

Pipeline Management Solutions

Stop Age Discrimination in Pipe Replacement Strategies

Wisconsin Wastewater Operators Association

October 10, 2019



Buried Infrastructure Challenges



Over 240,000 water main breaks per year in the US

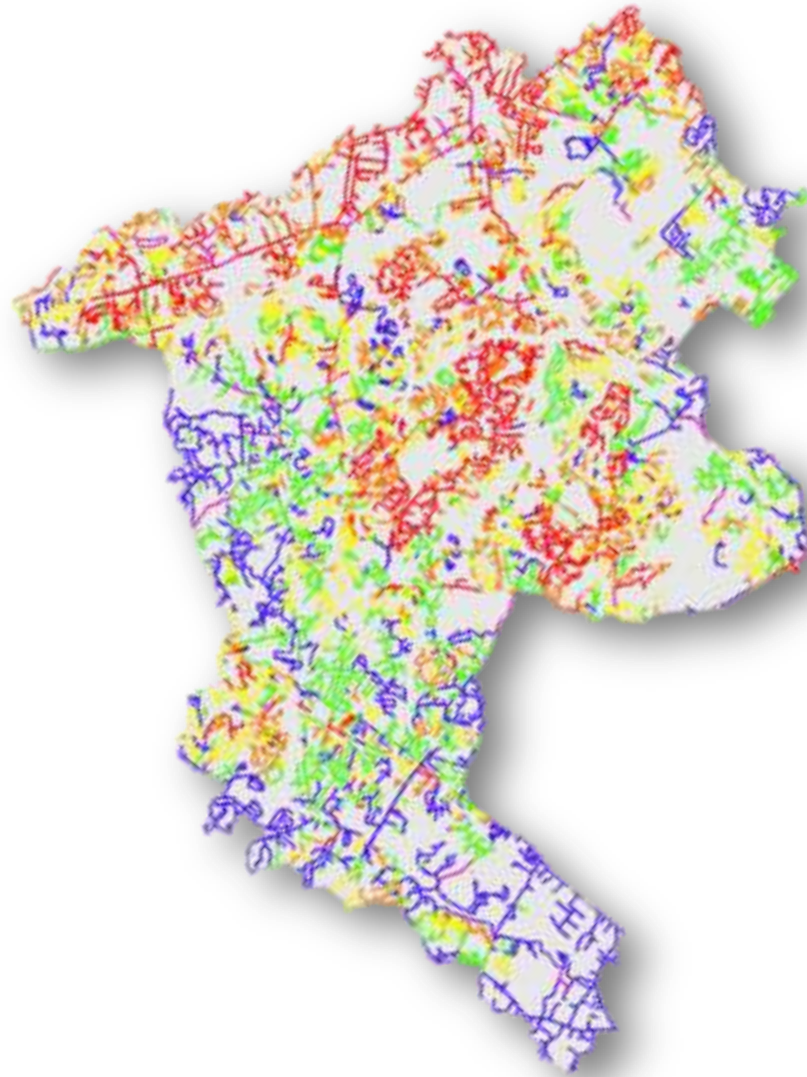
Over 900 billion gallons of sewage overflows per year in the US

>\$250 billion investment needed for water pipelines within 20 years

>\$80 billion investment in wastewater pipelines within 20 years

70% to 90% of replaced pipelines have remaining service life

Sources: ASCE & EPA



Risk

Likelihood of Failure (LoF)



Consequence of Failure (CoF)



$$\text{Risk} = \text{LoF} \times \text{CoF}$$

Likelihood of Failure

Pipe Condition

- Material quality
- Manufacturing
- Design
- Environmental
- Operational
- 3rd party damage
- Installation
- Age



Consequence of Failure

Social

- Loss of trust
- Traffic disruption

Environmental

- Creeks and rivers
- Sensitive areas

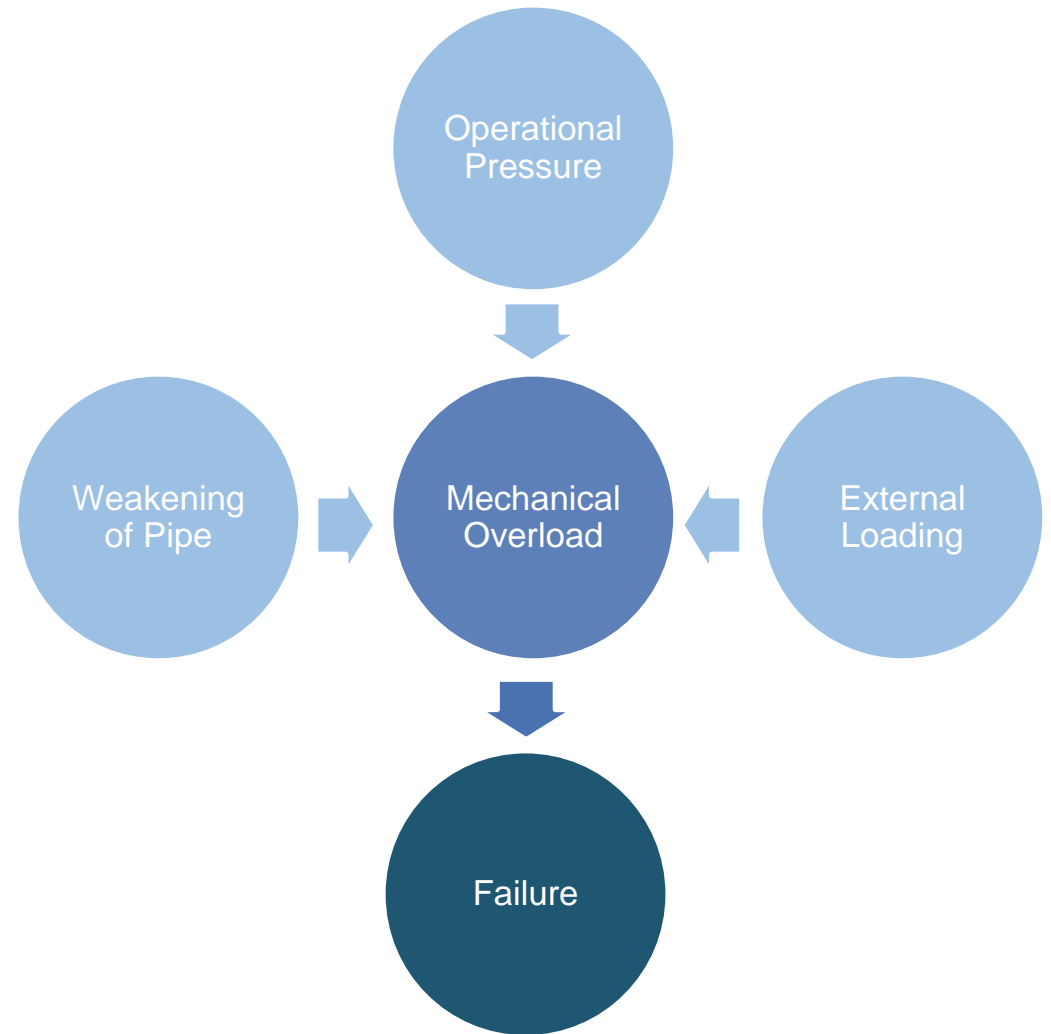
Economic

- Repairs
- Damage
- Loss of product





Why do Pipes Fail?





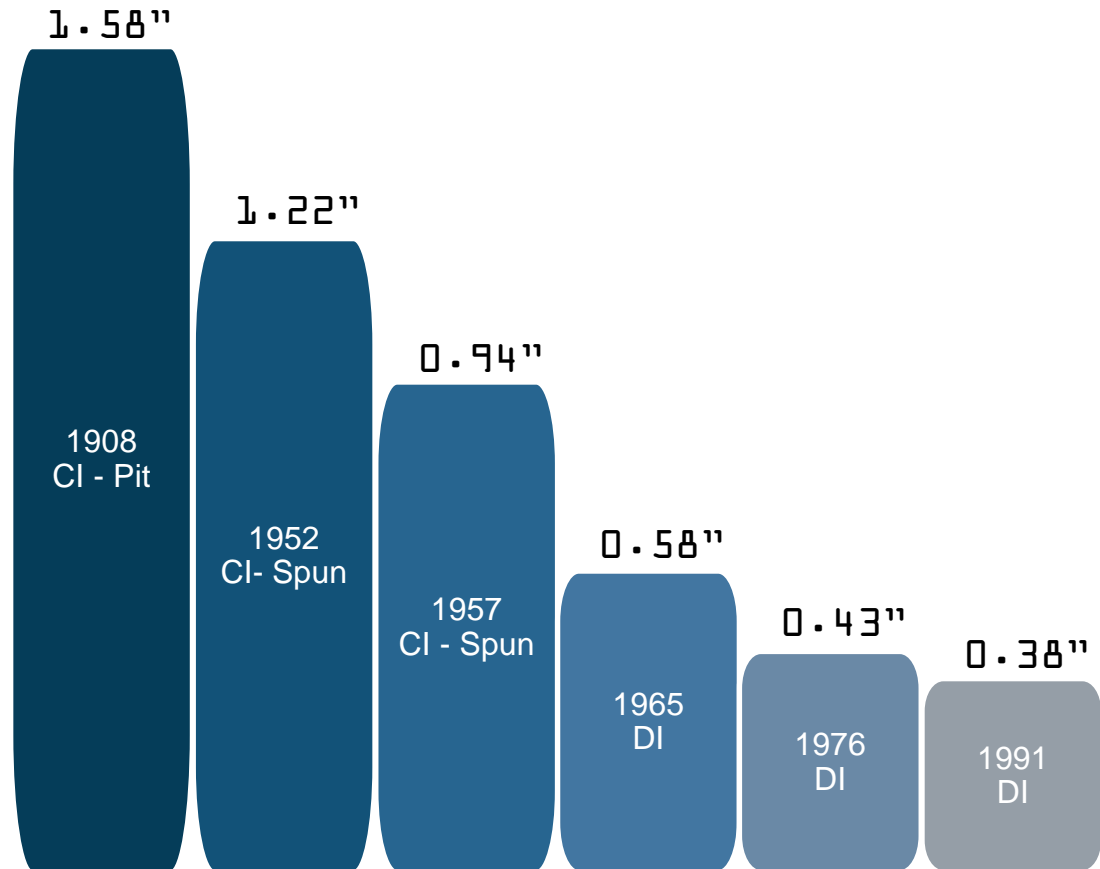
Cast Iron Pipes

- Cracking from joints (leadite)
- Longitudinal or circumferential cracking
- Graphitization, corrosion and pitting

Ductile Iron Pipe

- Broad areas of corrosion
- Internal or External

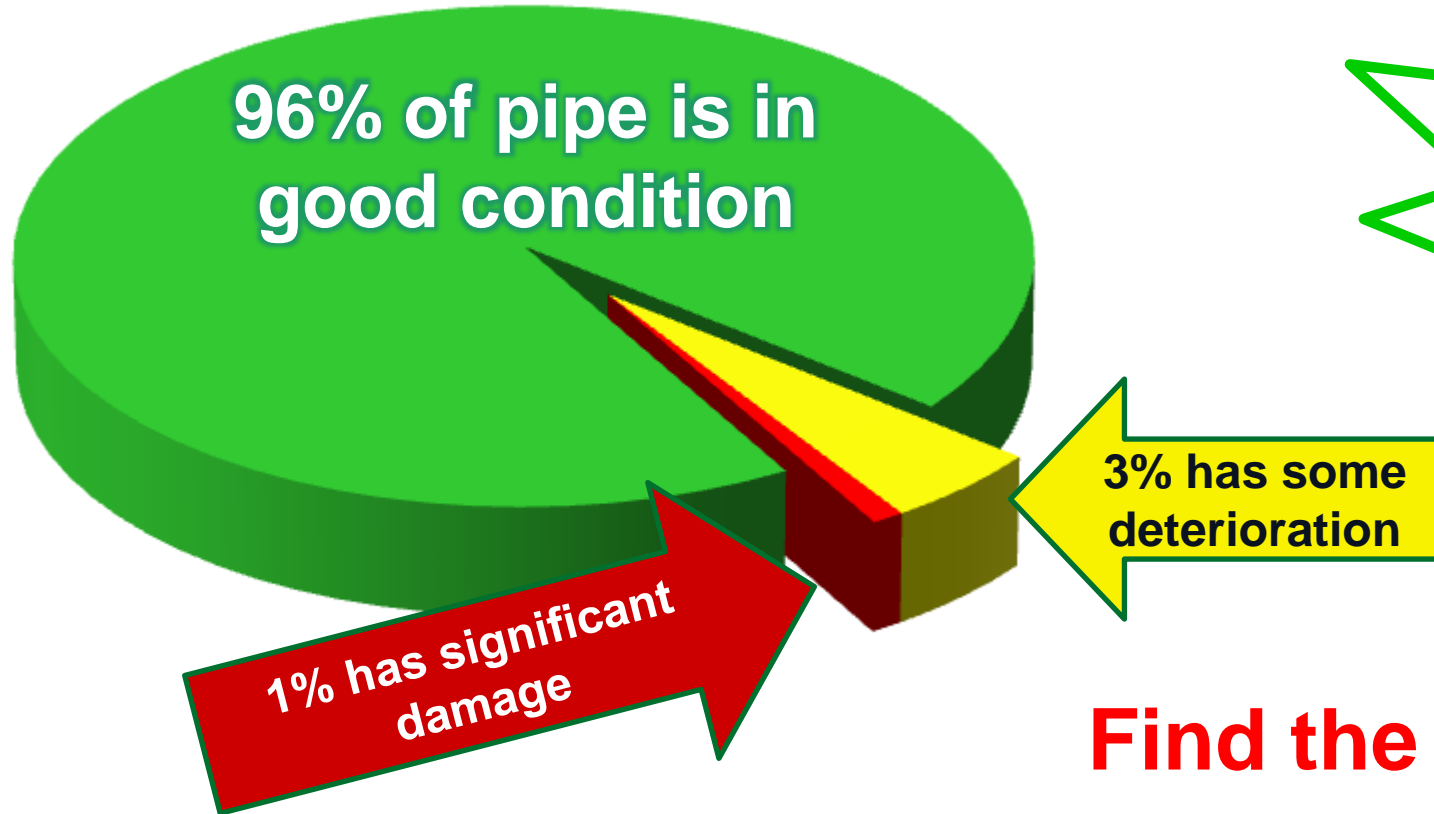
Age alone is a poor indicator of condition



36-inch Diameter – Pressure Rated for 150 psi



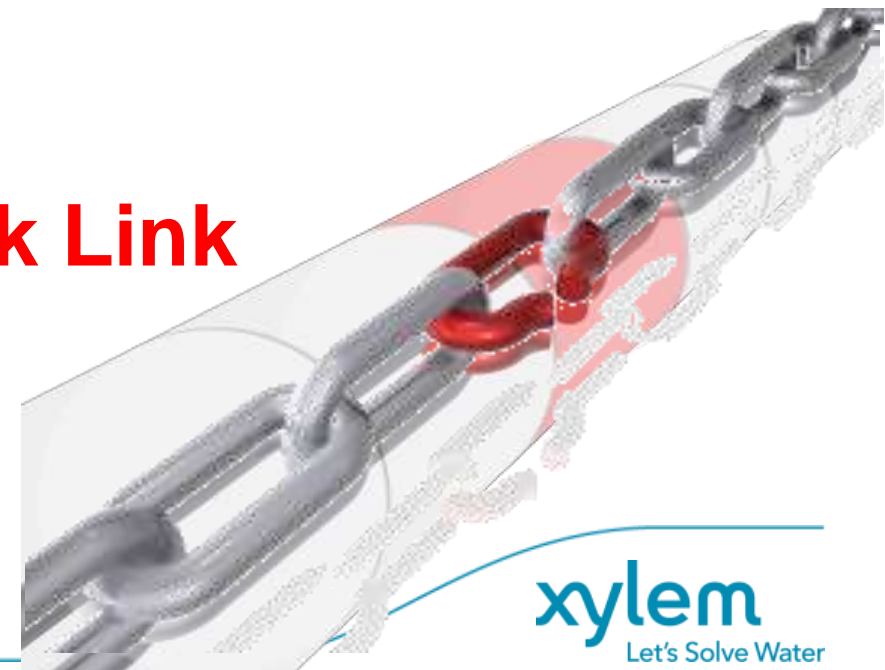
The Good News



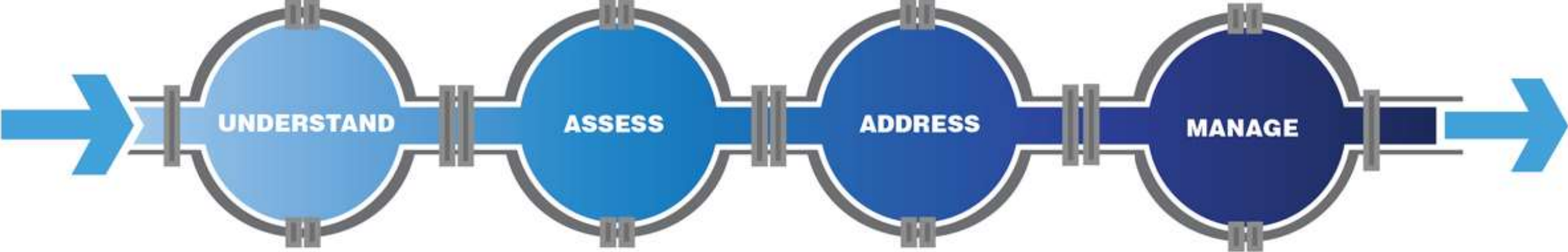
We only need to address 4% of our pipelines!

Find the Weak Link

Manage individual assets



Approach to Pipeline Condition Assessment



Risk, Operational
Characteristic, History



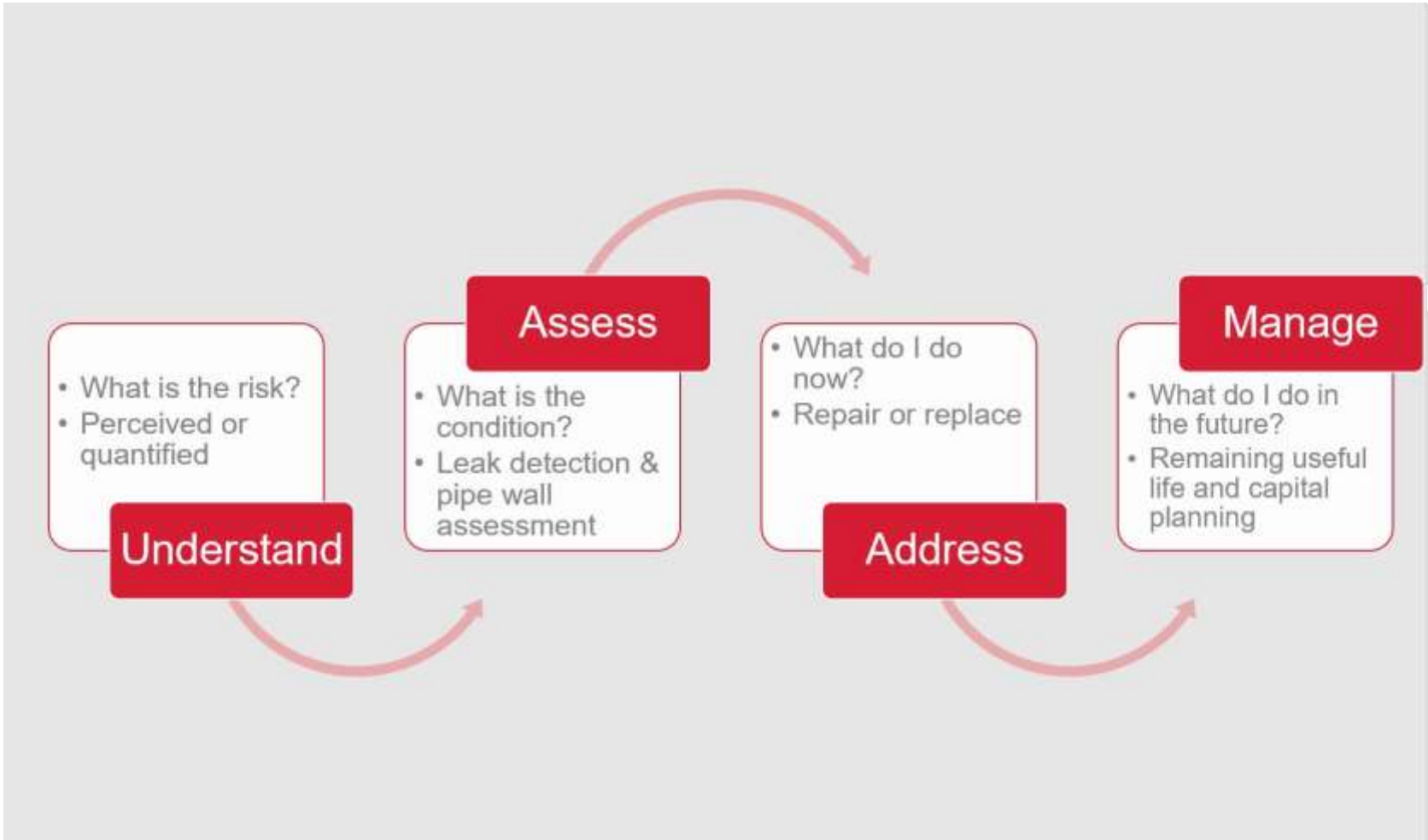
Gather condition data



Repair/Rehabilitation



Reinspection
Capital Planning



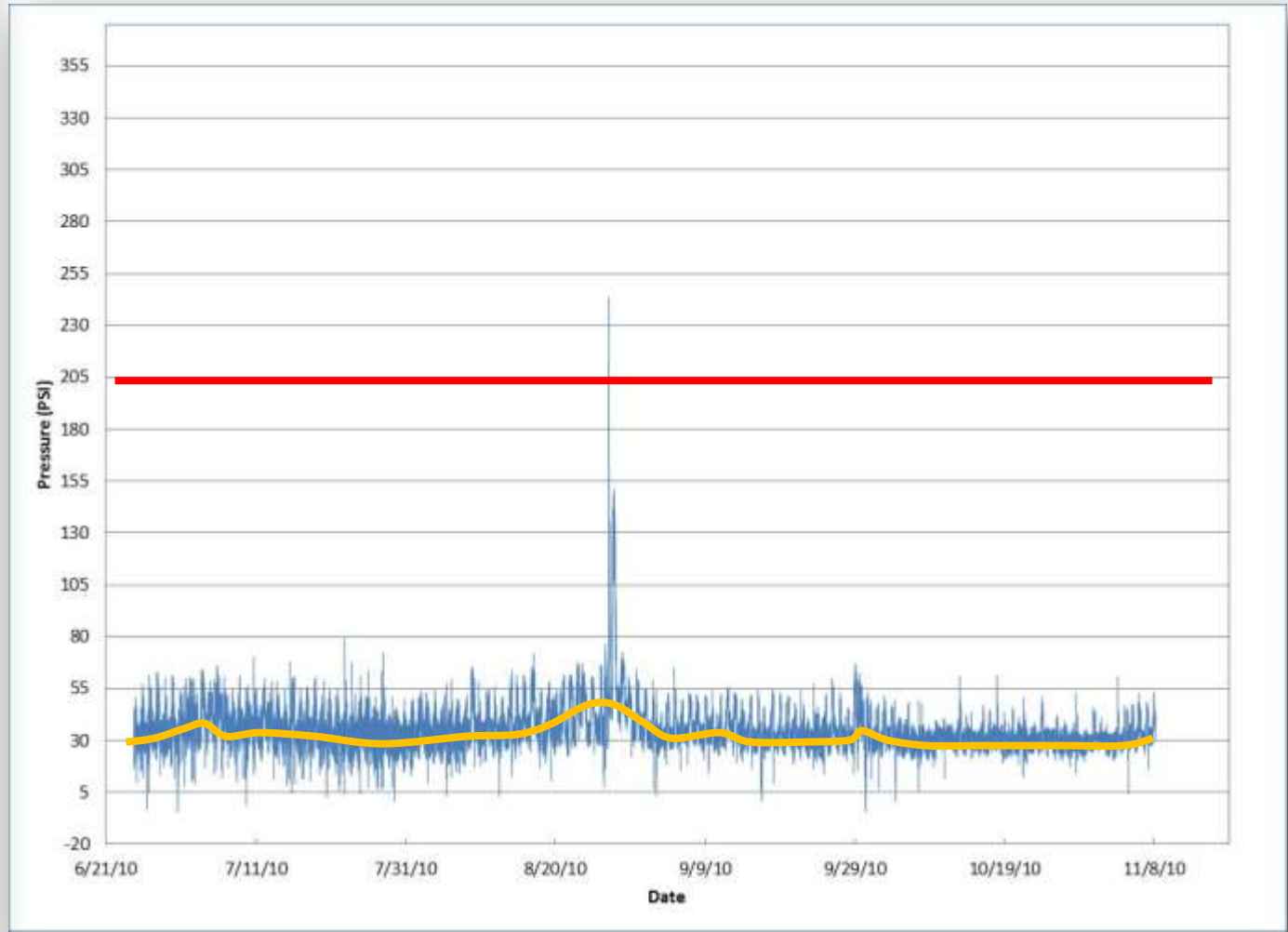
*No **single** technology or technique can identify **all** of the indicators of pipe deterioration.*

*Therefore, a **holistic**, risk based approach should be used.*

Using Risk as a Guide for Condition Assessment



Transient Pressure Monitoring

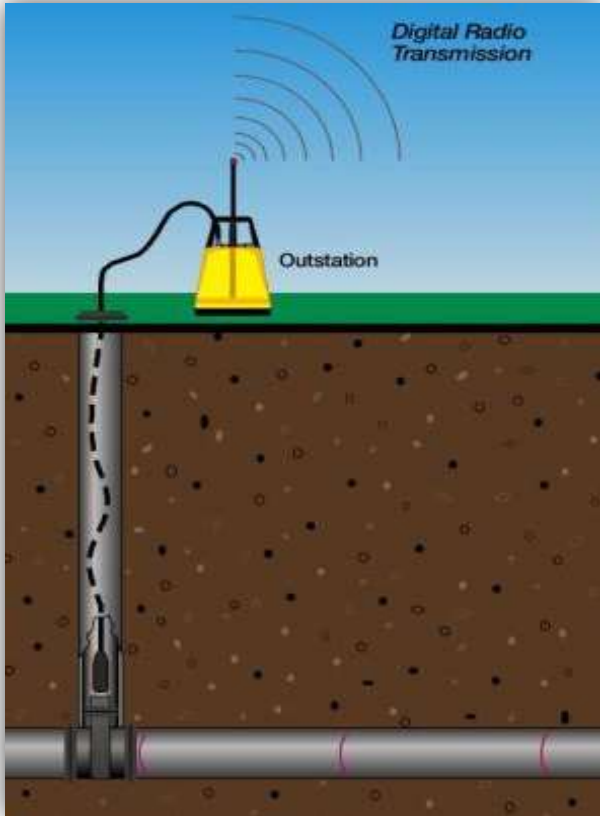


Small Diameter Leak Detection

Leak Survey with Loggers

Localize with Correlators

Pinpoint with Handheld Mic

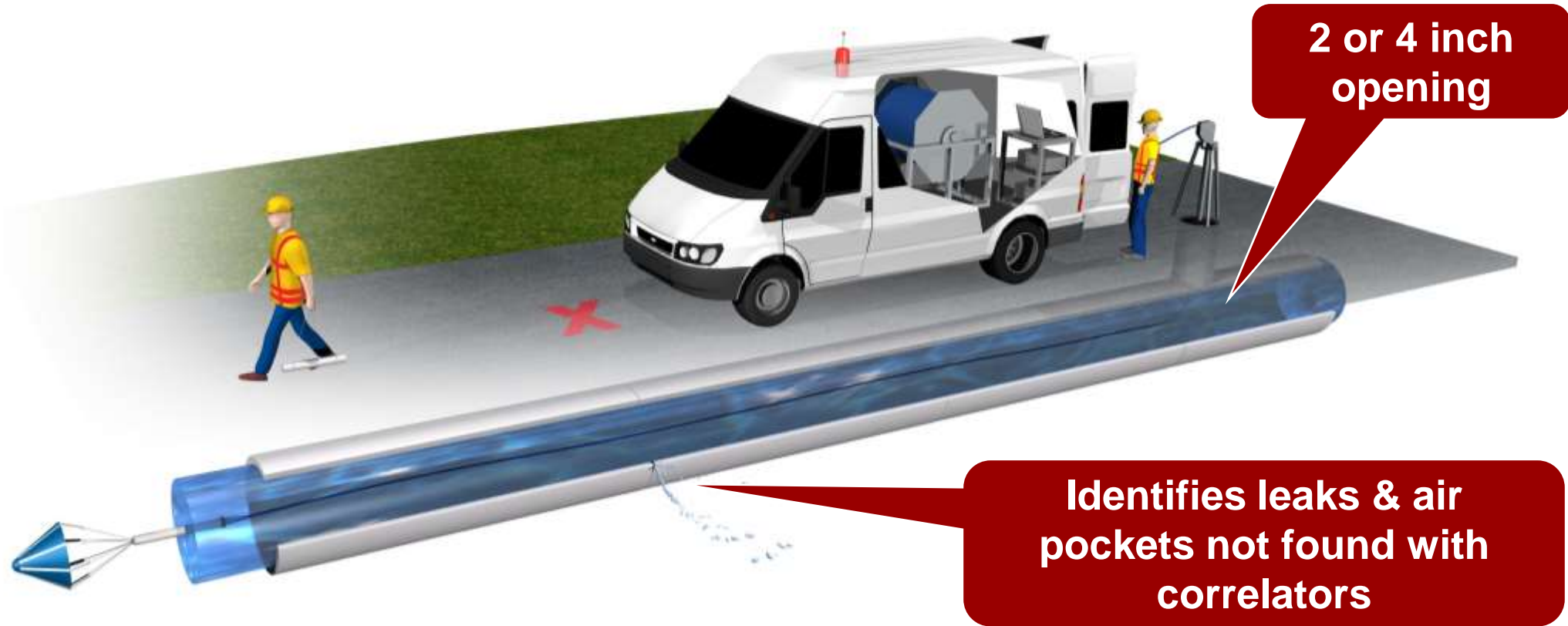




Leak and Gas Pocket Detection

- *Precursor to failure*
- *SmartBall and Sahara*
- *Contribute to force main failure*
- *Operational impact*

Tethered hydrophones can identify leaks and air pockets



Dallas Water Utilities Award Winning Program

- 144 leaks repaired in large diam pipe following 111 miles of inline leak detection

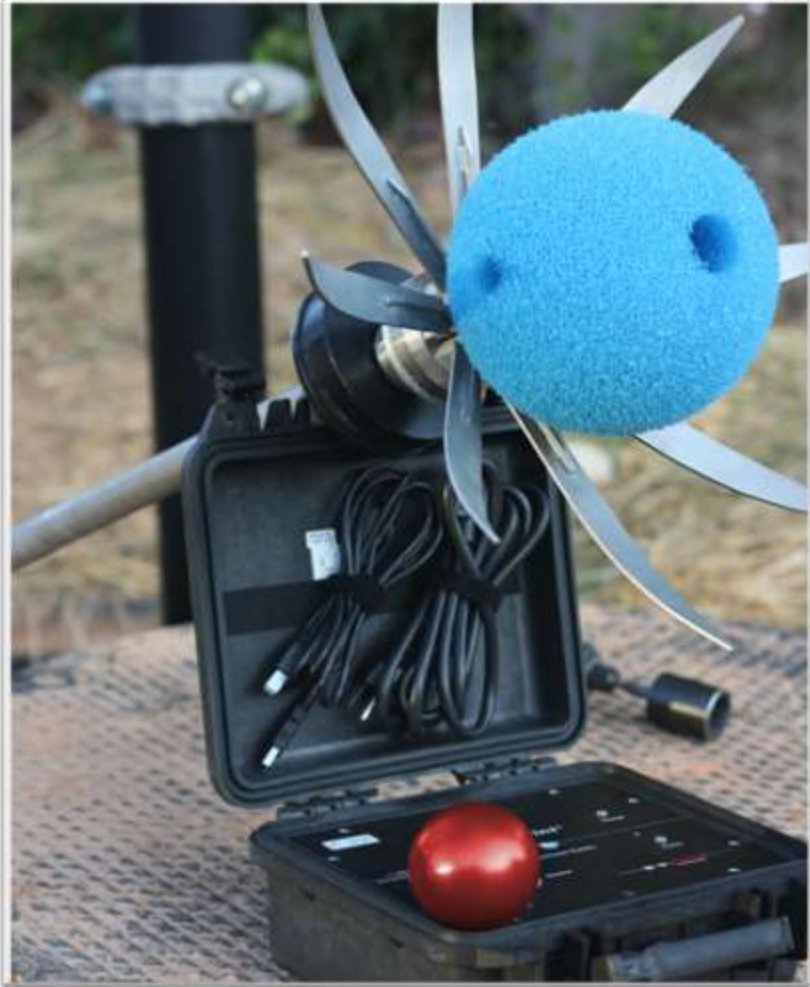
In-line Acoustic Leak & Gas Pocket Detection

Free Swimming/ Non-Tethered Hydrophone Technology

- Locates leaks and gas pockets in transmission or force mains
- Launch and retrieve in live flow through 4" openings
- Average 1 leak per 3 miles in concrete pipe
- Average 1 leak per 2 miles across all pipe materials



Introduction to SmartBall



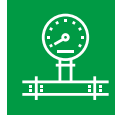
SmartBall is a free-swimming inspection platform that is used to help pipeline owners better manage their pipelines by:



Identifying and locating hidden leaks and gas pockets with high accuracy



Mapping the pipeline to confirm alignment



Measuring the pressure along the pipeline to identify partial blockages and confirm pipeline elevations



Identifying and locating potential undocumented features and pipe type changes



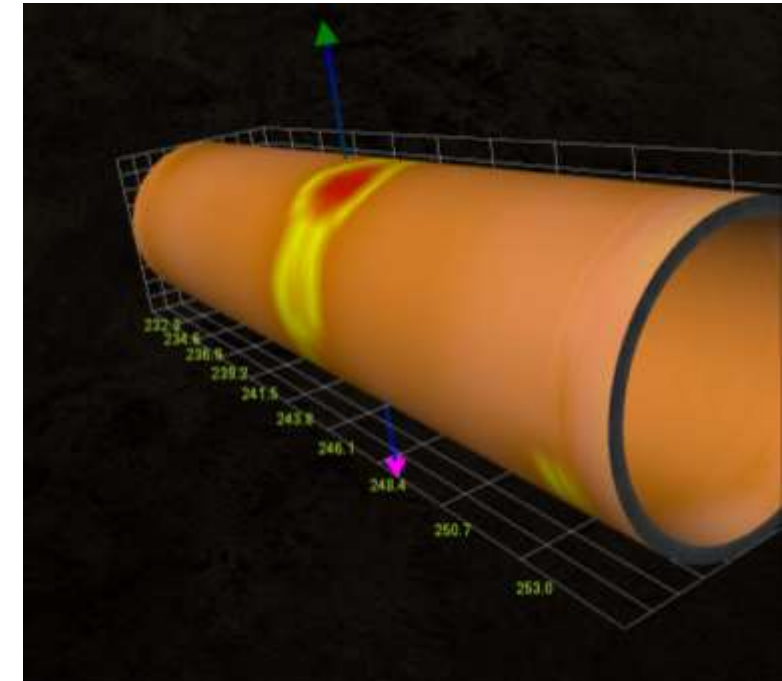
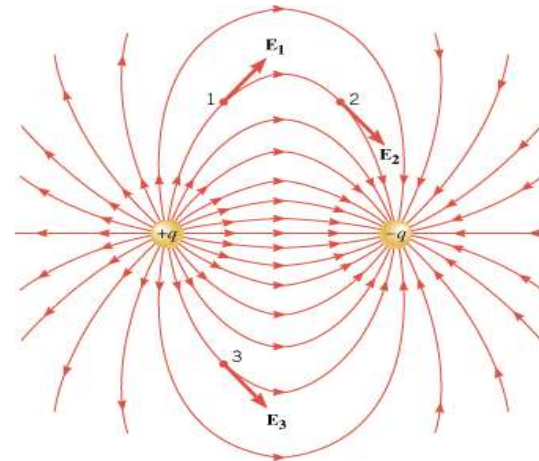
Contributing current inspection data to engineering analysis used for capital planning



Pipe Wall Condition

Identify pipe wall *defects*

- *Corrosion*
- *Wall loss*
- *Broken prestressing wires*
- *Broken bar-wraps*

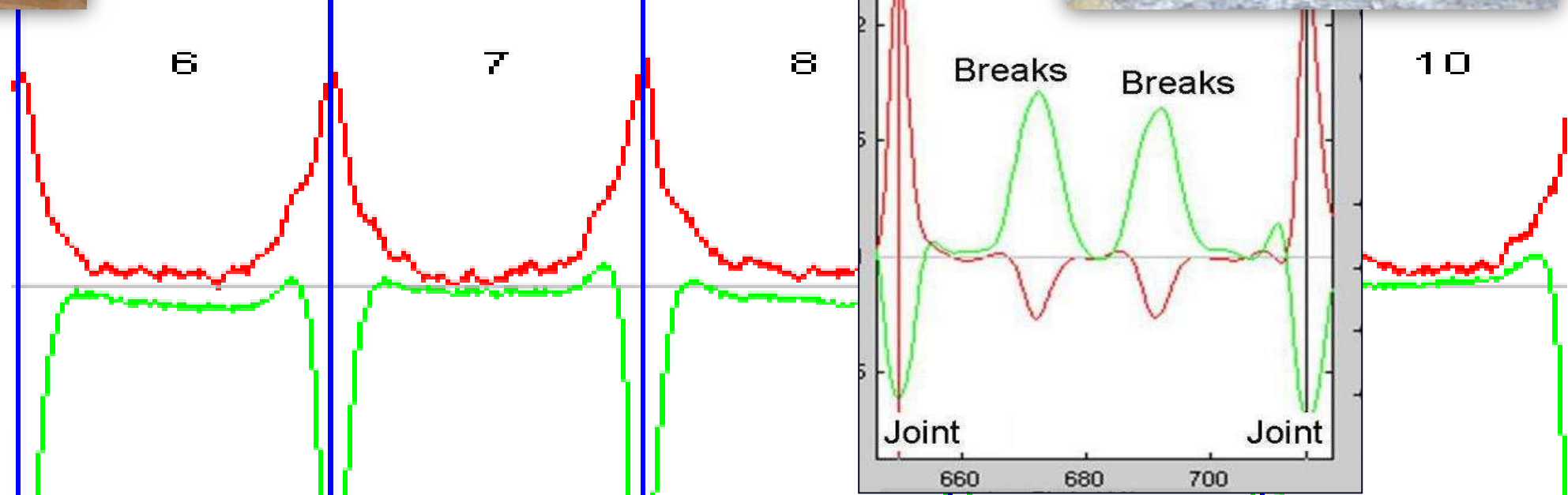


Electromagnetic inspection identifies each pipe joint and broken wire wraps



AMPLITUDE

PHASE



Internal and External EM Inspection Tools

Manned



Diameter: 36"+
Dewatered
Manned system
Allows for visual
and sounding
inspection
3D Mapping

External



Diameter: Any
Pipe segments
excavated to
springline
Manned system

Long Range Robotics



Diameter: 18"+
Depressurized pipeline
8,000 foot tether
Robotic with EM,
CCTV, SONAR, laser,
etc.
3D Mapping

Free-Swimming



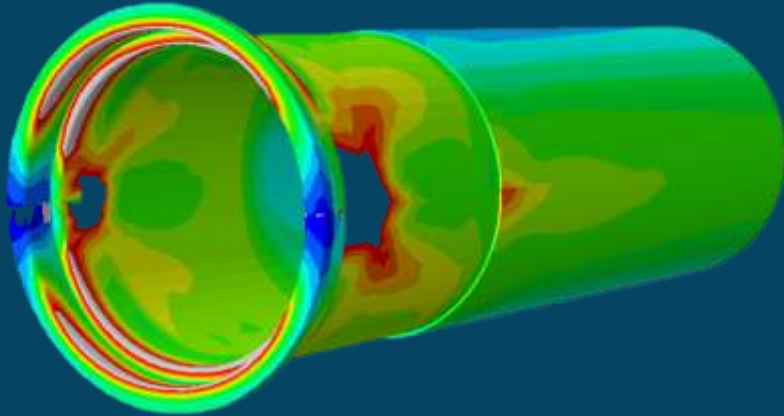
Diameter: 16"+
Pipeline In Service
Free swimming
* SONAR
* CCTV recording

Internal Visual and Sounding Inspection

- Complements EM Inspection and Structural Analysis
- Identifies problems with joints not addressed by EM
- Finds non-wire break related to problems (i.e., over loading, cracking, spalling, etc.)
- Provides accurate lay schedule and pipe inventory

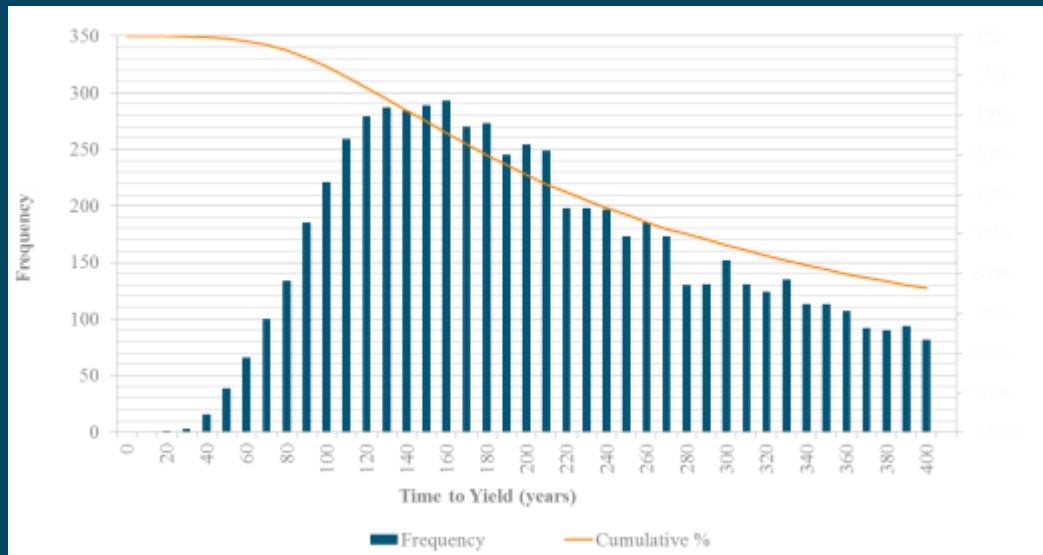


Engineering & Analytics



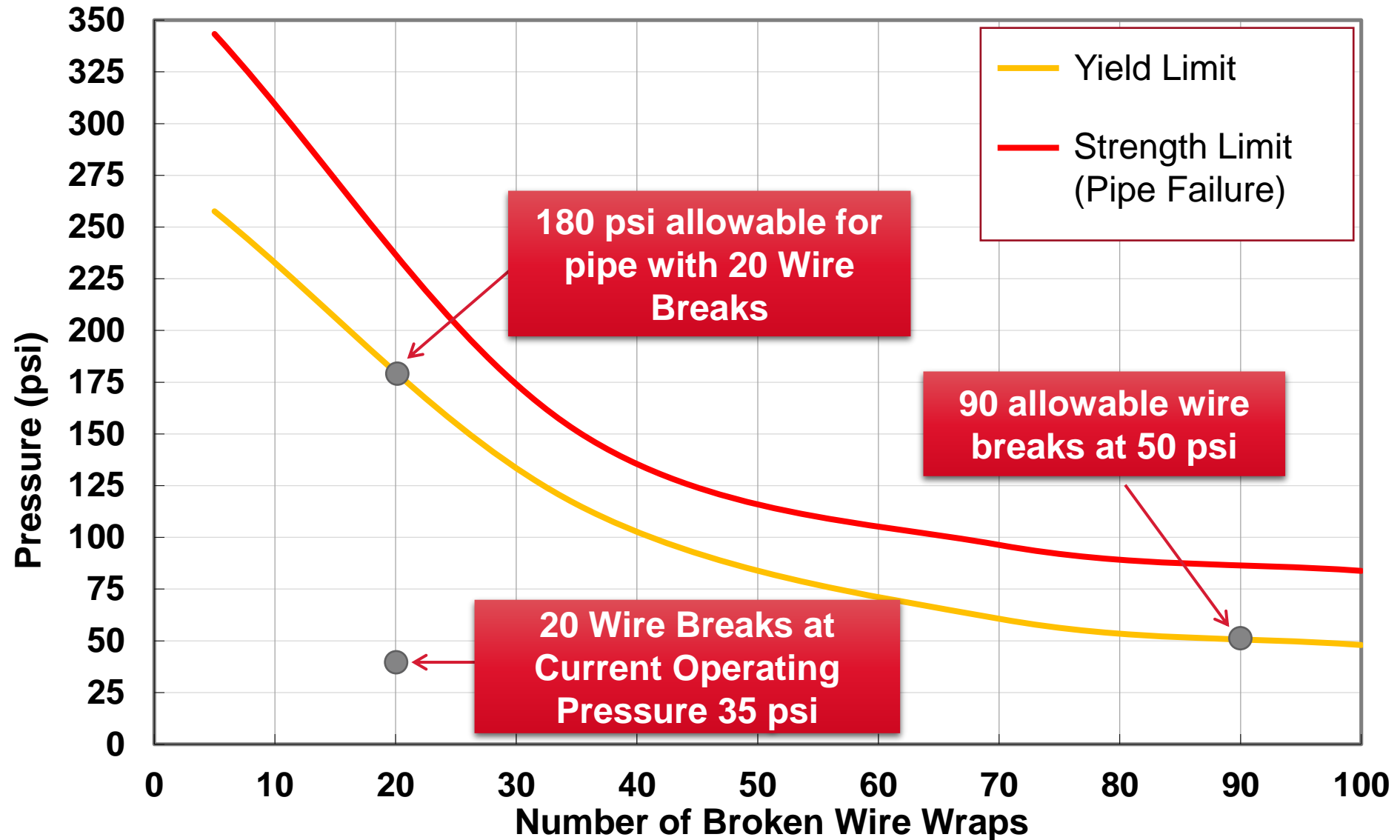
Structural Evaluation

- AWWA Design check
- Finite Element Modeling

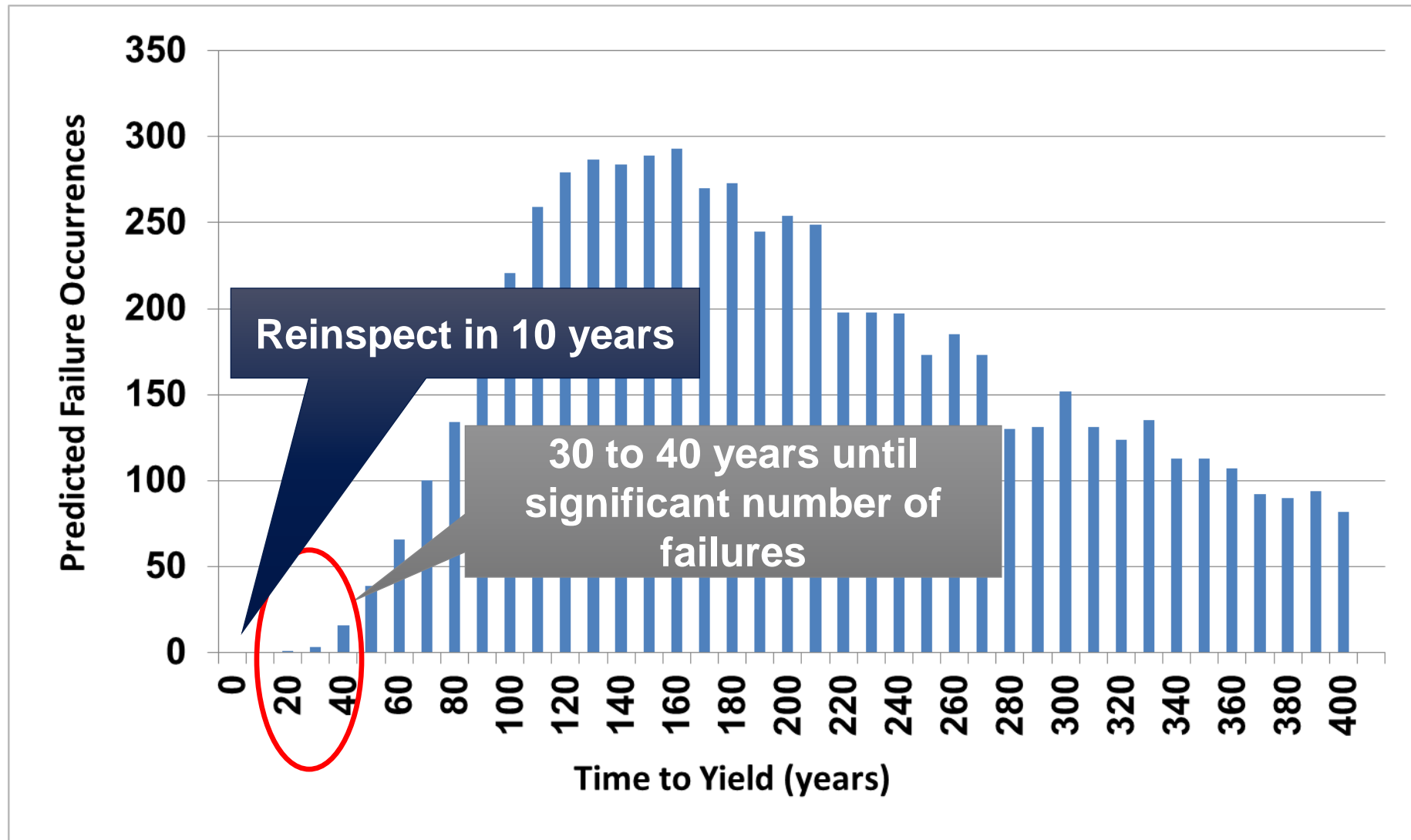


Remaining Useful Life Projection

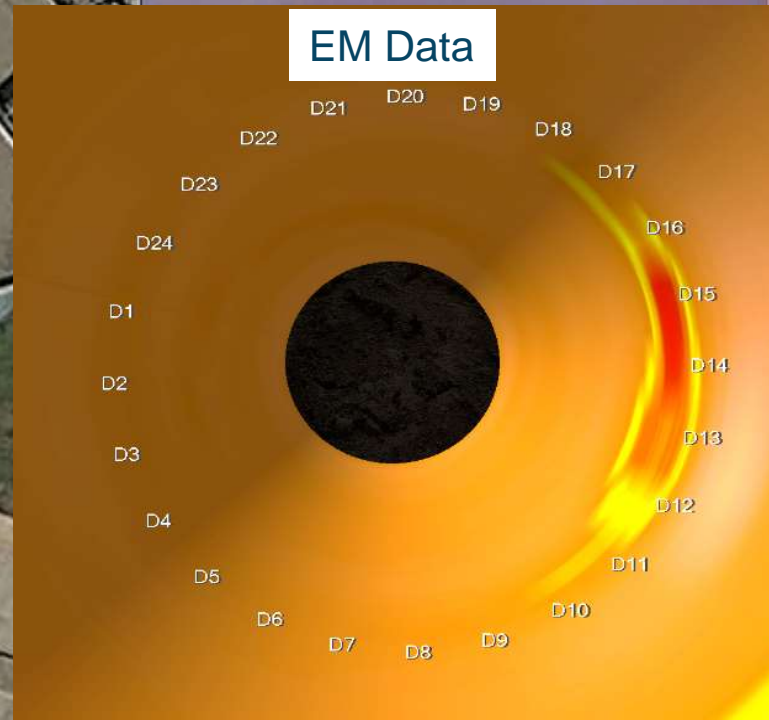
Pipe Performance Curves based on FEA Provide Structural Assessment



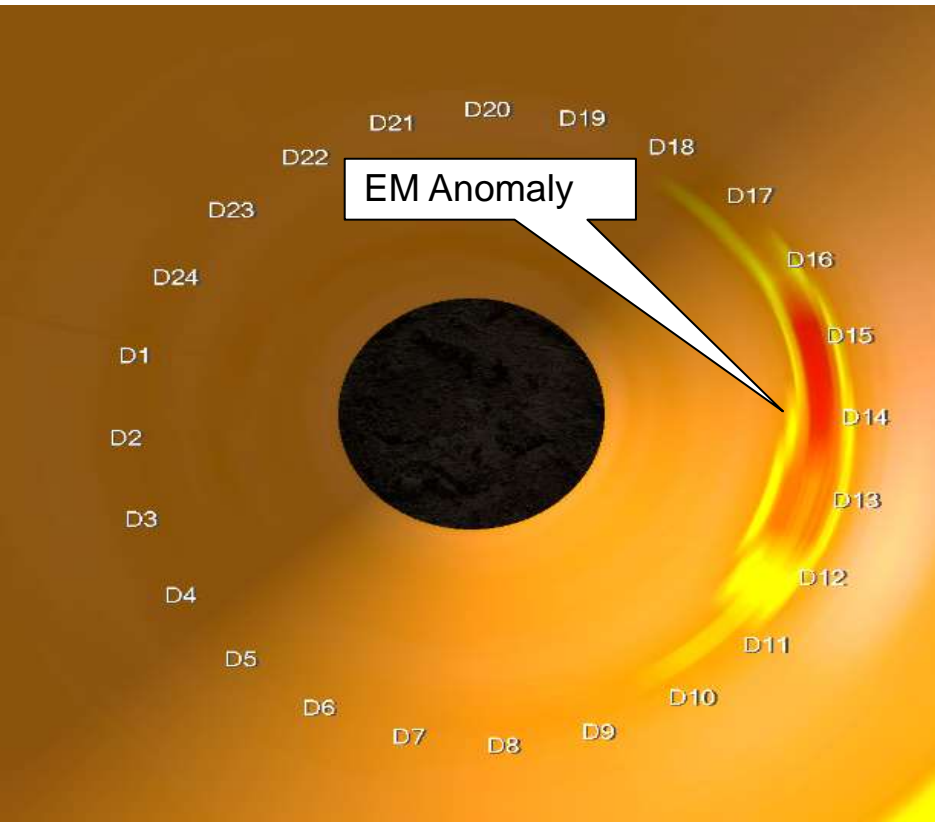
Pipeline condition data and statistical models estimate remaining useful life



Validation



Validation of Pipe 127



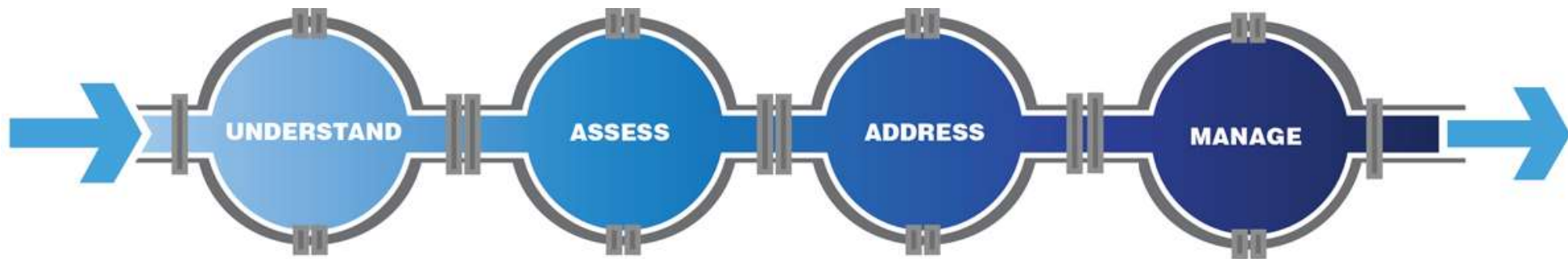
Take Aways

- Time to move beyond age, failure, and material based replacement strategies
- Cost effective pipeline asset management uses risk to guide data collection, not replacement
- Data collection technique selection should be life-cycle based
- Inspection and repair approach typically 5 to 10% of the cost of most replacement only strategies
- Advanced pipeline asset management strategies can provide significant financial benefits

Summary

Condition assessment is an important part of your asset management program

- Reduce risk
- Manage more effectively





Questions?

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