Question 18: Some refiners have installed gas injection in FCC secondary cyclone diplegs to increase capacity and avoid defluidization problems. Please describe your experience operating with gas addition in the diplegs and any maintenance issues. What advice would you give to others considering this installation?

THOMPSON (Chevron)

Cyclone dipleg aeration is a technique used to improve cyclone dipleg fluidization. It involves adding steam, a stream of purge gas—usually air or steam—to the dipleg just ahead of the trickle valve. It ensures that the cyclone dipleg does not defluidize and plug. This can be a problem for lightly-loaded secondary cyclone diplegs.

We have two similar units with dipleg aeration, both are reactor and generator secondary cyclone diplegs. One regenerator has three sets of two-stage cyclones; the other has two sets of two-stage cyclones. Both have air purges just upstream of the trickle valve. Air purge on these purges is controlled by a restriction orifice. These systems have worked pretty well. We have not had any plugging issues with the aeration system or loss of the lines. We also have the system that was installed on the reactor side on the secondaries and that, too, has worked well. Those were actually installed after we had some problems initially after a revamp. There were a lot of concerns about routing the piping: thermal expansion. But on these units at least, it looks like that system has worked out very well and we have not had piping failures.

NPRA

Description of Installations with Dipleg Aeration

- Two similar units with dipleg aeration of both the reactor and regenerator secondary cyclone diplegs
- Regenerator: 2nd stage diplegs each have an aeration purge in the sloping mitre bend section of the dipleg ahead of vertical trickle valve. Purge is plant air.
- Reactor: single set of close coupled cyclones. Second stage dipleg has steam purge in sloping mitre bend section. The trickle valves are in dilute phase. Stripper bed level operates approx 1.5 meters below bottom of the trickle valves.
- Small flows regulated by ROs

HEATER (BASF Catalysts)

Some FCCs use conventional pressure taps to measure the flowing catalyst density in the diplegs. Purge gas, typically nitrogen (N2), provides some aeration. External aeration is not a common practice due to poor mechanical reliability of the piping and connections. It is possible to over-aerate the dipleg. The better option is well designed trickle valves so as to not allow defluidization in the diplegs, especially during startups during which the loading can be so light that the residence time is long and defluidization can occur.

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