Introduction

◆ Question: “how many assets do you have?”
  ◆ Inventory = 1st Step of Asset Management
◆ Ask 100 different people: “What is Asset Management?”
  ◆ Expect 100 unique responses
◆ The Pipeline Asset Management Conundrum
  ◆ The Investment “Sweet Spot”
    ▶ What is the COST of replacing a pipeline too soon or too late?
◆ The benefits of “high resolution” data
◆ Common Language
  ◆ RISK = Probability x Consequence (of Failure)
Pipeline Condition Assessment Considerations

- All pipes/pipe materials leak
- All pipes can break
  - 1 in 10 leaks will result in a break
- Industry figures show you can expect to find two leaks a mile in DI or CI transmission mains (>16”)
- Condition assessment helps you proactively manage pipelines - Probability
- System Control helps you reduce the cost of main breaks - Consequences

The Challenge
Reduce Consequences of Failure

40% of Valves in Your System May Not Be Operating Properly

Replace vs. Control Comparison

ROI EXAMPLE:

- Utility Estimated Size: 500 miles of main
- Main Replacement Cost (All): $725MM tab, ($1.45MM per mile)
- Main Condition Assessment (All): $125MM tab, ($250k per mile)
- System Control/Valve Renewal (All): $3.5MM tab, ($7k per mile)
Connecting Dots

◆ The U.S. EPA Reports:
  - “There are 240,000 water main breaks per year in the U.S.”
  - “The number of main breaks increases substantially near the end of the system’s service life”

The Challenge

◆ Default Strategy is to “fix it when it breaks”
◆ Conundrum: Replacing assets too early or too late increases costs
◆ How to make the “business case” or “smarter” decisions with data/information?
◆ The Ten Steps to Asset Management (WRF)
Assets do not deteriorate at a constant rate

PIPE DETERIORATION CURVE

1. Excellent
2. Good
3. Fair
4. Bad
5. Worst

Percent Effective Life Elapsed

Asset Management Conundrum

Diminishing returns – 100% asset usability isn’t cost effective just as replacing every piece of pipe isn’t cost effective

Regulatory Non-Compliance Costs
Environmental and Societal Costs
Collateral Damage Costs
Water Purchasing & Treatment Costs

Wholesale Pipe Replacement
Condition Assessment and Tactical Rehabilitation
Control Point Management
NRW Management

100% Reactive → Asset Management Strategy → 100% Proactive
Ten “simple” A.M. Steps

Step 1: Inventory Assets
Step 2: Assess Condition
Step 3: Determine Residual Life
Step 4: Determine RRR $ & Timing
Step 5: Set Target LOS

Step 6: Assign BRE Rating (Criticality)
Step 7: Determine Appropriate Maintenance
Step 8: Determine Appropriate CIP
Step 9: Fund Your Strategy
Step 10: Build the AMP

Water Loss Considerations

✦ U.S. Leaks
  ✦ 7 Billion GPD in Loss
  ✦ 700 main breaks day

✦ U.S. Pipe Age
  ✦ 30% = 40-80 yrs. old
  ✦ 10% = >80 yrs. old

✦ Leak Detection AND Condition Assessment
Pipe Leaks

- Leak within a pipe barrel
  - Tear in pipe wall
  - Corrosion of steel cylinder
- Leak in joint
  - Improperly installed gasket
  - Deteriorated gasket
  - Joint opening
  - Thrust restraint

Available Technologies

**Internal**
- Free-swimming system
- Tethered system

**External**
- Listening microphones
- Noise Loggers/Correlators
External Leak Detection Tech

Analog and Digital Survey
- Ground Microphones
- Loggers
- Correlators

Internal Leak Detection Tech

Higher Resolution (Accuracy)

Internal tools pass right over the leak.
Internal Condition Assessment Technologies

Minimum intrusion and inconvenience
LOOK BEFORE YOU DIG

Cost effective
High Data Resolution Gives you the ability to make INFORMED decisions

In-Situ Pipeline Image
Internal Pipeline Condition Assessment

The Tools can identify:
- Closed valves
- Undocumented valves
- Illegal service connections
- Undocumented fittings
- Pipeline material
- Improperly installed liner
- Faulty repairs
- Unknown diameter changes
- Pipe corrosion
- Pipe blockages & flow restrictions
- Damaged pipe joints

- Tuberculation levels
- Damages service connections
- Leaks
- Damaged pipe walls
- Air pockets
- Screw plugs
- Hardwood dowel repairs
- Operability of valves
- Debris accumulation

What else do you want to KNOW about?
Visual Inspection for Signs of Pipe Failure

Pipe wall cracks and failures
Tuberculation and Flow Restrictions

Severe flow restrictions due to late stages of tuberculation build up. Leads to pressure loss.

Joint Inspection

Corrosion at cast iron pipe joint

Clean joint verification
Pipe Wall Thickness

- **What info do clients want?**
  - Which lines will fail
  - Which lines to repair
  - Where are leaks
  - Where are priorities

- **What info helps them make those decisions?**
  - Actual vs. Average Wall Thickness

- **What technologies are available?**
  - EM, MFL, BEM, CCTV, Ultrasonics

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**Ultrasonic wall thickness**

- Based on proven external methods
- Inside pipe
- Do not take line out of service
Electromagnetics

Detects broad areas of wall loss

Tool Box Approach

- **Leak and Gas Pocket Location**
  - Pit-hole, joint, bedding loss from leak
  - 95% of leaks are at joint
- **Internal CCTV inspection**
  - Liner, internal visual condition, valves, joints, laterals
- **Acoustic Pipe Wall Assessment**
  - Average stiffness, thickness
- **In-line EM inspection**
  - Localized defects in metallic pipe
  - Broken wires in PCCP
    - Requires line out of service OR >12" access into pressurized pipe
- **External MFL testing**
  - Testing at excavation pit, then predictive model
- **Ultrasonics**
  - In-line wall thickness
- **Monitoring performance**
  - Critical pipeline management
  - Solutions for small diameter with AMR/AMI,
  - Transmission mains?
Combined Technologies

- PCCP
  - Electromagnetic inspection
  - Impact Echo
  - Others
- Metallic Pipe
  - Electromagnetic inspection
  - Ultrasonic test
  - Magnetic flux
  - Guided wave
- Asbestos Cement Pipe
  - Petrographic analysis

Questions?

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