Question 34: What is considered your practical limit on TAN (Total Acid Number) of blended crude diet before monitoring, treatment, or metallurgy upgrades should be considered to avoid naphthenic acid corrosion issues?

BILL CATES (Hunt Refining)

For our facility, we limit the TAN of the crude to control the individual yield streams TAN content.

Understanding the mechanism of naphthenic acid corrosion, we model the hot circuits looking at the potential TAN of the stream, metallurgy and fluid velocity within the circuit. Once this has been done, we evaluate the options, if the corrosion potential is high enough.

The easiest option to be utilized is chemical injection since this can be installed underway. Changing line size to slow velocity or changing metallurgy typically can only be achieved with a unit outage. In each case, we will evaluate the risk of waiting until the outage to help make the decision. Economics around changing line size or metallurgy will need to be evaluated at each facility site as compared to the operational cost of installing and using a chemical injection system.

Our Crude Unit is several decades old so that very little piping is of enough metallurgy to resist naphthenic acid attack. For this reason, we limit the TAN of the crude to a level that does not aggressively attack the metal. We monitor the hot circuits using a variety of inspection techniques to ensure that no abnormal amount of corrosion is occurring. This imposes limitations at to what crudes can be purchased since we have limited blending capability in the upstream supply system.

In our Delayed Coker, we only do atmospheric distillation with the atmospheric resid being sent to the coke heaters. The vapors from the coke drums are returned to the flash zone of the atmospheric distillation tower. Since naphthenic acids tends to cycle up in the heavier streams, we allow crudes to be purchased and processed that contain a higher TAN. Since naphthenic acids will be destroyed in the coke heater, the yields off the atmospheric tower tend to have a lower TAN than a vacuum gas oil would have.

As with the Crude Unit, we model and monitor the hot circuits for TAN content and potential corrosion. Again, our metallurgy is predominantly carbon steel, so we have installed chemical injection to utilize a filmer to protect the equipment on an as needed basis.

SAM LORDO (Consultant)

The answer is complex as it depends not only on the TAN but the naphthenic acid content as well as the sulfur species and content, composition and distribution. Hence, each crude blend needs to be assessed

individually for processing on the any crude unit, considering the existing metallurgy, circuit configuration, stream temperature and flow characteristics.

If you plan to process naphthenic acid crude you should first, consider:

1. Developing a comprehensive assessment of the existing facilities with respect to processing higher Nap Acid crude.

2. Determine where and at what concentration the Nap Acids will go when they enter the crude tower. For example, a “safe” whole crude TAN may not be compatible with downstream facilities if the low TAN blend stock is stripped off in the first tower.

3. Identify the areas of greatest risk.

4. Determine a robust monitoring protocol, locations, type and responsibilities for its maintenance.

DENNIS HAYNES (Nalco Champion)

Care must be taken in determining an absolute limit for TAN in whole crude blend. The limit can be impacted by the sulfur level in the crude, naphthenic acid distillation ranges, naphthenic acid type corrosivity as well as downstream temperatures and flow/turbulence relative to the metallurgies in place. Therefore, there is not an absolute TAN limit that may be applied to all systems for all crude feed blend combinations. Each would need to be reviewed on a case-by-case basis.

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