

Inspection of Distribution Piping Systems: A Risk Based Approach

Joe Maciejczyk, PE
Structural Integrity Associates

IDEA's 27th Campus Energy
Conference

February 18-21, 2014

Atlanta

Why inspect?



**KNOWING
WHERE
YOU ARE**



**“CORROSION
NEVER SLEEPS”**

Why inspect?

PERSONNEL SAFETY!

RISK Risk from unknown hazards

Protection from negligence claims

Disruptions

Unbudgeted expenditures

Forced Maintenance



- End user disruptions
- Loss of efficiency
- Safety issues
- Unbudgeted Expenditures



Why inspect?



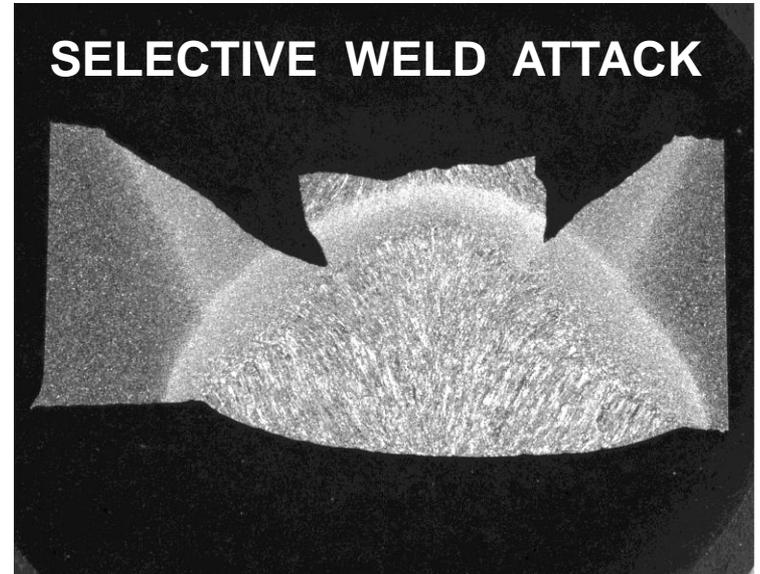
**KNOWING
WHERE
YOU ARE**

INFRASTRUCTURE CONDITION

PLANNING

**NEW
CONSTRUCTION**

Why inspect?



**“CORROSION
NEVER SLEEPS”**

Damage Mechanisms

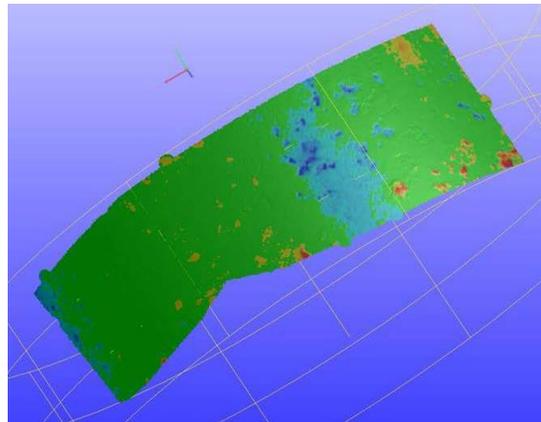
- Corrosion

- External (protection system failure)
- Internal (water chemistry issues)
- Corrosion under insulation
- MIC (Microbial induced)



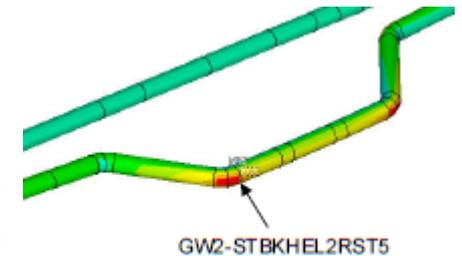
- Erosion

- Flow induced
- Particulate



- Stresses

- Low cycle thermal fatigue (start-ups/shut-downs)
- Primary pressure (wall loss)



Traditional Piping Inspection Programs

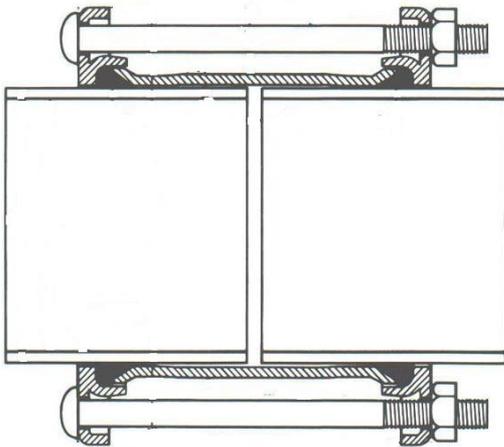
- Exception based
 - No inspection program unless failure (forensic vs. proactive)
 - Reactionary mode
 - Opportunity driven
- Ease of access
 - Out of sight, out of mind (buried, vaulted, cased)
 - Insulation concerns
 - Safety
- Limited review
 - Point selection
 - Selection basis



Diverse Infrastructure



Localized Issues



RISK

BASED

PROGRAM

Risk Based Program

- Data Collection
- Definition of Corrosion Segments
- Risk Assessment
- Inspections
- Program Maintenance

Risk Based Program

Data Collection

- Piping drawings - compilation and review of drawings
- Structural details
- Support and anchor details
- Piping Specifications
- Flow diagrams
- P&ID diagrams
- Failure history
- Past Inspection results
- Repair history
- Water treatment - assembly of water chemistry and water chemistry history, and water treatment and treatment history
- Leakage history
- Cathodic protection history including coating inspections
- ID cleaning history
- System walkdowns
- Safety record (e.g. near miss incidents, etc.)

Risk Based Program

Corrosion Segment Definition

- Define segments

Prioritization Examples

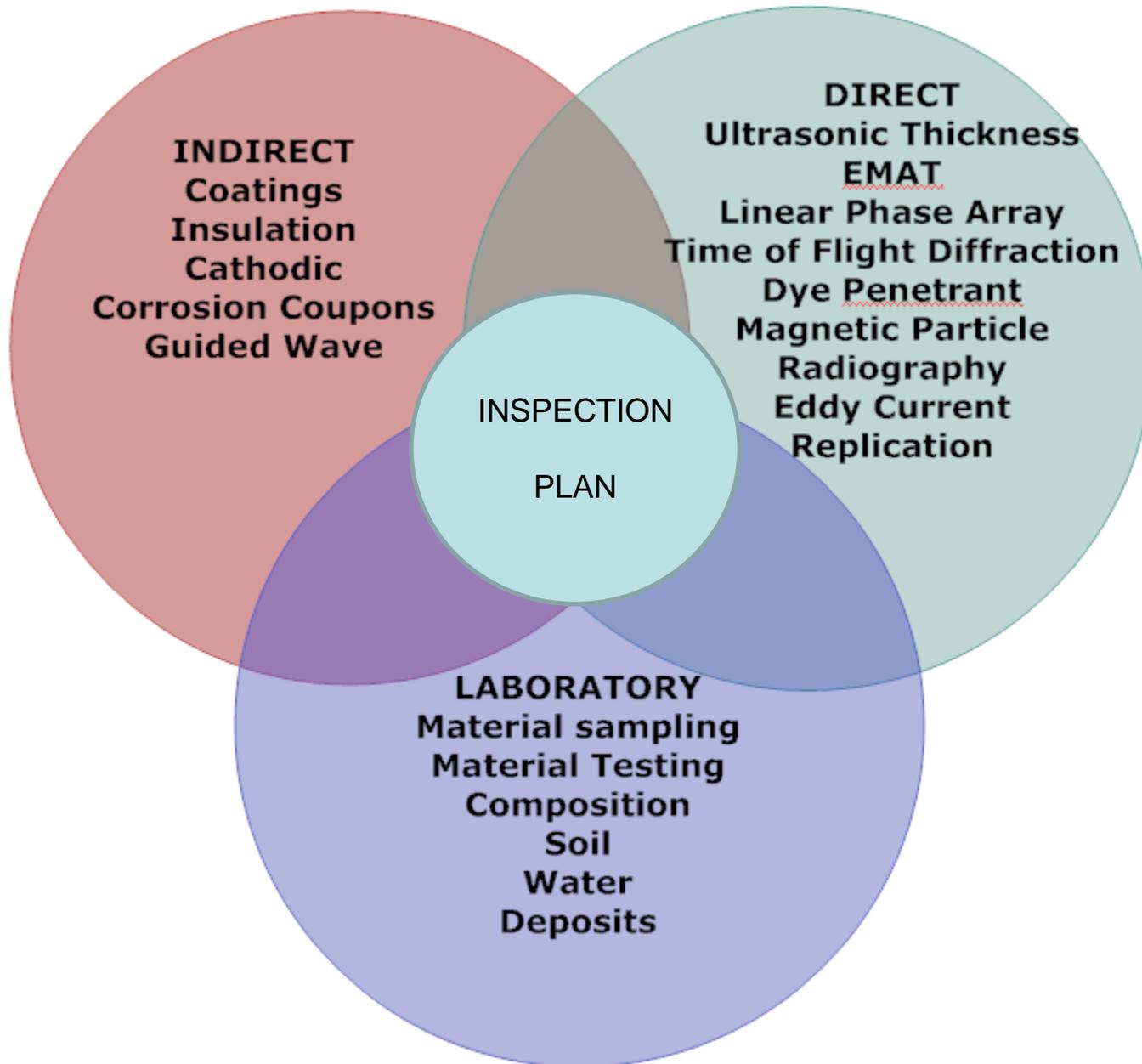
- High Risk Zones/Services
- High Risk Services
- Localized Issues (expansion joints, bolting, etc.)
- Component Issues

Risk Based Program

- Data Collection
- Definition of Corrosion Segments
- Risk Assessment
- Inspection plan
- Program Maintenance

Program

- Segment and Risk Priorities
- Walk downs
 - Leaks/Exceptions (local issues)
 - Hangers, Supports, Anchor inspections
 - Specification issues
 - As-built design
- Stress Analysis (if needed)
- Apply the Non Destructive Examination “Toolbox”
 - Surface Examinations
 - Volumetric Examinations
 - Metallurgical Examinations
 - Screening Technologies



Program Maintenance

- Maintain specifications
- Document
- Failure Analysis Program

Contact Information



Joe Maciejczyk, PE

Associate

Structural Integrity Associates

Cell: 804-502-2820

jmac@structint.com

www.structint.com

