The Governance of Ships' Sulphur Emissions: Issues of Enforcement and Equal Treatment

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Abstract

Uncontrolled emissions from international shipping have been the single most important contributor to 'acid rain' in Northern Europe and have resulted in an estimated 27,000 premature deaths per annum (including deaths of retired seafarers) across Europe. Accordingly, progressive controls on sulphur levels in fuel were introduced in the Emission Control Areas of the Baltic (2006), the North Sea/English Channel (2007) and coastal North America in 2012. This paper draws on observational data from 16 Port State Control inspections in the UK and Sweden, 50 semi-structured interviews with international and national regulators, surveyors, fleet managers, industry associations, class societies, port management, bunker suppliers, trade unions, environmental NGOs and other stakeholders, and also on unpublished statistical data relating to laboratory testing of fuel samples. Although it is widely accepted that Port State Control has been a broadly effective instrument for the enforcement of international shipping regulations, at least in the Paris MoU region, enforcement of the new sulphur regulations poses a new critical challenge, since the rewards for non-compliance (in the shape of lower fuel costs) are substantial. Compliance rests in part on the perception that non-compliant competitors will be detected and sanctioned. The paper identifies several current barriers to detection of non-compliance and argues that future effective enforcement may depend on the extension of current limited programmes of fuel sampling and testing.

Introduction

Uncontrolled emissions from international shipping have been the single most important contributor to 'acid rain' in Northern Europe (Mellqvist and Berg, 2010). In a study conducted for the International Maritime Organisation, Corbett et al. (2007) estimated that the fine particulate matter emitted from vessels burning high sulphur fuel was causing 27,000 premature deaths per annum across Europe from pulmonary and other diseases. It should be remembered that, while this fine particulate matter does not fall on the decks of the emitting vessel, seafarers in busy harbours and seaways, such as Rotterdam and the English Channel, are exposed to fine particulate matter emitted by other vessels in the area: retired seafarers are

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likely to be disproportionately represented among those suffering premature deaths as a result of uncontrolled emissions.

IMO regulations on sulphur content in fuel came into force in 2005 and were revised in 2010. The world-wide sulphur cap was initially set at 4.5%, reducing to 3.5% in 2012, with a projected further reduction to 0.5% in 2020. This last 2020 deadline is subject to a planned review and could be postponed until 2025. Additionally, IMO set up Emission Control Areas (ECAs) in the Baltic (from 2006), the North Sea/English Channel (from 2007) and North America (from 2012). Initially, the sulphur limit for the ECAs was set at 1.5%, reducing to 1.0% in 2010, and due to reduce further to 0.1% in 2015. There are also regional, national and local restrictions on sulphur levels. The EU has introduced restrictions on sulphur levels for passenger ships in EU waters and restrictions on the sulphur levels of fuel that can be burned in EU ports and harbours. Sweden's 'fairway dues', charged to cover the costs of ice-breaking and navigation lights, are differentiated to reward vessels continuously using low sulphur fuel, and Swedish ports operate similar environmentally differentiated charges. California also has restrictions on fuel sulphur levels in ports and coastal waters.

It is possible to point to a number of shipping operators that have sought to position themselves in the market-place as environmentally responsible companies. Swedish ferry operators discharge all their toilet waste ashore, although regulations do not oblige them to do so. A number of operators, including BP Shipping and Maersk Line, have joined Forum for the Future and WWF to form the Sustainable Shipping Initiative, whose goals include 'dramatically reducing greenhouse gas intensity' (Sustainable Shipping Initiative, 2011). However, compliance with the IMO and EU environmental regulations on sulphur entails very considerable costs. At the time of writing (April, 2013), the price difference between 3.5% sulphur fuel oil and 0.1% sulphur marine gas oil (distillate) was around $150 per tonne; the price difference between 3.5% sulphur fuel oil and 1% sulphur fuel was around $12 per tonne (in early 2011 this differential leapt to $80 per tonne, following disruption of supplies of low-sulphur Libyan oil). The car carrier operator, Wallenius Wilhelmsen, has chosen to operate a global low-sulphur fuel policy since 2005; the company estimated that, in 2009, this policy cost an additional $2.7 million (Wallenius Wilhelmsen, 2011). Fuel costs are already greater than crewing costs for operators of non-passenger vessels, and the additional costs of complying with the IMO and EU regulations have occurred at a time when operators are facing falling freight rates and operating losses: in early 2012 the Baltic Dry Index, which measures short-term freight rates for the bulk carrier sector, dropped to the lowest point in its

26-year history (Norris, 2012). Thus, the financial incentives to evade compliance with the sulphur regulations are very considerable, dwarfing the potential savings to be made by, say, evading the safe manning regulations. Providing effective enforcement of the sulphur regulations is thus a critical test for the international governance of the shipping industry.

This paper reports on the findings of a comparative study of the enforcement of the sulphur regulations in the UK and Sweden (grant reference RES-062-23-2644). A number of problems with enforcement practice are identified which militate against effectiveness, although conscious evasion of the regulations is currently surprisingly low – a situation which seems unlikely to persist unless enforcement practice changes.

Methods

The data comprise observational data on 16 Port-State control ship inspections in Sweden and the UK, and 50 audio-recorded, semi-structured interviews with Port-State Control Officers, officials of national and international regulatory agencies, and industry stakeholders representing a wide range of interests (fleet management, industry associations, bunker suppliers, classification societies, port management, trade unions and NGOs concerned with shipping and the environment). In addition, several unpublished datasets were collected on statutory fuel sampling and testing, commercial sampling and testing, and bunkering activity. The interviews were transcribed and the transcripts and the observational fieldnotes were both indexed (using the same index codes) and systematically analysed using analytic induction (Bloor, 1978).

Compliance levels

Although commercial testing of fuel samples is commonplace, there are no published data on the total numbers of samples and tests taken for statutory purposes. We estimate that for ocean-going vessels in European ports (as opposed to inland waterways) the total number of statutory tested samples is only around 500 per annum: Sweden and Germany supply the majority of these, with smaller contributions from the Netherlands and Denmark. To put this figure in perspective, it would comprise only 2.6% of Paris MoU Port State inspections in

2011 (Paris MoU, 2012). The 86 test samples taken in Rotterdam in 2011 (Vink, unpublished) would only comprise around 0.1% of all arrivals.

With such a small number of statutory samples tested, it is difficult to be specific about the levels of compliance with the sulphur regulations. But the indications are that a large majority of vessels are compliant. Of the 86 Rotterdam vessels, 14 vessels (16%) were found to be non-compliant (ibid.). The Swedish Maritime Administration has kindly made available the results of tests on the sampling they undertake as part of the enforcement of their environmentally differentiated fairway dues: allowing for a margin of error in sulphur content of +/-0.05%, samples from 149 vessels in 2010 yielded only 6 vessels (4%) with non-compliant fuel oil. One might expect compliance levels to be higher in Swedish ports than in Rotterdam: the Swedish testing programme has been running since 1998 and a higher proportion of vessels trading in and out of Swedish ports are likely to be continuously operating in the Baltic and North Sea ECAs. Further confirmation of the Swedish data is provided by an academic report on laser equipment mounted at the entrance to the port of Gothenburg in 2007: analysis of the exhaust plumes of 80 individual vessels found 3 (i.e. 4%) to be non-compliant (Mellqvist and Berg, 2010). Further geographical variations in compliance may exist (for example, between Mediterranean and Baltic ports in levels of compliance with EU regulations on sulphur levels in fuel burnt in port), but sufficient statutory sample testing evidence is lacking.

Many operators routinely dispatch bunker samples for commercial testing. In the absence of large-scale statutory testing, these commercial test data are a valuable research resource, although it must be recognised that ship operators who are deliberately flouting the regulations are hardly likely to be sending samples for testing. Michael Green of Lintec Ltd has kindly supplied us with test data for 2011: 2.7% of West European bunker samples were off-spec for sulphur (within this figure, the proportion of off-spec Rotterdam samples was 2.3%), and 1.4% of Baltic bunker samples were off-spec.

Reasons for non-compliance

The Lintec data clearly indicates that one (but not the only) reason for non-compliance was that off-spec fuel was supplied by the bunkerer. This may occur through a phenomenon known as ‘stratification’: 1% sulphur fuel oil is obtained by blending residual fuel oil with

distillate – partial separation of the fuel and distillate may then occur in storage, to result in off-spec fuel.

Another reason for non-compliance to occur lies in faulty changeover procedure on vessels switching from high sulphur fuel oil to low sulphur fuel when transiting the ECA. Meindert Vink of the Netherlands Human Environment and Transport Inspectorate, who kindly supplied us with the Rotterdam statutory test data, believes that this is the commonest cause of non-compliance. Although expert advice on changeover procedures is available from organisations such as Lloyd's FOBAS, it is clear that actual changeover practice differs substantially between similar vessels and between different chief engineers on the same vessel. The following fieldnotes from an observed port-state inspection provide an illustration:

> 'The chief engineer followed a 4-hour changeover procedure, which he began 8 hours steaming time from the ECA boundary. He remarked that he had noticed that his predecessor as chief had previously followed a 6-hour changeover procedure'.

That vessel had three service tanks serving the main engines, one service tank for each type of fuel carried. Changeover procedures are much more problematic when a vessel has only one service tank and therefore compliant fuel may be contaminated by a residue of non-compliant fuel remaining in the service tank. Here the fieldnotes on the changeover procedure for a vessel with a single service tank record that:

> 'Their changeover procedure specified part-emptying the settlement tank (upstream from the service tank) for 4 days and flushing through the service tank. The capacity of the settlement/service tank was 17 cubic metres and each day they emptied out 4 or 5 cubic metres. The main engines took 0.55 cubic metres of fuel per hour (i.e. 13 cubic metres every 24 hours).'

However, despite this seemingly rigorous procedure, it was quite possible that the vessel was actually operating on non-compliant fuel because the low-sulphur fuel oil used for flushing/ dilution was itself 1.0% sulphur, so only a tiny amount of remaining high sulphur fuel oil would be required to put the post-changeover fuel over the statutory limit. A dry dock manager we interviewed stated that his company and other European dry dock facilities were experiencing a high demand for the retro-splitting of service tanks on single-service-tank vessels – testimony to the difficulties operators of such vessels are facing in achieving compliance.

Stratification and faulty changeover procedures might both be termed inadvertent reasons for non-compliance, but regulatory avoidance (by the bunkerer or the operator) also plays part here, as is implicit in the substantial differences sometimes found in statutory testing between the test results and the declared sulphur level on the Bunker Delivery note. The Grande Mediterraneo (IMO no. 9138393) inspected in Wallhamn, Sweden, on 10/11/2010 was found to have been burning fuel oil with 1.68% sulphur, while the Bunker Delivery Note recorded 0.98% sulphur.

A culture of compliance?

It should be no surprise that some regulatory avoidance is occurring, particularly given the substantial cost advantage associated with operating with non-compliant fuel. The surprise might perhaps be that deliberate regulatory avoidance is not more common. In recent years, the evidence from Paris MoU port-state inspections is that a culture of compliance has developed among ship operators. In 2001, the proportion of vessels detained following Paris MoU inspections was 9%. In 2011, the targeting system for Paris MoU inspections changed, so the last year in which inspections can be compared with 2001 figures was 2010: in that year, the proportion of inspections resulting in detentions (for all causes) was just 3% (Paris MoU, 2011). Compliance levels are probably greater amongst vessels trading in and out of European and North American ports than in some other parts of the world, compliance levels also vary by type of regulation (with compliance with labour and health and safety standards probably being relatively poorer), levels vary by sector (with the tanker sector, for example, more compliant than the bulk carrier sector), and levels vary within sectors - with some operators seeking to position themselves as blue riband carriers (Bloor et al., 2013). Nevertheless, a fall in detentions from 9% of inspections to 3% of inspections speaks for itself.

However, as our interviewees repeatedly emphasised, regulatory compliance in the shipping industry is conditional: it is conditional on operators perceiving that regulatory enforcement is sufficiently effective to detect and punish non-compliant competitors. Thus:

> ‘We don’t have a problem with enforcement because we fully comply. *And we expect everyone else to fully comply*.’ [ship operator, emphasis as in the original]

> ‘We will not invest in [scrubbers] technology unless there is compliance with [fuel] regulations ensured by all the other companies.’ [ship operator]

> '...the industry wants enforcement because we don't want people cutting the corners. So all the good ship-owners want everybody else to be paying the same price'. [shipping industry representative]

There is a Gresham's Law of the Sea: bad ships drive out good (Bloor et al. 2006). Unless operators are in a niche market, in the long run, they cannot afford to comply with expensive fuel regulations unless their competitors are similarly compliant. There is a general desire in the industry for a 'level playing field', but it is a moot point whether current enforcement practice is sufficiently rigorous to secure that level playing field in respect of the sulphur regulations.

Problems of enforcement practice

As we have seen, statutory fuel sampling-and-testing only occurs very rarely. Standard enforcement practice in port state inspections in the UK and Sweden is checking the sulphur levels in the Bunker Delivery Note (BDN) and to check the recording of fuel changeovers in the Oil Record Book. Such checks need not be carried out at every inspection. It is frequently stated that Port State Control is 'a sample, not a survey', and so some checks may be omitted in a 'light touch' inspection.

The problems with reliance on the BDN and the Oil Record Book are several, but even when statutory sampling-and-testing occurs, effective enforcement may be problematic. The sampling-and-testing procedure followed in Rotterdam ensures receipt of the test results within three hours of sampling, allowing detention of the vessel. In contrast, the procedure in Sweden is such as to only yield the test results after the vessel has departed. In respect of the Swedish fairway dues, a non-compliant test result leads to the disqualification of the vessel for reduced dues, but in respect of the IMO regulations, the Swedish authorities typically undertake only to notify the flag-State of the departed vessel's non-compliance. Such notifications do not always receive a reply.

Where detentions occur, they gain much of their deterrent effect by their publication on the Paris MoU THETIS website, and their subsequent re-publication on industry websites such as Equasis. This 'naming-and-shaming' of the non-compliant vessel has an immediate impact on the freight rates that the vessel can command from charterers. However, the THETIS website

only records detentions as a result of non-compliance with IMO regulations: failures to comply with the 0.1% EU port fuel regulations are not recorded on THETIS and Equasis.

Turning to the BDN and the Oil Record Book, as a number of interviewees pointed out, neither of these documents was designed to have a statutory purpose and it is debatable whether they are robust enough for such a purpose. Both are frequently hand-written and vulnerable to forgery and fraud. The ship's copy of the BDN is a carbon copy and frequently unreadable, particularly after storage. Bunker suppliers must be registered and withdrawal of registration represents a possible sanction for wrong-doing, but the bunkerer registration number does not appear on the BDN. The BDN is not always in English: it is expecting rather a lot of inspectors to know that 'zwavel' is the Dutch for 'sulphur'. And in many smaller ports the bunkers (and the BDN) may delivered by sub-contractors with little knowledge or interest in the regulations.

Port State inspectors can board vessels from pilot boats, but most inspections take place when a vessel is berthed. Although experiments have been taking place with remote monitoring of emissions by use of laser technology, it is not currently practicable to enforce the sulphur regulations on non-berthing ships that are merely transiting territorial waters and ECAs. Relatedly, port state inspections are not particularly well-resourced and are subject to budgetary restraints in several countries. The UK's Maritime and Coastguard Agency has to find cuts of 22% over the period 2011-2015 (Massey, 2011). This militates against investment in, and deployment of, technological aids which could increase effective enforcement. For example, portable, laser-based testing kits are commercially available (and routinely used by refineries) and could, in principle, be carried on-board as part of a port state inspection, but the kits currently retail at around £30,000 each.

Finally, it should be noted that effective enforcement itself carries potential dangers to vessels with single service tanks, where the changeover procedure entails partial drainage of the service tank. There is a consequent danger of engine breakdown where the operation is poorly conducted: the tanker *Overseas Cleliamer* reportedly came close to grounding at the entrance to San Francisco Bay, due to engine breakdown while undertaking a fuel changeover (*Lloyd's List*, 2011).

Conclusions

At present, compliance levels are high and most non-compliance is inadvertent, rather than the result of conscious regulatory avoidance. However, the potential rewards for non-compliance, in the shape of lower fuel costs, are considerable. The current ‘culture of compliance’ is unlikely to continue into the future unless operators believe that a ‘level playing field’ is being effectively enforced on their competitors.

However, it is doubtful whether, in European ports, current enforcement is sufficiently effective to secure that level playing field. This, it seems, is also the recently expressed view in Brussels. The revised European Parliament and Council Directive of 21/11/2012, paragraph 17, states:

‘...there is a need for a stronger monitoring and enforcement regime [...] it is necessary that Member States ensure sufficiently frequent and accurate sampling of marine fuel placed on the market or used on-board ship as well as a regular verification of ships’ logbooks and bunker delivery notes’ (Official Journal of the European Union, 2012).

It appears that Member States will be required to undertake a step-change in enforcement practice.

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