
Question 39: With lower severity requirements due to ethanol blending and corresponding reduced coke make in the reformer, what changes are you making in regards to reformer operation? What opportunities does this evolution present for both CCR and semi-regen units?

John Clower (Chevron)

Increased ethanol blending has reduced the severity of the reformers on average 2 octane numbers. This has increased reformat yield and decreased hydrogen production. Although the octane boost realized by ethanol blending reduces overall pool octane requirements, minimum reformer severity may be dictated by octane requirements of premium gasoline grades, or by refinery hydrogen requirements. Therefore, hydrotreated naphtha blending into conventional grades may be required to reduce pool octane length.

The net effect on semi-regenerative operation is longer cycle life, and generally positive for those operations, especially where the reformer is the sole source of hydrogen supply. The only downside would result from the NHT cycle (from fouling of the combined feed exchanger or reactor bed differential pressure) setting the regeneration schedule.

The effect of low severity on CCR operation is more problematic. This topic was discussed fully at the 2009 Q&A session, Reformer Question #23.

The opportunities presented by lower severity, with respect to CCR operations, are related to increasing the severity of the CCR and maintaining the asset full utilized. They include:

- Aromatics production
- Shut down of existing semi-regeneration units at the same facility

Greg Harbison (Marathon Petroleum) The main issue with the low octane operation is the idling of the regenerator and in some cases near continuous operation of the regenerator in black burn mode. The sum effect is low activity catalyst and, hence, poor unit productivity for hydrogen and reformat yields. Where practical, Marathon has used process variable manipulation such as lowering the unit pressure, using lower H₂/HC molar ratios, and increasing feed endpoint where necessary to maintain spent catalyst coke levels adequate for continuous CCR regenerator operation. In addition, where feasible we have block operated our units on high and low octane runs to permit operating the regenerator in white burn to maintain catalyst activity. These measures have allowed us to keep the regenerator operating and maintain catalyst activity.

Other suggestions that have been offered include one by UOP to modify regenerator operation to permit

low coke CCR catalyst regeneration. Another idea that could be explored is the use of high boiling hydrocarbons to increase catalyst coke and permit more stable white burn regenerator operation.

In the case of fixed bed semi-regen type units, low severity operation would increase cycle lengths and time between catalyst regenerations and catalyst life. Matching up catalyst regenerations or changeouts with naphtha Hydrotreater cleanouts will require additional planning compared to historical planning.

For refineries that are hydrogen limited, the options for avoiding octane giveaway are few. Decreasing hydrogen consumption in the downstream units, recovering additional hydrogen from purge and fuel gases, operating at lower unit pressure, or increasing hydrogen production from a hydrogen plant are some of the options available.

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