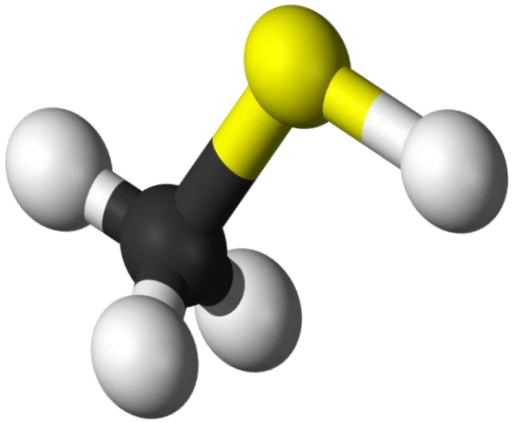
PROCESSING & REFINING OF AVIATION FUEL

This module will introduce you to processing and manufacturing of jet fuel. Definitions and methods, specification and some understanding on their effect on product quality

By Jon Mathisen 1st June 2016



KEROSENE IS A VERY GOOD JET FUEL

- Good combustion characteristics – clean burning

- Easy to handle liquid fuel with excellent energy density

- Good cold flow performance – easy to handle at low temperatures

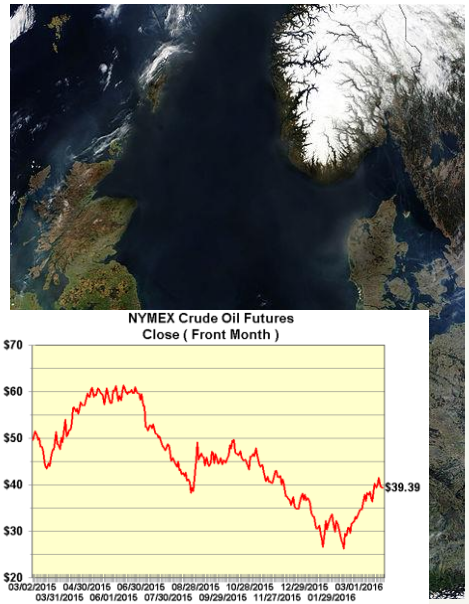
CRUDE OIL VARIES WIDELY

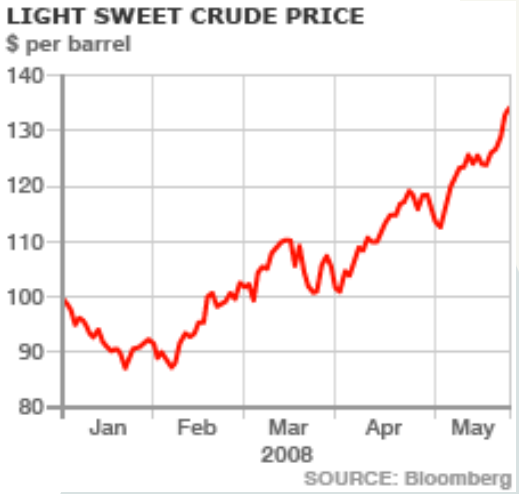
- Crude oil s vary in colour, from clear to tar-black
- Crude oils vary in viscosity, from water to almost solid
- Crude comprises paraffins, aromatics, naphthenes across a wide range of molecular weights
- Crude quality varies greatly, (e.g. density and S) and yields of different products vary widely
- Levels of sulphur, mercaptans and acids are key to determine which refinery processes are needed to produce kerosene to meet the jet fuel specification
- Almost all jet fuel is derived from crude oil…

CRUDE OILS AVAILABLE TO REFINERIES AROUND THE WORLD

Crude oil is “sweet”

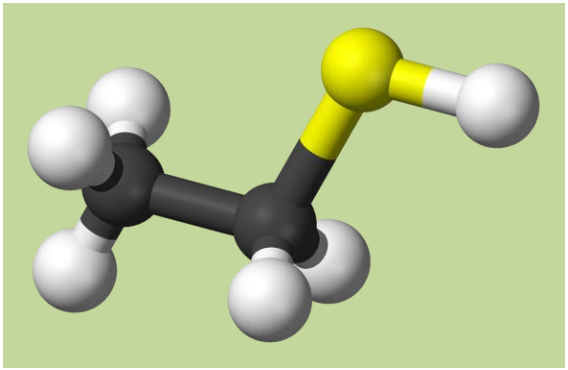
“Sweet” is a description of how much Sulphur is in the oil. In the 19th century, oil workers would taste and smell small amount of oil to determine its quality. Crude oil with low Sulphur content had a mildly sweet taste and pleasant smell. Today, oil workers can measure the Sulphur content of an oil sample and it is classified as sweet if it contains less than 0.5% Sulphur.





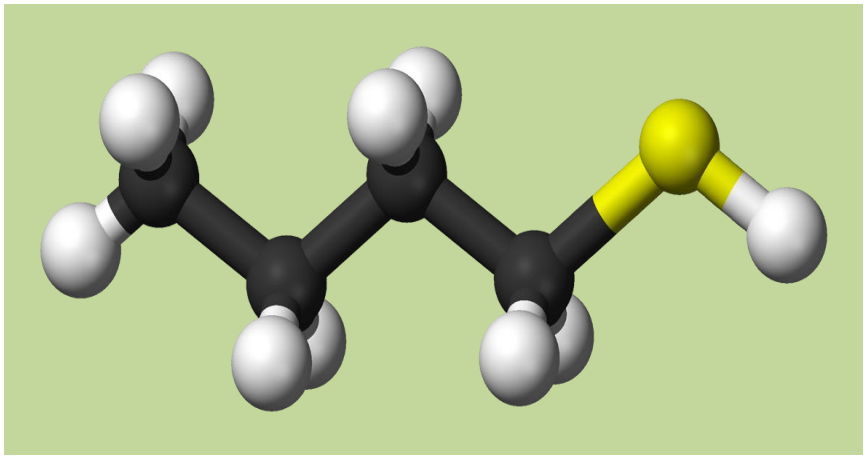
MERCAPTAN

- Ethanethiol, commonly known as ethyl mercaptan (CH3CH2)



It occurs naturally as a minor component of petroleum, and may be added to otherwise odorless gaseous products such as liquefied petroleum gas (LPG) to help warn of gas leaks.

- Butyl mercaptan

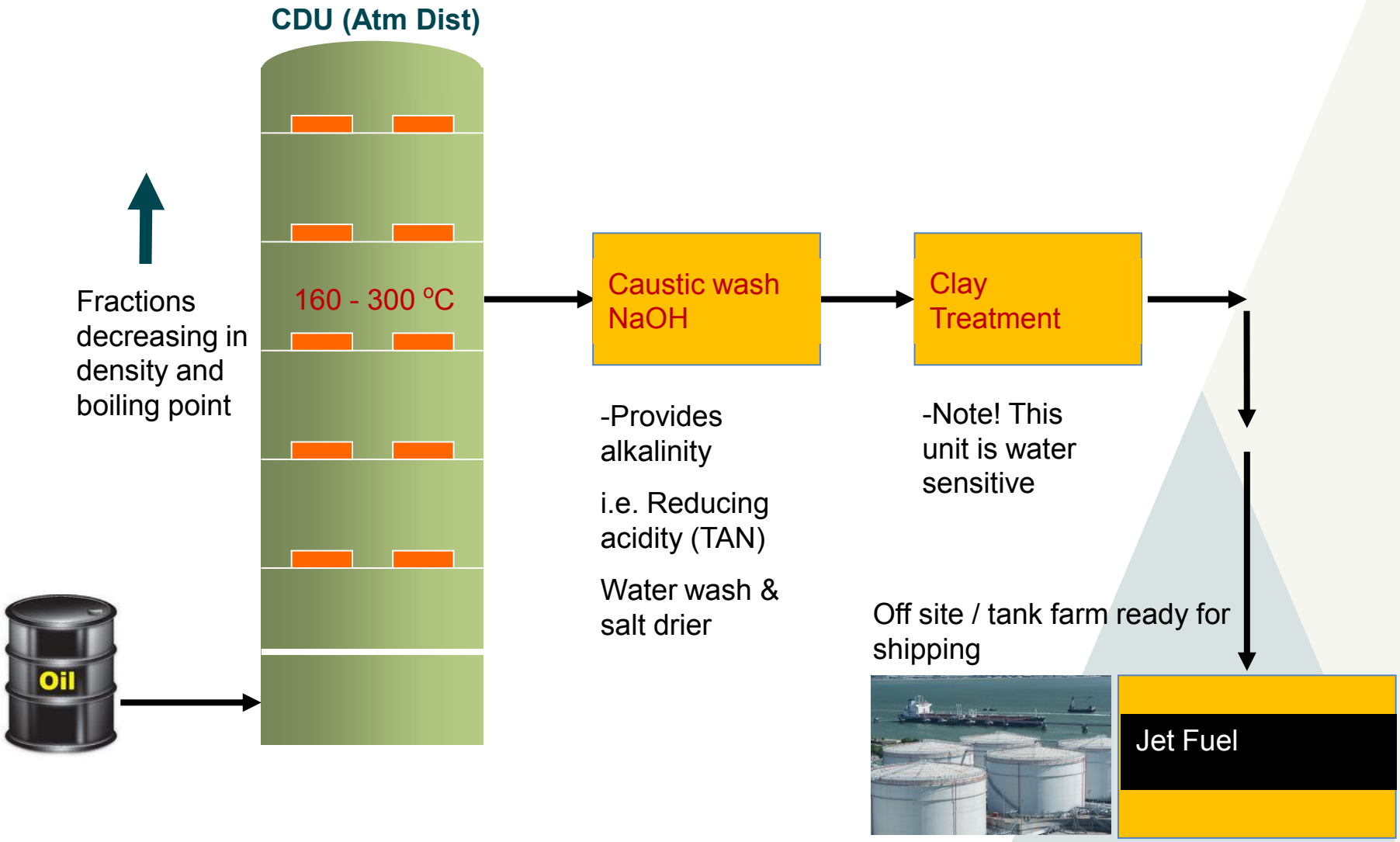


SINCE SEPT 2009 CRUDE OIL IS NOT THE ONLY SOURCE FOR JET FUEL

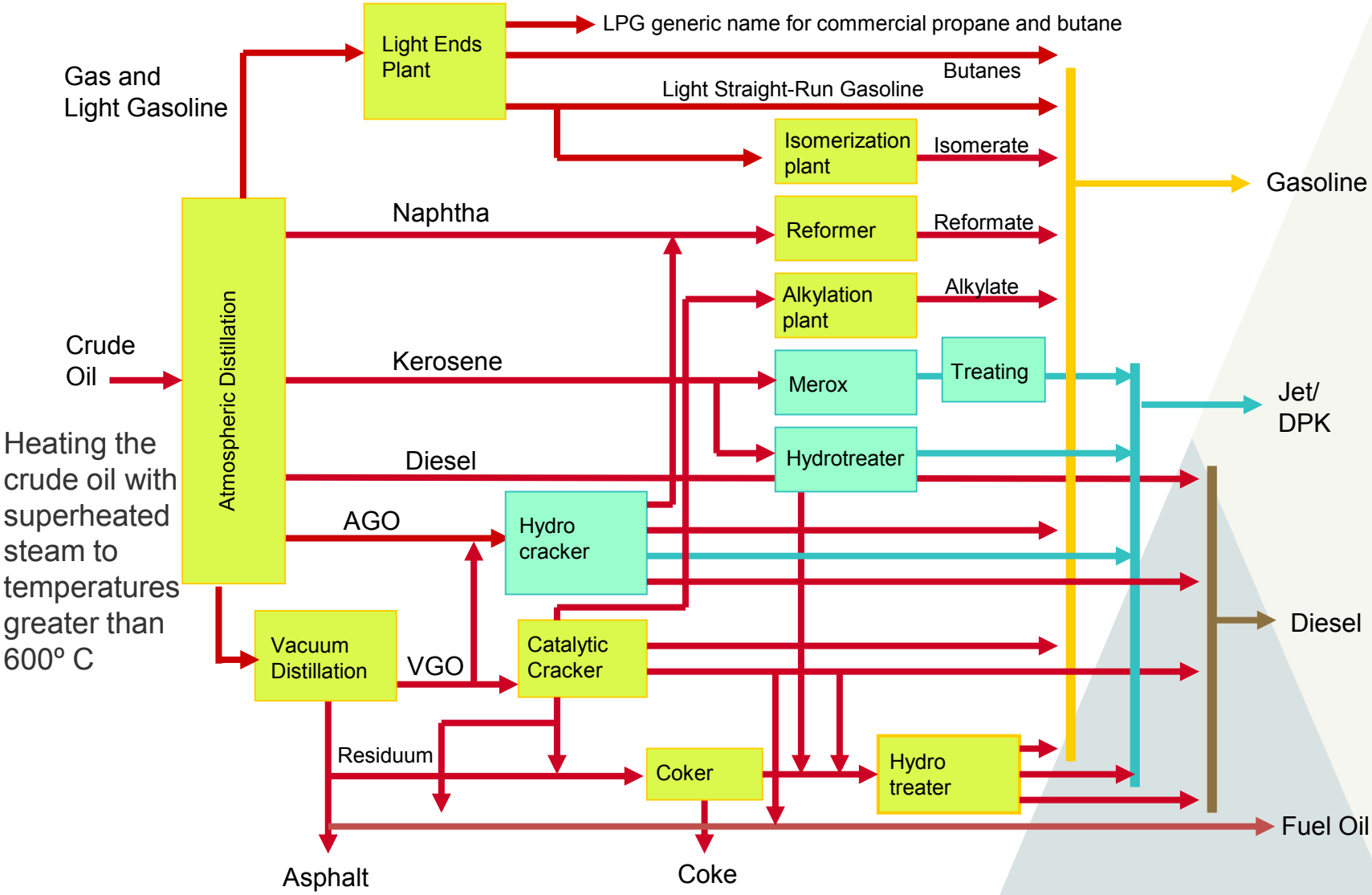
Kerosene made via the Fischer-Tropsch process now permitted

- Work started by SASOL – semi-synthetic jet fuel approved in 1999 as a special case
- More recently interest in new alternative and bio fuels has lead to a generic approval for kerosene made via the FT process (ASTM D 7566, September 2009)
- Feedstocks can be natural gas, coal or biomass and all are approved.

BLENDING SCHEMES – CAUSTIC WASH UNIT



BASIC REFINING LAYOUT



PROCESSING, REFINING & SPECIFICATIONS

Jet Fuel – Hydrotreating and effects:

- Eliminates sulphur, contents depend on the severity (pressure, temp and catalyst) of hydroprocessing and range from as low as 10ppm up to 600ppm, other 'impurities' and other chemical properties like olefins, nitrogen.
- Good thermal stability,
- Water shedding properties and Fuel cleanliness
- Good response to SDA i.e. no trace impurities
- Poor lubricity or deteriorates
- But Expensive!!

Catalyst (e.g. Ni_2Mo_3S – Nickel Molybdenum material)

PROCESSING, REFINING & SPECIFICATIONS

Jet Fuel - Hydrocracking

- Hydro cracking is another major conversion process
- Use heat and pressure to 'crack' heavy molecules into lighter ones
- The reactions take place under a high pressure of hydrogen
- Yet not very common which produces kerosene from larger hydrocarbon molecules. It is similar to hydro treating but uses higher temperatures and pressures. Sulphur levels are typically very low 10-60ppm
- The feed to the hydro cracking process is usually a heavy VGO (Vacuum Gas oil)
- The large molecules in the VGO are broken down into smaller molecules by breaking carbon-carbon bonds and adding hydrogen atoms to the fragments

JET FUEL SPECIFICATION