipe cleaning, or equipment companies. We provide independent consulting and laboratory services.*


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