TECH TIPS
FROM NASSCO

USING INLINE ACOUSTIC TECHNOLOGY TO ASSESS METALLIC FORCE MAINS

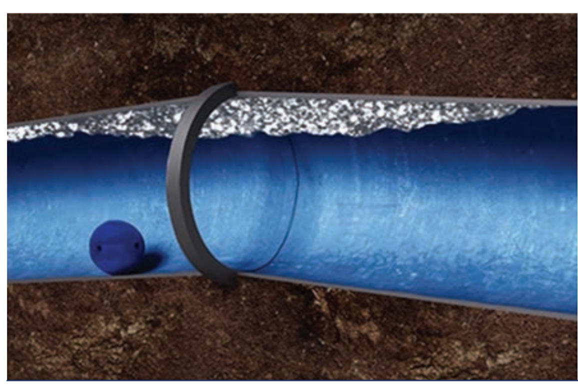
By NASSCO Pressure Pipe Committee Members Brent Johnson and Jimmy Stewart

According to industry surveys, force mains account for only about 7.5% of wastewater collection systems. However, they are often located in highly critical areas where the consequences of failure can be severe. A survey of utility subscribers conducted by the Water Environment Research Foundation (WERF) and the National Association of Clean Water Agencies (NACWA) found that the primary cause of force main failures is internal corrosion, indicating that these mains typically fail from the inside out.

Inspecting force mains is significantly more challenging than inspecting gravity mains. In addition, budget constraints often limit the extent of a utility's inspection efforts, making it important to select an assessment approach that balances risk, effort, and cost. One cost-effective strategy is to begin with an inline acoustic inspection, which is less expensive than higher-resolution inspection technologies, followed with engineering analysis at targeted locations.

WHAT IS INLINE ACOUSTIC TECHNOLOGY?

Inline acoustic tools contain a hydrophone housed in a watertight sphere that records sounds within the force main as the tool travels through the pipeline. These tools may also contain other instrumentation such as an accelerometer, gyroscope, magnetometer, pressure sensor and temperature sensor.

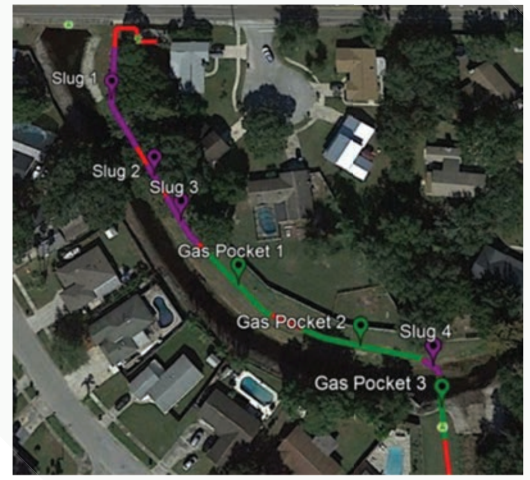


HOW IS THE INSPECTION COMPLETED?

The tool is free-swimming and travels with the flow of wastewater while collecting data. It is inserted through a check valve at a pump station or through a small tap in the pipeline. During the inspection, the tool is either tracked in real time or its arrival time is based on the arrival of dye introduced into the system prior to tool insertion. Data is collected continuously by the onboard sensors as the tool moves through the pipeline. The tool is then retrieved at a manhole or at a bar screen structure within the treatment plant, after which the data is downloaded and analyzed.

WHAT DATA IS OBTAINED?

Acoustic tools cannot directly assess pipe wall condition or identify areas of wall loss. They can, however, detect leaks (provided the pressure within the force main is sufficient for the leak to be acoustically identified) and pockets of trapped gas. Analysts can distinguish whether the trapped gas is moving or stationary. Large, stationary pockets of hydrogen sulfide gas promote the formation of sulfuric acid, which rapidly degrades ferrous pipe materials. On board pressure sensors will identify if any blockages are present.



HOW TO USE THE RESULTS?

Leaks

If the pressure in the force main is high enough for a leak to be detected, it will be reported and a dig/locate sheet provided. The analysts will be able to report whether the leak was detected on the barrel of the pipe or at a joint, enabling the utility to make a more informed decision about the appropriate repair approach.

Gas Pockets

Gas pockets can present both operational and structural concerns. From an operational perspective, large gas pockets can interfere with pump performance. Comparing the locations of detected gas pockets with air release valve locations and maintaining those valves through a regular inspection and maintenance program, can help minimize the accumulation of trapped gas.

External Wall Thickness Testing

Although acoustic technologies do not provide data on pipe wall condition, the detection and locating of established gas pockets helps utilities identify areas which have an elevated risk of hydrogen sulfide-induced corrosion. Those areas can then be excavated and evaluated using external wall thickness testing methods such as ultrasonic testing, broadband electromagnetic testing, or pulsed eddy current testing.

The resulting wall thickness data can be used in structural modeling to evaluate the remaining strength of the corroded pipe. This helps utilities determine whether immediate action is required or whether repairs can be planned for a later date. In addition, probability-of-failure modeling can be performed to estimate remaining useful life, or time to failure, at the tested location. Together, these analyses support more informed decisions regarding repair, rehabilitation, and future reinspection planning.

CONCLUSION

Although corrosion in a force main can occur anywhere around the pipe circumference, it is often cost-prohibitive to deploy the high-resolution technologies needed to collect detailed condition data on every force main of concern. Using a lower-resolution acoustic inspection tool allows utilities to assess a larger portion of their force main network and identify locations with a higher likelihood of corrosion for further evaluation. This targeted approach supports more effective decision-making, risk management, and capital planning.

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