Question 54: What are your best practices for soot blowing or scouring waste heat boiler tubes that ensure minimal impact to process variables, environmental limits are met, and spurious trips of safety instrumented functions on the ESP are avoided?

ALEC KLINGHOFFER (Coffeyville Resources)

Successful Soot Blowing

- Make sure the soot blowers are mechanically working. Many times, the blowers can be overlooked when they are not operational. It is very important to have operator rounds that catch this.

- The soot blowers should be properly sequenced. It is recommended that each activates twice in a 24 hr period.

Waste Heat Boiler Scouring

- Proactive in minimizing waste heat boiler fouling by monitoring catalyst losses very closely.

- Using “walnut” shells to scour flue gas cooler. Personally, had success at two separate facilities using “walnut” shells for flue gas cooler scouring.

CASEY LANG (MERRICK & Co.)

Automated systems are employed at Refineries that inject some type of abrasive (e.g., sand, walnut/pecan shells) on a scheduled interval basis. Injection duration must be controlled to ensure opacity limits are not exceeded. Manual injection of abrasives is also utilized.

From a control's viewpoint, some prefer that the DCS will “hold last” instrumentation signals for the instruments that are affected by the blowing. Although process data will be lost for that duration, the controls just ‘ride out’ the data blackout until the soot blowing ops are complete. To be clear, each soot blower operates individually, with some time delay between blowers.

MINAZ MAKHANIA (UOP)

The reactor vapor line isolation valve is not a part of UOP's standard design, but UOP can add it upon customer request. UOP doesn't consider this isolation valve to be man-safe and blind is still required for man entry.

Over 15 UOP licensed units have installed reactor vapor line isolation valves and the feedback from them is positive.

These valves have to be continuously purged to prevent coke formation and reactor over pressure protection will be required (because reactor is isolated from main column when the valve is closed, and reactor vent is not open due to hydrocarbon atmosphere).

TIFFANY CLARK (BASF)

An additional item that needs to be considered, especially when isolating the structuring and granting vessel entry while the Main Fractionator and Gas Plant are still being decontaminated, is personnel exposure and increased contractor foot traffic through areas otherwise controlled by Operations during. Ensure you have a method to protect the safety of all those working on the unit during decontamination.

JONATHAN ARANA (UOP)

Co-processing renewable feedstock in a conventional unit poses a challenge to the refiner as the design, construction, and catalyst loading, may not be amenable to the incremental addition of renewable feeds. Directionally, a treating unit that was designed for high severity fossil feedstock, i.e. LCO, is better positioned to intake renewable feeds as the unit would have a degree of margin/capacity for severe feed.

A recent renewable customer study indicated that a 5% substitution of fossil feed for renewable feed resulted in a 16% increase in hydrogen consumption, and a 0.4% increase in product cetane, with little to no increase in CAPEX/OPEX. All units and renewable feeds (soy, tallow, palm, beef, poultry, etc.) are vastly different and can have differing bottlenecks so a proper study is prudent before taking on this operation.

Generally, a conventional hydrotreating unit can process up to ~5 vol% without additional modifications. A conventional unit processing higher amounts of renewable feed without further modifications can lead to issues outlined below:

1. Renewable feeds contain oxygenates which release a significant amount of heat relative to typical hydrotreater fossil feed sulfur and nitrogen.

2. Naturally, hydrogen consumption will be higher as triglycerides, fatty acids, and oxygenates are saturated. Makeup gas and recycle gas compressor capacity should have enough margin to account for incremental addition of renewable feed.

3. Quenches should have enough margin to deal with the sustained high heat release and yet still have enough emergency quench reserve available.

4. Processing of renewable feeds leads to high amounts of CO & CO_2 which compete with hydrodesulphurization reactions. This may require higher amine scrubbing and/or a constant purge.

5. Water is a significant by-product of renewable feed stocks.

6. Renewable feeds contain significant levels of alkali earth metals (Na, Mg, Ca, K, and Fe) and phosphorous. These can lead to rapid catalyst deactivation and/or rapid pressure drop increase if the catalyst loading does not have guard bed and trapping layers for protection.

7. Renewable feed typically has high content of fatty acids and thus significantly high TAN number relative to conventional fossil feed. The fatty acid content of the renewable feedstock needs to be considered while reviewing the existing feedstock system metallurgy.

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