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2020 Vision

PREPARING FOR THE BIG SWITCH

Option 2: Compliant VLSFO Products

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The reduction of the MARPOL Annex VI global fuel sulphur cap to 0.50% will come into force on 1 January 2020.

There will be no transition phase or grace period after this date. Shipowners and charterers need to act now and make the transition to compliance before 1 January 2020 and remove any non-compliant fuel before 1 March 2020.

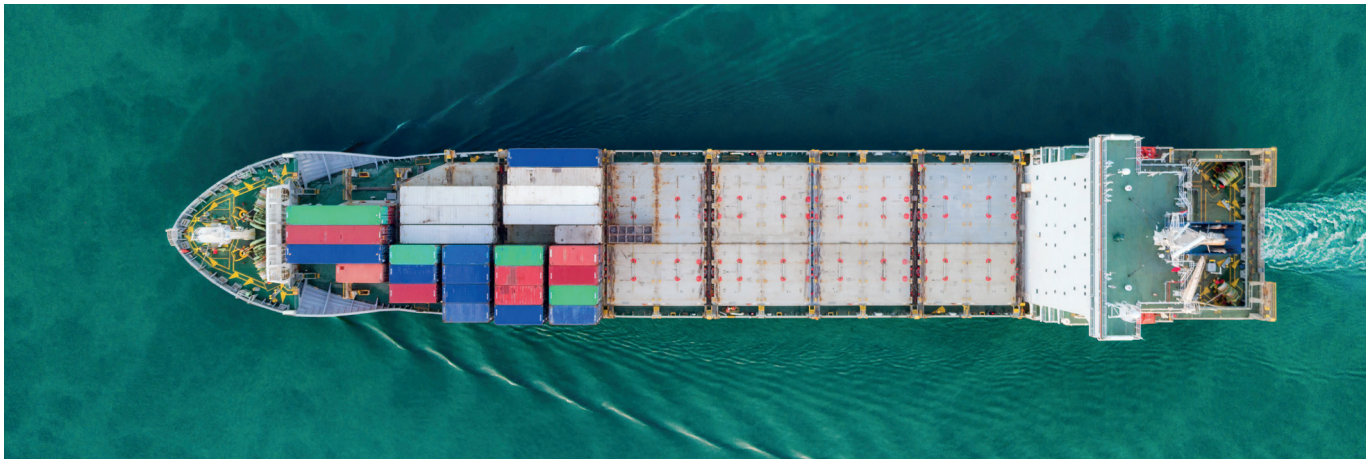
There are several options on how to comply, the most common being distillates (MGO/MDO), blended very-low-sulphur fuel oils (VLSFO) or installing exhaust gas cleaning systems (scrubbers).

Whichever method of compliance is chosen, the switchover and future operation has to be carefully planned and managed. The risks that threaten safety or impact compliance must be identified and controlled.

This guide looks at the second option: compliant VLSFO fuels. It is designed to assist you with the transition process and ensure safe and compliant continued operation.

Plan the Switch

Whatever the method of compliance, it constitutes a major change in vessel operation. Each method of compliance also presents unique risks – and these risks need to be managed.



The Technical, Chartering and Operations departments of the shipping company should meet together as early as possible to discuss planning and what is achievable.

It is important to avoid a scenario where the technical department makes transition arrangements that conflict with agreements already made by the chartering department.

When to Switch to Compliant fuel?

Agree as early as possible a date for the switchover to compliant fuel.

This needs to be discussed internally and, in the case of vessels on charter where the charterer provides the bunkers, externally.

It's likely that most shipowners will want to change over onto compliant fuel well before the 1 January 2020. They will want to make sure all the tanks are clean, systems are flushed and there is little risk of contaminating subsequently bunkered fuel by residues remaining in the system.

But what about vessels on time charter? A charterer may want to keep providing cheaper high sulphur residual fuel as close to the deadline as possible. Or what about a time charter that finishes end of December 2019? Can the owner achieve compliance in such a short time after that charter?

These issues must be discussed at an early stage and planned accordingly.

Ship Implementation Plan

IMO is helping shipowners develop a 'Ship Implementation Plan'. MEPC.1/Circ.878 *"Guidance on the development of a ship implementation plan for the consistent implementation of the 0.50% sulphur limit under MARPOL Annex VI"* outlines how a ship may prepare in order to comply.

This provides a template for a vessel-specific implementation plan and focuses on vessels that intend to use compliant fuel rather than those operating with scrubbers. The plan can, however, prove useful for vessels using open-loop scrubbers that intend to use compliant fuel as a contingency or where wash-water discharge is prohibited.

The ship implementation plan guidance covers:

1. Risk assessment and mitigation plan (impact of new fuels)
2. Fuel oil system modifications and tank cleaning (if needed)
3. Fuel oil capacity and segregation capability
4. Procurement of compliant fuel
5. Fuel oil changeover plan (conventional residual fuel oils to 0.50% sulphur compliant fuel oil)
6. Documentation and reporting

Although a ship implementation plan is not mandatory, it could assist in satisfying visiting Port State Control officers when verifying compliance.

It is not the intention of this document to replicate the advice provided by IMO. As such, the guidelines, complete with template plan, can be downloaded at **www.nepia.com/insights/2020-vision/articles-resources**

Plan the Switch (cont.)

New Fuel Risks – VLSFO

It is expected that most shipowners will initially turn to compliant distillates, such as marine gas oil (MGO) or marine diesel oil (MDO). It is equally likely that the popularity of hybrid/blended VLSFO products will increase as more products enter the market.

At time of writing, little information has been publically released about these new VLSFO products. There is likely to be a lot of different fuels with different properties marketed under the umbrella term of VLSFO.

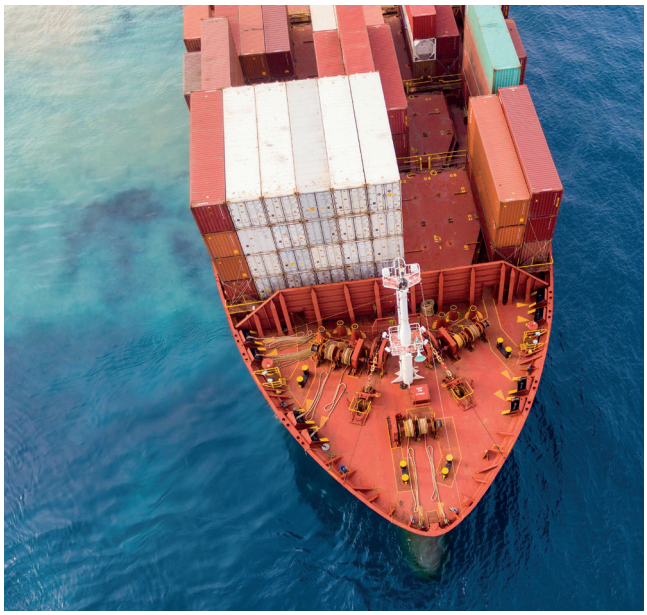
These might be blends of distillates and residuals or they might come from less traditional streams from the refinery process or using new refining techniques. Or they could even be heavier products sourced direct from sweet crudes. Some new fuels might consist largely of vacuum gas oil or even use shale oil.

Stability and Compatibility

VLSFO composition is anticipated to vary significantly between regions – European volumes are anticipated to contain significant volumes of low sulphur atmospheric residues, whereas Asian volumes will contain significant portions of cracked and straight run vacuum residues, with North American volumes comprising of more fluid catalytic cracking (FCC) products, such as slurries and cycle oils.

These differences raise a serious concern of incompatibility; and not just incompatibility between different products but even between batches of the same product.

Individually, VLSFO products may pass the stability criteria of the ISO 8217 but become unstable when mixed together – therefore incompatible.



Incompatibility results in sludge formation caused by precipitation of asphaltenes. This leads to blocking of filters, centrifugal separators and, in extreme cases, fuel pipes. The risk of losing propulsion or electrical power becomes very high.

The addition of stabilising chemicals could be beneficial in treating unstable or incompatible fuels if caught at an early stage. But take care in choosing additives as they must be matched to the fuel. A poorly-matched additive could worsen the situation.

Perhaps the most reliable test for compatibility will be carried out by shore-based independent laboratories. As most operators and crew are all too aware when using shore laboratory services, it could be several days before results are known. This places the crew in a difficult position if there is a limited amount of 'safe' fuel on board and the vessel is operating in areas with a poor bunkering infrastructure.

Ship's engineers have long used onboard compatibility test kits where a mixed sample is dried on blotting paper – the 'spot-test'. However, some fuel experts are concerned that this test may not be suitable for use with VLSFO products. In the absence of a better alternative, this should continue but with caution.

Some industry experts have also raised concerns that the current laboratory tests for stability and compatibility may not be suitable for new VLSFO products. The deposition of sludge is a slow process and short timespan tests in laboratories rely on artificially severe conditions.

An additional laboratory test that can be useful in predicting future stability and possibly compatibility problems is 'optical scanning' (Turbiscan ASTM D7061-12). This laboratory test is supplemental to the usual suite of ISO 8217 tests and provides a Reserve Stability Number (RSN), which fuel experts maintain is a better indication of stability than the regular 'total sediment' tests.

Organisations such as ISO, CIMAC and Concawe are currently working together to develop a tool to determine compatibility criteria.

To date, only Exxon has publically given assurance that their batches will be compatible with each other, despite not being tried and tested in the market. Furthermore, this does not mean they will be compatible with every other fuel.

Attention to the cold-flow properties of VLSFO products with a high distillate content will be needed, These products, which are more paraffinic in nature, could be prone to wax formation at lower temperatures. It may take the industry time to understand the wax-formation characteristics of these new fuels.

Life Span

Traditionally, only distillate fuels such as MGO were considered to have limited life span. The shelf life of HFO has never been a real issue.

But limited life spans may become an issue with VLSFO products. This is because the components in some VLSFO products will be short-chained cracked residuals, which are highly reactive. For example, a component which may end up in some VLSFOs – Ethylene Cracker Residue – has a shelf life of days. Of course, this does not mean that the whole fuel parcel will have a shelf life of days, but it is something to take into consideration when ordering and managing fuel.

Buying Bunkers

Due to the concerns on compatibility between these products, and the expected variations in their characteristics, fuel purchasing will require much more care.

Be aware that a purchased VLSFO product may be very different to previously stemmed products.

Until the new bunker market has matured and experience is gained on handling and using the new VLSFO products, shipowners may wish to exercise heightened levels of diligence when purchasing.

Be clear on what you want and be satisfied that the supplier can be relied upon to provide safe and on-spec fuel, and try to ensure that requirements are specified in relevant contractual documents.

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Fuel System Modifications

Depending on the chosen method of compliance, there may be a need to modify the vessel's fuel storage arrangements, fuel transfer system or fuel supply/pushing system.

The scope and complexities of any modifications can vary; therefore proper planning and project management is vital.

It is also imperative that any modifications to these systems are carried out in full consultation with the vessel's Class and Flag.

Some points to consider:

- If switching to compliant low-viscosity fuels – where there is a risk that the viscosity could drop below that recommended by the engine manufacturer – does the fuel service system need to have a cooler installed?
- How long will the vessel spend operating within emission control areas (ECA) where 0.10%S limit applies? This will help determine storage requirements for each type of fuel and in turn require the change in use of some tanks.
- Does the fuel system require additional segregation to minimise the risk of contamination of 0.10%S bunkers by 0.50%S bunkers?
- Does the fuel system require additional segregation or additional storage to prevent co-mingling of bunkers and therefore reduce the risk of incompatibility?
- Does the fuel transfer system allow for the easy de-bunkering and removal of fuel if found or rendered non-compliant?
- Are there suitable and safe fuel sampling points that allow for a representative sample to be taken from various sections of the fuel supply system (e.g. engine inlet, centrifugal separator inlet and outlet)?

Plan the Switch (cont.)

Tank and System Cleaning

If choosing new VLSFO products as the method of compliance and the vessel currently burns residual fuels, it is likely that tank and system cleaning will be required.

This is not a simple or quick task. It needs planning. How long will cleaning take and how will it be done?

It is unlikely that simply bunkering MGO into a tank that previously held heavy fuel oil, and then flushing through, will achieve compliance. Rather, it is much more likely that manual cleaning within each tank will be required or there may be cases where specialist chemical additives could be used.

It is important to do it right. If the system is not properly cleaned, it could contaminate several hundreds of tons of subsequently bunkered fuel.

There also may be a need to clean tanks again after 1 January 2020. If compliant fuel is unavailable in certain geographical areas, a vessel may be left with no choice but to bunker non-compliant heavier fuels. Therefore, these tanks will need to be in a suitable clean condition before returning to low-sulphur service.

Safety considerations will be even more important. Tank cleaning is likely to involve multiple tank entries and we are all fully aware that too many people die in enclosed or confined spaces. Such operations must be subject to a risk assessment and strict adherence to a permit-to-work system.

Record keeping requirements are not specifically addressed within the IMO guidance on Ship Implementation Plans. Planned maintenance records should of course be updated, but official documentation such as the Oil Record Book must be kept up to date. The vessel must be able to account for the removal of any tank residues resulting from manual tank cleaning.

Will it be the shipowner or the charterer that is obliged to arrange for and/or pay for the removal of non-compliant fuel and the cleaning of the tanks prior to bunkering compliant fuel? This will depend on the wording of the charterparty. Therefore, if such tank and system cleaning will be undertaken during a charter then it will be important to consider this at the drafting stage.

Some key points to consider when cleaning the fuel tanks and system follow:

Cleaning during drydock

In an ideal world, the need for tank cleaning would coincide with the vessel's special survey/ docking cycle. However, in reality this is unlikely and the majority of vessels will not be able to align their tank cleaning with this.

But if circumstances allow for system cleaning and flushing in drydock then the process will be less disruptive than when undertaken in service.

- Resources are plentiful during drydock but there is of course a cost attached to this. Larger cleaning squads can be used. This reduces the overall time to clean tanks and allows for several tanks to be cleaned concurrently.
- Although deadlines are set, there is less commercial pressure applied when tank cleaning in drydock compared to a vessel in service.
- Disposal of residues and sludge to shore side facilities is easier when in drydock.
- If looking to recover expenses, it is easier to present cleaning costs to charterers, if appropriate, as the yard generally provides a detailed itemisation in comparison to when crew perform these tasks when in service.

If the system is not properly cleaned, it could contaminate several hundreds of tons of subsequently bunkered fuel.

Cleaning in service

It is likely that most vessels will need to clean their fuel tanks whilst in service.

- Firstly, the tank should be emptied as much as possible using the fuel oil transfer pump. This gets the most use of the fuel and minimises waste – therefore reducing cleaning time and removal costs.
- Take advantage of the crew's vessel-specific knowledge of suction bell-mouth locations and the optimal trim/list for emptying the tanks.
- It is difficult to accurately estimate how long it will take to clean a tank. It depends on:
  - number of persons
  - size of tank
  - number of frames and longitudinals within the tank
  - current cleanliness
  - quantity of old fuel residue
  - ease of access to and from the tank
- IMO guidance suggests allowing four days per tank but in reality this could be longer. A shore riding squad that are dedicated to tank cleaning may take half this time, especially if they are working shifts.
- Consider inviting Class to carry out tank inspections during cleaning, but in any event we would suggest that an assessment of the tank condition is carried out and recorded. Check the condition of tank coatings and take advantage of the opportunity to carry out maintenance and any required repairs, e.g. heating coils.
- Flushing of fuel transfer and service system must be carried out after the tank cleaning. Failing to do so could result in contamination of subsequently bunkered compliant fuel.
- Be aware of the risk of sludge or other residue that has been dislodged finding its way into the service system. Closely monitor fuel supply and filter differential pressures after flushing.

Fuel tank and system cleaning using specialised additives

An alternative to manual tank cleaning is to dose the fuel with additives that gradually remove the sediments and asphaltenic sludge from fuel tanks and fuel system.

The two main types are 'dispersants' and 'stabilisers'.

Dispersants work to break up sludge, whereas stabilisers work to keep asphaltenes in suspension and stable within the fuel. If a neat dispersant is used, it will break up the sludge, but used without a stabiliser it will dislodge the sludge from one area within the fuel system to another.

It is important to speak to the additive manufacturer and make sure you fully understand the chemistry on offer and how it can be used in your fuel system.

An example of this cleaning additive is Innospec's Octamar BT series (there are others on the market), which contains an asphaltene dispersant stabiliser. Additive manufacturers usually recommend that a gradual clean-up is conducted over several bunkers prior to the change in tank allocation. It may be possible to reduce the time taken, depending on how long it has been since tanks were last cleaned as well the level of sludge build-up.

Additives are introduced directly in to the fuel storage tanks and as the fuel is used, it cleans the full fuel system, including settling and service tanks.

Care must be taken – the action of the dispersant can lead to increased levels of sludge and sediments in the fuel service system. During this process, the vessel's engineers should closely monitor the operation of centrifugal separators and filters for any issues or deterioration in performance.

Where the time for cleaning is for shipowners' account, then using these additives in lieu of manual tank cleaning can reduce the time the vessel is off-hire. The cost of additives is generally around US$1 per treated ton of fuel, so it may be a commercial decision when comparing with the impact of manual tank cleaning.

Plan the Switch (cont.)

Changeover procedures

There are notable risks when changing between different types of fuels. The nature and frequency of changeovers will depend on the choice of fuel and trading pattern.

For vessels that will turn to VLSFO products, there will be the big switch over from using high sulphur heavy fuel to the new compliant fuel. This will be followed by periodical changeovers between 0.50%S and 0.10%S fuels as the vessel operates in emission control areas.

Do it Safe, Do it Right

In any of these scenarios, changeovers must be properly planned and executed so not to put the vessel and its crew in danger and to avoid contaminating otherwise compliant fuel.

If the changeover is not carried out correctly or there are problems with the fuel at the engine manifold then there is a significant risk of losing electrical power or propulsion.

Contaminating fuel can prove costly. Not only will it potentially leave the vessel in breach of emission regulations, but it could devalue the fuel significantly. It might also result in the need to debunker and carry out further cleaning, which will result in increased costs and time. It is likely that the sulphur content of VLSFO products will be close to the 0.50% limit, therefore leaving little margin for error. A little contamination could render a lot of fuel non-compliant.

Establish and document fuel change-over procedures to cover all scenarios. Consider the following:

- How to control the rate of temperature change when changing between fuels
- Ensure fuel oil spill returns from engines and other equipment are properly routed to avoid contamination of tanks.
- Changeover procedures must be workable and practical.
- Carry out compatibility tests on the different fuels on board before use.
- If possible, carry out the changeover operations away from busy traffic areas and coastal areas.

Crew should receive training and instruction on the fuel change-over procedure and ensure that they fully understand the process and consequences of getting it wrong. Fuel changeover calculators are readily available and will assist in ensuring the right timing of the changeover. Correct use should mean that the vessel is burning compliant fuel before entering the emission control area (or before the new sulphur cap enters into force).

Ensure the time and vessel position is properly recorded and documented for each changeover. These documents come under close scrutiny from Port State Control officials if they suspect non-compliance.

Machinery

Modifications on board the vessel are not restricted to the fuel systems. When using fuel with lower sulphur content, consider the following:

- Consult the lubricating oil suppliers to ensure the correct grade cylinder oil with suitable base number (BN) is available on board prior to the changeover to lower sulphur fuel. Check also that there are no compatibility issues or cylinder oil tank cleaning requirements.
- The feed rate should be adjusted in accordance with the BN of cylinder oil and sulphur content of the fuel. Incorrect feed rate may lead to liner and piston ring wear. See: **www.nepia.com/insights/signals-online/ships/engine-room-operations/main-engine-breakdown-and-cargo-claims**
- Consult main and auxiliary engine manufacturers about the following:
  - The impact of prolonged running on distillate fuels with low sulphur content. Some manufacturers recommend cermet coated piston rings with a harder coating to prevent liner scuffing caused by bore polished liner surfaces.
  - The use of the specific type of VLSFO to ensure there are no operational concerns.
- Review the operational set-up of centrifugal separators (purifier/clarifier). There may be a need to adjust heating, feed rate and gravity disc sizes.
- Monitor centrifugal separator desludge and fuel filter blowdown frequency – these could provide an early alert of a fuel quality problem.

Consult vessel's Flag State or Class on whether the fuel tanks for the vessel's emergency generator, emergency compressor and lifeboat engines need to be replaced with compliant fuel. If so, cleaning and flushing may be required to ensure compliance.

Contingency Planning

There may be times when compliance cannot be achieved. Compliant fuel may not be available in a particular geographical area. It is therefore important to think about contingencies.

Fuel Oil Non-availability

A commonly asked question is what happens if compliant fuel is not available.

There are already existing provisions in MARPOL Annex VI Regulation 18 dealing with this. The shipowner must first notify the vessel's Flag State and the competent authority of the next port of call. They must then evidence reasonable efforts were made to acquire compliant fuel but without the need to deviate from the intended voyage.

FONAR

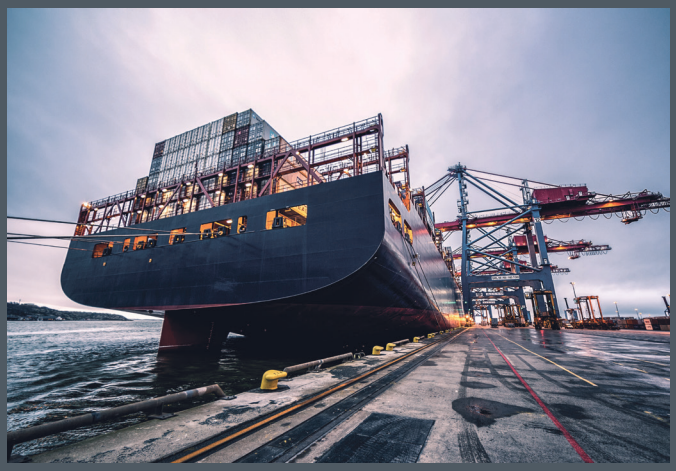
IMO is expected to release details of a fuel oil non-availability reporting (FONAR) system at MEPC 74 in May 2019.

A similar system is already in place for the US ECA and mitigates the penalties for non-compliance. This is not a waiver and the US authorities closely monitor any owner who submits FONAR reports on multiple occasions.

At this time it is not unreasonable to consider that an IMO FONAR would be based on similar principles – with a focus on achieving maximum compliance rather than facilitating easy exemptions.

How a Port State requires a vessel to achieve compliance upon arrival is less certain. If a vessel arrives with non-compliant fuel due to lack of availability, the local authorities are likely to impose the need to bunker compliant fuel as soon as practically possible. It is not clear if the authorities will require de-bunkering of any remaining non-compliant fuel before allowing a vessel to sail, although such fuel will need to be debunkered at some point since it will not be possible to use once compliant fuel has become available.

It is likely that FONAR reports should be filed with Flag and the PSC (Port State Control) or relevant Port Authority, of the next port of call **in advance** of arrival or as soon as the non-compliance situation is known.



Information will most likely need to be given about why the vessel cannot comply and what steps have been taken or will be taken to try and remedy the situation. If the notice concerns non-availability of compliant fuel then it is likely that cooperation will be required from the time charterer to allow the shipowner to provide the required information. It may be sensible to include provisions in time charterparties to deal with such situations.

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Enforcement

Broadly speaking, the signatory countries to MARPOL Annex VI are free to decide how they enforce the regulation and how non-compliance will be penalised.

A Consistent Approach?

It is hoped that at the forthcoming MEPC.74 (May 2019), guidance will be provided to Port States on enforcement. This should allow for a consistent approach on how Port State Control Officers check for compliance including when and how samples are drawn for testing for sulphur content.

Testing is currently another grey area – in particular the allowable tolerances in test results. The widely-used standard for marine fuels ISO 8217 refers to ISO 4259 which provides details on single test criteria. It states that a single test result will be considered within specification if it is not more than 0.59 x R (reproducibility factor) outside the limit. This provides a 95% confidence in a single test result. As such, the maximum allowable limit (when accounting for single test criteria) is 0.53% for a 0.50% limit and 0.11% for a 0.10% limit.

It is not yet clear if this tolerance will be applied to sulphur content testing in accordance with MARPOL Annex VI. There remains a risk that a test result that is even fractionally above the limit will be considered non compliant. It is, however, expected that MEPC.74 will provide clarity on this.

Penalties

How non-compliance is dealt with will be wholly dependent on the jurisdiction. The usual methods include vessel detention (with the threat of banning orders for repeat offenders) and financial penalties.

The level of financial penalty is likely to vary significantly across the globe and may escalate with repeated violations.

Charterparty Protection

Whether it will be shipowners or charterers who are liable for the time, costs, fines and other losses associated with non-compliance will depend on the facts of the case and the terms of the charterparty.

While a shipowner may be liable in the first instance, they will usually seek to pass such costs on to the charterer. The shipowner may also seek an indemnity where it is the charterer's obilgation to provide and pay for fuel under the charter and non-compliant fuel has been provided but a charterer will not be liable for non-compliance due to inadequate cleaning by the shipowner.

The use of the BIMCO quality and BIMCO 2020 sulphur content clauses are recommended for use in all charterparties. As there is the potential for an increase in bunker quality claims, Members may wish to refer to our guide 'Marine Fuels: Preventing Claims and Disputes' for information on how to try to avoid such claims and, where they can't be avoided, on how to deal with them.

Transition Clause

More importantly, a suitable transition clause is highly recommended as part of the transition preparations.

It will be very important to ensure that the technical objectives of the transition plan are reflected in the charterparty to allow for a smooth transition.

Both BIMCO and Intertanko have produced transition clauses, as has North. For more information, please approach your usual North contact.

Finally, it is possible that new fuels will affect the performance of the vessel so it might be necessary to review and amend charterparty performance warranties accordingly.

Learning From The Past

Previous reductions in fuel sulphur content in 2010 and 2015 saw numerous incidents relating to non-compliance. These led to outcomes such as vessel detentions and financial penalties levied by the Port State as well as commercial disputes between shipowners and charterers.

It's important that these valuable lessons aren't forgotten as we approach 2020. Typical circumstances included:

- Insufficient tank and system cleaning leading to contamination of fuel tanks and lines by residues of waste oil or sludge.
- The fuel system was incorrectly set up, resulting in fuel taken from the wrong tank.
- Fuel isolation or cross-connection valves left open or passing that allowed high sulphur fuel to contaminate low sulphur fuel.
- Change over from high sulphur to low sulphur fuel was not carried out early enough in advance of vessel arriving in an emission control area.
- Engine spill returns directed back to the low sulphur service tank when high sulphur fuel remained in the system – either through a failure to change over the spill returns or changing over the returns too soon.
- The sulphur content of the fuel supplied was already above that as declared on the bunker delivery note (BDN).

North: Helping Our Members Trade with Confidence

North has published further information and guidance on the 2020 sulphur cap:

- North's dedicated Insights area on 2020: **www.nepia.com/insights/2020-vision**
- Signals Newsletter Special on 2020: **www.nepia.com/media/927346/North-Signals-Issue-112-June-2018-Online.pdf**
- North's loss prevention guide 'Marine Fuels: Preventing Claims and Disputes'

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- Damien Valdenaire – Concawe: **www.concawe.eu**
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