What are the advantages and disadvantages for rerunning slurry to FCCU as feed. I realize that slurry would likely not crack due to high aromatic content. Would increased coke be a concern?

Response by Ken Peccatiello.
The biggest negatives from recycling slurry to the reactor are increased coke, which is reduced air availability from the main air blower (MAB; this also translates into higher regenerator temperatures, which decreases conversion) and increased dry gas, which translates into reduced wet-gas compressor (WGC) availability, (which can reduce unit conversion or throughput if the unit is WGC; limited).

The expected yield structure is dependent upon the gravity of the slurry. The more negative the gravity, the more coke and dry gas and the less valuable liquid products (C3 thru LCCO) are produced. Recycling slurry that has a fairly high positive gravity (over +4 API) can be cracked with a lesser impact on coke and dry gas and a good impact on liquid yields (C3 thru LCCO).

The only real reason to recycle slurry with less than a -2 API would be to heat the regen during full burn operations, when the regen temp is too cool/cold to support complete / full combustion of CO to CO2. There is not enough hydrogen left in the slurry to generate valuable liquid yields at this gravity.
In a partial burn, there is absolutely no incentive to recycle slurry that is less than -2 API. It will just "chew-up" the already limited air (oxygen).

An FCC would be much better off to reduce slurry yield through catalytic means. This could be accomplished by incorporating more active matrix into the catalyst particle, or through the use of separate particle additives. Again however, at less than -2 API it would not be economically justifiable to utilize a separate particle additive; there is just not enough hydrogen remaining to be upgraded into lighter liquid products to justify the cost of the additional bottoms cracking additive.

There could be some incentive to review, and employ, a modification to the catalyst formulation to incorporate a slight increase in the bottoms cracking component(s). This would follow an evaluation by the catalyst supplier and the unit process engineer.

The slurry yield could also be reduced through process changes such as increased catalyst to oil or increased reactor temperatures. However, both of the actions also have consequences on yields, selectivities and other process considerations.

With lower slurry yield, there is also the impact on the rundown rate, which translates into velocity issues. We would want to ensure that we do not have a negative impact of slurry rundown velocity in either the process lines or in the exchangers. The target for this velocity is 5 ft/s, (the range is from a low of 3 ft/sec to a high of 8 ft/s).

Finally, considering that your FCCU now employs/utilizes high technology feed injectors, we should be cognizant of the impact the catalyst /coke contained within the slurry has on the erosion of the feed injectors and hence injector performance and the physical condition of the injectors. Erosion of the internals would lead to lower/poorer performance of the injectors and thus lower conversion and a change in the product selectivities.

Ken Peccatiello has over 32 years experience in FCC operations and technology including Director of FCC Technology for Valero Energy Corporation in San Antonio, TX and ChevronTexaco FCC Expert (worldwide) providing:

- Troubleshooting/Problem-solving,
- Turnaround Support,
- Start-up and Shut-down support,
- Operational support and optimization,
- Best practice development and implementation,
- Project development and implementation,
- Training of personnel.