

Sulphur emissions: The outstanding challenges

The International Maritime Organization (IMO) has been working to reduce the harmful impacts of shipping on the environment.

It adopted Annex VI (Regulations for the Prevention of Air Pollution from Ships) to the International Convention for the Prevention of Pollution from Ships (MARPOL Convention) in 1997. Regulation 14 therein covers emissions of sulphur oxides (SO_x) and particulate matter from ships.

The IMO has been setting progressively stricter limits on the sulphur content of fuel oils used by ships. Last year, it adopted a 2008 resolution that introduces a reduced global sulphur cap on marine fuels. The current global limit of 3.5% mass/mass (m/m) shall decrease to 0.5% m/m from 1 January 2020. The 0.1% m/m limit in Emission Control Areas (ECAs) such as the Baltic Sea area, the North Sea area, the North American area, introduced on 1 January 2015, remains unaffected.

While the new regulation has been welcomed by all, there are challenges in ensuring its compliance and enforcement. These challenges will be discussed below.

The challenges

Will there be sufficient affordable low-sulphur fuel oil (LSFO)?

With 1 January 2020 less than two and a half years away, there is a real concern over whether sufficient LSFO will be available to enable compliance.

Improving hydrocracking technology in refineries is leading to higher productions of LSFO. Sulphur from residual fuels can also be processed away using hydroconversion or hydrosulfurization technology, and low sulphur distillates can be blended with high sulphur residuals to create heavy fuel oil with sulphur contents of 0.5%

or less. So, it seems likely that sufficient compliant fuel will be available. Blended LSFOs will, however, bring challenges of their own in the form of catalytic fines and other impurities.

Increasing demands for 0.5% m/m fuel is anticipated to drive its price up to 50% higher than the cost of residual fuel, bringing with it challenges for closing loopholes for non-compliance.

Scrubbers

One method to meet the legal requirements of MARPOL without the use of low sulphur fuel is installing exhaust gas cleaning systems known as “scrubbers”. There are two general types of scrubbers: wet scrubbers and dry scrubbers. Wet scrubbers spray alkaline water into a vessel’s exhaust to remove sulphur before it is released into the atmosphere, whereas dry scrubbers expose dry reagents to the exhaust stream to create a chemical reaction that removes the sulphur from the gas.

The benefit of installing scrubbers is that ships may continue to use cheaper high sulphur fuels. The up-front cost of the scrubber (US\$1.5m to US\$2m), retrofitting costs, potential loss of cargo

space on board, shipyard capacity to meet installation demands and training of crew to maintain the scrubbers are, however, challenges for the shipowner. The estimated payback time for a scrubber is 2 to 4 years but this is assuming the fuel prices prognoses are correct.

Only scrubbers fitted with continuous emission monitoring equipment are acceptable. In the United States, scrubbers are permitted but the ship must at all times still continue to comply with requirements and prohibitions in regards to water pollution. Germany and Belgium have also mandated for closed loop scrubbers in some of their ports and parts of their territorial waters. In closed loop scrubbers, the washwater is treated to restore its alkalinity after it leaves the scrubber, and then recirculated in the system. Little or no water from the scrubbing process is discharged overboard. The German green lobby group Nabu has claimed that discharge from scrubbers can have a significant impact on the marine environment.

Accordingly, whilst scrubbers are generally effective for removing SO_x from the gas exhaust, there are a number of considerations shipowners



need to bear in mind when deciding whether or not to have scrubbers fitted.

Alternative fuels - LNG and Methanol

LNG, when used as a fuel, significantly reduces the emission of SO_x. It was traditionally used as a fuel onboard LNG ships only but is now also used in other trades such as short sea shipping. LNG's use as a fuel has been recognised by the IMO in the development of the International Code for Ships Using Gases and other Low Flashpoint Fuels (the IGF Code), adopted in 2015. Other recent regulations include ISO 20519 (2017) which standardises LNG bunkering operations internationally.

Methanol is a clean burning alcohol, and emissions of SO_x and particulate matter from its combustion are low. Methanol is transported in chemical product tankers at atmospheric temperature and pressure, and stored in tanks similar to those used for gasoline. It can be produced from a wide range of feedstocks including natural gas, coal and renewables.

There are, however, several challenges facing the success of these fuels as genuine alternatives to high-sulphur content fuel. LNG's use as a fuel is constrained by the cost of retrofitting propulsion units capable of burning gas and by the lack of port infrastructure to handle bunkering. An LNG bunker barge costs between 5 and 10 times a liquid fuel barge. The biggest challenge for using LNG as a fuel, however, is methane slippage due to the incomplete combustion of the methane in the engine. The global warming potential of methane is 25 times higher than CO₂; consequently, the release of even small volumes of methane can easily negate the CO₂ reduction benefits of using LNG as a marine fuel.

The energy density of LNG and methanol is also far lower than for petroleum, which means higher volumetric quantities are needed to propel a ship a given distance than with traditional petroleum fuel. Ships will therefore need to have larger fuel tanks (2.5 times larger in the case of LNG)

which in practice means reducing its cargo carrying capacity.

Commercial disputes and criminal penalties

Potential disputes under charter party contracts in regards to compliance with fuel emission regulations are foreseeable. Issues that may arise include whether the ship had been "fitted for the service" if she is not able to burn compliant low sulphur fuel, which party is liable to pay for deviations to take on compliant fuel, off-spec bunkers, difficulties in managing and segregating different fuels onboard to avoid contamination, delays, detention of the ship and even criminal penalties.

Owners and charterers are strongly advised to bear in mind the potential issues above and to pay attention to costs and risks allocation clauses when negotiating their charter parties.

Sanctions

Member States to MARPOL (Flag States and Port States) are to implement the new regulation through the introduction of "effective, proportionate and dissuasive" penalties. Most violations are likely to be met by fines, which in the absence of any harmonisation of sanctions framework, can vary in severity from jurisdiction to jurisdiction.

Due to the economic benefits of non-compliance, it is likely that fines will be set at up to ten times the economic benefit for a year's operation. Therefore, fines in the region of US\$10m to US\$50m per ship can reasonably be expected.

Penalties in the US are even more severe. In addition to the imposition of fines, the US Coast Guard (USCG) has the power to seize ships in breach of sulphur regulations, and the Environmental Pollution Agency (EPA) may impose fines of US\$25,000 per day for the duration of the violation. The PSC, in contrast, has no power to detain ships for non-compliance.

Methods of enforcement

The IMO has made efforts to upgrade

global enforcement of the regulations. In January, the IMO's sub-committee on Pollution Prevention and Response (PPR) prepared a list of enforcement considerations in order to achieve the environmental benefits sought through Regulation 14. Amongst its recommendations, the committee suggested that the industry considers a draft standard format for reporting fuel oil, and develop guidance that may assist Member States and stakeholders in assessing the sulphur content of fuel oil delivered for use on board ships.

Some countries have developed the use of sniffers as a method for enforcing the sulphur cap. Sniffers are sensory systems that detect the levels of sulphur that are emitted from a given ship's exhaust gas. In Denmark, for example, a sniffer has been installed underneath the Great Belt Bridge, and sniffers have also been attached to light aircrafts and drones.

Localised sulphur regimes are also in force in various jurisdictions including China, Hong Kong, Australia, Turkey and California, and ships trading to these jurisdictions should be aware of the specific rules and regulations applicable in these regimes.

Enforcement methods are becoming more sophisticated but if the ultimate goal is to make ships switch to LSFO completely, the question of whether it is the Flag or Port States that will be responsible for enforcing the sulphur cap in international waters must be settled.

Conclusion

Air pollution from maritime transport is a global environmental concern. The need to control the emission of SO_x in shipping through regulations is acknowledged but as highlighted above, challenges for compliance and enforcement remain. It is hoped that some of these challenges can be addressed before the new global cap comes into force in 2020. ■

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