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Getting Optimized

PARTNERSHIP FOR SAFE WATER GUIDELINES

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Sustain Distribution System Integrity With Pipeline Installation, Replacement, or Rehabilitation

BY BARB MARTIN AND TOM RIES

Pipeline installation, rehabilitation, and replacement practices can affect a distribution system's physical integrity and a water utility's ability to maintain optimized performance. Applying appropriate pipeline assessment and planning practices will help utilities maintain performance and condition of this significant system asset.

Potable water distribution systems play an essential role in providing safe water to consumers and protecting public health. Because of their importance, it's critical that distribution system assets, such as the pipelines comprising much of a system's physical infrastructure, are properly maintained, rehabilitated, or replaced. Compromised pipeline condition can result in main breaks, increased potential for contaminant exposure, and water loss issues.

OPTIMIZING PIPELINE RENEWAL

With AWWA's *Buried No Longer* report citing a need for at least $1 trillion in infrastructure investment during the next 25 years to maintain current levels of water service, this is a significant challenge that requires prudent and comprehensive long-term planning to address utility needs.

Key optimization parameters of the Partnership for Safe Water's distribution system optimization program focus on maintaining a system's water quality as well as hydraulic and physical integrity. The Partnership uses main break frequency as a numerical performance indicator of physical integrity. The program's self-assessment process includes several areas relating to physical integrity: pipeline installation, rehabilitation, and replacement; internal and external corrosion control; asset management; and utility administration. Pipeline rehabilitation and replacement are also components discussed in AWWA Standard G200, Distribution Systems Operation and Management.

CASE STUDY

ENSURING RELIABLE UTILITY OPERATIONS

By Tom Ries, Aurora Water (www.aurorawater.org), Aurora, Colo.

The city of Aurora, Colo., has a large, diverse potable water distribution system. With a total length of approximately 1,380 miles, the system contains pipes of multiple sizes and materials, including asbestos cement, cast iron, ductile iron, polyvinyl chloride, high-density polyethylene (HDPE), steel, and other materials.

Information about the system's asset inventory such as size, age, and pipe material is maintained in the utility's geographic information system. Along with routine maintenance of the pipes and appurtenances, rehabilitation and replacement has long been a part of Aurora Water's (AW) asset management program. In fact, most of AW's asset management annual rehabilitation budget is focused on linear assets.

AW typically selects between 15,000 and 25,000 ft/yr to be included in the annual contracted neighborhood waterline replacement program. An additional 5,000–8,000 ft is replaced by in-house crews on an as-needed basis in areas not suitable for a contracted project. Exact footage for replacement depends on available budget and project complexity. Selection of specific segments is performed internally based on guidelines contained in AW's Waterline Replacement Standard Operating Procedure (SOP).

Developed and refined over several years with input from staff in operations, engineering, finance, and management, the SOP includes criteria used to select areas that need to be replaced. The criteria include number, type, and severity of water breaks; pipe material; age; soil resistivities as a measure of potential corrosion; and observed pipe conditions as documented by repair crews.

Also, AW has ranked critical water-dependent facilities such as hospitals, critical-care facilities, nursing homes, and schools, and the consequences of disrupting those areas are important factors in planning replacement projects. In addition, AW coordinates with the Public Works Department to identify areas being considered for pipe replacement that are also scheduled for paving overlay. These areas are given priority to avoid disrupting newly paved streets.

Historically, "dig and replace" has been the utility's preferred method of rehabilitation and replacement. AW has had limited experience with trenchless technologies in rehabilitating potable water pipelines, having participated in only one small pipe-bursting project and using HDPE to line a pipeline suspended on a bridge. Because of the increasing reliability of existing techniques and the development of new and innovative trenchless technologies, AW recently began exploring a potable pipe lining project in an area that's difficult to reach and isn't conducive to the dig-and-replace method. Although planning is still in the early stages, if this project is technically feasible and cost-effective, it could pave the way for AW to increase use of trenchless methods in the future.

OPTIMIZED SYSTEM COMPONENTS

Distribution systems optimized regarding pipeline rehabilitation and replacement have implemented a structured program by which pipelines are inventoried and assessed. Optimized systems use such information with associated data to identify needs and develop and prioritize pipeline rehabilitation and replacement strategies, both in terms of funding and physical requirements. Although renewal rates and practices may vary from one utility to the next, these steps can help utilities maximize asset life, minimize leaks and breaks, and continuously deliver desired water quality and quantity to consumers.

Pipeline Inventory. An important component of an optimized pipeline renewal program is an accurate inventory of the system's pipeline assets, including location information, pipe age, physical attributes such as size and construction material, the surrounding soil conditions, and external coatings or protection. This information is typically stored in a database, often as part of the utility's asset management program, where it may be compiled with associated financial information for cost determination and planning purposes.

Accurate asset inventory information benefits distribution system operations in many areas. For example, knowing the sections of pipe in the system that may compromise water quality can help utility staff develop proactive water quality sampling and analysis procedures concerning those sections.

Performance Assessment. Several factors may help utilities identify specific areas of a system for pipe replacement. AWWA Standard G200 offers a weighted model for evaluating 10 parameters associated with prioritizing pipeline renewal and replacement, including main break frequency, pipe material and age, water quality, and maintenance cost. Although main break frequency is a significant factor in identifying areas of pipe for renewal, optimized distribution systems will consider these data in conjunction with other information, including customer complaints, water quality, pressure data, and the frequency of operational procedures such as flushing conducted to address water quality concerns. Technologies are also available to more directly assess pipe condition, such as acoustic leak detection, pipe coupon testing, and nondestructive inspection techniques.

The quality and quantity of data available to decision makers will be an important factor influencing the resulting outcome, so standard operating procedures (SOPs) should be developed and used for the most critical data collection processes. By systematically assessing pipeline performance, utilities will obtain the data necessary to identify, prioritize, and develop a plan for pipeline renewal.

Planning and Prioritization. With the significant long-term expense associated with pipeline rehabilitation and replacement, optimized systems will have a systematic plan for conducting pipeline renewal throughout the distribution system. The plan will, ideally, include strategies for securing funding to support ongoing renewal activities and for prioritizing the specific pipeline segments to be addressed over time, selecting appropriate renewal techniques, and completing the pipeline renewal activities.

Several models are commercially available to assist utilities with the prioritization and planning process. AWWA Manual of Water Supply Practices M28, *Rehabilitation of Water Mains*, describes several pipeline renewal, cleaning, and rehabilitation techniques to help utilities identify the best approach for their needs based on cost, site conditions, and anticipated long-term performance.

AN ONGOING PROCESS

Optimizing pipeline rehabilitation practices can increase asset life, improve water quality, reduce water loss, and improve public health protection. Pipeline renewal is an ongoing process, with optimized utilities continually updating system information and gathering data that contribute to planning and help ensure a distribution system's physical integrity for future generations.