Increased Reliability and Reduced Risk

Applying FTIS™ Intelligent Pigging Technology to Inspect Certain Process Heaters Containing Plugged Headers

Process Heater Risk Management Solutions
FTIS™ Design Advancements

Prototype
- Development: 1995
- Investment: $1.5M USD
- 8 Ultrasonic Sensors
- 4" to 8" Pipe
- 1 mile maximum

Generations - I, II, III, IV, V
- Investment: $4M USD
- 16 - 32 Ultrasonic Sensors
- 4" to 8" Pipe
- 1 mile maximum
- More robust design
- Increased data analysis algorithms
- 2D & 3D Modeling
- LifeQuest Remaining Life capabilities

Generation - VI
- Development: 2007 - 2008
- Investment: $1.5M USD
- 48 - 96 Ultrasonic Sensors
- >100% inspection coverage
- 3" to 12" Pipe
- 25 mile maximum
- Additional robust design features
- Increased data analysis algorithms
- Additional positioning technology

Heater Configuration

- Flow Meter
- Block Valves (Launcher & Receiver)
- ¾" Female fitting (for pig locator)
- Pressure indication (supply and return)
- Choker Valve (on return)
Applications

- **Furnaces Piping / Tubing** (~500 Heater Coils Inspected Each Year!)
  - Numerous Furnace Types (Platformers (CCR), Vacuum, Coker, Crude, Can, Cabin, etc.)
  - Various Coil Configurations (Vertical, Horizontal, U-Shape, etc.)
  - Changing Diameter Coils (4” → 5” → 6” → 8”)
  - Non-pigable furnaces in some cases (i.e. Common Headers) (Common Header Delivery Systems*)

- **Pipelines**
  - Underground / Buried / Road Crossings
  - Insulated (i.e. Asbestos)
  - Overhead (i.e. Congested Pipe Racks)
  - In Plant / Between Plants / Wharf Lines

*Common Header Delivery System only available in Europe at this time
FTIS™ / LOTIS® Detectable Failure Mechanisms

- Pipe/Tube Wall Loss
  - Corrosion (Int. or Ext.)
  - Erosion (Int. or Ext.)
  - Pitting (Int. or Ext.)
  - Mechanical Damage (Int. or Ext.)

- Deformation
  - Bulging (i.e. Flame Impingement)
  - Swelling (i.e. Creep Strain)
  - Denting
  - Ovality

Naphtha Hydrotreater

Decoking Quality Control / Quality Assurance

Inner Radius

Coke

Cut Out Pipe Section w/ Coke
Convection Pipe Studded / Finned Pipe

Internal Corrosion

3D View

2D View

New Pipe

Sample Convection Pipe

New Pipe

Corrosion (Convection Section)

Corrosion Damage

NEW Pipe

The Weakest Link In the System Can Cost Your Plant!
Corrosion (Convection Section)

Various Tube Wall Thickness (Radiant Section)
Plugged Headers

- Also known as mule ear returns
- Cast fittings mounted at the ends of serpentine piping coils
- Original intent was to allow access to the interior of the heater in the event of a coke blockage

FTIS™ - Previous Generations

- Previous generations of FTIS could not navigate the rectangular-shaped configuration
- Global demand for this navigational capability still exists
Plugged Header Inserts

Shoe-horn style inserts round-off the hard internal angles

FTIS™ - New Generation

The new generation 4” FTIS™ has successfully navigated plugged headers with inserts of this type in 6” diameter heater coils.
Case Study #1

CRUDE HEATER – Radiant Section

- Number of Coils / Passes = 5
- Radiant Pipe Material = A335-P9 (6” x Sch-40)
- General wall thinning caused by internal erosion/corrosion was detected throughout.
- Piping has been in service since 1994.
- Several return bends in the radiant section contained plugged headers with show-horn style inserts.
- Most significant wall thinning in radiant section (31% loss) was approximately 2x that in convection section.
- Refinery personnel indicated radiant section coils were not previously navigable by intelligent pig technology.
- Refinery personnel indicated that without the FTISTM inspection data, the wall thinning in the radiant section would have remained undetected.

Case Study #1 – Corrosion Damage in Radiant Section
Case Study #1 – Corrosion Damage in Radiant Section

Wall Thinning Damage Caused by Erosion/Corrosion Damage

Case Study #1 - Corrosion Damage in Radiant Section

Wall Thinning Damage Caused by Erosion/Corrosion Damage
THANK YOU!

PLEASE ASK ANY QUESTIONS THAT YOU MAY HAVE AT THIS TIME

Copies of presentation can be provided upon request.

Contact: Tim Hill at T.Hill@QuestReliability.com
1.303.938.3023