



**Ahern Fire Protection's presentation to:**



**Wisconsin Healthcare Engineering Association**  
*August 31, 2006*

# M.I.C.

(Microbiologically Influenced Corrosion)

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# M.I.C. & NFPA Codes

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## □ NFPA-13 (2002 Edition)

### ■ 15.1.5\* Water Supply Treatment.

Water supplies and environmental conditions shall be evaluated for the existence of microbes and conditions that contribute to microbiologically influenced corrosion (MIC). Where conditions are found that contribute to MIC, the owner(s) shall notify the sprinkler system installer and a plan shall be developed to treat the system using one of the following methods:

- Install a water pipe that will not be affected by the MIC microbes.
- Treat all water that enters the systems using an approved biocide.
- Implement an approved plan for monitoring the interior conditions of the pipe at established time intervals and locations.



# M.I.C. & NFPA Codes

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- NFPA-13 (2002 Edition)
  - 8.15.3.2.2 Where water supplies are known to have unusual corrosive properties and threaded or cut-groove steel pipe is to be used, wall thickness shall be in accordance with Schedule 30 [in sizes 8 in. (200 mm) or larger] or Schedule 40 [in sizes less than 8 in. (200 mm)].



# M.I.C. & NFPA Codes

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- NFPA-25 (2002 Edition)
  - Annex D – Obstruction Investigation section D.2.6 addresses MIC



# WHAT IS MIC?

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- ❑ Microbiologically influenced corrosion (MIC) is any form of corrosion influenced by the presence & activities of microbes.
- ❑ MIC is caused by many types of microbes working together.



# MIC IS A MATERIALS INTEGRITY PROBLEM

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- ❑ Organisms which can find breaches in pipe coatings and colonize, creating conditions under which localized, pitting corrosion can occur. If other conditions in the FPS are permissive of continued pitting corrosion, these can cause rapid failure of FPS components.



# MIC DEPOSITS:

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- ❑ Interfere with efficient water flow in FPS
- ❑ Interfere with proper operation of sprinkler heads
- ❑ Interfere with proper function of o-rings, gaskets, & valves



# Discrete Deposits

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# Gasket with Deposits

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# Sprinkler Head Full of Debris

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# MIC in Steel Pipe

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# MIC in Dry FPS Galvanized Pipe

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# MIC in Dry FPS Galvanized Pipe

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# MIC in Wet FPS Copper Pipe

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# Sediment & Air Pocket in Pipe Near Peak of Building

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# OPERATIONS IN WET FPS WHICH PROMOTE MIC

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- ❑ Frequent addition of untreated waters
- ❑ Addition of sediment-laden waters
- ❑ Flushing at flow rates too slow to remove deposits
- ❑ Flushing from large to small diameter pipe
- ❑ Introduction of air and water containing air leading to formation of air pockets



# OPERATIONS IN DRY/PREACTION FPS WHICH PROMOTE MIC

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- ❑ Frequent testing or tripping
- ❑ Failure to treat waters used in tests & trips
- ❑ Failure to completely remove water after tests or trips
- ❑ Addition of humid air which condenses & puddles at low points



# Corrosion Equations

Ingredients	Type(s) of Deposits	Type(s) of Corrosion	Relative Rates of Corrosion	Relative Rates of Penetration
Iron + Water + Oxygen	Generalized (rust-type)	Generalized (rust-type)	Slow	Slow
Iron + Water + Oxygen + Chloride	Generalized	Generalized Some pitting	Generalized faster Pitting faster	Faster
Iron + Water + Oxygen + Microbes	Discrete	Localized Pitting Crevice Under-deposit acid attack Oxygen-cell	Generalized slower Pitting much faster	Much faster
Iron + Water + Oxygen + Microbes + Chloride	Discrete	Localized Pitting Crevice Under-deposit acid attack Oxygen-cell	Generalized faster Pitting very fast	Very fast
Iron + Water (no oxygen)	None	None	Very slow, if any	Very slow, if any
Iron + Water + Chloride (no oxygen)	None	None	Very slow, if any	Very slow, if any
Iron + Water + Microbes (no oxygen)	Tends to be localized	Tends to be localized	Slow, in most cases	Slow, in most cases
Iron + Water + Microbes + Chloride (no oxygen)	Localized	Localized	Faster than without salt	Faster than without salt
Iron + Oxygen + Microbes + Chloride (no water)	None	None	None	None

# TESTING OF M.I.C.

## M.I.C. test kit



- ❑ Test municipal water supply
- ❑ Test water in existing systems
- ❑ Total procedure takes about 2 weeks to get complete results.
- ❑ Results will indicate which types of M.I.C. are present.



# PHYSICAL PIPE INSPECTION

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- If water test data indicate MIC, physical inspection and analysis of pipes from different portions of FPS will provide info on extent & severity of problems.
- This information is used to determine mitigation needs (i.e., replacement, chemical cleaning, etc.) & target mitigation to affected areas.



## PHYSICAL PIPE INSPECTION (CONT.)

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- Pipe inspection allows any deposits to be tested for removal & chemical composition prior to chemical cleaning. This is essential to determining effective & safe cleaning agents & methods.
  - For example, sulfides, if present in deposits, can generate hydrogen sulfide (a toxic gas) when combined with some cleaning agents.



# PIPE INSPECTION LOCATIONS

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- Use system diagrams & system history to choose locations representative of different scenarios.
- Dry/preaction FPS - inspect horizontal pipes which are likely to collect water (low points).
- Wet FPS - inspect larger pipes which collect sediments or areas where air pockets form (peaks).



# PIPE INSPECTION DATA INTERPRETATION

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- ❑ Discrete deposits which are brown or rust-colored on the outside are indicative of deposits formed in higher oxygen conditions & may have pits associated with them. These may have dark to black interiors.
- ❑ Generalized deposits & “slime” which are black on the outside are materials which formed in low oxygen conditions; these type deposits may have little pitting corrosion associated with them & may be protective.



# MAKING A DIAGNOSIS

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- ❑ In many cases the potential for MIC exists in the entire FPS, HOWEVER, in most cases only portions of the FPS suffer from severe MIC.
- ❑ This is due to the fact that only portions of the FPS have conditions allowing severe MIC to occur.



# MAKING A DIAGNOSIS (cont.)

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- The ultimate objective is to understand where in the FPS SEVERE MIC problems have occurred, or will occur, and why (what conditions are present at those locations which permit SEVERE MIC to occur).
- Then to use this information to design mitigation strategies which are most effective and least costly.



# PREVENTION & CONTROL

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- ❑ Eliminating factors that contribute to MIC will help to control or prevent these problems.
- ❑ In dry/preaction FPS, eliminating water puddles/moisture, microbes, sediment and air/oxygen are key.
- ❑ In wet FPS, eliminating sediment, air pockets/oxygen, & microbes is key.



# TREATMENT AND REPAIR

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- Flushing
- Chemical Cleaning
- Pipe Replacement
- Chemical Treatment of Incoming Water



# MICtreat FPS SYSTEM

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# A NOTE ABOUT USING CHEMICALS IN FPS

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- ❑ Regulations for use & discharge vary from location to location.
- ❑ Before using *any* additives or chemicals in FPS, it is necessary to inform local AHJ's, water purveyor(s), sewage treatment plant(s), etc. of intent to use such chemicals & gain their permission.



# NFPA 25

## Chapter 13 – Obstruction Investigation

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### □ 13.1 General.

This chapter shall provide the minimum requirements for conducting investigations of fire protection system piping for possible sources of materials that can cause pipe blockage.



# NFPA 25

## Chapter 13 – Obstruction Investigation

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- 13.2\* Obstruction Investigation and Prevention.
- 13.2.1 An investigation of piping and branch line conditions shall be conducted every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of one branch line for the purpose of investigating for the presence of foreign organic and inorganic material.



# NFPA 25

## Chapter 13 – Obstruction Investigation

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- 13.2.1.1 Alternative nondestructive examination methods shall be permitted.
- 13.2.1.2 Tubercules or slime, if found, shall be tested for indications of microbiologically influenced corrosion (MIC).



# NFPA 25

## Chapter 13 – Obstruction Investigation

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- 13.2.2\* An obstruction investigation shall be conducted for system or yard main piping wherever any of the following conditions exist:
  1. Defective intake for fire pumps taking suction from open bodies of water
  2. The discharge of obstructive material during routine water tests
  3. Foreign materials in fire pumps, in dry pipe valves, or in check valves



# NFPA 25

## Chapter 13 – Obstruction Investigation

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4. Foreign material in water during drain tests or plugging of inspector's test connection(s)
5. Plugged sprinklers
6. Plugged piping in sprinkler systems dismantled during building alterations
7. Failure to flush yard piping or surrounding public mains following new installations or repairs
8. A record of broken public mains in the vicinity
9. Abnormally frequent false tripping of a dry pipe valve(s)



# NFPA 25

## Chapter 13 – Obstruction Investigation

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10. A system that is returned to service after an extended shutdown (greater than 1 year)
11. There is reason to believe that the sprinkler system contains sodium silicate or highly corrosive fluxes in copper systems.
12. A system has been supplied with raw water via the fire department connection
13. Pinhole leaks
14. A 50-percent increase in the time it takes water to travel to the inspector's test connection from the time the valve trips during a full flow trip test of a dry pipe sprinkler system when compared to the original system acceptance test



# NFPA 25

## Chapter 13 – Obstruction Investigation

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- 13.2.3\* Systems shall be examined for internal obstructions where conditions exist that could cause obstructed piping.
- 13.2.3.1 If the condition has not been corrected or the condition is one that could result in obstruction of the piping despite any previous flushing procedures that have been performed, the system shall be examined for internal obstructions every 5 years.



# NFPA 25

## Chapter 13 – Obstruction Investigation

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- 13.2.3.2 Internal inspections shall be accomplished by examining the interior of the following four points:
  1. System valve
  2. Riser
  3. Cross main
  4. Branch line



# NFPA 25

## Chapter 13 – Obstruction Investigation

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- 13.2.3.3 Alternative nondestructive examination methods shall be permitted.
- 13.2.4\* If an obstruction investigation carried out in accordance with 13.2.1 indicates the presence of sufficient material to obstruct sprinklers, a complete flushing program shall be conducted by qualified personnel.



# *Any Questions?*

