

The background of the slide is a photograph of a ship's engine room. The room is filled with large, complex machinery, including a large cylindrical component in the foreground and various pipes and structures in the background. The lighting is somewhat dim, with a bright light source on the left side of the frame. The image is partially obscured by a dark blue diagonal overlay on the left side.

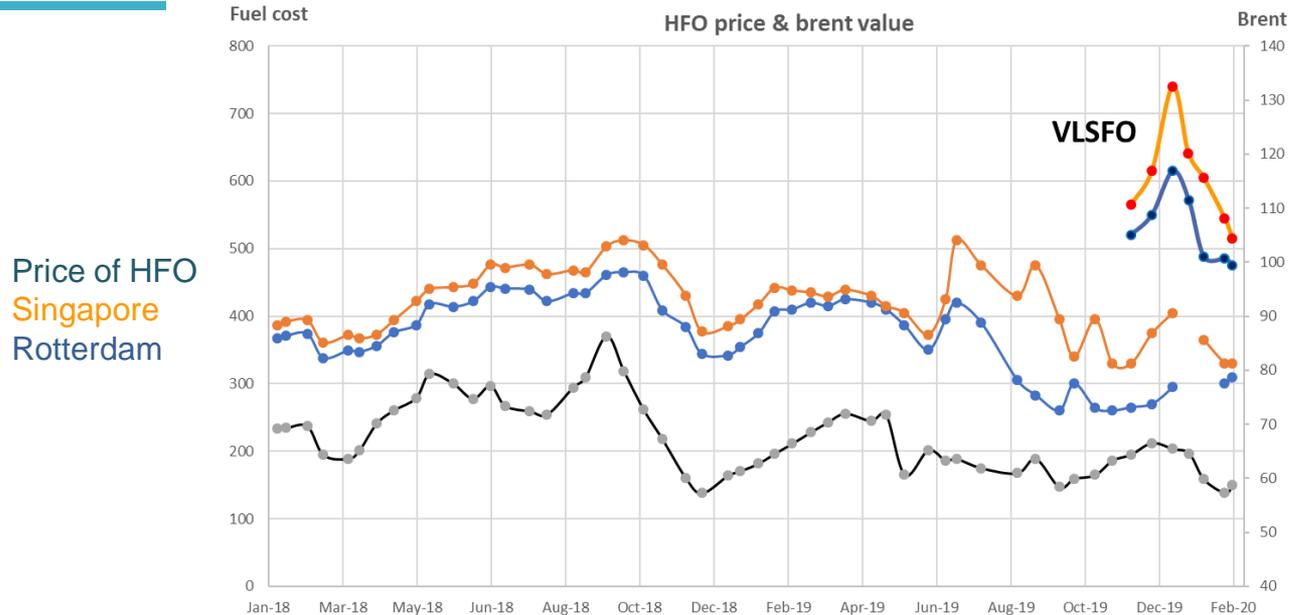
2020 Sulphur cap Experience so far

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The cost impact of the new fuel



- VLSFO arrived as a new grade with its own price, well above that of HFO
- The shipowner had to pay the extra cost, and this had a tremendous impact on the market
- The covid19 moderated this effect to a great extent
- Only fuel availability has been the focal point of discussions, leaving the market distortion aside

How a P&I club experienced the change of fuel



The most experienced problems with fuel reported to Gard were high total sediment potential (TSP) and marginal exceedance of Sulphur

The most common operational problems faced onboard was an increase in sludge formation in purifiers and filters, although so far these have not led to a high frequency of major breakdowns or engine damage cases

Our data for fuel related machinery damage claims shows that **the first six months of 2020 saw fewer claims** than the same period in 2018 and 2019

This data only captures incidents where there was damage to machinery and the repair costs were above the deductible (*we know the damages were higher than before*)

From Gard's perspective, the more dire predictions regarding potential engine damage, have not materialized

Known facts for VLSFO

Fuel manufacturers and fuel suppliers did not give a lot of information

The residual streams (containing large heavy hydrocarbons such as asphaltenes etc.) carry much of the sulphur and are either diluted with lighter incompatible fractions or refined further to remove the sulphur (removing much of the natural stability in the process)

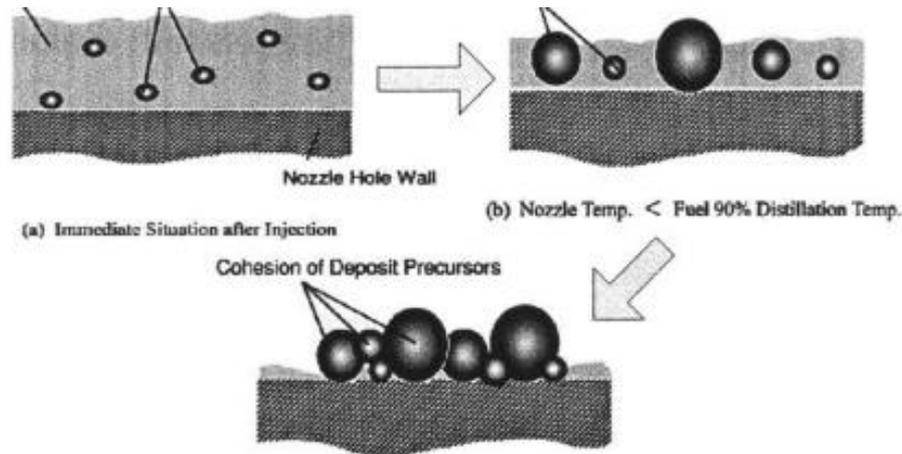
Wide variation of viscosity (10-380cst) and density (from 870-991 kg/m³) has been noticed already in Q3/2019 and supports blending of distillates which are essentially paraffinic grades with heavier streams

Covid 19 resulted in a surplus of more volatile fuels and consequently they have been used as blend components within marine fuels

VLSFOs with a high paraffinic content are more vulnerable to wax formation if the temperature drops below a certain point, and need to be heated to ensure a stable flow and prevent wax formation, but then stability collapses faster

Stability reserve ?

Formation of deposits on fuel nozzles



When the local temperature is close to the distillation temperature of the fuel, most of the distillate part evaporates and deposit precursors (asphaltenes) cohere on the surface of fuel injector nozzle, and it is very difficult to be washed away

The significance of asphaltenes

Deposits in holes of fuel nozzles strongly affect the fuel jet, and sequentially its atomization upon entering in the combustion chamber

When larger molecules of asphaltenes are injected, they require more time and oxygen than is available to burn. These unburnt residuals deposit on liners and pistons

The asphaltenes pack the gap of piston rings with carbonaceous material rendering ring immobile resulting in high wear rate and eventual fracture

Once deposits build up behind piston rings, they are pushed outwards until they impinge on to the cylinder liner surface, breaking through the protective CLO layer and achieving metal on metal contact, leading to wear

Conclusions



- All the above are well known, but unfortunately this knowledge was not composed across the industry in a coherent form to issue guidelines , which could prevent so many damages
- Since all evidence was there that problems with asphaltenes are almost certain, we should give more attention to the need of cleanliness and not assume a perfect fuel and start with BN40
- If the wear mechanism is established, the remedial actions should be carefully selected; most reacted with increasing the feed rate , in accordance with previous standards but this was not the appropriate solution for this particular case.
- Although serious problems were indeed experienced, they were not linked to the sources identified before 2020, while the cost impact, luckily moderated by the covid19 effect, was not addressed
- Going forward and entering a phase where shipping will be asked to find possibly a new fuel, we should be closer to the target in what to expect and what to avoid, and especially to make sure that the cost for the global environmental benefit should NOT be a concern for the shipowners

Thank you !

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