IRON PIPE CORROSION - LESSONS LEARNED

"Lessons Learned from Iron Pipe" is a six-volume document that investigates iron pipe corrosion. The study was funded by the American Concrete Pressure Pipe Association in conjunction with several large engineering consulting companies. Volume 6 includes a summary of materials covered in the other volumes and is the reference used for this Technical Brief. (Click here to see Volume 6.)

DUCTILE IRON CORROSION - CASE STUDIES

The "Introduction" section of Volume 6 states that the first five volumes include ductile iron (DI) corrosion case studies over a service life of 5 to 36 years. The case studies demonstrate that ductile iron pipe:

1. Corrodes in corrosive soils
2. Requires corrosion protection to avoid premature failures and pipe replacement

VOLUME 5 - TEN POINT METHOD NOT RELIABLE

The Volume 6 "Introduction" section also reports that Volume 5 contains data and analyses for 60 incidents of ductile iron corrosion. All of these projects were evaluated using DIPRA's Ten-Point Soil Test Evaluation Method. The conclusion was that the Ten-Point system is not a reliable method for determining soil corrosivity. Also included in Volume 5 are the corrosion rates (mm lost per year) for each specimen.

VOLUME 6 - SUMMARY AND CONCLUSIONS

Volume 6 lists notable conclusions drawn from the analyses and the literature cited in the first five volumes. Here are six of those conclusions:

1. On ductile iron versus cast iron:
   "DIP water mains corrode at the same rate as its forerunner product, grey cast iron water mains."
2. On iron-pipe corrosion and wall thickness:
   "The time to external corrosion penetration in pipe is directly related to wall thickness…"
3. On corrosion time-to-penetration:
   "Typical DIP products have substantially thinner walls than grey cast iron pipe. When compared to the durability of grey cast iron pipe, unprotected DIP in corrosive environments has more rapid penetration of the pipe wall through pitting corrosion."
4. On asphalt coating:
   "The factory-applied asphaltic coating that is typically provided for DIP provides no appreciable level of corrosion protection to underground pipe."
5. On polyethylene (PE) encasement:
   "Corrosion failures occur at polyethylene-wrapped ductile iron piping at tears in the polyethylene encasement and directly under undamaged polyethylene encasement."
6. More on PE encasement:
   "In some cases, polyethylene encasement can elevate the risk of corrosion failures."

To summarize these six points:

1. Corrosion: ductile corrodes at the same rate as cast, but has much thinner walls. Thinner walls mean quicker corrosion penetration. (To see Tech Brief "Iron Pipe Wall Thickness – Thinner and Thinner," click here.)
2. Corrosion prevention: commonly used corrosion-prevention methods are problematic – DI's asphaltic coating does not provide protection against corrosion and PE encasement can sometimes do more harm than good.

DI CORROSION - A BIGGER PROBLEM THAN THOUGHT?

This document presents convincing evidence that corrosion of ductile iron pipe is a significant issue. Despite the large number of known DI pipe corrosion failures, Volume 6 makes the point that the problem may be much larger than thought:
"However, the true extent of the corrosion failures is not known because most failures of DIP are repaired by water and wastewater crews without being evaluated for corrosion and without documentation as to the cause of the failure."

References: American Concrete Pressure Pipe Association, "Lessons Learned from Iron Pipe," Volume 6 (unpublished); Uni-Bell, Tech Brief: "Iron Pipe Wall Thickness – Thinner and Thinner" (2016)

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