White Paper

Industry Myths Regarding Corrosion in Fire Sprinkler Systems

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Awareness of corrosion and the associated risks is growing within the fire sprinkler industry. For most property owners, corrosion is generally unknown and unsuspected until pin-hole leaks begin to occur. Once corrosion problems are exposed, awareness of the risk is elevated. There are four basic risks associated with corroding fire sprinkler systems. Two of the risks result from fire sprinkler systems that do not perform as designed:

- Life safety risk from fire
- Structure and content risk from fire

Two other risks are associated with leaking sprinkler systems:

- Content risk from water damage
- Business continuity risk associated with leaking sprinkler systems

As the industry seeks answers for mitigating these risks, it is important that sound scientific solutions be developed and deployed. Heretofore there have been pervasive myths regarding corrosion that have hindered the implementation of effective corrosion control strategies. In order to move forward these myths must be dispelled so that effective solutions can become standard practice.

Myth No. 1: MIC, MIC, MIC - Microbiologically Influenced Corrosion is the primary cause of pin-hole leaks in fire sprinkler systems.

Oxygen gas is the primary cause of corrosion and pin-hole leaks in fire sprinkler systems. Oxygen removes metal from the pipe walls and creates insoluble solid by-products which can create obstructions within the piping. Bacteria are always present in fire sprinkler systems. If you look for them you will find them. There is very little correlation between the level of microbial contamination and corrosion related leaks. Bacteria cause fewer than 10% of the pin-hole leaks that occur in fire sprinkler systems[1]. Oxygen corrosion produces the balance of the leaks.

Myth No. 2: Galvanized Steel Piping Performs Better Than Black Steel in Preventing Corrosion in Dry Pipe Systems

Galvanized steel piping for dry pipe fire sprinkler systems can begin leaking 3-4 times faster than black steel piping that is exposed to identical operating conditions. Under a pool of trapped water within a galvanized dry pipe system oxygen corrosion is very localized and leads to the creation of steep walled individual pits in the metal. In black steel pipes oxygen corrosion is much more dispersed and causes general thinning of the pipe wall under the pools of trapped water. Galvanized steel piping also costs 30% more than black steel piping. So galvanized pipe costs more and fails faster than black steel[2].

Myth No. 3: Once a Fire Sprinkler System Starts to Have Frequent Pin-Hole Leaks, It Must be Replaced to Stop the Leaks

When fire sprinkler systems are removed and replaced because they leak too much, inspection of the old system piping reveals that only about 20% of the piping has incurred significant damage from corrosion. The majority of the pipe from the demolition and removal has no corrosion at all. Oxygen corrosion in fire sprinkler systems is highly localized. Inspection of the removed piping reveals that oxygen corrosion generally occurs at trapped air pockets in wet pipe systems and at pools of trapped water in dry and preaction systems. It is far more cost effective to remove the damaged piping and then institute a comprehensive corrosion management system.

Myth No. 4: Bad Water Causes Fire Sprinkler System Leaks

Almost all fire supply water comes from municipal water purveyors. For the most part fire supply water is very fresh and very clean. Water chemistry does vary throughout the country but in general it is the introduction of oxygen into the fire sprinkler piping that causes increased leaking not the quality of the supply water.

Myth No. 5: The Quality of Fire Sprinkler Piping and Fittings Has Declined

Failed fire sprinkler piping that shows evidence of material defect from the manufacturer is very rare. The quality of fittings and tubular goods being used today in fire sprinkler systems generally meets or exceeds the ASTM standards. Corrosion at weld seams that is often recognized as the cause of leaks is not the result of materially defective piping. It is the lack of heat annealing the piping and the subsequent exposure to oxygenated water that causes accelerated attack at the weld seams. Leaks that occur at weld seams in fire sprinkler piping can be completely controlled by keeping the oxygen out of the fire sprinkler system.

Periodic introduction of oxygen to water based fire sprinkler systems always leads to oxygen corrosion. The cumulative amount of oxygen that is introduced to the piping has a direct impact on how fast leaks are created and the service life of the system. When wet pipe systems are drained and refilled frequently they will develop more leaks. When pressure maintenance compressors run more frequently on dry and preaction systems they will develop more leaks. Removing the oxygen and preventing its introduction by inerting the systems with nitrogen can completely stop corrosion. Dry Pipe Nitrogen Inerting (DPNI) and Wet Pipe Nitrogen Inerting (WPNI) are the most effective solution for corrosion control, risk reduction and fire sprinkler system service life extension.

References

[1] **"MIC is NOT the Primary Cause of Corrosion in Fire Sprinkler Systems"** by Jeffrey T. Kochelek, *Sprinkler Age Magazine*, October 2009

[2] **"Galvanized Steel Piping in Dry and Preaction Systems: Six Reasons Why It Should NOT Be Used"** by Jeffrey T. Kochelek and Lucas Kirn, *Sprinkler Age Magazine*, May-June 2011.

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Engineered Corrosion Solutions, LLC is a corrosion management consulting firm that offers fire sprinkler system assessment and analysis coupled with design services and a full suite of corrosion management strategies that include equipment and integrated devices for controlling corrosion in water-based wet, dry, and preaction fire sprinkler systems. We understand the science of corrosion in fire sprinkler systems in a complete variety of different settings from parking structures to warehouses to clean rooms to data centers.

Engineered Corrosion Solutions, LLC offers proprietary dry pipe nitrogen inerting technology (DPNI) and wet pipe nitrogen inerting technology (WPNI), which includes the ECS Protector Nitrogen Generator, Pre-Engineered Skid Mounted Nitrogen Generator, Gas Analyzers, SMART Dry Vent, Two (2) Wet Pipe Nitrogen Inerting Vents and the industry's first real time in-situ corrosion monitoring device the ECS In-Line Corrosion Detector. Finally, we offer the first comprehensive remote corrosion monitoring system that provides live validation of the corrosion control strategy that is in place within your facility.

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