WASTE MANAGEMENT IN PETROLEUM REFINERIES
Analysis of Catalyst usage

FCC CATALYST AND its REUSE/REGENERATION/DISPOSAL

The FCC catalyst is basically a Silica (Si02) and Alumina (Al2 03) catalyst which crack's gas oil feed stock to products. During the process the carbon deposited on the catalyst which blocks the active sites is oxidized and the activity is restored in the regenerator with air. The gas oil feed also contains metals such as Nickel (Ni). Vanadium (Va), Sodium (Na), Iron (Fe) and others when deposited in the catalyst has tendency to deactivate the catalyst. Also these metals produce undesirable Hydrogen and increase gas make thus reducing the capacity of the unit. This way the catalyst ages in the unit, looses its activity and selectivity.

RECOVERY/REUSE AND DISPOSAL OF SPENT CATALYST:

The following are the methods adopted for Reuse and disposal of spent catalyst:

(a) Use of VGO FCC catalyst Spent cat in Residue FCC units
(b)Disposal to catalyst vendor.
(c)Use of demetalising technology.

(a) Use of VGO FCC catalyst Spent cat in Residue FCC units

Vacuum gas oil (VGO) FCC's that crack VGO has less metal in it and hence their spent catalyst has lower metal contamination and the catalyst consumption rate in such units is about 1 ton/day. In comparison Residue FCC's that crack atmospheric residue has high levels of metals which leads high metals deposition in the spent catalyst. In order to maintain activity and low metals, the unit spent catalyst is withdrawn and fresh catalyst is loaded. The consumption rate in these Residue FCC units is about 3 to 4 tons per day. Since the residue FCC consumption is higher the spent catalyst from VGO FCC unit which has less metals with good activity, it is reused in the residue FCC units.

(b) Disposal to catalyst vendor.

Some catalyst vendors do take the spent catalyst from the refiner and sell it to the other refiners who are commissioning new FCC which may use the spent catalyst as an initial charge. Also some refiners take the spent catalyst if the metal levels are tolerable to use in Residue FCC where the catalyst consumption rate is high.

(c)Use of Demetalising technology.

There are spent catalyst Demetalising technologies which separate selectively high metal and aged catalyst form the spent catalyst. Generally magnets are, used to separate the high metal contaminants such that low metal contaminated catalyst gets separated out and can be reused in the unit. This technology and services are offered by selective vendors.

DHDS (Hydro-Treating) CATALYSTS and its regeneration.

The DHDS (Hydro-treating) catalysts are either Ni-Mo or Co-Mo. Ni-Mo catalysts are preferred when there is a high pressure operation and cetane improvement is major objective along with desulphurization. The Co-Mo catalyst is used when there is a low pressure operation with desulphurization as the prime objective. When the DHDS (hydro-treating) catalyst is in operation, there is an accumulation of carbon, nitrogen and sulfur on the catalyst, which reduce the activity of the catalyst. It is necessary to regenerate this catalyst followed by catalyst unloading, sieving, reloading and sulfating the catalyst to reactivate the catalyst. It is usually seen that the regeneration of hydro-treating catalysts is carried out maximum two times after completion of its normal cycle length.

IN-SITU regeneration of DHDS (Hydro-Treating) CATALYSTS:

In-situ regeneration of a catalyst of a licensed unit is a very critical operation. Catalyst regeneration is done by burning off carbon, nitrogen and sulfur accumulated on the catalyst during normal operation. This is accomplished by circulating nitrogen with the make up gas compressor and carefully injecting air from the regeneration air compressor while maintaining catalyst temperature above coke ignition temperature. Air injection rate is controlled carefully. Excessive quantities of oxygen will ignite two much coke at one time generating more heat than the inert recycle gas stream can remove leading to overheating of the catalyst bed. Since it is possible to get the bed hot enough to do serious damage to DHDS reactors and the catalyst by injecting too much air, extra care is exercised at all times.

The expected desulphurization activity recovery is around 50-60% after in-situ regeneration of the hydro-treating catalyst.

EX-SITU regeneration of DHDS (Hydro-Treating) CATALYSTS

Reputed catalyst companies provide services for ex-situ regeneration of hydro-treating catalyst by Eurecat Roto-Loure process. In ex-situ regeneration, the conditions are controlled to micro-scales. Instead of regenerating the entire catalyst charge at one time, the regeneration is done in small batches of catalyst. The activity recovery is the best due to homogeneous regeneration, strict temperature control, rapid heat and H20/S02 removal. The control/homogeneity is assured through slowly rotating kiln, thin layer of catalyst, controlled catalyst feed rate and air rate. There is almost no generation of catalyst fines. The catalyst loss is lower due to better treatment of the catalyst. However, the initial cost is higher due to spare catalyst batch requirement to run the unit. The expected desulphurization activity recovery is 95% after ex-situ regeneration of the hydro-treating catalyst.