PVC PIPE ASSOCIATION
TECHNICAL BRIEF

DIPRA STUDY ON WATER PIPE MATERIALS PROVIDES BIASED RESULTS

A 2016 study funded by the Ductile Iron Pipe Research Association (DIPRA), titled "A Framework to Evaluate the Life Cycle Costs and Environmental Impacts of Water Pipelines," is advertised as a tool to help utility professionals determine the cost-effectiveness, environmental impacts and life cycle costs of pipe materials used for water systems. The report was written by Thomas, Mantha, and Menassa of the University of Michigan. Unfortunately, when comparing ductile iron (DI) pipes to PVC pipes, the study contains unjustifiable design assumptions on pipe service lives and hydraulic flow factors. These assumptions have biased the analysis in favor of DI pipe.

SKEWED DESIGN ASSUMPTIONS

The paper based its comparison on three key assumptions:

1. DI pipe's expected service life
2. PVC pipe's expected service life
3. DI pipe's Hazen-Williams "C" factor

Unfortunately, the study has missed the mark on all three.

UNREALISTICALLY LONG DI PIPE SERVICE-LIFE

The authors assigned DI pipe a useful life of 100 years. However, an AWWA WRF study, titled "Long-Term Performance of Ductile Iron Pipes," reported that 8-inch Pressure Class 350 DI pipe in moderately corrosive soils may last as little as 11 to 14 years. This finding is significant because much of the iron pipe sold today is thin-walled Pressure Class 350. In addition, DI pipe's service life can vary due to variables that were not addressed in the study, such as:

- Construction damage – service life may be shortened by construction damage to DI pipe asphaltic coatings or to corrosion mitigation items
- Soil corrosivity – service life can be affected by soil conditions experienced by the majority of U.S. water utilities
- Corrosion mitigation – mitigation techniques may not function as designed

In addition, according to a recent LCA report titled "Life Cycle Assessment of PVC Water and Sewer Pipe and Comparative Sustainability Analysis of Pipe Materials," several other studies have advocated significantly reduced life expectancies for DI pipes. For this reason, the LCA assigned a 50-year life to ductile iron.

SHORT PVC PIPE SERVICE-LIFE

Conversely, the authors gave PVC pipe a life of only 50 years. In one of the references used by the authors, a 2012 report by Folkman, the life of PVC pipe is assigned 41 to 60 years. However, Folkman made no such statement in his 2012 report – instead in a 2014 study, he put the service life of PVC pipe "in excess of 100 years." In a recent letter to the University of Michigan authors, Folkman verified the 100-year life for PVC pipe and cited 15 additional studies from around the world attesting its 100-year-plus longevity.

Click here to view Folkman's 2014 report on PVC pipe longevity. Click here for Folkman's letter to the authors.

UNJUSTIFIED DI PIPE FLOW FACTOR

The authors provided a pumping-cost study assuming a Hazen-Williams "C" flow factor of 140 that remains constant for 100 years for DI pipe. However, a study by St. Clair using 27 DI water pipe field samples from Washington Suburban Sanitary Commission showed that actual "C" values ranged from a high of 140 down to a low of 75. These test results call into question the constant-value assumptions made for "C" and demonstrate that DI pipe's flow factor declines with age rather than remaining constant over time. Recent data from the City of Detroit also show that DI's flow characteristics decline over time.

Click here for St. Clair study. Click here for City of Detroit study "C-Factor Projections."

ASSUMPTIONS NEED TO BE REVISED FOR STUDY TO PROVIDE OBJECTIVE DATA

The authors should revisit their paper in light of the above discussion and revise their design example with three changes:

1. A reduction in DI service life
2. An increase in PVC service life
3. A reduction in DI flow factors over time

Only with more realistic input parameters will the design example become relevant for utilities that are considering both materials.

References: "A Framework to Evaluate the Life Cycle Costs and Environmental Impacts of Water Pipelines," Thomas, A., Mantha, B., and Menassa, C. (2016); Detroit Water Master Plan, City of Detroit, MI (2015); "Development of a Novel Performance Index and a Performance Prediction Model for Metallic Drinking Water Pipes," St. Clair, A. (2013); letter to University of Michigan, Folkman, S. (2016); "Life Cycle Assessment of PVC Water and Sewer Pipe and Comparative Sustainability Analysis of Pipe Materials," Sustainable Solutions Corporation (2017); "Long-Term Performance of Ductile Iron Pipes," AWWA WRF (2011); "Validation of the Long Life of PVC Pipes," Folkman, S. (2014)

PVCPIPE association
Uni-Bell PVC Pipe Association | 201 E. John Carpenter Freeway, Suite 750 | Irving, TX 75062
Phone: (972) 243-3902 | Fax: (972) 243-3907 | info@uni-bell.org

5.22.2017