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IMPACT ASSESSMENT

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council

amending Directive 1999/32/EC as regards the sulphur content of marine fuels

{COM(2011) 439 final}
{SEC(2011) 919 final}

Abbreviations

CEN	European Committee for Standardisation
ECA	Emission Control Area
EMSA	European Maritime Safety Agency
ETS	Emissions Trading Scheme
EU	European Union
GHG	greenhouse gas
HFO	heavy fuel oil
IMO	International Maritime Organisation
ISO	International Organisation for Standardisation
LNG	liquefied natural gas
LoLo	lift on, lift off freight ship
MARPOL	International Convention for the Prevention of Pollution from Ships
MEPC	Marine Environment Programme Committee (IMO)
MFO	marine fuel oil
MGO	marine gas oil
NECA	NOx Emission Control Area
NOx	nitrogen oxides
PM	particulate matter
PrEN	Preliminary European Standard
RoPax	roll on, roll off passenger ship
SECA	Sulphur Emission Control Area
SO2	sulphur dioxide
SSS	short sea shipping
UNCLOS	United Nations Convention on the Law of the Sea

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1. INTRODUCTION

This impact assessment brings together the results of two principal and closely related work streams, i.e. an in-depth assessment of the amended international rules governing emissions from maritime shipping as adopted by the International Maritime Organisation (IMO) in October 2008 (a.k.a. the MARPOL Annex VI), and the review of the Directive 1999/32/EC (The Directive) as called for in article 7 of the amending Directive 2005/33/EC. It accompanies a legislative proposal to further amend the Directive, for the purpose of aligning it with the latest rules adopted by the IMO, notably those on the maximum permitted sulphur content of marine fuels.[1] The impact assessment has also supported the identification on non-regulatory measures meant to support relevant stakeholders in the timely adoption of the new IMO standards. Importantly, this impact assessment is *not* meant to justify the latest international rules but rather to assess, amongst other issues, whether and how the latest international rules should be *incorporated into EU law*.

2. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

2.1. Organisation, timing, and consultation of interested parties

2.1.1. Impact Assessment Steering Group

This impact assessment report was developed by DG ENV in close co-operation with relevant Commission services. The following services were invited to the Inter-service Steering Group meetings: CLIMA, COMP, ENER, ENTR, MARE, MOVE, RTD, SANCO, SG, SJ, TAXUD, JRC, DEV and EEAS (formerly RELEX). In addition, EMSA representatives attended the meetings and contributed to the assessment.

2.1.2. External expertise and public information

Several studies were conducted in the run-up to this impact assessment report. These are listed in Annex 1.A and were made available at the Commission's webpage.[2]

2.1.3. Public consultation

The Commission met stakeholders regularly and also undertook an online consultation open to all interested parties (including business organisations, Member States, NGOs and the general public) from 29 October 2010 to 5 January 2011. Stakeholders were invited to respond to a series of questions about the possible incorporation of the latest relevant IMO rules into EU legislation. The consultation was advertised through Commission news alerts and participation was further promoted at stakeholder meetings.

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[1] The International Maritime Organization (IMO) is a specialized agency of the United Nations with 169 Parties (including all EU Member States) and 3 Associate Members. The Convention establishing the IMO was adopted in Geneva in 1948 and the IMO first met in 1959. The IMO's main task has been to develop and maintain a comprehensive regulatory framework for shipping and its remit today includes safety, environmental concerns, legal matters, technical co-operation, maritime security and the efficiency of shipping.

[2] http://ec.europa.eu/environment/air/transport/ships.htm.

The public consultation yielded 244 responses from various organisations. In general, stakeholders hailed the 2008 amendments to IMO MARPOL Annex VI as a major step forward in addressing air pollution from maritime shipping and necessary to improve air quality in the EU. There was also broad support for further aligning EU law with those (new) rules for the purpose of complementing and strengthening the international monitoring and enforcement regime. A number of industry organisations, however, claimed that the implementation costs associated with the new IMO regulations, notably the rules applying in the so called Sulphur Emission Control Areas (SECAs) would adversely affect their competitive position. Those respondents further claimed that the time available to comply with the new IMO fuel quality-equivalent standards (irrespective of their inclusion in EU law) was too short. The same respondents suggested important modal shifts (from short sea shipping to trucks) could occur whilst referring to associated greenhouse gas impacts. Other respondents downplayed this concern and pointed at the shipping sector's slow response to the 2008 agreement, hence calling for prompt EU action to safeguard the environmental and health benefits associated with the new IMO rules. A summary of the responses is available in Annex II. Comments are accounted for in relevant sections of the report.

2.2. Impact Assessment Board

On 25 February 2011 the Impact Assessment Board issued a positive opinion on the draft impact assessment subject to a number of recommendations. These were incorporated in the present report and comprise, inter alia, a clear prioritizing of the present problems related to the implementation and enforcement of the Directive; a clear identification of the areas for which proposals would go beyond the IMO requirements, and an overview of costs and benefits of the retained policy package.

3. PROBLEM CHARACTERIZATION AND BASELINE

3.1. Air quality and pollutant emissions from maritime shipping

Clean air matters to all EU citizens[3]. Air pollution seriously impacts people's health and the environment. Hence, the objectives to reduce air pollution have been an important element of the EU's environment policy over the past decades.

Significant progress has been made in reducing air pollution, notably from land-based sources, albeit sustained health and environmental damage will continue to occur for the foreseeable future. Whilst the EU is well on track to resolve the problem of ecosystems damage due to acid deposition of air pollution, ecosystem biodiversity remains under serious threat due to excess nutrient deposition (eutrophication). Likewise, there remain widespread problems with high levels of ground-level ozone damaging both vegetation and human health. In summary, several of our air quality standards such as those for ground-level ozone (O_3), particulate matter (PM) and nitrogen dioxide (NO_2) are widely exceeded in the EU, especially in urban areas[4].

[3] http://ec.europa.eu/environment/archives/barometer/pdf/summary2008_environment_en.pdf

[4] Data from EEA website suggest that for 2005 35 % of EU's urban population lived in cities where the EU PM10 standard is exceeded and 25% where the EU NO2 standard (for 2010) is exceeded.

The setting of environmental standards for international shipping has so far lagged behind those of land-based resources given the latter's closer proximity to populated areas. The growth of the international shipping sector and improved insights in the contribution of their emissions to inland air pollution levels directed attention to maritime emissions as a major source of air pollution. Emissions of SO_2 and PM are primarily linked to the type (quality) of fuel being used: liquid fuels used for maritime transport (like for other modes of motorised transport, industrial, commercial combustion, and domestic heating) contain sulphur which is released upon combustion in gaseous form, predominantly as SO_2. Following its release into the atmosphere, SO_2 reacts with other pollutants and forms PM which is referred to as *secondary* PM (SO2 is a *precursor* of PM). Other pollutant emissions arising from the combustion of liquid fuels include *primary* PM and NOx.[5] More recently, attention has also turned to emissions of "black carbon" from shipping due to its radiative forcing properties which significantly contribute to the arctic climate impacts.

Air pollution from international shipping (sailing also outside 12 miles zones or territorial waters) is regulated by MARPOL Annex VI and by the Directive.

MARPOL Annex VI covers issues such as sulphur oxides (SOx) and nitrogen oxides (NOx) and recognizes the need for additional protection in sea areas particularly sensitive or relevant to pollution, the so called Emission Control Areas (ECAs).[6] Considering that northern Europe is particularly affected by acidification, and that SO_2 emissions from shipping are a major contributor to the problem, the IMO defined three sea areas as SECAs following proposals from Member States, i.e. the Baltic and North Sea and the English Channel.[7]

The Directive has been the main instrument for transposing IMO MARPOL agreements into EU law. The incorporation of IMO standards into EU law aimed, inter alia, at reinforcing the (weak) international monitoring and enforcement regime. The latest significant revision of the Directive was reflected in Directive 2005/33/EC, which introduced, *inter alia*, the IMO concept of SECAs and the associated stricter fuel standards, i.e. capping the maximum sulphur content of fuels allowed in those areas at 1.5% from 2006 and 2007 onwards.[8] In addition, and in recognition of the need to further improve air quality for the protection of human health beyond the SECAs, some requirements that went beyond the IMO rules were introduced of which the most important are:

- The obligation for ships at berth or anchorage in EU ports to use fuels containing max. 0.1% sulphur;
- The obligation for passenger ships on regular service to EU ports to use fuels containing a maximum sulphur content of 1.5%;
- The introduction of a possibility to test and use the emission abatement technologies.

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5 In the case of ship engines, the levels of secondary PM typically exceed the levels of primary PM.

6 To have a sea area designated as an ECA, the IMO Member States bordering that sea area have to send an application to the IMO. If the proposal meets the criteria set out in Annex VI, the IMO can accept the application and adopt the necessary amendment that enters into effect 16 months later.

7 Outside Europe, the 200 nautical miles zone around US and Canada has been designated recently as both SOx and NOx ECA.

8 Directive 2005/33/EC of 6 July 2005; OJ L 191, 22.7.2005, p. 59. The SECA provisions for the Baltic Sea applied from 11.8.2006 onwards whilst those for the North Sea and English Channel applied from 11.8.2007 onwards.

The conclusion of the 2005 amendment coincided with the finalization of the EU Thematic Strategy on Air Pollution which focused particularly on the acidification, eutrophication, and health-related impacts caused by fine particles (PM, of which SO_2 is a precursor) and ground-level ozone (formed by the interaction of NOx and volatile organic compounds or VOCs).[9,10] It concluded, inter alia, that unless further action was taken at the international level emissions from maritime shipping (notably related to SO_2 and NOx) would exceed the sum of all emissions from land-based sources in the EU by 2020 despite the fact that the maritime transport sector accounts for less than 5% of the EU GDP (see Table 1).[11,12, 13]

Table 1: Projected emissions from land-based and maritime sources for 2020

	SO2		NOx	
	2000	2020	2000	2020
Land-based sources (kt)	8,735	2,805	11,581	5,888
International sea transport (kt)	2,430	3,526	3,557	5,951
Share of land-based sources (%)	27.8	125.7	30.7	101.1

Source: Commissions Staff Working Paper accompanying the Communication on Thematic Strategy on Air Pollution , based on work from IIASA, RAINS(SEC (2005) 1133)

Therefore, both the Commission and the co-legislators advocated further reductions in marine-based emissions for the purpose of meeting EU environmental and health objectives, notably through the International Maritime Organization (IMO). For that reason the co-legislators also introduced a clause in article 7 of the 2005 amending Directive to review the Directive taking into account, amongst other elements, progress made at the IMO with respect to fuel standards. The latter is described the in sections 3.2, 3.3, and 3.6. Other issues arising from reviewing the implementation of the Directive and specific questions from the co-legislators are addressed in sections 3.4, and 3.5, respectively.

3.2. Progress at the IMO – the 2008 amendment of MARPOL Annex VI

Following the above mentioned calls for further action, the IMO's Marine Environment Programme Committee (MEPC) unanimously adopted an amendment to MARPOL Annex VI in October 2008.[14] The amendment introduced, *inter alia*, a step-wise reduction of the maximum sulphur content allowed in marine fuels. These changes are summarized below and in Figure 1:

9 Decision No 1600/2002/EC on the Environment Action Programme.

10 The EU Thematic Strategy on Air Pollution (COM (2005) 446).

11 SEC (2005) 1133: Commissions Staff Working Paper accompanying the Communication on Thematic Strategy on Air Pollution (COM(2005)446 final) and the Directive on Ambient Air Quality and Cleaner Air for Europe(COM(2005)447 final).

12 EU Energy and Transport in Figures 2010, Statistical Pocketbook, European Commission.

13 These problems were also previously acknowledged in the Commission's Communications on the Strategy to reduce atmospheric emissions from seagoing ships. See COM(2002) 595 final

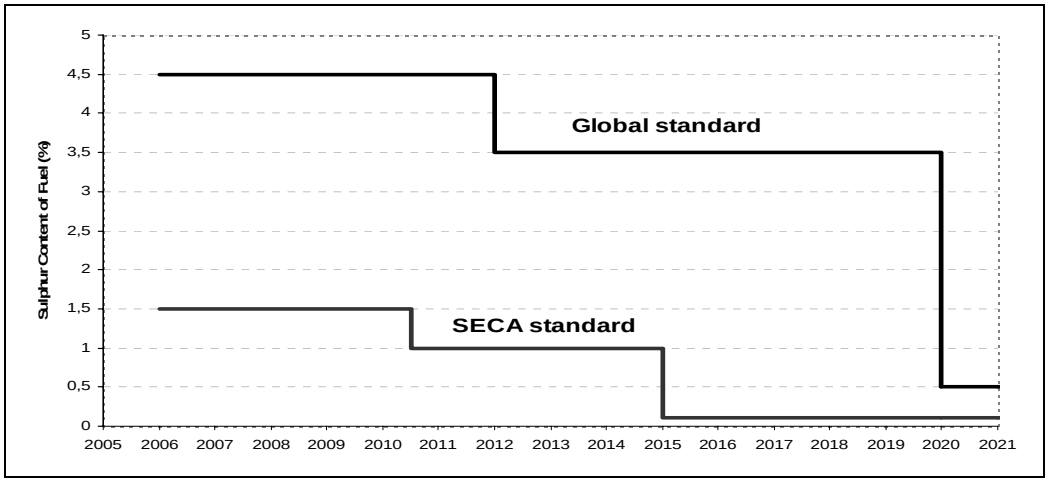
14 The IMO MEPC October 2008 meeting was attended by about 1 000 representatives from 95 IMO Parties (including 22 EU Member States), 2 Associate Member States, 4 other UN Organizations, 8 Inter-Governmental Organizations (including the European Commission) and 41 Non-Governmental Organizations. Of the 22 EU Member States present, Malta is not a Party to MARPOL Annex VI but supported the agreement. Austria, Bulgaria, Czech Republic, Hungary and Slovakia did not attend.

(1) A reduction from 4.50% by weight of the sulphur content of all marine fuels used globally (outside of SECAs) to 3.50% from 1 January 2012 and to 0.50% and from 1 January 2020 (the latter subject to a fuel availability review in 2018);

(2) A reduction from 1.50% by weight of the sulphur content of all marine fuels used in SECAs to 1.00% from 1 July 2010 and to 0.10% from 1 January 2015.

The 2008 amendment furthermore introduced additional provisions for reducing emissions of NOx. It also mentions particulate matter PM).[15]

Figure 1: The new standards related to the sulphur content of marine fuels contained in MARPOL Annex VI as amended in 2008



All IMO provisions are *technology neutral*, hence, ships may be equipped with *alternative emission abatement methods* such as scrubbers or alternative fuels (e.g. liquefied natural gas) to achieve compliance. This aspect is addressed in section 3.3.2.

3.3. Differences between the EU and IMO provisions regulating shipping emissions

Following the adoption of the new IMO MARPOL Annex VI, there are now significant discrepancies with the provisions of the Directive.

3.3.1. Differences related to the maximum sulphur content of marine fuels

The main discrepancies related to the maximum sulphur content of marine fuels resulting from the 2008 IMO amendment are summarised in Table 2.

[15] Measures adopted at the IMO related to NOx and *primary* PM emissions are mainly linked to the performance of the vessel engine and that of exhaust after-treatment devices. Considering that the Directive focuses on fuel quality, including other than marine fuels, regulatory initiatives to advance emission reductions for NOx and PM are not addressed in detail in this report. Such measures are nevertheless considered important to be pursued in due course. Further options will therefore be assessed as part of a comprehensive review of the Thematic Strategy on Air Pollution starting in 2011 and due in 2013.

Table 2: The new provisions agreed at IMO against those contained in Dir. 1999/32/EC

Maximum permitted sulphur content of marine fuels [(a)] (Limit Values in the Directive before 2008 Marpol Annex VI)		
	IMO Standard	EU Standard
SECAs	1.0 % as of 2010 0.1% as of 2015	1.5%
Non-SECA areas (aka. Global standard)	3.5% as of 2012 0.5% as of 2020[(b)]	Unregulated

Notes: (a) All flags, including vessels whose journey began outside the Community;
(b) Possibility to delay to 2025 subject to review in 2018.

If no EU action is taken, different rules on the sulphur content of marine fuels in SECAs would apply in parallel. Those required by the Directive (1.5%) would be less strict than the MARPOL Annex VI limits (1.0% as of 1 July 2010 and 0.10% as of 1 January 2015 in MARPOL Annex VI).

Although legally undesirable but possible, such a situation would cause practical difficulties and legal uncertainty for stakeholders, including Member States' authorities, ship operators, bunker suppliers. Maintaining a situation whereby EU environmental standards are more lenient than international standards would also send wrong or at least mixed signals to stakeholders. It would for example indicate that the EU no longer strives to uphold internationally agreed standards for the purpose of protecting its citizens and the environment. In addition, the EU enforcement mechanism would only apply to the less stringent sulphur limits set in the Directive, while compliance with MARPOL Annex VI sulphur limits could only be ensured by the IMO, which lacks a comprehensive and harmonised compliance enforcement mechanism.

Finally, it is noted that the Directive currently covers only the fuel sulphur requirements applying within SECAs. The decision not to include the IMO's "global" standard (applying outside SECAs) was justified at the time on the basis of the fact that no strong compliance mechanism was required. That is because the "de facto" average sulphur content of marine fuels used globally was at a level of around 2.7% and well-below the level allowed by MARPOL (4.5%). However, since IMO also significantly revised the global standard (to 3.5% from 2012 and ultimately 0.5% in 2020, or 2025 pending review) there is now an equally significant risk that ships may use non-compliant fuels comparable to the situation in SECAs. Considering that the global standards are forecasted to bring substantial benefits to human health and the environment also beyond the coastal areas, an inclusion of the global standard into EU law should be considered (see chapter 3).

3.3.2. Differences related to the use of "equivalent abatement methods"

In addition to achieving compliance by using low sulphur fuels, the current Directive foresees the possibility to use *equivalent* emission abatement technologies. However, the range of allowed abatement technologies is limited in comparison to the abatement methods authorised by MARPOL Annex VI.[16] If no EU action is taken to

16 The Directive defines the emission abatement technology as 'an exhaust gas cleaning system, or any other technological method that is verifiable and enforceable', while MARPOL Annex VI defines 'equivalents' as 'any fitting, material, appliance or apparatus to be fitted in a ship or other procedures, alternative fuel oils, or compliance methods used as an alternative (…)'.

broaden the scope of the Directive and to align it with MARPOL Annex VI, EU ship operators would have, compared to operators of ships of non-EU flags, a limited choice of options to achieve compliance using equivalent methods. The discrepancy could also pose difficulties for non-EU ships travelling in EU territorial waters that are equipped with abatement methods recognised outside of the EU, but not allowed by EU rules. This limitation of the ship operators' compliance options needs to be revisited also in view promoting the development of new or innovative greener technologies in the EU as advocated by the EU 2020 Strategy and to ensure a level playing field compared to the rest of the world.

3.3.3. Environmental standards for passenger ships

The present Directive requires passenger ships operating outside SECAs and on a regular service to or from EU ports to use marine fuels with a maximum permitted sulphur content of 1.5% (equal to the SECA standard applying until June 2010). As mentioned in section 3.1, this provision went beyond the requirements of IMO MARPOL Annex VI. It was introduced in the Directive as an additional health and environmental safeguard considering that passenger ships operate mostly in ports or close to coastal areas, hence having a greater adverse impact than other ships. At that time the 1.5% fuel grade was available on the market following demand from ships operating in SECAs. However, with the 2008 amendment to MARPOL Annex VI, the sulphur content of marine fuels in SECAs is limited to 1.00% from July 2010 onwards and it will be further reduced to 0.10% in 2015. This raises the question to what extent the provisions on passenger ships should continue to be aligned with the new standards for SECAs also considering the state of play of air quality in the EU.

3.4. Other issues arising from the review of the implementation of the Directive

The review of the implementation of the Directive yielded a number of issues which could undermine the enforcement of key provisions of the Directive, in particular now that the standards have been tightened at the international level. The key issues to be addressed in the new post-2008 context are summarized below. A detailed report is provided in Annex IV of this report.[17]

3.4.1. Member State reporting

Member State reports on the sampling of fuels submitted pursuant to article 7 of the Directive were found to vary significantly in structure and content, with many reports exhibiting significant information gaps. Few reports distinguished between fuels used for marine or similar land-based uses, making the assessment of compliance levels with marine fuels difficult if not impossible. Furthermore, although EMSA concluded that the information contained in the log books and bunker delivery notes is quite reliable, it was not used as a source of information for the reporting. The present situation thus rendered the assessment of the level of compliance with the

[17] Whilst the review was due in 2008, it was postponed to account for the outcome of the negotiations at the International Maritime Organisation (IMO) which were concluded at the end of the same year. This allowed a more comprehensive assessment of the impacts the IMO provisions on the European shipping sector and of a possible transposition into EU legislation. It is furthermore noted that the Directive and the review cover in principle also other than fuels used for marine shipping. The use of such other fuels has either been removed from the scope of Directive 1999/32/EC (e.g. road transport fuels or fuels used by inland water vessels) or use has gone down significantly over time. Hence, these were not further covered by the present analysis.

Directive very difficult also because the Directive currently lacks clarity on minimum sampling standards (see also below).

3.4.2. Sampling frequency and methods

Reports by Member States furthermore showed that the number and frequency of fuel samples taken in the EU are very low (typical 1 sample per 1000 ships), hence insufficient to ensure a representative view about the fuel quality used and sold as required by the Directive. Samples were furthermore almost exclusively used to monitor the sulphur content of fuels covered by the Directive whereas Article 7.1 specifically requests monitoring of other maritime fuels not directly covered by the Directive, i.e. fuels having to comply with the existing global limit for sulphur of 4.5%. Whilst the level and quality of sampling and analysis has often not met the requirements of the Directive, problems seem to stem also from a lack of clear provisions on the frequency and analytical methods to be used. Fuel sampling-based studies conducted by EMSA found evidence of non-compliance with several provisions of the Directive thus adding to the concerns.

3.4.3. Adapting the Directive to recent technical progress and standards

Several of the internationally recognised technical standards and definitions set out in the Directive have been revised since their inclusion in the text of the Directive and would therefore require updating. These include:

- test methods of the International Standards Organization used to determine the sulphur content of fuels and referred to in the Directive, i.e. ISO 8754:1992, PrEN ISO 14596 and EN 24260:1987. These standards were updated by ISO to 8754:2003, EN ISO 14596:2007 and EN 24260:1994 respectively;
- international standards for defining and specifying marine fuels which underwent a revision in 2010 (ISO 8217:2010) thus making changes necessary to the definitions of marine fuel, marine diesel oil and marine gas oil in the Directive.

If the Directive's rules on fuel specifications, the verification of samples, or arbitration methods remain unchanged, the discrepancies would continue to exist whilst ultimately causing problems for ship operators, in particular for ships operating internationally (as different standards would apply inside and outside of the EU).

3.4.4. Legal clarity

Finally, and based on recurrent queries to the Commission, additional clarifications in the Directive might serve stakeholders' efforts in applying the rules of the Directive correctly. Specific provisions are, for example, related to the definitions for "passenger ships on regular service", "port area", and the provisions related to the verification procedure for fuel oil samples.

3.5. Additional Emission Control Areas and complementary measures

In addition to the elements outlined above, the co-legislators called on the Commission to consider the benefits and costs associated with the creation of additional ECAs and other alternative and complementary measures. The EU is not a signatory of MARPOL Annex VI and has no mandate to make proposals to the IMO.

However, the Commission can support Member States to propose new ECAs. The 2008 amendment to MARPOL Annex VI introduced the possibility to designate NOx Emission Control Areas (NECAs) setting limit values for emissions of NOx and mentioned particulate matter. Following the adoption of the 2008 MARPOL Annex VI amendment, several (mainly Nordic) industry groups called for an expansion of the SECAs along the entire EU coastline on the grounds that such an EU-wide SECA would address intra-sectoral competition issues. So far, no new ECAs have been proposed for approval at IMO. Meanwhile, the parties to the Helsinki Commission (HELCOM), are considering to propose the designation of the Baltic Sea as the first European NECA to the IMO.[18] Such introduction of NECAs in the EU would make EU-level enforcement of NOx standards a relevant issue albeit that it would require a significant extension of the scope of the present Directive, as it focuses on fuel quality rather than emission limit values, or adoption of a new instrument. Similar remarks apply to transposing PM provisions into EU law once they are developed at the IMO[19].

3.6. The baseline

3.6.1. The policy baseline

For the purpose of this impact assessment the "policy" baseline includes the provisions agreed at the international level as reflected in the 2008 amendment of the IMO MARPOL Annex VI which are binding for most EU Member States as already explained in section 2.2.3. It furthermore includes the current provisions of Directive 1999/32/EC as amended (2005/33/EC), including the shortcomings identified above.

3.6.2. The post-2008 environmental and socio-economic baseline

Compared to the business-as-usual scenario defined in 2005 (see section 3.1), the 2008 agreement is expected to deliver significant pollutant emission reductions from the shipping sector as part of the baseline. Table 3 shows the emission reduction effects in the Baltic and North Sea SECA which are expected to exceed 90 per cent for SO2, and up to 80% for PM. Outside SECAs, reductions are less or even cancelled out due to growing transport volumes. Theoretically, additional demand for distilled fuels may result in increased emission of CO2 emissions up to 5% from EU refineries in the 2010-2015 period. Since refineries are covered by the EU Emission Trading Scheme, no net increases in greenhouse gases are expected to occur. [20]

Table 3: Impact of MARPOL Annex VI on emissions from international shipping

	Projected ship emissions for 2020 without MARPOL agreement			Projected ship emissions for 2020 with 2008 MARPOL agreement		
(kt)	SO2	NOx	PM 2.5	SO2	NOx	PM 2.5
Baltic Sea	171	404	29	14	349	4

[18] HELCOM is an intergovernmental organisation for the protection of the environment in the Baltic Sea area. See also: http://www.helcom.fi/press_office/news_helcom/en_GB/Maritime_9/

[19] At the moment, the revised MARPOL Annex VI only mentions the particulate matter (PM) in the title of Regulation 14 with no specific limit values.

[20] Rather an overall reduction of GHG emissions is expected since emissions from engines using low sulphur distillate fuels are lower compared to HFO and because of other operational benefits such as the reduced need for pre-heating of heavy fuels at the bunkering sites.

North Sea	406	946	68	32	816	13
Mediterranean	1714	2311	198	1714	2220	97

Source: http://ec.europa.eu/environment/air/pollutants/pdf/nec6.pdf

Monetised benefits associated with the post-2008 emission reductions and the cost ranges for complying with the new IMO standards are summarized in Table 4. The benefit/cost ratios associated with the IMO decision taken in 2008 are highly favourable. Benefits associated with full IMO compliance are at least between €3 and €13 for every €1 spent whilst for the EU SECAs the benefits are at least between €5 and €25 for every €1 spent.

Table 4: Benefits and Costs associated with the IMO rules adopted in 2008 (AEAt, 2009)

2020 (€billion)		Use of 0.1% sulphur marine fuel in SECAs (Baltic Sea, North Sea, and the English Channel)	Use of 0.5% sulphur marine fuel in non-SECAs	Full IMO compliance (SECAs and non-SECAs)
Benefits	High	23	11	34
	Low	*10*	*5*	*15*
Costs	High	4,6	6,4	11
	Low	0,9	1,7	2,6
Benefit/Cost ratio	High	5,0	1,7	3,1
	Low	25,6	6,5	13,1

Benefits relate to human health benefits only (reduced mortality and morbidity). They do not include monetized environmental benefits (e.g., from reduced acidification and eutrophication) nor economic benefits linked to reduced crop losses. The higher amounts follow the established monetisation of benefits of the CAFE[21] programme. The lower amounts flow from the experimental NEEDS project figures and are included only for sensitivity analysis purposes.[22]

The high-end cost estimates reflect a compliance strategy based primarily on the use of low sulphur marine fuels. Such strategies require the supply and use of distillate instead of the currently used residual fuels. Refineries will have to adjust or expand capacity to meet the new demand.

The low-end cost estimates assume a compliance strategy based primarily on equivalent emission abatement methods. Examples include vessels fitted with scrubber technology that remove SO_2 from the exhaust gas, or vessels propelled with alternative fuels such as liquefied natural gas (LNG). Options for lowering the average compliance costs are further elaborated in chapter 5.2.2.

[21] Clean Air for Europe Programme.

[22] The range of benefits results from the use of different assumptions to monetise premature death. The monetised benefits presented are nevertheless considered to *underestimate the full benefits*. That is because the benefits arising from positive effects on other receptors including ecosystems, agriculture and buildings, including cultural heritage, are not included.

3.6.3. Competiveness issues and issues related to possible modal shifts

Although the monetized benefits yielding from the 2008 IMO agreement significantly exceed the estimated compliance costs, concerns about the incidence of those costs on specific industry sectors were raised by several stakeholders. Most concerns focused on the new 0.1% standard applying in SECAs from 2015 onwards. The short-sea shipping sector, for example, feared that the introduction of this standard would negatively impact on their competitiveness vis-à-vis road transport.

Eight studies were commissioned by the European Commission to support the revision of the Directive. One of them assesses the possible impacts of the 0.1% sulphur limit in SECAs, notably on short-sea shipping due to its role in the EU sustainable transport policies. A series of studies on the impact of the MARPOL Annex VI fuel requirements on SSS in SECAs were conducted by stakeholders. The European Maritime Safety Agency (EMSA) conducted a follow-up assessment also summarising the findings of studies commissioned by other stakeholders.[23] These studies are listed in Annex. I.[24] Further details on fuel consumption and fuel price developments are provided in Annex VII.

Table 5 summarizes our key findings even though it is noted again that certain studies, notably those commissioned by industry associations, yield more significant impacts associated with the implementation of the new IMO rules. Findings on modal shift are discussed separately below.

[23] The 0.1% sulphur in fuel requirement as from January 2015 in SECAs, EMSA, 13 December 2010

[24] All studies develop a scenario (besides others) that assumes the 0.1% sulphur limit will be met in 2015 exclusively by means of using distillate fuels in the form of MGO. Since the price of MGO is higher than the price of the currently used HFO, all studies conclude that fuel costs will increase. The studies differ in their assumptions on the baseline price to be expected in 2015 and the subsequent development of the fuel price. The estimates for the price of 1 ton of MGO in the year 2015 range from €379 to €1250. With regard to price development, some studies argue that the price of MGO will rise due to increased demand whereas one study suggests a decrease due to economies of scale in refining. The EMSA analysis concludes that under normal circumstances the price for MGO will be in the range of €450 to €680. Compared to HFO with a sulphur content of 1.5% (SECA standard before MARPOL Annex VI was revised) it is predicted that MGO with a maximum sulphur content of 0.1% would on average become 65% more expensive under a *fuel-based-only* compliance scenario (i.e. whereby the less costly technology-based compliance is not used).

Table 5: Summary of costs and similar impacts arising from implementing the 2008 IMO agreement

Refineries	Maximum additional investment in refining capacity of €10 billion, (beyond €15 billion already foreseen) over the six-year period 2010-2015.[25] Increase in unit operating costs due to increased GHG emissions in the range of $0.04 to $0.13 per barrel equivalent or between 1% and 4% of operating costs.[26]
Cost of fuels	Fuel price increase of 65% (middle estimate of Purvin and Gertz).[27]
Consumer prices	Negligible cost increase as 1) fuel prices are a fraction of transport costs and 2) transport costs are a fraction of end-user prices (TML, 2010).[28]
Ship operators' costs	TML's worst case scenario estimates total cost increases between 6% (RoPax) and 29% (LoLo) (fuel-based compliance only; more details are provided in annex VI) According to Purvin and Gertz (2009) operational costs are estimated to increase by between 6.5% and 24% for SSS and by 40% for certain container lines (fuel-based compliance only).
Trade	Industries most likely to be affected are paper pulp and iron ore in the Nordic region (low value goods transported by bulk carriers). The effect on trade is not expected to be significant (TML,2010).
Third countries	In the Mediterranean region the global standard will apply from 2020 (pending review). Syria is the only non-EU coastal state in the region that has ratified MARPOL Annex VI. In the Baltic Sea the Russian Federation now ratified Annex VI. Since the Russian Federation has land borders with the EU there may be impacts on cross-border trade under the baseline should enforcement of the rules be not stringent enough. Specific impacts need to be assessed on a route-by-route basis. There will also be environmental and health benefits in third countries due to reduced trans-boundary air pollution from EU ships meeting IMO obligations.

Several studies assessed the effect of the increased fuel price with regard to the total transport costs and the consequence for export oriented industry and/or with regard to potential shifts in transport modes. Whilst it is undisputed that the transport pattern

25 Purvin and Gertz (2009), Impacts on the EU Refining Industry and Markets of IMO Specification Changes and Other Measures to Reduce the Sulphur Content of Certain Fuels.

26 Assuming a worst-case scenario where only a low sulphur fuel compliance option is available but no technological equivalents, are used to meet compliance. Hence these estimates are considered to reflect an upper range.

27 Purvin and Gertz (2009). Estimates are considered to reflect an upper range for the same reason referred to in the footnote above.

28 TM Leuven (2010), The COMPetitiveness of EuropeAn Short-sea freight Shipping compared with road and rail transport

in SECAs will change, no coherent scheme emerged as to the pattern of those changes. The EMSA summary report draws the following conclusions:[29]

- Increased fuel costs will affect profit margins for the shipping sector and have some effects on the short-sea shipping patterns in SECAs, albeit the risk for modal (back) shifts to road transport applies mainly to certain routes to and from the Baltic States and English Channel under the high-cost fuel-only compliance scenario;
- Medium distance routes would be more affected than shorter or longer routes as transport operators favour shorter sea segments as opposed to a truck only option;
- Routes that have a low degree of utilisation are more prone to receive additional traffic.
- Cargo and container ships are more affected than ferries whereby low value cargoes are more vulnerable;
- Existing shipping routes that were competitive already when using 1.5% HFO will remain so after 2015 when the 0.1% limit applies.

In sum, the ultimate impact of the new IMO rules will vary depending on the specific route taken, the ship and commodity type (cargo), length of sea segment and whether a ship operator can pass on increased fuel prices to its customers. Some studies conclude that certain industries competing with businesses located in countries outside SECA zones would have a competitive disadvantage. Examples of products concerned include forest products/paper, metals/ore and to a smaller extent foodstuffs, building materials and chemicals.

4. OBJECTIVES

4.1. General objectives

Considering the progress made at the IMO and the issues that arose from reviewing the implementation of the Directive, the general objectives being pursued during the present review are:

a) To ensure the delivery of the health and environmental benefits by reducing the negative impacts of air pollutant emissions from shipping;

b) To ensure the functioning of the internal market for maritime shipping, EU ports, and fuels and emission abatement technologies used in shipping.

4.2. Specific objectives

In addition, a number of specific objectives have been pursued in line with the problem characterization and baseline issues described in chapter 3. These are:

(1) To ensure alignment of EU law with the latest international rules on maritime fuels and pollution, including the adaptation to advanced technical standards and technologies;

[29] Based on a price for MGO in the range of €450 to €680

(2) To identify additional and/or alternative measures for reducing the negative environmental impact of emissions from maritime shipping on human health and the environment;

(3) To strengthen and enhance the implementation of the EU monitoring and enforcement regime ensuring compliance with the Directive.

4.3. Consistency with the other European Union policies

Consistency with other EU policies and stated priorities has been sought in the development of the policy options. Policies particularly considered include "Europe 2020", notably in relation to its smart and sustainable growth priorities and associated flagship initiatives such as the 'Resource Efficient Europe' and 'Innovation Union' [30], and more specifically EU policy promoting of environmental friendly transport modes. Where appropriate, guidance from relevant Council meetings has been accounted for. Examples include the 2 December 2010 Transport Council conclusions that emphasised the need for a comprehensive approach to address the intra EU waterborne transport environmental issues whilst inviting the Commission to "closely monitor Short Sea Shipping cost developments and to propose and evaluate possible responses aiming at avoiding possible distortions in the logistics chain and modal backshift from sea to land […]. The White Paper on competitive and sustainable transport calls for a reduction of GHG emissions from the transport sector, inter alia, through a decarbonisation by improving energy efficiency and developing new sustainable fuels.

4.4. Treaty base and the subsidiarity principle

The right for the EU to act on the regulation of the sulphur content of liquid fuels with significant impact on the internal market and the environment is established in Article 3 of the Treaty.

Given that the IMO's new requirements on marine fuels will *de facto* bind ship operators, there is a question of whether there is sufficient added value in transposing these new regulations from the IMO into EU law and whether such a course is proportionate and consistent with the subsidiarity principle.

Compliance with the subsidiarity principle depends on two tests. Firstly, the necessity test assesses whether the objectives can be sufficiently achieved by Member States. Incoherent transposition of the 2008 IMO MARPOL Annex VI amendments by Member States could potentially lead to distortions of the internal market for the shipping industry, port operators and suppliers of marine fuels. The lack of EU action would lead to two coexisting but inconsistent legal systems (2008 MARPOL Annex VI and Directive) resulting in an unequal implementation of international rules.

Secondly, the EU value-added test considers whether objectives can be better achieved by action at EU level. The legal framework of international agreements such as MARPOL lacks the mechanisms that would ensure an even *enforcement* of the rules on the sulphur content of liquid fuels across the EU. Unequal enforcement

[30] COM(2010) 2020, Communication from the Commission on “EUROPE 2020 - A strategy for smart, sustainable and inclusive growth”

practices would undermine compliance with the environmental standards set at IMO, with associated negative health and environmental impacts, and would introduce distortions to the internal market.

In conclusion, action at EU level is necessary to deliver a harmonized legal framework to meet the objectives associated with the transposition of the 2008 MARPOL Annex VI amendments.

5. POLICY OPTIONS AND THEIR ASSESSMENT

The sections below list and assess the policy options that were identified to address the general and specific objectives defined during the review process.

5.1. Method and criteria for assessing impacts

The methodology recommended by the impact assessment guidelines was adopted for the purpose of comparing the policy options. The impacts of the different policy options were considered according to their effectiveness, efficiency, as well as legal certainty and coherence with standing EU objectives and priorities. For each of the respective policy options, a 'do nothing' or 'option 0' has been considered.

5.2. Options for aligning EU law with the latest international maritime fuel rules

5.2.1. Options for aligning the maximum sulphur content of marine fuels

The sulphur content of marine fuels in the EU is to a large extent regulated through the Directive. The latest international agreement on this issue makes it necessary to consider updating several provisions in the Directive. The options here are:

Option 0	Do not incorporate the 2008 IMO amendment of MARPOL Annex VI relating to the sulphur content of marine fuels into the Directive
Option 0-	Repeal Directive 1999/32/EC
Option 1	Incorporate the 2008 IMO amendment of MARPOL Annex VI relating to the sulphur content of marine fuels into the Directive
Option 2	Incorporate the amendment with (a) earlier; (b) later dates for the entry into force of the obligations to move to lower sulphur fuels.

Option 0 was discarded at the early stages of the analysis as it would result in parallel and inconsistent regulations that would lead to mixed signals to operators and public authorities and create distortions. The main motivation to transpose MARPOL Annex VI provisions into EU law is to ensure its application by the EU's monitoring and enforcement infrastructure and experience. This is deemed necessary because IMO does not systematically verify the transposition and enforcement of these provisions by its parties. The implementation of the 2008 provisions on the sulphur content of fuels may result in significant marine fuel price increases creating an incentive for circumvention strategies:

- Not complying with IMO standards would yield lower operating costs for ship owners thus allowing to gain illegitimate operating margins (higher profits) or lower transport fees (higher volumes).
- By not monitoring or enforcing IMO standards, ports could attract higher traffic volumes.

Moreover, harmonised transposition and enforcement of the MARPOL Annex VI provisions would ensure a level playing field across MS, including those who have not yet signed and ratified this Annex.

Option 0 minus was discarded for similar reasons. This option would not only abolish the EU's system of enforcement. Provisions that go beyond IMO rules would also be lost (e.g. on fuels used at berth or for passenger transport). Furthermore, options 0 and 0-minus would not be in line with the overall EU objective to improve human health and environment.

Option 1 was retained. This option aligns EU rules on the sulphur content of liquid fuels used in maritime transport with international law (the 2008 IMO MARPOL Annex VI) and would be consistent with the EU's commitment to honour and enforce international agreements. Equally, it would meet the rights and obligations of Member States under international law, while making the EU's compliance mechanisms available to Member State authorities as well as stakeholders covered by the IMO provisions. Option 1 would furthermore extend the scope of the current Directive to include the global standard (non-SECA standard). The inclusion of the global standard in the Directive would bring together all applicable marine fuel sulphur standards in one legal text, which would provide greater legal clarity and ensure that the environmental and health benefits associated with the IMO sulphur standards applicable outside SECAs materialize. Further, EU law offers a framework for monitoring and enforcement, which is lacking at IMO, allowing the harmonization of rules across the territorial waters of Member States. The global sulphur standard of 0.5% from 2020 (or 2025 pending review) will have economic implications for operators, indicating that harmonized and robust monitoring and enforcement will be necessary. The impacts associated with keeping this option are therefore considered the same as those expected to occur for the baseline scenario, albeit with more certainty that the full environmental and associated monetized impacts on health would be reaped. Option 1 would contribute towards meeting the general objectives defined in Chapter 4 and specific objective 1 in a most effective way as it would align EU law with the more ambitious international sulphur limit standards while ensuring that these standards are properly enforced as well as ensuring the proper functioning of the internal market. This alignment would foresee the same date of entry into force for the new sulphur standards as MARPOL Annex VI, providing legal certainty for stakeholders.

The variants developed under option 2 were discarded. Incorporating the amendment at a later date (option 2.b) could leave Member States which are Parties to MARPOL Annex VI in breach of international law if they decided to implement its rules only when implementing the Directive. Incorporating the amendment at an earlier date (option 2.a) would advance these benefits. However, there are transitioning costs associated with the change to the new MARPOL Annex VI

provisions. As such it is recommended that the full amount of time until IMO rules come into force is given to operators.

5.2.2. Options for aligning the provisions allowing the use of "equivalent methods"

Option 0	Maintain the current Directive's approach to achieve the reduction of SO_2 emissions, i.e. fuel-based compliance as a rule and limited possibilities for technology-based compliance
Option 1	Align the Directive with the IMO provisions that allow a broader range of equivalent emission abatement methods
Option 2	The same as option 1 but complemented with additional safeguard measures to those already developed by IMO to ensure that equivalent abatement methods do not cause environmental damage.

Option 0 (no EU action) **was discarded** for the reasons described in section 3.3.2.

Option 1 would provide the most effective and efficient way to achieve the objectives defined in Chapter 4 as it would allow the use of a broader range of abatement methods to meet the sulphur emission limits, at the same providing more cost-effective means of compliance compared to petroleum fuel based compliance.

Liquefied natural gas (LNG) is virtually sulphur free and its use for the propulsion of ships is an attractive alternative to reach compliance with MARPOL Annex VI. LNG propelled ships also emit less PM, NOx, and GHG improving their overall environmental performance. The current price for LNG is more than 50% lower than the price of heavy fuel oil, resulting in pay back times for the additional costs of LNG engines of less than a year. The current lack of sufficient LNG supply infrastructure, however, remains a challenge but the use of LNG as fuel could be a suitable option in particular for short-sea shipping.

Scrubber technologies use fresh or sea water in order to remove SO2 from exhaust gases with a potential efficiency of more than 90%. Following successful trials, classification societies have already certified such equipment for use. According to their manufacturers, scrubbers are currently available for use in ships.[31] As outlined in the example below which assumes a yearly fuel consumption of 30 000 tonnes, the installation of scrubber technology can be significantly cost-effective when compared to fuel-based compliance. Pay-back times comparatively short suggesting to significantly increasing the cost-effectiveness of the IMO decision 2008.

[31] EMSA, December 2010

Example

Comparison of the costs of compliance of a cruise ferry, with a combined engine power of 40MW, requiring 30K tonnes fuel per year, operating in a SECA requiring the use of 0.1% sulphur fuel or achievement of equivalent emissions of SO2 using a sea water scrubber.

1) Yearly fuel costs for 0.1% sulphur fuel[32]:	13.5 – 20.4	M€
2) Yearly fuel costs HFO	9.9	M€ [33]
Estimated investment costs for the scrubber:	3	M€
Total:	12.9	M€
3) Scrubber pay-off time in relation to fuel:	8 - 12	months

The 2009 AEAt study estimated annual abatement costs resulting either from the use of low-sulphur fuel or from the use of equivalent technology/scrubbers. Table 6 summarizes the result for the Baltic Sea and the North Sea.

Table 6: Regional IMO compliance costs (Million Euros, 2020)

		Low price scenario	High price scenario
Baltic Sea	SO2 scrubber cost	120	540
	Low sulphur fuel cost	977	1180
North Sea	SO2 scrubber cost	284	1271
	Low sulphur fuel cost	2302	2778

Depending on the price scenario, the cost of using scrubber technology reduces the overall compliance costs with the 0.1% SECA standard between 50% and 88%. The cost difference between the use of low sulphur fuel and the installation of scrubbers to achieve the same reduction of SO2 emissions is considerable and it can be anticipated that ultimately the use of scrubbers will prevail as a compliance option.

It should be noted, however, that the use of abatement methods incurs operational costs as regards monitoring of compliance. On the other hand, safeguard measures developed at international level for alternative methods might need to be reassessed with regard to their impact on vulnerable European ecosystems such as brackish waters, enclosed ports and estuaries. For example, the impact on ocean acidification in case of widespread use of sea water scrubbers and releases into the marine environment of substances other than SO_2, such as polyaromatic hydrocarbons, may make it necessary to revise criteria for the discharge of wash water for the exhaust gas cleaning systems when more data becomes available. Moreover, scrubbers generate sludge that requires proper processing following transfer to waste reception facilities. Safety guidelines might be necessary to ensure safe treatment of the sludges.

Option 2 was **retained.** Like option 1, this option aligns EU rules with international rules whilst incorporating a mandate for the Commission to develop, if deemed necessary, safeguard measures to ensure that equivalent abatement methods do not cause damage to health, safety or environment. This would entail, for example, a

[32] Based on a price for MGO in the range of €450 to €680

[33] Price for HFO with 2.97% sulphur content projeted by Purvin and Gertz study (2009): 420USD. It is assumed that operational costs including additional fuel consumption for exhaust gas cleaning add 4% to the fuel costs.

review and possible strengthening of the IMO wash-water criteria applying to scrubbers.

The overwhelming majority of respondents to the public consultation (72%) supported this option, while one fifth suggested that additional safeguards to those already developed by the IMO should be considered to ensure that abatement methods do not cause damage to health, safety or the environment.

5.2.3. Options for adapting the Directive to technical standards

Option 0	Do not align EU law with the most recent ISO and CEN standards
Option 1	Align references and definitions in the Directive with the latest international standards.

The most recent ISO and CEN standards reflect the most up-to-date knowledge. In view of maintaining the Directive in line with the most recent standards **option 0 is discarded** and **option 1 kept** as the most efficient and effective in meeting the objectives defined in Chapter 4. The application of the internationally recognised technical standards is also important to ensure legal certainty for stakeholders. A clear majority of stakeholders supported option 1.

5.2.4. Fuel verification procedure

Two concurrent methods for the statistical interpretation of the verification of the sulphur content of marine fuels are applied by different Member States, which results in lack of clarity for shipping operators:

Option 0	Do not change current provisions
Option 1	Introduce ISO method 4259 for fuel verification;
Option 2	Adopt IMO fuel verification procedure

The 'do nothing' **option 0 is discarded** as it does not provide an effective and efficient solution to meeting the objectives defined in Chapter 4. To ensure legal certainty for ship operators the Directive should indicate more clearly which method is to be used for the purposes of assessing compliance. Further, the Directive should refer to only one method as such an approach is sufficient for sampling and analysis purposes and will improve clarity (at the moment there is a reference to two ISO methods).

IMO and ISO methods differ in their minimum test requirements making the ISO methods less precise and less costly. However, the IMO method is statistically more reliable and thus provides a higher legal certainty compared to the ISO method. **Option 1 is discarded** and **option 2 is retained**. A majority of more than 60% of the respondents of the public consultation supported option 2.

5.3. Options for additional and alternative measures to improve the environmental performance of the shipping sector

5.3.1. Additional Emissions Control Areas and emission limit values

Option 0	Do not introduce new ECAs and emission limit values for NOx in the Directive
Option 1	Introduce new ECAs or new emission limit values as a requirement in the Directive

An initial assessment[34] of the costs and benefits associated with the designation of the Mediterranean and the Black Sea as additional ECAs for both SOx and NOx suggested that the benefits exceed the costs, although the benefit-cost ratio would likely be smaller than for the existing European SECAs. However, **option 1 cannot be fully assessed at this point of time.** In order to allow for an improved analysis necessary to meet IMO's ECA criteria and for an assessment of emission limit values as an instrument to regulate ship emissions, **option 0** is retained for the time being.

The Commission intends to proceed with additional analysis, also looking at the costs and benefits of additional ECAs. The overwhelming majority of respondents to the public consultation (close to 70%) were of the view that the EU Member States should endeavour to establish new SECAs in the EU.

5.3.2. Options for reducing emissions from passenger ships on regular service

Option 0	Maintain the 1.5% obligation for passenger ships
Option 0 -	Remove current obligation to comply with 1.5% sulphur content for passenger ships, implying the use of 3.5% fuel until 2020 and 0.5% fuel thereafter
Option 1	Restore the link with the SECA sulphur content in fuel provisions, introducing the new 0.1% limits for passenger ships as of 2015
Option 2	Restore the link with the SECA sulphur content in fuel provisions for passenger ships, introducing the new 0.1% limit in 2020

The cost-benefit analysis associated with the present options under review is provided in Table 7 below. It uses the high price scenario of the AEA study in order to calculate the additional costs compared to the baseline of 0.5% fuel use.

[34] AEAt (2009), Cost Benefit Analysis to support the impact assessment accompanying the revision of Directive 1999/32/EC on the sulphur content of certain liquid fuels.

Table 7: Cost-benefit analysis assessing the introduction of the 0.1% fuel standards for passenger ships operating outside SECAs on a regular service

		€ million/year		
	Costs of compliance using low-sulphur fuel	Costs of compliance using scrubbers	Benefits	Benefits / costs ratio for scrubber use
2015	0	0	0	-
2020	304	57 - 157	102 – 339	1.5 – 6
2025	368	45 - 168	132 – 455	0.8 – 10

The results suggest that the compliance costs for using low sulphur fuel are in the same order as the expected benefits. A cost benefit analysis based on the more realistic scenario of achieving compliance by using scrubbers indicates net benefits of up to 10 euro for each euro spent (see table 6).

Option 0 implies the use of 1.5% fuel until the global standard of 0.5% comes into force in 2020. This corresponds to the baseline (do nothing option) and would therefore bring no additional environmental benefits in the non-SECA areas.[35] Considering the persistent air quality problems, notably also around the Mediterranean sea, option 0 is **discarded** as it would be inconsistent with the general and specific objectives being pursued.

Option 0 minus is equally discarded as it would allow passenger ships operating outside SECAs to use fuel with a sulphur content of 3.5% at least until 2020 and would lead to a worsening of environmental and health impacts. This option would have negative effects on meeting the objectives defined in Chapter 4 and would not be coherent with the overall EU objective to improve the environment and citizens' health.

Option 1 is discarded. This option would have positive health and environmental impacts. However, it would not be the most efficient option from the economic perspective as it could further increase demand for 0.1% fuel and thus put additional pressure on a market that needs to adjust to new fuel requirements.

Option 2 reflects the scenario whereby the maximum sulphur content for passenger ships operating outside SECAs in a regular service would be lowered from the present level of 1.5% to 0.1% in 2020. Option 2 would be slightly less effective in meeting the health and environmental objectives as it would be introduced 5 years later than option 1. It would be more efficient from an economic perspective while giving passenger ships more time to ensure compliance with the new sulphur limits and thus is an effective and pragmatic approach to meet specific objective 2. An assessment of a possible increase of an individual ferry passage is only feasible at the

[35] Passenger ships operate mostly in ports or close to coastal areas and their impacts on human health and the environment are typically greater per tonne of emissions than other types of ships. In particular, many passenger ships on regular service such as ferries operate on schedules that entail a residence time at ports of less than two hours. In such a case, ferries are not obliged to carry out a switch to 0.1% fuel and may continue to use fuel of a higher sulphur content contributing to low ambient air quality observed in port cities. To address this issue the obligation for all ships to meet 1.5% in SECAs was extended to passenger ships operating with regular service in non-SECAs.

level of individual routes, albeit impact on end-consumer prices is assumed to be negligible. Considering the costs of fuel based compliance and the costs of compliance applying alternative methods, an increase of the operating costs in the range of 2-13% may result. The Compass Study examined the cost structure of small and large passenger ferries (RoPax) and, according to this study, the share of fuel costs for these ships is between 16 and 19% of the daily operating costs.

5.3.3. Emission Trading Options

The use of an *emissions trading scheme* to meet environmental goals, could be more efficient (cost-effective) in meeting the objectives. In 2005 the Commission published a study on the feasibility of using economic instruments to reduce ship emissions in the EU[36]. This followed from an initial study published in 2004[37]. The study focused on a selection of economic instruments, namely emissions trading and voluntary differentiated port charges. In addition the study also considered the possibility of using public subsidies to meet environmental objectives. The key recommendation of the study supported emissions trading as more cost-effective than 'command-and-control' legislation (although on the basis of a set of assumptions, including 0.5% minimum sulphur content of fuels in SECAs). However, a more recent study specifically focusing on the issue (for both SO2 and NOx) concluded that it is not legally possible to deviate from or offset the MARPOL Annex VI requirements (applicable to individual ships) through an EU Emissions Trading System (ETS) unless such a possibility was created within the IMO framework (VITO 2010[38]). The study also concluded that, under the assumptions that individual ships comply with MARPOL Annex VI and that there would be the possibility to trade with land-based emission sources, there was limited scope for SO2 trading. As no IMO agreement currently exists allowing for environmental objectives set at international level to be met by an emissions trading scheme, this option has been discarded.

5.4. Options for strengthening the monitoring and enforcement provisions to enhance the implementation of the Directive

5.4.1. Options for strengthening the provisions on sampling and analysis of fuels

The requirement in the Directive for representative sampling and analysis allows a wide range of interpretation. Also, the Directive does not set out what format Member State reporting should take. Reports from Member States differ widely in format and content and do not allow an assessment of the implementation of the Directive.

Option 0	Do not change current provisions
Option 1	Issue non-binding guidelines at EU level, developed by the Commission itself or with the support of stakeholders (e.g., EMSA,

[36] Economic Instruments for Reducing Ship Emissions in the European Union (2005) http://ec.europa.eu/environment/air/pdf/task3_final.pdf

[37] Evaluation of the Feasibility of Alternative Market-Based Mechanisms To Promote Low-Emission Shipping In European Union Sea Areas (2004) http://ec.europa.eu/environment/air/pdf/04_nera_report.pdf

[38] Market-based instruments for reducing air pollution (VITO, June 2010)*I*

	CEN, Member States)
Option 2	Produce harmonized binding rules
Option 3	Foresee developing a non-binding guidance at a first stage and, should this approach fail, consider adopting binding rules (a combination of option 1 and 2)

Option 0 is discarded as it would not provide an effective and efficient solution to meet the objectives defined in Chapter 4. **Option 3** (a combination of options 1 and 2) is the preferred option as it would provide a more efficient solution compared to option 1 or 2 alone. 0ption 3 is in line with the general approach to EU policy making, i.e. to choose a lighter course of action, if possible, and only if that approach fails to introduce binding rules. The review showed that problems of non-compliance often stem from a lack of understanding on how to implement the rules of the Directive. Therefore, guidance can be the most efficient means to meet specific objective 3, mentioned in section 4.2., as it also incurs lower transaction costs than option 2. However, the non-binding character of the measure is not optimal from a legal certainty and effectiveness point of view, so this option foresees the possibility to adopt binding rules if the lighter approach does not deliver the expected results. Option 3 also best meets the divided views of stakeholders expressed in the public consultation. The public consultation showed an overwhelming support for strengthening the enforcement of rules on the sulphur limit for marine fuels.

5.4.2. Options for improving legal clarity and certainty

The need to provide clarification on the definition of "port area" and "passenger ships on regular service" was set out above in section 3.4.4 and Annex IV.

Option 0	Do not change current provisions
Option 1	Same as option 0 but issuing guidance to assist stakeholders with the interpretation and implementation of the Directive
Option 2	Include a definition for "Passenger ships on regular service" and "Port area";

Option 0 is discarded as it would not clarify the status of passenger ships on regular service and port area under the Directive.

Option 1, supported by a substantial number of stakeholders that expressed their opinion in the public consultation, **is kept** as it is sufficient to keep the possibility for the Commission to issue guidance on the enforcement of the Directive with regard to port areas and passenger ships on regular service. This option seems more efficient than option 1 as provides competent authorities with flexibility necessary to take into consideration local circumstances. Even though option 1 seems to provide more legal certainty than option 2, the rigid definition could provide room for circumvention.

Option 2 is equally discarded as too strict definitions may introduce undue loopholes or insufficiently address local circumstances.

5.5. Supplementary measures to address impacts on short sea shipping

Option 0	No measures specifically addressing possible modal shift from sea to land-based transport
Option 1	Adaptation of existing measures to specifically target impact on modal shift
Option 2	Develop additional approaches for a sustainable waterborne transport

The EMSA summary of available studies on the impact of the 0.1% sulphur requirement in SECAs on short sea shipping concludes that this provision will have some effects on shipping patterns. This may justify future measures. **Option 0** is discarded because it would exclude potential measures.

Option 1 would allow for measures to support SSS industry for a transitional period, with the objective of reducing undesirable modal shift from sea-based to land-based transport. Such a package might include the adaptation of existing measures (e.g. the Marco Polo programme or the TEN-T programme) in a way which addresses the new challenges. This would not incur additional costs to existing programmes. The vast majority of respondents to the public consultation supported this option.

Option 2 would imply additional measures. Such measures may require new proposals and need further studies and stakeholder consultation to be further assessed to be integrated in a more comprehensive policy framework. An overview of existing and additional measures is provided in Annex VIII. In line with the objectives of the future White Paper for Transport and the revised TEN-T policy, the Commission will present a multi-dimensional action approach --'a sustainable waterborne transport toolbox'-- which could assist the sector to improve its environmental performance while maintaining its competitive position.

The main policy objectives will be to improve the environmental performance and energy efficiency of the Short Sea Shipping, while protecting the internal market for SSS. It will also endeavour to provide for the right infrastructure which would support clean technology, and encourage green shipbuilding.

The sustainable waterborne transport toolbox could include regulatory measures, green technology, alternative fuels, infrastructure, economic and funding instruments, research and innovation. Further details are elaborated in annex VIII.

Option 2 requires further assessment. Under current evidence option 1 is kept as an efficient and effective means of meeting the objective of delivering the environmental and health benefits by making the sulphur limits stricter, while providing support to the affected industry. At a later stage option 2 may be considered.

6. SUMMARY OF THE IMPACTS ASSOCIATED WITH THE PREFERRED OPTIONS

6.1. Summary of baseline, retained options, benefits and costs (€ billion, 2020)

Baseline ("no action")	Retained options	Benefits	Costs
1. Alignment of EU law with revised MARPOL rules			
Alignment of maximum sulphur content of marine fuels			
Do not incorporate the 2008 MARPOL Annex VI provisions relating to the sulphur content of marine fuels into the Directive	Incorporate 2008 MARPOL Annex VI provisions relating to the sulphur content of marine fuels into the Directive (option 1)	Ensure full environmental and health benefits, harmonized and improved enforcement	Risk of undue modal backshift to land based transport on some routes
Alignment of the provisions related to the equivalent emission abatement methods			
Maintain limited possibilities for technology-based compliance	Broadening of the allowed technology-based compliance complemented with additional environmental safeguards (option 2)	A more cost-effective means of ensure full environmental and health benefits, harmonized and improved enforcement	Reduced compliance costs compared ranging between €3.7 and 8.4 billion
Adaptation to advanced technical standards			
Do not align EU law with the most recent ISO standards and international definitions	Align references and definitions in the Directive with the latest international standards (option 1)	Legal certainty	Immaterial
Fuel verification procedure			
Do not change current provisions on the method of analysis	Adopt IMO fuel verification procedure (option 2)	Legal certainty	Not significant when compared to fuel price
2. Designation of additional ECAs and/or emission controls			
Additional emission control areas and emission limit values			
Do not introduce new ECAs and ELVs in the Directive	Baseline is the retained option	Allows refinement of cost benefit analysis	Costs of inaction: unrealised env and health benefits
Environmental standards for passenger ships on regular service			
Maintain the 1.5% obligation for passenger ships	Link with the SECA standard for passenger ships 0.1% limit in 2020 (option 2)	Monetized health benefits ranging between € 102 – 339 million	Compliance costs ranging between € 57 – 304 million
3. Strengthening the implementation of the Directive			
Sampling ,and analysis of fuels, definitions of regular service and port area			
Do not change current provisions	Develop non-binding guidance followed by binding rules if necessary	Tiered and proportionate approach	Effectiveness uncertain
4. Supplementary measures to address impacts on short sea shipping			
No measures on possible modal shift (sea- to land-based transport)	Adaptation of existing measures to specifically target impact on modal shift (option 1)	Reduction of undesirable modal shifts; promotes innovation	No additional costs, redirecting public funds from other uses

6.2. Environmental Impacts

The transposition of the IMO provisions relating to the sulphur content of marine fuels into EU legislation has *a priori* no additional major environmental impact as IMO provisions cover 84.23% of world shipping tonnage and all but one costal state of the EU are parties to MARPOL Annex VI. The added-value of a transposition results from the strengthening of the enforcement of the IMO requirements. An estimate of the environmental impacts is a function of the extent Member States would enforce IMO provisions on fuel quality in the absence of EU legislation. The implementation of any legislation incurring potentially significant costs requires strong enforcement. Therefore only mandatory enforcement at EU level will ensure the delivery of the predicted environmental benefits of the IMO provisions.

As an alternative to the use of low sulphur fuel, compliance with the sulphur requirements can be achieved by using scrubber technology. Scrubbers do not only reduce the SO2 content of exhaust gases but reduce also other pollutants such as NOx and particulate matter to some degree. On the other hand, scrubbers increase the fuel consumption of a ship by 1-3% and cause an increase of greenhouse gas emissions if no further measures to increase the overall energy efficiency of a vessel are taken. A cost-effective measure is for example to marginally decrease the speed of a ship. A future inclusion of the maritime sector under EU ETS would cap any increase in CO2 emissions and would incentivise reduced fuel use. Additional safeguard measures may become necessary in order to avoid a negative environmental impact from the use of emission abatement methods. The chosen option provides for the possibility to develop such measures.

The designation of new Emissions Control Areas for emissions of SO2 and NOx and the introduction of emission limit values for NOx would result in a reduction of the emissions of these pollutants and the formation of secondary particulate matter. However, since IMO has not yet agreed on such measures it would be premature to propose new ECAs or other emission limits at EU level at this point.

The maximum sulphur content allowed for passenger ships on regular service outside SECAs will decrease from 1.5% to 0.5% as of 2020 (pending review, the introduction of this provision might be postponed to 2025). An introduction of the 0.1% standard to international passenger shipping instead of the 0.5% standard will have a significant environmental impact on emissions in the Mediterranean Sea, the North East Atlantic and the Black Sea.

Measures addressing compliance monitoring, reporting, adaptation to technical progress and legal clarity improve implementation of legislation and thus have a positive environmental impact.

6.3. Economic Impacts

The IMO agreement is considered to be a cost-effective internalization of pollution damages, thus moving the economy to a more efficient equilibrium. This effect is part of the baseline. In addition to the baseline, the harmonization of the enforcement of IMO rules at EU level will contribute to a more level competitive field for economic operators across intra-EU borders.

Costs resulting from the 2008 IMO requirements on the sulphur content of marine fuels are included in the baseline. Broadening the present provisions for "equivalent emission abatement methods, will help achieving the benefits associated with the new IMO at significantly reduced costs with savings ranging between €3 and 8 billion by 2020 or between 50 and 80 percent of the baseline costs. Demand for alternatives to low sulphur fuels will stimulate innovation and productivity in the abatement technology market.

Direct costs resulting from the transposition of the IMO provisions on the sulphur content of fuels are limited to additional sampling and analyses necessary to further verify the global fuel standard. Compared to baseline compliance costs, these additional cost are negligible.

The 0.1% fuel standard for passenger ships operating on regular service outside of SECAs will result in additional yearly compliance costs of €57 million-€300 million (for details see table 8). Consumer prices (e.g. for the use of a ferry) are likely to increase. The wider monetized impacts on health of this measure are generally expected to exceed these costs. This provision harmonizes the fuel standards for passenger ships operating within and outside of SECAs. Therefore, it contributes to a level playing field for the passenger ship industry in the EU. The provisions on compliance monitoring, reporting, adaptation to technical progress and legal clarity will strengthen and harmonize implementation of the Directive and are expected to reduce distortions of competition in the internal market for port services and maritime shipping.

6.4. Social Impacts

The implementation of IMO provisions at EU level will deliver significant human health benefits. The IMO agreement may lead to some shifts in employment from the maritime sector to the land-based transport sector. The significant relative cost-effectiveness of abatement technologies is expected to increase investment in this sector and to generate high-quality jobs. All of these effects are part of the baseline.

For the purposes of the impact assessment most non-baseline provisions are expected to have limited additional health and employment effects. An exception is the implementation of provisions on passenger ships, which is additional to the IMO agreement. These provisions will deliver increased human health benefits. Measures improving compliance monitoring, reporting, adaptation to technical progress and legal clarity contribute to good governance and to public access to information.

6.5. Administrative burden

'Administrative burden' is defined as information obligations that are placed on citizens, businesses or public administration (excluding the EU) by EU legislation and that entail financial costs. These obligations can be to provide, record and/or keep information. Following the EU guidelines for the assessment of administrative burden, the obligations in the Directive were mapped and changes resulting from the proposed were assessed on their significance. The changes introduced, either in terms of increases or decreases in administrative burdens, are deemed not significant in relation to the existing provisions of the Directive (the 'baseline'). Detailed information on this assessment can be found in Annex IX.

7. MONITORING AND EVALUATION

7.1. Indicators of progress towards meeting the objectives

The core indicators for measuring progress against the general and specific objectives set for this policy initiative are the following:

(1) Trends in the levels of emissions from international shipping and their associated contribution to air quality levels measured on-shore pursuant to the EU air quality Directives;

(2) Application of the latest international standards by the shipping sector, their suppliers and public authorities;

(3) Effective programme of compliance verification based on reporting by Member States;

(4) Evolution of transport patterns in short sea shipping and land-based transport;

7.2. Outline for monitoring and evaluation planning

The monitoring and assessment exercises will be based on the reporting requirements of the Member States existing (and enhanced) under this and other Directives. In particular, the following issues will be addressed:

- Assessment of the reports provided by Member States on the sulphur content of fuel for comprehensiveness and statistical validity;
- Monitoring of emissions and ambient air quality reported by Member States pursuant to Ambient Air Quality Directive (2008/50/EC).
- Eurostat reports on transport volumes and modes;

Member States' implementation will be supported throughout the introduction and implementation of the revised legislation, including through the implementation committees and ad hoc expert groups where appropriate.

8. CONCLUSION AND PREFERRED POLICY MIX

The new international limit values for the sulphur content of marine fuels are expected to significantly reduce emissions of SO_2 from the maritime sector. This will greatly contribute to achieving the general environmental objectives stated in the 2005 Thematic Strategy on Air Pollution as well as the specific objectives stated in the Directive. It will furthermore yield ancillary benefits in terms of reducing emissions of NOx and PM. Also, for the purpose of promoting compliance with existing ambient air quality limit values, a problem for several Member States facing infringement procedures, it is essential to ensure that these projected benefits materialise. The recommended options resulted in the overall policy package summarised in Table 8.

Table 8: Recommended options

Quality of marine fuels: introduce IMO standard for the maximum sulphur content for vessels operating in and outside of Emission Control Areas; allow technology-based compliance; in addition to IMO provisions, introduce 0.1% sulphur limit applicable for passenger ships on a regular service.
Compliance costs and impacts on short sea shipping: clarify the use of mitigating measures.
Implementation: develop non-binding guidance followed by binding rules if necessary for sampling and analysis of fuels and reporting by Member States, clarify terminology.

It is recommended that the Directive is fully aligned with the IMO rules related to fuel standards so as to complement the IMO regime with the monitoring and enforcement regime offered by EU law. In going beyond IMO provisions, changes to fuel standards for passenger ships on a regular service are proposed.

Furthermore, and while recognizing that the cost implications resulting from the new IMO rules are fully warranted on the basis of benefits and costs, certain specific industries may face significant impacts. It is therefore also recommended that the Directive recognizes and promotes the use of innovative emission abatement technologies as an equivalent compliance option. Such an option will significantly lower the IMO compliance cost, thus also reducing the risk that ship owners and operators will fail to comply with the new rules agreed internationally. Facilitating technology-based compliance will have ancillary benefits in the promotion of innovative solutions both within the air pollution abatement technologies industry and in those sectors under the scope of the Directive, in line with the priorities of the Europe 2020 Strategy. For similar reasons, it is recommended that the Commission and Member States use and, where possible or necessary, adapt existing instruments, to assist industry in the transition towards the new standards, notably in SECAs.

To ensure that the monitoring and enforcement as currently defined in the Directive is rendered more effective and efficient, certain limited modifications are recommended based on the review of the state of implementation.

The cumulative impacts of the policy package can be summarized as follows:

- Full implementation of an effective monitoring and control mechanism to reap the full human health and environmental benefits of the baseline;
- Considerable improvement of Member States performance in meeting the provisions in the Directives on ambient air quality and national emission ceilings;
- Positive economic and social benefits from stimulating innovation aimed at the development, production and marketing of alternative compliance technologies;
- Reduction of the risk of a shift from sea- to land based transport modes;
- Improvement of the monitoring of fuel quality by port state controls.

Finally, it is recommended that the transposition of NOx and PM standards that are set in the future by the IMO is further considered, given that air quality problems related to ground-level ozone and fine particles persist and that there are high benefit-cost ratios associated with such actions. It is also recommended that further analytical work is conducted to support IMO action in this area.

ANNEX I EXTERNAL STUDIES CONDUCTED IN SUPPORT OF THIS IMPACT ASSESSMENT

A. Studies commissioned by the European Commission

1. Analysis of Policy Measures to Reduce Ship Emissions in the Context of the Revision of the National Emissions Ceilings Directive (International Institute for Applied System Analysis –IIASA, April 2007)

2. Technical support for European action to reducing Greenhouse Gas Emissions from international maritime transport (Delft CE et all, December 2009)

3. Greenhouse Gas Emissions for Shipping and Implementation Guidance for the Marine Fuel Sulphur Directive (Delft CE et all, December 2006)

4. Impacts On The EU Refining Industry & Markets Of Imo Specification Changes & Other Measures To Reduce The Sulphur Content Of Certain Fuels (Purvin and Gertz, June 2009)

5. Cost Benefit Analysis to Support the Impact Assessment accompanying the revision of Directive 1999/32/EC on the Sulphur Content of certain Liquid Fuels (AEA et al., December 2009)

6. COMPASS: The COMPetitiveness of EuropeAn Short-sea freight Shipping compared with road and rail transport (TML et al., August 2010)

7. Market-based instruments for reducing air pollution (VITO, June 2010)

8. The 0.1% sulphur in fuel requirement as from 1 January 2015 in SECAs – An assessment of available impact studies and alternative means of compliance (EMSA, December 2010)

B. Studies conducted or reviewed by the European Maritime Safety Agency

1. AEA (2009) – Cost Benefit Analysis to Support the Impact Assessment accompanying the revision of Directive 1999/32/EC on the Sulphur Content of certain Liquids Fuels, prepared for the EU Commission.

2. COMPASS (2010) – The COMPetitiveness of EuropeAN Short sea freight Shipping compared with road and rail transport, performed by Transport & Mobility Leuven, supported by EU Commission through DG ENV.

3. ECSA (2010) – Analysis of the Consequences of Low Sulphur Fuel Requirements, performed by University of Antwerpen, Institute of Transport and Maritime Management Antwerpen (ITMMA).

4. German Shipowners" Association and Association of German Seaport Operators (2010) – Reducing the sulphur content of shipping fuels further to 0.1 % in the North Sea and Baltic Sea in 2015: Consequencs for shipping in this area, performed by Institute of Shipping Economics and Logistics.

5. Maritime Coast Guard Agency (2009) – Impact Assessment for the revised Annex VI of MARPOL, performed by ENTEC.

6. Ministry of Transport and communications Finland (2009), Sulphur content in ships bunker fuel in 2015, A Study on the impacts of the new IMO regulation on transportation costs, performed by the University of Turku, The Centre for Maritime Studies.

7. Shipowner association of Belgium, Finland, Germany, Holland, Sweden and UK and endorsed by the wider membership of ECSA and ICS (2010) – Study to Review Assessments Undertaken of The Revised MARPOL Annex VI Regulations, performed by ENTEC.

8. SKEMA (2010) – Task 2 and 3 Impact Study on the future requirements of Annex VI of the MARPOL Convention on Short Sea Shipping, supported by DG TREN at the time.

9. Swedish Maritime Administration (2009), Consequences of the IMO's new marine fuel sulphur regulations.

C. Other relevant studies:

1. Miola, A. Ciuffo, B., Marra, M., Giovine, E., (2010) - Regulating Air Emissions from Ships: The State of the Art on Methodologies, Technologies and Policy Options. ISBN 978-92-79-17733-0. EUR 24602 . EC, Luxemburg

2. Miola, A. B. Ciuffo "Estimating air emissions from ships: Meta-analysis of modeling approaches and available data sources" Atmospheric Environment 45 (2011) 2242- 2251

3. Miola, A ,Ciuffo, B., Marra, M., Giovine, E., (2010) "Analytical framework to regulate air emissions from maritime transport. EUR 24297 EN 2010ISBN 978-92-79-15308-2. EC, Luxemburg

4. A.Miola, Paccagnan V, Turvani M, Massarutto A, Mannino I, Perujo A. (2009)External Costs of Transportation. Case Study: Maritime Transport. EUR 23837 EN; ISBN: 978-92-79-12534-8 EC, Luxemburg

5. Miola, V. Paccagnan, V. Andreoni, A. Massarutto, A. Perujo, M. Turvani (2008) - Maritime Transport – Report 1: Review of the measurement of external costs of transportation in theory and practice. EU report EUR 23714 EN ISBN 978-92-79-11279-9 EC, Luxemburg

6. V. Andreoni, A., Miola, A., Perujo, (2008) "Cost Effectiveness Analysis of the Emission Abatement in the Shipping Sector Emissions" EU report EUR 23715 EN - ISBN 978-92-79-11280-5, EC, Luxemburg

ANNEX II INTERNET QUESTIONAIRE

An internet consultation was organised during the period of 29 October 2010 till 6 January 2011. A total number of 243 responses were received and analysed. Most replies were received from organisations (75%). Most of the replies originated from ship owners and mangers (33.6%) followed by land operators (11.9%) and administrations (11.1%). Hundred six submissions are without sector assignment (43%; "other"). However, it should be kept in mind that a considerable number of almost identical contributions (67 contributions derived from 6 different templates) were submitted. Most respondents (93%) indicated that they know the sector and the legislation related to air pollution from ships.

The main outcome of the consultation can be summarised as follows:

- A general support for aligning the Directive with the MARPOL Annex VI provisions on the sulphur content of fuel including the global standard was expressed in submissions from all sectors. Critical views
    - referred to high costs and risk of modal backshift;
    - suggested to reopen discussion on fuel quality at IMO and
    - to first address the availability of the 0.1% SECA standard in a feasibility study;
    - expressed doubts that the current systems of port state controls is in a position to enforce the new fuel standards.
- Most respondents (91%) support a harmonization of EU provisions on the use of abatement technologies with MARPOL Annex VI. Suggestions received propose to
    - ensure additional safe guard
    - not to deviate from IMO provisions
    - regulate exhaust gas cleaning system under the Marine Equipment Directive
    - request guarantees from equipment manufacturers on the performance
    - ensure legal certainty (grandfather clause)
    - not restrict equivalent measures to abatement technologies
    - harmonise regulations on trial procedures at IMO
- A majority of respondents (85%) called for a clarification of measures to mitigate the costs of the new requirements.
- With regard to the designation of new emission control areas (ECAs), 69% of the replies were in favour of supporting this process at IMO.
- As regards to possible solutions for reducing compliance costs, a strong support was expressed to support ship owners willing to invest in new technology (82%), to develop adequate infrastructures to support the use of low emissions technologies in EU ports (66%, multiple answers were allowed) and to promote short sea shipping (59%). The following specific actions are summarized as follows:
    - Provide incentives for early adopters
    - Establish and emissions trading System
    - Ensure legal certainty (grandfather clause for installed equipment)
    - Introduce a system of emission charges similar to the Norwegian NOx fund
    - Speed up procedure for the approval of new technologies
    - Support short sea shipping promotion centers
    - Exceptions for ships operating in arctic areas
    - Support for investment for retrofitting of existing and for new ships
    - clarify standards for scrubber wash water discharges

    - establish system of reception facilities
    - no fee for reception facilities
    - R&D
    - Internalise external costs of road transport
    - Widen ECAs in order to increase economies of scale
    - Synchronise state aid in order to avoid out-flagging
    - Develop LNG infrastructure
    - Penalise non-compliant ship owners
- The issue of dispute settlement in case the analysis of a fuel sample raises doubts whether the sulphur content of a fuel complies with the legal limit was raised. A majority (64%) favoured provisions for dispute settlement developed by IMO. Keeping the ISO 14596 method was supported by 11% of the replies. 25% indicated "no opinion".
- Most respondents (62%) support to aligning the Directive with the new ISO standard on distillate marine fuels. One third of the replies indicated "no opinion". The question whether fuel quality parameters other than sulphur content should be specified in the Directive raised split views: About half (53%) of the replies were against, 36% were in favour and 12% of "no opinion. A two third majority supported the updating of methods to measure the sulphur content of fuels, 22% were against, 13% indicated "no opinion".
- With regard to enforcement of the sulphur standards of marine fuels, about one quarter (27%) of the replies indicated that current practices ensure efficient control. Two third of the respondents considered that effective enforcement helps to deliver the intended environmental improvements of the lower sulphur marine fuels and 43% (multiple answers were allowed) point out that harmonized enforcement is important for an equal level playing field for ports.
- As regard to the harmonisation of sampling each option put forward (guidelines, binding rules, no action) received similar support. However, preferences varied considerable within the stakeholder groups: Among the ship owners and managers, 71% considered that no action is necessary; whereas not a single land operator or administrator shared this view. Administrators favour guidelines (63%) and land operators tend towards binding rules (57%).
- Most of the respondents (78%) replied that the fuel supplier should have an obligation to provide fuel of the correct quality. At the same time, 29% (multiple answers were allowed) considered that this should be the responsibility of the ship operator. Among ship owners this view was more polarised (100% considered it an obligation of the supplier, 9% of the ship operator) whereas 46% of the land operators regarded it as an obligation for the ship operator and 32% as an obligation for the fuel supplier. The replies of administrators were close to the overall result.
- A clear majority (90%) of the replies called for a publicly accessible register of marine fuel suppliers.
- The consultation did not reveal any priority on the fuel standard that should apply for passenger ships operating on regular service outside SECAs and visiting EU ports. Within the different stakeholders, a majority of 55% of ship operators considers that even the current sulphur limit should be deleted. Administrators and land operators did not support this view. The former considered that further reductions of air pollution out side SECAs are needed (44%) or that the global standard should apply as of 2020 (37%). The latter group considered that the global standard should apply (46%) or is of no opinion (36%).
- With regard to the clarification of the concept of "regular service", 30% of the respondents considered a need to clarify this term. The option to apply to cruise ships the same provisions as to passenger ships on regular service was supported by 25% of the

respondents and 20% of the replies suggested to exclude cruise ships from these provisions. "No opinion" was indicated by 25%.

- No clear picture emerged on the clarification of the meaning of "port area". 39% of the respondents favour to add a definition, 34 did not and 27% are of no opinion. Ship owners tend not to seek clarification (61% no, 39% yes). Land operators favour clarification (46%) or have no opinion (50%). Administrators have no preference.

ANNEX III TRENDS IN EMISSIONS FROM INTERNATIONAL SHIPPING AND RELATED IMPACTS

1. DEPOSITION OF SULPHUR AND ACIDIFICATION OF ECOSYSTEMS IN THE EU

1.1. Emissions of sulphur dioxide

The emissions of sulphur dioxide over the period 2000 to 2008 for the EU-27 countries and various sea areas are shown in table 1 below

Area	***Emissions of SO_2 in kT per year***								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU-27	10436	10174	9685	9206	8651	8126	7870	7331	5867
Baltic Sea	216	221	227	233	239	245	225	205	185
North Sea & English Channel	464	475	487	500	513	526	484	442	400
Mediterranean Sea	1108	1137	1166	1196	1227	1259	1277	1292	1309
Black Sea	58	59	61	62	64	65	66	66	66

Table 1: *Emissions of SO_2 in the EU 2000-2008. Data provided by EMEP (Cooperative Programme for* ***monitoring*** *and evaluation of the long-range transmission of air pollutants in Europe; under the auspices of the EMEP protocol and the Convention on Long Range Transboundary Air Pollution; (http://www.ceip.at/emission-data-webdab/emissions-used-in-emep-models/)*

Over the period 2000 to 2008, emissions from land-based sources in the EU have decreased by approximately 44%. Against this backdrop, emissions from sea areas not yet designated as SECAs such as the Mediterranean Sea and Black Sea have increased over the same period by 18% and 14% respectively. However, emissions of sulphur dioxide in the Baltic Sea and North Sea/English Channel show substantial reductions following the entry into force of the first SECA in the Baltic Sea in mid-2006 and the North Sea and English Channel in mid-2007. It should be recalled that the ships in the Baltic Sea region may have been using fuels with lower sulphur content than the global average (c.a. 2.7%) due to the operation of local schemes to incentivise cleaner ships, thereby lessening the apparent benefit of the mandatory use of fuels with a maximum permitted sulphur content of 1.5% by mass. In addition, the estimates are based upon limited information about ship activity, ship location and limited measurements of ships' actual emissions.

1.2. Sulphur Deposition and acidification of ecosystems

Ecosystems vary in their sensitivity to acidifying gases and acidifying deposition such as sulphur and nitrogen compounds (NOx and ammonia). This sensitivity depends upon several factors including the so-called buffering capacity of soils or underlying geological formations. The sensitivity is described in terms of a critical load of deposition below which damage is not expected to occur. The sensitivity to sulphur is shown in the figure below which shows the 5th percentile and median

sensitivity of ecosystems[39]. Critical loads are generally lower and ecosystems generally more sensitive in North Western Europe.

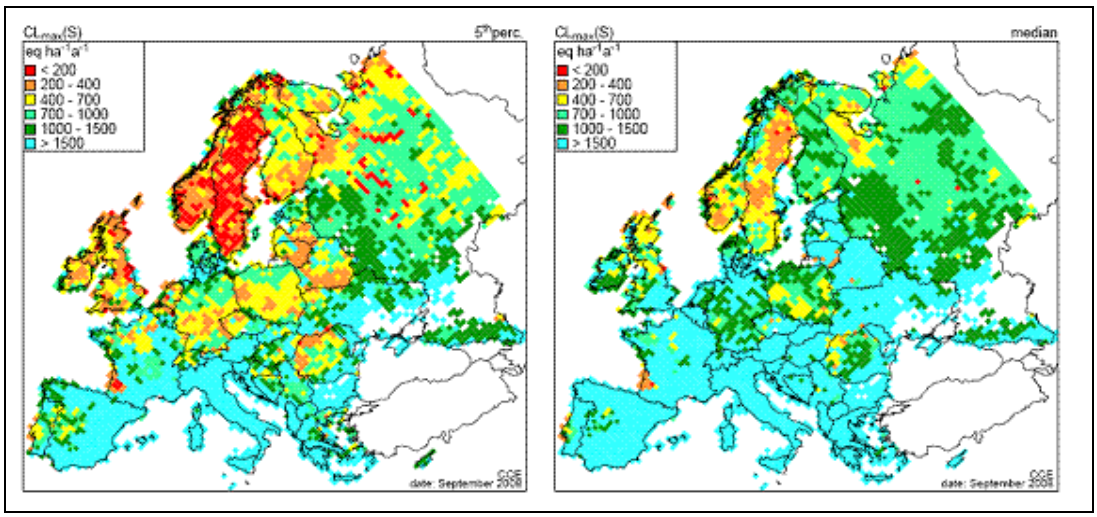


Figure 1: *Sensitivity of ecosystems to sulphur deposition. Data provided by the Coordination Centre for Effects under the LRTAP Convention (CCE Status Report 2009).*

The total amount of sulphur deposited in the EU-27 geographic region is shown in the table 2 below for the period 2000 to 2008 and in figures 2 and 3 below which also depict the contribution from shipping and land–based sources respectively for the years 2000 and 2007.

Area	***Estimated deposition of Sulphur in kT per year***								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU-27	3067	3027	2894	2783	2649	2583	2515	2348	2024

Table 2:*. Deposition of sulphur in the EU. Data provided by EMEP: Transboundary air pollution by main pollutants (S, N, O_3) and PM in the European Union; Agnes Nyiri et al, MSC-W 1/2010.*

Taking account of the different scales in the figures depicting total deposition and that from shipping, it is clear that the deposition of sulphur due to shipping in the Southern North Sea region for example is significant and of the order of 200–2000 mg Sulphur(S) m^{-2} in the year 2000 and of the order of 200–1000 mg S m^{-2} in 2007. This compares to a total deposition from land based sources of 500–2000 mg S m^{-2} in the years 2000 and 2007 respectively.

The GAINS integrated assessment model from the International Institute of Applied Systems Analysis (IIASA) has been used to estimate the evolution of ecosystem acidification risk up to 2020 and 2030[40]. Using an energy projection ('2009 PRIMES') incorporating the climate & energy package of measures and current legislation on air pollution abatement (including the latest rules from the IMO on the

39 CCE Status Report 2009: Progress in the modelling of critical thresholds, impacts to plant species diversity and ecosystem services in Europe; http://www.pbl.nl/en/themasites/cce/publications/040/index.html.

40 CCE Status Report 2009: Progress in the modelling of critical thresholds, impacts to plant species diversity and ecosystem services in Europe; page 16. http://www.pbl.nl/en/themasites/cce/publications/040/index.html.

sulphur content of marine fuels), future acid deposition has been calculated from emissions of sulphur dioxide, nitrogen oxides and ammonia.

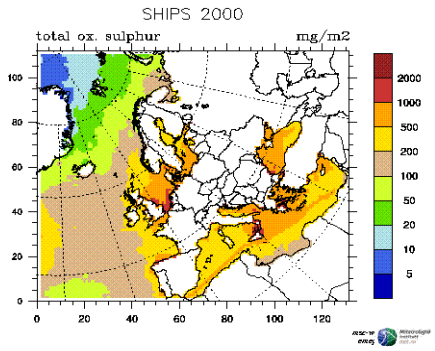
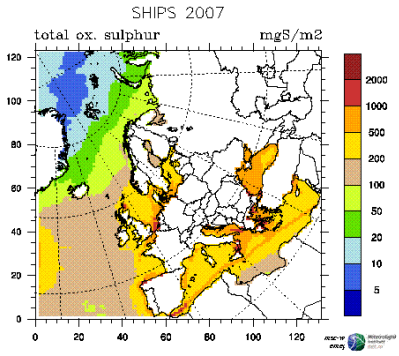
S deposition due to ships in 2000	S deposition due to ships in 2007
	

Figure 2: *Sulphur deposition in the EU from ships. Data provided by EMEP; (http://www.ceip.at/emission-data-webdab/emissions-used-in-emep-models/).*

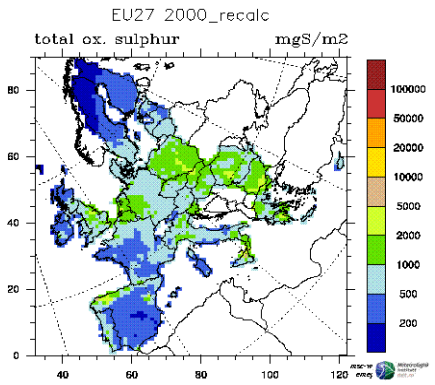
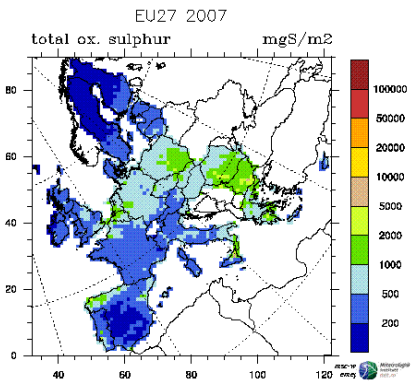
Total Sulphur deposition in the EU in 2000	Total Sulphur deposition in EU in 2007
	

Figure 3: *Sulphur deposition in the EU from land based sources. Data provided by EMEP; (http://www.ceip.at/emission-data-webdab/emissions-used-in-emep-models/)*

In the EU27, the area at risk from acidification decreases from 19% in 2000 to 5% in 2020 and 2030. The Average Accumulated Exceedance (AAE)[41] represents the extent to which an ecosystem critical load is exceeded and so long as this remains above zero damage is expected at some point in time. The AAE for critical loads for acidification for the EU 27 in 2000 was determined to be 105 acid equivalents per hectare per year (eq ha^{-1} yr^{-1}) which declines to 17 and 15 eq ha^{-1} yr^{-1} in 2020 and 2030 respectively. The areas with the largest exceedances in the year 2000 are in the

41 The Average Accumulated Exceedance (AAE) is the area weighted average of the difference between deposition and the critical load. From the point of biodiversity protection the aim is to reduce the AAE to zero.

UK, Netherlands, Germany and Poland but these exceedance areas diminish substantially in 2030 with some smaller exceedance areas remaining in the Netherlands and Poland

Even where the acid deposition falls below the critical thresholds recovery of the ecosystem may take many years during which time damage may still occur. Based on information provided by the Member States to the Convention on Long Range Transboundary Air Pollution (CLRTAP), damage will still occur beyond 2100 in countries such as the UK and Germany. This recovery time lag can only be shortened by reducing the acid deposition (including sulphur) to levels below the critical load.

2. PM AND SO2 AMBIENT AIR QUALITY

Directive 2008/50/EC[42] on ambient air quality and cleaner air for Europe entered into force on 11 June 2008. It merged the existing legislation into a single directive (except for the fourth daughter Directive) with no change to the existing air quality objectives including those for sulphur dioxide or PM_{10}. It did, however, introduce new limits and exposure-related objectives for fine particulate matter ($PM_{2.5}$).

2.1. Emissions of fine particulate matter (PM2.5)

The emissions of fine particulate matter ($PM_{2.5}$) over the period 2000 to 2008 for the EU-27 countries and various sea areas are shown in table 3 below.

Area	***Emissions of $PM_{2.5}$ in kT per year***								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU-27	1711	1697	1634	1632	1618	1571	1528	1492	1490
Baltic Sea	22	23	23	24	25	25	25	24	24
North Sea & English Channel	50	51	52	54	55	56	55	54	54
Mediterranean Sea	123	126	129	132	136	139	142	145	148
Black Sea	6	6	7	7	7	7	7	7	7

Table 3: *Emissions of $PM_{2.5}$ in the EU 2000-2008: Data provided by EMEP; (http://www.ceip.at/emission-data-webdab/emissions-used-in-emep-models/)*

The trends in emissions of primary fine particulate matter are similar to those for sulphur dioxide in that emissions from land based sources have declined appreciably since 2000 (13%) whilst those in the SECAs have shown an increase than a small decrease and a levelling off. Emissions in the Mediterranean Sea have been estimated to have increased continuously over the period whilst those from the Black sea have been relatively stable.

[42] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe; OJ L 152, 11.6.2998, p. 1.

2.2. PM_{10} concentrations

The population weighted mean concentration of PM_{10} in urban agglomerations varies between 27 and 31 µg/m^3 for the years 2001 to 2007 with no discernable trend[43]. In 2008, 288 zones in 21 Member States (out of c.a. 900 zones in total) did not comply with PM_{10} air quality limits which formally entered into force on 1 January 2005. The identity of these zones has been published and is available on the web[44]. Sixteen of the ports in Table 1 (indicated by asterisk) are situated in air quality management zones where an exceedance of the daily (and most stringent) air quality limit value for PM_{10} was recorded in 2007 or 2008. These include the major European ports in Rotterdam, Antwerp, Marseille and elsewhere.

The Air Quality Directive creates the possibility to postpone the deadline for compliance up until June 2011 for PM_{10} based on conditions and the approval of the European Commission. The single most important condition is that the notification must include an air quality plan that delivers compliance by the extended deadline. Up until December 2009, notifications concerning PM_{10} had been received from 18 Member States covering 307 air quality management zones (out of approximately 900):

– For around 16% of these, the Commission did not raise any objection

– A further 15% or so of the zones were already in compliance whilst

– Objections were raised for approximately 70% of notified zones.

As of mid-2010, there were open infringement proceedings against 21 Member States in respect of PM_{10}.

2.3. Sulphur dioxide concentrations

There are three air quality limit values for sulphur dioxide which entered into force from 1 January 2005 for hourly, daily and annual concentrations respectively. Out of 775 air quality zones, 9 and 11 zones respectively exceeded either the hourly or the daily (or both) limits representing about 1% of all zones. In fact substantial decreases of the order of 65% have been observed in the measured concentrations of SO_2 at traffic-related, urban and rural sites in the period 1997 to 2007. However, as of mid-2010, there were ongoing infringement proceedings in respect of exceedances in 5 Member States for one or both of the hourly or daily limits in respect of concentrations measured in the period 2005-2008.

The annual average concentration limit for the protection of vegetation in Directive 2008/50/EC is set at 20µg/m^3 and is stricter than that for the protection of human health but nonetheless exceedances were observed at only 2 of the rural monitoring stations (although exceedances were also seen at industrial, traffic and urban stations which are not necessarily relevant for the protection of natural vegetation).

[43] http://air-climate.eionet.europa.eu/docs/ETCACC_TP_2009_3_eoi2008_2007aqdata.pdf; p. 41

[44] http://air-climate.eionet.europa.eu/reports/ETCACC_TP_2009_10_prelim_AQQanalysis_2008

3. EUTROPHICATION OF ECOSYSTEMS

The critical load for nutrient nitrogen expresses the risk that an ecosystem will undergo compositional change with a loss of biodiversity following excessive deposition of reduced and oxidised forms of nitrogen. Agriculture is primarily responsible for most emissions of reduced nitrogen in the EU in the form of ammonia whilst mobile and fixed combustion sources are responsible for emissions of nitrogen oxides (oxidised nitrogen).

The exceedance of the 5th percentile critical load (of all ecosystems) for nutrient nitrogen is shown in Figure 4 for the year 2000 and 2020 and 2030 under a business as usual scenario. In the EU27 area, the ecosystem areas at risk from eutrophication are 74% in 2000, 56% in 2020 and 54% in 2030. In addition, the area weighted average of the difference between deposition and critical loads (so-called Average Accumulated Exceedance) is 331 equivalents ha^{-1} yr^{-1} in the year 2000 and estimated to be 152 and 1444 eq. ha^{-1} yr^{-1} in 2020 and 2030 respectively. From the point of view of achieving biodiversity protection, the AAA should be zero otherwise damage is expected at some point in the future.

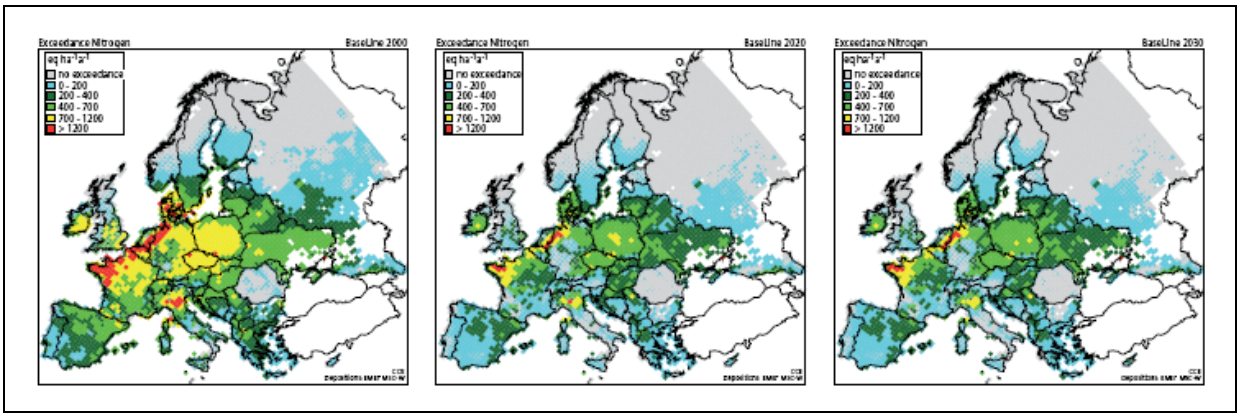


***Figure 4:**. Exceedances of the critical load for nutrient nitrogen under a business as usual scenario in the years 2000, 2020 and 2030 (5th percentile of all ecosystems). Reproduced from the CCE's Status Report for 2009 under the auspices of the UN ECE LRTAP Convention.*

Ship emissions of nitrogen oxides contribute significantly to the observed deposition of oxidised nitrogen in the EU. Figure 5 shows the deposition due to ships and land-based sources of oxidised nitrogen in 2008. The figure shows that ships contribute as much as land based sources in some parts of North Western Europe bordering the North Sea, Baltic Sea and English Channel.

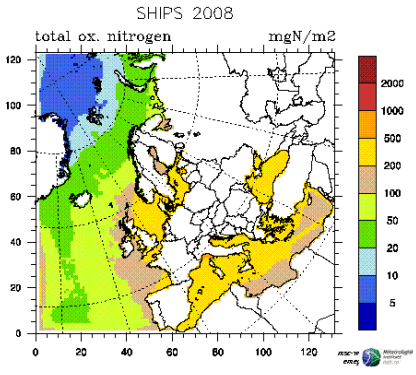
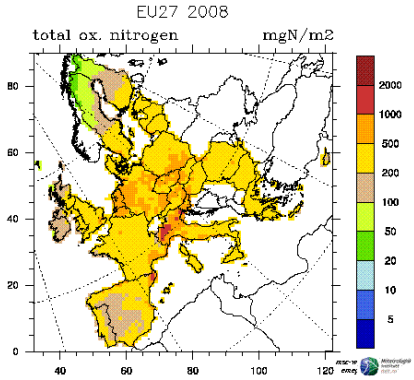
Ship-derived deposition of oxidised nitrogen	EU-27 land-based deposition
	

Figure 5: Oxidised nitrogen deposition in the EU from ships and land-based sources. Data provided by EMEP; (*http://www.ceip.at/emission-data-webdab/emissions-used-in-emep-models/*).

4. GROUND LEVEL OZONE

4.1 Current ozone air quality

Impacts of ozone on health are associated with short term effects on the respiratory system, chronic disease and death. Health impacts have been observed at concentrations as low as 70µg/m^3 which is below the current guideline of the World Health Organization (daily 8-hour average concentration of 100 µg/m^3). The Commission has estimated that there may be as many as 21 000 cases of premature death each year due to acute exposure to ozone.

The European Environment Agency prepares a report annually on the observed concentrations of ground level ozone of the previous summer. The latest report covers ozone levels measured in 2009[45] and figure 6 below shows the degree to which the long term objective for the protection of health was exceeded. The long term objective is expressed in terms of a concentration of ozone in air of 120 µg/m^3 expressed as the daily maximum 8-hour mean concentration.

45 Air pollution by ozone across Europe during summer 2009: Overview of exceedances of EC ozone threshold values for April–September 2009; EEA Technical Report N°2 / 2010. http://www.eea.europa.eu/publications/air-pollution-by-ozone-across-europe-during-summer-2009

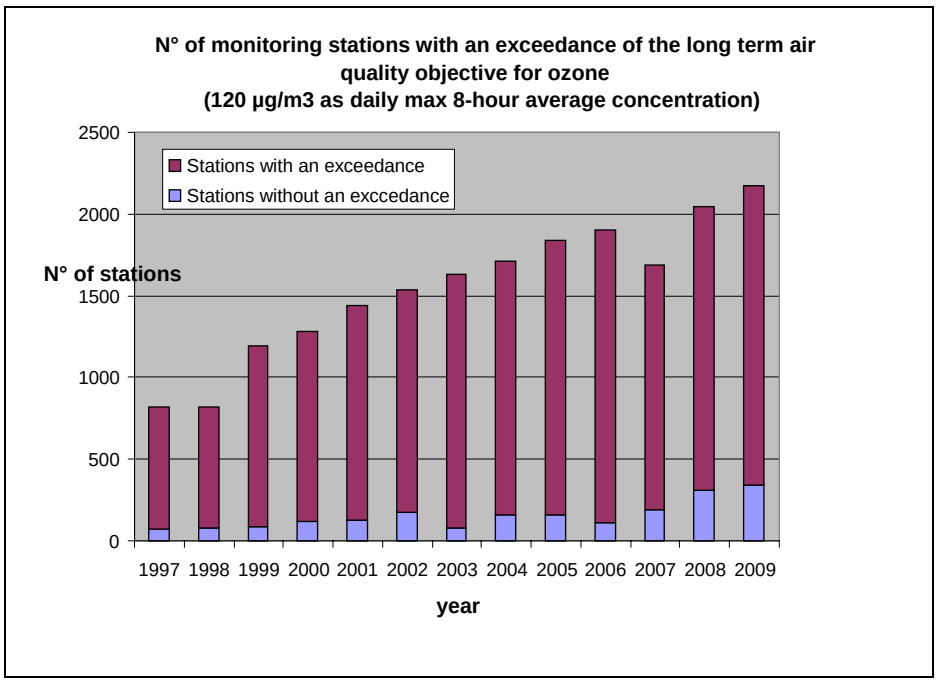


Figure 6: *. Exceedences of the long term objective for ozone in the EU*

Whilst EU-27 emissions of ozone precursors, weighted according to their contribution in ozone formation fell about 40 % in the period 1990–2005 the concentrations measured at rural ground-level stations during the summer months show atmospheric ozone concentrations remaining largely unchanged over the period 1997 to 2009 (and ignoring the extreme year of 2003). The constant baseline levels are the net result of a number of possible processes:

- the increase in hemispheric background concentrations;
- less ozone deposition during the (more frequent) dry periods during summer, increased ozone formation due to higher temperatures;
- less ozone formation due to emissions reduction.

Between the late 19th century and 1980, concentrations of background ozone in the mid-latitudes of the northern hemisphere doubled to approximately 60–75 µg/m^3 and have since increased to 80 µg/m^3. The increase since 1980 is not fully understood but is thought to be due mainly to increases in emissions from poorly regulated sectors in northern hemisphere countries, such as international shipping and aviation. Increased ozone from the stratosphere may also have contributed. The Task Force on Hemispheric Air Pollution (HTAP) under the Convention on Long Range Transboundary Air Pollution (LRTAP) will publish a further assessment on ozone at the end of 2010.

It is clear that Northern hemisphere background concentrations of ozone are now close to established levels for impacts on health and the terrestrial environment raising concerns about the global impacts of ozone. Importantly, it is now believed that the overall impact of ozone on health is driven by the many days when ozone is at or slightly above background levels rather than the few days during photochemical episodes with very high concentrations.

A comprehensive study conducted by the Royal Society in 2008[46] concluded that because ozone is a global pollutant, a globally coordinated approach is required (UNEP or CLRTAP) for ozone management and that national or even regional controls are unlikely to achieve their policy objectives in the absence of such a global framework. Whilst the Royal Society report pre-dates the 2008 agreement to amend MARPOL Annex VI, it recommended that the IMO and ICAO must agree to regulate NOx, carbon monoxide and VOCs from international shipping and aviation as far as is technically feasible, to implement agreed emissions controls and to continue research into the development of emission reduction technologies in these sectors[47].

4.2 Ozone and particles as radiative forcers

There have been numerous articles about the linkages between air pollutants and climate change and how short-term climate change mitigation can be achieved by tackling some of the most potent air pollutants. Ground level ozone (including methane as an important precursor) and particulate matter including "black carbon" are particularly relevant. These are the most significant air pollutants in terms of public health impacts but methane, ozone and black carbon also have significant atmospheric warming contributions (ozone is rated as the third most important greenhouse gas based on radiative forcing). The climate co-benefits have not previously been recognised in developing air quality policies and may provide additional justification and support to propose air quality improvement measures.

[46] Ground-level ozone in the 21st century: future trends, impacts and policy implications – Summary for policy makers, The Royal Society, October 2008, p. 9

[47] *Ibid*, Recommendation 7, page 103.

ANNEX IV – ISSUES ARISING FROM THE REVIEW OF THE DIRECTIVE

1. INTRODUCTION

Liquid fuels used for motorised transport, industrial and commercial combustion and domestic heating contain sulphur which is released upon combustion in the form of sulphur oxides. Primary particulate matter is also emitted during the combustion of the fuels. These emissions contribute to local air quality problems (where limits exist for sulphur dioxide and particulate matter concentrations in ambient air), including in urban areas, and regional air pollution impacts such as the acidification of natural ecosystems.

Historically, the sulphur content of certain liquid fuels was regulated by Directive 93/12/EC which placed restrictions on the *marketing* of diesel fuels used in road vehicles and gas oils used for transport in general (but excluding aviation). The provisions on road fuels were subsequently repealed and replaced by those in Directive 98/70/EC.

The provisions on the sulphur content of gas oils now appear in the Directive which also addresses the sulphur content of land-based heavy fuel oil and heating oil as well as marine fuels used both inside and outside of EU territorial seas.

The current provisions on marine fuels essentially incorporate into EU law the rules from the IMO on marine fuels used in SOx Emission Control Areas (SECAs) as they were before their amendment in October 2008. Annex VI of the Marine Pollution Convention 73/78[48] governs air pollution emitted by ships, operating under the auspices of the United Nations' IMO. It was adopted in 1997 and at that time included provisions establishing the Baltic Sea as a SECA which required fuels with no more than 1.5% by mass to be used. Outside of SECAs, marine fuels could contain up to 4.5% by mass. In 2000, an amendment to Annex VI was adopted by the IMO which designated the North Sea and English Channel as an additional SECA but neither was immediately operational because at the time the ratification threshold consisting of sufficient ratifications by IMO Member States and sufficient representation of world tonnage had not yet been met.

In 2005, when the co-legislators amended the Directive and introduced the IMO's rules on marine fuels to be used in SECAs[49], the provisions of MARPOL Annex VI had still not entered into force. Nonetheless they were widely recognised as being insufficient to address observed environmental impacts due to shipping and that without further action sulphur dioxide (SO_2) emissions from ships would continue to grow and surpass all emissions of SO_2 from land-based sources in the EU by 2020. These problems were acknowledged in the Commission's Communications on a "Strategy to reduce atmospheric emissions from seagoing ships"[50] and "the Thematic Strategy on Air Pollution"[51] both of which advocated further reductions in marine-based SO_2 emissions given their greater cost effectiveness relative to further reductions of land-based emissions.

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48 The International Convention for the Prevention of Pollution from ships 1973 as modified by the Protocol of 1978 (is commonly referred to as MARPOL 73/78) operates under the auspices of the IMO and contains several annexes address various forms of ship related pollution.

49 Directive 2005/33/EC of 6 July 2005; OJ L 191, 22.7.2005, p. 59.

50 COM(2002) 595 final

51 COM(2005) 446 final

Given this background, the co-legislators called upon the Commission when adopting Directive 2005/33/EC to undertake a later review of the legal requirements on fuel sulphur content (and for marine fuels in particular).

Directive 2005/33/EC represents a substantial amendment to the parent Directive 1999/32/EC particularly in respect of the sulphur content of marine fuels. Member States were obliged to transpose the former Directive by 11 August 2006 but only three Member States had reported their national transposing measures by that date. Seven Member States submitted their transposition information later in 2006 whilst the last Member State to transpose reported only in April 2010. In response to the late and/or missing transpositions, the Commission initiated 16 infringement procedures, all of which are now closed following complete transposition.

Given that Directive 2005/33/EC was adopted on 6 July 2005 and published in the Official Journal on 22 July a transposition deadline of 11 August 2006 represents a relatively short period within which to undertake the required transposition into national law. However, this short period was necessary because of the entry into force of the SECA in the Baltic Sea on 11 August 2006 pursuant to Article 4a(2)(a) of the Directive. Transposition into national law always presents an administrative burden for the Member States and cannot be avoided if a directive is selected as the appropriate legislative instrument. However, a directly applicable regulation could be considered for future reviews of the legislation given the technical and precise nature of the subject matter covered by the current Directive.

2. COMPLIANCE AND MONITORING, REPORTING AND VERIFICATION ISSUES

Evidence of non-compliance

Studies conducted by EMSA found evidence of non-compliance with several provisions of the Directive:

EMSA assessed the level of compliance based on Lloyds Register and Det Norske Veritas[52] data on the sulphur content of different fuels covered by the Directive. The data covers some 50 EU ports and 15,000 fuel samples. The sulphur content of the fuels was measured according to method of analysis ISO 8754. These studies have shown that:

- residual fuel oil - Article 4a of the current Directive stipulates that fuels with a sulphur content in excess of 1.5% by mass cannot be used in SECAs. 4.1% to 9.2% of samples taken in 2008 of residual fuel oil bought as being 1.5% sulphur content (for use in SECAs) were in fact non-compliant. However, three-fifths of these non-compliant samples were within the margins of error associated with the specific method of analysis (ISO);

- marine gas oil - Article 4b(3) of the current Directive stipulates that from 1 January 2008 marine gas oil cannot be *used* if it has a sulphur content in excess of 0.1% by mass. Samples taken in 2008 had sulphur content in excess of 0.1% in between 19.5% and 25.5% of the cases. From 2010 equivalent stipulations have applied to marine gas oils *placed on the market* and all marine fuels *used* while a ship is at berth in an EU port;

[52] Lloyds Register and Det Norske Veritas are private international classification societies responsible for defining and maintaining shipping standards.

- fuels used by passenger ships– Article 4a(3) requires passenger ships entering or leaving any EU ports (i.e., even in non-SECAs) on a regular service to use a fuel with a sulphur content below 1.5% by mass. This requirement has applied since 11 August 2006. Samples obtained between that date and 27 April 2008 were often in excess of the legal requirement (except in France and parts of Spain). The relatively low number of ships controlled only allows to see this as a strong indication. In some cases the sulphur content of passenger ship fuels was between 2.3% and 3.3%. The fact that both the sample analysed and the bunker delivery notes showed exceedances, suggests a lack of knowledge of the Directive by both operators and competent authorities.

2.1. Issues related to enforcement and the robustness of the testing and analysis

A concern raised by bunker fuel suppliers and ship owners is the statistical interpretation of the result of the analysis of a fuel sample.

EN ISO 4259 states that "most laboratories do not carry out more than one test on each sample for routine quality control purposes, […]". According to this standard, a given test result X and a fuel sulphur limit A is interpreted as follows:

- A supplier can be certain with 95% confidence that the fuel *respects* the limit if $X < (A - 0.59R)$ where R is the reproducibility of the specific test method used to measure the sulphur content and which is specified in each test method. A result between A and (A- 0.59R) is not proof of non-compliance;

- A recipient can be certain with 95% confidence that the fuel *fails* the relevant sulphur limit if $X > (A + 0.59R)$ where R is again the reproducibility of the specific test method.

The Directive refers to several possible test methods each with its own reproducibility which varies with the sulphur content as shown below according to the maximum permitted sulphur content.

Marine Fuels and Heavy Fuel Oil

Test Method/*Max Fuel sulphur level*	Reproducibility	A + 0.59R	A – 0.59R
ISO 8754:2003			
1.5%	0.134	1.58%	1.42%
1.0%	0.093	1.05%	0.94%
0.5%	0.053	0.55%	0.45%
0.1%	0.020	0.12%	0.09%
EN ISO 14596:2007			
1.5%	0.04	1.52%	1.48%
1.0%	0.04	1.02%	0.98%
0.5%	0.02	0.52%	0.49%
0.1%	0.02	0.12%	0.09%

Table 1: *Uncertainty limits related to the measurement of the sulphur content of marine fuels.*

According to the IMO standard[53], two sub-samples of a given fuel sample are tested in succession. If the results of test are within the repeatability of a test method, the results are considered as valid. In the next step, an average of the two results is calculated and if this average is equal to or falls below the applicable limit required by the Directive, the fuel oil is deemed to meet the requirements.

Example: A passenger ship on regular service that is obliged to use fuel with a sulphur content not higher than 1.50% orders fuel. A fuel sample is taken and is analysed in accordance with ISO 8754. (1) According to ISO 4259 one analysis is carried out and the test result indicates 1.58% sulphur content. Such a result is deemed acceptable within the 95% confidence interval. (2) According to the IMO method, two subsamples are analysed. A test result of 1.42% and 1.58% sulphur content, respectively, results in an average of 1.50% and is considered to meet the requirements.

There is thus a grey area where the measured sulphur content lies in between the two values of (A+ 0.59R) and (A – 0.59R) where compliance with the standard in the IMO rules or EU legislation is uncertain. Arguably, a purchaser should insist on a measured sulphur content of less than (A – 0.59R) in any contract for the purchase of marine fuel. Member State regulatory authorities will probably wish to be sure of a non-compliance before acting and therefore will probably want to see measured fuel sulphur levels in excess of (A + 0.59R) before acting. The recommended test method for sulphur measurement in ISO 8217:2010 on marine fuel quality stipulates the ISO 8754 method from 2003 whereas the Directive permits this and an alternative method EN ISO 14596 which generally has lower uncertainty.

Additional issues have arisen relating to the location and frequency of sampling for the verification of compliance in respect of the requirements of national law and the burden of proof to secure a conviction. These issues are a matter for the member State competent authorities who best understand the requirements of national law and what should be done to ensure successful prosecution of non-compliance offences. It must be remembered that the Member States have an obligation under the Directive to implement a system of penalties that is effective, dissuasive and proportionate.

2.2. Compliance with marine fuel sulphur limits: statistical analysis by EMSA

The European Maritime Safety Agency has assisted the Commission in assessing the degree of compliance by ship operators with the various marine fuel sulphur limits. EMSA has secured access to anonymised analyses conducted by Lloyds Register and Det Norske Veritas of the fuel samples sent to them by ship operators following fuel purchases. EMSA was provided with monthly statistical data on sulphur levels of heavy fuel oils (RFO), marine diesel oils and marine gas oils bunkered on board ships and placed on the market in the EU. This captured some 50 European ports and 15,000 fuel samples (approximately 600 samples per month) where the sulphur content was tested according to the method ISO 8754 developed by the International Standards Organisation.

[53] Appendix VI of MARPOL Annex VI

2.2.1. Residual Fuel oil

EMSA found that only a small number of bunker deliveries in the EU had sulphur levels in excess of the permitted 1.5% for fuels intended to be used in SECAs. The monthly degree of non-compliance in 2008 ranged from 4.1% to 9.2% of samples tested. However, three fifths of the non-compliant samples had sulphur levels within the uncertainty range of the test method (1.58%).

2.2.2. Marine gas oil

Pursuant to Article 4b(3), marine gas oils cannot be placed on the market in the EU if their sulphur content exceeds 0.1%. The monthly amount of "off-spec" samples of marine gas oils in 2008 varied between 19.5% and 25.5%. This indicates that there may be an ongoing contravention with the requirements of the Directive in respect of marine gas oils which needs to be verified with samples taken in 2010 following the entry into force of the EU's legal provisions on 1 January 2010.

2.2.3. Fuels used by passenger ships entering or leaving EU ports

Pursuant to Article 4a(4) of the Directive, operators of passenger vessels on regular services to or from EU ports must use fuels with a maximum permitted sulphur content of 1.5% by mass. This obligation has applied since 11 August 2006. EMSA selected 8 different routes for analysis covering the main Southern European ferry routes covering a period 11 August 2006 to 27 April 2008. The fuel sulphur results obtained by EMSA demonstrate that except in the case of France and parts of Spain, the overwhelming majority of fuel samples contained sulphur in excess of 1.5%. Moreover, in several areas the average fuel sulphur values based on either the Bunker Delivery Note or the fuel sulphur analysis were in the range of 2.3 to 3.3%. Based on these results, EMSA concluded that ferry companies, fuel suppliers and regulatory authorities are not well informed of the prevailing legal requirements.

2.3. Non-Compliance with the requirement to use 0.1% sulphur fuels whilst at berth

Article 4b of the Directive requires ships at berth in EU ports to use fuels with a sulphur content not exceeding 0.1% by mass as from 1 January 2010. This obligation was brought into force in 2005 when the co-legislators adopted Directive 2005/33/EC at second reading.

In order to comply, certain ships had to modify their on-board boilers so as to be able to burn marine distillates safely[54]. The necessary adaptation is in most cases technically uncomplicated and retrofit kits are provided by boiler manufacturers. Whilst ship operators had five years or so to prepare for the entry into force of this new obligation many ships did not undertake the necessary modification to their boilers in good time thereby creating a large demand on the boiler manufacturers just before the 1 January 2010 deadline.

Whilst recognising the potential safety hazard the Commission does not have the general authority to delay the legal requirements of the Directive. Moreover, the Member States are still obliged to enforce the requirements of the Directive. A short

[54] Distillate fuels have a lower flash point and can present an explosion risk in a boiler which has not undergone the necessary adaptation.

term solution was found whereby the Commission recommended[55] to the Member States' competent authorities to take into account the positive actions taken by a particular ship operator to ensure its compliance when enforcing the Directive's provisions. So that, for example, an operator that had signed a contract for the technical modification to its boilers but which had to wait for the retrofit to be carried could be treated more leniently than a ship that had taken no preparatory measures. Some ships are able to use liquefied natural gas (LNG) as part or for all a ship's fuel needs. LNG contains no sulphur and so its use provides an alternative means to comply with the 0.1% fuel sulphur requirement as does the use of shore side electricity. The Commission has adopted guidelines on the use of LNG in respect of compliance with Article 4b of the Directive[56] and a recommendation on the use of shore side electricity[57].

As noted earlier, ships are required to use fuels with a maxim sulphur content of 0.1% whilst at berth in EU ports. This regulation entered into force on 1 January 2010 and the Commission does not yet have any official information on compliance with this provision as the Member States are not obliged to report until mid-2011. *Include reference COSS/MS first impressions?*

However, DNV fuel quality testing services (DNVPS) has undertaken a customer survey in relation to this and the entry into force of the IMO's new SECA regulation on fuel sulphur content (1.00% max from 1 July 2010)[58]. According to DNVPS, when the previous SECA regulations came into force imposing a limit of 1.5% sulphur for marine fuels, DNVPS' sulphur test results showed that even by early 2010, around 10% of all samples of RFO had an associated Bunker Delivery Note[59] certifying a sulphur content less than 1.50% sulphur but where the sulphur content was greater than 1.50% when tested. This is an apparent improvement from the position in 2008 which showed around 17.5% of those samples tested were over the 1.50% limit certified in the Bunker Delivery Note. DNVPS' testing of the sulphur content of fuels used at berth has shown a higher proportion of results under the limit (0.1%) than for fuels used in SECAs. Apparently, only a few port areas show systematic potential non-compliance. Fuel availability was reported to be an issue in some ports, although generally for 0.1% gas oil, the larger ports have products available. DNVPS reports that specially made residual fuel oil (1.00% low sulphur RFO) is generally not being delivered but that the market is trying to adapt to the 1 July 2010 change from 1.5% to 1.00% in SECAs.

One of the survey's findings regarding Port State controls was that many ports had already begun to verify compliance with the Directive, with additional smaller ports

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55 Commission Recommendation on the use of low sulphur fuels at berth in Community ports; OJ L 348, 29.12.2009, p. 73.
http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:348:0073:0074:EN:PDF

56 2010/769/EU

57 Commission Recommendation on the promotion of shore-side electricity for use by ships at berth in Community ports; OJ L 125, 12.5.2006, p. 38.
http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_125/l_12520060512en00380042.pdf

58 Experience with low sulphur in European Ports, dated 25 June 2010.: http://www.dnv.co.uk/industry/maritime/publicationsanddownloads/publications/dnvbullkcarrierupdate/2010/1_2010/ExperiencewithlowsulphurinEuropeanports.asp

59 IMO rules requires a marine fuel supplier to provide a Bunker Delivery Note with every purchase of marine fuels. This BDN must indicate the maximum sulphur content of the fuel delivered and be kept by the master of the ship for possible inspection by port state and flag state authorities.

starting to verify. An important signal for those customers that might be checked in the future was that 15% of the gas oil bunker samples tested had a sulphur value above the limit of 0.10% which is higher than indicated by DNVPS' testing. However, no one in the DNVPS' study had been fined, delayed or banned from ports for non-compliance with the 0.1% sulphur requirements whilst at berth in EU ports.

2.4. Annual reports on the quality of marine fuels

2.4.1. Reporting requirements

Pursuant to Article 7.1 of the Directive, Member States must report annually to the Commission information on the sampling and analyses conducted pursuant to Article 6 for the purpose of (i) ensuring that the sulphur content of marine fuels complies with the relevant provisions in Articles 4a and 4b; and (ii) that the sulphur content of heavy fuel oil used in land based installations complies with Article 3; and (iii) that the sulphur content of gas oil complies with Article 4.

Article 6 describes the types of sampling, analysis and inspections that should be performed to ensure compliance, i.e.: *sampling and analysis of marine fuels* for on-board combustion *while being delivered to ships* […] and *contained in tanks or bunkers* […], as well as *inspections of ship's log books and bunker delivery notes*. Samples are to be taken with a sufficient frequency and for sufficient quantities so that they produce representative results for the fuels used by vessels steaming in the relevant waters and ports. Sampling of marine fuels should commence as of the date on which the relevant maximum permitted sulphur content value enters into force (see table below).[60] For fuels used in SECAs this date was 11 August 2006 (Baltic Sea) and 11 August 2007 (North Sea and English Channel) and for 0.1% sulphur fuels used whilst at berth in EU ports the date was 1 January 2010.

2.4.2. Overview of Member State reports

The Commission received 26 reports covering the calendar year 2007, the first full calendar year following the transposition deadline for Directive 2005/33/EC. For the year 2008, 25 reports were received 13 of which came after the reporting deadline. Pending the decision to launch infringement procedures, a series of reminders were sent between 2008 and 2010.

2.4.3. Conclusions drawn on the basis of the Member States' reports

Member State reports submitted to the Commission pursuant to Article 7 have been analysed on an annual basis by the Commission assisted by the European Maritime Safety Agency (EMSA). Analysis has shown that reports received from Member States vary significantly in structure and content with many reports exhibiting significant information gaps making assessment difficult. The most important issues would appear to be:

– Few reports distinguish between sampling and results related to fuels for marine use and similar fuels used in land based installations;

[60] Note that the sampling, analysis, and inspection provisions for specifications contained in international legislation are not covered by this Directive or EU legislation.

– the number of samples taken and sampling frequency in the EU are very low and are insufficient to ensure that samples are representative of the fuels used and sold and that the Directive is correctly implemented;

– Sampling and analysis were almost exclusively used to monitor the sulphur content of fuels covered by the Directive whereas Article 7.1 specifically requests monitoring of other maritime fuels not directly covered by the Directive (i.e. fuels having to comply with the global limit for sulphur of 4.5%);

2.5. Safety issues related to fuel quality

Whilst it is difficult to obtain clear statistics, there seems to be a relatively high incidence of engine failures linked to fuel quality, particularly in SECA areas. In order to produce SECA compliant fuels there has been a greater tendency to blend different fuel grades.

The greater the degree of blending the greater the possibility that the resultant mix could be unstable and leading to sludge formation and blocked fuel pumps. Creating blends with lower sulphur content may furthermore be increasing the level of "catfines" consisting of aluminium silicates used in fluidised catalytic cracking units at oil refineries. This may be due to an increased use of cycle oils[61] as "cutter" stock in the fuel blend

In 2010, the International Standards Organisation (ISO) finalised a revision to ISO 8217 on marine fuel quality standards. This revision lowers the permitted amount of aluminium silicates ("catfines") and the sludge limits. It remains to be seen whether these limits will be respected by suppliers once purchasers ensure that the new standard is routinely inserted into their fuel supply contracts. At the current time, all issues regarding fuel quality and liability are determined by the contract between supplier and purchaser. Ultimately, there may be a role for establishing a mandatory fuel quality standard for marine fuels placed on the market in the EU as this would permit intervention by public authorities in the Member States to ensure compliant fuel quality.

2.6. Issues related to interpretation difficulties and associated implementation issues

The text of the Directive itself has led to confusion when it comes to distinguishing between marine gas oil and marine diesel oil. The origin of this is that the Directive has introduced an "or" between viscosity and density which suggests that only one of the two is determinative whereas the ISO Fuel Standard 8217 requires both criteria to be satisfied.

Another difficulty encountered by competent authorities is the precision of the various sulphur limits specified in the Directive. The sulphur limit for fuel used by ships at berth is specified to one decimal place whereas article 4, now only covering gas oil used on land, refers to a sulphur content of 0.10% (i.e. 2 decimal places) and article 4b on the use and placing on the market of marine gas oil refers to 0.1%. All sulphur limits in MARPOL Annex VI are indicated with 2 decimal places and it is probably sensible to align the Directive with ANNEX VI.

[61] Cycle oils are a low sulphur, highly viscous refinery product from the FCC process and which tends to contain an elevated amount of catfines

The meaning of "port" has also raised uncertainty in relation to the requirement to use marine fuels with a maximum permitted sulphur content of 0.1%. This is relevant as ships at anchorage are also covered by this article if they are inside a community port. It is up to the Member States to decide what is considered to belong to the port area. Many will use the definition as provided by Article 11 of the United Nations Convention on the Law Of the Sea (UNCLOS).

2.7. Trials and the use of new abatement technologies

The provision in Article 4c of the Directive on trials and use of new emission abatement technologies has been subject to discussion, both with Member States and with industry. The requirement to notify the Commission and Member States 6 months in advance and the limitation of the trial period to 18 months have been considered as burdensome thus leading to only a few uses of that possibility.

2.7.1. *Scrubber technologies*

Scrubber technologies, however, have clearly advanced since the adoption of Directive 2005/33/EC. There are now several manufacturers that can supply scrubbers[62] that meet approval of Class[63] or Recognized Organization[64] and the IMO's guidelines on scrubbers which set out criteria for the discharge water (a by-product of scrubber operation).

There is an important difference between the provisions in MARPOL Annex VI and the Directive regarding monitoring of exhaust emissions. The former allows both for type approval of scrubbers and/or for continuous monitoring of emissions but the Directive *always* requires on-board equipment for continuous monitoring of emissions.

Industry has claimed that the stricter provisions of the Directive might be a potential impediment to the installation of scrubbers because of the additional cost of monitoring sensors.

2.7.2. Other equivalent technologies

In May 2010, by means of committee procedure, a Commission Decision was adopted based on Article 4c to approve the use of a dual fuel system for LNG carriers as means to comply with the requirement in article 4b on the use of fuel with a sulphur content not exceeding 0.1% for ships at berth. However, LNG carriers often use a mixture of sulphur free LNG and heavy fuel oil with a relative high concentration of sulphur. The Commission Decision allows for such a mixture to be used provided the overall emissions are equal to or lower than would be the case with using fuel containing 0.1% sulphur[65].

62 Communications by both EGCSA and EMEC

63 A Classification Society or a non-governmental ship inspection and survey organization

64 Ship inspection and survey organizations as referred to in Directive 94/57/EC

65 (2010/769/EU

This decision significantly reduces compliance costs for LNG carriers as it can be deployed without modifications to the ships' boilers which might cost well over 1 million Euros[66].

2.8. Fuel used by passenger ships on regular service to or from EU ports

Article 4a(4) of the Directive requires passenger ships on regular services to or from EU ports to use fuel with a maximum permitted sulphur content of 1.5% by mass. This obligation applies irrespective of the fact whether the passenger ship operates inside of an established SECA albeit the 1.5% fuel sulphur level was established so as to be the same as that previously required by all ships operating within a SECA.

For passenger ships operating in SECAs (English Chanel, the North Sea or the Baltic Sea) the obligation to use fuels with a maximum sulphur content of 1.5% will be superseded by the new IMO rules on the sulphur content of marine fuels whereby (all) ships operating in SECAs will need to use fuel with a maximum sulphur content of 0.10% from 2015 onwards. Hence, there will be no additional cost incurred due to the Article 4a(4) provisions in the Directive

At present, Article 4a(4) continues to apply, however, for passenger ships operating to or from EU ports outside of SECA areas such as the Mediterranean Sea. Hence, the Directive did impose additional costs as reported in this section.

Passenger ships, including RoRo vessels and Ferries (but excluding cruise ships), contribute to air pollution in the Mediterranean Sea as indicated in table 2 below. The data base did not contain separate information on cruise ships. The emissions from cruise ships are expected to be significantly lower than those from passenger ships.

Pollutant	***Emissions in 2010 (kT per year)***
SO_2	88.56
NMVOC	3.61
CO	9.45
PM	4.58
NOx	112.35

Table 2: *The estimated emission from passenger ships, excluding cruise ships, in the Mediterranean Sea for 2010, based on extrapolation of emissions from 2000 data.*

Assuming the total amount of fuel used by passenger ships in the Mediterranean Sea area is 2.953 million tonnes and that the price premium between residual fuel oil containing 1.5% sulphur and 2.7% (observed on average outside of SECAs) is of the order of € 20 per tonne of fuel then the cost effectiveness of the sulphur abated can be determined as shown in table 3 below. Additional fuel costs would amount to approximately €59 million and abated emissions would be around 70 900 tonnes of SO_2 giving a cost-effectiveness of €830 per tonne of SO_2 abated.

The incremental cost estimates depend upon the fuel price premium selected for the calculations. ENTEC UK has also determined the cost-effectiveness of sulphur emissions that are abated from ships by using desulphurisation technology (scrubbers). For new ships the cost effectiveness is between €320 – 390 per tonne of SO_2 abated whilst for retrofitting existing ships, the cost-effectiveness is between €500 – 580 per tonne abated for large and small ships respectively.

[66] AEA report

Fuel consumed (tonnes)	*Fuel sulphur content (%)*	*SO_2 released on combustion (tonnes)*	*Fuel costs increase with +€20/tonne premium (k€)*
2953000	2.70	159,462	-
2953000	1.50	88,590	59,060
Cost effectiveness			
Emissions abated (tonnes SO_2)		70,872	
Cost effectiveness (€/tonne SO_2)		833	

Table 3: *Cost effectiveness of reduced emissions of sulphur dioxide from passenger ships operating in the Mediterranean Sea using 1.5% sulphur fuel instead of RFO containing 2.7% sulphur.*

The cost effectiveness of measures to reduce sulphur from ships are of the same order of magnitude as the least expensive measures available to reduce SO_2 emissions from last based sources as shown below for the case of Germany in respect of a 2020 end point.

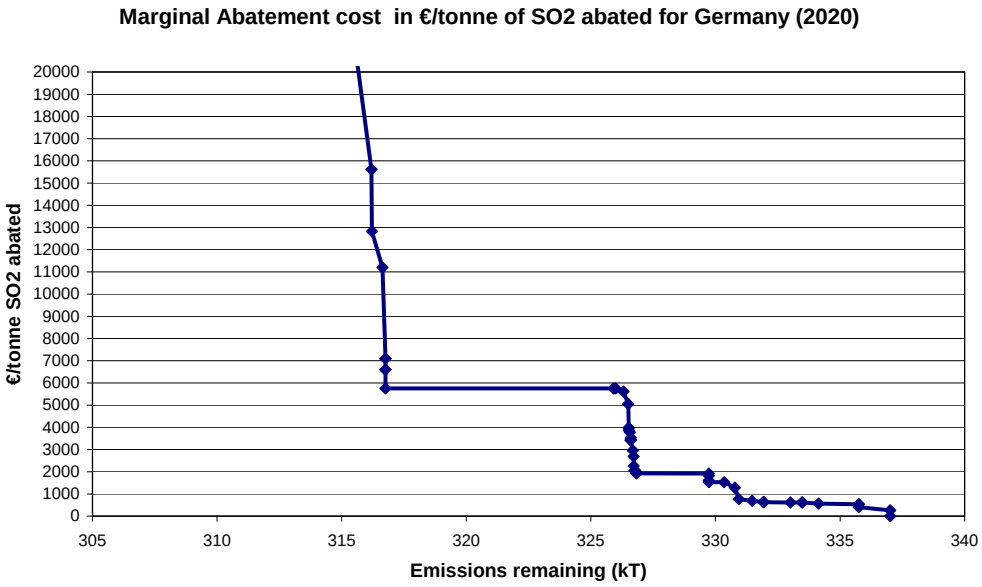

Figure 1:. *Cost curve for the abatement of sulphur dioxide emissions in Germany in 2020. Data generated by the GAINS integrated assessment model from IIASA using the Primes 2009 energy baseline from January 2010*[67].

In addition, the emission of PM was estimated a 4.58 kton. Assuming that the majority of passenger ships uses medium speed engines, the PM emission when using fuel with 1.5% sulphur is 1.787 kg/ton and when using 2.7% fuel 2.596 per ton. So if ships would still have used fuel containing 2.7% sulphur, than the total emission of PM would have been 6.65 kton, an increase of 2.07kton representing an additional annual reduction of damage of €1,2 million.

3. CONCLUSIONS

The analysis of Member State reports indicates that on the whole there is insufficient monitoring undertaken of fuel sulphur levels for the fuels covered by the Directive. It is difficult to be sure that fuel suppliers and users are ensuring that fuels comply with

67 http://gains.iiasa.ac.at/index.php/gains-europe

the requirements of the Directive and this is borne out in reports on fuel quality published by third parties such as fuel quality monitoring laboratories. As such the Directive's aims to protect the environment and health, and to ensure safety and fair competition in the shipping industry are compromised. Possible solutions to tackle this issue include:

– More fuel sulphur monitoring and fuel quality monitoring should be undertaken to assess compliance against the requirements of the Directive and ISO 8217 on marine fuel quality particularly in relation to (i) the placing on the market of marine gas oils (sulphur content less than 0.1%); (ii) fuels used by passenger vessels travelling to and from EU ports (sulphur content less than 1.5%); and (iii) ship safety related to fuel-induced engine failure.

– A Commission Recommendation on harmonized guidelines for sampling and inspections accompanied by harmonized formats for reporting to the Commission;

– Development of a CEN technical standard for monitoring and reporting as has been done for road fuels;

– Infringement proceedings against those Member States that undertake insufficient monitoring and inspection;

– Ultimately, if these approaches do not work the Commission could propose detailed legislation on monitoring and reporting based upon technical advice from EMSA and or other studies.

In relation to fuel parameters indirectly linked to sulphur and which may influence engine operation and engine failure, there may ultimately be a need to guarantee that marine fuels placed on the market actually conform to the recognised international standards.

Where the bunker supplier is at fault, the fuel purchaser may only have recourse to private (contract) law in the absence of any public law/statutory requirements on the quality of marine fuels placed on the market in the EU.

ANNEX V –CRITERIA FOR NEW EMISSION CONTROL AREAS[68]

APPENDIX III

CRITERIA AND PROCEDURES FOR DESIGNATION OF EMISSION CONTROL AREAS
(Regulation 13.6 and regulation 14.3)

1 OBJECTIVES

1.1 The purpose of this appendix is to provide the criteria and procedures to Parties for the formulation and submission of proposals for the designation of Emission Control Areas and to set forth the factors to be considered in the assessment of such proposals by the Organization.

1.2 Emissions of NO_x, SO_x and particulate matter from ocean-going ships contribute to ambient concentrations of air pollution in cities and coastal areas around the world. Adverse public health and environmental effects associated with air pollution include premature mortality, cardiopulmonary disease, lung cancer, chronic respiratory ailments, acidification and eutrophication.

1.3 An Emission Control Area should be considered for adoption by the Organization if supported by a demonstrated need to prevent, reduce, and control emissions of NO_x or SO_x and particulate matter or all three types of emissions (hereinafter emissions) from ships.

2 PROCESS FOR THE DESIGNATION OF EMISSION CONTROL AREAS

2.1 A proposal to the Organization for designation of an Emission Control Area for NO_x or SO_x and particulate matter or all three types of emissions may be submitted only by Parties. Where two or more Parties have a common interest in a particular area, they should formulate a coordinated proposal.

2.2 A proposal to designate a given area as an Emission Control Area should be submitted to the Organization in accordance with the rules and procedures established by the Organization.

3 CRITERIA FOR DESIGNATION OF AN EMISSION CONTROL AREA

3.1 The proposal shall include:

.1 a clear delineation of the proposed area of application, along with a reference chart on which the area is marked;

.2 the type or types of emission(s) that is or are being proposed for control (i.e. NO_x or SO_x and particulate matter or all three types of emissions);

.3 a description of the human populations and environmental areas at risk from the impacts of ship emissions;

.4 an assessment that emissions from ships operating in the proposed area of application are contributing to ambient concentrations of air pollution or to adverse environmental impacts. Such assessment shall include a description of the impacts of the relevant emissions on human health and the environment, such

[68] Full text of the 2008 MARPOL Annex VI: http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Documents/23-Add-1.pdf

as adverse impacts to terrestrial and aquatic ecosystems, areas of natural productivity, critical habitats, water quality, human health, and areas of cultural and scientific significance, if applicable. The sources of relevant data including methodologies used shall be identified;

.5 relevant information pertaining to the meteorological conditions in the proposed area of application to the human populations and environmental areas at risk, in particular prevailing wind patterns, or to topographical, geological, oceanographic, morphological, or other conditions that contribute to ambient concentrations of air pollution or adverse environmental impacts;

.6 the nature of the ship traffic in the proposed Emission Control Area, including the patterns and density of such traffic;

.7 a description of the control measures taken by the proposing Party or Parties addressing land-based sources of NO_x, SO_x and particulate matter emissions affecting the human populations and environmental areas at risk that are in place and operating concurrent with the consideration of measures to be adopted in relation to provisions of regulations 13 and 14 of Annex VI; and

.8 the relative costs of reducing emissions from ships when compared with land-based controls, and the economic impacts on shipping engaged in international trade.

3.2 The geographical limits of an Emission Control Area will be based on the relevant criteria outlined above, including emissions and deposition from ships navigating in the proposed area, traffic patterns and density, and wind conditions.

4 PROCEDURES FOR THE ASSESSMENT AND ADOPTION OF EMISSION CONTROL AREAS BY THE ORGANIZATION

4.1 The Organization shall consider each proposal submitted to it by a Party or Parties.

4.2 In assessing the proposal, the Organization shall take into account the criteria which are to be included in each proposal for adoption as set forth in section 3 above.

4.3 An Emission Control Area shall be designated by means of an amendment to this Annex, considered, adopted and brought into force in accordance with article 16 of the present Convention.

5 OPERATION OF EMISSION CONTROL AREAS

5.1 Parties which have ships navigating in the area are encouraged to bring to the Organization any concerns regarding the operation of the area.

ANNEX VI BENEFITS AND COSTS RELATED TO THE NEW RULES ON SULPHUR CONTENT OF MARINE FUELS ADOPTED BY IMO PARTIES IN 2008

Several studies were initiated by the Commission to look at the additional costs and benefits of moving to the fuel sulphur requirements promulgated by the IMO. These have looked at the costs of additional refinery processing requirements, increased emissions of CO_2 as well as the likely price of sulphur compliant fuel. In addition, some air quality benefits have been monetized whilst other benefits have also been identified qualitatively.

1. ESTIMATED BENEFITS FROM MOVING TO LOWER SULPHUR FUELS

There are also significant health, environmental and operational benefits of moving to lower sulphur marine fuels. The new fuel standard will not only reduce sulphur, but will in parallel also reduce emissions of fine particles and other pollutant emissions associated with the combustion of petroleum derived fuels. In addition, use of a distillate fuel is likely to increase of new engines[69] and thus contribute to higher safety and reduced risk of accidents and oil spills at sea. Old engines might require modifications to enable running on low sulphur fuels permanently.

A study conducted by AEAt[70] estimated that the benefits associated with the use of 0.1% sulphur marine fuels are between twice and 26 times the costs as shown in the table below. The lower bound for the costs represents the costs for fitting scrubbers to reduce SO_2 emissions whilst the upper bound represents the high estimate using only low sulphur fuels to reduce SO_2 emissions. The range for the benefits is based on the use of the value of a life year (lower bound) or the value of statistical life (upper bound) to value premature mortality from exposure to particulate matter.

Costs and benefits in 2015 (€billions)		***Baltic Sea , North Sea and the English Channel as SECAs***
Costs	Low	0.6
	High	3.7
Benefits[71]	Low[72]	8
	High	16

Table 1: *Annual costs versus the annual benefits of using fuel not exceeding 0.10% sulphur compared to the base case (1.5%).*

69 Final Report of the Cross Government / Industry Scientific Group of Experts, IMO, December 2007, page 68

70 Cost Benefit Analysis to Aupport the Impact Assessment accompanying the revision of Directive 1999/32/EC on the Sulphur Content of certain Liquid Fuels, AEA, December 2009

71 NB the monetised benefits presented are underestimates of the full benefits. Benefits arising from positive effects on other receptors including ecosystems, agriculture and buildings including cultural heritage are not included..

72 The lower bound figures are seen as less robust than the upper bound figures. The lower figures are based on value of life-years lost (VOLY) monetised costs produced under the New Energy Externalities Developments for Sustainability (NEEDS) Project. The results of this work have not been peer-reviewed.

Further analysis was undertaken to assess the effect of further uncertainties on the balance of costs and benefits. This found that the probability of benefit exceeding cost can be described as virtually certain, using terminology developed by the Intergovernmental Panel on Climate Change (IPCC). The probabilities calculated here are quantified only against benefits for improved health. The inclusion of impacts to materials (including cultural heritage) and ecosystems, in particular, would add to the benefits and further increase the already certainty that the benefits exceed the costs.

The benefits are clearly dominated by the reduction of emissions of fine particles. There are two factors contributing to the reduction of particulate matter emissions. The cleaner fuel will reduce the primary emissions of particles and reduce SOx emissions which in turn reduce the formation of secondary aersol such as sulphate particles. The AEAt study assumed particulate matter emissions from 0.1% residual fuel oil to be 54% below those associated with 1.5% residual fuel oil. In the case of 0.10% marine gas oil, particulate matter emissions are 90% lower[73]. Measurements (figure 1) resulted in comparable reduction levels[74].

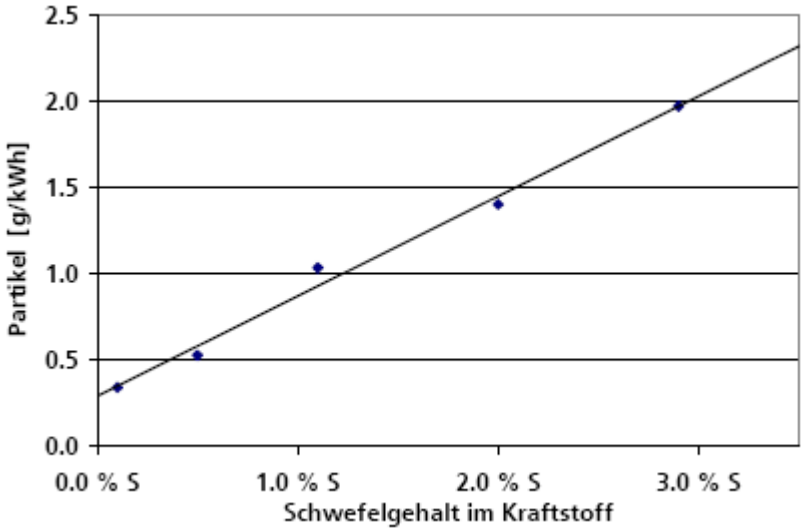

Figure 1: *Relation between the sulphur content in fuel and PM mass (Reproduced by kind permission of Germanischer Lloyd)*

If scrubbers are used, the reductions of particulate matter can be reduced by 0 to 85%[75]. US EPA mentions an example reducing 80%[76].

Several studies have looked into the consequences but none of them as extensive as the AEAt study.

The AEAt study[77] assumes the cost (€0.9 – 4 billion) to be higher than the benefits (€0.33 – 0.8 billion). However, the study itself clarifies the benefits are underestimated for several reasons. Most importantly, as only the benefits to the UK

73 AEA December 2009, page 87

74 Schiffsemissionen Partikelminderung durch Schwefelgrenzwerte, Dipl. Ing. Claus Kurok, Schiff Hafen September 2009

75 AEA December 2009, page 63

76 http://www.epa.gov/region1/eco/diesel/sp-vessels.html#SeaWaterScrubber

77 Impact Assessment for the revised Annex VI of MARPOL, ENTEC on behalf of UK Maritime and Coast Guard Agency, July 2009

are quantified, it concludes that most of the benefits will be outside UK due to the prevailing western winds.

A study from the Antwerp University[78] quantified external costs of some transport corridors including costs additional road transport. However, it seems as if no increase of overall transport is foreseen. This combined whit the assumption that the same number of ships would sail but with (far) less cargo heavily influences the outcome. The benefits have not been calculated like in the studies mentioned above but a fixed price per tonne abated emission is assumed. The prices used seem quite unbalanced as for PM from shipping in the North Sea a value of €8210 per tonne is used whereas PM emissions in Belgium and the Netherlands from road transport are valued at €180,000 per tonne. However, for the Thematic Strategy on Air Pollution, very different figures have been used[79]: €28,000 per tonne PM2.5 for the North Sea and for Belgium and the Netherlands respectively €61,000 and €63,000. As PM emissions dominate the benefits to health, the difference in assumptions is likely to influence the outcome.

If only quantifying total emissions due to modal shift[80], the conclusion is that in all cases where cargo moves from ship to road this would be accompanied by an overall reduction in air pollutant emissions due to the lower emissions of SOx, NOx and PM per tonne km.

2. QUANTIFYING THE COST INCREASE OF LOWER SULPHUR FUELS

A ship operator has two means with which to comply with the new sulphur emission requirements. The first involves the installation of on-board sulphur emissions abatement technology or to use lower sulphur marine fuels. The costs of abatement technology can be substantially lower than using cleaner fuels (see below).

Low sulphur fuel will come at a significant cost because additional refinery processing will be required to deliver large quantities of marine fuel containing less than 1% sulphur and ultimately less than 0.1%. More specifically, additional investment will be required to convert residual ("heavy") fuel oil to distillate fuels like marine gas oil which will be needed for compliance with the 0.10% maximum permitted sulphur content coming into force in 2015. Marine gas oil is less dense, less viscous but more expensive to produce than residual fuel oil. Additional production costs at refineries will ultimately be passed on to fuel users in the form of higher prices.

On the 1st June 2010, the price of IFO 380 was $417 per tonne whilst that of marine gas oil was $646 per tonne representing a difference of 55%. The magnitude of this difference has been routinely observed over several years as seen from Figure 1 and

78 Analysis of the Consequences of Low Sulphur Fuel Requirements, University of Antwerp and Transport and Mobility Leuven, commissioned by ECSA

79 Damage per tonne emission of PM2.5, NH3, SO2, NOx and VOC from each EU25 Member State (excluding Cyprus) and surrounding seas, March 2005

80 Impact Study on the future requirements of Annex VI of the MARPOL Convention on Short Sea Shipping, SKEMA, June 2010

is consistent with the estimated increased refinery costs of converting RFO with 1.5% sulphur content to marine gas oil with 0.1%[81].

2.1. Impacts on EU fuel producers (refiners)

The impact on EU refineries has been assessed by analysing a maximum impact scenario by assuming that ships would not reduce their fuel consumption, use other fuels or abatement equipment. The investments necessary to upgrade EU refineries would increase by $13.2 billion above the $19.1 billion already envisaged as part of the business as usual situation assuming no further change to fuel standards for ships and a need to comply with the EU refined product demand as forecast in December 2008[82]. This additional investment would allow the refineries to convert heavy fuel oil into lighter products amongst which diesel oils suitable for use by the shipping industry. Alternatively, refiners could import distillate products to satisfy demand in the EU. However, the EU is currently already a net importer of distillate fuels due to the high demand for road diesel and aviation fuel and a net exporter of motor gasoline.

Additional conversion of residual fuel oil components to distillates will require additional processing and energy use at the refinery which will result in additional carbon dioxide (CO_2) emissions. These have been estimated at nearly 7 Megatonnes per annum. This represents an increase of around 5% in current total carbon dioxide emissions from EU refineries. The overall increase is somewhat mitigated due to the reduction in utilisation of Fluid Catalytic Cracker or FCC units. In addition, part of the additional CO_2 emissions will be off-set during use on the ship, thanks to the lower carbon intensity of the fuel and because pre-heating of residual fuel oil will no longer be necessary in the ship's fuel system as will pre-treatment of fuel[83].

The increase in annual operating costs for EU refineries related to the additional CO_2 emissions has been estimated in the range of €170 million per year to €520 million per year based on CO_2 emission allowance costs ranging between €25 and €75 per tonne. This represents an increase in unit operating costs in the range $0.04 to $0.13 per barrel equivalent or between 1% and 4% of operating costs[84].

Additional processing of residual fuel oil has been undertaken for many years because of the price premium placed on distillate fuels and the new fuel sulphur requirements are likely to accelerate this process.

2.2. Estimated cost increase for ship operators

The resulting cost increase for ship operators will depend on many factors. The relative importance of the fuel price differs between cargoes and is highly dependent on the crude oil price. Currently, fuel costs can be assumed to be between 10%

81 Impacts on the EU refining industry & markets of IMO specification changes and other measures to reduce the sulphur content of certain liquid fuels: Final report prepared for the European Commission by Pervin & Gertz 30 June 2009

82 Pervin & Gertz 30 June 2009, page 74

83 Final Report of the Cross Government / Industry Scientific Group of Experts, IMO, December 2007, page 68 and 155

84 Purvin & Gertz 30 June 2009, page 11

(RoPax) and 47% (LoLo or short distance container carriers) of the overall operational costs for short sea shippers and up to 60% for container vessels[85].

Assuming a fuel price increase of 65% (middle estimate of the Purvin & Gertz analysis), the operational costs would increase by between 6.5% and 24% for short sea shipping and by 40% for certain container lines. In absolute terms, the increased transport costs would be between €2 and €11 per tonne (depending on type of ship and cargo) and €2 per passenger travelling from Sweden to Finland (assuming crude oil price of $100 per barrel)[86]. These costs increases assume no technological alternatives (such as stack gas scrubbing) and as such that ship owners would not try to mitigate against increased fuel prices which seems unlikely given, for example, the efforts of the global container industry to reduce fuel consumption in response to recent high fuel prices. The Purvin and Gertz figures should be seen as a 'worst case scenario'. There are several ways in which an operator can reduce the additional costs including:

– The use of sulphur abatement equipment in order to reach an equivalent emissions performance as provided by low sulphur fuels. This will reduce the additional costs by about 80% whilst there will be costs and issues to be addressed in relation to the operation of such equipment such as waste disposal[87];

– The use of Liquefied Natural Gas will reduce fuel costs by 20% relative to the use of marine gas oil and has as an additional advantage in terms of reduced emissions of other pollutants such as NOx, fine particles and CO_2. This not only gives additional benefits for health and environment, it can also give additional cost savings for ships calling at Norwegian or Swedish ports where port dues and fairway dues incentivise better environmental performance

– Measures to reduce fuel consumption. The most obvious way is to reduce speed. According to Maersk, a 20% speed reduction results in a reduction of 40% in fuel consumption for container ships. According to a presentation given by TT-line, their high speed RoPax (25 knots) consumes 50% more fuel than a similar size vessel operating at 18.5 knots. Therefore, speed reduction has been observed widely during the recent financial crisis and period of elevated fuel prices. Maersk for example managed in response to high fuel prices in 2008, to reduce the energy intensity of containers it transported in 2008 by 15% compared to the previous year[88].

– Other technical and operational measures to reduce fuel consumption. A study on policy measures to reduce green house gas emissions[89] derived a marginal CO_2 abatement cost curve for the Maritime Transport Sector for 2030. This curve displays the overall costs and savings relative to normal operational costs. For a bunker fuel price of US$ 700/tonne (interest rate 9%), the abatement measures

85 The Competitiveness of European Short sea freight Shipping compared with road and rail transport, Transport and Mobility Leuven, August 2010

86 Consequences of the IMO's new marine fuel sulphur regulations, Swedish Maritime Administration, May 2009

87 Cost Benefit Analysis to Aupport the Impact Assessment accompanying the revision of Directive 1999/32/EC on the Sulphur Content of certain Liquid Fuels, AEA, December 2009

88 Maersk, Annual report 2008

89 Technical support for European action to reducing Greenhouse Gas Emissions from international maritime transport, CE Delft, December 2009, page 13 and 260 and following

considered could maximally reduce the total 2030 fuel consumption by on average 33% (min/max 27-47%). The largest part, 31%, would be measures that have negative marginal abatement costs (so the savings would outweigh the additional costs). Should the fuel price go up from US$ 700/tonne to US$ 1,050/tonne, the cost effective reduction potential would increase from on average 33% to 36%. So it is clear that as fuel costs increase the number of cost effective options to improve fuel economy also increases.

2.3. Impact of the IMO 2008 agreement on modal share

From 2015, the maximum permitted sulphur content of marine fuels that can be used in SECAs will be 0.10% compared to 1.00% currently. The expected increase in fuel costs that will accompany this change has raised concerns by transport users and businesses particularly in the Baltic Sea region about the impact of increased transport costs on local businesses and on short sea shipping in particular.

Whilst a policy exists to encourage short sea shipping, a general aim of the EU's transport policy has been to ensure that the transport costs for all transport modes fully reflect relevant externalities such as air pollution. With this in mind, in 2008, the Commission presented Communications on the "greening of transport"[90] and a strategy to internalise the external costs of transport[91]. These principles have been reconfirmed in the 2011 White Paper on Transport[92]. Furthermore, in 2008, the Commission presented a proposal to amend the "Eurovignette" Directive[93] so as to permit the Member States to incorporate a financial element related to air pollution, noise and congestion into road tolls for heavy goods vehicles. Such charges would nonetheless remain optional. Whilst the European Parliament has adopted its first reading resolution, the Council has so far not managed to reach political agreement on this proposal.

Beyond this strategy on internalisation, one must expect that different modes like short sea shipping and road haulage can and should compete with each other (where this is possible). Short sea shipping will face stronger competition from road freight transport as a result of increased marine fuel costs due to operations in a SECA despite the fact that road fuels are heavily taxed (unlike marine fuels). In 2007, road fuel was more than three times as expensive as heavy fuel oil and twice as expensive as marine gas oil (chapter 2.5). So also if ships shift to use of MGO, road fuel will remain significantly more expensive[94].

Besides competition with road, short sea ships will also experience competition from rail and deep sea shipping.

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90 COM(2008) 433 : "Greening Transport"

91 COM(2008) 435 : "Strategy for the internalisation of external costs"

92 White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144, 28.3.2011

93 COM(2008) 436 : proposal for a directive of the EP and of the Council amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures.

94 Member State taxation must comply with a minimum rate of 302 Euro per 1000 litre for diesel oil but in most Member States the figures is between €400 and €600 per 1000 litre (ref: http://www.energy.eu/)).

Several studies assess the potential impacts on short sea shipping. These studies have each taken different assumptions and scope which unavoidably leads to differences in the overall impacts on the modal shift.

None of these reports assume that ships take measures to reduce fuel consumption. Yet, an increased fuel price will make a number of operational and technical measures to reduce fuel consumption cost effective (see further explanation in paragraph 4.2.3.). So the real fuel cost increase is likely to be less.

In all studies the oil price is seen independent of the cargo volumes to be transported. It is likely that a high oil price will only materialize in case of strong economic growth, with strong increase in cargo volumes.

One study aimed at assessing the competitiveness of several types of (short sea) shipping[95]. It calculated the impact of several policy measures and concluded that the main impact comes from the fuel requirement in SECAs as of 2015 and to a lesser extend potential future measures to reduce greenhouse gas emissions and designation of NOx Emission Control Areas.

This study assumed that compliance with the MARPOL regulation is obtained by the use of low sulphur fuel – as most expensive scenario for shipping. In addition, it only focussed on those lines which are susceptible for modal shift.

	Modal share		Change in modal share
Modal share	Baseline	Policy E	
LoLo	34%	31%	-7%
RoRo	35%	33%	-4%
Ropax Small	13%	12%	-1%
Ropax Large	26%	26%	-2%

Table 1: *Modal share of the SSS option and change of modal share*

Including all measures combined, by 2025 the maximum change of modal share calculated ranges from -1% for Ropax Small to -7% for LoLo ships. These resulting modal shifts are fairly limited, especially noting that it is considered a "worst case scenario".

Compared to the other studies, the oil price for 2025 (taken from iTREN) is relative low. On the other hand, the maximum modal shift is predicted for the longer distances and the study has, by taking an average speed of 60 km/h for trucks regardless of driving time legislation, clearly underestimated road costs for longer distances. So the competitive position of shipping will be better than assumed in this report.

Another study done for the European Commission[96] quantified a number of parameters that will influence costs of maritime and road transport and how that

95 TML, August 2010

96 Impact Study on the future requirements of Annex VI of the MARPOL Convention on Short Sea Shipping, SKEMA, June 2010

could translate into change of transport modes for some selected freight corridors where a choice exists between routes with more, less or no ship transport. Whereas the scope of the report does not allow to draw conclusions on an overall modal shift, the study gives insight in consequences of different policy instruments or scenarios. The impact of introducing MARPOL Annex VI was found the most important potential cost increase for short sea shipping whereas a decrease in truck driver salary would have a similar impact by decreasing road freight costs. The study found that the vulnerability for mode shift on the same transport corridor with different choices of road/ship transport could be very different. Shipping lines with a relatively high fuel consumption seem to be influenced most. Even it the SECA standard for sulphur in fuel would have been set at 0.50%, still a clear impact on mode shift is observed, be it less than with 0.10%. Where scrubbers are assumed to be implemented by ship operators, the compliance costs are obviously much reduced and the study concluded that there will be almost no risk of modal shift in such cases.

The study assessing the additional fuel costs for ships visiting Finnish ports[97] assumes maximum 30 to 50% increase in shipping freight charges but again does not quantify potential modal shift.

The study focussing on Sweden[98] assumes oil prices per barrel of $60, $100 and $150, resulting in mgo prices per tonne of $662, $1158 and $1650 respectively. The resulting reduction in the share of ships is assessed at -2%, -7% and -10%, respectively, resulting especially in the middle scenario in a remarkable increase in rail transport (+8%). This study is the only one to also include impact on rail transport.

The report does not reveal if and how the oil price scenarios are translated into prices for road and rail transport, nor if other costs increases have been taken into account.

Assuming the middle scenario, the cost per tonne per voyage would increase between €2 and €10 (depending on type of ship and cargo). Per passenger the costs increase for a ferry from Stockholm to Turku (Finland) would be about €2.

The study done on behalf of the ECSA (European Community Shipowner Association)[99] predicts significant shift towards road transport (3 to 50%) whereas the use of fuel containing 0.5% sulphur would not lead to any modal shift at all. Therefore, the future SECA standard is believed to counteract an important portion of the benefits. The potential mode shift is however far higher than assessed in studies mentioned above which might be influenced by a number of assumptions that are not clear or questionable:

(1) In is not clear how the oil price increases are included in truck costs or how other legislation (like Euro VI) is included. The average speed for trucks seems optimistic: 90km/h on highways, 75km/h on other roads.

97 Sulphur content in ship bunker fuel in 2015, Ministry of Transport and Communications, Finland, April 2009

98 Consequences of IMO's new marine fuel sulphur regulations, Swedish Maritime Administration, May 2009

99 Analysis of the Consequences of Low Sulphur Fuel Requirements, Universiteit Antwerpen and TML; commissioned by ECSA, January 2010

(2) It is not clear how capacity of other transport modes is taken into account and whether indeed certain changes would be feasible at all.

(3) The total amount of freight transport is assumed to be stable and certain percentage of modal shift is assumed to result in the same number of ships carrying less cargo, which will impact on the freight charge. However, as trade and certainly container trade is expected to increase, even a relative loss in market share could still be an increase in absolute terms.

(4) The assumed price for fuel containing 0.50% sulphur is underestimated as unlike assumed in the report, it would be a distillate fuel. Basing the future price on historical figures leads to further underestimation as before there was no legal requirement so no price premium for this fuel.

So in summary, it is clear that with the introduction of the 2015 emission requirements, short sea shipping will experience increased costs and competition from road, rail and deep sea shipping. This will impact especially those shipping lines that already today are least competitive, for example due to a relatively high fuel consumption. Based on the information available today, it seems however that the impacts are not as imposing as suggested by the industry. At the same time, given the large range in predictions, there is a clear level of uncertainty to what might happen and the European Commission will therefore be keeping a close eye on the consequences and look for solutions in case of disproportional impacts.

2.4. Potential impact on trade

The choice as to where goods are sourced geographically will depend on the relative cost difference between similar products (from different locations) to which transport costs may contribute. It is clear that the impact of an increase in transport costs will be small for goods transported by containers due to the relatively high value of goods transported. So the cargoes most at risk of enhanced competition are rather the relatively low value goods transported by bulk carriers. For industries in the Nordic region the most relevant products include paper pulp and iron ore.

The assessment of the potential impact on European imports and exports (especially regarding to trade in low value goods) showed that with ECAs as they are now, the sailing to and from European ports from/to other continents becomes only marginally more expensive. While this leaves Short Sea Shipping at a risk of losing activity to more fuel efficient Deep Sea Vessels making extra stops, other aspects than explicit costs (flexibility, opportunity costs, load factors) will likely temper this effect. Hence, it is not expected that changes in entry/exit points or shifts in modal balance (SSS to land) will take place. Given the marginal cost increase of maritime transport and the marginal share of maritime transport cost in end user prices, the new legislation will cause negligible cost increase to end user prices of national consumption[100].

An independent consultant assessed the price increase for goods transported from the middle of the Baltic Sea to the English Channel at $2 per tonne for bulk goods (relative to the fuel price of September 2009). This is consistent with a Swedish

[100] TML, August 2010

report assessing the price increase at €2 to €9 for containers[101]. Relative to price fluctuations of iron or paper pulp, this increase is limited.

2.5. Miscellaneous concerns

Some concerns have been raised on whether ship engines can cope with low sulphur fuel which is less lubricating. However, several communications from both engine manufacturers and lubricating oil manufacturers indicate that this should not be an issue. More over the revised ISO 8217:2010 specification for marine fuels now contains minimum lubricity requirements.

A more widespread concern will be the availability of compliant fuel when the new sulphur limits enter into force. As on the first of January 2015 the sulphur limits of fuels used by ships passing through SECAs will reduce significantly by a factor of ten from 1% to 0.1% by mass. It can not be excluded that there might be problems regarding universal fuel availability in all ports. However, as the amount of fuel used in SECAs is only a few percent of the total amount this is likely to be a temporary problem and the situation is not significantly different to previous changes in marine fuel sulphur requirements. Indeed, given that the USA and Canada have also introduced SECA's covering a 200 mile zone contiguous with the USA/Canadian coastline it is more likely that geographically balanced availability of SECA compliant fuel will be seen in practice.

[101] Swedish Maritime Administration (2009), Consequences of the IMO's new marine fuel sulphur regulations

ANNEX VII TRENDS IN ACTIVITY, FUEL QUALITY AND PRICES, AND MODAL SPLIT

1. TRENDS RELATED TO THE USE OF MARITIME FUELS

1.1. Maritime and port activity

Table 1 shows the total freight traffic for major EU ports ranked in order of increasing traffic (bulk and container cargoes) in millions of tonnes per annum. Most of the top 25 busiest ports below have shown consistent growth in the 2000–2007 period whilst the financial crisis has affected traffic in 2008 although the degree is mixed with some ports actually having experienced continued growth such as Amsterdam, Bremerhaven, Antwerp and Rotterdam.

Port	Member State	2000	2005	2006	2007	2008	% change 07-08
Rotterdam**	*NL*	302.545	345.819	353.576	374.152	384.210	2.7
Antwerpen**	*BE*	116.003	145.835	151.705	165.512	171.237	3.5
Hamburg	*DE*	76.950	108.253	115.529	118.190	118.915	0.6
Marseille**	*FR*	91.279	93.308	96.527	92.561	92.523	0.0
Le Havre**	*FR*	63.885	70.801	69.973	73.897	75.636	2.4
Amsterdam**	*NL*	42.044	47.133	56.794	62.516	74.366	19.0
Grimsby & Immingham	*UK*	52.501	60.686	64.033	66.279	65.267	-1.5
Algeciras**	*ES*		55.184	60.023	62.128	61.869	-0.4
London**	*UK*	47.892	53.843	51.911	52.739	52.965	0.4
Dunkerque**	*FR*	44.318	48.503	50.386	50.244	50.464	0.4
Valencia**	*ES*	21.958	34.990	40.742	45.935	50.182	9.2
Taranto**	*IT*	33.117	47.869	50.871	49.240	49.522	0.6
Bremerhaven	*DE*	24.835	33.728	40.350	43.618	48.956	12.2
Genova**	*IT*	43.797	42.640	44.425	48.358	46.469	-3.9
Constantza**	*RO*		44.377	42.888	44.916	45.750	1.9
Tees & Hartlepool	*UK*	51.472	55.790	53.348	49.779	45.436	-8.7
Göteborg	*SE*	33.261	36.479	39.912	40.353	42.331	4.9
Barcelona**	*ES*	25.787	37.061	38.267	41.040	41.516	1.2
Southampton**	*UK*	34.773	39.947	40.556	43.815	40.974	-6.5
Wilhelmshaven	*DE*	43.402	45.977	43.106	42.643	40.556	-4.9
Forth	*UK*	41.143	34.218	31.556	36.681	39.054	6.5
Trieste**	*IT*	44.015	43.355	44.644	39.833	37.195	-6.6
Bilbao**	*ES*	26.623	32.219	36.118	37.313	36.862	-1.2
Milford Haven	*UK*	33.768	37.547	34.307	35.496	35.875	1.1
Zeebrugge**	*BE*	32.660	28.442	32.763	34.843	34.768	-0.2

Table 1: *Freight traffic (bulk and container) in Mtonnes at major EU ports 2000 to 2008. Data taken from 'EU Energy and Transport in figures, statistical pocket book 2010.** signifies a port situated in an air quality management zone that experienced an exceedance of the daily air quality limit value for particulate matter PM_{10} in 2007 or 2008 (see section 2).*

In the period 2005-2007 container traffic at the largest EU ports grew substantially so that in the top 25 ports listed below in Table 2 only 4 experienced growth lower than 10% during the period whilst at Zeebrugge a change of 74% was recorded. The financial crisis affected traffic in several ports whilst for some growth continued strongly.

Port	Member State	2005	2006	2007	2008	% change 07/08
Rotterdam	*NL*	9,194.6	9,575.4	10,773.4	10,631.0	-1.3
Hamburg	*DE*	8,084.3	8,878.1	9,913.5	9,767.3	-1.5
Antwerpen	*BE*	6,220.9	6,718.2	7,878.9	8,378.9	6.3
Bremerhaven	*DE*	3,696.1	4,479.3	4,884.0	5,451.4	11.6
Valencia	*ES*	2,415.0	2,614.8	3,048.9	3,606.3	18.3
Algeciras	*ES*	3,183.1	3,262.5	3,419.9	3,297.6	-3.6
Gioia Tauro	*IT*	3,123.2	2,835.2	3,464.2	3,164.8	-8.6
Felixstowe	*UK*	2,759.7	3,029.8	3,342.3	3,131.4	-6.3
Barcelona	*ES*	2,071.3	2,314.6	2,605.6	2,564.5	-1.6
Le Havre	*FR*	2,144.3	2,118.9	2,684.7	2,511.6	-6.4
Southampton	*UK*	1,384.2	1,502.3	1,905.2	1,616.8	-15.1
Genova	*IT*	1,037.6	1,145.7	1,229.6	1,461.9	18.9
Constantza	*RO*	867.0	1,170.4	1,444.7	1,405.3	-2.7
Zeebrugge	*BE*	682.3	895.5	1,191.0	1,400.8	17.6
Las Palmas, Gran Canaria	*ES*	1,209.7	1,291.1	1,309.8	1,302.5	-0.6
La Spezia	*IT*	915.6	1,086.5	1,130.1	1,185.9	4.9
London	*UK*	765.1	742.6	857.8	983.5	14.7
Marseille	*FR*	910.6	950.2	1,058.5	901.4	-14.8
Bilbao	*ES*	861.5	898.7	956.1	894.1	-6.5
Göteborg	*SE*	771.7	811.8	840.9	863.9	2.7
Medway	*UK*	702.9	594.3	514.5	767.6	49.2
Dublin	*IE*	590.2	680.7	744.2	676.5	-9.1
Liverpool	*UK*	613.1	613.4	675.7	673.9	-0.3
Kotka	*FI*	376.5	460.6	576.5	627.1	8.8
Gdynia	*PL*	392.9	458.7	611.9	610.9	-0.2

Table 2*: Container traffic in 1000 TEU at major EU ports 2005 to 2008. Data taken from 'EU Energy and Transport in figures, statistical pocket book 2010.*

Whilst there has been an overall increase in freight activity at EU ports, this growth is dominated by a shift towards containerised freight. This has implications for the relative modal shares of seaborne versus road transport within the EU given that products transported by container are generally of a higher value and relatively less affected by increased transports costs (such as those potentially caused by a requirement for lower sulphur fuels).

1.2. Trends in the sulphur content of marine fuels

The IMO has established a monitoring programme which reports on the sulphur content of marine fuels sold globally. The information is provided by third party organisations involved in analysing fuel quality on behalf of fuel purchasers. The monitoring programme reports annually and results are available since 1999[102]. However, the average fuel sulphur level has been determined by averaging each fuel sulphur measurement but not taking into account the quantity (mass) of fuel that the sample represents. In 2009, 106,503 samples of residual fuel oil were tested (associated with 94,323,860 tonnes of RFO bunkered) with an average sulphur content (not mass weighted) of 2.35% m/m. As shown in Table 3 below, this figure has declined significantly since 2006 because of the introduction of SECA-compliant fuels and the more frequent testing of such fuels by fuel purchasers.

Year	Corresponding quantity of	Number of Samples	Tonnes per	Average

[102] MEPC 61/4 "sulphur monitoring for 2009": Paper prepared by the IMO secretariat and submitted to the 61st session of the Marine Environment Protection Committee of 16 February 2010.

	residual fuel oil (tonnes)	tested	bunkering	sulphur content
1999	47,000,000	53,000	886	2.7%
2000	49,000,000	54,000	907	2.7%
2001	56,000,000	62,000	903	2.7%
2002	59,000,000	63,000	936	2.6%
2003	67,395,141	66,958	1006	2.7%
2004	74,408,066	66,312	1122	2.7%
2005	82,436,438	79,592	1035	2.7%
2006	86,857,565	86,117	1008	2.59%
2007	92,757,373	97,172	954	2.42%
2008	97,600,555	106,925	913	2.37%
2009	**94,323,860**	**106,503**	**886**	**2.35%**

Table 3: *Average sulphur content of residual fuel oil from 1999 to 2009 based on the number of samples tested (i.e. not weighted by mass of residual fuel oil)*

The average sulphur content based solely on the average of sulphur measurements is not representative of the actual fuel used. For example, when the average sulphur content of residual fuel oil in 2009 is weighted by the mass of fuel bunkered the average sulphur content is 2.60% as reported by the IMO rather than 2.35% based on the simple average of fuel sulphur measurements. Having recognised this weakness in its fuel quality testing guidelines, the IMO intends to ensure that fuel sulphur monitoring data is mass weighted in future years.

1.3. Marine fuel prices

There are three broad categories of marine fuel which are covered by the international ISO standard ISO 8217 all of which are generally exempt from taxation. The first category of marine fuel is referred to as "residual fuel oil (RFO)", "intermediate fuel oil (IFO)" or "heavy fuel oil (HFO)" and is characterised by its dark colour, high boiling point and high viscosity such that heating is required before it can be pumped to a ship's engines. Different grades of residual fuel oil are identified by their specific viscosity in centistokes. IFO 380 is a mix of (heavy) residual oil and some (light) distillate oil. The fuel used in SECAs is typically a low sulphur IFO.

The second category is the lightest marine fuel, known as marine gas oil (MGO) which is a middle distillate fuel and has properties similar to heating fuel and road diesel. Currently, this fuel is only allowed to be placed on the market in the EU if its sulphur content does not exceed 0.1%. The third category covers marine diesel oils (MDO) which are heavier distillate fuels and in practice are made from blending light distillate fuels together with RFO components. There is no legal requirement related to the use of this quality of fuel but MDO is currently only allowed to be placed on the market (sold) in the EU if it contains no more than 1.5% sulphur by mass.

The evolution in the spot price of the three categories of marine fuel since 2004 is depicted in Figure 1 below. Unsurprisingly, this shows that marine gas oil is more expensive than residual fuel oils by about $150-200 per tonne but that this difference has been smaller since 2008. There is little difference in price between high and low

sulphur residual fuel oils. Price information for low sulphur RFO is only available from 2006 when the requirements for the first SECA in the Baltic Sea formally entered into force thereby creating a demand for this fuel. The entry into force of the second SECA in the North Sea and English Channel in August 2007 seems not to have had any significant impact on marine fuel prices. The price of all refined products is heavily influenced by the price of crude oil which exhibited a sharp rise in 2008 where crude prices rose to $125 per barrel. Any price increase effect from the lowering of the sulphur content of MGO from 1 January 2008 (from 0.2% to 0.1%) in the EU is probably masked by the changes in the crude price.

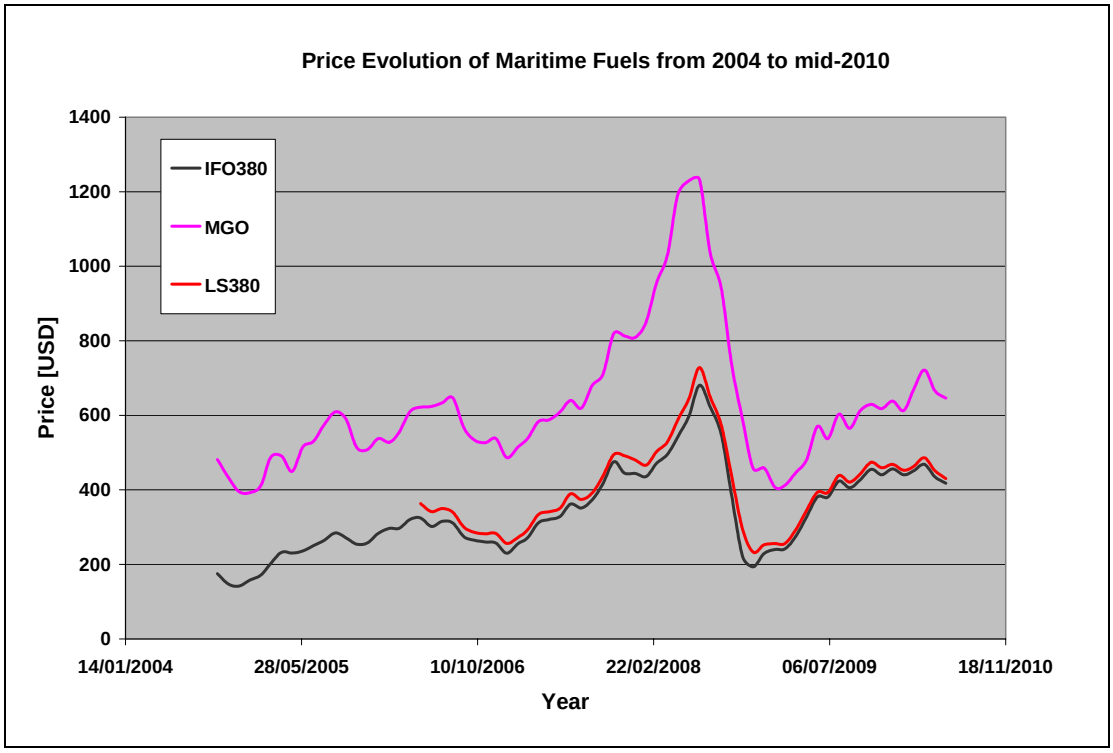

Figure 1: *Monthly average prices for high sulphur IFO380, low sulphur (1.50%) IFO380 and MGO in Rotterdam from 1 October 2004 to 15 June 2010. Data provided by Bunkerworld.*

The US Energy Information Administration has produced energy forecasts for the consumption and prices of energy products including transportation fuels such as residual fuel oil[103]. Figure 2 shows the predicted evolution of the price of RFO out until 2035 for a "reference" case and low and high sensitivity cases. RFO prices are predicted to be fairly static over the next 10 years or so in the reference case.

103 http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2010).pdf

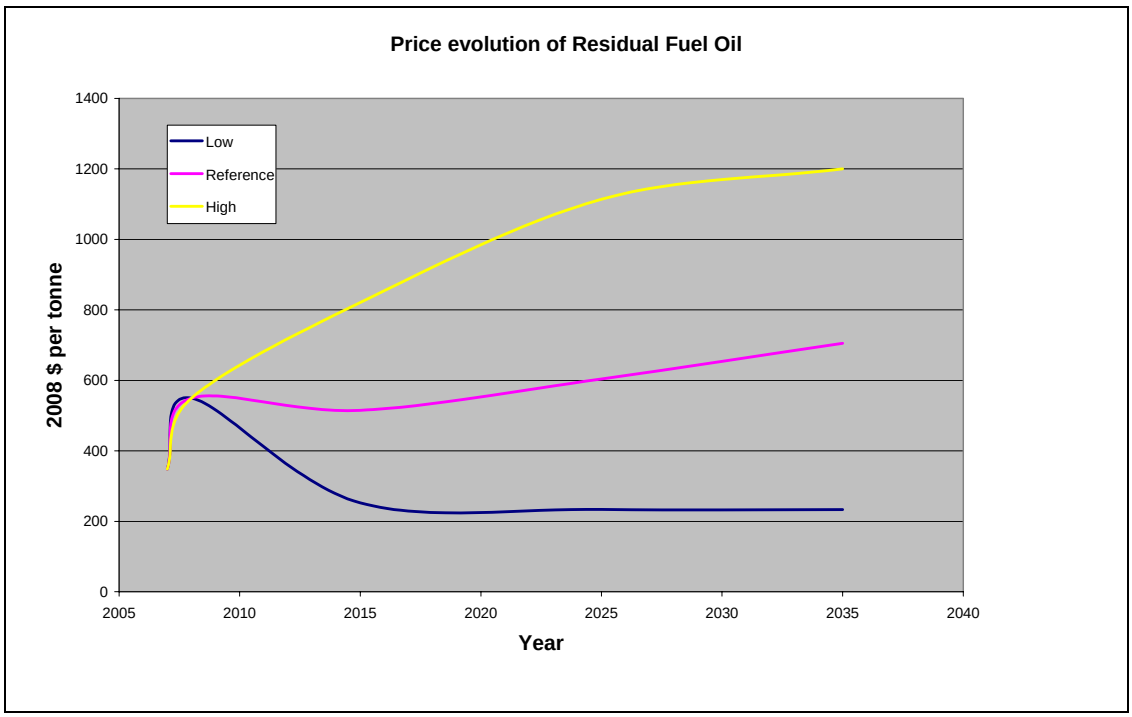

Figure 2: *Predicted price evolution of residual fuel oil in 2008 $ per tonne. Data taken from the Annual Energy Outlook 2010 of the US Energy Information Administration.*

1.4. Trends in modal share of freight transport

During the period 2000-2008 total freight transport in the EU-27 increased by 2.0% per annum whilst those for road, sea and rail increased at 2.7%, 1.7% and 1.2% per annum respectively (see table below).

EU-27 Freight transport in Billion tonne-km	**Road**	**Rail**	**inland waterways**	**pipelines**	**sea**	**Air**	**Total**
1995	1289	386	122	115	1146	2	3060
1996	1303	392	120	119	1160	2.1	3096.1
1997	1352	410	128	118	1193	2.2	3203.2
1998	1414	393	131	125	1232	2.3	3297.3
1999	1470	384	129	124	1268	2.3	3377.3
2000	1519	404	134	127	1314	2.5	3500.5
2001	1556	386	133	133	1334	2.5	3544.5
2002	1606	384	133	128	1355	2.4	3608.4
2003	1625	392	124	130	1378	2.4	3651.4
2004	1747	416	137	132	1427	2.5	3861.5
2005	1800	414	139	136	1461	2.6	3952.6
2006	1854	440	138	135	1505	2.7	4074.7
2007	1915	453	147	127	1532	2.8	4176.8
2008	1878	443	145	124	1498	2.7	4090.7

Table 4 :*. Freight transport demand in the EU 1995-2008. Data from statistical pocketbook 2010.*

ANNEX VIII – CURRENT AND POTENTIAL FUTURE SUPPORT MEASURES THAT COULD BE USED FOR THE IMPLEMENTATION OF MARPOL ANNEX VI.

1. INTRODUCTION

The introduction of the new environmental standards on sulphur emissions is expected to entail changes of a technical and operational nature in the shipping business as well as in upstream and downstream industries. Accordingly, the Commission will further examine the possible impacts namely on shipping and especially in the Short Sea Shipping (SSS) sector. On one hand impacts might result from higher costs due by the use of low sulphur bunker fuels. In this context, cost developments will be monitored in order to propose well informed policy responses to avoid possible distortions in the logistics chain and modal backshift from sea to land. On the other hand, making use of the equivalent compliance methods would require investments for the retro-fitting or newbuilding of ships, which would also often require additional operational efforts, both on-board and on-shore. Especially a switch to the use of LNG or LPG will need adequate infrastructure and superstructure to support the implementation of the technology.

The European Commission's proposal is intended to be both flexible and neutral as regards the way in which compliance with the new limits can be achieved, leaving the choice of the most appropriate technology to the operators. Nevertheless, compliance needs to be achieved on time and at the scale required while minimising any possible unwanted collateral effects. To this end, a number of short-term accompanying measures are being considered by the Commission to seek solutions for minimizing the compliance costs.

The following text discusses support measures to address the imminent challenges for the shipping sector relating to coping with the effects of the extra costs induced by actions to improve its environmental performance, by reducing the SO_x emissions from ships as foreseen in the revision of Directive 1999/32.

In Chapter 3 it describes possible international measures to avoid trade distortions and finally it presents the Commission's considerations on an additional set of measures to address, from a broader perspective, the environmental impact of shipping in the medium and longer term. In this respect, a "sustainable waterborne transport toolbox" could assist the sector to improve its environmental performance while maintaining its competitive position. This multi-dimensional policy approach would explore measures such as: hard and soft regulatory measures, green ship technology and alternative fuels, adequate green infrastructure, economic and funding instruments, research and innovation, international cooperation, etc. These measures will be put in place following the adoption of the Roadmap to a Single European Transport Area - White Paper on Competitive and Sustainable Transport System[104], and the new TEN-T Policy and Guidelines, and will require further assessment and validation with the stakeholders.

[104] Commission White Paper – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 of 28.3.2011

2. SHORT TERM MEASURES TO SUPPORT THE IMPLEMENTATION OF NEW SULPHUR LIMITS

2.1. EU Instruments

a) TEN-T Work Programme 2011

In 2011, the TEN-T Work Programme will continue to finance projects addressing environmental issues and facilities. These may include for instance the deployment of LNG and scrubber technologies, such as LNG stations and port reception facilities aiming at collecting the sludge produced by scrubbers. LNG bunkering vessels can also be funded as pilot projects.

b) Marco Polo II – Work Programme 2011

The Marco Polo Work Programme for 2011 includes as a political priority the encouragement of the use of maritime services that implement innovative technologies, which significantly reduce polluting emissions from ships. Therefore, the use of low sulphur fuel, SO_2 abatement technologies, and the use of alternative fuels like LNG will be specific eligibility criteria for Short Sea Shipping projects under the Call for 2011. In practice this means that SSS-based projects submitted under the Modal shift, Catalyst and Motorways of the Sea actions shall only be eligible provided they implement innovative technologies or operational practices which significantly reduce polluting emissions of maritime transport, such as the use of low sulphur fuels, alternative fuels like LNG and abatement technologies.

c) EIB --European Clean Transport Facility (ECTF)

The maritime transport sector can already benefit from the European Investment Bank (EIB) loans. The EIB introduced the **European Clean Transport Facility (ECTF)** at the end of 2008, which should significantly underpin innovation in the sector, by supporting investments targeting research, development, and innovation in the areas of emissions reduction and energy efficiency in the European transport industry. The ECTF will amount to EUR 4bn per year and targets in particular the shipping industries. The average EIB lending for shipbuilding and maritime infrastructure has been to the order of €500m-€550m in recent years

d) Strategic Transport Technology Plan (STTP)

The STTP under preparation for 2011 will support research, development and innovation with a view to ensuring the implementation of the research results especially into innovative products and processes. It could in particular help the introduction of new abatement technologies or of new fuels such as LNG.

2.2. State aid measures

2.3. State aid measures

Member States may decide to compensate for the net increased costs for the ship industry to comply with new EU standards by providing State aid under certain conditions.

Such State aid must have an incentive effect, contribute to environmental protection and comply with existing guidelines or regulations, in particular the Community Guidelines on State aid for environmental protection[105] or the Commission Regulation N° 800/2008 of 6 August 2008(General block exemption)[106].

When new EU standards are considered or adopted, Member States may in particular grant two categories of investment aid.

In case of investments which take place before the adoption of new EU standards, Member States may grant investment aid enabling companies to go beyond existing EU standards.

When new EU standards have been adopted but are not yet in force, Member States may grant investment aid for early adaptation ahead of the entry into force of the new standards.

In order to reduce the administrative burden, Member States may grant investment aid to go beyond EU standards and investment for early adaption to SME, without prior notification to the Commission, in accordance with the provisions of Commission Regulation N° 800/2008 of 6 August 2008 (General block exemption)[107].

Financing of port reception facilities and LNG fuelling stations may be under certain conditions approved by the Commission under Community Guidelines on National Regional Aid for 2007-2013[108].

Aid to research, development and innovation may be granted to shipbuilding, ship repair or ship conversion yards on the basis of the Framework on State aid to shipbuilding[109]. This Framework will expire at the end of 2011 and is currently being reviewed by the Commission.

It follows from the above that Member States could grant aid to support measures such as retro-fitting air pollution control devices or marine engines on vessels ahead of the entry into force of the new standards, or developing onshore infrastructure, such as for marine-LNG refuelling stations.

3. INTERNATIONAL ACTION

Similar standards for all Baltic Sea third States are necessary in order to avoid potential traffic flow shifts between Baltic ports. In this context, the Commission proposes to use international dialogue, e.g. within the framework of the EU-Russia Common Spaces, or as appropriate within the Helsinki Commission, so that all Baltic third countries do ratify MARPOL and

[105] OJ C82 of 1.4.2008, p.1.
[106] OJ L 214 of 9.8.2008; p 3
[107] OJ L 214 of 9.8.2008; p 3
[108] OJ C54 of 4.3.2006, p13
[109] OJ C 317 of 30.12.2003, p.11, and the Communication from the Commission concerning the prolongation of the Framework on State Aid to Shipbuilding, OJ C 173 of 8 July 2008, p.3.

effectively comply with all Annex VI requirements. In more general terms, the Commission is preparing a Communication to set conditions for a renewed transport policy with its neighbours, one aim of which will be to make transport more efficient and bring it closer to EU standards.

The Commission will also stimulate the exchange of experiences and best practices on new emissions abatement technologies and the use of alternative fuels, compliance monitoring, safety and cost aspects with third countries bordered by SO_x ECAs, as the United States of America. The ultimate objective is to set up harmonised standards based on cost effectiveness assessment, which will permit to use vessels in all seas without technical hindrances.

4. MEDIUM-TERM AND LONG-TERM MEASURES TO FOSTER SUSTAINABLE MARITIME TRANSPORT

In the long run, the main challenges of the shipping sector relate to meeting the increasing demand for transport in an efficient and sustainable way, and to contribute to the general EU effort to reducing the GHG emissions from transport. To this end, as mentioned above, the Commission is considering a "sustainable waterborne transport toolbox" which could assist the sector to improve its environmental performance while maintaining its competitive position. This would be an integrated, multi-dimensional action, tailored to the sector's specific needs. Its implementation could be undertaken by the Commission, the Member States, and the relevant stakeholders, either individually or jointly.

Following the adoption of the Roadmap to a Single European Transport Area - White Paper on Competitive and Sustainable Transport System, and in line with the new TEN-T Guidelines and Policy, as well as further assessment and validation with the relevant stakeholders, the sustainable waterborne transport toolbox will include the following measures:

1. **Regulatory measures** to reduce emissions from ships, not exclusively in the context of transposing international emission reduction requirements, but also to create the adequate regulatory framework to facilitate the implementation and the safe and secure use of green ship technologies and the development of the necessary standards, notably in an amendment of the marine equipment directive[110]. The European Commission, in cooperation with EMSA will assess the benefit of averaging compliance methods which could provide to operators some flexibility to meet the requirements of the directive on sulphur emissions.

This may lead to a change of legal requirements, which will be submitted to the IMO. Furthermore, in its Roadmap to a Single Transport Area[111], the Commission announced its intention to proceed, over the period 2016-2020, to internalising the costs for local pollution and noise in ports, as well as for air pollution at sea, which would reduce potential imbalances between regions resulting from the implementation of SECAs.

2. **Implementation of advanced green technology and alternative fuels.** The Commission will analyse the creation of a dedicated programme to promote the use of

[110] Council Directive 96/98/EC of 20 December 1996 on marine equipment, OJ L 46 of 17.2.1997, p.25

[111] Commission Staff Working Document accompanying the White Paper – Roadmap to a Single European T Transport Area – Towards a competitive and resource efficient transport system, SEC(2011) 391 final of 23.3.2011

alternative fuels, notably LNG, contributing to the global effort to reduce GHG emissions from transport and optimise ship energy efficiency.

3. **Development of adequate green infrastructure and superstructure** to support clean vessel technologies such as LNG shore-based infrastructure and bunker delivery logistics. The use of LNG requires investment in terminals with LNG filling stations for ships. Appropriate locations for developing safe and efficient LNG bunker logistics need to be identified. The case for specific governmental support for the initial development of the necessary shore based infrastructure will be examined. The Commission will consider supporting the deployment of LNG shore-based infrastructure and bunker delivery logistics in the European Union. A support programme for the development of a EU LNG bunkering network or the installation of coastal stations will be studied. These actions will be part of wider programmes (like TEN-T or Marco Polo) and may be also assessed with these respective programmes.

Given the budgetary constraints of the TEN-T programme, which provides for relatively low co-funding rates, a better coordination will be required with funding opportunities under the Structural Funds (European Rural Development Fund and the Cohesion Fund), which allow for higher co-funding rates. To this end, the Commission aims to develop a transport infrastructure framework, encompassing the investment strategies of both the TEN-T and Structural Funds. In view of continued pressure on public sector budget resources, unlocking the potential of private finances is very important to support investment in green technologies and alternative fuels. In its Roadmap to a Single Transport Area[112], the Commission announced its intention to establish an enabling framework for the development of PPPs, and to participate in designing new financing instruments for the transport sector, such as the EU project bond initiative[113].

4. **Research and innovation**: moving towards low carbon waterborne transport requires substantial research efforts. Furthermore, it is very important to optimise research and innovation activities and to ensure the timely deployment of their results. The Commission in its Strategic Transport Technology Plan (STTP) will address options for all transport modes, and notably for waterborne transport. Furthermore, funding for European research and innovation relevant to this mode of transport should be part of future framework programmes, and industry-driven priorities be reinforced, as supported by the Communication on Innovation UnAnnex

[112] Commission White Paper – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 of 28.3.2011

[113] Commission White Paper – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 of 28.3.2011, p.109

ANNEX IX ADMINISTRATIVE BURDENS

The European Commission's Impact Assessment Guidelines request that administrative burdens associated with the delivery of EU legislation are assessed and reduced where feasible whenever an impact assessment is conducted.

For the purposes of legislative impact assessment 'administrative burdens' are strictly defined as *information obligations* that are placed on citizens, businesses or public administration (excluding the EU) by EU legislation and that entail financial costs. These obligations can be to provide or record and keep information.

The Directive contains information obligations mostly related to compliance monitoring and reporting. The following is a mapping of information obligations currently included in the Directive:

- For Member States

Article	Description	Comment
Art. 4a (6)	Maintain a register of local suppliers of marine fuel	This provision is not revisited in this impact assessment.
Art. 4c (4)	Communicate to IMO criteria for the assessment of impacts on ecosystems of waste streams associated with abatement technologies.	This is a conditional obligation, dependent on the use of abatement technologies to meet compliance (instead of low sulphur fuels). This provision is not revisited in this impact assessment.
Art. 7 (1)	Provide the Commission with a short yearly report	This provision is not revisited in this impact assessment..

- For companies

Article	Description	Comment
Art 4a (5), Art. 4b (1b) and Art. 6 (1a)	Register fully information on the sulphur content of fuels in log books and bunker delivery notes.	Ships hold log books on which operational information is registered. This requires the entry of information on the sulphur content of fuel, which also has to be present on the bunker delivery note. There is an IMO obligation to keep fuel bunker delivery notes for at least one year. In general the sulphur content of fuel has to be known by the operator to ensure it is compatible with a ship's

		installed technology. This provision is not revisited in this impact assessment.
Art. 4a (6)	For fuel suppliers. Document the sulphur content of fuels on a bunker delivery note.	This provision is not revisited in this impact assessment.
Art. 4c (1)	Notify in writing the Commission and the port State on trials; provide full results to the Commission and to the public.	This provision is not revisited in this impact assessment.
Art. 4c (4)	Document that waste streams associated with abatement technologies used to meet compliance have no impact on ecosystems.	This is a conditional obligation, dependent on the use of abatement technologies too meet compliance (instead of low sulphur fuels). This provision is not revisited in this impact assessment.

The options generated in the impact assessment would not introduce some changes to these information obligations.