Increasing Delayed Coker Productivity Through Reliable Flow Measurement Solutions





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<u>The Need to Improve Reliability</u> of Furnace Feed Flow Measurements

- -Thermal Cracking/Recycling to Extinction
- -Recycled Coke Fines
- -Wedge Meter/DP Performance
- -Limited Alternative Technologies
- -Heavier Crudes to Process
- -Increased Refining Capacity





2 / GE Title or job number / 10/20/2012

<u>The Need to Optimize Control Strategies</u> <u>through Furnace Feed Flow Measurements</u>

-Furnace Balance Control Strategies

- Accurately controlling feed rates:
 - -Produces more uniform tube coking characteristics
- Minimizing Tube Fouling Rates means:
 - -Extending Spalling, Steam-Air Decoking & Pigging Frequency
 - -Reducing Energy Consumption and Heat Loss
 - -Reducing Furnace Tube Bend Wear
 - -Increasing Production Rates





<u>The Need to Improve Accuracy</u> <u>Furnace Feed Flow Measurements</u>

-Calculating Mass Balance:

Most Effective Calculation of Recycle Rate, requires accurately measuring:

Fresh Feed Rate to the Fractionator

Mixed Feed Rate to the Furnace

Individual Furnace Pass Feed Flow Rates

Wedgemeter Accuracy?





<u>The Need to Reduce Maintenance Cost</u> <u>Furnace Feed Flow Measurements</u>

Reducing Maintenance Costs:



Wedge Meters: Cost of Ownership

Requires increased Man Hours to maintain feed flowmeters Requires Increased Man Hours in the unit Increased Risk of Personal Injury Purging DP Impulse Lines, Consumes Volume and Reduces Feed Throughput (Taps/Furnace) X (Barrels/Day) X (Life of the Unit) = Total Lost Production?



FURNACE FEED RELIABILITY PROBLEMS ConocoPhillips Refinery/Sweeny, TX/2001



-Delayed Coker & Vacuum Distillation
-ConocoPhillips/PDVSA Joint Venture
-Heavy Resid Processing Capacity
-Processing Heavy Venezuelan Crude



FURNACE FEED RELIABILITY PROBLEMS ConocoPhillips Refinery/Sweeny, TX

-Reliability Problems with Vortex Technology





Alternate Technologies to Improve Reliability?



<u>GE Sensing</u> <u>Ultrasonic Transit Time Flow Measurement</u>









<u>Ultrasonic Transit Time Flow</u> <u>Measurement Technology</u>

-Alternate Transit Time Measurements (Upstream & Down)

-Measured Delta T is Proportional to Velocity (Linear)

- -High Turndown
- -Zero Pressure Drop





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Existing Sensor Technology Temperature Limitations

•Existing Sensors are <u>limited to 536F</u>, or less. -Higher Process Temperatures will Damage the Sensor

• OPTIONS:

- -Design a Sensor with Higher Temperature Rating
- -Design a Buffer to protect the sensor from

Process Temperatures extremes





Initial Solution: "Solid Buffer Rod"

- -Buffer Protects Sensor from Process Heat Extremes
- -Weaker Signal Strengths

-Attenuating Fluids





Initial Solution: "Solid Buffer Rod"

- -Works better with Higher Frequencies (5MHz)
- -Higher Temperature Liquids Require Lower Frequencies
 - (200 KHz to 500 KHz) and a Larger Diameter Buffer
- -Lines Sizes: 3" & 4"
- -The Solution?





Solution: "A Bundled Waveguide"

- -Bundled Waveguide TechnologyTM (BWT)
- -Large number of thin metallic conductors to efficiently
 - transmit the ultrasonic signal (Similar to Fiber Optics)



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<u>Bundle Waveguide Technology™ (BWT)</u> Standard Offering:



Buffer Design Bundle Waveguide TechnologyTM (BWT)

BWTTM improves signal shape and SNR over solid buffers





Bundled Waveguide Technology





Bundled Waveguide Technology

-Totally Reliable Feed Flow Measurements

- -Repeatable (+/- 0.5% of Reading)
 -Accurate (+/- 1% of Reading)
 -No Obstruction to Flow
 -No Pressure Drop
 -No Maintenance
 -No Calibration...ever
 -No Impulse Lines to Maintain
 -No Purging of Impulse Lines
- -Increased Production Rates
- -Reduced Maintenance Cost





Bundled Waveguide Solution

Replaced existing Vortex meter in (1) VDU Furnace Pass Line





Matched existing face-to-face dimension



After (2) weeks, the Refinery Installed Redundant <u>BWT Measurements on each Pass Line</u> (16 Redundant) of the VDU and Coker Furnaces





Bundled Waveguide Technology Performance

Since 2001....

- Totally Reliable Feed Flow Measurements
- No Pressure Drop or Obstruction to Flow
- No Maintenance or Re-Calibration required...ever
- Accuracy (+/-1%) & Repeatability (+/-0.5%), that never degrades
- No Moving Parts, Nothing to Wear Out
- No Wedge Meter Impulse Lines to Maintain
- Sensors are Retractable under Flowing Conditions
- Unlimited Redundant Configurations Available
- BWT's require the same Face-to-Face dimension(s) as wedge elements





Bundled Waveguide Technology Performance Impact on the Bottom Line:

- 80% + Reduction in Feed Flowmeter Maintenance Cost (400 man hours/year)
- Improved Measurement Accuracy, Enables the Calculation of Mass Balance and Recycle Rate
- Safer Work Place (Less Hours in the Unit)
- Optimization of Furnace Balance Control:
 - -Reduced Tube Fouling Rates
 - -Reduced Heat Loss
 - -Decreased Spalling, Steam-Air Decoking, Pigging Frequency
 - -Reduced Tube Bend Wear
- Increased Production
 - -No Purging of Impulse Lines (No Lost Volume)
 - -Increased Unit Up Time





Scheduled Maintenance Pulled Buffers to Inspect



Discussion Questions & Answers



