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PIPELINE CONSTRUCTION & MAINTENANCE

END OF THE LINE

Replace asbestos-cement pipe without turning the jobsite into a hazardous-waste site.

By Kent Von Aspern, PE

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For nearly a century, asbestos-containing products have been an important part of American society as thousands of products — from roofing materials and insulation to tape wraps and pipe — were chosen for their strength, low unit weight, and resistance to heat and corrosion.

Hundreds of thousands of miles of the pipe remain in service. Since much of it's nearing the end of its design life, it's the proverbial elephant in the room that must be dealt with but seems easier to ignore.

Originally marketed as a strong, lightweight, non-corrosive alternative to cast iron and steel, asbestos-cement pipe offered superior flow properties due to its smooth interior walls, exceptional corrosion resistance from the asbestos fibers matrix, and simplified construction due to the low unit weight. By the mid-1940s, four major companies were manufacturing the pipe at more than a dozen U.S. plants.

From the 1940s through the late 1970s, the pipe became the predominant choice for water transmission and distribution systems, storm drains, and sanitary sewer force mains. Vitrified clay remained the more popular choice for gravity sewers, and reinforced concrete was typically used for sewer interceptors.

The pipe's performance, however, has varied. Failure rates are higher than other materials when surrounding soils are acidic or high in sulphates, magnesium salts, or alkaline hydroxides. Performance also suffers when the water supply contains ammonia or is classified as "soft water." In clay soils, the failure rate increases during the summer when the groundwater level reaches the pipe. Absent other factors, rates increase linearly with age.

In 1973 the National Emissions Standards for Hazardous Air Pollutants (NESHAP) was created by the EPA under the Clean Air Act in response to studies that found that asbestos was a leading contributor to asbestosis and certain forms of cancer. Through NESHAP, the EPA sought to protect the public by controlling exposure to asbestos found in more than 3,000 products.

Regulating so many diverse products proved to be daunting, so in 1979 the EPA announced its intent to ban all materials containing asbestos. A decade later, the Asbestos Ban and Phaseout Rule proposed eliminating all asbestos-containing materials in three stages between 1990 and 1997.

When a large manufacturer sued to block the ban, the 5th U.S. Circuit Court of Appeals ruled that EPA had failed to present a compelling case. It did, however, reinforce the agency's responsibility to regulate the material, and asbestos was banned from new products.

After 1973, asbestos fiber content in pipe was reduced from 15% to 20% down to less than 0.2%. By the 1980s its popularity had waned dramatically due to fears of liability and market conditions, especially the availability of PVC pipe. Manufacturers stopped producing the pipe in the United States, but it is still produced in other countries.

MASSIVE UNDERTAKING

In 2002, an American Water Works Association survey of 337 large utilities serving nearly 60 million customers found that 15.2% — more than 30,000 miles — of distribution systems were composed of asbestos-cement pipe. An informal survey using public information sources on the Internet reveals that much of it is installed in the West (see table).

Substantial portions have been in use for 40 to 60 years — its typical life expectancy. With an estimated 630,000 miles of the pipe in the United States and Canada, a tremendous amount will need attention in the near future.

But replacement won't be easy.

The key to regulation centers is on the word “friable,” which the EPA defines as any material containing more than 1% asbestos that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. According to the agency, activities such as cutting, grinding, or crushing render the pipe friable.

Disposal is limited to 260 linear feet, or 35 cubic feet, of broken pipe. These days pipe removed during short spot repairs to correct breaks is commonly — and legally — crushed and mixed with backfill material. Pipe that's crushed and left in place and is more than 260 linear feet long, or has a total volume of 35 cubic feet, is considered a regulated asbestos-containing material — essentially making it hazardous waste.

Cutting, grinding, or crushing the pipe must be performed while water is sprayed directly on the work area to control dust. Broken pieces must be wrapped in water-tight bags and handled and disposed of as hazardous waste.

Unbroken segments aren't classified as friable material and may be disposed of at Class II facilities. Workers must receive special training, but special licenses aren't required.

Regulations control cutting into the pipe to make spot repairs or to install new connections, as well as to remove, dispose of, and rehabilitate pipes using bursting and reaming trenchless construction technologies.

COST CONSIDERATIONS

The Water Research Foundation has commissioned a study of 17 public agencies throughout North America to determine the long-term performance of asbestos-cement pipe and when it should be replaced. The study is expected to be completed by March 2011.

Meanwhile, if your system contains asbestos-cement pipe, start thinking about how to fund replacement.

Unfortunately, two of the best alternatives — and the only ones that provide increased capacity — are severely restricted by NESHAP. In most cases the EPA has ruled that bursting and reaming render the pipe friable, so using those methods to replace more than 260 linear feet of pipe creates an active hazardous-waste site.

In many areas, the agency has delegated enforcement of asbestos programs to local air quality control boards that have more stringent policies. San Francisco's Bay Area Air Quality Management District, for example, limits replacement length to 100 linear feet.

With pipe bursting, broken pipe fragments are pushed into the surrounding soils, and a new, often larger, pipe is pulled into the opening. Bentonite is usually added to reduce friction on the pipe and help hold the tunnel open. Excavations are typically required at pulling and receiving pits and for reconnecting each service.

Reaming uses specially adapted horizontal directional drilling equipment. Although similar to pipe bursting, the host pipe is ground into small particles, many of which are removed with the surrounding soil to create space for the new pipe.

Sliplining, cured-in-place lining, fold-and-form lining, and similar techniques can be used, but beware: Lining is appropriate only when the hydraulic capacity of the existing pipeline can be reduced to accommodate the resulting smaller cross-sectional diameter. The smooth pipe interior presents challenges for methods — such as fold-and-form lining and sliplining without grouting the annular space — that don't involve mechanical bonding to the host pipe.

Every project is different. But generally, lining is more cost-effective than bursting and reaming; and both rehabilitation methods are less expensive than open-cut construction, assuming the replacement of an existing utility pipe in urban environments requiring traffic control and bypassing, at depths of 5 feet or more, and with a moderate number of service reconnections.

In addition, unlike bursting and reaming, lining doesn't render the material friable, leaving both public works directors and the public at ease.

— Kent Von Aspern is the business class leader for pipelines and pump stations in Northern California for HDR Inc.

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ABOUT THE AUTHOR

Kent Von Aspern, PE

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