Question 83: What is the typical flashpoint for your slurry oil product? Can a flashpoint of 200°F or higher be achieved with steam stripping the main fractionator bottoms? What are your storage temperature guidelines? What lower explosion limit (LEL) and H2S levels are found in the tank vapor space?

BROOKS (BP Refining)

I will start by saying that everyone should reference Question 84 of the 2011 NPRA Q&A because this question is an exact replica of what was answered by BP and Western Refining last year. To very briefly recap what was covered, from the BP perspective, we see flashpoints in the 140ºF to 220ºF range. We are typically able to meet the flashpoints greater than 200ºF with our internal stripping rings, which we have on the majority of our cats. We do have some units with small external stripping towers, but most of them have internal stripping stream rings that provide enough of an upgrade to the flashpoint that we can typically meet our storage recommendations.

In addition to the points referenced in last year's question, API RP 2003 recommends that you store all materials at 15ºF below the flashpoint if they are in fixed roof tanks. The one consideration on slurry oil storage is that there is a rather narrow safe storage temperature because you do not want to rundown slurry at temperatures too low due to difficulties with flowing properties, which means you want it as close to the flashpoint as possible. You may have some pour point and viscosity problems if you try to pump the slurry oil at temperatures too low, which makes it a bit more difficult to meet some of these flashpoint regulations.

An additional note is that there was a detailed response from Marathon Oil at the 2008 NPRA Q&A. At that time, they indicated having seen external strippers which were much more efficient. FCCs can use much less steam to get the same flashpoint upgrade with external strippers than would be required on an internal stripping steam ring.

A final thought is that low flashpoint issues may not necessarily just be due to a need for additional stripping. If you are having issues, then you should also look at other possible low flashpoint causes, such as poor fractionation problems, thermal degradation in your slurry bottoms, slurry exchanger tube leaks, or flushing oil that is coming in with a low flashpoint. This is another consideration when you are reviewing your storage temperatures and determining how to meet your flashpoint for your slurry oil storage.

SCHOEPE (Phillips 66)

When I surveyed Phillips 66 units, I found a large range in flashpoint for slurry. For example, one of the units that does have a steam ring in the main fractionator is able to keep its slurry flash between 190ºF and 210ºF, just with steam injection to the fractionator. A second unit, also with a steam distributor, has a flash of between 120ºF and 170ºF, but it is rate dependent. So, at a low rate, this unit gets a slurry flash of 170ºF; at higher rates, the slurry flash drops down to 120ºF. A third unit struggled with that issue and recommissioned an external slurry steam stripper, which was very successful. This unit is now able to keep the flash greater than 220ºF.

We have the same rundown guidelines as BP. At one of the units, the chemical vendor uses an H2S scavenger to keep the H2S content in the tank below 10 ppm.

LALL (UOP, A Honeywell Company)

In a properly operated FCC main fractionator, the slurry or flash can usually be increased to approximately 150ºF to 160ºF without any modification to the system. When slurry flashpoint specifications exceed this range, the addition of a stripping steam distributed to the main column bottom will deliver a small flash improvement of approximately 10ºF to 14ºF. To achieve slurry flashpoints of about 175ºF, either a side cap stripper or a vacuum flasher can be added to permit flashpoints in the range of 230ºF to 240ºF. A low flashpoint is not typically an issue of poor column fractionation; rather, it is due to excessive thermal cracking in the fractionator bottoms. If there is tray damage to the column internals, then a large quantity of LCO could be dumped into the bottoms and sub-cool it. As a result, tray damage can depress the flashpoint.

HOWARD LEE (BP Products North America Inc.)

I am Halle’s colleague, and I want to say that you did a good job with the response. I just realized that we did not get to discuss this question with Halle. I want to ask the panel and the audience if anyone has thought about the pumparound rate, as far as this question. We have units with pumparound rates on the magnitude of fresh feed rate; in other words, fairly large volumes. We have other units running lower pumparound rates; for instance, 6 gpm/ft2 (gallons per minute per square foot). So I have always wondered if a very high pumparound rate had to do with absorbing light ends down to the bottom and if it is affected by it. Has anyone considered that parameter or made any observations?

PIMENTEL (CITGO Petroleum Corporation)

Yes, absolutely. You are right for two reasons. First of all, a very high pumparound rate will surely carry more light material back into the fractionator bottoms because they are contacting with the light gases coming from the reactor, which will reduce the residence time in the bottoms compartment. So your steam will probably have a lower efficiency when you run at higher pumparound rates.

BROOKS (BP Refining)

This question is identical to a question answered during last year's NPRA Q&A. Please reference Question 84 in the 2011 NPRA Q&A Answer Book for the full response. BP and Western Refining provided responses on this question during that session. This is a brief summary of their responses:

• BP's typical slurry oil flashpoints range from 140°F to 220°F.

• BP has multiple units that meet flashpoints of greater than 200°F with internal steam stripping rings.

• Some units use small external stripping towers (less than 10 trays).

• Other units use internal stripping steam rings below the liquid level in the base of the main fractionator. This ring is typical of a slurry pool quench system, but it has been also shown to be somewhat effective at stripping the DCO (decanted oil) product and increasing its flashpoint.

• BP has performed stripping steam tests that confirm higher flashpoints at higher steam rates.

• The effect of internal stripping rings on flashpoint is highly dependent on the steam distribution.

• Too much internal stripping steam can cause issues with bottoms level indication.

• Our storage temperature guidelines specify temperatures below slurry flashpoint temperatures.

• This question is similar to another question addressed during the 2008 NPRA Q&A which included detailed responses from Marathon.

• Per documents from the asphalt and chemical cleaning industry, volatile organic compounds (VOCs) can be released after processing. The levels of combustibles and H2S in the vapor space can increase over time depending on the storage temperatures.

Additional considerations around DCO storage are as follows:

• In most cases, DCO is stored in un-blanketed, fixed roof tankage, thus the DCO needs to be stored below its flashpoint temperature.

• API RP 2003 recommends that the storage temperature be at least 15ºF below the flashpoint.

• The safe storage temperature range is typically very narrow due to pour point and viscosity concerns around pumping and solids settling in DCO streams.

• Based on the 2008 Q&A Marathon response, external DCO strippers required 10% to 50% of the steam rates necessary to see the same flashpoint improvements with internal stripping rings.

• When investigating low flashpoint issues, consider some of these possible causes: poor fractionation, thermal degradation, slurry exchanger tube leaks, and low flashpoint flushing oil.

LALL (UOP, A Honeywell Company)

This is the same question posted in the 2011 FCC Q&A (see Question 84). UOP's additional comments are that in a properly operating FCC main fractionator, the slurry oil flash can usually be increased to approximately 150°F to 160°F (65°C to 70°C) without any modifications to the system. When slurry flashpoint specifications exceed this range, the addition of a stripping steam distributor to the bottom of the main fractionator will deliver a small flash improvement of approximately 10°F to 18°F (6°C to 10°C) to a flashpoint range of 165°F to 175°F (75°C to 80°C). To achieve slurry flashpoints over 175°F (80°C), either a sidecut stripper or a vacuum flasher can be added, capable of achieving flashpoints around 230°F to 240°F (110°C to 115°C). Low flashpoint is not typically an issue of poor column fractionation; rather, it is due to excessive thermal cracking in the fractionator bottoms. However, if there is damage to the column internals, a large quantity of LCO could be dumping into the bottoms and sub cooling it. As a result, tray damage can suppress the flashpoint of the fractionator bottoms. UOP recommends that the rundown tank temperature always operate below the flashpoint by providing adequate rundown cooling to meet these specifications.

SCHOEPE (Phillips 66)

Slurry flashpoint differs significantly from unit to unit. One Phillips 66 unit is able to achieve a flashpoint of 190°F to 210°F by adding stripping steam to the bottom of the main fractionator. A different unit with stripping steam in the main fractionator sees a correlation of slurry flashpoint with respect to FCC feed rate. At low FCC rates, a flashpoint of about 170°F can be achieved while the flashpoint can drop to 120°F at high rates. A third unit recommissioned an external slurry stripper after struggling with this issue. This unit is now able to increase the slurry flashpoint to 220°F. Slurry typically has to be cooled 15°F to 20°F below the flashpoint. One site controls the H_2S in the vapor space of the tank down to 10 ppm by using a H_2S scavenger.

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