
Question 5: What is your experience with CCR catalyst on-the-fly replacement compared to changing at turnaround?

CHRISTIAN ARNOUX (Valero)

The opinions expressed are those of the author and do not necessarily represent the views of Valero Energy Corp.

Valero's best practice is to evaluate changing CCR catalyst during turnarounds as it saves about 25% of the cost vs. on-the-fly change out as follows:

- -10% vs. On the Fly replacement which typically adds 110% catalyst to account for back mixing
- -10% vs. the next T/A Dump Screen and Reload following the on-the-fly change out
- -5% for miscellaneous costs such as extra platinum reclaim/ losses and extra catalyst handling

Don't necessarily change catalyst out during every turnaround but evaluate at turnaround intervals. Only change catalyst when it is economic.

GAYL MERCADO (Axens North America)

On-the-fly catalyst replacements are becoming more common, but still an economic decision for the refiner based on trade-offs between the continuous replacement approach and the historical changing at turnaround approach. On-the-fly catalyst replacement allows for full catalyst replacement while catalyst circulation is maintained, with both reaction and regeneration sections still in operation to allow for reduced unit downtime. Keeping the unit in full operation gives refiners the ability to replace catalyst outside of a planned turnaround while the unit is still in operation to take advantage of improved yields by replacing with fresh catalyst.

On-the-fly catalyst replacement requires a 24-hour loading operation for a 6 to 7-day period, but with minimal production loss. During the change-out, catalyst circulation is redirected so that the unit catalyst is unloaded from a Lock Hopper drum at the bottom of the regenerator and fresh catalyst is loaded in its place upstream of the reduction chamber. Backmixing of spent catalyst is minimized to less than 3 to 4% with this procedure. Safety risks are also minimized with on-the-fly change-outs as reactor entry and drying is not required.

With on-the-fly catalyst change-out, refiners do not have the ability to inspect CCR reactors and regenerator since the unit is still on stream. Axens recommends that refiners plan to clean and inspect these vessels during a regularly scheduled turnaround.

KA LOK (UOP)

UOP's Catalyst Changeout On-The-Fly is a design feature that allows for replacement of the total catalyst inventory in the CCR Platforming™ unit and the CCR section while maintaining the Platforming unit operations. Refineries find this design useful when there is a desire to replace old CCR Platforming catalyst with a new load of catalyst between scheduled unit turnarounds. The old catalyst is unloaded from the CCR section while fresh makeup catalyst is continuously added to the CCR section until the inventory of the old catalyst is replaced. During the Changeout On-The-Fly operation, coke is removed from the old catalyst before it is removed from the unit for easy catalyst handling and transportation. UOP incorporates this Catalyst On-The-Fly design in all three types of UOP's CCR units which include the Atmospheric CCR, Pressurized CCR and CycleMax™ CCR. UOP has experience with this reload method for small and large size CCR units including a 6,000 lb/hr (2,727 kg/hr) CCR unit. In addition, UOP has experience with changing from regular density catalyst to high density catalyst using this reload method. Due to the economic benefits of this reload method, refineries have completed more than 60 catalyst reloads using this approach.

Alternatively, catalyst replacement can be executed during scheduled unit turnarounds. The old catalyst from the Platforming reactors and CCR section will be unloaded. The unit will be replenished with fresh catalyst during the turnaround. The turnaround schedule would have to consider of the time required for catalyst unloading and loading. Using this conventional catalyst change method, the catalyst unloaded from the reactors is not coke free. Transportation and catalyst handling of the unloaded coked catalyst will need to be arranged accordingly.

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