



An IMarEST information paper on the introduction of the fuel oil 0.50% m/m sulphur limit under regulation 14.1.3 of MARPOL Annex VI

The purpose of this information paper is to provide an overview of the upcoming change in the fuel oil sulphur limit to 0.50% m/m and to address some commonly asked questions.

Regulatory situation

Regulation 14.3.1 of MARPOL Annex VI sets a 0.50% max limit of the sulphur content in respect of all fuel oils used by any type of combustion machinery outside Emission Control Areas (ECA-SOx) from 1 January 2020, down from 3.50% m/m currently. In emission control areas (ECAs) the limit remains, as it has been since 1 January 2015, 0.10% m/m.

When agreed in 2008, provisions were included to consider 0.50% max sulphur fuel oil availability and the feasibility of the introduction of such limit no later than 2018. A key element of that review was a study commissioned by the International Maritime Organization (IMO) and led by CE Delft into the expected availability of 0.50% max sulphur fuel oil by year 2020. The IMarEST was represented on the Steering Committee of this study.

The study concluded:

'The analysis demonstrates that in all cases, as well as in a number of sensitivity scenarios, the refinery sector can produce sufficient amounts of maritime fuels with a sulphur content of 0.50% m/m or less to meet demand, while at the same time producing fuels for other sectors of the required quality. The maximum amount of compliant fuels that the global refinery industry can produce is 24% above the demand projected in the base case and 2% above the demand projected in the high case.'

In a sentence, it was concluded that sufficient amounts of fuel could be produced, however the study did highlight some potential difficulty for the refining industry to meet the change and required investments. Subsequent discussion of the study at IMO revealed concerns regarding significant regional/local variation

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in fuel oil availability and fuel oil quality and safety in addition to overall fuel availability (i.e. also described by the EnSys report submitted at MEPC 70). Nevertheless the majority outcome at IMO was that the information available justified the retention of 1 January 2020 as the start date of the 0.50% limit on fuel sulphur content, whilst acknowledging the fact that there would inevitably be transitional issues which would need to be worked through. IMO Resolution MEPC.280 (70) confirms that the fuel oil standard in regulation 14.1.3 of MARPOL Annex VI shall become effective on 1 January 2020.

Is it a 0.50% max sulphur cap?

In many instances, this 0.50% max sulphur requirement is mistakenly referred to as a 'Global Cap'. A cap would imply that the only means of compliance is via 'capping' the sulphur content of the bunker fuel. This is incorrect as under regulation 4 equivalent alternative means are allowed provided that they are at least as effective in terms of emissions reductions. The use of Exhaust Gas Cleaning Systems (EGCS) – whereby the exhaust gas is washed before release to the atmosphere – is allowed provided that remaining SO₂ content is no higher than would have been produced burning a 0.50% max sulphur fuel oil. Consequently it is permissible that fuel oils with sulphur content in excess of 0.50% as given in regulation 14 may be supplied – hence there is no 'Global Cap' only a 'limit applicable outside SO_x Emissions Control Areas'.

Could there yet be a revision to regulation 14.1.3 in respect of either its scope of application or start date?

No, due to the length of time built into the MARPOL revision process, there will be no changes to regulation 14.3.1 before the set 1 January 2020 implementation date.

The amendment process defined by the MAPROL Convention is effected through tacit acceptance whereby when an amendment is approved at an MEPC meeting, this needs to be circulated to the member States for their information and if the member States are in agreement, it is then adopted at the next MEPC meeting. Thereafter, the member States have a 10 month period during which they may raise objections to the adopted text. If no objections are raised, it will be deemed to have been accepted and will subsequently enter into force six months later. So even if an amendment were presented at the 72nd session of MEPC in April 2018, and adopted during the 73rd session of MEPC in October 2018, it would take effect on 1 March 2020 well after 1 January 2020. In addition, there is nothing in the MEPC 72 agenda that proposes any postponement.

However, there are expected to be guidelines developed by IMO to enable a consistent implementation of the regulation.

What are the routes to compliance?

The main routes to compliance are:

- Switch to low sulphur liquid fuel oils (sulphur controlled residual or distillate fuel oils);
- Use approved alternative means to remove sulphur from fuel on board ship or remove SO_x from exhaust;
- Use an alternative fuel oil type which meets the required sulphur limit (i.e. LNG, biofuels, hydrogen, methanol, etc.).

It is expected that most ships will switch to a low sulphur liquid fuel oil despite concerns regarding fuel quality (incompatibility between different deliveries resulting in instability, suitability for engine) and higher costs.

SO_x scrubbers have been installed to meet ECA requirements and thus are proven to work. However, they require significant CAPEX investment, increase operational costs and, dependent upon design (e.g. inclusion of equipment to clean the contaminated wash water/means of disposal of any resultant sludge) may have an environmental impact in addition to overall increased complexity. The commercial attractiveness of SO_x scrubbers will depend on the fuel cost differential.

LNG as a fuel can provide additional benefits in addition to SO_x emissions reduction (reduction of NO_x, PM, black carbon and GHG emissions), however limited bunkering infrastructure, high CAPEX and uncertainty in the LNG/low sulphur fuel oil cost differential is currently limiting uptake.

Use of biofuels may be possible, but requires a number of issues to be addressed. Availability and pricing also currently limit uptake. Further information is contained in the IMarEST paper MEPC 70/7/2 submitted to IMO.

0.50% max sulphur fuel oils

Under MARPOL Annex VI the original outside ECA-SO_x limit was 4.50%. In 2012, this limit was decreased to 3.50%. This affected about 10-15% of fuel oil deliveries but was resolved by such simple expedients as slightly increasing the light blend ratio. In contrast, the decrease to 0.50% by year 2020 will displace by tonnage around 98% of residual fuel deliveries for which the average sulphur content is currently around 2.6% based on the IMO's 2016 fuel data (MEPC 71/5/1).

Distillate fuels would generally readily meet the 0.50% max sulphur limit although it is possible that some uncontrolled distillates could have sulphur contents in excess of 1.00%. The reality, however, is that worldwide demand and associated regulatory requirements ensure that 0.50% sulphur is a commonly applied limit. Despite all the debate on the topic, the fact remains that fuel oil still has to be

delivered/supplied. It will not be known until after 2020 how the shipping industry's switch to 0.50% max sulphur fuel oils will affect demand for such fuels overall and the possible impact this will have on price differentials.

In terms of residual based fuel oils, currently (IMO 2016 data) around only 2% by tonnage meets that 0.50% max sulphur limit. Recognising the limited current demand for such fuel oils, which is mostly produced from certain (i.e. S America) low sulphur crudes, there is potentially some scope for increase but it would be limited as naturally occurring sulphur crude itself is limited. The major source will need to be via reworked processes within the refinery systems and it is expected that initially these would include a number of stop-gap measures but that over time there would be a gradual increase in sophistication as means such as coking and dedicated de-sulphurisation become the new norm. However, a cause for concern is that such fuel oils may well lack the general and specific batch uniformity to which the industry has become accustomed. One of the paradoxes of the anticipated move to the wider use of SOx scrubbers is that this could act as a disincentive to costly refinery upgrades.

Additionally, as in the case of meeting the 0.10% max sulphur ECA-SOx fuel oil limit, it is expected that hybrid type fuels will appear – these may be limited only to certain ports areas and differ significantly worldwide. Such fuels are typically off-takes from refinery systems (a form of de-bottlenecking) and therefore specific to that refinery, and even the crude streams being run and the season.

Hence, whereas to date any ship using say IFO 380 could expect broadly the same fuel viscosity, density, carbon residue etc. on delivery to delivery around the world, post 2020 this will no longer be the case. Fuel oils will potentially vary greatly in terms of composition, physical and performance characteristics and questions will be raised about the actual meaning of fuel oil quality under these circumstances.

The only certainty amid this uncertainty is that these 0.50% max sulphur fuel oils will be trimmed to that specification limit in a similar way to what currently happens for the 0.10% max sulphur fuel oils. Hence, all 0.50% max sulphur content fuel oils will be produced to that value – with delivery values in the range of 0.45-0.50% being expected.

Fuel oil suppliers

In the discussions on this topic, an often neglected point is the impact on the physical suppliers responsible for delivering fuel oil to ships.

Any transitional arrangements end 31 December 2019. Therefore, no marine fuel oil supplier, unless they have an assured outlet to ships fitted with SOx scrubbers, will want to be left with what, post 1 January 2020, will be unsellable stock. Their changeover will involve extensive and thorough tank, pipeline and barge clean-outs given the expected closeness of producing to the limit. Furthermore, once systems and delivery means have been changed over, they will not be readily or willingly reversed.

In the months leading up to the 1 January 2020, it is worth bearing in mind potential shortages of 3.50% max sulphur fuel oil. Ship owners / charterers will have little option but to take delivery of 0.50% max sulphur fuel oil and accept the associated cost differential.

In terms of fuel oil availability, paradoxically the most affected users could turn out to be those with SOx scrubbers. High, above 0.50%, sulphur fuel oils will not be available at all ports where currently supplied. Where suppliers do not see a sufficient market, the necessary facilities for holding residual fuel oils such as tank / line heating and dedicated delivery barges will not be retained.

Ship issues

These may be divided into four topics:

- 1. Change-over**
- 2. Availability**
- 3. Storage**
- 4. Use**

Change-over

The question is at which point prior to the 1 January 2020 implementation date ship owners will start the change-over process. This will most certainly be a multi-stage activity and it will take some time to work the existing fuel oils out of the system and clean up where necessary, therefore it cannot be left to the last moment. Currently, the date of 1 January 2020 applies irrespective of whether a ship is in port, just started a voyage or is near to completing a voyage on that date. It is unclear if IMO will urge Administrations to take a 'soft' touch and demonstrate leniency in such cases. The situation will be less complicated in cases where the ship owner is also the fuel oil purchaser. Where the fuel oil purchaser is the charterer, negotiation may be required. How many ship owners will have a change-over plan in place in a timely manner?

Availability

The change-over cannot be undertaken until the issue of availability is solved. The fact that the required fuel oil is produced does not necessarily ensure that it will be available at all bunkering ports in the quantities required. Annex VI regulation 18.2 specifies the necessary actions to be taken by ship owners in instances where the required fuel oil is not available including notification to the flag State and responsible authority in the port, which are then required to notify IMO.

One element to consider is those cases where 0.10% max sulphur fuel oil is available but not 0.50% max sulphur fuel oil. Will purchasers be expected to nevertheless take the more expensive option? One precedent is when the ECA-SOx fuel oil sulphur limit was 1.00% and could typically be met by using

sulphur controlled residual fuel oils. The US EPA for example did not require distillate to be purchased where such residual fuel oil was not available.

Storage

While it has long been recognised that the best practice is to maintain different bunker deliveries separately, many ships are still provided with only a limited number of bunker tanks. If this point was important before it will be vital following the introduction of the 0.50% max sulphur fuel oils limit as it is expected that these fuel oils will range from distillates through all permutations of intermediates to full residuals which should not be mixed and hence a need to avoid intermixing.

Apart from compatibility issues, it is possible that 0.50% max sulphur fuel oils will be produced close to the limit with the associated risk that when differing fuels are mixed, the incoming fuel oil (if even marginally above the 0.50% limit) would degrade any previously compliant fuel oil remaining in a tank to the point that the overall mix was above that limit value. While ship owners and charterers may be able to successfully claim in respect of miss sold (over limit) fuel oil loaded, it will be a different matter to obtain recompense for the degradation of fuel oils that have been contaminated by over-limit fuel oil.

Use

The expected wide variations in composition, physical and performance characteristics will create substantial fuel oil management issues. The 3.50% to 0.50% change will impact all those areas of the world (outside ECA-SOx) which, to date, have not been exposed to these change-over problems from the previously conventional residual fuel oils (ie IFO 180 / IFO 380).

As in the case of the 0.10% max sulphur fuel oils, it is expected that many ships will experience problems with what can be considered fully acceptable fuel oils. The majority of 0.50% max sulphur fuel oils will have lower viscosities than the residual fuels used to date. The outcome will be that where fuel injection systems had been capable of sealing and generating the required pressures with those higher viscosity fuels, this will not necessarily be the case where the pumps and injectors are worn and clearances have duly increased. In those instances, engines would encounter loss of power and responsiveness even to the point of failure to restart.

Overall this change-over to 0.50% max sulphur fuel oils will be extremely challenging for all parties and problems are anticipated. However, these problems would be the same had the date for regulation 14.1.3 of MARPOL Annex VI to become effective been 2025 instead of 2020. To minimise the impact of the change-over, marine engineers should give full consideration to the ramifications on ship operation and, as much as possible, prepare a plan of action ahead of the implementation date.