Rehabilitation of Fire Sprinkler Systems Affected by Corrosion - The piping dilemma: Wholesale or partial replacement?

Ockert J. Van Der Schijff, Pr.Eng., Ph.D.
President
CorrConsult, LLC
55 Constitution Street
Ashland, MA 01721
Tel: (617) 320-9111
Fax: (508) 881-8535
E-mail: info@CorrConsult.com
Web: http://www.CorrConsult.com

The rehabilitation of fire sprinkler systems affected by internal corrosion is a topic that is often debated amongst owners and installers of such systems. Once a system has been diagnosed with internal corrosion, it is usually a challenge to determine the extent and severity of the damage. Fractional pipe replacement is almost always a necessity due to the irreversibility and detrimental effects of corrosion damage. Both the accumulation of corrosion product deposits, as well as the degradation (metal loss) of the pipe wall negatively impact the hydraulic characteristics of the sprinkler piping and significantly lower the integrity of the fire protection system. In many instances, owners feel the necessity to condemn the entire system, resulting in wholesale removal of piping and replacement with new pipe. This is a very expensive procedure due to the costs associated with tearing out the existing pipe, replacing new pipe in an already crowded ceiling space, and the intangibles associated with disrupting normal operations to complete the task.

Past experience has proven that the location and severity of corrosion damage can be determined effectively by performing a condition assessment of the fire protection system. Due to the corrosion mechanisms at work, corrosion damage in dry and preaction systems is usually located in areas where trapped water has accumulated at low or inadequately sloped sections of the system. Our past involvement with numerous such systems has shown that the corrosion damage is invariably confined to the larger diameter mains and cross-mains. These are oftentimes long pipe runs that were difficult to pitch properly at the time of installation. Branch lines, however, are typically shorter and can be pitched more appropriately and consistently towards the mains and cross-mains. As a result, there is very little trapped water accumulation and low potential for corrosion damage. Conversely, in wet sprinkler systems, the corrosion is usually located at high points along the sprinkler piping where trapped air pockets exist. Trapped air will eventually rise and accumulate at the highest points, creating an air/water interface, which results in corrosion damage at the higher elevations in affected systems. The piping at the lower, water-submerged locations lacks the air/water interface and therefore remains unaffected by corrosion.

There are various techniques that may be employed during a condition assessment, such as spot removal and testing of pipe spool samples, analysis of past leakage history,

internal video-borescope inspection and ultrasonic scanning. Condition assessments can take place outside of normal business hours with the assistance of qualified sprinkler technicians. In most instances, targeted inspections can be conducted during one to three 12-hour nighttime shifts. With the results of the assessment in hand, experienced engineers can identify affected piping, establish trends and delineate the piping that is most likely to be affected by corrosion. The affected piping can then be selectively replaced, thus preserving a large portion of the unaffected, original piping. This translates to significant materials cost savings. The pipe replacement efforts can be scheduled to occur during times that will have minimal impact on normal business operations. In addition, any modifications to eliminate recurrence of corrosion damage (such as the installation of nitrogen supervisory systems and auxiliary low point drains in dry and preaction systems, or automatic vents in wet systems) can be implemented at the same time.

Based on our past experience with condition assessment and rehabilitation of corrosion-affected fire sprinkler systems, 10 to 30 percent of the piping is typically replaced selectively. The remainder of the piping is unaffected by corrosion and therefore wholesale replacement is not warranted or necessary to restore the system to its original design specifications.