Force Main Condition Assessment: Systematic approach, agency perspective

FMCA engineering perspective: Chris Ewers, P.E., Ewers Engineering, Inc.

Why assess force main condition?

Our pipelines are getting older, and manufacturing of these pipelines has shaved material and safety factors over the decades. Local corrosion experts see a "tidal wave" of pipeline failures bearing down on us.

Good management: FMCA saves money, protects your agency, and serves your customers.

Regulatory compliance: The State of California is not amused by agencies that endanger public health through failing force mains. Don't risk significant, million-dollar-plus fines for failures.

Risk reduction: Stay out of the crosshairs for environmental NGOs. State fines are a pittance compared with follow-up Clean Water Act lawsuits.

Which technology to use?

Generally, the marketplace for technology is divided into two types of tools, Level 1 (leak and gas pocket detection), and Level 2 (pipeline structural assessment). We'll tour the technologies in the presentation.

Approach

Take the reins: Develop data. Find out what you've got, where it is, how it works, and document it. Pay particular attention to as-built records.

Find out what has failed. Complete a Level 1 (leak and gas pocket detection) program.

Prioritize Level 2 projects. Update priorities and communicate with boards and councils.

Stay agnostic. Vendors dominating the market do not necessary have the tool you need. Keep an open mind.

Agency perspective: Ron Hipkiss, P.E., Fairfield-Suisun Sewer District

Emergency event: A 36-inch force main failed in June 2013, a result of a cascade of issues, including pipe material and age, system changes, control problems, and maintenance practices. This failure prompted us to start our own FMCA program -- maybe the best thing to have happen.

Motivations

Force mains (FMs) are typically buried (out of sight, out of mind), always in service (due to lack of redundancy), difficult to access (hard piped, no manholes), have material challenges, and are costly to replace. No one wants to pay attention to them and won't until it becomes an emergency.

Getting started

Decide how the program will "look." Data could be in an asset management database, a spreadsheet, on Post-its, or integrated into an enterprise GIS.

Start with the basic information. Find out what you have and where it is. Age, material, depth, slope, ARV locations, cathodic protection, and utility crossings are all key. These will inform what tools are available and the urgency of using them.

Key challenges

Who will be the FMCA champion? This is a tough spot until emergencies are averted.

Get staff buy-in. This is more than an engineering exercise. Implementing new or changing O&M practices can be difficult to implement. Look for conflicts around pigging, pipe flushing, ARV test tools.

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Know what you have, plan what to do.

See if your agency has already started an FMCA program. Much of the front-end information needed for FMCA is available through the existing documents and staff. Check off all the data collection already completed. You might have much of the critical information already in hand.

Inventoried and mapped
- o Pumping facilities
- o Force mains
- o Isolation and air-vacuum valves
- o Access points

Verified
- o Force main diameters, materials, access points
- o Air-vacuum valve function
- o No leakage, disturbance
- o [Installed signage with contact number on alignment]

Tested
- o Lift station pressure/flow
- o No pressure transients
- o Corrosion test stations within correct operating range
- o Air-vacuum valves function

Condition assessment tools are developing, but the marketplace is consolidating. This table was developed for a condition assessment program in 2014 and is provided to give you an understanding of the requirements for some of the most popular and prominent tools. Note: Tool cost inflation is high, approximately 20 percent per year as big players consolidate.

Conceptual-level cost and timeline for C.A. investigation, 36-in.-diam. AWWA C303 force main [a]

Tool	Brand Name	Supplier	Mobilization	Tech. Fee/Inspection	Production Rate	Inspection cost	Site Visit	Reinsertion Fee	Report	Estimated Cost, 1 mile of evaluation	Est. project time, weeks [b]
Level 1: Leak and gas pocket detection											
Pipe-mounted hydrophones	LeakFinder RT	Echologics	$ 4,950	$30,902/mi. [c]	1 mi/day	$ 30,902				**$ 35,852**	NR
Free-swimming hydrophone	Smartball	Pure Technologies	$ 25,000	$14,000/mi.	2 mi/day	$ 14,000		$ 5,000	$ 10,000	**$ 54,000**	14
Tethered hydrophone	Sahara		$ 35,000	$17,000/day	2 insertions/2 mi/day	$ 17,000			$ 10,000	**$ 62,000**	14
Soil envelope investigation	Dependent on conditions.										
Pigging	Dependent on conditions.										
Inline mutiple-sensor robotic evaluation	Robotics	Pure Technologies	$ 60,000	$60,000/mi		$ 60,000			$ 10,000	**$ 70,000**	NR
	MSI Responder	Redzone Robotics		$31,680/mi		$ 31,680				**$ 31,680**	10
Level 2: Structural evaluation											
Inline mutiple-sensor robotic evaluation	See above in Level 1										
Ultrasonic thickness (UT) testing	Many	Many	0	$5,250	per site	$26,250			$ 2,000	**$ 28,250**	2-4
Broadband Electromagnetic (BEM) testing	BEM	Rock Solid Group	0	$15,500	per site	$77,500				**$ 77,500**	NR
Inline relative remaining metal evaluation	Pipe Diver	Pure Technologies	$ 70,000	$70,000/mi		$ 70,000			$ 10,000	**$ 150,000**	NR
Magnetic Flux Leakage (MFL) pig	MFL Pig	Pure Technologies	Much greater than any other technology. Specific costs not available.								

[a] Costs for 1 mile of 36-inch-diameter CPP pipeline evaluation as a pilot project, data gathered mid-2014.

Assumptions: Site-specific testing requires 5 sites/mile.

[b] "NR" = No response.

[c] Cost for more than 1 mile of pipe evaluation is $3.58/lf, or $18,902/mi.

FAIRFIELD-SUISUN SEWER DISTRICT

Fairfield-Suisun Sewer District oversees wastewater collection and treatment, water recycling, and stormwater management in a 41-square-mile area of Solano County. It serves the cities of Fairfield and Suisun City and Travis Air Force Base. The District owns and operates approx. 12 miles of force main 18-48 inches in diameter.

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Ewers Engineering has worked with California agencies to develop flexible, effective approaches for force main condition assessment. We have developed programs as extensions of staff to make a custom-cut force main condition assessment program. Contact us to talk about how to protect your agency and manage your facilities to minimize risk.

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