Optimising Plant Integrity Through Continuous Wall Thickness Monitoring

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Permasense – Real-Time UT Wall Thickness Monitoring
WT Technology - Unique High Temperature Capability

Time of flight
EMAT excites ultrasound directly in the metal sample – direct contact is not required.

External protective coating left in place.

Pipe wall.

1st backwall reflection  2nd backwall reflection  Subsequent backwall reflections

Time used for thickness measurement.
Technology overview - data transmission

Measurement

Communication

Analytics

Permasense sensor

WirelessHART

Max 100 sensors per gateway

Example location: Control room

Server with database

Remote access for Permasense support

50 meters (150 feet) max per hop, up to 8 hops

User's office

Network

Data viewer software

EMERSON

Experts in remote monitoring solutions
The right tool for the right application
Complimentary to Integrity Management Techniques
UT Wall Thickness Trending

Graph showing UT measurement (in) against time. The graph displays two rates:
- Rate: 6 mpy
- Rate: 86 mpy

Options for zooming and excluding events are available. Graph preferences include:
- Show nominal & retirement
- Line of best fit (decreasing trends only)
  - All Data
  - 1 Month
  - 6 Months
  - 12 Months
  - 3 Months

Save Preferences button is also available.
Global Experience to-date

>20,000 sensors in >250 facilities in >40 countries

>18 million wall thickness measurements delivered to desk, >170 million operating hours
Permasense Applications - Upstream

Damage Mechanisms
- Erosion
- CO2 / H2S Corrosion
- MIC
- Pitting
- PWC

Applications
- CRI
- Well Testing
- HPHT
- Corrosion Inhibitor Monitoring
- Inspection planning / verification
- Difficult to access pipework / vessels
- Insulated pipework / vessels
- Personnel Safety Issues
Permasense Applications - Downstream

Overhead and top pumparound
   Crude unit
   FCC

Reactors effluent air cooler
   Naphtha and gasoil hydrotreaters
   Hydrocracker

Sulfidation and naphthenic acid attack
   Crude unit
   Vacuum unit
   Mild hydrocracker
   Visbreaker

Alkylation unit
Amine circuit and regenerator
Sour water stripper
Case Study 1 – Erosion

- Onset of sand production from key producing well
- Erosion detected from UT inspections
- Flow restriction set based on CFD
- Acoustic sand detectors / erosion probes already installed
- Inspection team mobilised regularly to monitor wall loss.
Case Study 1 – Erosion (cont.)

- Operator believed flowrate restrictions too conservative
- Platform facilities able to tolerate sand production
- Looking for a monitoring solution:
  - simple to retrofit
  - real-time monitoring of pipework degradation
  - unaffected by flowing conditions
Case Study 1 – Erosion (cont.)

- Permasense sensors installed at critical areas
- Data relayed back to shore and monitored by integrity team
- Permasense verified erosion rates as production increased.
- Production output increased by 10 – 15%
- Payback on system in days
Case Study 2 – Localised Corrosion

• Corrosion issue on water injection system – sea water

• 8 x ET210 sensors on extrados of key bends and at 6 O’clock position on straight sections of pipework.

• Permasense to be used to trend against chemical & operating data to give insight into causes / rates of corrosion

• Monthly manual inspection UT inspection carried out for evaluation purposes
Case Study 2 – Localised Corrosion (cont.)

• Four sensors recorded measurable wall loss over a 6 month period.

• Excellent correlation between Permasense data and manual UT.

• Excursions from integrity operating windows (IOWs) identified.

• Data used to inform our maintenance program and chemical dosing rates for the system.
Case Study 3: Equipment Life Management

- Known thinning on Vacuum Residue Rundown system.
- 4 sensors monitoring critical locations
- Uncertainty about remaining service life of the line.
- Data Manager software being used to project retirement date.
Case Study 3: Equipment Life Management (cont.)

• Extrapolation provided reliable prediction of wall thickness.

• Vacuum Residue Rundown system able to remain in operation until next scheduled TAR.

• Sufficient time to prepare replacement of the line (design, procurement, prefabrication).
Benefits of continuous wall thickness monitoring

Asset Integrity

- Detect onset of corrosion / erosion
- Trend corrosion / erosion rates
- Trend against other process parameters
- Targeted / Focused Inspection
- Enhanced RBI
Benefits of continuous wall thickness monitoring

Process Operations

• Minimise Equipment Failures / Downtime
• Equipment Life Management
• Extended duration between TARs
• Improved chemical utilisation
• Optimise production
Key insight – Expert Analysis
Summary
Thank You

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