

Technical eNewsletter

Change-over to low sulphur fuel – a practical example to consider

From feedback recently received from one of our surveyors, we give an example of a change-over from high sulphur to low sulphur fuel operation that did not work as intended.

More stringent requirements for low sulphur fuel (LSF) operation came into force on 1 January 2010 (EU ports) and the requirements concerning operation in European and Californian waters will stepwise become stricter. The Revised MARPOL Annex VI including maximum sulphur limit requirements (1.00% by mass) for Emission Control Area entered into force on 1 July 2010.

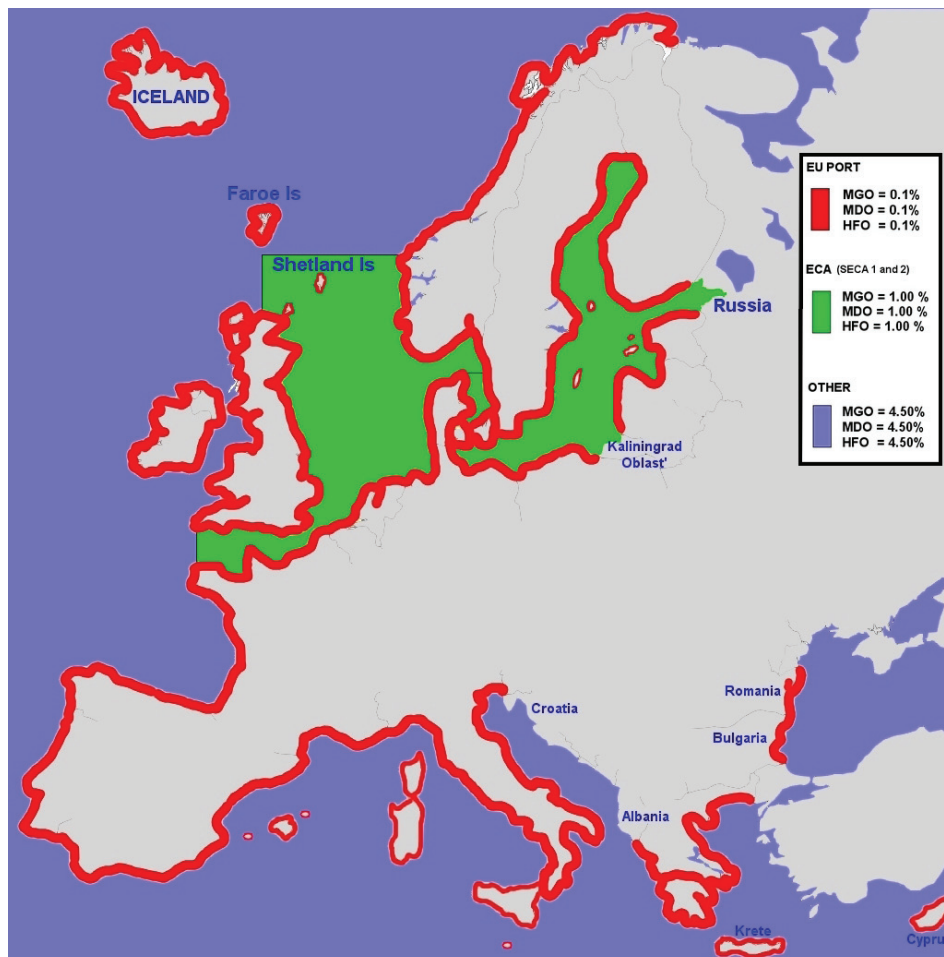
The amending directive 2005/33/EC, which requires a max sulphur content of fuel in use of 0.1% at berth in EU ports, entered into force on 1 January 2010. We may therefore expect an increased focus on sulphur content of fuel in use, from Port State Control (PSC) officers and harbour authorities in EU, during this autumn and onwards.

The situation described by the surveyor was the following:

During surveys by DNV for the issuance of statements in connection with change-over from MGO to low sulphur MGO while entering/operating in EU/CARBS areas, it was found that when the actual fuel in use was tested, the sulphur content exceeded the statutory maximum sulphur limit, even though the Master and officers in charge were under the impression that the fuel change-over had been completed satisfactorily.

In discussions with the client, their preliminary investigation revealed the following:

1. *The sulphur content of the previous oil in use was 1.00%.*
2. *The vessel was trading in a SOx Emission Control Area at the time.*
3. *There was previous contamination in MGO (Marine Gas Oil) tanks and tanks were not cleaned prior to bunkering LSMGO.*
4. *The fuel was mixed in the tank (with probably too large a volume of mixing) and there had been poor flushing of lines prior to starting mixing.*
5. *The change-over was based on a pure volume exchange and no mixing volume based on the consumption rate/sulphur content differential had been considered. They believe it is difficult to estimate the volume of deposits on the piping walls and how fast this coating releases sulphur.*
6. *Some of the fuel was actually slightly off specification. This was discovered after testing by DNV Petroleum Services (DNVPS).*



Possible explanation

When dealing with change-over procedures, it is imperative to realise that many fuel supply systems are closed-loop systems in which the fuel is continuously circulated.

When changing over from HFO (Heavy Fuel Oil) service tanks to LSF service tanks, there will be no immediate change of supply to the consumers (engines, boilers), only a dilution of the fuel circulating in the supply system.

Consequently, the change-over time will be governed by the fuel oil consumption. Due to the relatively large quantities of fuel circulating, the time needed to complete the change-over can be relatively long. With only the main engine running, the blending-in ratio may be in the region of 1% per two minutes, and with only one auxiliary boiler or one auxiliary engine in operation the ratio can be much lower.

Experience has shown that in some cases fuel change-over is not complete even after 48 hours. As a result, the sulphur content of the fuel consumed may be in excess of the applicable sulphur content limits.

Furthermore, but maybe not illustrated in the case discussed, time should be allowed to maintain the temperature gradient recommended by the engine manufacturer, e.g. 2°C/minute, in a controlled manner. This will in many cases be necessary in order to avoid a thermal shock to the system, e.g. seizure of fuel injection pumps, and/or other operational problems that may occur due to low viscosity and/or rapid temperature changes.

Lessons learned

In this case, the surveyor suggested taking a sample of the LSMGO by the boiler's burner inlet, which showed a sulphur content of 0.22% rather than the 0.08% stated in the BDN (Bunker Delivery Note) for the LSMGO. This indicated contamination

(mixing) in the MGO tanks and/or an insufficient change-over time.

The contamination detail of compliant low sulphur MGO is important and interesting. A little mixing with HFO or MGO (with higher sulphur content) can affect the entire operation leading to non-compliant fuel in use.

It is highly recommended that sufficient time be allowed for the fuel change-over before entering an area in which limitations to the sulphur content apply.

This can be verified by testing fuel quality vs. time during change-over. Depending on outcome it may be necessary to install/retrofit separate service tanks and pipelines for HFO and MGO to auxiliary engines and boilers to achieve a satisfactory change-over time and result.

In the case discussed some of the low sulphur MGO was delivered with sulphur content exceeding 0.10% when tested by DNV Petroleum Services. One should be aware of that some European Union Member States may conclude that a tested sulphur result between 0.11% and 0.14% is above the maximum 0.1% by mass (one decimal) limit stipulated in EU Directive 2005/33/EC.

During an audit to verify that the safety management system effectively ensures compliance with rules and regulations, an ISM Code auditor will normally focus on any new relevant regulations entering into force. The choice of which regulations to verify will be at the auditor's discretion. ISM verification in relation to MARPOL Annex VI and Sulphur Emission Control Areas (SECAs) is relevant for several of the ISM Code requirements.

The fuel change-over procedure is the operational responsibility of the owner and the DNV surveyor is not normally involved in any verification of such a procedure (in the case discussed above, DNV issued an independent statement of witnessing at the owner's request).

Recent PSC detentions

In the last week of August, two vessels were detained in a European port due to too high sulphur contents in the fuel. For one of the vessels, fuel samples were taken from circulating fuel line of main engine at the booster pump, showing a sulphur content of 1,68%. Most probably this vessel was following an "old" change-over procedure, that did not account for the max 1,00% sulphur contents requirements, applicable in ECA from 1 July 2010. This was considered evidence that the environmental protection policy of the company is not fully implemented and the vessel was requested to update the change-over procedure before departure. The other vessel had 1,17% measured in the daytank even if the bunker delivery note stated 0,95%.

The analysis of the sulphur contents is usually done in an independent laboratory and takes about one hour to perform. However, it is understood that one normally gets an answer the day after (24h), due to practical arrangements (transport of samples etc.). We are not aware of any "hand-held" analysis-kit that is used directly on board.

Support and references

DNV Petroleum Services can assist in developing and documenting ship-specific change-over procedures in order to demonstrate compliance with regulation 14 of MARPOL Annex VI. See www.dnv.com

The 32-page DNV booklet "MARPOL Annex VI - Technical and Operational Implications" addresses SOx emissions in one of the chapters. See www.dnv.com

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