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THE OFFICIAL PUBLICATION OF ASPE American Society of Plumbing Engineers™

April 2016

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Pipe preservation

A look at the Fort Knox 2.5-mile plumbing problem. p 76

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Proactive protection of drinking water system at Fort Knox

By Amanda Strouse

An important part of being an engineer is the ability to foresee problems and find ways to prevent them. Generally speaking, the older a system is, the more likely it is to have operational issues that impair functionality and reduce efficiency. When working on a building, engineers must consider the longevity of not only the building, but also the infrastructure that keeps it operational.

Some of the most complex and highly used systems within a building are its plumbing and mechanical systems. As they age, the likelihood that these systems will encounter problems increases. That is generally understood. However, new piping systems can also endure operational issues. So, it is important to understand how pipe systems work and the various environments that make them break down and fail faster than normal.

Design: Prevention rather than reaction

An imperative first step in plumbing system design is making sure that the design is laid out correctly and with efficiency in mind. Whether it is a brand new structure or an older one, piping systems can be constructed with many angles, which can impede flow and are also more likely to erode.

When high-use piping systems are encased in concrete or placed above electrical conduit lines, access is nearly impossible and almost always financially unfeasible. If a building undergoes a remodel or an extension, new pipes may be added that tie into existing mains or other pipes. When this occurs, it is critical to make sure that all unused pipe lines are properly tied off and to ensure that the main can handle the increased amounts of water and pressure. Plumbing design can make or break a piping system, so hiring an experienced contractor who will advise about efficient plumbing design can greatly reduce the chances of failures occurring.

Another factor that can be overlooked is the type of pipe that is used for a particular system. Metal pipe systems are more susceptible to erosion and corrosion, which can lead to pipe system failure. Copper pipes, which are commonly installed as hot and cold water lines, are susceptible to pinhole leaks due to the water chemistry eroding the copper. Galvanized pipes experience corrosion, resulting in low water pressure; they can erode, resulting

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Fort Knox

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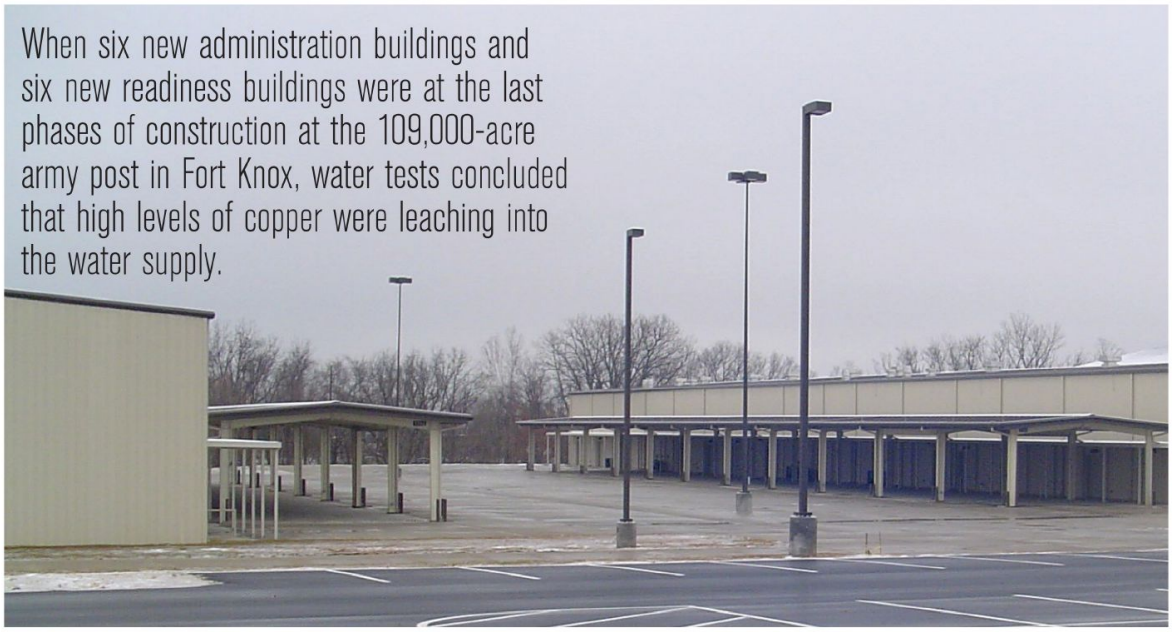

in rusty water and leaks; and they also leach lead into the water system. Lead pipes, solder and fixtures are known for leaching unsafe levels of lead in water.

Knowing the acidity of the liquids or gasses flowing through the pipes is another helpful factor in determining the potential longevity of the pipe systems and what types of pipes should be installed. If the area's drinking water has a low pH, and is therefore acidic, then it is best to assume that the water will erode the interior of the pipes at a faster rate than normal. Piping systems that carry natural gas can experience corrosion, cracked seals and faulty joints/connectors, which can result in dangerous leaks. Fire suppression and sprinkler systems that are not well-maintained, or barely used, can experience MIC corrosion, which could impede the flow of water in desperate times of a fire emergency. It is also worth noting that, generally speaking, most water and mechanical pipe systems have a lifespan of approximately 25 to 50 years.

Using epoxy coatings

Not all of the above-mentioned piping failures occur to old pipes in old buildings. Copper pipes, for example, can experience pinhole leaks within the first year of installment. So, the question that engineers should be asking themselves is: How can I extend the lifespan of the pipe systems?

Since corrosion, erosion and metal leaching from metal water and mechanical pipes are inevitable, there is an increasingly popular solution that greatly reduces or prevents corrosion, erosion and metal leaching from occurring: epoxy coatings (a particular type of pipe lining).

Epoxy coatings were first introduced to North America a few decades ago, and have evolved into a proven pipe restoration technique that has been utilized and trusted by engineers, property managers and plumbers ever since. Although there are several different companies that manufacture their own epoxy coating for water and mechanical piping systems, as well as their own method for installation, most follow the similar in-place processes. Generally these methods rely on compressed air to push the epoxy through a cleaned and prepped piping system. The epoxy cures for a specific amount of time, and then transforms into a protective barrier coating, which is durable and reduces to varying extents, depending on product and application, the water from touching the metal pipes.

When the water does not touch the metal pipes, the interior does not erode; corrosion does not buildup; and metal leaching occurs at an extremely minuscule amount. Epoxy coatings are not only beneficial due to those time-tested qualities, but also because they may be applied to pipes using existing access points, thereby minimizing tearing up walls, digging up floors and other types of demolition that are a normal part of alternative solutions—pipe replacement or reroutes. Pipe lining technologies are a true alternative to traditional repipes and reroutes.

"Piping systems that carry natural gas can experience corrosion, cracked seals and faulty joints/connectors, which can result in dangerous leaks."

Epoxy coatings are another tool for building engineers, being readily available all over North America (and the world) to preserve buildings' piping systems, reduce operational disruption, prevent property destruction, salvage budgets and alleviate headaches. Unfortunately,

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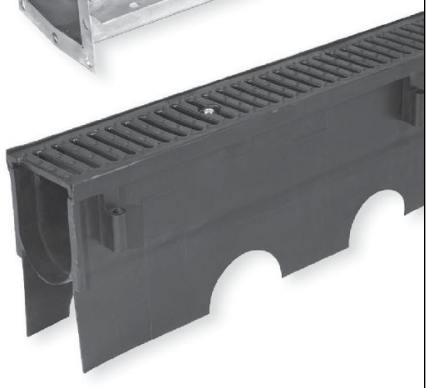

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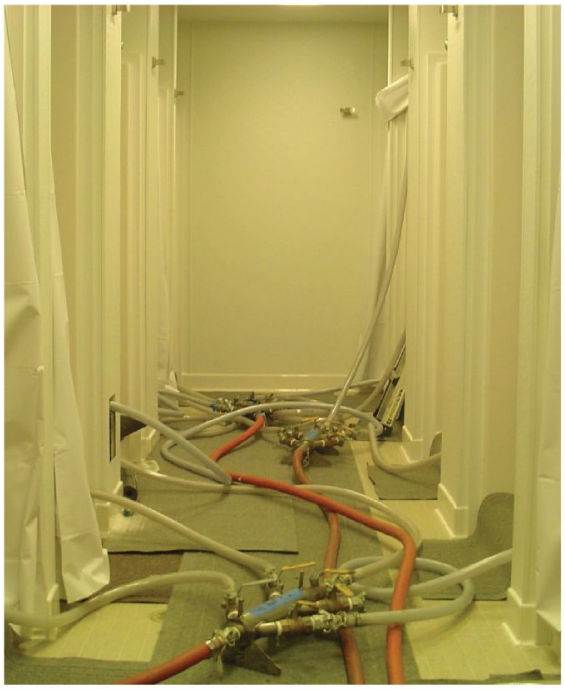

epoxy coatings are more often applied to aging and failing pipe systems, meaning that the building's maintenance team did not take advantage of a proactive or preventative approach to protecting the piping systems and waited until it was too late. The best practice is to prevent foreseeable pipe system challenges by preserving them with an epoxy coating, prolonging the pipe's useful lifespan and increasing the pipe system's efficiency.

A notable project in which an epoxy coating application was requested for brand new buildings was a 2.5-mile piping restoration project at the Fort Knox Army Base, located in Kentucky.

The 2.5-mile piping restoration

When six new administration buildings and six new readiness buildings were at the last phases of construction at the 109,000-acre army post in Fort Knox, water tests concluded that high levels of copper were leaching into the water supply. The 12 buildings, totaling around 400,000 square feet, had approximately 12,500 feet of copper piping for its hot and cold water systems. The general contractor, hired by the U.S. Army Corps of Engineers, also knew that the buildings would encounter long periods of vacancy, which would most likely accelerate pipe system problems, such as pinhole leaks and copper leaching. So, it was decided that a long-term

pipe preservation solution must be applied to the pipes before the buildings were turned over to the government for use.

The 12 new buildings were almost completed, so a pipe replacement was not a desired solution. A pipe replacement would have destroyed at least half of all the tiled bathrooms, as well as many other types of rooms and hallways throughout the buildings (and the new pipes would have to be something other than copper pipes). Also, some of the pipes are located above electrical conduits and other sensitive infrastructure, so access would be extremely difficult, if possible at all. It was additionally obvious that if a pipe replacement were to commence, the project would be over-budget and completed weeks or months after the deadline.

The general contractor, BL Harbert International, knew of epoxy coating technology's benefits and chose the patented ePIPE epoxy coating process to use proactively in order to extend the life of the potentially doomed plumbing systems. ePIPE franchisee, Pipe Restoration Inc., sent a crew to Kentucky for the project. After facing challenges — freezing temperatures, snow and an original 12-week schedule condensed into six weeks — at the request of the general contractor the epoxy coating application project was completed. The project was finished on time and to the satisfaction of the general contractor and U.S. Army Corps of Engineers.

The technology was applied to the hot and cold water systems in all 12 buildings, totaling an astounding 2.5 miles of copper pipe. Existing access points were used to prevent the need to unnecessarily tear open the newly-constructed walls and floors. The piping systems' plumbing fixtures included: 120 showers; 72 sinks; 30 urinals; 54 toilets; 12 water heaters; six janitor sinks; 12 drinking fountains; and 43 boot washes.

After the epoxy coating project was completed, water tests revealed that copper leaching was reduced to a very low, safe level and the pipes were well protected against pinhole leak formation. The project received such high praise that Pipe Restoration Inc. went on to apply the epoxy coating technology at other Department of Defense facilities. ■

Amanda Strouse *is on the marketing and public relations team for Pipe Restoration Inc. and ACE DuraFlo, which licenses and uses the patented ePIPE process. ePIPE technology provides a remedy for pinhole leaks, epoxy lining, corrosion control and prevention of metal leaching, such as lead, from pipes without the destruction or disruption encountered by pipe replacements. She can be reached at www.restoremypipes.com or 1-800-359-6369.*