
Question 60: How do you detect leaks in an isomerization unit's steam charge heater? Have you been able to detect a leak before a significant portion of the catalyst bed was deactivated?

FERNANDEZ (Jacobs Consultancy Group)

Okay. This question is related to the performance of light naphtha isomerization units that are operating with a platinum on chlorinated aluminum base. The common problem in these units is deactivation of the catalyst by the ingress of water over the catalyst, because water actually deactivates the catalyst. This is a slide of a typical flow scheme for these units, and kind of shows you the conundrum of designing and operating these units.

On the one side, you have makeup gas dryers and feed dryers to eliminate any possibility of water coming into the unit. On the other hand, you put in a charge heater that is a steam-driven charge heater. It is a very practical solution. These units operate at reactor inlet temperatures of about 350°F, so a steam exchange heater is the best, simplest, and the lowest cost solution for these units. But, with that comes the problem of potential ingress of water into the system.

Just to put it in perspective how sensitive these catalysts are to water: The old rule of thumb says that one pound of water will kill 100 pounds of catalysts. I'm sure that different catalyst types and manufacturers will report different numbers, but it is a general range. If you have 10,000 barrels of feed at 1 ppm of water, you will kill 225 pounds of catalysts a day. This number is important because if you start to think about what you can do with a moisture analyzer, you start seeing that the moisture analyzers are really not the way to go because a very small change in moisture damages a large amount of catalysts. So the solution comes somewhere else, and not really with the moisture analyzers. So, as always, the best solution is to avoid the water coming in; not just trying to measure when it's coming in.

We're quite familiar with UOP practices for designing these types of charge heaters. The recommended practice is that you first design the charge heater with a steam pressure side being lower than your process pressure side. That way, you avoid steaming to the process; you have process going to the steam. The second is that you make sure that the tubes are welded to the tube sheet. This will then minimize if there are any potential leaks from the exchangers. We have checked. We have not found that there's any refiner that actually has a moisture analyzer as a measure to protect itself from steam exchanger leaks. The reality is that's a practical position. If you think about it, if you put an analyzer in the service, you have a two-phase flow. It's a very difficult service to measure.

Secondly, unless the leak is caused by a major mechanical failure, the leak will be very small and very hard to detect. So what happens? You may have a moisture analyzer there and it will give you a minute change in the readout. What do you do then? Do you shut down? Do you assume there's a leak in the steam exchanger? Is it just due to bad dryers operation, or is it just a bad read? Therefore, it is not a

very practical solution to put in a moisture analyzer in this service. On the other hand, if the failure in the charge heater is not small—it's catastrophic—you will see it very quickly on your reactor delta P. So the moisture analyzer just doesn't seem to be a solution to this problem.

An alternative solution that is probably much more precise is to put a hydrocarbon detector in the condensate coming out of the charge heater. In that respect, whenever you have a leak, there will be hydrocarbon flowing out to the steam side that's coming out of the condensate. You will be able to see an immediate spike in the hydrocarbon content of that condensate.

HAZLE (NPRA)

That is the panel response. Questions? Additional comments? Question 61. We'll start with Pedro.

Print as PDF:

Tags

[Isomerization](#)

Submitter

[Consultant](#)