

Risk Based Approach to Metallic Pipe Condition Assessment

INFRA Congrès 2014

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Pressure Pipes in Canada



15.4% of Water and **30.1%** of Wastewater linear infrastructure is in **Fair** to **Very Poor** Condition



Over **\$20B** is required to replace all of the Fair to Very Poor Condition water and wastewater pipelines



The EPA estimates that **70% to 90%** of pipelines being replaced still have remaining useful life



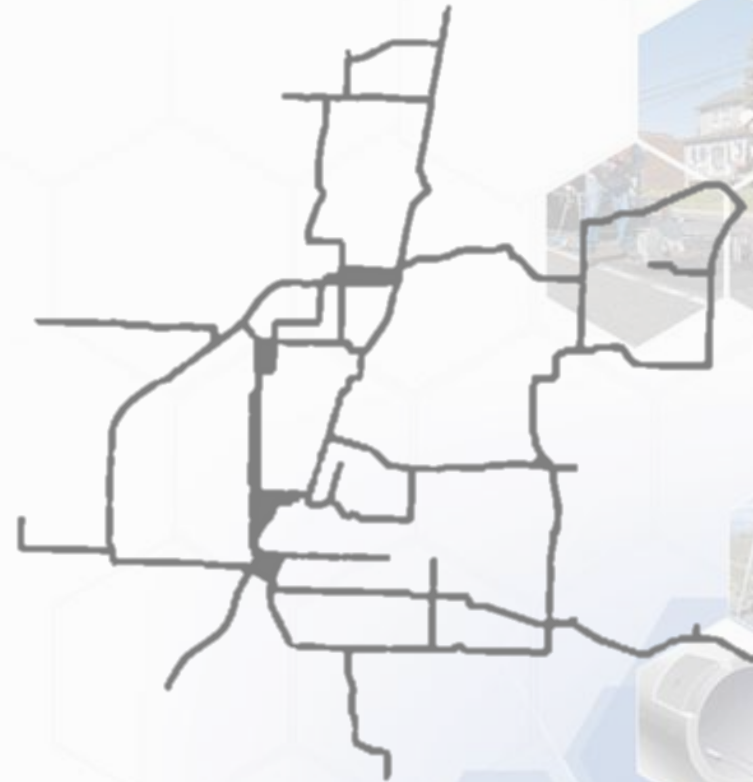
Remaining Useful Life

- Capital Planning
- Selective Rehabilitation

Preventive Maintenance Condition Assessment Goals

- Hard and Soft Costs
- \$500k to \$1.5M

The **Cost** and **Complexity** of executing a condition assessment project **rises** with increasing **Resolution** and **Reliability** of results



Risk Based Condition Assessment Program

Risk Based Prioritization

Likelihood of Failure

- ☐ Material
- ☐ Catalog Remaining Useful Life
- ☐ Vicinity to Power Lines
- ☐ Failure Records
- ☐ Soil Corrosivity

Risk Mitigation

- ☐ Condition Assessment
- ☐ Corrosion Control
- ☐ Ease of repair
- ☐ Transient Pressures
- ☐ Planned Capital Works

Consequence of Failure

- ☐ Size of Pipe
- ☐ Redundancy
- ☐ Critical Facility
- ☐ Large User
- ☐ Urban Impact

Risk Score
LoF x CoF x RM

GREEN

Reactive Strategy

YELLOW

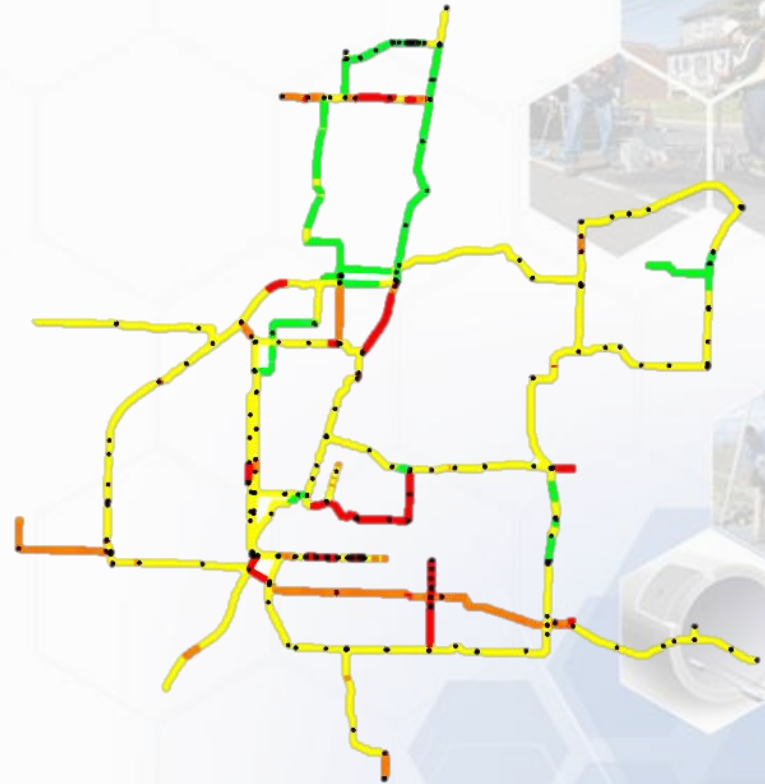
Condition Assessment
(Low/Med)

ORANGE

Condition Assessment
(Med/High)

RED

Capital Plan



Pipe Assessment Options

Lower

- Resolution
- Reliability
- Cost

Desktop Study

Soil Survey

Test Pits

External Leak Detection

External Acoustic Pipe Wall Assessment

Inline Leak Detection and CCTV

Inline Stress Pipe Wall Assessment

Near Field Electromagnetic

Broadband Electromagnetic

Remote Field Electromagnetic

Magnetic Flux Leakage

Higher

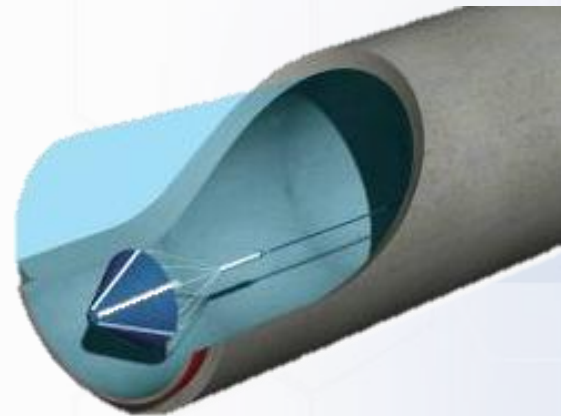
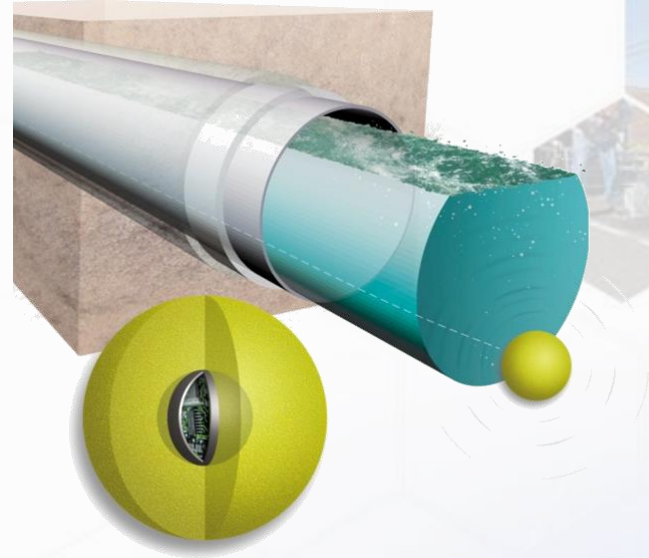
- Resolution
- Reliability
- Cost

Inline Stress Pipe Wall Assessment

Measures the **Self Generated Magnetic Field** of a Pipe

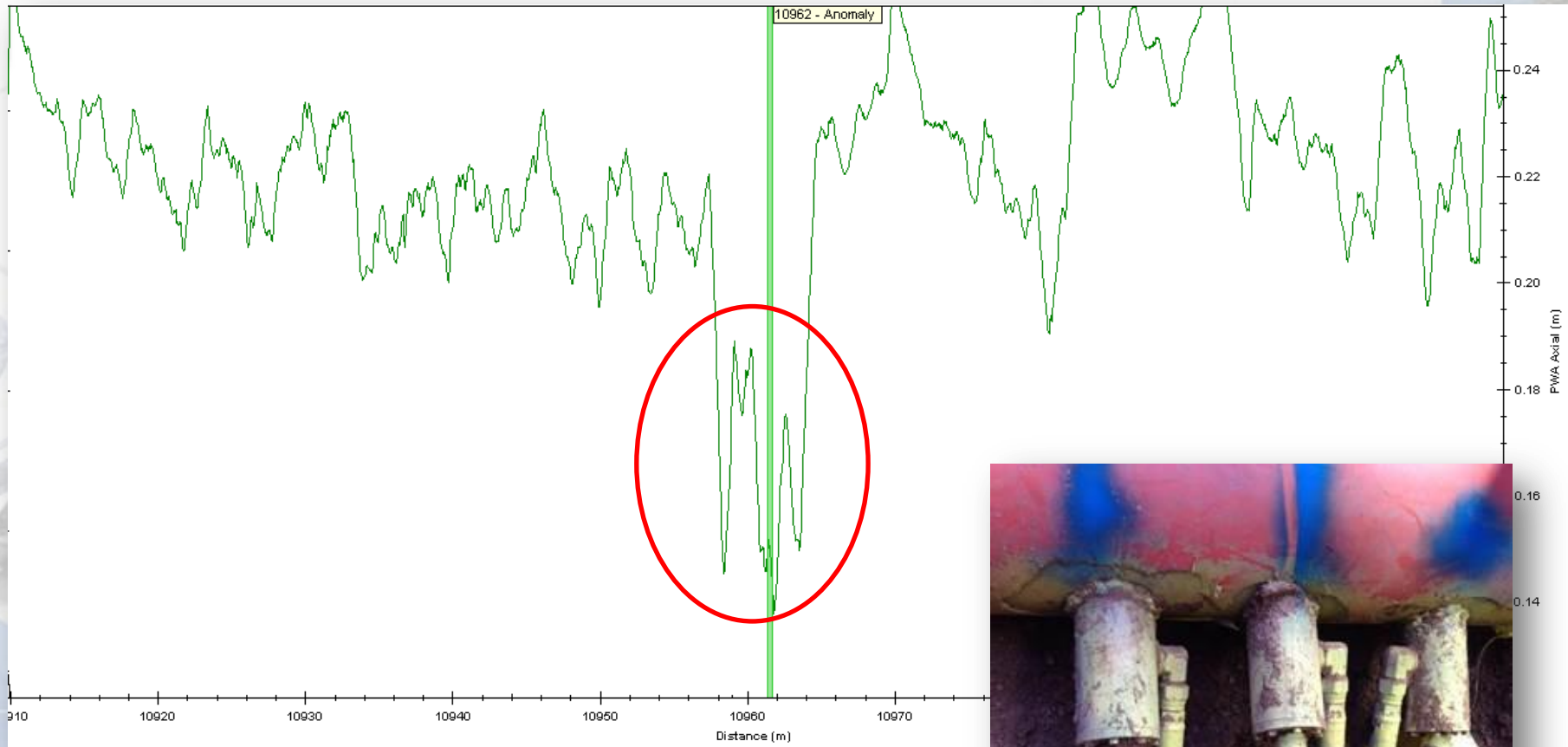
Sensitive to Changes in **Stress**

- Wall thinning
- Cracks
- Severe bending, compressive, tensile, or torsional stress exists

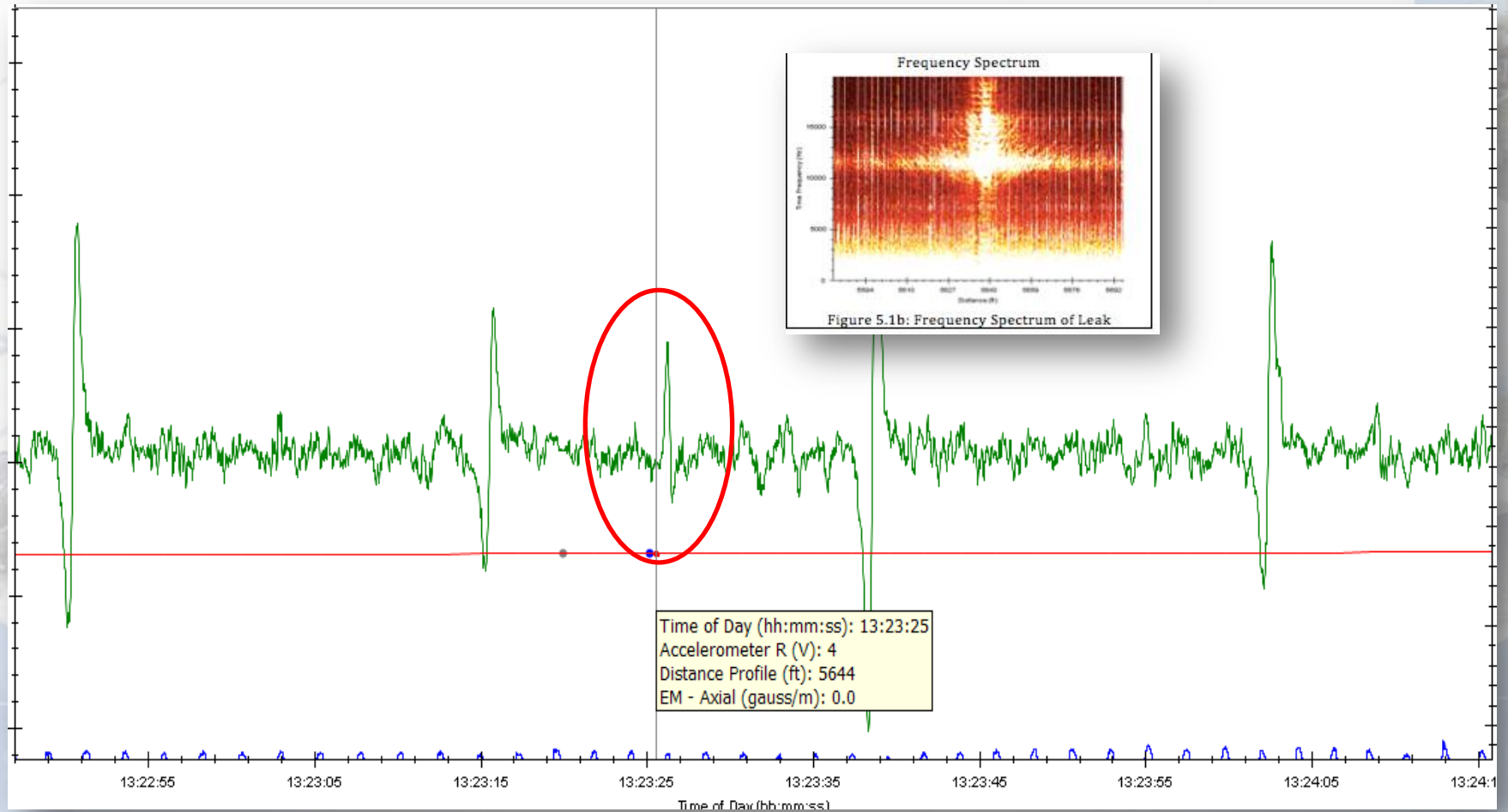




Korea - 350 mm Steel Pipeline



750 mm Ductile Iron Pipe



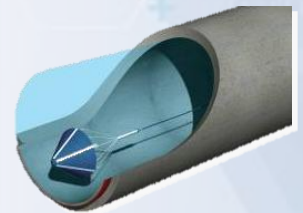
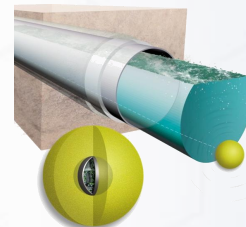
Inline Stress Pipe Wall Assessment

Experience

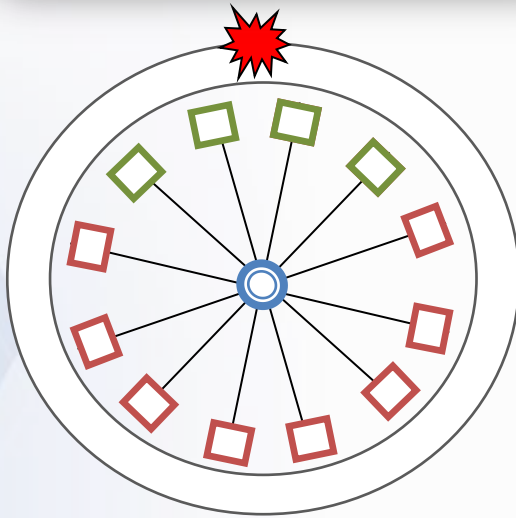
- 96.5 km in Korea
- 22.5 km in US
- 1.6 km in Australia
- Excavations pending with 6 utilities

Uses

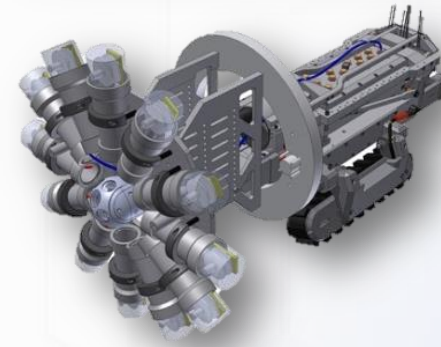
- PWA anomalies are grouped or ranked
- Small set of anomalies are recommended for test pits
- Focus a higher resolution tool in certain areas



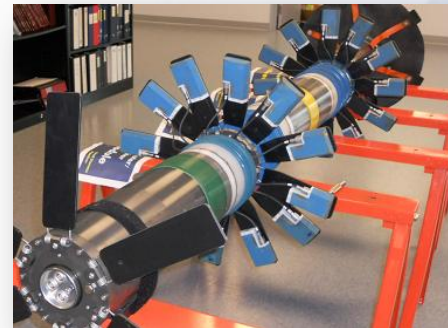
Near Field Electromagnetic



Manned

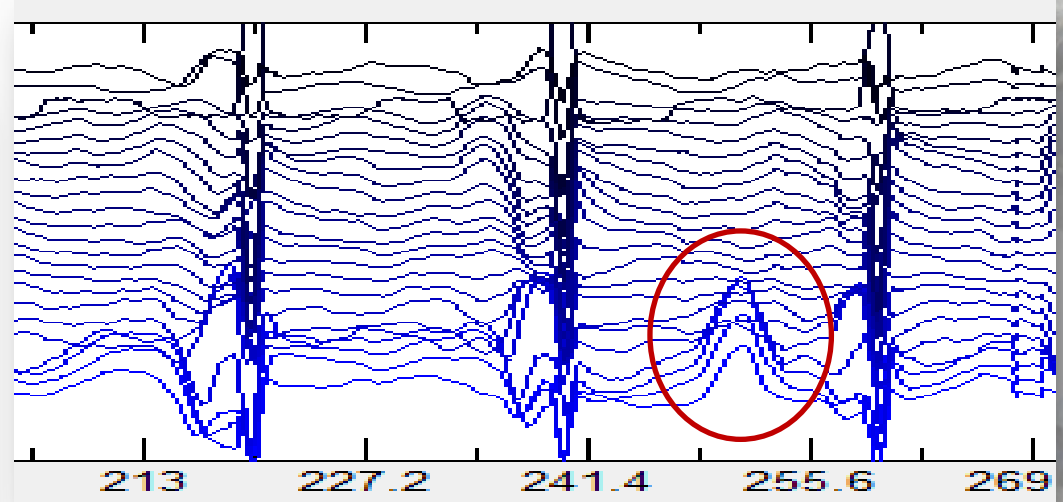


Robotic



Free Swimming

Kentucky – 1200 mm DIP



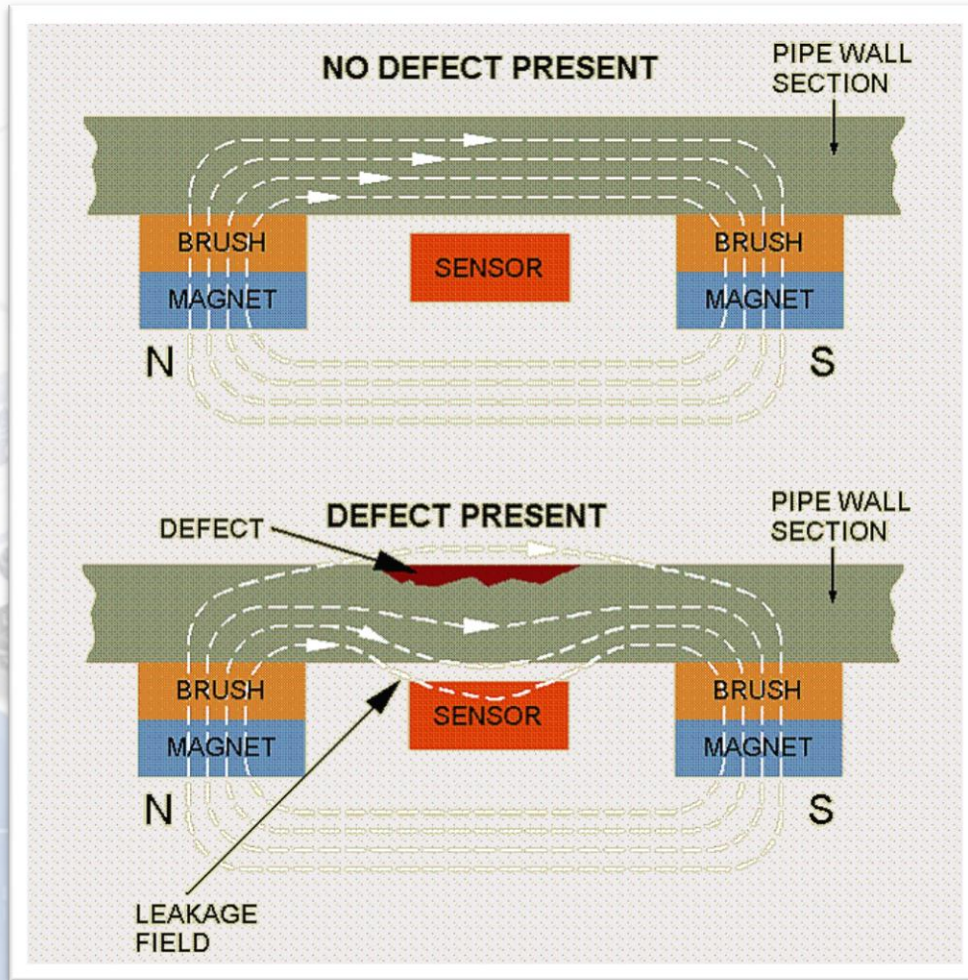
35% Wall Loss
20 cm x 20 cm

California – 600 mm Steel

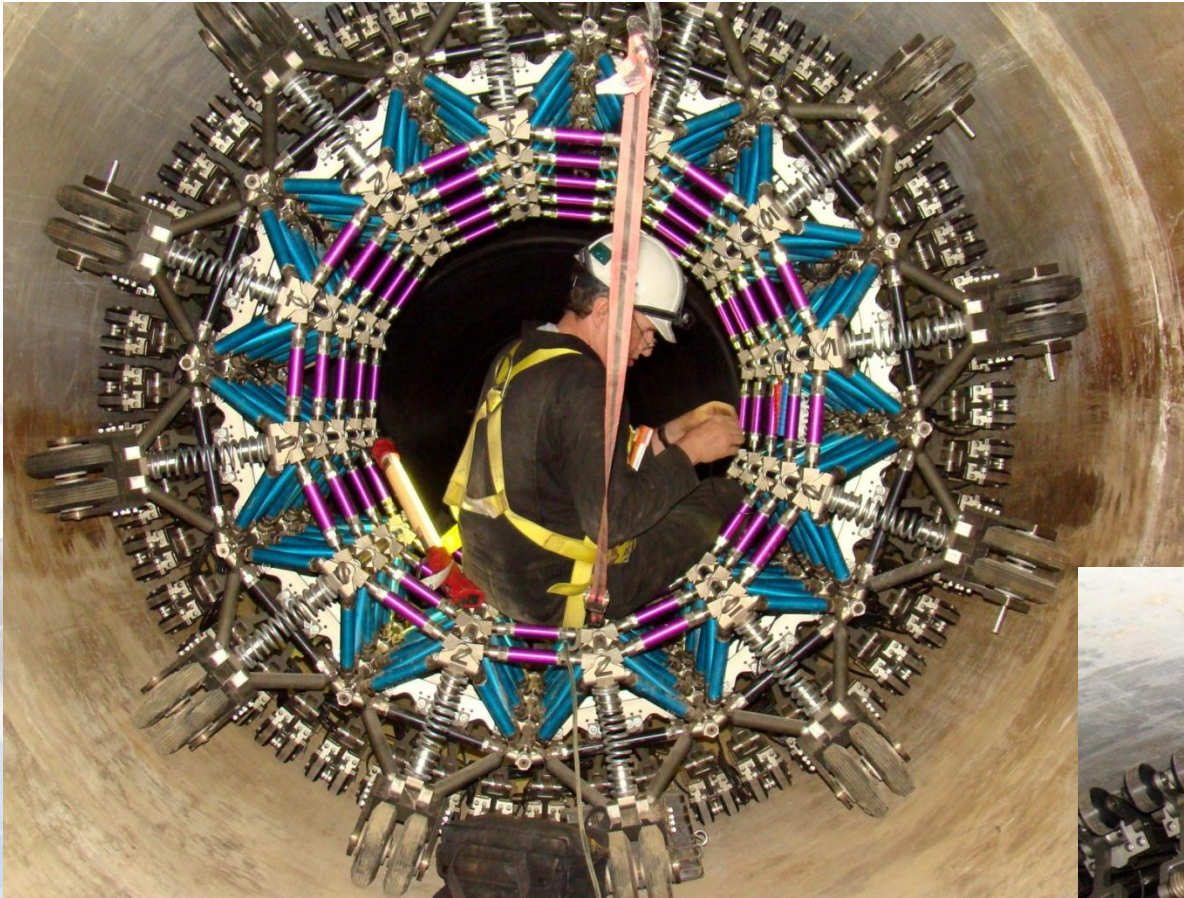
- 3.1 km
- 17 pipes with wall loss (4%)



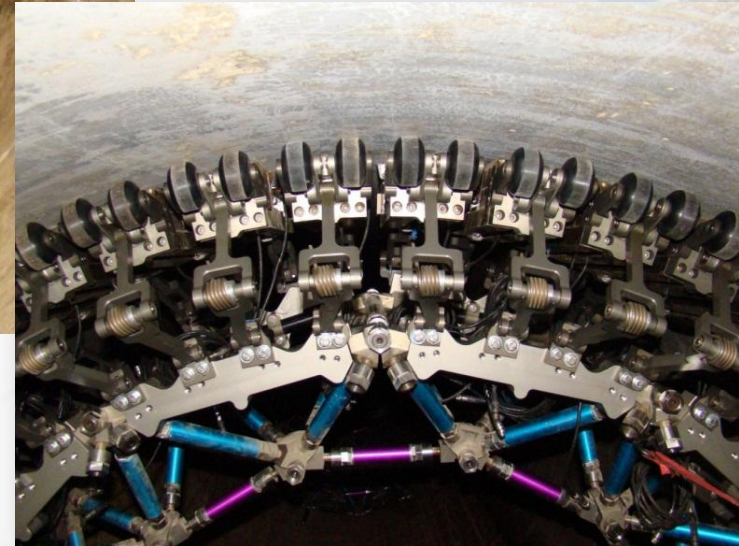
Magnetic Flux Leakage



San Diego – 1800 mm Steel

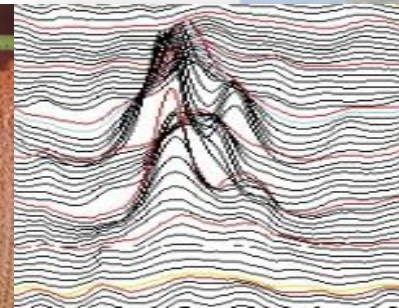
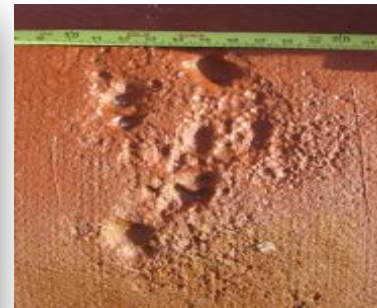


- Increase in Pressure
 - 8.2 km long
 - Built in 1959
-
- 198 locations identified w metal loss
 - Up to 75% wall loss
 - Up to 32 cm²

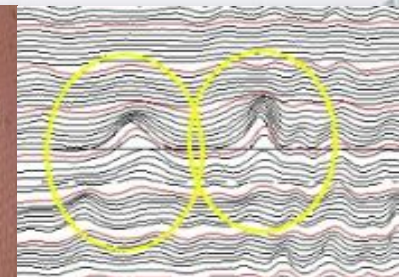




Ontario – 300 mm DIP



5% Wall Loss



1% Wall Loss

Summary

- There is significant remaining useful life left in many of the fair to very poor condition pipelines
- Condition Assessment can be used to identify the weak links in a pipeline
- Pipeline Risk Prioritization can be used to determine:
 - a) Where it makes sense to perform a condition assessment
 - b) Which level of condition assessment is justified
- Multiple metallic pipe condition assessment tools are available with varying levels of certainty and operational constraints



Thank You

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