Internal Corrosion Monitoring Equipment and Methods

Why am I doing this?

- To develop a representative monitoring program that indicates internal corrosion rates of the system.

- “If something is going to happen, it’s going to be in the worst location at the worst possible time.”

Where Do I Begin?

- Regulated or Non-Regulated Line?
- Monitoring Location (Top, Middle, Bottom)
- Material Type (Standard or Specialty Alloy)
- Type of Process Connection: Flanged or Threaded?
- Process Connection Size/Access Valve
- ANSI Rating (150, 300, 600, etc.)
- Size of Pipeline (inches)
- Working PSI/MAOP
- Velocity of Product Line
- Working Temp/Max Temp
- Product Type (Liquids, Gas, other)
- Sweet or Sour Service?

Methods of Monitoring

- Corrosion Coupons
- Retractable Coupon Holders
- Liquid Samplers
- Fixed (Plug Mounted) Coupon Holders
- Electrical Resistance (ER) Probe
- Linear Polarization Resistance (LPR) Probe
- Galvanic Probe
- Pipeline Monitor
- Gas Sampling
- In Line Inspection
- Alternative Methods (Coupled Multi-array Sensor, High Sensitivity ER, etc.)

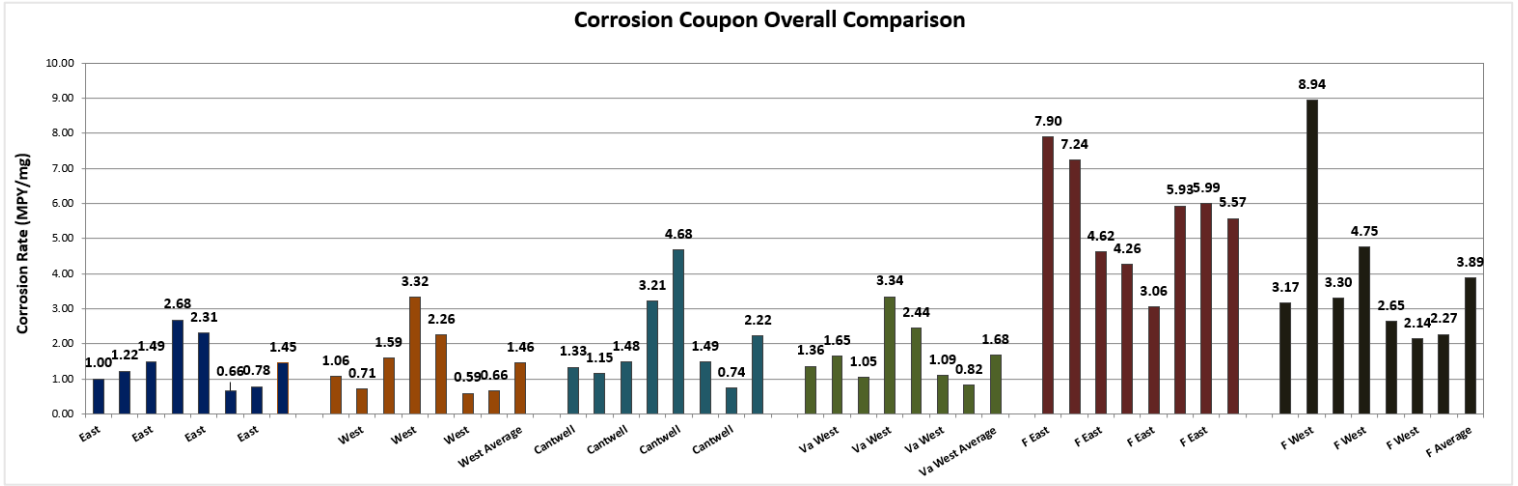
Corrosion Coupons

Advantages:

- Easy to Use
- Allows Examination
- If located properly, very representative of system
- Inexpensive

Disadvantages:

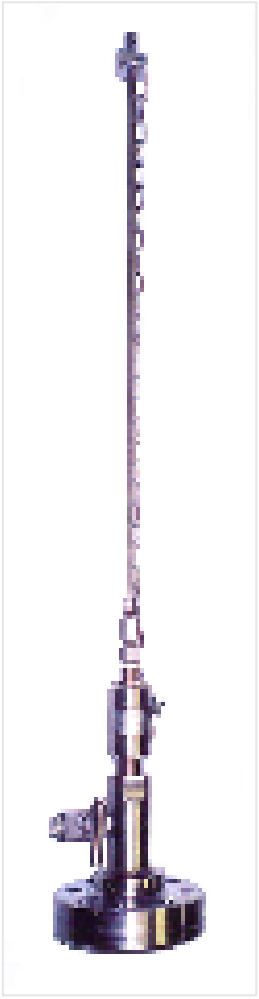
- Long time needed to collect data
- Time consuming
- If not located properly **NOT** representative of system



Retractable Coupon Holders

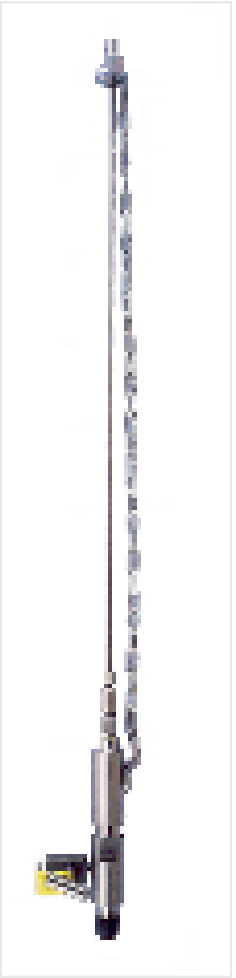
Advantages:

- Provide a safe and easy method of inserting and removing coupons from systems under pressure
- Can be hand inserted in low-pressure systems or used with EnhanceCo Retrieval Tools at higher pressures.
- Rugged stainless-steel construction, bleed valves, safety chains and triple safety locks provide operator and pipeline safety while eliminating the possibility of over withdrawal.
- These tools allow you to insert and withdraw coupons without disturbing or shutting down the system.



Disadvantages:

- Retractable Coupon Holders need to be retracted during pigging operations
- Removal
- Non-continuous readings



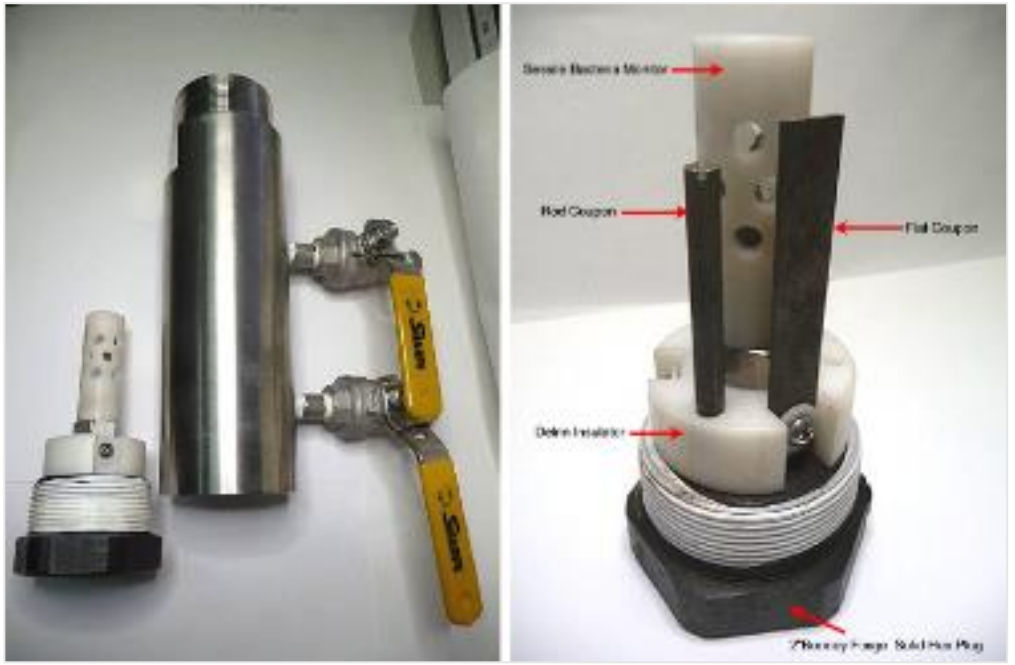
Liquid Samplers

Advantages:

- Low Spot to collect water
- Don’t have to shut in the system
- Liquid Samples, Bacteria and Coupons at the same location

Disadvantages:

- No Flow
- Easy to fill with solids
- Can have exposure to fluids



Fixed (Plug Mounted) Coupon Holder

Advantages:

- Simple and easy to use
- Low cost

Disadvantages:

- Locations can be limited
- Shut down of system required
- Depressurization is required

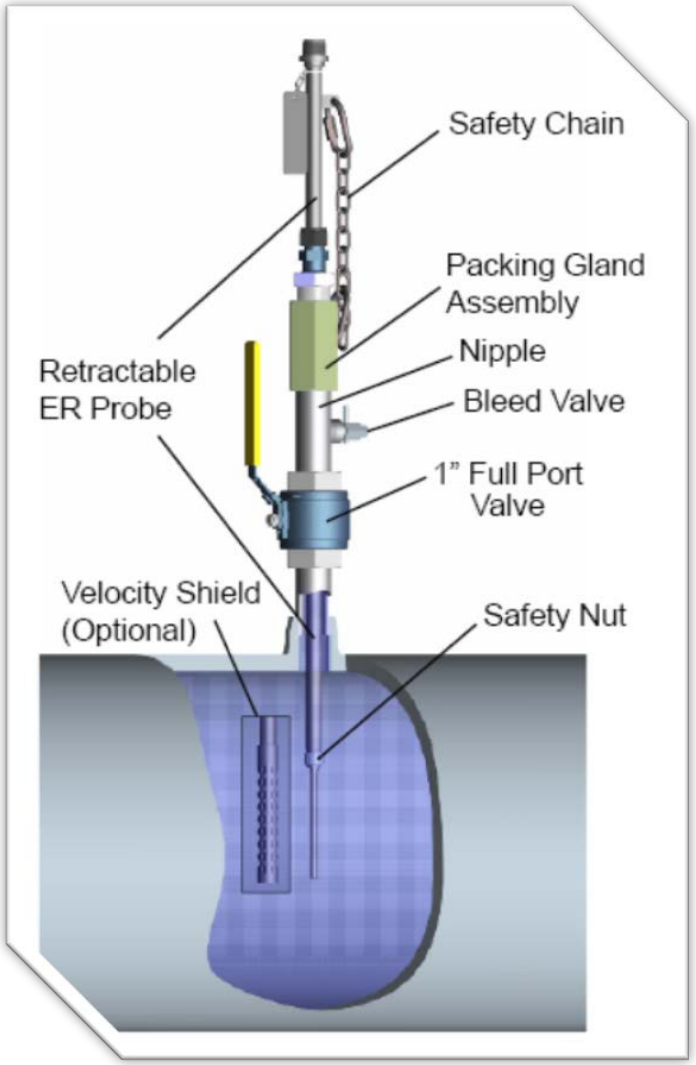
Electrical Resistance Probes

Advantages:

- Great for Monitoring General Corrosion
- Reduces Personnel Exposure to Pressures and Product
- Allows for Continuous Monitoring

Disadvantages:

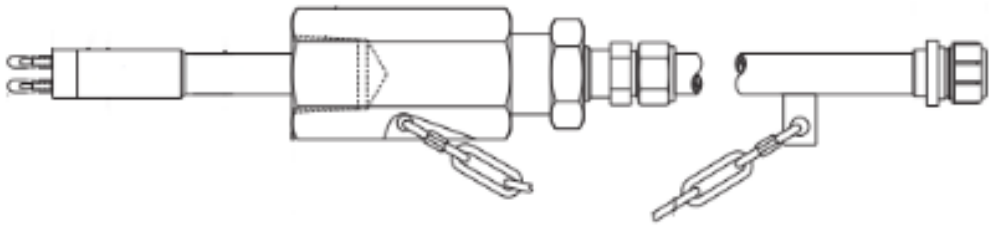
- Difficult to use in a system with solids
- Doesn’t detect pitting very well
- Requires additional equipment to retrieve data
- Data acquisition requires a power source (battery or 4-20 mA connection)



Linear Polarization Resistance (LPR) Probe

Advantages:

- Detects Fluctuations
- Directly gives an instantaneous Corrosion Rate in mils per year (MPY)
- Can be used to indicate pitting



https://www.alspi.com/lp4000.pdf

Disadvantages:

- Difficult to use in a system with solids
- Requires additional equipment to retrieve data
- Data acquisition requires a power source (battery or 4-20 mA connection)
- Limited to electrolytically conducting liquids

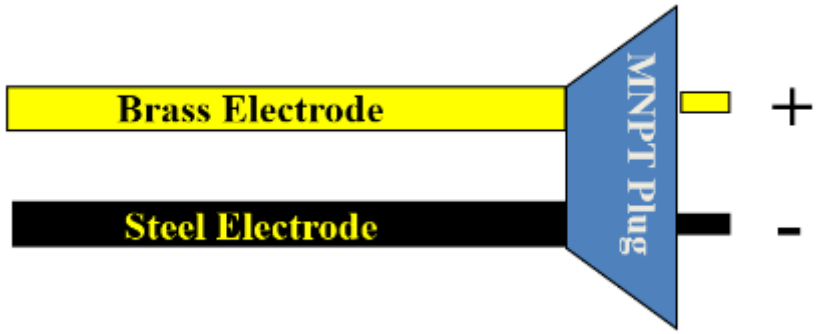
Galvanic Probe

Advantages

- Easy to use
- See changes rapidly
- Excellent for detecting Oxygen ingress
- Easy to maintain and very field friendly

Disadvantages

- Does NOT give corrosion rate
- Elements can become fouled
- Data needs some interpretation



Pipeline Monitor

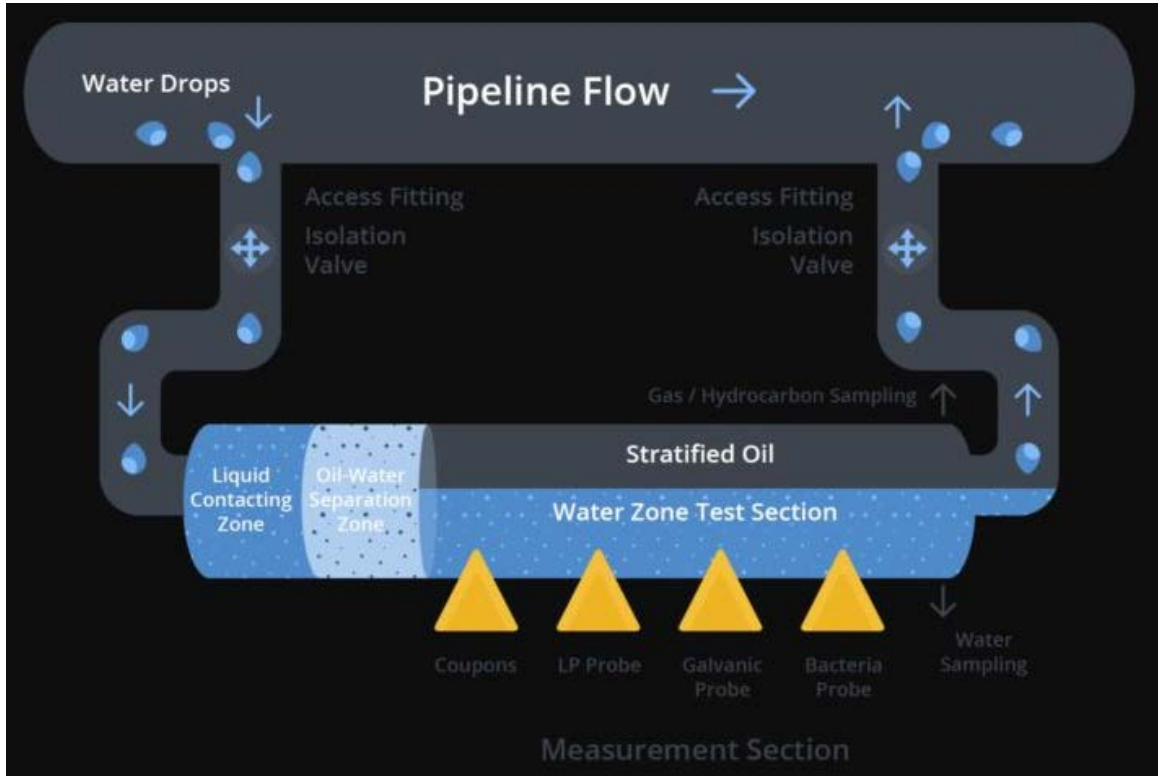
Advantages:

- It allows the use of multiple methods in one location
- It creates a worst- case scenario in an accessible location
- Provides data on how potentially corrosive the system could be.
- Provides a method of monitoring product quality

Disadvantages:

- Usually require Management of Change (MOC) in order to be installed
- Requires maintenance to ensure representative data is being collected
- Requires an understanding of the system

Pipeline Monitor



Direct Measurements

In Line Inspections

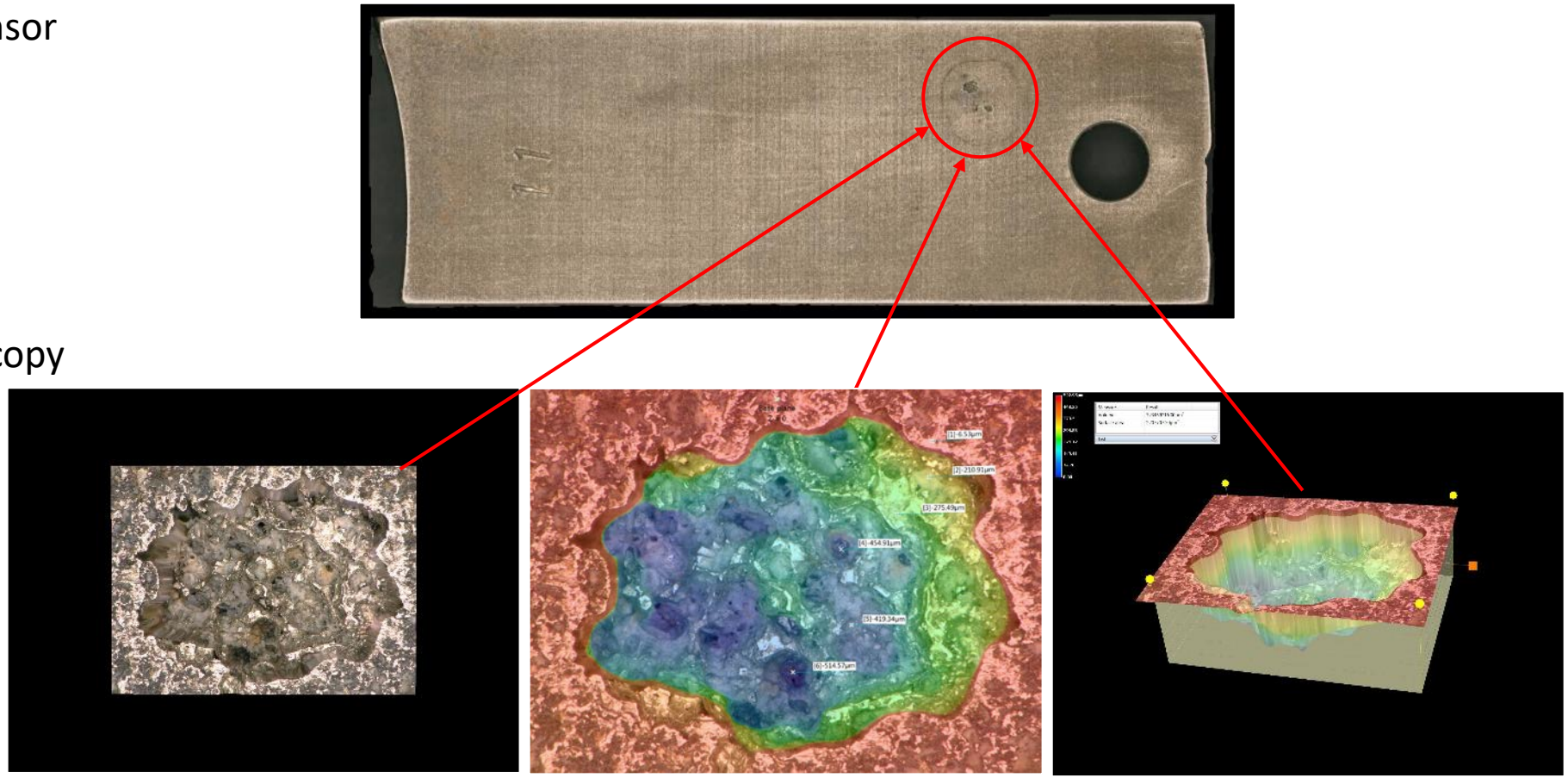
Ultrasonic Thickness Inspections

Cut outs and Tie Ins

In Line Inspection

Additional Alternative Methods

- Coupled Multi-Array Sensor (CMAS)
- High Sensitivity ER
- Ultrasonic Thickness
- Structured Light Microscopy
- SEM/EDS
- XRD/XRF
- Field Water Chemistry



Structured Light Microscopy

Conclusions

- Location, Location, Location!
- Use appropriate tools
- Use multiple techniques
- Maintain OUTSTANDING records
- Look for trends, excursions and upsets
- Understand the System!

Questions?

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