Question 7: Recognizing that onstream factor is an important component of margin capture, what are the common areas of improvement for each of the gasoline processing units to reduce downtime or increase turnaround interval?

KEADY (Technip USA)

At the very beginning, we talked a lot about how to improve onstream factors. Since my background is technology and engineering, I have seen everything: from clients who did not want to spend any money to clients in the Middle East who were willing to put in empty, spare reactors just so they could get four years and almost push five years. They were willing to install spare compressors, maybe more so than clients here in the U.S. Also, we think that the alkylation unit will have to be able to operate within the same turnaround schedule as the FCC, so you can keep that unit. There are corrosion issues in alkylation units that will have to be addressed. There is fouling in the naphtha hydrotreater, which may be from nitrogen and air contamination from tankage and transport.

Utilities are often overlooked. I went to speak with a colleague, who is our utility expert, and he said, “We do all these things in the process area, and then the utilities sometimes let us down.” Air compressors should always be spared. Reliability sometimes is due to overuse and the fact that people do not maintain compressors as much as they should. The system needs a backup power source. Nitrogen is an important system because it is used for purging processes. It needs extra capacity. And then for fuel gas, you need many sources of fuel gas to avoid problems resulting from insufficient fuel gas.

LAMBIE (KBC Advanced Technologies, Inc.)

Maintaining good water, chloride, and nitrogen control around the units will help minimize fouling and corrosion in equipment, which will lead to improved onstream factors. Having a good reliability KPI (key performance indicator) monitoring program that includes equipment replacement strategies, as well as doing a good job cleaning or passivating equipment, will prevent premature fouling and possible failures due to corrosion. You also need a good catalyst management system for naphtha hydrotreaters that includes catalyst bed grading, scale traps, or outlet collector design to prevent premature shutdowns due to pressure drop. In fact, there is going to be a paper this afternoon by Valero which addresses this particular topic. Also, take advantage of windows of opportunity. If there is a mechanical issue in the reformer that caused a shutdown, use that time while the unit is down to do a skim of the NHT (naphtha hydrotreater) catalyst. This requires good maintenance planning and scheduling practices.

As far as turnaround time intervals, there is not a lot of incentive to go beyond five years. Going beyond five years between turnarounds would require a full inspection of each turnaround, per the 10-year API inspection guidelines. Maintaining a five-year cycle allows you to inspect half of the equipment each turnaround, thereby shortening the turnaround time. Having an integrated Process, Mechanical, and Contractor plan and ensuring that everyone is on the same page will provide for an efficient turnaround. You also want to make sure you have the correct spares in inventory so you will not have to go searching around and ordering new parts, if needed. Finally, you should have good bolt-up procedures for flanges to avoid leaks and potential re-bolting of flanges.

FRY (Delek Refining Ltd.)

We have a Kellogg-style sulfuric acid alkylation unit, and we recently made some efforts to improve certain aspects of our alkylate wash system. Based on our experience, I would say that you need to make sure that you understand the entire process. Small changes in one part of the process can have great impacts elsewhere. The change that we made did not help our reliability. In fact, it decreased it. So, make sure you have a good understanding of how the entire process works and how a small change might impact it. Do not do it piecemeal. Make sure that you have consider the big picture.

KEVIN PROOPS (Koch Industries, Inc.)

Those were great answers from the panel. Thank you. I will put on my old Solomon hat for a minute. A good target for operational ability is around 97%. The question asks about increasing turnaround interval. I agree with Scott's comment that interval may not be the correct focus. From our Flint Hills Refinery data, I know that once you get four- or five-year intervals, you are probably in good shape. But really, the turnaround duration is more important. Even the really good performers that have fairly short downtimes often have opportunities, maybe in startup and shutdown, when they are really pushing the mechanical window as hard as possible but not paying enough attention to how much time it takes to start up and shut down a unit.

UNIDENTIFIED SPEAKER (Indian Oil Corporation)

I have a specific question about the CCR unit. I am not talking about the downtime for annual maintenance; I am asking about catalyst fines management. What are the best times between two catalyst-saving operations? Could we have a cycle end of two years with a license that can go up to four years with room required to see and remove the fines? So, I would like to ask the panel their opinion about a good run-length for the catalyst.

ROBERTSON (AFPM)

His question is: How long can you run a CCR between the time that you screen or remove fines from the catalyst?

WAYNE WOODARD (Valero Energy Corporation)

For our CCR units, we target mechanical availability of eight to 10 years. What we do for every CCR turnaround is inspect Reactor One and document how much it has plugged over the course of the cycle. I wrote a paper stating that although the unit may be on a five-year cycle. I will offer an opinion based on the plugging in Reactor One that this unit can operate reliably for up to 10 years, possibly shorter, depending on the findings of the Reactor One inspection). It is common to go over a five-year turnaround cycle to capture economics.

MEL LARSON (KBC Advanced Technologies, Inc.)

Going forward, I think we will have to consider all of the new EPA guidelines and regulations that are coming into play. The industry may find we not pushing units up against the hydraulic limit, even with the economic value for running the units. With all of the environmental guidelines, such as opening up vessels and emissions allowances, the industry might cut rates with the need for better reliability because of the lower tolerance of emissions excursions and the associated higher cost. Just a point to consider.

PATRICK BULLEN (UOP LLC, A Honeywell Company)

Related to the CCR question and Wayne’s comment, to attain a five- to eight-year run without fouling the lead reactor, you really have to pay attention to the Best Practices on the regen side to make sure you are continuously monitoring your regen screens and not allowing them to plug up too much. This requires taking an outage on the regen side to clean the screens while you are running the platforming unit. Ensure that you are separating your catalyst fines efficiently by checking to see if you are getting whole pills overhead. These Best Practices are critical to get that longevity.

GARY HAWKINS (Emerson Process Management)

We have seen considerable interest in automation to monitor asset health, such as heat exchangers and process pumps, specifically to lessen the surprises of mechanical equipment failure. The business drivers of these investments are to improve onstream availability and the advent of wireless field devices has lowered the capital cost hurdles of adding instrumentation.

SCOTT LAMBIE (KBC Advanced Technologies, Inc.)

Turnaround time intervals approaching 60 months are becoming more frequent as processes and procedures improve over time. The incentive to extend the turnaround cycle beyond 60 months does nothing more than prolong turnaround times. All refinery equipment should be inspected within a 10-year period. Beyond 60 months (five years) between turnarounds, all equipment would need to be inspected every turnaround, which increases the turnaround time. Inspecting half the equipment every five years allows for shorter turnaround times, and complete inspection of all the equipment within a 10-year period.

Some of the common areas that can help improve onstream factor and unit reliability are listed below.

- Maintain good water, chloride, and nitrogen control to minimize corrosion and fouling in exchangers, towers and compressors including

- Use chloride guards' beds to reduce salting and fouling issues and
- Apply sufficient/effective water-wash of reactor effluent trains and stabilizer towers, where applicable.

- Perform adequate instrument/emergency shutdown testing and providing appropriate instrument redundancy.
- Have a good Reliability KPI Monitoring Program that includes an equipment replacement strategy and a corrosion control program.

- Minimize thermal cycling to improve equipment life and minimize leaks.
- Identify and have in stock critical spare equipment.
- Perform compressor strengths and weaknesses audits

- Identification of adequate instrument availability to measure critical parameters,
- Trip system checks,

- Verification of spare parts/spare rotor availability, and

- Fouling protection needs.

- Good regeneration procedures for semi-regen/cyclic reforming units to minimize corrosion and fouling post regeneration.

- Assure adequate corrosion control in the CCR section.
- Good furnace refractory and skin temperature measurement and monitoring.
- Effective catalyst life management on naphtha hydrotreaters to account for poisons buildup
- Catalyst bed grading, outlet collector design, scale traps, etc. in NHTs and
- Good corrosion control upstream of the naphtha unit.
- Have a reliable steam/power supply for all units.
- Be opportunistic:
- Requires good maintenance planning and scheduling.
- Take advantage of windows of opportunity to do maintenance.
- For example, if the reformer has a mechanical problem and needs to shut down, fix, replace, or repair a piece of equipment or skim the NHT reactor during the shutdown time.

Some of the common ways to reduce turnaround time are listed below.

- Integrate the process, mechanical, and contractor plans.
- Ensure good corrosion control to avoid unplanned corrosion, leaks, or fouling of compressors during the shutdown.
- Utilize the best regeneration procedures for semi-regen units to maximize catalyst online stability in the minimum amount of time.
- Use good equipment cleaning and passivation.
- Use the best quality swing valves in cyclic reforming units.
- Ensure the correct spares inventory for reactor/vessel internals.
- Use Best Practice bolt-up procedures to avoid leaks and repeat bolt tightening by using controlled bolting on higher pressure flange and using correct gaskets.

GINGER KEADY (Technip)

Technology and engineering design help improve onstream factors. Depending on the cost tradeoff, sparing philosophy increases onstream time. Some client's spare reactors and compressors.

The alkylation process must match FCC (now three to five years between turnarounds) with corrosion management in alky units that operate out of the design conditions.

Fouling occurs in NHT due to nitrogen and air contamination from tankage and transport. Fouling and corrosion due to chlorides is managed with continuous water-washing. Waterwash pumps should be spared. The waterwash rate depends on the NH_3 and H_2S in the feed, approximately 5 to 10 vol% of feed rates. Overcooling in reactor effluent cooler should be prevented to reduce fouling.

These support utilities are sometimes overlooked:

1. Instrument Air: Air compressor is always spared. Reliability is reduced due to overuse, as well as lack of maintenance and uneven load share. The system needs backup power.

2. Nitrogen System: Nitrogen used for purging processes requires spare capacity.

3. Fuel Gas: Several sources of fuel gas are required, particularly for gas turbines.

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