Internal Corrosion Monitoring and Mitigation What NOT To Do!

Tom Pickthall
EnhanceCo

37th Annual Meeting

Disclaimer

- Anything I say today may or may not have happened in the course of my career
- It might /or might not have happened to me
- This presentation is designed to prompt discussion –
- Our industry is one of the safest industries in the world… and we are just small cogs in the machine, but if we don't do a good job of our job, the machine does not function
- And when it does not - we get the opportunity for more rules/regulations/oversight…….

Internal Corrosion Monitoring and Mitigation
What are We Trying to Accomplish?

- Verify System Integrity
- Identify Potential Issues
- Validate Our Internal Corrosion Monitoring and Mitigation Program is Working!

What Are We Trying NOT to do?

- Gather False or Misleading Data
- Bad Data + Good Decisions = Poor Outcome
- Not Follow our Standard Operating Practices (SOP's)
- Generate Reporting that are Confusing or can be Mis-Interpreted

What Tools Do We Have?

- RECORDS!
- Standard Operating Procedures
- Monitoring
  - Coupons and other Monitoring Devices
  - Water, Solids and Product Chemistry
  - Flow, Volume, Temperature and other Operational Information
  - Anticipated Changes in Flow/Operations (Scheduling Information)
- Mitigation
  - Maintenance Pigs
  - Chemistry (Cleaning, Inhibition, Biocides, Chelants and Floculants, Foamers, De-Foamers, Etc)
  - Coatings and Cathodic Protection
  - Tariffs and other Product Quality Restrictions

Records

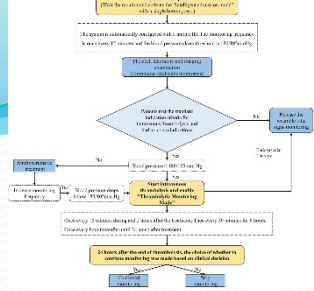
General Use

- How do we keep them?
- Are they accessible to ALL?
- Are they transferable (Ie can we integrate them into GIS or other systems?)
- Do the SOPs match the forms?

Forms

- Are the forms too complicated?
- Do the forms have too much extraneous information?
- Do they meet the Intention of the current requirements
- Do they spur action?

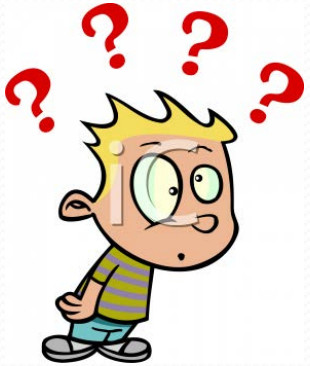
SOPs'



- Is there agreement between "normal field operations" and the SOP? –IE are we well-meaning what the procedure calls for?
- If not –Why Not? Did somebody make a best-intentioned change, but its not applicable to your area?
- Are we reporting what is required by federal, state and local authorities?
- What is the process to make changes? And is it defensible in court?

What are the Ways We Monitor and Mitigate Internal Corrosion?

- Test for, record, and minimize entrance of corrosive constituents (Water/CO_2/Oxygen etc.)
- Keep the corrosive constituents moving (Pigging/Velocity/Operations)
- Chemicals (Corrosion Inhibitors/Biocides/Oxygen Scavengers/Hydrate Inhibitors)
- Internal Paints and Coatings
- Design



To Monitor, What Do I Need to Know?

- What are Corrosive Constituents that I Have? (Water/ Solids/ Bacteria/ Acid Gasses
- What is the Pigging Frequency, Flow and Movement?
- What are the Chemicals – how do they work and are they appropriate?
- Are there Internal Paints and Coating, are they appropriate for the present service?
- Are there Flaws in the Design (Low spots/dead legs etc.).

How Do I Find Out?

- Review of Drawings, Other Previous Data
- Sampling
- Chemical residuals/testing for effectiveness
- Location and Type of Monitoring Devices
- Calculations for Flow Velocity/Corrosivity/Partial Pressure/Water Entrainment and Hold Up
- Modeling
- Other???? Is AI Useful?

Monitoring

- LOCATION, LOCATION, LOCATION!
- Are your monitoring or sampling devices in the proper location?
  - Representative of the worst case scenario
  - Out of the way of operational constraints (Are you going to run over it with a pig?)
  - Ease of Access – Can you get to it?
  - Is it safe to operate (high pressure vs. low pressure)

Water

- How much water do I have?
- Is it a different amount in various locations?
- Can be collected at drain valves or at pig traps.
- How do I test for water?
  - Water Finding Test Paper
  - Water Chemistry Test
  - Basic Sediment & Water (BS&W)
  - Total Dissolved Solids (TDS)
  - Conductivity / Resistivity
- How do I know what is actionable?
- Are those values in your SOPs?
- Is there a RECORD available?

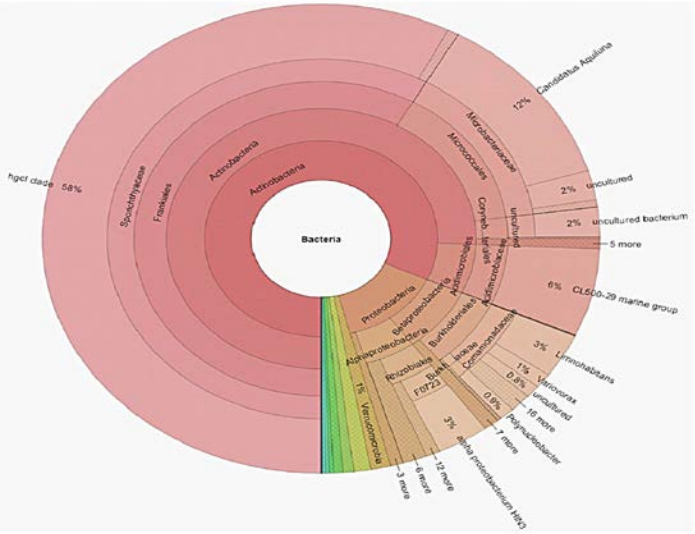
Solids

- What type of solids are observed? (Silica, Sludge)
  - How do I test them?
    Field Tests – pH, Bacteria, FeS drops for carbonates and FeS
  - SEM/EDS
  - XRD/XRF
  - Soil Resistivity
  - Conductivity

- How do I know what is actionable? –Are those values in your SOPs? Is there a RECORD available?

Bacteria

- What types of bacteria are in my system?
- What do they like to eat?
- What do they produce?
  - How do I test for them?
    Serial Dilution Vials AKA Bug Bottles
  - ATP
  - Molecular Methods (DNA/qPCR)
- ***Are they causing a problem?***



Acid Gasses and Moisture

- Oxygen
- Carbon Dioxide
- Hydrogen Sulfide
- Water Vapor
- Stain tubes, sample bombs or Gas Chromatographs

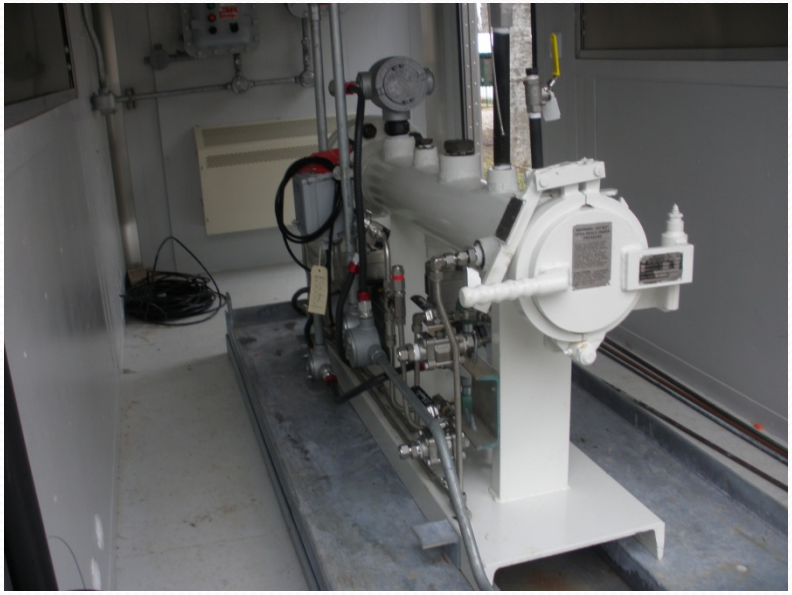
https://www.draeger.com/en-us_us/Home

https://www.sensidyne.com/colorimetric-gas-detector-tubes/gas-detector-tube-pumps-and-accessories/detector-tube-pumps-from-sensidyne.php/

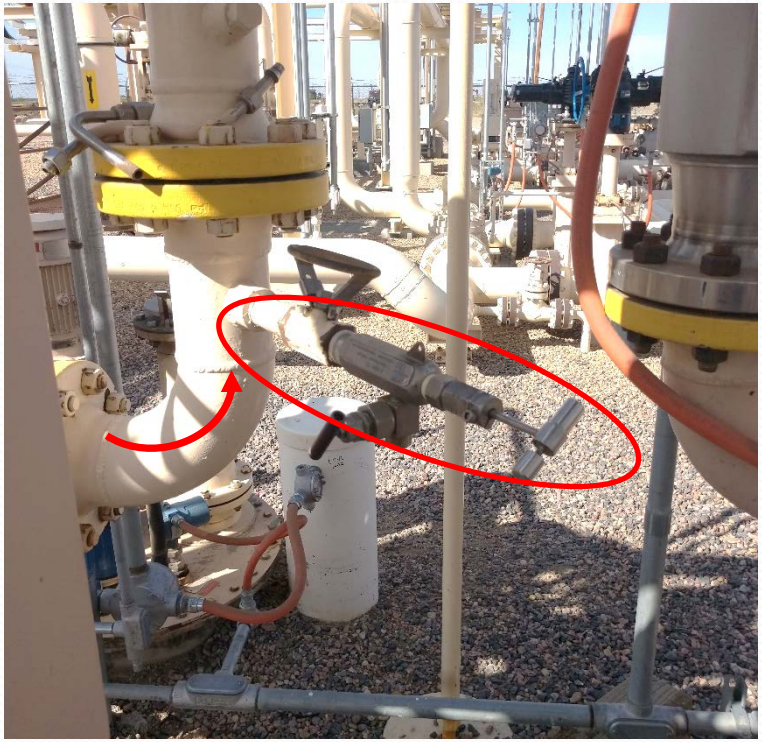
https://www.swagelok.com/en/product/Sample-Cylinders

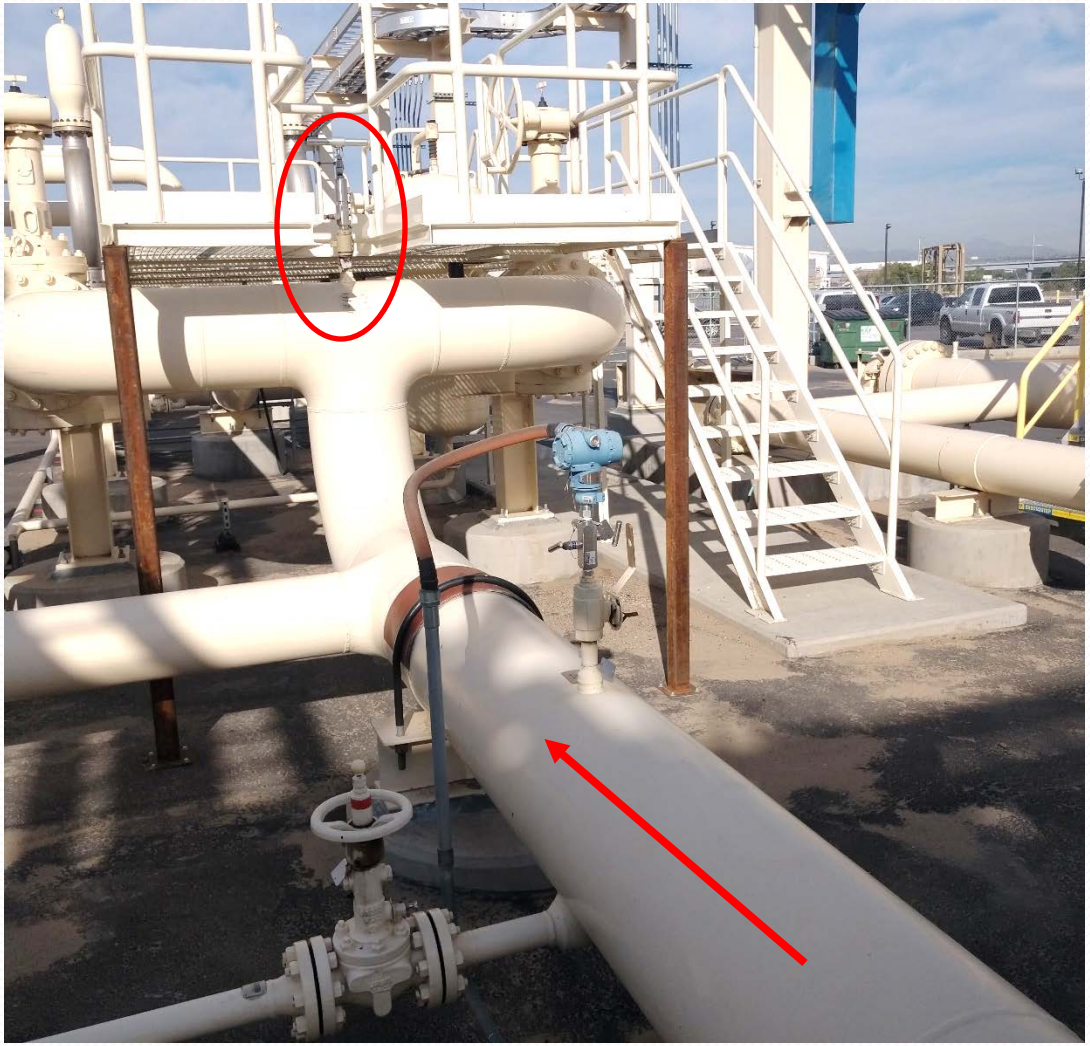
Locations

- Existing valves
- Drains
- Thief Tanks
- Pig solids / Pig trap doors
- Bypass Units

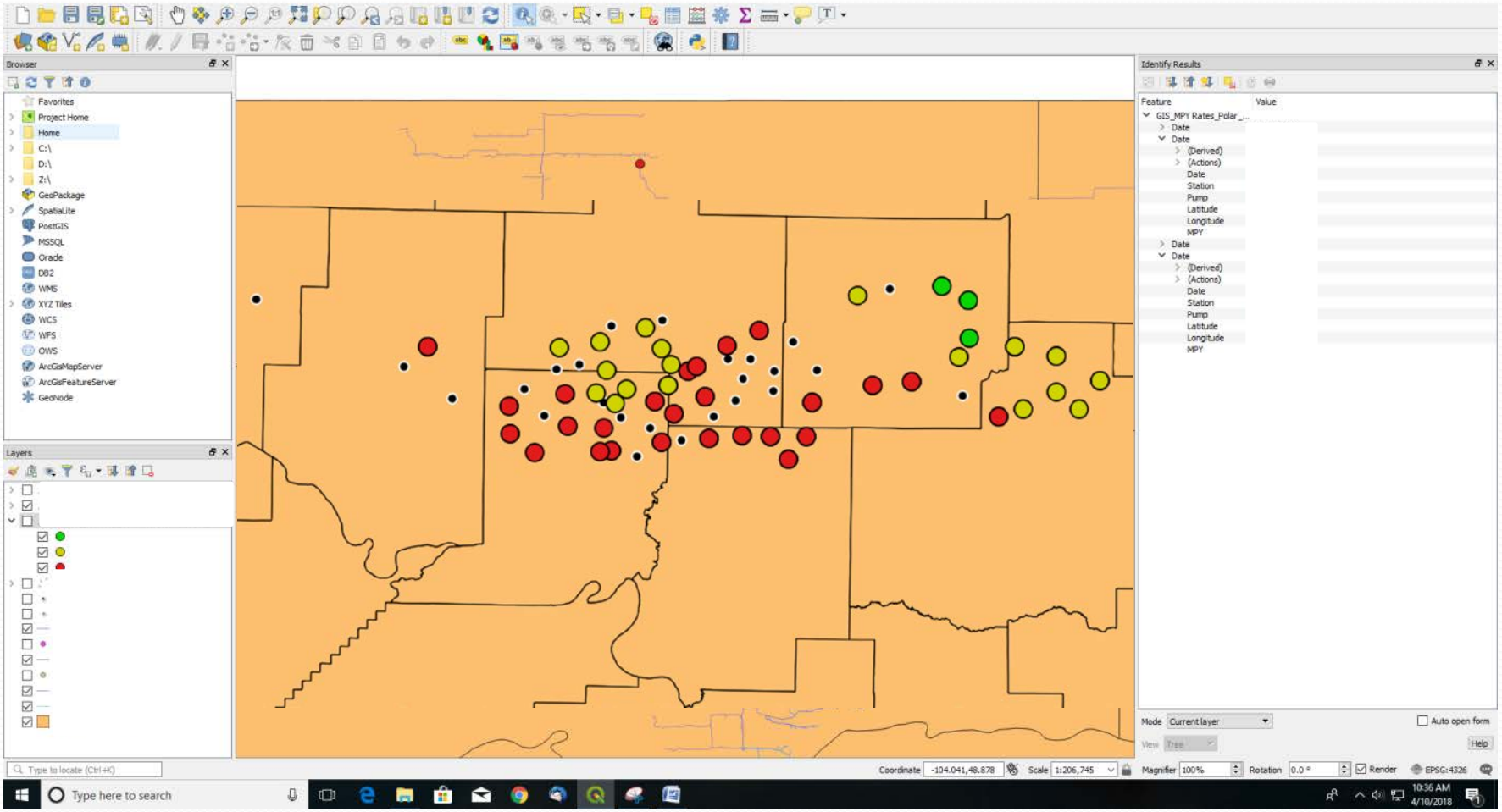


Am I monitoring at Representative Locations?

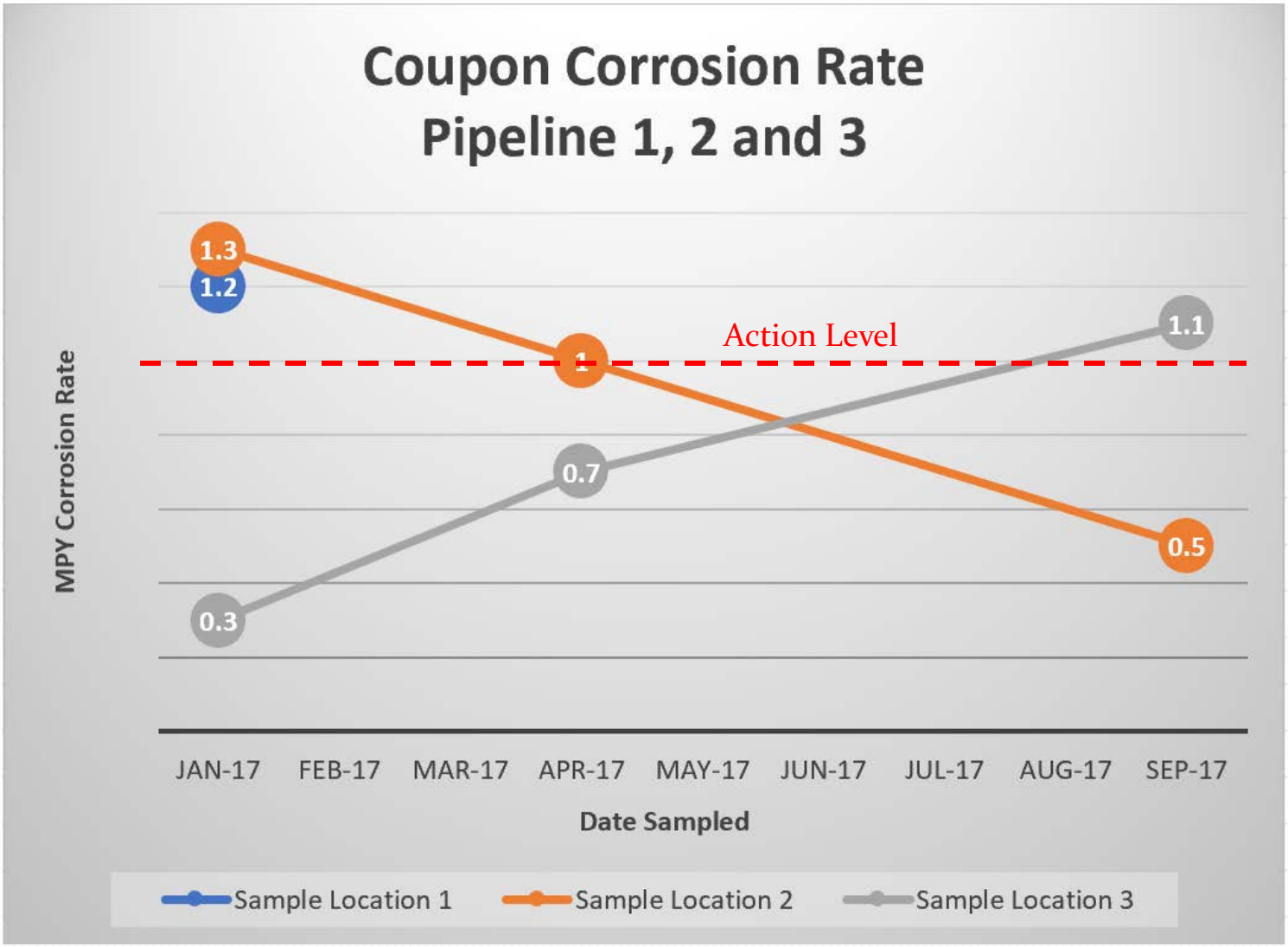




Mapping and Data Combined



One Point Does Not Make A Trend



Pigging

- How often are you pigging?
- What type of pigs are you using?
- Are you gathering samples at the pig trap?
- What do the pigs look like when you retrieve them?
- Are those captured in your pigging forms?

Courtesy Inline Services

Internet file photo

The Right Tool

- Am I using this correctly?
- Is this the right tool for the job?
- What will it tell me (How am I going to use the data?)
- How am I going to store the data so I can use it

Questions???

Thanks for your attention

EnhanceCo, Inc.

Tom Pickthall

O: 281 499 4426 C: 713 906 4841, tomp@enhanceco.net

EnhanceCo
Internal Corrosion Specialists