Question 95: How often do you perform CCR and cyclic reformer turnarounds? What determines the turnaround interval? What actions can you take to extend the turnaround cycle?

Javier Quintana (Valero Energy)

Valero's best practice guideline for reformer turnarounds is currently 4-6 years, but eventually we will target 10 years. With the longer turnaround horizon, catalyst condition in a CCR unit can be managed with on-the-fly change out, which has been demonstrated several times in practice, while in cyclic units, a reactor can be changed out while the remainder of the unit is operating.

In CCR units, the primary determinant of turnaround timing is plugging of the lead reactor center screen with catalyst fines, due to incomplete elutriation or misoperation in the regeneration section, leading to fines generation downstream of the elutriation system. Ultimately, regulatory requirements related to inspection frequency will govern the turnaround timing if the catalyst condition is maintained such that no such reactor fouling occurs. In the case of cyclic units, mechanical issues with motor-operated valves (MOVs) are key factors with turnaround timing, along with any regulatory inspection requirements.

Extending the turnaround frequency begins first and foremost with maintaining good catalyst quality. Units that operate with lower coke levels on spent catalyst (i.e., lower severity operation) generally have longer periods between turnarounds. Key factors to maintain include ensuring complete fines removal in the elutriation system, ensuring good mechanical condition of the catalyst piping such that there are no protruding lips or rough edges that can generate catalyst fines, proper drying and cooling of the catalyst in the regeneration equipment, and ensuring that the regenerator operating curve is followed to ensure complete combustion occurs in the burn zone, with no coke slip into the chlorination section. Episodes of coke slip lead to overheating of catalyst, with attendant phase change which is more susceptible to attrition.

Also essential is to maintain stable operation, with minimum number of emergency shutdowns. Thermal cycling of the reactors is associated with internals damage, although slow, regulated transfer of catalyst out of the reactors during cooldown can be used to largely eliminate bed pressure increases that are associated with internals damage. Additionally, it is important to monitor the reactor operation to ensure catalyst pinning does not occur, as pinning leads to rapid catalyst attrition and fouling of reactor centerpipes. Such events usually lead to the need to open the reactors for cleaning and repairs shortly after such events.

Chris Polaniecki/Joe Zmich (UOP LLC)

The frequency of a turnaround on a UOP CCR PlatformingTM unit depends largely on refinery and local government requirements. The reactor internals of the Platforming™ process should be thoroughly inspected on a routine basis. The first inspection should come after the initial two years of operation. Most licensees are increasing the time between turnarounds with some looking to go to more than an 8 year run time.

Although many factors contribute to long operational runs and unit safety, preventative maintenance is probably the most important. A proper and thorough unit inspection during scheduled turnarounds not only results in extended run lengths and maximum safety but also greatly reduces the probability of unscheduled shutdowns. UOP can provide a comprehensive checklist of all major unit equipment and piping recommended by UOP for inspection during a turnaround. This checklist includes recommendations for inspection and repair of piping, compressors, combined feed exchanger, fired heaters, and reactors.

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