Delayed Coker
Safe Sampling - Tar or Spalled Coke

Presented by Mitch Moloney of ExxonMobil
mitchell.j.moloney@exxonmobil.com
@ Galveston TX  coking.com   May-2013
Safe Sampling - Tar or Spalled Coke

**Topics:**

(1) Reasons for Sampling Resid

(2) Background Review

   => Systems on various coker sites

   => Types employed

(3) Sampling Resid - Our Practice

(4) On-Line Analyzer Experience

(5) Sampling Furnace Effluent during On-Line Spalling

   => Used at one site
Hot Tar - Safe Sampling

Reasons for Sampling Resid:

Validate CCR or Vis levels are in line with blend plan projections
Material Balance Validation
Performance testing
New feed trials
Unit Monitoring & Optimization
Pilot plant feed gathering
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Background:

Most cokers originally cooled the hot tar by passing the tar through a \( \frac{3}{4}'' \) coil immersed in a bucket of flowing water.

- The tar line in & out was steam traced & insulated (maybe)
- Disposable tubing may have been used as well
- The flowing tar was
  - either diluted with oil and sent to the oily water sewer (back in the day)
  - or directed to a barrel, diluted with light oil and then loaded into a vacuum slop truck
  - or returned to a lower pressure location in the process
  - or piped to a slop oil system
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Resid Tar Does Not Flow When Cool:
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Background:

Many of the old resid sample systems used a simple water cooler, which creates a low resid film temperature, high viscosity and plugging.

Additionally, resid foulant reduces heat transfer and the ability of the cooler to properly cool the sample.
Site-1:

**Hot Tar - Safe Sampling**

- Tar Sampler
- Oily Water Drain
- Absorbent Foam
- Later
- Sample Container no longer fit
- Storm Water Drain
- Closed off with Cement to protect the API Separator
- Oily Water Drain

Original

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Site-1:

Tar Sampler

Absorbent Foam

Oily Water Drain

Vacuum Truck

Ground
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Background:

Site-2
The Simplest Design

It worked for many years where they obtained a daily sample

=> Main Disadvantage - Created slop oil for disposal/handling

=> Eventually it was not flushed and plugged several times creating additional work and more safety risk
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Site-3 Sample Cooler on Fast Loop
Hot Tar - Safe Sampling

Background:

Site-3
Water Cooled Design

Sample Cooler

Sample Station Enclosure
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**Background:** Site-3 Water Cooled Design

Facing the Sample Enclosure

- **Warning Sign on Valve Operations**
- **Pressure gauge to detect plugging**
- **Air to Aspirated Vent to remove fumes**
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**Background:** Site-3 Water Cooled Design

- Disposable Plexiglas
- \(\frac{1}{4}\)-Turn Block Valve
- \(\frac{1}{4}\)-Turn Sample Valve
- Sample Can
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Background:

Site-4 - Good on Paper, NOT in Practice

Pump out of service and system gets plugged without proper flushing and steaming

Flow control was problematic

Required purging dead leg
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Site-5 Hot Resid Sampler (650°F)

We do not recommend taking a sample at this temperature due to flashing & spitting
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Site-5 Hot Resid Sampler

Removing the disposable plastic shield
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Our Practice:

Use of a Strahman valve, close-coupled to the sample line.

=> A "regular" normal-body Strahman design should be used in the fast-loop piping.

=> Extended body Strahman valves used in heavy-wall-piping can distort and leak through the packing.

=> It is also important to have the valve piping well supported to avoid any torque on the Strahman body.

Installation of sample valve as a take-off on a fast loop line installed in parallel with a flow control valve or other pressure drop device.

If the sample point temperature is > 475°F (246°C), consider a steam or tempered-water cooler to lower the temperature to <475°F

=> The cooler should be installed in the fast loop line rather than in a separate take-off line that requires flushing after each sample.
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Our Practice (cont’d):

Use of steam tracing or jacketing and insulation to prevent line pluggage.

Flushing connections and isolation valves around the sample valve to allow the sample valve to be taken out of service for maintenance (these would normally be provided on the fast loop sample line).

The capability to fill one gallon (or 1 quart if desired), 5 gallon and 55 gallon sample containers.

=> The sample container should be rated for the sample temperature and allow safe handling in the field and the laboratory.

=> Proper shielding to protect the sample taker

=> Adequate lighting and proper sample station ingress/egress

Use of a drilled gate valve downstream of the sample to allow control of the sample line flow.

Optional – Depending on the sample temperature, an aspirated vent in the sample box can be employed.
Our Arrangement

- Piping steam traced & insulated of nominal 2-inch diameter
- Concentrically Drilled Gate Valve
- Low point drain
- Sample Table
- Threaded, retractable plug sample valve
- Sample Can Protected by a disposable plastic shield
- Process Control Valve
- High Point Vent
- CSC
- CSO
- Hot Resid @ 450°F (246°C)
- Flushing Oil
- Steam Hose connection
- Minimum Distance

Proper Procedures are Essential no matter how good the facilities
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Layout in the Field
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Strahman Valve:

“Sealing system uses a range of material combinations to create a differential hardness between the body and plunger seat.”

These valves do not allow any fluid flow until they are opened 9 turns, and the flow increases with each extra turn open.

August 29, 2009 Brochure

Strahman Valve: Sealing system uses a range of material combinations to create a differential hardness between the body and plunger seat. These valves do not allow any fluid flow until they are opened 9 turns, and the flow increases with each extra turn open.
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Strahman Valve - Half Coupling:

Use of Half-Coupling
Design reduces chance of seal leakage due to torque on the plunger.
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Our practice requires only one Sample Can:

Eliminates need for Sample Purge Can
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There should be no need for this:

Eliminates need for Sample Can Holder
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Still Need to Wear Proper PPE:
Spalled Coke - Safe Sampling

Sample Take-Off and Return

Sample Take-Off & Return piping around Control Valve
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Open Sample Box
Spalled Coke - Safe Sampling

Sample Box - Sample Outlet & Fume Vent
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Vent Aspirator Controls
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Experience with On-Line Hot Tar Analyzers

An On-Line Flow-Through Viscometer was used successfully for many years at a formerly-owned site.

=> Expensive Installation

=> High Maintenance & Frequent Calibration

Recently installed an On-Line Gravity Analyzer

=> Nuclear-based instrument

=> Non-intrusive, low maintenance
Spalled Coke – Safe Sampling

Continual Sampling of Furnace Pass During On-Line Spalling allows tracking of Coke Removal Effectiveness during the Spall

A slipstream of furnace pass outlet flow (steam and coke) was passed through a coil in a counter-flow water bath.

Samples are taken into calibrated beakers, allowed to settle and effectiveness of the spall could be gauged as time progressed.
Spalled Coke – **Safe Sampling**

Close-Up photos of the water and sample piping

Sample inlet & outlet piping from furnace

Water outlet & inlet piping from furnace
Fluid Coker Hot Coke - Safe Sampling

Incident (Tuesday Oct 3, 2000)

A Field Technician was preparing to catch a normal Hot Coke sample. Prior to catching the sample he walked over to the sample box and opened both exterior and inner doors to obtain the sample pot which rested on the grid. He then walked over to the forklift/chunky cart, located just East of the heater chunky chute, and emptied the contents of the pot into the cart. He walked back to the sample box, replaced the sample pot and closed both doors. He then operated the forklift and positioned it under the heater chunky chute at which time he heard a popping sound coming from the direction of the Hot Coke Sample Box then a small fire coming out of the sample box, extending upward about 2-3 feet. After reporting the fire, he & another technician put out the fire using a fire hose. Upon further inspection they noticed an accumulation of coke below the "grid" of the sample box and determined that the box was partially plugged. They connected a nitrogen hose to the sample box and proceeded to clear the vacuum line.

Investigation Conclusion: The vacuum line from the sample box was partially plugged allowing hot (1000°F) coke from a previous sample to accumulate in the bottom section of the sample box. When the technician opened the box to remove the sample pot, air was introduced to the smoldering coke. The location of this sample point is at ground level under the heater structure and the lighting in this area is less than adequate. The technician did not notice that there was an accumulation of coke in the cone part of the sample box.