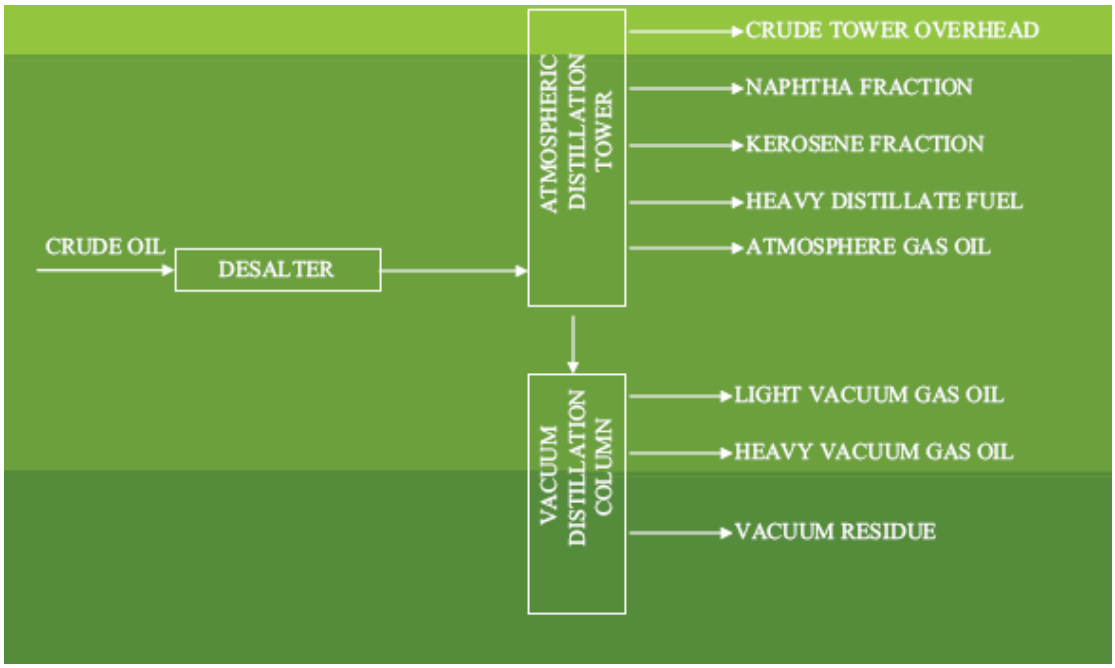
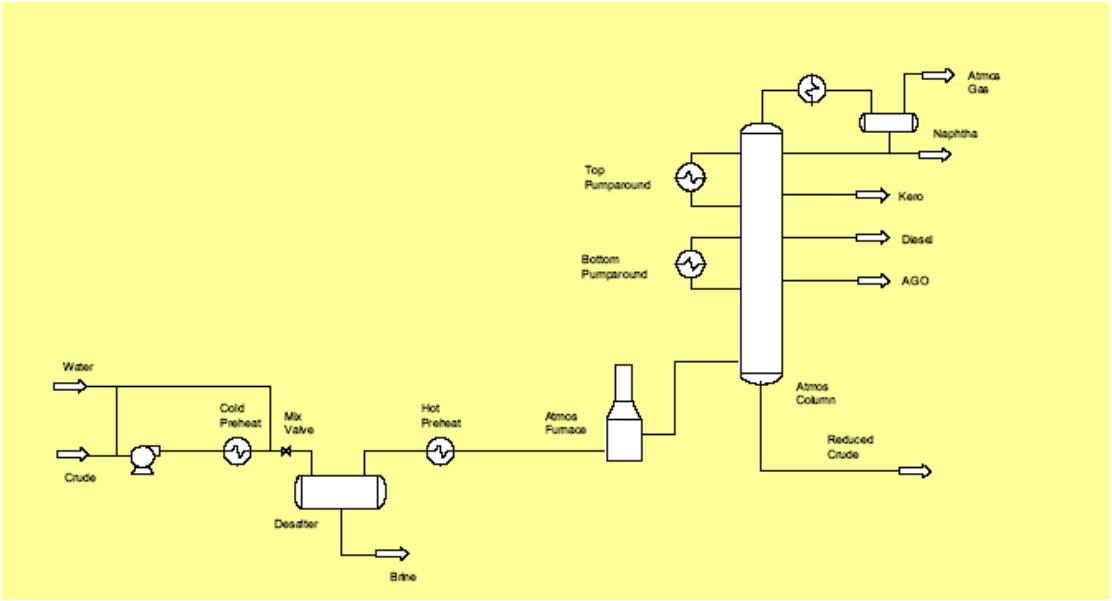
PROCESS DESCRIPTION OF OIL REFINERIES



HISTORY OF OIL REFINERY

- 3000 BC Sumerians use asphalt as an adhesive; Eqyptians use pitch to grease chariot wheels; Mesopotamians use bitumen to seal boats
- 600 BC Confucius writes about drilling a 100' gas well and using bamboo for pipes
- 1500 AD Chinese dig oil wells >2000' deep
- 1847 First "rock oil" refinery in England
- 1849 Canada distills kerosene from crude oil
- 1856 World's first refinery in Romania
- 1857 Flat-wick kerosene lamp invented
- 1859 Pennsylvania oil boom begins with 69' oil well producing 35 bpd
- 1860-61 Refineries built in Pennsylvania and Arkansas
- 1870 US Largest oil exporter; oil was US 2nd biggest export
- 1878 Thomas Edison invents light bulb
- 1901 Spindletop, Texas producing 100,000 bpd kicks off modern era of oil refining
- 1908 Model T's sell for $950/T
- 1913 Gulf Oil opens first drive-in filling station
- 1942 First Fluidized Catalytic Cracker (FCC) commercialized
- 1970 First Earth Day; EPA passes Clean Air Act
- 2005 US Refining capacity is 17,042,000 bpd, 23% of World's 73MM

ATMOSPHERIC CRUDE DISTILLATION



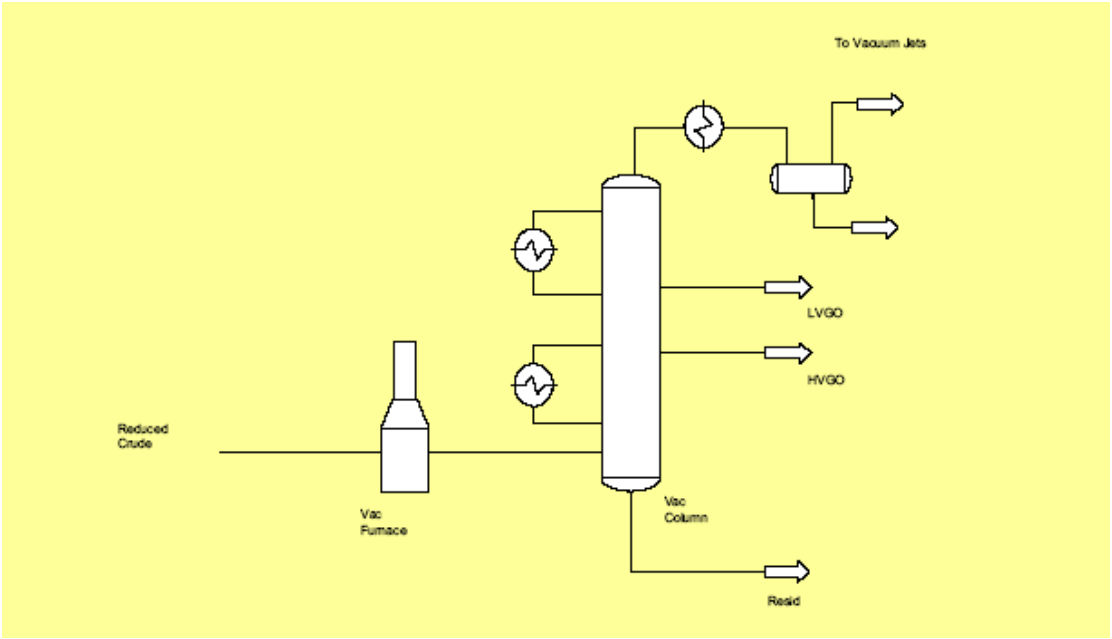
TYPICAL YIELDS

PRODUCT	Yield, wt% of Crude	Disposition
Light Ends	2.3	LPG
Light Naphtha	6.3	Naphtha Hydrotreating
Medium Naphtha	14.4	Naphtha Hydrotreating
Heavy Naphtha	9.4	Distillate Hydrotreating
Kerosene	9.9	Distillate Hydrotreating
Atmospheric Gas Oil	15.1	Fluid Catalytic Cracking
Reduced Crude	42.6	Vacuum Distillation Unit

VDU PROCESS

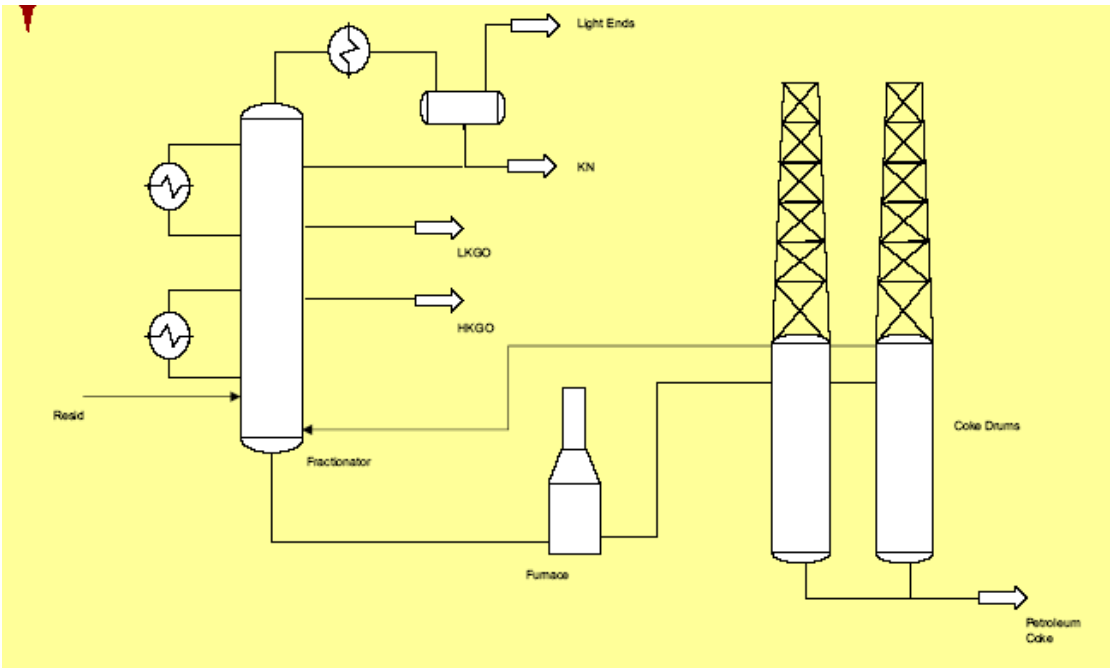
– To recover valuable gas oils from reduced crude via vacuum distillation.

VACUUM DISTILLATION UNIT



- Typical Yields and Dispositions

PRODUCT	Yield, wt% of Crude	Disposition
Light Ends	<1	LPG
Light VGO	17.6	Distillate Hydrotreating
Heavy VGO	12.7	Fluid Catalytic Cracking
Vacuum residue (Resid)	12.3	Coking


Light Ends
KN
LKGO
HKGO
Resid
Fractionator
Furnace
Coke Drums
Petroleum
Coke