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In this article Andrew Bates looks at the experience of the industry following the introduction of the 0.5% sulphur content limit for marine fuel oils and, later, Dr Rene Macahig provides some valuable insights into quality and performance issues.

The IMO global sulphur content cap -one year on



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Maritime shipping is still the most carbon-efficient form of transporting goods, far more so than road or air transport. The introduction of the sulphur content cap by the IMO under MARPOL Annex VI in January 2020 further enhanced the benefits global shipping has for the environment comparative to other modes of transport.

On 1 January 2020 the new global sulphur limit for marine fuels became 0.5% by mass, reducing it from the previous 3.5%. To broadly illustrate the difference this makes, a ship burning 37 tons of 3.5% fuel would emit 2.2 tons of sulphur oxide (SO_x), whereas with 0.5% fuel the emission is reduced to just 0.36 tons.

Regulating and reducing shipping emissions is central to the climate change agenda of greenhouse gas reduction. Cleaner marine fuels produce cleaner coastal air and reduce ecological damage, in particular from acid rain.

A smooth transition

The implementation of the new sulphur limit went a lot smoother than many in the shipping industry had predicted. In terms of availability, producers such as ExxonMobil, Total, Shell and BP were marketing very low 0.5% sulphur fuel oil (VLSFO) well in advance of January 2020 and there was a stockpiling of such fuels at strategic points around the world, such as Singapore. Furthermore, the softening of global crude prices in December and January helped to ensure a smooth transition.

Compliance

In terms of compliance, reports present a relatively positive image. For instance, statistical data from the Tokyo MOU Asia-Pacific shows that so far this year only five detentions were reported in connection with the sulphur content of fuel used on board, and these five were all reported before the end of April 2020. Statistical information published online by the Paris MOU shows that there were no violations reported concerning Annex VI.

The COVID-19 effect

The COVID-19 pandemic in 2020 has undoubtedly impacted on the ability of port state control (PSC) authorities to conduct physical inspections of vessels. For instance it had been anticipated that PSC officers would board vessels using portable sulphur content analysers, conduct documentation checks, and physically check SO_x emissions in exhausts using sniffers, as well as test samples taken directly from the fuel oil storage and supply system of a ship with increased frequency. Such 'in use' samples are separate from the statutory MARPOL sample taken at the time of the stem. Not surprisingly, there is anecdotal evidence that the ability of PSC officers to implement such measures in the climate of COVID-19 has been reduced.

Variations in testing

MARPOL also contains provisions relating to a 95% 'confidence limit', to consider the variances associated with testing of 'in use' fuel oil samples. This means that when such samples are taken by PSC and analysed for compliance a sulphur content of up to 0.53% must be accepted as compliant. This helps ensure that ship operators are not unfairly penalised for marginal excesses due to factors beyond their control. Bunker suppliers are not, however, accorded any confidence limit and are required to stay at or below 0.5%.

In the months following the introduction of the sulphur cap the Club saw instances of the BDNs declaring the fuel to be less than 0.5% whereas subsequent testing produced results above it (usually marginal increases of 0.02% or 0.03%). In all cases the fuel was eventually

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consumed without any unwelcome consequences. That takes place within a regulatory framework where the BDN is the primary evidence of compliance with MARPOL. However the risk will always remain that on some future occasion PSC will test the MARPOL sample retained on board and that may not produce results reflective of the BDN.

The FONAR

Most ship owners will already be familiar the Fuel Oil Non-Availability Report - the FONAR. Part of the scheme of Annex VI (see regulation 18) is that when facing enforcement action a ship owner should be able to fully document efforts to achieve compliance. This information is embodied in the FONAR, and it is to be presented to the flag state and the port of destination in advance of a call.

In the early stages of 2020, the Club observed some cases of shipowners having to chase a time charterer (who is contractually responsible for sourcing and supplying compliant fuel) for updates on the bunkering situation in anticipation of the possibility of filing a FONAR. It caused frustration for some members and is an example of

the tension that can exist between commercial realities and statutory (MARPOL) compliance.

Pricing

IMO 2020 was expected to push up bunkering costs and disrupt markets but investment in desulphurisation plant and blending by refiners, combined with severe demand destruction from COVID-19, has meant that prices for low sulphur products have only risen modestly compared to high sulphur fuel oil. The premium for VLSFO had fallen from over USD 300 per ton in January to about USD 70 per ton by mid-June. Weaker global trade because of the pandemic has reduced demand for marine fuels generally.

Quality and usage issues

In the run-up to the 0.5% sulphur cap it was anticipated that the characteristics of VLSFOs could vary considerably, given the wide range of residue streams and cutter stocks expected to be used as blend components. Fuel characteristics such as density and viscosity were expected to vary widely and, indeed, compliant bunkers customarily ordered as RMG 380 grade

currently exhibits a broad spread of viscosity values.

Stability

Marine fuel oils are complex mixtures consisting of a wide spectrum of different molecules, from simple hydrocarbons to large complex asphaltenes. A fuel oil mixture can be considered as a multi-phase system in which the asphaltene, aromatic, and saturate fractions are kept in balance, meaning it is 'stable' fuel.

Thermal stresses or changes in the chemical properties can lead to instability, and may ultimately result in flocculation (by which fine particulates

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are caused to clump together) and deposition of asphaltenes. In fuel oil these asphaltenes are generally stabilised by aromatic components. However, the increased use of paraffinic blend components to meet the more stringent sulphur requirement for new compliant fuels can affect the stability of the resulting blend leading to a higher risk of breakdown and sludging. High levels of sludge formation can cause filtration and separator issues in fuel systems, hence ISO 8217 includes a specification requirement for fuel stability, termed as Total Sediment Potential (TSP). It is the responsibility of the fuel supplier to provide stable fuels compliant with ISO 8217 requirements.

There are many alleged contamination cases where the bunkers are found to be within specification for the routine ISO 8217 parameters but, when put into use, machinery problems occurred. Typically the most common problem is filters clogging and needing replacement along with certain other parts. The result is not so much material or engine failure but a more troublesome experience for the crew in running fuel through the ship's system, and the purchase of expensive fuel additives and spare parts.

Viscosity and pour point

Low sulphur fuel can have viscosities near or at the lower limits of allowed viscosity. As more distillates enter the VLSFO blend pool, fuel viscosity has fallen, a trend that has been widely reported by most testing houses. Whilst the lower viscosity values may not necessarily be off specification, there are nonetheless important operational implications to be considered. For example, it is essential that the viscosity at the fuel injectors remains within the limits prescribed by the engine maker. When the viscosity is too low, it may lead to inadequate dynamic lubrication of fuel injection equipment and poor distribution of the spray pattern in the combustion space.

Some VLSFOs may exhibit relatively higher pour points which would mean that higher transfer temperatures, typically 10°C above the pour point, are required to facilitate pumping. At the same time, the crew would need to

closely monitor the viscosity of the fuel such that it does not fall below the minimum set by the engine makers. A combination of low viscosity and high pour point, though not necessarily off specification, could present operational challenge.

Cylinder lubrication

Prior to the introduction of the 0.5% sulphur cap engine parameters were set up to use residual fuels with an expectation that fuel sulphur content would typically be in the range of 2.0 to 3.5%. With the use of VLSFOs, however, the neutralising demand on the engine lubricants and cylinder oil becomes much reduced. The base number (BN) of lubrication oil should be carefully considered for extended operation with VLSFOs and should be referred to the engine maker. Too low or too high a BN leads to operational issues. Shipowners are advised to engage with their lubricant suppliers and follow original equipment manufacturer (OEM) guidelines to ensure that the appropriate lubricants are being used with respect to low-sulphur fuels.

Sampling

Fuel quality disputes will often involve testing, and hence the provenance and integrity of the samples to be tested is and remains of great importance. Aside from dispute resolution, suitably drawn and witnessed representative samples of the fuel also form the basis for compliance verification under MARPOL. Properly drawn representative samples are particularly important for potentially unstable fuels, as the sediments might settle to the bottom of the cubitainer during drip sampling.

A team effort

The introduction of the IMO 0.5% sulphur cap under MARPOL has been considerably more seamless than many observers had anticipated. The environmental and health benefits from the reduction of SOx emissions are clear and it is perhaps fair to say that IMO 2020 has been a success, notwithstanding the adversities of COVID-19 restrictions. Industry participants will need to remain aware of the various operational aspects of

VLSFO usage and the characteristics of the fuel, as described above. Crew members will need to be particularly mindful of the correct procedures for storage, handling and operation. For their part, time charterers will need to source fuel where blend components conform to the ISO 8217 standard. In short, in order to avoid the sorts of problems described in this article, the resulting fuel must be a homogenous blend, and able to withstand the expected forces through normal on-board use and storage. 🇦🇺



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