Stop Throwing Money Away in the Coker Unit!

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Feedback from coker units

Chevron ● CNRL ● ConocoPhillips ● Hovensa ● Lyondell ● Marathon ● PetroCanada ● Shell ● Suncor ● Total

Flushing oil
Missed coker cycles
Ceramic heat blankets
600 psig steam

Problems emerge over time

Plant start-ups focus on conversion rates, chemistry, and coke morphology… not on stress testing the thermal maintenance system
## Agenda

1. What are the problems?
2. Why are there problems?
3. How much do the problems cost?
4. Is there a better way?

### What are the problems?

- Reported plugging areas
  - Vacuum distillation column
  - Main fractionator
  - Coker drums from steam-out / quenching cycle

### Reported plugging areas

- Resist lines
  - Ceramic heat blankets
  - Hydroblasting
  - Ram pumping
  - Flood oil
  - Steam hoses

- Redundant pump lines
  - No-flow side plugs
  - Can't operate when needed

- Wedge meters
  - Ceramic heat blankets
  - Flushing oil

- Electric tracing
  - Uneven heat distribution
  - High-temperature shorts
  - Premature coking from crossed lines

- Condensate drum
  - Condensate to fractionator / slop oil system
  - Vapor to fan deck

- BLOW-DOWN
  - Resid lines
  - Ceramic heat blankets
  - Hydroblasting
  - Ram pumping
  - Flood oil
  - Steam hoses

- Redundant pump lines
  - No-flow side plugs
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### Option #1

- 600°F fractionator
- Recycle pump-around with strainers

### Option #2

- Surge tank HX w/ HGO

### Option #3

- Tank farm HX w/ HGO

### Between the instrumentation and the furnace

- Steam is injected into the line; the flashing steam creates the high velocity.

### Typical coker uses n=4 parallel furnace passes for each coker drum pair.

- Each furnace pass has its own flow meter, temp sensor, and control valve.
Why are there problems?

No heat needed if flowing

Coker Feed Flowing Through 8" Line Without Heating

Pipe Length (ft) 0 2,000 4,000 6,000 8,000 10,000

Pressure Drop (°F) 550 560 570 580 590 610

No flow/ melt out = design condition #1

• No-flow condition is common…
  – Bypass lines (NNF)
  – Turnarounds
  – Upsets

→ Need melt-out capability!
Inadequate specifications #2

- Typical P&ID:
  - “Heat Trace”, “Heavy Tracing”

- Problem?
  - Does not specify what outcome is required!
  - A single tube trace could be used and meet spec
  - Need to define more specific requirement:
    Steam tracing design basis: (1) Maintain process at 325°F during no flow and (2) raise process temperature from ambient to 325°F within 12 hr after loss of utilities. Vendor is required to supply calculations to show compliance.

Heavier resid makes it worse #3

- Heavier Crude Sources
- More Efficient Processing
- Heavier Resid
- To Coker

Historical heating methods ineffective #4

- Tube Tracing
- Electric Tracing

Both give the illusion of “working” when lines are flowing!
Low expectations of heating system

- Common Coping Mechanisms:
  - Flushing oil procedures to clear lines
  - Ceramic heat blankets
  - Hydro-blasting or other mechanical removal
  - Steam hoses
  - Ram pumping

3 How much do the problems cost?

Operational cost impact

<table>
<thead>
<tr>
<th>Operational Cost</th>
<th>$ Impact</th>
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</thead>
<tbody>
<tr>
<td>Flushing oil (prevent plugging prior to pending incan downtime)</td>
<td></td>
</tr>
<tr>
<td>Missed coker cycles (dependant on drum size, coke margin)</td>
<td></td>
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<tr>
<td>Plugging removal (insulation removed/replacement; ceramic blankets)</td>
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Is there a better way?

Different heating approaches

- Jacketed Pipe
- ControTrace™
- Tube/Electrical Tracing

1. \[ q = U \times A \times \Delta T \]

ControTrace

- 2"x1" rectangular tubing is banded onto piping
- Designed with ASME Section VIII
- Contoured to fit pipe OD
- Heating medium flows through tracing
- HTC used to remove air gaps
- Add elements for more heat

2. \[ q = U \times A \times \Delta T \]
Higher U and A with CT

\[ q = U \times A \times \Delta T \]

\[ \begin{array}{c|c|c}
TT & U = 1 \\
CT & U = 40 \\
\end{array} \]

Faster melt-out with CT

Melt-out time - 8"NPS

Baseline system

10" NPS header from furnace charge pumps (330 ft)

16" NPS from fractionator to furnace charge pumps (110 ft)

4" NPS branches to furnace passes (340 ft)

Qty 44 valves
Consider all the costs!

Heating system cost

Ongoing Costs:
1. Flushing oil
2. Missed Coker cycles
3. Ceramic heat blankets
4. HP (600psig) steam

Summary & recommendations

• Specify required thermal duty for the system
• Require vendors to perform engineering to:
  – Meet thermal duty
• When evaluating a heating system, consider:
  – Will it be able to melt out?
  – Will it keep the process from plugging in no flow?
  – Capital cost of an engineered solution versus the ongoing costs of plugging

CSI general overview

1. Heated piping systems
   – ControTrace™ & ControlHeat™ bolt-on jacketing systems
   – Jacketed piping
   – Flexible metal hoses (jump-overs and jacketed)
CSI general overview

1. Heated piping systems
2. Process piping
   - Up to 200 spools/week

3. Specialty fabrication
   - Code pressure vessels
   - Precision manifolds
   - Skids/modules

4. Engineering services
   - Manifold-to-manifold responsibility
   - Thermal and fluid modeling
   - Piping and pressure vessel design
   - Project integration