June 2024

Bunker Quality Trends

Driving continuous improvement

BIOFUEL QUALITY
& AVAILABILITY

OFF SPECIFICATIONS
& HIDDEN LOSSES

BUYING STRATEGIES
& ISO 8217:2024

Integr8
Fuels

Introduction: Driving continous improvement

One of the key aspects of any quality system is the need to continually improve your processes, assessing root causes as to deviations encountered, as well as planning and implementing corrective and preventative action. Taking these concepts and applying these across the roles of stakeholders in the bunkering industry remains vital given the continued challenges we face to maximise returns in some sectors, or in others to minimise losses.

This is the fourth Integr8 Fuels Quality Report covering the last six months of global supply where we utilise our best-in-class data from over 130 million metric tons (MT) of deliveries to assess fuel quality trends and challenges from region-to-region, port-to-port and supplier-to-supplier.

Using our own Integr8 Quality Index which scores the proximity (or otherwise) of individual parameters within each sample to the relevant table 1 or table 2 specification limits within ISO 8217, the problem ports can be identified, and avoided. This smarter buying approach can prevent time-consuming disputes and the losses that inevitably follow.

Moreover, and with one eye on the future, we provide an update on the availability and quality of biofuels while considering some of the interesting trends that are now appearing.

Data Used in This Report

+130m	1,300	+800
MTs of Deliveries	Global Locations	Suppliers

Part 1: Off specification frequencies

How likely are we to be faced with an off specification situation?

In the last 180 days, owners' analysis available to Integr8 Fuels has highlighted that you are still most likely to have an off specification incident* with Heavy Fuel Oil (HFO) than with Marine Gas Oil (MGO) with the lowest percentage off specification rate being with Very Low Sulphur Fuel Oil (VLSFO). (See figure 1)

Grade	Off Spec %	Compliance Off Spec %	Critical Off Spec %	High Risk Off Spec %	Low Risk Off Spec %
HSFO	3.4 (+0.4)	0.1 (=)	0.4 (+0.1)	0.5 (+0.1)	2.9 (+0.3)
VLSFO	2.1 (+0.1)	0.7 (+0.1)	0.4 (-0.1)	1.1 (=)	1.1 (+0.1)
MGO**	2.8 (-0.2)	1.9 (+0.1)	0.2 (+0.1)	2.1 (+0.1)	0.7 (-0.4)

Figure 1: Types and frequencies of off specification incident by grade excluding biofuel blends (previous figure in brackets)

*Beyond 95% confidence for a parameter listed in table 1 or table 2 of ISO 8217:2010

**Data includes pour point off specifications in Singapore (which is not routinely guaranteed)

What is the likelihood of receiving non-compliant or critically off spec bunkers?

The significance and outcome of a confirmed off specification incident varies greatly from parameter to parameter with statistically very few off specifications resulting in the fuel having to be being debunkered. An example of which being that an HSFO viscosity of 400cst can be resolved by simply increasing the temperature of injection by a degree or two and so these instances are termed low risk.

Some situations are far more serious, for example sulphur and flash point off specifications that are due to breaches in legislation, or off specification parameters that may affect the safe operation of the vessel, such as aluminium and silicon or total sediment potential.

The rule of thumb when comparing off specification incidents by grade is that the parameters targeted in any blending model are the most likely to be outside the specification. For example, VLSFOs are targeted on sulphur, with the price difference for 50,000MT of fuel with a sulphur content of 0.49 compared to 0.45 equating to hundreds of thousands of dollars. It's hardly surprising, therefore, that both VLSFO and MGO, both of which are blended to a sulphur target, have more prevalence of MARPOL non-compliances at 0.50% and 0.10% respectively.

However, MARPOL Annex VI is not the only compliance issue - we cannot ignore the requirement for flash point being 60°C or above as demanded by SOLAS. Indeed, off specification flash point, particularly with LSMGO, may be an unintended consequence of pulling low sulphur automotive or inland grades into the bunker pool as identified later in this paper.

High risk off specification incidents, defined as the total of both compliance and high risk off specifications, are seen to be most prevalent in MGO followed by VLSFO and, finally, HSFO. In fact, if you strip out compliance off specification, incidents relating to total sediment potential (TSP), aluminium and silicon (Al+Si) etc. for residual grades are very low indeed. These situations are less common and are often batch based in nature, clearing as fast as they appear.

As written previously, many nuances exist, from region-to-region, port-to-port, supplier-to-supplier and even barge-to-barge at the same location. It therefore remains essential for us to continually assess our buying to improve our processes and performance when purchasing bunkers and we will address some of the recent challenges later in the paper.

Availability of products (March 2024)

Unsurprisingly, Marine Gas Oil is the most available product (663 ports) given the ability to substitute and supply higher quality inland or automotive grades and logistical ease of supplying what are quite often small quantities.

VLSFO is also seen to be readily available across all continents but at 28% fewer ports (458 ports), this because of larger quantities being ordered and the storage and barge infrastructure needed to support these supplies in general.

High Sulphur Fuel Oil is the only product which is not readily available, with just 231 ports listed as of March 2024 (see figure 2). HSFO availability is centred around bunkering hubs and geographically key areas likely to receive passing trade from very large crude carriers (VLCCs) and / or other scrubber fitted sectors. It is important, therefore, to plan to bunker carefully for HSFO and equally consider the type of scrubber fitted to the vessel and any local limitations in forthcoming voyages that may require a fuel switch to LSMGO, for example.

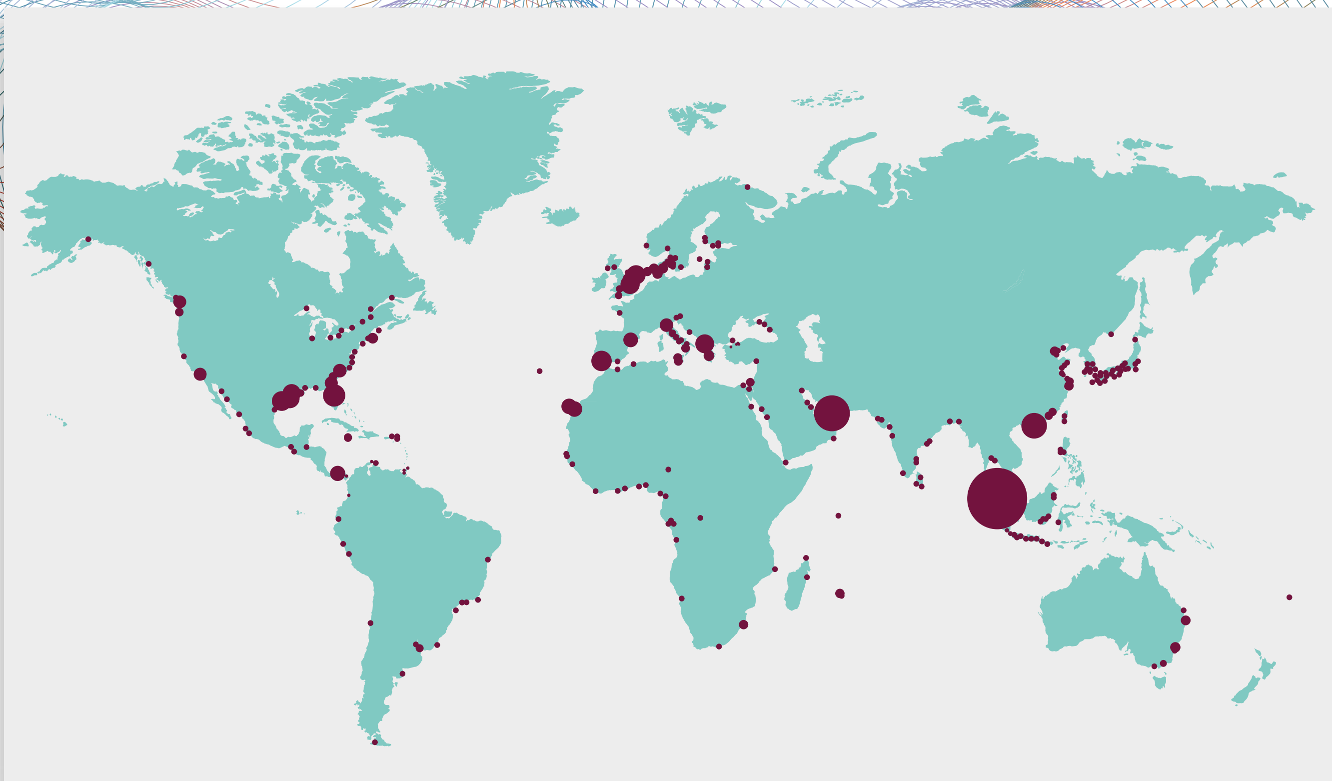


Figure 2: Availability of HSFO 380 March 2024

Biofuel blends

Data is now becoming available for biofuel supply globally and whilst this is still very small in comparison with conventional fuels, the main concentration of biofuels supply revolves around the bunker hubs of Singapore, ARA, Spain (and Gibraltar) and China.

Moreover, we are not currently able to comment on the sustainability of the biofuels being supplied but can confidently predict that Indonesia fuels, for example, will likely be sourced from palm oil which would not satisfy a verifier of emissions. ARA and in particular Rotterdam is seen to be the epicentre of supply in Europe given the current subsidies available in the Netherlands. However, given the practice of the Proof of Sustainability (POS) being surrendered to the Dutch Government for HBE credits, the end user will not be able to receive the POS themselves, which dependent on flag, may not satisfy the verifier of the vessel's emissions.

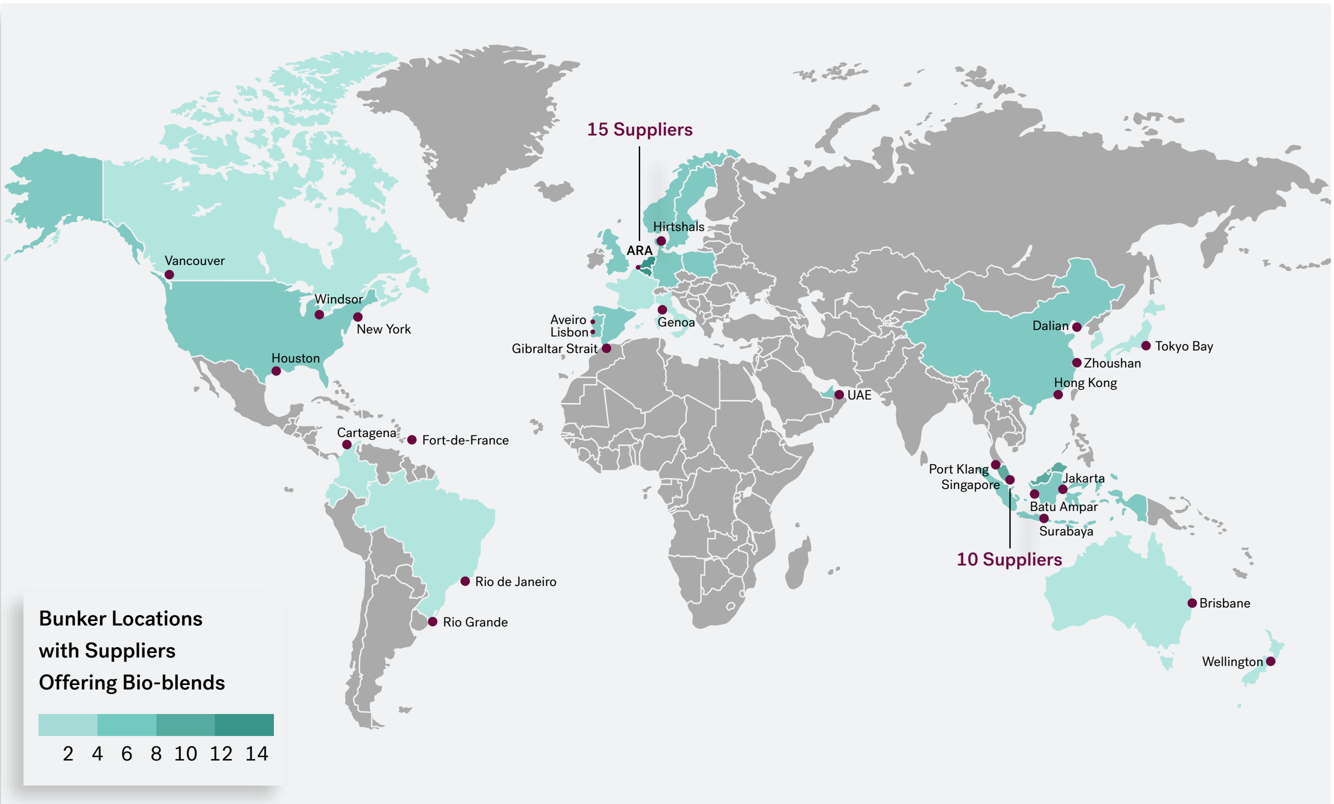


Figure 3: Availability of biofuels and biofuel blends (all grades)

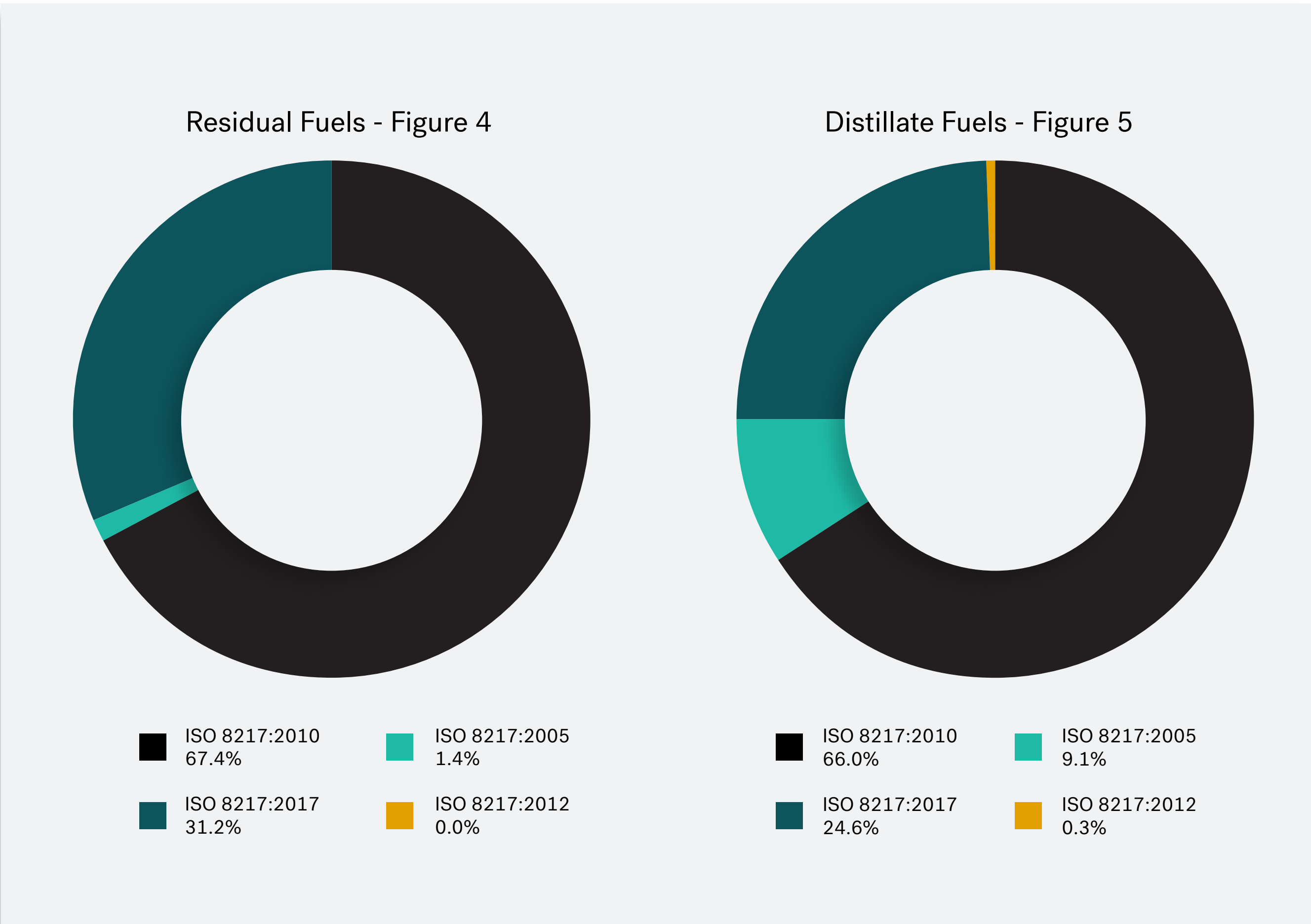
Which specifications are being traded?

At the time of writing, we sadly continue to operate in the past when it comes to the specifications we buy and sell on a day-to-day basis. However, the long-awaited ISO 8217:2024 specification has now been published and we hope the significant changes which we discuss later in this paper may help to catalyse change.

The scale of the challenge to continually improve when it comes to purchasing up to date specification fuel can be laid bare by considering the charts below, (figures 4 and 5), which identify the split of residual ISO 8217 grades traded by product group in the last 180 days. The (previous) latest version of the specification (2017) is still only being guaranteed for just under one third of trades, which is only slightly improved in comparison with previous figures, proving traction remains poor.

Distillate Fuel

In the case of MGO, a quarter of fuels traded were sold as 2017 fuels in the last 180 days, this up from 18% previously. It remains a concern that one in 10 of all fuels continues to be traded using a 19-year-old specification.



Figures 4 and 5: Guaranteed specifications (last 180 days)

Continuous Improvement: The uptake of new specifications.

Not only is it our own businesses that must strive for continuous improvement but also the industry in general, with specifications remaining a major focus in this drive especially given that two-thirds of all fuels have been guaranteed basis obsolete specifications (in comparison with the 2017 specification).

In previous reports we have discussed the reasoning behind this, my aim in this paper is to stress the need to put the building blocks in place for the future and how better to do this than to embrace the new ISO 8217:2024 specification across the industry.

How can this be done? Well simply put, if we do not embrace the future we could be left behind, living in the past, at best becoming irrelevant, at worse, possibly extinct.

Charles Darwin famously said "**Only the plants and animals best adapted to their environment will survive** to reproduce and transfer their genes to the next generation." This same analogy is perfect for the challenges the industry now throws at us, not least when it comes to specifications.

Why do we need to embrace the new specifications?

Given that we have moved from a straightforward position post IMO 2020 to a much more challenging landscape thanks to the patchwork quilt of fuel blend types in the mix, the unintended consequences of having to shoe-horn blending components into a 0.50% sulphur fuel are, in the main, finally addressed in the new 2024 specifications.

If you think back to 2019, would you have predicted a VLSFO with a viscosity of 10cSt let alone with an extremely high pour point, which when combined makes handling and purification of the fuel onboard almost impossible? Thankfully, provided you purchase a fuel guaranteed to ISO 8217:2024 this won't be of concern thanks to the minimum viscosity limits across all residual grades.

As well as the scope and general requirements of Clause 5 of ISO 8217 being amended, it has also for the first time named a number of chemical species where experiences have shown strong links between their presence and operational problems, including organic chlorides (chlorinated hydrocarbons) and some polymers.

The presence of organic chlorides are thankfully not governed by non-standard, often in-house, test methods revolving around gas chromatography mass spectroscopy (GCMS) but by an international standard EN 14077 which uses microcoulometry. However, the 2024 specification does not set clear maximum limits in the tables. Instead, it only mentions in the small print that the de-minimis value should not exceed 50 mg/kg, matching the CIMAC guidance published last year.

The 2024 specification will also prepare us for the new world of biofuel blends. Bio-residual marine fuel blends with residual fuels now have their own table within the specification and include the reporting of additional testing parameters such as FAME content and net heat of combustion.

How quick will the uptake of the 2024 specification be?

I am hopeful that owners will seize upon the material improvements provided by the 2024 specification, and as a result, it will achieve much more traction than the 2017 specification which was widely derided by many laboratories as being weak - a point picked up by many owners. That said, the only way the new specifications will be traded is if the end user demands them, which in turn will force the hand of the supplier to guarantee them, else we rinse and repeat. This will need a root and branch review of charterparty wording, adapting the term "latest version of ISO 8217 unless unavailable", which in my view is long overdue in any case.

How quick will the uptake of the 2024 specification be?

The simple answer is as fast as owners demand them in their charterparties as I see little reason for suppliers to offer the new specifications unless they really are forced to do so.

I am much more hopeful that owners can create traction in the uptake of the 2024 specification by seizing upon the meaningful and material improvements over the obsolete 2010 and 2017 versions, and as a result, push long overdue wording demanding the latest version of ISO 8217 (unless unavailable) into charterparty agreements.

Could it go further?

Firstly, the age-old problem of cold flow properties has not been addressed given the need to only report these for 2024 fuels but not guarantee limits within them. This leaves us in the same conundrum, where certificates of quality, especially those provided at a distant time of offer in comparison with the delivery date, are rarely worth the paper they are written on. There will still be no alternative therefore for buyers with specific cold flow requirements to seek additional guarantees outside of ISO 8217:2024 which seems to be a missed opportunity given the real and present challenges we have written about throughout the history of this publication. Secondly, a slight concern remains that the 50mg/kg limit for organic chlorides was not incorporated into the tables but included as a de-minimis value in the small print. Ultimately, fuels should be free from organic chlorides but it remains to be seen if, when faced with a dispute, some suppliers try and skirt around the requirements of the standard like we have seen with Clause 5 matters previously. It is useful however that CIMAC guidance and more recently the MPA enhanced testing, which has recently come into force in Singapore, does address this matter.

Part 2:

Integr8 Quality Index

The Integr8 Quality Index is a high-level index which allows a comparison by port, supplier and grade against key quality parameters and their proximity to the specification. It is important to note that the Quality Index not only picks up on "off specification" incidents beyond 95% confidence but also fuels that are even within limits but close to the specification.

In the last six months the Quality Index for HSFO has slid backwards, this explained by an increase in low risk, blend orientated claims. VLSFO and Gas Oil are both seen to be almost at parity with the previous period. (see figure 6)

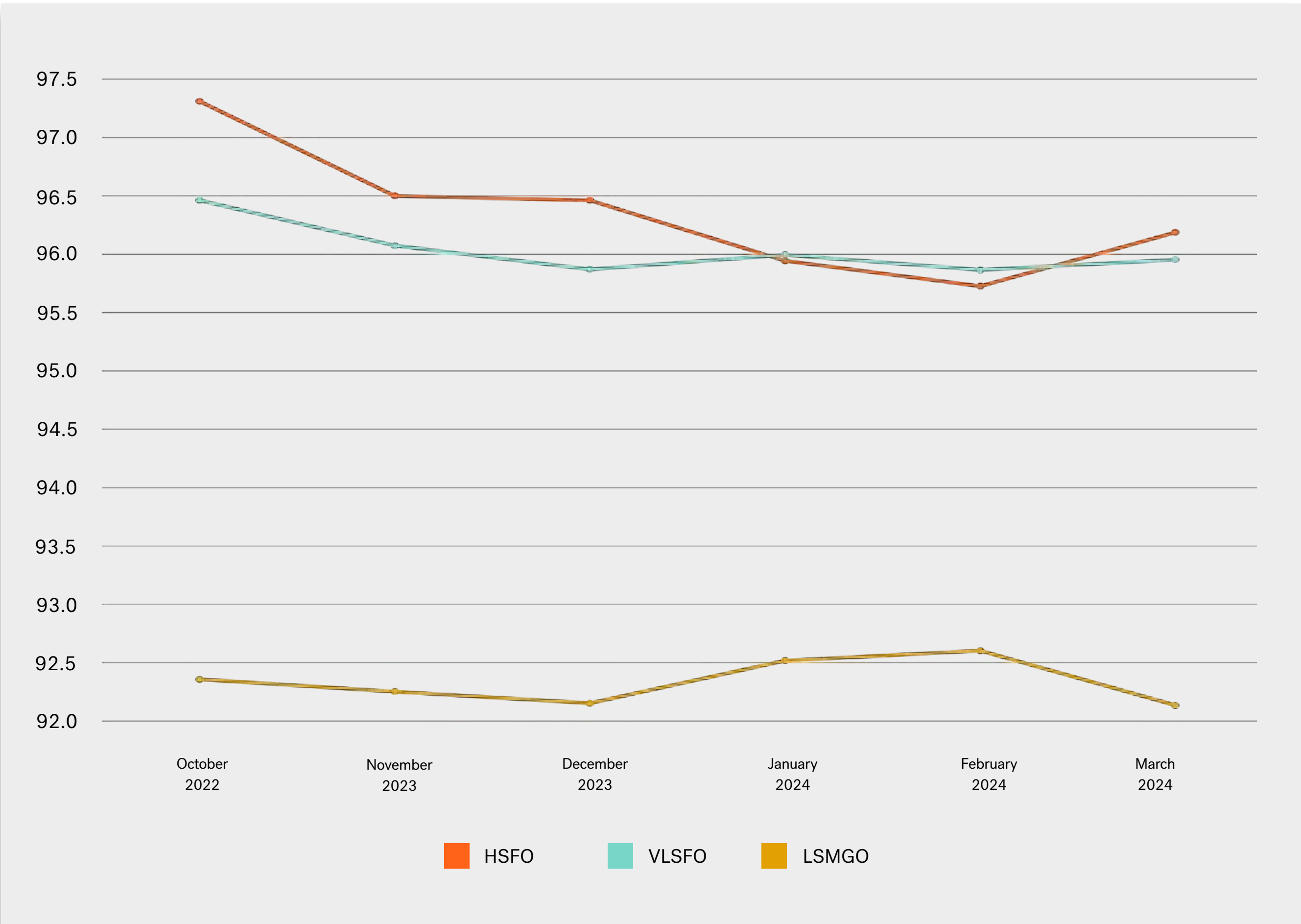


Figure 6: Integr8 Quality Index for HSFO, VLSFO & LSMGO

Clause 5 Chemicals and Added Substances

It is important to note that the Quality Index does not account for incidents relating to Clause 5; chemicals and added substances are not captured in this data, given you cannot apply a 95% confidence interval when there are no specification maximum or minimums.

These issues, however, tend to be centred around bunker hubs where there is more likelihood of obscure cutter stocks making their way into the supply chain given their availability and proximity to other industrial processes. Another notable feature of such claims is that they are also possible in ports with an active debunker market where, anecdotally, potential problem fuels appear to be removed and then resupplied to another unsuspecting vessel.

Indeed, we can report positive news relating to chemicals and added substances in that the Maritime and Port Authority (MPA) in Singapore again are leading the way in putting into place enhanced testing of marine fuel intended to be delivered as bunkers in the port of Singapore. That said, deliveries outside of port limits will not have the same level of quality control.

Focus on HSFO

3.4% of all HSFO supplies tested outside of specification (and beyond 95% confidence limits) for ISO 8217 table 2 parameters in the last 180 days, this significantly up from 3.0% when compared to previous.

The data identifies that the risk of elevated sulphur (above 3.5% Wt.) or flash point (SOLAS) compliance is very low, and based on the cross section of off specifications, we can identify the hit-rates of high risk off specification matters such as Al+Si and TSP remain at extremely low levels (see figure 7) - in real terms around one supply per thousand each.

In the last 180 days, almost half of all off specs are what can be termed blending related, i.e., against the limit of 0.991 Kg/Ltr for density or 380cSt for viscosity. In other words, a fuel will be actively made worse, or optimised against these limits to reduce the cost of the barrel, hence increasing profit between wholesale and retail.

Water content is the next most prominent off specification parameter for HSFO, accounting for one third of all off specification HSFOs or 1.1% of all supplies.

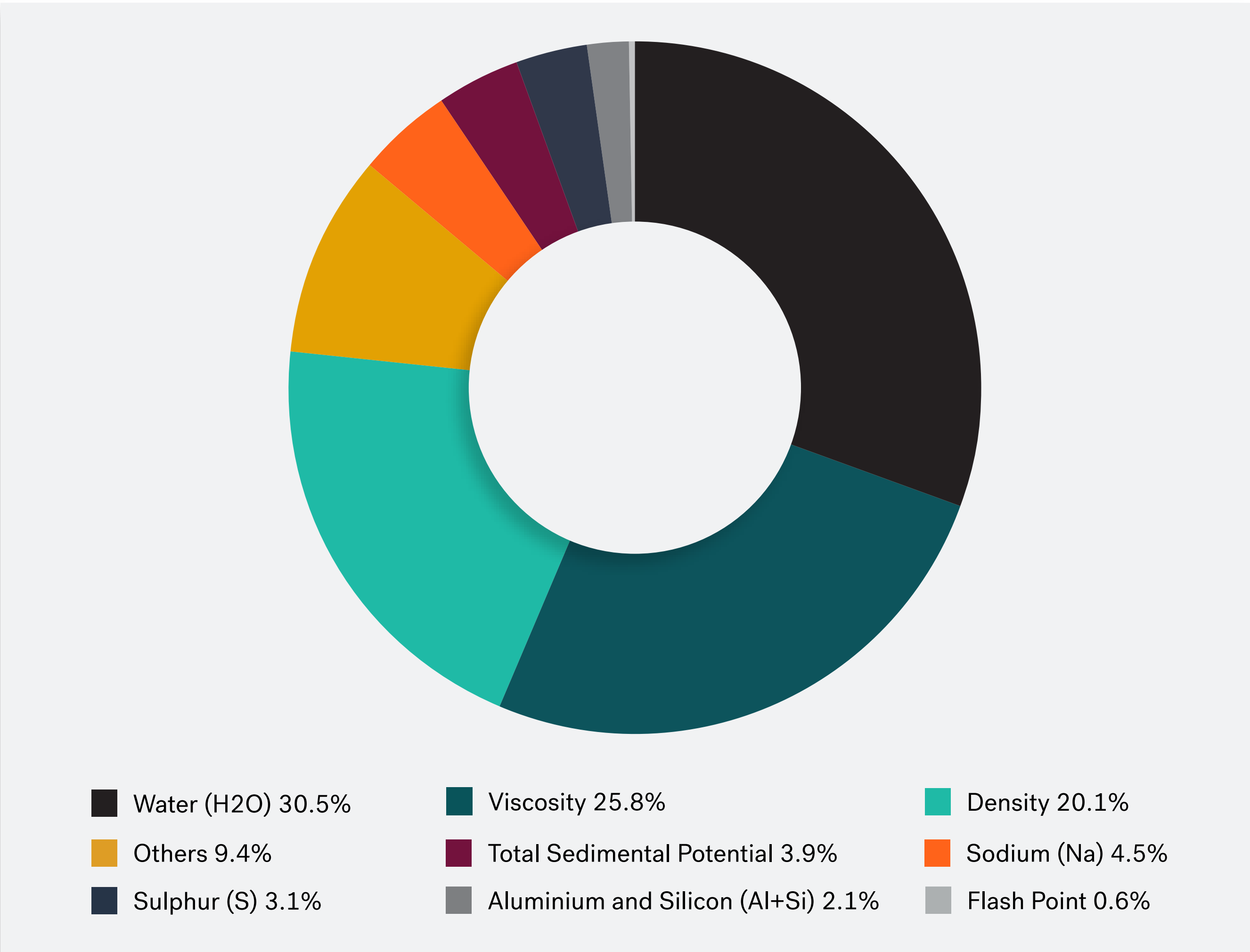


Figure 7: HSFO off specification distribution by parameter

Focus on VLSFO

2.1% of all VLSFO supplies tested outside of specification (and beyond 95% confidence limits) in the last 180 days for ISO 8217 table 2 parameters - this similar from 2.0% in the previous report and 2.3% a year ago.

The data identifies that the risk of MARPOL non-compliance for VLSFO is significantly higher globally than for HSFO at 0.7%, a slight increase from 0.6% previously, however, this again does not tell the full story given the elevated risk of non-compliance noted in certain locations.

Based on the cross section of off specifications, we can identify the hit-rates of high risk off specification matters such as Al+Si and TSP thankfully remain very low at rates of around two supplies per thousand (see figure 8). The risks of issues because of complex blending remains almost exclusively in bunker hubs rather than those areas with either simpler blending models or refined products available.

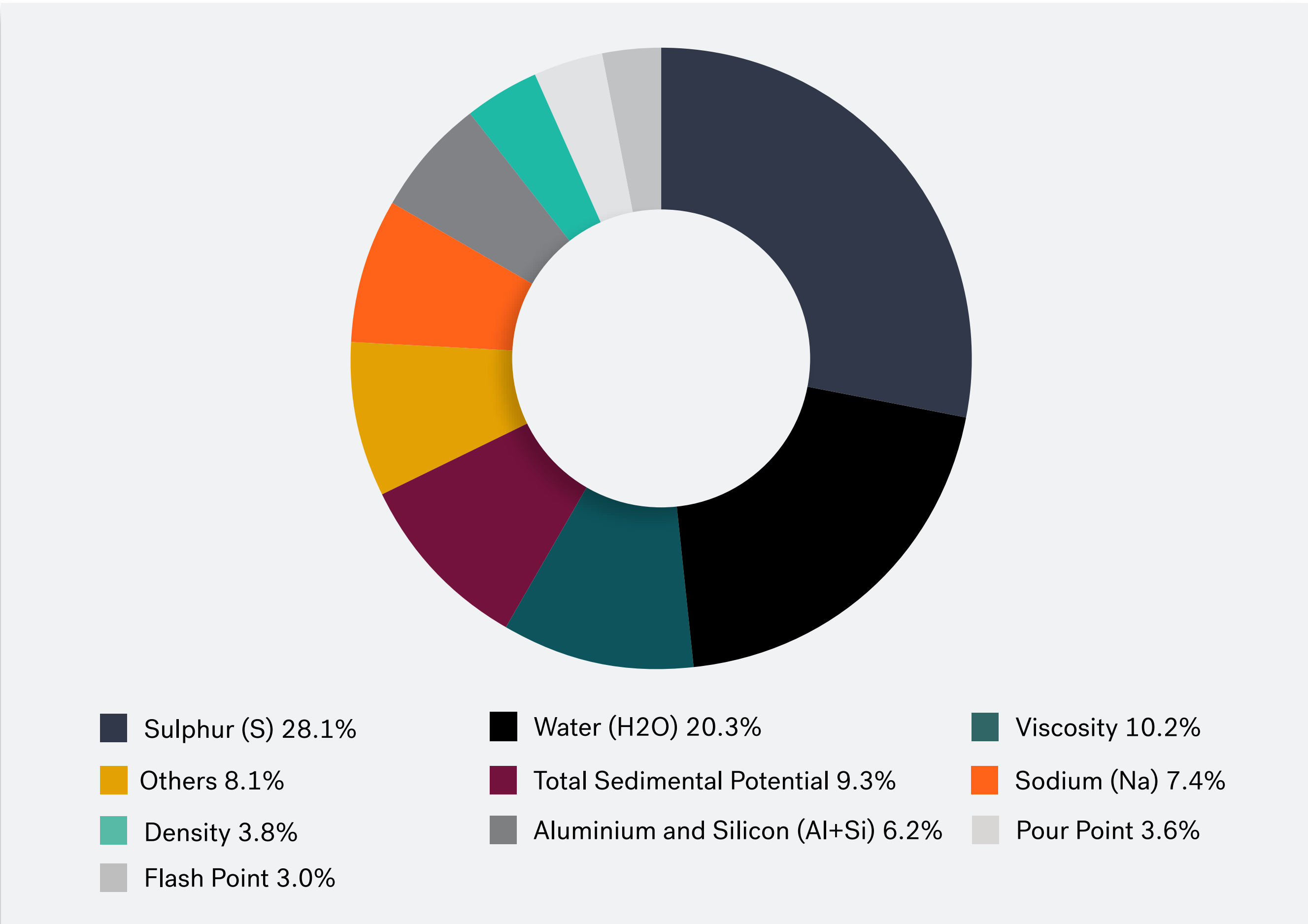


Figure 8: VLSFO off spec distribution by parameter

The cross section of VLSFO claims remains very similar to the last report with almost two thirds of all off specification VLSFO occurrences because of sulphur, water, TSP and cat-fine (Al+Si) infractions. Flash point issues on VLSFO remain very rare, only noted in under one sample in 1000. Viscosity and density issues are not prevalent to the same level as HSFO due to these not being targets for blending.

A year ago, it was reported that Belgian and Dutch ports (ARA) were particularly affected with issues relating to sulphur compliance in VLSFO, with a receiver previously 14 times more likely to receive a notification of a VLSFO above 0.50% than in Singapore and more than five times more likely, on average, than other ports in the rest of the world.

This trend was seen to improve significantly in the November 2023 report, however, given that average sulphur content for VLSFO in ARA ports has climbed considerably in recent months, (see figure 9), we regretfully report that we are almost twice as likely to face a sulphur off specification incident now than in the previously reporting period, (see figure 10), no doubt affected by blend economics.

Interestingly, whilst the level of samples with sulphur exceeding 0.53%Wt. has stayed virtually static in Singapore, we are also two and a half times more likely than the previous period to be faced with a sulphur notification from 0.51 to 0.53% S inclusive, a fact simply explained by blending which is also being optimised towards 0.50% in recent months with averages trending up over the period (see figure 11).

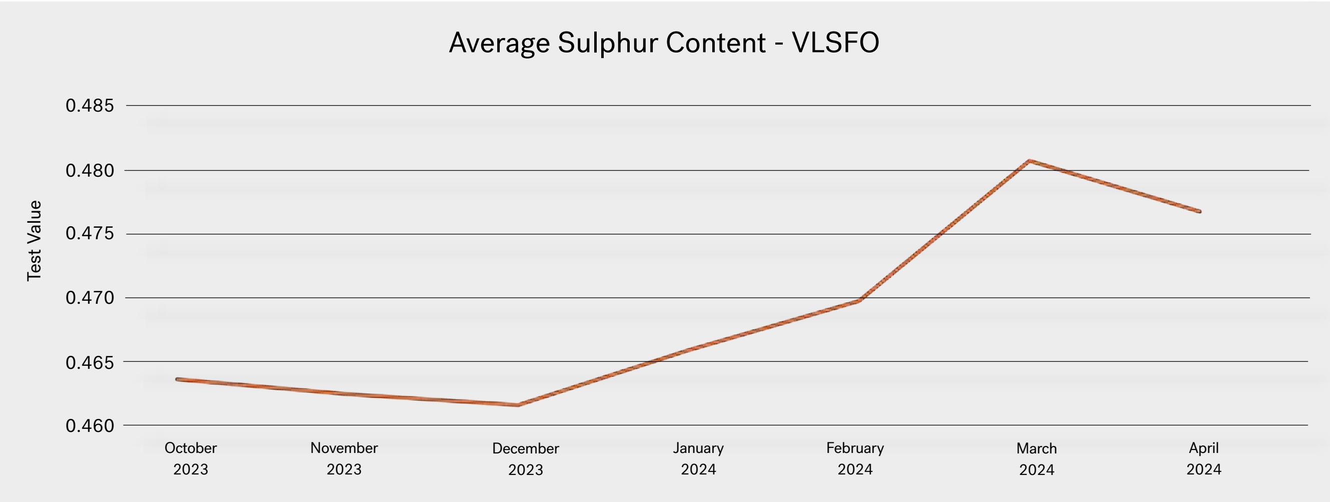


Figure 9: ARA Region: Average sulphur content in VLSFO

Country	Avg Sulphur Wt. (%)	Tolerance Sulphur 0.51-0.53 Incl. (%)	Off Spec Sulphur (%)
ARA	0.46	7.7 (2.4)	2.0 (1.2)
Singapore	0.47	1.0 (0.4)	0.3 (0.2)
Rest of the World	0.45	2.0 (1.1)	0.8 (0.8)

Figure 10: % of deliveries last 180 days with sulphur tested in categories spec +95% confidence or off specification for VLSFO

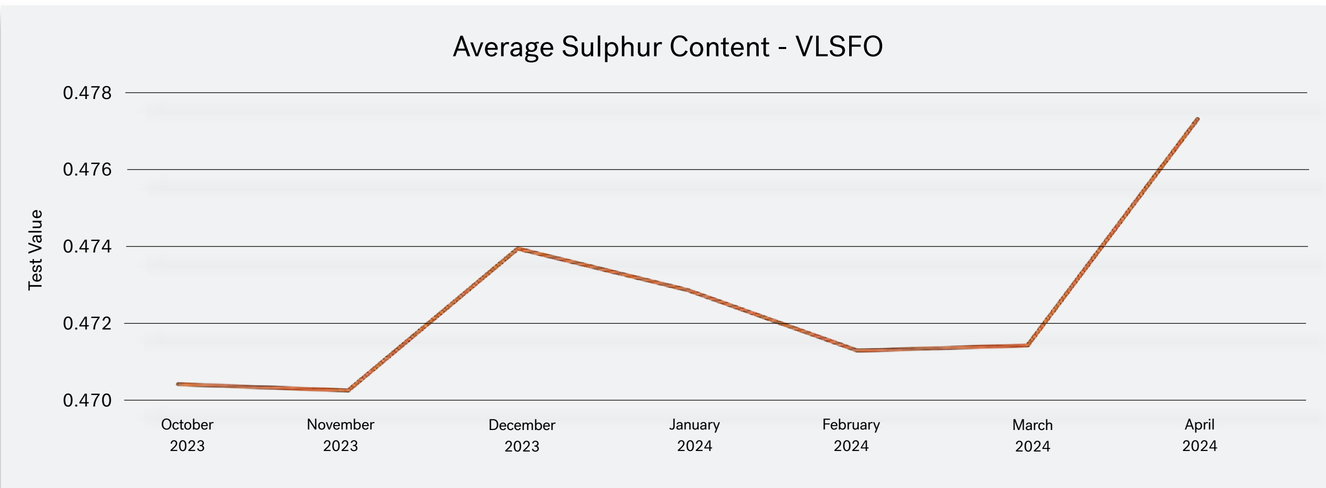


Figure 11: Singapore VLSFO average sulphur content %Wt.

Focus on VLSFO sulphur non-compliance

So given the focus on VLSFO non-compliance as a direct result of blend optimisation, we need to home in on any other factors that may affect these trends, such as port and supplier performance which continue to vary wildly from one to another including the ARA region and Italy where we will now look in more detail.

ARA

Within ARA we have identified some interesting statistics relating to port risk profile with VLSFO in Amsterdam being three times more likely to breach the 0.53% sulphur limit than Rotterdam and six times more likely than Antwerp (see figure 12).

Port	Avg Sulphur Wt. (%)	Tolerance Sulphur 0.51-0.53 Incl. (%)	Off Spec Sulphur (%)
Amsterdam	0.49	11.3	5.9
Rotterdam	0.47	7.9	1.9
Antwerp	0.47	7.4	1.1

Figure 12: ARA port comparison VLSFO sulphur content last 180 days

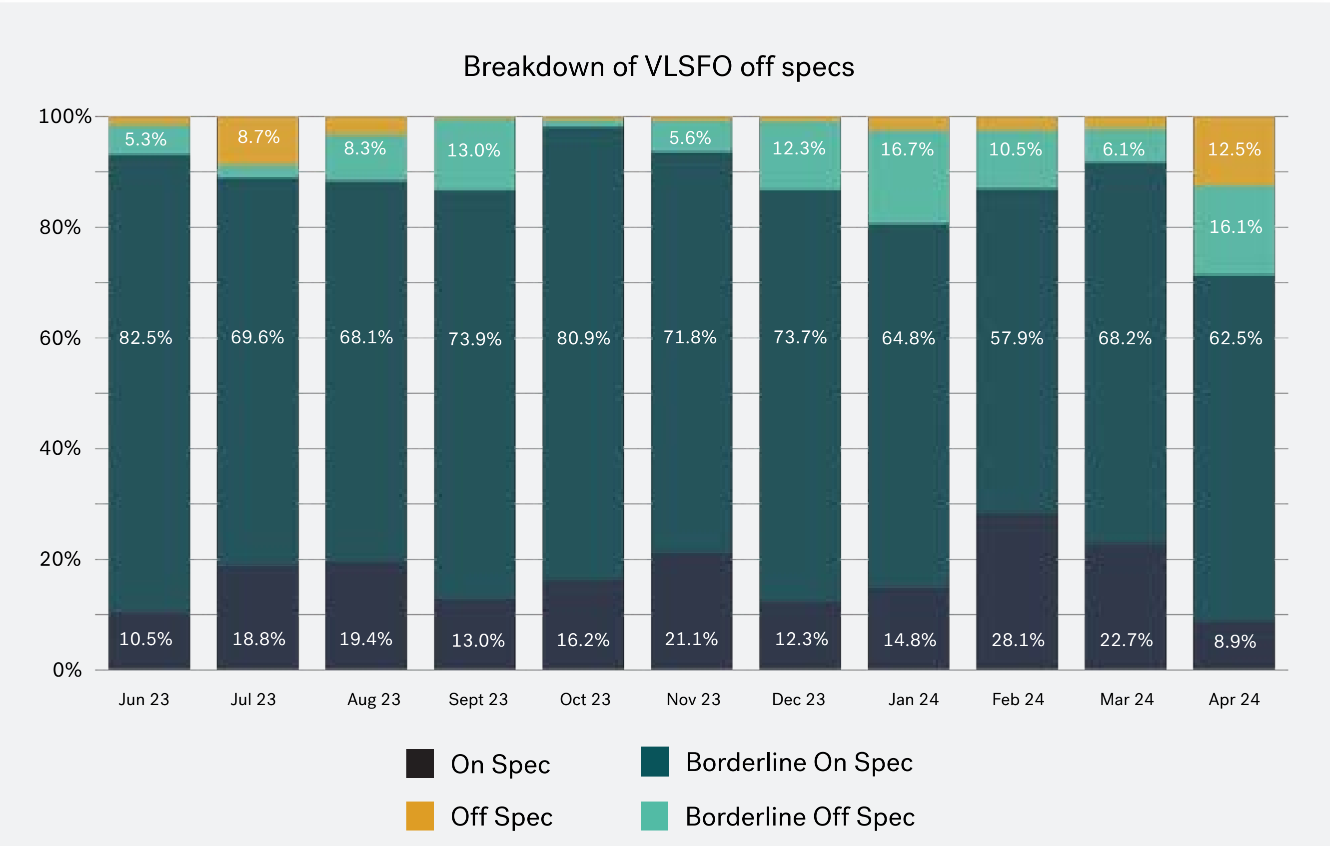


Figure 13: ARA supplier VLSFO sulphur content: inferior performance

Interestingly, when a comparison is run on barges within the physical supplier's fleet there is a significant variance in the likelihood of results exceeding 0.53% depending on barge operations. See redacted example below in figure 14.

Barges B and D, which are dedicated to VLSFO are close to what we would expect the residual risk of compliance in ARA as being as a direct result of blending.

However, when we then add in the additional variable of cross contamination in examples A & C - almost inevitably due to the common deck lines (and/or sampling points) on board the barge - this increases the risk enormously to similar magnitudes of some of the worse performing assets identified in port.

Therefore, and given the severity of outcome should such an incident result in a proven claim, it remains essential, if identified, to avoid such barges and suppliers if at all possible.

Barge	VLSFO & HSFO Deliveries Identified	% 0.51-0.53% Sulphur	% > = 0.53% Sulphur
A	YES	17%	8%
B	NO	7%	0%
C	YES	19%	14%
D	NO	8%	2%

Figure 14: Barge performance related to sulphur compliance in VLSFO

Red Sea closure ripple effect impacting VLSFO compliance as far as Barcelona

Geopolitical events often have a knock-on effect on fuel quality, sometimes relating to blending economics, and occasionally, also relating to the impact on barge infrastructure because of rapidly changing demand.

Of course, since the last report, we have seen many more vessels heading around Africa rather than travelling via the Red Sea, resulting in a significant uptick of HSFO demand as far as Barcelona in the western Mediterranean. During the same period, we can also identify a 30% increase in VLSFO sulphur off specification incidents in ports along the African coast and nearby Spain, which upon closer inspection, have the same root cause in that the affected barges also carry HSFO. That said, in some ports we have identified suppliers who run a similar model who are unaffected, this likely due to the infrastructure allowing double valve segregation and separate manifolds onboard the barge preventing any cross-over contamination and/or proper management of grade changeover.

The increase in HSFO demand is also putting pressure on supply models

Another factor is the significant increase in the number of vessels equipped with scrubbers, resulting in a far higher demand for HSFO than in recent years with data available to Integr8 suggests approximately 100 million MT of deadweight being either delivered or retrofitted with scrubbers in 2023. This, combined with the price spread which remains very appealing, and the scrubber assets travelling further at higher speeds continues to support the demand going forwards.

Suppliers of course want to meet this increased demand and in doing so can place transitional temporary pressure on existing assets or could be forced into a sea change in strategy both of which may result in the practice of storing both HSFOs and VLSFOs onboard the asset.

This is further supported at the time of writing by increased sulphur off specification occurrences, with the root cause being the switching of grades with certain suppliers in ports including but not limited to Barcelona, Callao and Hong Kong.

Local risk of critical off specs

Whilst we have previously reported that the chance of critical off specs for VLSFO are generally very low, some outlying ports continue to create challenges. There are numerous theories as to why this is the case, but in general the flow of oil is more variable and as such the supply chain is less secure and may even include the influx of previously debunkered and repackaged fuels as mentioned earlier.

For example, Chittagong has a hit rate of 8.3% for both aluminium and silicon and total sediment potential, indeed all examples cited were alleged to be off specification for both parameters.

Mombasa, Kenya, has a hit rate of almost 35% for TSP off specification occurrences for VLSFO, and the risk of issues at OPL Singapore compared to inside port is stark, as is the comparison between Fujairah and Khor Fakkan.

Focus on MGO

2.8% of all MGO supplies tested outside of specification (and beyond 95% confidence limits) for ISO 8217 table 2 parameters in the last 180 days, this down from 3.0% in the previous report.

The data identifies that the risk of either MARPOL or SOLAS non-compliance is 1.9%, virtually the same as previous. Drilling into the individual parameters, sulphur remains responsible for 32% of all off specification incidents and flash point has now increased from 25% to 33% (see figure 15).

Concentrating on the legislative requirements for both sulphur and flash point, these are driven by completely different factors.

Sulphur issues are again because of very tight blending to the 0.1% limit with these being so borderline it is not uncommon that, when tested again, these exceed the limit. LSMGOs contaminated with MGO do not occur in Europe as it is not marketed, is rare in the USA, but is a possible source of issues in Africa and the Middle East.

Flash point on the other hand is either because of cross contamination, which tends to be rare, or more endemic issues such as the use of road fuels in the marine sector. These are generally characterised by their improved cetane (ignition capabilities) and much lower viscosities due to the increased amount of kerosene in these blends which by default, given kerosene is more volatile, depresses the flash point to a level close (or even below) SOLAS requirements. Indeed, during the period around 90% of all off specification MGO flash points reported continue to have viscosities less than 3cSt.

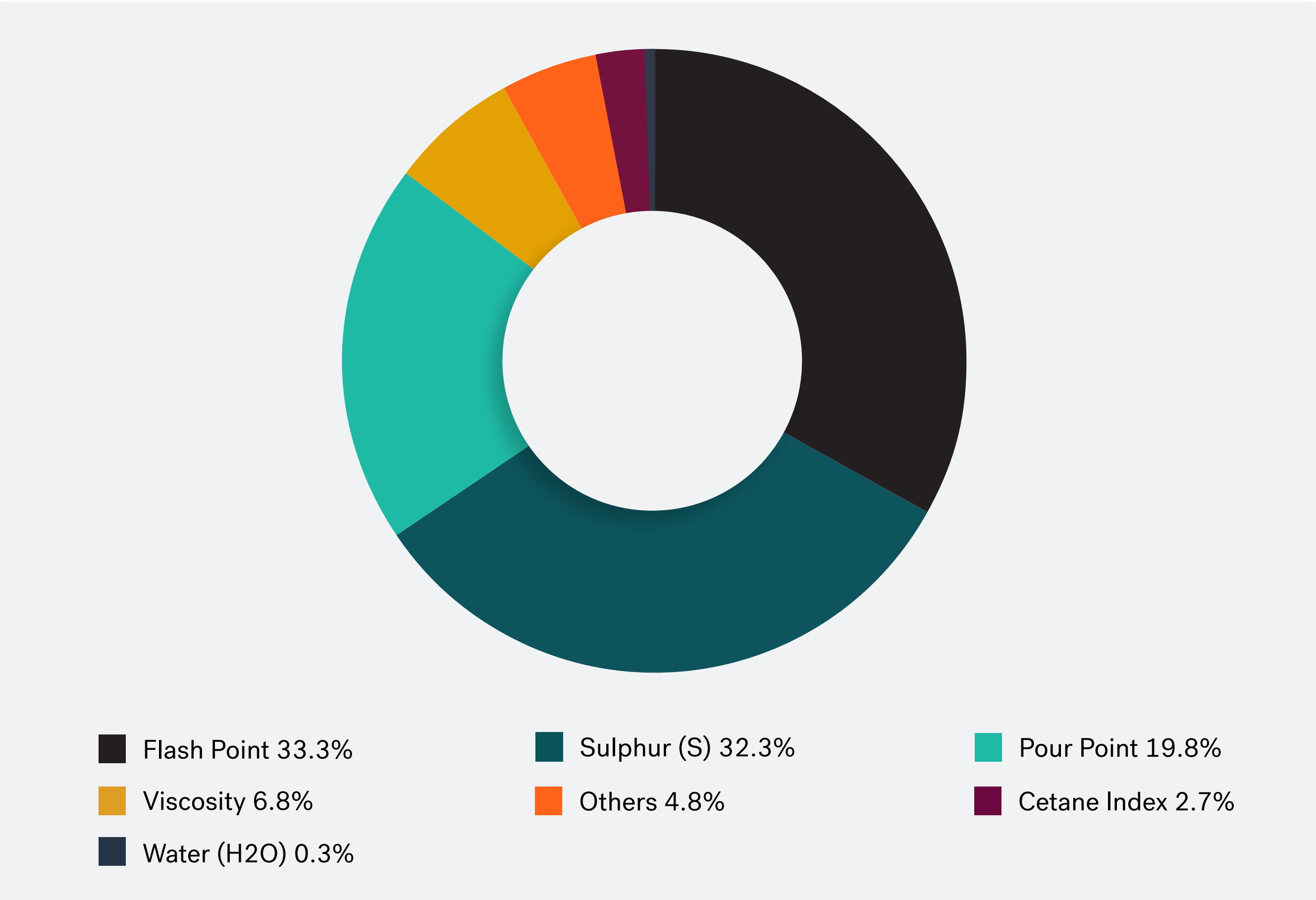


Figure 15: MGO off spec distribution by parameter

SOLAS Regulation II-2/4.2.1 specifies a minimum limit of 60°C for flash point in marine fuels with no tolerance, unless specifically provided for emergency generators, where the limit is 43°C minimum.

The prevalence of these fuels can be easily identified when identifying fuels with certain characteristics, i.e., a flash point less than 60°C and a viscosity less than 3cst at 40°C (see figure 16).

The risks of SOLAS non-compliance are noted to be magnified in certain parts of the world, one such area being Spain, with truck supplies in outlying ports particularly noteworthy with up to one in three samples testing below 60C.

Pockets of off specification fuels can, however, pop up anywhere with another notable example continuing to be the port of Aliağa in Turkey (26%), and stark variances in risk at UAE ports outside of Fujairah with these being magnitudes more likely to face a flash point situation than Fujairah itself (see figure 17).

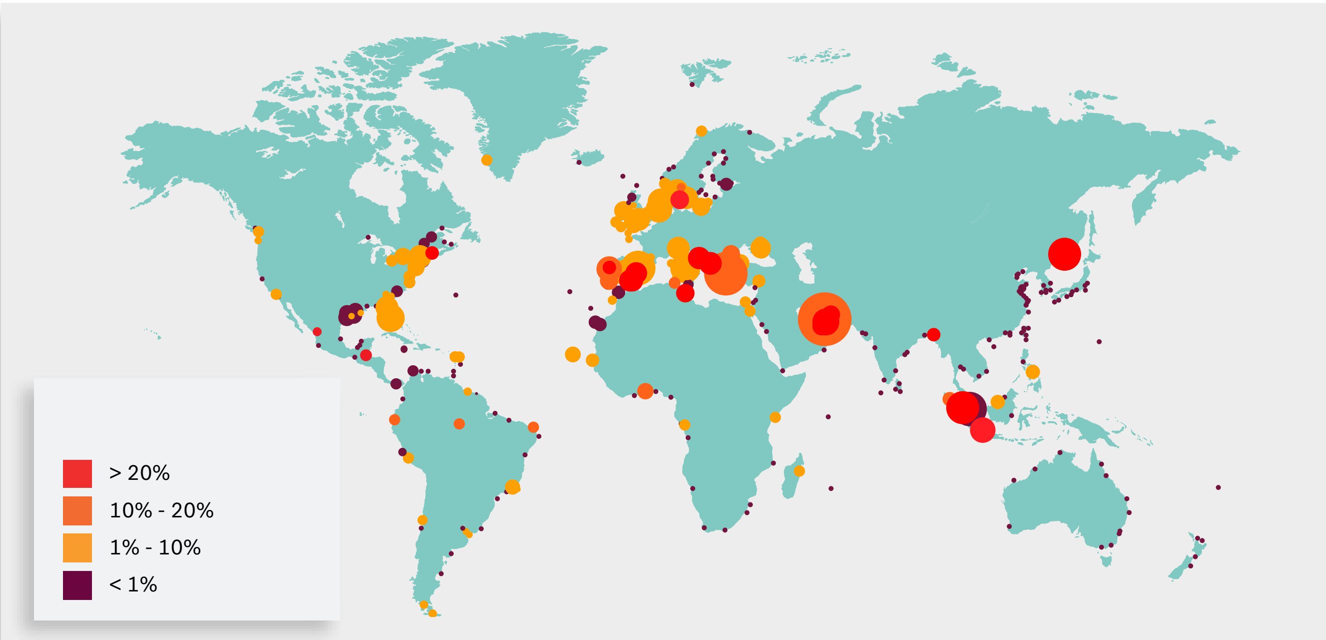


Figure 16: Flash point off specification combined with viscosity <3 cSt

Port	% Off Specification Flash Point
Hamriyah	26.3%
Sharjah	20.9%
Mina Saqr	38.5%
Dubai	15.8%
Khor Fakkan	2.6%
Jebel Ali	2.4%
Fujairah	0.2%

Figure 17: LSMGO flash point off specification occurrences in UAE ports last 180 days

Part 3: Biofuel quality

Two main (but very different) types of biofuels are currently available, these being fatty acid methyl ester (FAME) made from a variety of sources such as rapeseed methyl ester (RME), palm (PME) and used cooking oil (UCOME) and, alternatively, hydrotreated vegetable oil (HVO) again produced from similar plant or animal fat-based sources.

The physical characteristics of FAMEs are closer to those of fossil diesel fuels than pure vegetable oils, but properties depend on the feedstocks utilised to produce them. FAMEs must comply with EN14214 in Europe and ASTM D6751 in the USA and can be supplied as blends from B7 (7% biofuel) to B100 (100% biofuel).

Data available to Integr8 has now begun to identify both neat and blended biofuel availabilities and qualities, although still at far lower levels than conventional fuels.

VLSFO blending with FAME is generally limited presently to the bunker hubs of Singapore and ARA, and in particular Rotterdam which currently benefits from price rebates.

Due to the nature of the blends and the very wide variety of VLSFO base stock quality, correlations based on the level of bio component are very difficult to identify due to the masking nature of the base fuels themselves.

Figure 18: Distribution of B7-B100 marine fuels (FAME)

VLSFO biofuel blends: Off specification incidents

Despite initially reporting that VLSFO biofuel blends had no compliance issues, the latest report indicates that these are now a challenge with around 8% of fuels identified as containing FAME from B7 to B40 concentration testing above the limit. The root cause of these problems is difficult to ascertain, however given the demand for biofuel blends being hit or miss, the possibility of having to use a non-dedicated barge for supply remains the most likely at this time.

No high risk off specifications were noted for VLSFO FAME blends given that the blending of biofuels into VLSFO will reduce metals (since, for example, FAME is aluminium and silicon free), furthermore we note that TSP (stability) is not adversely affected by the addition of FAME.

LSMGO biofuel blends: Off specification incidents

One of the main areas of note remains that of pour point, which is seen to increase proportionally to the level of FAME in the blends. With respect to distillates, pour point becomes the dominant parameter causing difficulties above 20% FAME content. For blends of 40%+, pour point can be attributed to 68% of all issues (see figure 19).

Cloud points and cold filter plugging points (CFPPs) are also seen to be in close proximity to the pour point and given the levels noted (especially for FAME rich fuels - likely made from Used Cooking Oils), it is highly likely that heating the fuel will be necessary to prevent operational difficulties onboard the vessel and this will require storage tanks with heating coils.

However, this brings another challenge to the table in that FAME is highly susceptible to oxidation, with this chemical reaction being accelerated by heat. Therefore, any heating must be carefully controlled along with careful monitoring of the fuel to prevent the FAME from deteriorating, ultimately becoming rancid and forming fatty acids.

Indeed, from figure 19 we can already see a creep of total acid number, attributed to fatty acids in such blends with the average of a 40%+ FAME blend being twice (0.25 mg/koh/g) than that of a fuel with between 7-20% FAME (0.12), suggesting evidence of possible deterioration.

	Parameter	
Distillate Blend with Biofuel %	Pour Point (% share of all off specs)	Total Acid Number (Av) mg/KOH/g
7-20	14	0.12
21-40	50	0.18
40% +	68	0.25

Figure 19: Tested data B7-B100 marine fuels (FAME)

Hidden losses: Density short lifting

Whilst prices have remained similar in recent months, the practice of density short lifting (and as a result the impact with any associated losses) remains a very important consideration.

Data available to Integr8 Fuels continues to identify Asia and the Middle East as areas most likely to suffer with endemic density variances for both VLSFO and MGO.

VLSFO

Referring to the league table in figure 20 with more than 50 samples over the last 180 days, Jakarta is seen to be the worst performing port with an eye-watering 27 USD per metric ton loss because of density inaccuracies, however, some suppliers are completely unaffected. This pattern is mirrored across all ports barring Hambantota in Sri Lanka where the best variance that could be expected would still result in a 4 USD per metric ton loss.

Considering Sri Lanka in general, Colombo is also seen to be affected by similar variances (-1.1%) with such levels being similar to those previously reported.

Hong Kong also continues to be identified as a port with significant variations and is also seen to be quite polarized from supplier to supplier, with the worst-case supplier performance being as much as 21 USD per metric ton and the best case having no variance at all.

Port	VLSFO Var (%)	Avg $/MT (180 Days)	Adjusted $/MT (Average)	Adjusted $/MT (Best Case)	Adjusted $/MT (Worst Case)
Jakarta (Indonesia)	-2.0	732	+17	=	+27
Pasir Gudang (Malaysia)	-1.9	617*	+12	=	+28
Hambantota (Sri Lanka)	-1.2	706**	+8	+4	+18
Colombo (Sri Lanka)	-1.1	706	+8	=	+13
Hong Kong	-1.0	624	+6	=	+21

Figure 20: Impact of VLSFO density variances by port. Bracketed figures refer to previously reported value if available (over 50 samples).

*Note 1: Pricing based on Port Klang (Malaysia)

**Note 2: Pricing based on Colombo (Sri Lanka)

LSMGO

Again, referring to the league table of ports (see figure 21) with more than 50 samples over the last 180 days and the worse average density variances, Hong Kong and Sri Lanka remain prominent, along with the UAE ports of Jebel Ali and Dubai, and finally, Port Klang, Malaysia.

Losses are magnified given the increase in flat price of LSMGO in comparison with VLSFO and continue to be highly polarized from supplier-to-Supplier within the ports in question, however Hong Kong is the only port that has evidence of some suppliers being unaffected by these losses with all other ports being affected to a certain degree.

Port	LSMGO Var (%)	Avg $/MT (180 Days)	Adjusted $/MT (Average)	Adjusted $/MT (Best Case)	Adjusted $/MT (Worst Case)
Hong Kong	-2.4	735	+17	=	+33
Colombo (Sri Lanka)	-1.7	923	+16	+9	+21
Jebel Ali (UAE)	-1.0	705	+7	+1	+20
Port Klang (Malaysia)	-1.0	753	+8	+4	+21
Dubai (UAE)	-0.7	760	+10	+5	+18

Figure 21: Impact of MGO density variances by port. Bracketed figures refer to previously reported value if available (over 50 samples).

Conclusion

The last six months to a certain extent have really cemented the need to continually improve our processes, be it in procurement strategies or the supply chain security itself.

Drivers for these improvements include continued concerns relating to sulphur compliance in VLSFO which are again escalating given the changing landscape of supply. We saw that this is due to both geopolitical factors, and suppliers wanting a piece of the HSFO pie given the increased number of assets floating with scrubbers. Consequently, some suppliers are shoehorning more HSFO deliveries into existing supply infrastructure, perhaps without adequate quality control measures.

We support prioritising suppliers who have dedicated barges for HSFO and VLSFO given the proximity of sulphur content to the 0.50% limit inevitably being received ex-wharf, whereby less than one percent cross-over may result in a fuel breaching the 0.50% S limit and becoming potentially non-compliant.

Thankfully, fuel quality remains generally good and should improve further provided the uptake of the ISO 8217:2024 specification is good. Indeed, in Singapore the MPA to a certain extent will assist in this process with their implementation of enhanced testing, including that for chlorinated solvents.

That said, batch-based problems continue to rear their heads from time to time, however risk profiles of ports are relatively easy to evaluate given the prevalence of data available.

Ultimately the need to buy smartly from reputable suppliers with proven quality is essential and whilst the cost of bunkers remains on the high side, perhaps drawing the eye to cheaper solutions - the cost of time-consuming claims, which may even result in debunkering, is inevitably much greater.

For further information about this report or to discover how Integr8 can support your bunker procurement:

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With a career spanning over 30 years in the oil & shipping industries, Chris has a vast amount of experience including laboratory management, physical supply, bunker broking, trading and, more recently, providing technical supervision of exclusive buying for owners, charterers and operators, including the development and design of online bunker resources.

Chris is also a member of the IBIA technical working group, and a regular speaker, moderator and panel member at many global bunkering conferences worldwide.