AMERICA'S UNDERGROUND WATER PIPES ARE FACING AN ALARMING CORROSION EPIDEMIC

As the Trump administration and Congress continue to wrangle over a comprehensive infrastructure package, a new report warns that unless dramatic measures are taken, the nation's rapidly declining underground water networks will imperil public health and safety.

Signs of stress surface daily in cities and small towns across the country as the roughly 300,000 water main breaks the U.S. suffers annually trigger floods and service disruptions, the report notes. The loss of water service is more than an inconvenience; it causes significant social and economic disruptions.

A report released in March by Utah State University's acclaimed Buried Structure Laboratory titled, "Water Main Breaks in the United States and Canada: A Comprehensive Study," points out that "a critical component to public health and economic well-being is our drinking water which is brought to the tap through an elaborate network of underground water distribution systems."

It is the condition of these underground water distribution networks, specifically the pipes that serve them, that is the focus of the Utah State study. Because many of these pipes are beset by corrosion and age, a circumstance that contributed substantially to the recent lead contamination crisis in Flint, Mich., Utah State researchers sought to obtain the most reliable data available on the condition of these life-sustaining water pipes.

Some 308 water utilities in the United States and Canada, serving over 52 million people with nearly 200,000 miles of pipe, participated in the survey, making it one of the largest such studies ever conducted. The study was led by Dr. Steven Folkman, an internationally recognized expert in underground testing and analysis.

In examining pipe performance and longevity, researchers focused on water main breaks as the most objective way to quantify the condition of failing underground water networks.

The Curse of Corrosion

The findings were disquieting, to say the least. Between 2012, when Utah State last issued a similar report, and 2018, water main breaks increased by 27 percent. Much of this is attributable to corrosion, particularly when pipes are in naturally corrosive soils. Fully 91 percent of pipes in service are made of four distinct materials: cast iron and asbestos cement — both of which are no longer manufactured in North America — as well as polyvinyl chloride (PVC) and ductile iron.

The role of corrosion in water main breaks cannot be understated, with 75 percent of utilities reporting corrosive soil conditions. According to the study, cast iron pipe, 92 percent of which is over 50 years old, in a highly corrosive soil has over 20 times the break rate as one in a low-corrosion environment. Similarly, ductile iron pipe in a high-corrosion soil has over ten times the break rate as one in a low-corrosion soil.

Traditionally, the thickness of the cast iron pipe wall provided some protection against corrosion. But cast-iron pipes manufactured after World War II have significantly higher failure rates due to thinner walls. Because the wall thickness of ductile iron pipe also has decreased over time, “internal and external corrosion is a concern for this pipe material,” the study notes.

Of the four major pipe materials currently in use, only PVC pipe is not subject to corrosion, the Utah State researchers added. The study noted that PVC pipe has the lowest overall break rate of all pipe materials, reconfirming a finding in its 2012 report.

Because of their immunity to corrosion and improved installation techniques, PVC pipes have seen their break rate decrease by 10 percent since 2012. The break rate for corrosion-prone ductile iron pipes, on the other hand, has increased by 13 percent over the past six years. Noting that most utilities have a moderate-to-high corrosion risk, the study found there was a direct correlation between soil corrosiveness and break rates in metallic pipes.

Financial Crunch

“A total of 16 percent of all installed water mains are beyond their useful lives (up from 8 percent in the 2012 study), and utilities do not have the funds to replace them,” the study points out.

Because water-main failures tend to increase exponentially over time, utilities' corrosion-driven crisis threatens more and more communities. The study notes that the situation is particularly acute in such states as Minnesota, Wisconsin, Michigan, Illinois, Ohio, Pennsylvania, New York and Massachusetts, where the presence of rapidly deteriorating iron pipes spells trouble for water systems.

Facing decreasing water quality and increasing water loss, pipe replacement levels at both large and small utilities are inadequate to keep up with the rate of deterioration. “Maintaining an obsolete system can cause severe financial hardship for cities as well as increase public health risks,” the study points out.

The study has attracted international attention. Utah State reports that it has been downloaded in more than 60 countries, a sign of how seriously public health officials worldwide view water pipe safety and reliability. And mindful of the disaster that struck Flint, EPA has instructed its lab in Cincinnati to undertake a comprehensive study of corrosion in iron pipes.

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