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**Question 53: In the Third Stage Separator (TSS), what is the expected life of swirl tubes or cyclones assuming good performing regenerator cyclones? Of these two types, which handle upsets/ variable particulate loadings better?**

**CASEY LANF (MERRICK &Co.)**

The performance of swirl tubes is comparable with cyclones in terms of separation efficiency. Swirl tubes have distinct advantages over cyclones in being more compact, much easier to construct and have high mechanical integrity.

Swirl tubes are considered less prone to clogging than normal cyclones, and more forgiving for changes in the operating conditions.

Swirl tubes offer lower pressure drop and higher capacity and more stable flow.

Swirl tube and/or vanes are capable of handling upsets, but efficiency is reduced.

For both existing and new installs, the efficiency of centrifugal separators can be predicted by Computational Fluid Dynamic (CFD) simulations.

Normal catalyst wear is expected on valves and components, however expedited failures (<5 years) should not be expected.

**MINAZ MAKHANIA (UOP)**

Typical life of Third Stage Separator in hot service with swirl tubes is 12 to 15 years, which may be one turn around cycle lower than cyclone based TSS (typical life 15 to 20 years).

Inspection should however be carried out at each turn around for erosion.

TSS with swirl tubes handle upsets and variable loadings very well. Swirl vanes and critical flow nozzle can handle an order of magnitude higher catalyst loading, however, the limitation in such a situation is underflow and catalyst collection system (Fourth stage cyclone separator vs. filter). When underflow catalyst collection system is a fourth stage cyclone separator, by providing enough surge capacity, the system can be robustly designed to handle upsets / variable loading, for example to handle high regenerator side catalyst losses during startup.

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