Stop Plugging Those Coker Lines!

Jim Hartman
Controls Southeast, Inc.
Agenda

1. CSI overview
2. End-user feedback on heating problems
3. Reasons for the problems
4. Potential for enhanced value proposition
CSI overview

1. Heated piping systems
2. Engr. services
3. Process piping
4. Specialty fabrication
CSI bolt-on refinery successes

- **BP** – Carson, Cherry Point, Texas City, Whiting
- **Chevron** – El Segundo, Pascagoula, Salt Lake City
- **ConocoPhillips** – Borger, Rodeo, Sweeny, Trainer
- **Exxon** – Baton Rouge, Baytown, Beaumont, Sid Richardson, Torrance
- **Flint Hills** – Corpus Christi, Pine Bend, Rosemount
- **Lyondell** – Houston
- **Marathon** – Canton, Cattletsburg, Detroit, Garyville, Robinson, St. Paul
- **Opti/Nexen** – Fort MacMurray
- **PetroCanada** – Edmonton
- **Shell** – Anacortes, Caroline, Deerpark, Fort McMurray, Martinez, Shantz
- **Sinclair** – Tulsa, Wyoming
- **Sincor & Petrozuata** – Venezuela
- **Suncor** – Commerce City, Fort McMurray, Sarnia
- **Sunoco** – Eagle Point, Marcus Hook, Philadelphia
- **Syncrude** – Fort McMurray
- **TCO** – Kazakhstan
- **Valero** – Ardmore, Corpus Christi, Houston, Lima, Memphis, Norco/ St. Charles, Paulsboro, Three Rivers, Wilmington
General problem in cokers =
Heavy process subject to “plugging”
Specific problem areas

Delayed Coker Process Diagram

- ControlTrace application
- non-ControlTrace application

- Vacuum distillation column
  - 750°F

- Surge tank
- HX w/ HGO

- Tank farm
- HX w/ HGO

- Option #1
- Option #2
- Option #3

- Recycle pump-around with strainers

- Main fractionator

- Coker drums
  - 930°F

- 580psi

- Each furnace pass has its own (1) flow meter (2) temp sensor (3) control valve (4) steam injector.

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

- BLOW-DOWN
  - Blow-down tower
  - Vapor to fin-fan deck
  - Condensables to fractionator / slop oil system
  - Recycle pump-around with strainers

- CONDENSATE DRUM
  - Condensate drum
  - Vapor to fractionator
  - Condensables to fractionator / slop oil system
  - Recycle pump-around with strainers
End-user feedback

1. Those who have problems
2. Those who used to have problems
Why are they having problems?

- No problem when flowing
- Heavier products are worse
- Historical heating methods are ineffective
Flow = false sense of security

Coker Feed Flowing Through 8" Line Without Heating

Pipe Length (ft) vs. Process Temperature (°F)

- Process Temperature decreases linearly as pipe length increases.
No flow = real design condition

- NNF lines such as bypass lines
- Turnarounds
- Upsets
Low expectations of heating system

- Flushing oil procedures to clear lines
  - Send product to slop system for future re-treat
- Ceramic heat blankets
- Hydro-blasting or other mechanical removal

Workarounds Common – Why Tolerated?
Resid is getting heavier

Heavier Crude Sources + More Efficient Processing = Heavier Resid to Coker

WCSB Crude Production 1971-2003

Increasing Growth in Refinery Resid Conversion Capacity Expected Medium Term
Historical heating methods

Tube Tracing

Electric Tracing

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

\[ q = \text{Constant} = q_{\text{ambient \_ loss}} + q_{\text{process}} \]
## Historical heating methods

<table>
<thead>
<tr>
<th>Tube Tracing</th>
<th>Electric Tracing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor conductive heating</td>
<td>Lower inherent reliability due to number of active components</td>
</tr>
<tr>
<td>Usually requires HP steam</td>
<td>Crossed cables can lead to coking in line</td>
</tr>
<tr>
<td>Difficult to contact valves</td>
<td>Difficult to contact valves</td>
</tr>
<tr>
<td>High installer variability</td>
<td>High installer variability</td>
</tr>
<tr>
<td>Frequently distorted during maintenance actions</td>
<td>Temperature controlled only at thermostat points</td>
</tr>
</tbody>
</table>

*Both give the illusion of “working” when lines are flowing!*
ControTrace

- Process flows through piping
- 2"X1" rectangular tubing is banded onto piping
- Designed with ASME Section VIII
- Contoured to fit pipe OD
- Heating medium flows through tracing
- Use mastic to remove air gaps
- Add elements for more heat

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

- ControHeat for valves, pumps, instrumentation
Higher U and A with ControTrace

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

<table>
<thead>
<tr>
<th>TT</th>
<th>U = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>U = 40</td>
</tr>
</tbody>
</table>
Impact on melt-out time

Melt-out time - 8"NPS

- Tube Trace
- ControTrace

Tube Trace Coverage
Enhanced technology value

- Heating system
- HP (600psig) steam
- Flushing oil
- Ceramic heat blankets
- Thermal downtime
Summary

• End-users are having heating problems
  • Not designed for no-flow
  • Worsening with trend towards heavier feeds
  • Historical heating methods are ineffective
• ControTrace solves the heating problems and eliminates costly coping mechanisms
Thank you!

Controls Southeast, Inc. ● Charlotte, NC
www.csiheat.com