
Question 42: What are your best practices to minimize catalyst carry over to the main column on start up?

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Catalyst loss events experienced while bringing the FCC online after a shutdown are troublesome as they can add significant cost and delay to the startup. Because the main air blower is run close to design conditions throughout the startup, losses are more frequently observed from the reactor side.

Prior to feed-in, it's difficult to maintain sufficient velocity in the reactor cyclones for effective retention of the catalyst. However, some steam must be kept flowing to the distributors on the reactor side to keep them clear of catalyst, provide a steam purge through the reactor system and to circulate the catalyst during the reactor heat-up phase. These steam flows are generally minimized to reduce the amount of catalyst carried to the cyclones, which will typically not be efficient until after feed-in.

Developing a steam plan for use during startup can help mitigate problems. For each steam distributor, the exit velocity and nozzle delta P are calculated to ensure they are within design conditions. Additionally, riser, stripper and cyclone velocities are also calculated. These calculations are done for each of several conditions during the startup, and adjustments are made as the unit heats up. It's a good idea to consider the starting conditions, the status of the wet gas compressor, the removal of the main column blind, the presence of catalyst in the system, the heat up phase of the reactor and the increase in charge rate as you move from feed-in to a design condition hold (typically 60% of the design feed rate).

During the startup, some small amount of catalyst is circulated between the regenerator and reactor to heat up the reactor in a controlled fashion. This can be done continuously or via a batch method, depending on unit configuration. The catalyst flow rate required to heat the reactor is much less than typically seen on an operating FCC, and as such, the flux of catalyst in the cyclone diplegs, stripper and standpipes is much lower than normal. The lower flux rate can cause local de-fluidization of catalyst. This can go unnoticed until after feed-in when the circulation rate increases dramatically. Monitoring temperature profile in the reactor, stripper and if available, cyclones is a good way to catch de-fluidization before feed-in. Stopping circulation, lowering the reactor level to minimum, then restarting circulation and re-inventorying the reactor immediately prior to feed-in can help give the cyclone diplegs time to drain and the stripper a chance to re-fluidize.

Many times, during startup, while the level instrumentation is not yet operating properly, catalyst is being loaded to the system and moved between vessels. As a result, it's difficult to monitor the exact catalyst inventory. If you suspect you may have a loss problem, pause the start-up until you've identified the trouble area. Continuing with feed-in can make a small problem into a much bigger issue.

Working closely with experienced operations staff, technical services and your process licensor to develop startup procedures that address your specific unit, along with incorporating lessons learned from previous startup attempts will help prevent catalyst losses and other unit upsets during startup.

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