Air pollution from ships

What is the problem?

Shipping is a growing contributor to air pollution. The vast majority of emissions of nitrogen oxide (NO_x), sulphur dioxide (SO_x) and particulate matter in EU sea areas are emitted from cargo ships over 500 GRT. EMSA studies estimate that about 45% of all emissions come from EU flagged ships and approximately 20% of emissions are emitted within the 12 mile limit of territorial seas (EMSA website).

In port cities, ship emissions are in many cases a dominant source of pollution. Moreover, emissions from ships may travel over hundreds of kilometres and can thus contribute to air quality problems on land even if they are emitted at sea. This is particularly relevant for the deposition of sulphur and nitrogen compounds, which cause acidification of natural ecosystems and threaten biodiversity through excessive nitrogen inputs (eutrophication).


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Ships also emit ozone-depleting gases (for example from incinerators, cooling installations, fire extinguishing systems and cargo vapour (volatile organic compounds and other) and greenhouse gases. Carbon dioxide (CO_2) is the most important greenhouse gas (GHG) emitted by ships primarily with exhaust gases. A recent IMO study estimates that shipping has emitted 1046 million tonnes of CO_2 in 2007, which corresponds to 3.3% of the global emissions during 2007, contributing to climate change and ocean acidification. Most of these emissions (870 million tonnes or 2.7% of the global emissions) of CO_2 in 2007 have been attributed to international shipping. Mid-range emission scenarios show that, by 2050, in the absence of policies, ship emissions may grow by 150% to 250% (compared to the emissions of 2007) as a result of the growth in shipping. (IMO, 2009)

What has been done?

A Thematic Air Strategy was adopted by the European Commission in 2005 which also addresses shipping as emission source. Under MARPOL Annex VI, NO_x and SO_x Emission Control Areas can be designated leading to stricter emission standards. In 2007, the North Sea was established as a Sulphur Emission Control Area (SECA), which means that ships in the area are only permitted to burn lower sulphur content fuel. The allowed sulphur contents are however still 15 000 times of that of fuel for road vehicles. In October 2008, the IMO adopted amendments to MARPOL Annex VI regulations to further reduce harmful emissions from ships. This addresses, however, only sulphur but not other (hazardous) substances, which is a gap that needs to be closed. A detailed list of measures is given in Table 3.1.

A number of policies to reduce GHG emissions from ships have been developed by the IMO. It has been found that market-based instruments are cost-effective policy instruments with high environmental effectiveness. These instruments capture the largest amount of emissions under the scope, allow both technical and operational measures in the shipping sector to be used, and can offset emissions in other sectors.

Did it work?

Nitrogen oxide emissions show a significant increase since 1998. EMEP emission data estimate that total contribution of nitrogen oxides (NO_x) from international ship traffic on the North Sea and the Atlantic was 1850 kt/year in 2007. This is an increase by 21% since in 1998 (Figure 4.3). Model calculations suggest that the total contribution of emissions from ship traffic on the North Sea and the Atlantic to atmospheric deposition of NO_x from the main emission sectors in the five OSPAR Regions ranged between 16% in Region I and 20 – 28 % in Regions II – V (OSPAR, 2009a). It is expected that emission levels will continue to increase with growing ship traffic.

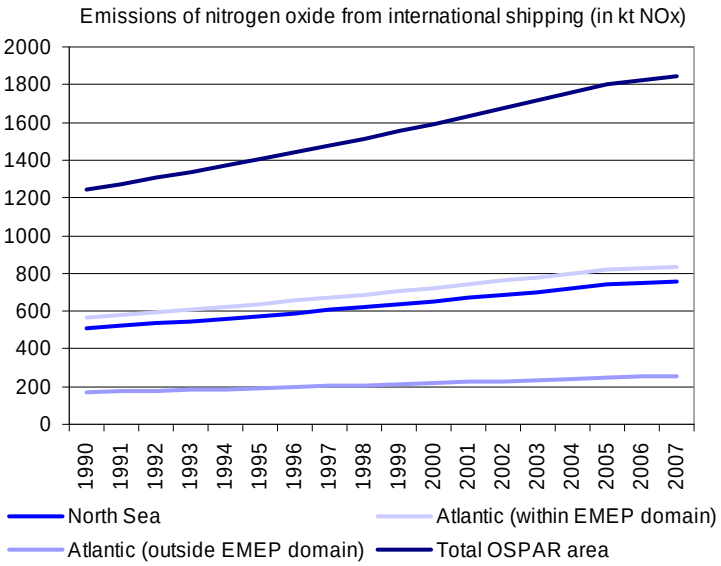

Figure 4.3 *Emissions of nitrogen oxides from international shipping in kt NO_x per year in 1990 – 2007. Source: OSPAR, 2009a based on EMEP emission data.*

Sulphur dioxide emission levels are expected to have increased since 1998.

Gaps in knowledge

There are gaps in knowledge to accurately quantify the contribution of international shipping to greenhouse gas emissions. This difficulty has been highlighted at a national level when collating inventories for submission to the UN Framework Convention on Climate Change and the EU European Monitoring and Evaluation Programme. For example, in the case of the United Kingdom, the inventories submitted only cover emissions from United Kingdom coastal and fishing vessels in United Kingdom territorial waters. Emissions from international shipping using United Kingdom fuels are not included in the national totals. This means foreign vessels passing through United Kingdom waters which have purchased fuel outside the United Kingdom are not included in the inventory, even though these could be contributing to regional air pollution problems in the United Kingdom.

What lessons have we learnt since 1998?

Studies performed for the European Commission show that, without the stringent standards of the review of MARPOL Annex VI adopted in 2008, by 2020, emissions of sulphur dioxide, nitrogen oxides and primary particulate matter (PM2.5) from international shipping in EU seas would be expected to increase from their 2000 levels by 40%, 45% and 55% to 3186, 4828 and 396 kt/yr respectively (Figure 4.4).

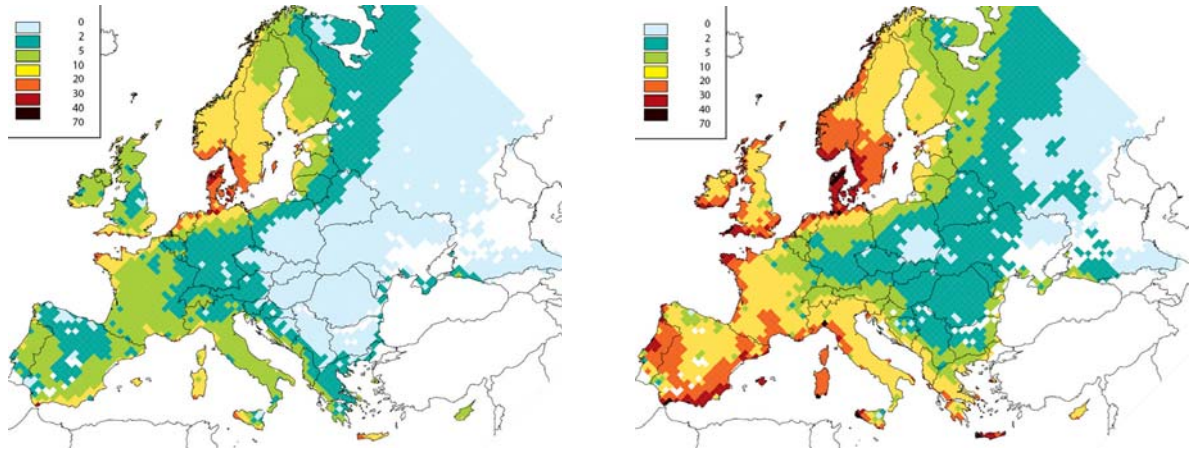

Figure 4.4 *Percent of sulphur deposition originating from international shipping in 2000 (left panel) and projected for 2020 if no action was taken (right panel). Emission controls as result of the revisions to MARPOL Annex VI adopted in 2008 are expected to progressively reduce deposition. Source: IIASA, 2007.*

➥*Go to full QSR assessment report on the impact of shipping on the marine environment (publication number 440/2009)*