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POLLUTION OF THE MARINE ENVIRONMENT FROM OR THROUGH THE ATMOSPHERE

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6.1 Introduction

Parties to the 1982 United Nations Convention on the Law of the Sea (UNCLOS) are under an obligation to take measures to prevent, reduce and control 'all sources of pollution of the marine environment'.¹ The term 'marine environment' is not explicitly defined by the Convention and the scope of this provision is ambiguous. On one reading of the term, it includes the air space above the water column and therefore pollution of the air is itself pollution of the marine environment.² Yet, even if one accepts that the Convention 'does not address directly the problem of pollution of the atmosphere itself',³ it is clear that polluting substances can enter the water column from the atmosphere, either through precipitation or through the direct deposit of particulates.⁴ Indeed, the Convention explicitly covers 'pollution of the marine environment from or through the atmosphere',⁵ thereby recognizing the complex interactions between the air and the sea.

¹ 1982 United Nations Convention on the Law of the Sea (Montego Bay, 10 December 1982, entered into force 16 November 1994) 1833 UNTS 3 (UNCLOS), Art. 194(3).

² Several proposals advanced during the negotiating process included air space above the water column within the definition of the marine environment and one leading commentary concludes that 'the term "marine environment" will include the atmosphere where relevant'. MH Nordquist et al (ed), *United Nations Convention on the Law of the Sea 1982—A Commentary* (Martinus Nijhoff, 1991) vol. IV, para. 192.11(a).

³ Nordquist et al (n. 2), vol. IV, para. 212.9(d).

⁴ See the Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP), *The State of the Marine Environment* (United Nations, 1990) para. 134.

⁵ UNCLOS, Arts 194(3)(a), 212, 222.

This chapter considers the international law that is applicable to pollution of the marine environment from or through the atmosphere. It will start by explaining the way in which this issue is addressed in UNCLOS. It will then analyse other relevant instruments that have been adopted to combat air pollution. The chapter will cover both general treaties on air pollution, as well as the specific regime for the prevention of air pollution from ships. It will pay particular attention to the nature of the international regulations and the extent to which they balance the various interests of different States. It will also consider the manner in which the international emissions standards have evolved in response to technological developments and the challenges for future evolution.

6.2 Scope and Nature of the Problem

Air-borne pollutants are a significant threat to human health, causing premature mortality, cardiopulmonary disease, lung cancer, and chronic respiratory ailments. However, they can also cause damage to the environment more generally. One study notes that 'acid deposition [through precipitation] has been blamed for increased acidity of soil, lakes, and rivers and for other effects including reduced crop growth, death or degradation of forests, and the disappearance of fish and wildlife'.⁶ Nor are these effects limited to the terrestrial environment.

Whilst precise figures remain uncertain, it is estimated that the atmosphere is the source of many contaminants in the marine environment, including nitrogen, sulphur, carbon, heavy metals, and other organic compounds.⁷ These substances contribute to pollution of the marine environment when they are absorbed into the water column. Sulphur, nitrogen, and carbon deposits can all lower pH levels of seawater causing ocean acidification, which is thought to 'have a considerable impact on calcifying organisms and the food-webs of which they are part'.⁸ Furthermore, CO₂ emissions also contribute to climate change, which has additional negative effects on the oceans, such as sea-level rise and water warming.⁹

There are various sources of pollution from or through the atmosphere. Clearly, land-based activities, such as factories or other industrial facilities, are a major source of such pollution as fumes can be blown over the seas by winds, depositing pollutants into the water column. The seriousness of this problem will depend on

⁶ P Birnie, A Boyle, and C Redgwell, *International Law and the Environment* (3rd edn, Oxford University Press, 2009) 343.

⁷ See GESAMP, *The State of the Marine Environment*, paras 132–41.

⁸ GESAMP, *Pollution in the Open Oceans: A Review of Assessment and Related Studies* (United Nations, 2009) 26–7.

⁹ See M Allsopp et al, *State of the World's Oceans* (Springer, 2009) ch. 5. See further Section 6.6.

a number of factors including meteorological conditions and the atmospheric residence time of a contaminant.¹⁰ As noted by one scientific study:

Since source of contaminants are mainly in mid-latitudes in the northern hemisphere, materials tend on balance to move from west to east, although in the case of specific events (e.g. the Chernobyl accident) weather conditions at the time of release determine the paths of the emissions. In general, North America contributes to the North Atlantic Ocean, and the Asian continent influences the North Pacific and Arctic Oceans. On the other hand, movement in the trade wind zone is from east to west so that the flow from southern North America is across the north Pacific and from north Africa across the north Atlantic.¹¹

Alongside land-based sources, ships are also a source of air pollution. Indeed, shipping is becoming a more serious source of air pollution as emissions from land-based sources become subject to increasingly strict regulation at the national and international level.¹² Emissions from shipping include sulphur dioxide, nitrogen oxide, and other particulate matter. Furthermore, the International Maritime Organization (IMO) has estimated that ships engaged in international trade contribute about 2.1 per cent of global greenhouse gas emissions on a CO₂ equivalent basis.¹³

By its very nature, air pollution is easily transferred across international boundaries. Therefore it is a topic that has long been subject to international rules and regulations. Over time, the body of law in this area has shifted from ascribing responsibility for transboundary air pollution¹⁴ to trying to limit the production of air pollutants at source.¹⁵ International cooperation is also important in the case of air pollution from ships, given that they travel around the world and they are subject to numerous jurisdictions.¹⁶ The following sections will explain and evaluate the legal framework for the regulation of air pollution, with a particular focus on ships given their close link with pollution of the marine environment.

6.3 Pollution from or through the Atmosphere under UNCLOS

Pollution of the marine environment from or through the atmosphere is expressly regulated by Article 212 of UNCLOS. First and foremost, Article 212(1) requires

¹⁰ GESAMP, *Pollution in the Open Oceans: A Review of Assessment and Related Studies*, 20.

¹¹ GESAMP, *The State of the Marine Environment*, para. 133.

¹² See eg House of Commons Transport Select Committee, *Sulphur Emissions by Ships* (UK Parliament, 2012) para. 7.

¹³ IMO, *Third IMO GHG Study* (IMO, 2014) para. 1.1.

¹⁴ See eg the seminal arbitral award in *Trail Smelter Arbitration*, Decision of 16 April 1938. On the importance and implications of the case, see RB Bratspies and RA Miller (eds), *Transboundary Harm in International Law: Lessons from the Trail Smelter Arbitration* (Cambridge University Press, 2006).

¹⁵ Birnie et al (n. 6) 343.

¹⁶ See A K-J Tan, *Vessel-Source Marine Pollution* (Cambridge University Press, 2006) 156.

states to 'adopt laws and regulations to prevent, reduce and control pollution of the marine environment from or through the atmosphere, applicable to the air space under their sovereignty and to vessels flying their flag or vessels or aircraft of their registry'.¹⁷ It is apparent that Article 212(1) has a broad scope and it covers both air pollution produced by all activities within the sovereign territory of a state, as well as air pollution from ships and aircrafts of their nationality, wherever they are in the world. All parties to the Convention are expected to control these sources through legislation, as well as to take 'other measures as may be necessary to prevent, reduce and control such pollution'.¹⁸

Recognizing the need for international cooperation, Article 212(3) encourages states to 'establish global and regional rules, standards and recommended practices and procedures' to prevent, reduce and control pollution of the marine environment from or through the atmosphere, applicable to *inter alia* air space under their sovereignty and vessels flying their flag.¹⁹ Given the breadth of Article 212, it is not surprising that paragraph 3 makes reference to international organizations in the plural.²⁰ There is no single organization which has responsibility for air pollution issues at the international level. The UN Division for Ocean Affairs and the Law of the Sea has identified a range of instruments as relevant for the purposes of Article 212, including the Vienna Convention for the Protection of the Ozone Layer²¹ and its Montreal Protocol²², the United Nations Framework Convention on Climate Change²³ and its Kyoto Protocol²⁴, and relevant regional agreements.²⁵

¹⁷ UNCLOS, Art. 212(1).

¹⁸ UNCLOS, Art. 212(2). Art. 222 of the Convention further requires states to enforce any national rules and regulations adopted in accordance with Art. 212(1).

¹⁹ UNCLOS, Art. 212(3).

²⁰ See Nordquist et al (n. 2) vol. IV, para. XII.17.

²¹ Convention for the Protection of the Ozone Layer (Vienna, 22 March 1985, entered into force 22 September 1988) 1513 UNTS 293.

²² Protocol on Substance that Deplete the Ozone Layer (Montreal, 16 September 1987, entered into force 1 January 1989) 1522 UNTS 3.

²³ United Nations Framework Convention on Climate Change (New York, 9 May 1992, entered into force 21 March 1994) (UNFCCC) 1771 UNTS 107.

²⁴ Protocol to the United Nations Framework Convention on Climate Change (Kyoto, 11 December 1997, entered into force 16 February 2005) 2303 UNTS 162.

²⁵ Division for Ocean Affairs and the Law of the Sea, *Obligations of States Parties under the United Nations Convention on the Law of the Sea and Complementary Instruments* (United Nations, 2004) 52–3. The following regional seas agreements all deal with pollution from or through the atmosphere: the Convention for the Protection of the Marine Environment of the North-East Atlantic (Paris, 22 September 1992, entered into force 25 March 1998) 2354 UNTS 67, Art. 1(e); the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki, 9 April 1992, entered into force 17 January 2000) 2099 UNTS 195, Art. 2(2); the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona, 16 February 1976, entered into force 12 February 1978, amended in 1995) 1102 UNTS 27, Art. 8(b); the Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan, 23 March 1981, entered into force 5 August

Indeed, potential overlaps may arise. This is particularly the case when it comes to the regulation of air pollution from ships. Many of the general air pollution treaties discussed below potentially apply to ships, particularly when they are within the jurisdiction of a State. At the same time, the IMO itself claims that it is 'the appropriate forum for States to establish global and regional rules, standards and recommended practices and procedures applicable to vessels to prevent, reduce and control pollution of the marine environment from or through the atmosphere'.²⁶ The need for specific regulations to address the prevention of air pollution from ships was first recognized in Resolution A.719(17) adopted by the IMO Assembly in November 1991, in which the Organization agreed to negotiate a new annex to the International Convention for the Prevention of Pollution from Ships (MARPOL)²⁷ to address this issue.²⁸ MARPOL Annex VI was ultimately adopted in 1997. Although the IMO has taken into account many of the existing international instruments addressing air pollution in negotiating its own response to air pollution,²⁹ questions about the interrelationship between the IMO and other relevant bodies may arise. The following sections will therefore consider both the general air pollution treaties, as well as the relevant provisions of MARPOL Annex VI.

The scope of Article 212 covers any potential pollutant of the marine environment from or through the atmosphere. However, due to space constraints, this chapter will focus on three of the most important atmospheric pollutants, namely sulphur oxides, nitrogen oxides, and carbon dioxide.

1984) 20 *ILM* 746, Art. 9; the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena de Indias, 24 March 1983, entered into force 11 October 1986) 1506 UNTS 157, Art. 9; the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region (Nairobi, 21 June 1985, entered into force 29 May 1996, amended in 2010) 1986 OJ C253, 10, Art. 10; the Convention on the Protection of the Black Sea Against Pollution (Bucharest, 21 April 1992, entered into force 15 January 1994) 1764 UNTS 3, Art. 12; the Convention for Cooperation in the Protection and Sustainable Development of the Marine and Coastal Environment of the Northeast Pacific (Antigua, 18 February 2002) Art. 6(1)(ii); the Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (Jeddah, 14 February 1982, entered into force 20 August 1985) Art. 6; the Convention for the Protection of the Marine Environment and Coastal Areas of the South-East Pacific (Lima, 12 November 1981, entered into force 19 May 1986) 1648 UNTS 3, Art. 4(a)(ii); the Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution (Kuwait, 24 April 1978, entered into force 1 July 1979) 1140 UNTS 133.

²⁶ See IMO, *Implications of the United Nations Convention on the Law of the Sea for the International Maritime Organization*, Document LEG/MISC.7 (2012) 72.

²⁷ International Convention for the Prevention of Pollution from Ships (London, 2 November 1973, entered into force 12 October 1983) 1340 UNTS 184 (MARPOL).

²⁸ *Prevention of Air Pollution from Ships*, Resolution A.719(17), adopted 6 November 1991.

²⁹ See *Prevention of Air Pollution from Ships*, IMO Resolution A.719(17), adopted 6 November 1991.

6.4 Regulation and Control of Sulphur Oxides and Particulate Matter

Sulphur Oxides (SO_x) are caused by a number of anthropocentric activities, particularly the burning of fossil fuels. Emissions of SO_x were first regulated at the regional level in North America and Europe by a Protocol adopted in 1985 under the 1979 Convention on Long-Range Transboundary Air Pollution³⁰ which committed the parties to 'reduce their national annual sulphur emissions or their trans-boundary fluxes by at least 30%'.³¹ The precise scope of the Protocol was not specified, but it potentially included emissions from shipping.³² Nine years later, parties to the 1979 Convention adopted an additional Protocol on Further Reduction of Sulphur Emissions.³³ This instrument set individual targets for states to meet. Although some of the provisions of the Protocol could potentially apply to shipping when within the jurisdiction of a party³⁴, States chose to adopt a global response to counter sulphur emission from ships at the IMO, in order to avoid unequal adverse effects on the economic operators in affected regions.³⁵

Regulation 14 of MARPOL Annex VI addresses SO_x emissions from international shipping by setting standards for the sulphur content of fuel oils used on board ships. In the original text, a single standard was set for the sulphur content of fuel.³⁶ However, amendments agreed in 2008 introduced incremental standards as follows:³⁷

- 4.5 per cent m/m prior to 1 January 2012
- 3.5 per cent m/m on and after 1 January 2012
- 0.5 per cent m/m on and after 1 January 2020

³⁰ Convention on Long-Range Transboundary Air Pollution (Geneva, 13 November 1979, entered into force 16 March 1983) 1302 UNTS 217.

³¹ 1985 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at Least 30% (Helsinki, 8 July 1985, entered into force 2 September 1987) 1480 UNTS 215, Art. 2.

³² 'Long-range transboundary air pollution' is defined by the 1979 Convention as 'air pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one State . . . '.

³³ Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Further Reductions of Sulphur Emissions (Oslo, 14 June 1994, entered into force 5 August 1998) 2030 UNTS 122.

³⁴ 1994 Protocol to the 1979 Convention, Art. 2(4): 'the Parties shall make use of the most effective measures for the reduction of sulphur emissions, appropriate in their particular circumstances, for new and existing sources, which include, *inter alia* . . . measures to reduce the sulphur content of particular fuels and to encourage the use of fuel with a low sulphur content . . . '.

³⁵ See Tan (n. 16) 156.

³⁶ See the original text of Regulation 14(1) which set a sulphur content standard of 4.5% m/m.

³⁷ MARPOL Convention, Annex VI, Regulation 14(1).

This provision directly addresses the reduction of SOx emissions by reducing the sulphur content of marine fuel. However, parties are also permitted to allow other abatement techniques to be used in place of the standards prescribed by the Annex, provided they are 'at least as effective in terms of emissions reductions'.³⁸

The Regulation also includes the possibility of applying higher standards for specific areas which are designated as SOx Emission Control Areas (ECAs). The premise behind the ECAs is that certain geographical areas are more vulnerable to ambient concentrations of air pollution and therefore stricter standards should be applied.³⁹ Thus, in designated areas, all ships must comply with stricter fuel content requirements:⁴⁰

- 1.5 per cent m/m prior to 1 July 2010
- 1.0 per cent m/m on and after 1 July 2010
- 0.1 per cent m/m on and after 1 January 2015

The inclusion of ECAs was also, however, intended to achieve a compromise between those states that wanted high levels of reductions and those actors that were resistant to regulation.⁴¹ Thus, it is an example of how the IMO has balanced the various interests of different states in order to achieve global regulation of shipping emissions.

In the original text, the Baltic Sea was specifically designated as a SOx ECA and a power was conferred on the Marine Environmental Protection Committee (MEPC) of the IMO to designate additional ECAs. In making a designation, the MEPC shall take into account, *inter alia*, the human populations and environmental areas at risk, the nature of ship traffic in the area, the meteorological conditions in the area, as well as existing control measures taken by the proposing state to address land-based sources of pollutants.⁴² Three additional SOx ECAs have since been designated: the North Sea SOx ECA;⁴³ the North American SOx ECA,⁴⁴ and the United States Caribbean Sea SOx ECA.⁴⁵

³⁸ MARPOL Convention, Annex VI, Regulation 4(1). Flag States permitting alternative measures must communicate the particulars thereof to the IMO. For the details of such communications, see MEPC.1/Circ.279 (Denmark, 5 July 2010); MEPC.1/Circ.789 (Bahamas, 7 September 2012); MEPC.1/Circ.798 (Bahamas, 27 November 2012); MEPC.1/Circ.799 (Malta, 13 December 2012).

³⁹ MARPOL Convention, Annex VI, Appendix III, para. 1.3.

⁴⁰ MARPOL Convention, Annex VI, Regulation 14(4).

⁴¹ *Tan* (n. 16) 155–62.

⁴² MARPOL Convention, Appendix III, para. 3.1.

⁴³ *Amendments to MARPOL Annex VI and the NOx Technical Code*, Resolution MEPC.132(53), Annex. See also 1997 Air Pollution Conference, *Resolution 5 – Consideration of Measures to Address Sulphur Deposition in North West Europe*.

⁴⁴ See *North American Emission Control Area*, Resolution MEPC.190(60), adopted 26 March 2010. The amendment entered into force on 1 August 2011.

⁴⁵ See *Designation of the United States Caribbean Sea Emission Control Area and exemption of certain ships operating in the North American Emission Control Area and the United States Caribbean Sea*

There has been some resistance to the designation of ECAs, largely because of the increased costs that they will impose on ships operating in the designated areas. In 2012, the State of Alaska sought to challenge in the United States courts the validity of the amendment to MARPOL Annex VI designating the North American SOx ECA. According to the claimants, the effect of the ECA's low sulphur requirements would be to increase shipping costs by 8 per cent, thereby increasing the costs of goods shipped into the state. The claimants argued, *inter alia*, that the designation of the ECA was invalid because it did not comply with the requirements of Appendix III of Annex VI as the effects of air pollution in Alaska had not been properly quantified.⁴⁶ The claims were eventually dismissed by the District Court for the District of Alaska due to lack of jurisdiction.⁴⁷ In any case, the claimants would seem to have overstated the role of the criteria contained in Annex III and the MEPC would seem to have a broad degree of discretion in designating ECAs as it must only 'take into account' the Annex III criteria.⁴⁸

The principal means of enforcing Regulation 14 is through port State control of relevant documentation. To this end, suppliers are required under the Regulation to document the sulphur content of fuel provided by them⁴⁹ and 'details of fuel oil for combustion purposes delivered to and used on board shall be recorded by means of a bunker delivery note (BDN)'.⁵⁰ The BDN must also be accompanied by a fuel sample which must be retained onboard the ship.⁵¹ Port States are explicitly empowered to inspect the BDN.⁵² Yet, it has been pointed out that there are problems with relying on these documents, as they were not originally designed to perform a regulatory function.⁵³ In particular, the BDN is not always written in English and it often takes the form of a carbon copy which may not be legible. A controversy has also arisen over whether port States are able to test the fuel samples accompanying the BDN. Whilst some states do carry out this practice, it has been

Emission Control Area under regulations 13 and 14 and Appendix VII of MARPOL Annex VI, Resolution MEPC.202(62), adopted 15 July 2011. This amendment entered into force on 1 January 2013.

⁴⁶ On this basis, it was argued that the Secretary of State had exceeded their authority under the Act for the Prevention of Pollution from Ships, s. 1909(b); see *State of Alaska v Hillary Rodham Clinton and others*, Complaint for Declaratory and Injunctive Relief, filed 13 July 2012, paras 20, 24.

⁴⁷ See *State of Alaska et al v John F Kerry et al*, Case No: 3:12-cv-00142-SLG, Order re Pending Motions, 17 September 2013.

⁴⁸ MARPOL Convention, Appendix VI, Annex III, para. 4.2.

⁴⁹ MARPOL Convention, Regulation 14.5.

⁵⁰ MARPOL Convention, Regulation 18.5. Such notes shall contain the information set out in Appendix V of the Annex. The notes must be kept on board and be retained for 3 years.

⁵¹ MARPOL Convention, Regulation 18.8.1. See also *Guidelines for the Sampling of Fuel Oil for Determination of Compliance with Annex VI of MARPOL 73/78*, Resolution MEPC.182(59), adopted 17 July 2009, replacing Resolution MEPC.96(47).

⁵² MARPOL Convention, Appendix VI, Regulations 18.7.1 and 18.8.2. See also Appendix VI of the Annex which contains a verification procedure.

⁵³ M Bloor, S Baker, H Sampson, and K Dahlgren, *Effectiveness of International Regulation of Pollution Controls: the case of the governance of ship emissions* (Seafarers International Research Centre, 2013) 12.

pointed out by some delegates in the MEPC that 'under regulation 14 of MARPOL Annex VI, sampling of fuel oil used on board ships is not identified as a means to determine compliance and that there was potential for the ship to be unduly delayed for fuel oil sampling and analysis'.⁵⁴ There was no consensus on how to proceed with this issue and the MEPC has called for further consideration of the matter.⁵⁵ Yet, this is a matter that the shipping industry has flagged as being of major importance, expressing a particular concern about the potential for inconsistent implementation, leading to unfair competition between operators.⁵⁶ Another problem arises when fuel is purchased in countries which are not a party to MARPOL Annex VI. Although this issue was raised at the MEPC, the Committee took no action apart from confirming that it is the ship that is responsible for documenting compliance with Regulations 14 and 18 and also 'inviting' non-parties to institute measures to ensure that ships are provided with the necessary BDN and representative samples of fuel oil delivered.⁵⁷ This issue highlights the difficulty of implementing shipping regulations at the international level in a comprehensive and consistent manner.

In recognition of the fact that compliance relies upon the availability of compliant fuel, a shipowner is permitted to defend a claim of non-compliance by showing that they made best efforts to purchase fuel in compliance with the regulations but it was not available.⁵⁸ Although there is no objective definition of 'best efforts', the regulation does clarify that '[a] ship should not be required to deviate from its intended voyage or to delay unduly the voyage in order to achieve compliance'.⁵⁹ This provision puts the impetus on port States to ensure that sufficient supplies of fuel are available at all of their international ports.⁶⁰ In order to avoid bad faith claims by shipowners, they are required to inform their flag State and the port State when they cannot purchase compliant fuel oil at a particular port.⁶¹ The Annex also requires a review of fuel oil availability to be carried out by the MEPC⁶² in

⁵⁴ IMO, *Report of the 64th Meeting of the Marine Environment Protection Committee*, Document MEPC 64/23, para. 4.21. Indeed, Regulation 18.8.2 only refers to the Administration (ie the flag State) being able to require the representative sample to be analysed. There was further discussion in 2014 when the Committee agreed to develop possible quality control measures prior to fuel oil being delivered to a ship and invited Member Governments and international organizations to submit concrete proposals; see IMO, *Report of the 65th Meeting of the Marine Environment Protection Committee*, Document MEPC 66/21, para. 4.18.

⁵⁵ IMO, *Report of the 64th Meeting of the MEPC*, para. 4.112.9.

⁵⁶ See eg International Chamber of Shipping, *Annual Review 2015*, 13.

⁵⁷ See IMO, *Report of the 53rd Meeting of the Marine Environment Protection Committee*, Document MEPC 53/24, paras 4.18–4.21.

⁵⁸ MARPOL Convention, Appendix VI, Regulation 18.2.1.

⁵⁹ MARPOL Convention, Appendix VI, Regulation 18.2.

⁶⁰ MARPOL Convention, Annex VI, Regulation 18.1.

⁶¹ MARPOL Convention, Annex VI, Regulation 18.2.4.

⁶² MARPOL Convention, Annex VI, Regulation 14.8. The MEPC will consider the issue at its 66th session; see IMO, *Report of the 64th Meeting of the Marine Environment Protection Committee*, para. 4.36.

order to determine whether the stricter standards due to be applied in January 2020 should be implemented at that time or delayed until January 2025.⁶³ This emphasizes the close interrelationship between economic and technological developments and the successful reduction of emissions.

6.5 Regulation and Control of Nitrogen Oxides

Nitrogen Oxides (NOx) are formed, *inter alia*, through the combination of Nitrogen and Oxygen during the combustion process. This gas is produced both through land-based industrial activity and through ship engines. Like SOx, NOx pollution was also initially addressed at a regional level in North America and Western Europe under the auspices of the 1979 Convention on Long-Range Transboundary Air Pollution. A 1988 Protocol required states to 'take effective measures to control and/or reduce their national annual emissions of nitrogen oxides or their transboundary fluxes' and it introduced targets for the contracting parties to meet.⁶⁴ How states were to meet these targets was left to their discretion.

The 1988 Protocol applies to both stationary and mobile sources of NOx emissions and it therefore potentially applies to ships.⁶⁵ However, as noted by the Technical Annex to the Protocol, 'until other data become available this annex concentrates on road vehicles only'⁶⁶ and therefore parties are not obliged to take measures relating to shipping into order to meet their commitments under the Protocol. Moreover, it was generally recognized that NOx emissions from shipping were best addressed at the global level, as opposed to through a regional treaty. The issue was therefore addressed by the IMO in the negotiation of MARPOL Annex VI.

Regulation 13 of MARPOL Annex VI addresses the emission of NOx by marine diesel engines. Generally speaking, this is achieved through the establishment of technical standards to be applied to the design and construction of ship engines. As a result, the regulations are largely prospective, only applying to newly constructed ships, although a major exception to this principle will be noted below.

The original text of Regulation 13 established limits for the emission of NOx for marine diesel engines installed on a ship constructed on or after 1 January 2000. The standards also apply where a marine diesel engine undergoes a major

⁶³ MARPOL Convention, Annex VI, Regulation 14.10.

⁶⁴ Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes (Sofia, 31 October 1988, entered into force 14 February 1991) 1593 UNTS 287, Art. 2.

⁶⁵ See 1988 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution, Technical Annex, para. 41, identifying 'ships and other marine craft' as a mobile source for the purposes of the Protocol.

⁶⁶ 1988 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution, Technical Annex, para. 44.

conversion after that date.⁶⁷ Amendments to Annex VI agreed in 2008 further decreased limits for NOx emissions that apply to ships built on or after 1 January 2011.⁶⁸ The 2008 amendments also created an exception to the general rule of non-retroactivity in the emissions standards. This additional regulation sought to alleviate the concerns of some states that the long life of many ships could mean that improvements in air quality would not be achieved, despite the introduction of standards for new ships. The change was possible because it had been discovered since the adoption of the original Annex VI that reductions in emissions may be achieved in existing engines through relatively minor adjustments.⁶⁹ Thus, a new provision was inserted into Regulation 13 that requires ships built on or after 1 January 1990 but prior to 1 January 2000 to comply with the emissions standards for certain types of engines,⁷⁰ if an 'Approved Method' has been certified by the flag State.⁷¹ Ship owners have 12 months from the notification of the Approved Method to make changes to their engines. However, the standards that apply in

Table 6.1 NOx Emissions Standards under MARPOL Annex VI, Regulation 13

	Ships constructed before 1 January 2000 and for which there is an Approved Method certified by the flag State	Ships constructed or subject to major conversion on or after 1 January 2000 but before 1 January 2011	Ships constructed or subject to major conversion on or after 1 January 2011	Ships constructed or subject to major conversion on or after 1 January 2016 and operating within an Emission Control Area
Rpm less than 130 rpm	17.0 g/kWh	17.0 g/kWh	14.4 g/kWh	3.4 g/kWh
Rpm is between 130 and 1999 rpm	$45 * n^{(-0.2)}$ g/kWh where n=rated engine speed (crankshaft revolutions per minute)	$45 * n^{(-0.2)}$ g/kWh where n=rated engine speed (crankshaft revolutions per minute)	$44 * n^{(-0.23)}$ g/kWh where n=rated engine speed (crankshaft revolutions per minute)	$9 * n^{(-0.2)}$ g/kWh where n=rated engine speed (crankshaft revolutions per minute)
Rpm is 2000 rpm or more	9.8 g/kWh	9.8 g/kWh	7.7 g/kWh	2.0 g/kWh

⁶⁷ The Annex uses the term 'major conversion' which is defined in MARPOL Convention, Annex VI, Regulation 13.2.1.

⁶⁸ MARPOL Convention, Annex VI, Regulation 13.4.

⁶⁹ *MARPOL Annex VI—Proposal to Initiate Review Process, submitted by Finland, Germany, Italy, the Netherlands, Norway, Sweden and the United Kingdom*, Document MEPC 53/4/4 (2005) para. 7.

⁷⁰ This rule applies to marine diesel engines with a power output of more than 5,000 kW and a per cylinder displacement at or above 90 litres.

⁷¹ MARPOL Convention, Annex VI, Regulation 13.7. See further MEPC.1/Circ.738 (Denmark, 19 October 2010); MEPC.1/Circ.742 (Germany, 17 February 2011); MEPC.1/Circ.764/Add.1 (Denmark, 15 September 2011); MEPC.1/Circ.770 (Denmark, 10 October 2011); MEPC.1/Circ.738/Add.2 (Denmark, 31 January 2013).

this case are lower than the standards that apply to new ships.⁷² Table 6.1 above summarizes the NOx emissions standards for ships.

Regulation 13 also allows for the possibility for NOx ECAs.⁷³ Ships built on or after 1 January 2016 will therefore also have to comply with stricter standards when operating in a NOx ECA designated by the IMO.⁷⁴ There are currently two NOx ECAs that have been designated: the North American NOx ECA⁷⁵ and the Caribbean United States NOx ECA.⁷⁶

To assist engine manufacturers and shipowners to comply with Regulation 13, the IMO has produced a Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines.⁷⁷ The NOx Technical Code is mandatory for all marine diesel engines with a power output of more than 130 KW installed on ships subject to Regulation 13.⁷⁸ According to the Code, engines must be pre-certified as complying with its requirements. Engines must then be tested again once they have been installed onboard a vessel to ensure that any adjustments that have been made in the installation process have not affected the ability of the engine to meet the emissions standards. Ships meeting the requirements of Annex VI must carry an International Air Pollution Certificate issued by the flag State after a survey of the ship's equipment, systems and fittings.⁷⁹ Certificates last up to five years, at which time the ship must undergo a renewal survey and receive a new certificate.⁸⁰ The certificate must also be presented to port State control officers who may verify that it is valid and, if the evidence so warrants, carry out more detailed inspections.⁸¹

Recognizing that the NOx limits will only be met by the development of appropriate technology, the Regulation provides that 'beginning in 2012 and completed no later than 2013, the Organization shall review the status of the technological developments to implement the standards set forth in paragraph 5.1.1 of this regulation and shall, if proven necessary, adjust time periods set forth in that paragraph'.⁸² Any adjustments may be made using the tacit amendment procedures

⁷² See MARPOL Convention, Annex VI, Regulation 13.7.4.

⁷³ The rationale for this provision is the same as the SOx ECAs and the same designation procedure and criteria apply.

⁷⁴ Subject to a number of exceptions.

⁷⁵ See Resolution MEPC.190(60).

⁷⁶ See Resolution MEPC.202(62).

⁷⁷ The NOx Technical Code was originally contained in Resolution 2 of the 1997 Air Pollution Conference.

⁷⁸ MARPOL Convention, Annex VI, Regulation 13.8. A New NOx Code was adopted at the same time as the amended Annex VI.

⁷⁹ See MARPOL Convention, Annex VI, Regulations 5 and 6.

⁸⁰ MARPOL Convention, Annex VI, Regulation 9.

⁸¹ MARPOL Convention, Art. 5. See also Annex VI, Regulation 10; *Guidelines for Port State Control under MARPOL Annex VI*, Document MEPC.1/Circ.472 (29 July 2005).

⁸² MARPOL Convention, Annex VI, Regulation 13.10.

found in the MARPOL Convention.⁸³ In other words, once adopted, amendments will automatically become binding on parties, unless they make an express declaration to the contrary.⁸⁴ This procedure facilitates the rapid development of the Convention to meet contemporary challenges. Whilst this mechanism could be used to delay the introduction of higher standards if the technology was not in place, it could also potentially be used to strengthen them. Indeed, Resolution 3 adopted at the 1997 Air Pollution Conference explicitly calls upon MEPC to review the NOx limits at five-year intervals 'with the aim of prescribing more stringent emission limits, taking into account the adverse effects of such emissions on the environment and any technological developments in marine engines'.⁸⁵ This anticipates a progressive strengthening of the regulations, although its actualization depends upon mobilizing sufficient political will of IMO Member States.

6.6 Regulation and Control of Greenhouse Gas (GHG) Emissions

The contribution to climate change by anthropocentric emissions of greenhouse gases, such as carbon dioxide, is today well-documented. The IPPC has stated that 'most of the observed increase in global average temperature since the mid-20th century is very likely due to the observed increase in anthropocentric GHG concentrations'.⁸⁶ The effects of such a temperature increase would be profound for the whole planet, including for the oceans. As one study says, 'present and predicted effects include increases in sea-surface temperature; increases in sea level; and, decreases in sea-ice cover. Changes in salinity and ocean circulation may also occur'.⁸⁷ All kinds of human activities contribute to GHG emissions.

The international community has responded to this threat by the adoption of the UN Framework Convention on Climate Change (UNFCCC) that seeks to achieve 'stabilization of [GHG] concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'.⁸⁸ An important feature of the UNFCCC is that it is based upon the principle of common but differentiated responsibilities, meaning that 'developed country Parties should take the lead in combatting climate change and the adverse effects thereof'.⁸⁹ Thus, whilst all parties to the UNFCCC are required to develop

⁸³ MARPOL Convention, Art. 16.

⁸⁴ MARPOL Convention, Art. 16(2)(g)(ii).

⁸⁵ See 1997 Air Pollution Conference, *Resolution 3 – Review of Nitrogen Oxides from Marine Diesel Engines*.

⁸⁶ IPCC, *Fourth Synthesis Report—Summary for Policymakers*, approved at IPCC Plenary XXVII, 5 November 2007.

⁸⁷ Allsop et al (n. 9) 158–9.

⁸⁸ UNFCCC, Art. 2.

⁸⁹ UNFCCC, Art. 3.

national inventories of GHG emissions and take measures to mitigate climate change from anthropocentric sources, only the developed country parties have binding commitments to meet specific GHG targets, as set out in the Kyoto Protocol.

Unlike the general air pollution treaties discussed above, the Kyoto Protocol explicitly addresses shipping emissions. It provides that ‘the Parties included in Annex I (ie developed countries) shall pursue limitation or reduction of emissions of greenhouse gas emissions not controlled by the Montreal Protocol from . . . marine bunker fuels, working through . . . the International Maritime Organization’.⁹⁰

In furtherance of this mandate, the issue of GHG emissions from ships was first raised at the IMO in 1997.⁹¹ The first step by the Organization was to undertake a study on GHG emissions from ships.⁹² This initiative was followed by a resolution on ‘IMO Policies and Practices Related to the Reduction of Greenhouse Gas Emissions from Ships’, stressing the pre-eminent role of the IMO in addressing GHG emissions from ships in cooperation with the UNFCCC.⁹³ The resolution also urged ‘the [MEPC] to identify and develop the mechanism or mechanisms needed to achieve the limitation or reduction of GHG emissions from international shipping’.⁹⁴ In particular, the Resolution called for the establishment of a GHG emission baseline and the development of a methodology to describe the GHG efficiency of a ship in terms of a GHG emission index.⁹⁵ The introduction of new regulations dealing with energy efficiency of ships was achieved at the 62nd session of the MEPC in July 2011 when amendments were adopted, inserting a new Part IV into Annex VI.⁹⁶

The first requirement imposed by the new Part IV is the duty on all ships of 400 gross tonnes or above engaged in international voyages to ‘keep on board a ship specific Ship Energy Efficiency Management Plan (SEEMP)’.⁹⁷ The overall purpose of a SEEMP is ‘for monitoring ship and fleet efficiency performance over time and some options to be considered when seeking to optimize the performance of the ship’.⁹⁸ However, it is only the development of a SEEMP that is compulsory

⁹⁰ Kyoto Protocol, Art. 2(2).

⁹¹ 1997 Air Pollution Conference, *Resolution 8—CO₂ Emissions from Ships*.

⁹² The first study was prepared in 2000. It has since been updated in 2009 and 2014.

⁹³ *IMO Policies and Practices Related to the Reduction of Greenhouse Gas Emissions from Ships*, IMO Resolution A.23/Res.963, para. 1.

⁹⁴ *IMO, Reduction of Greenhouse Gas Emissions from Ships*, para. 1.

⁹⁵ *IMO, Reduction of Greenhouse Gas Emissions from Ships*, para. 2.

⁹⁶ For a more detailed drafting history, see J Harrison, ‘Recent Developments and Continuing Challenges in the Regulation of Greenhouse Gas Emissions from International Shipping’ (2013) *Ocean Yearbook* 359.

⁹⁷ MARPOL Convention, Annex VI, Regulation 22.1.

⁹⁸ *2012 Guidelines for the Development of a Ship Energy Efficiency Management Plan (SEEMP)*, Resolution MEPC.213(63), adopted 2 March 2012, para. 1.2.

and shipowners have a large degree of discretion in deciding what energy efficiency measures, if any, to adopt for their ship. Indeed, Guidelines adopted by the MEPC in March 2012 make clear that 'goal setting is voluntary' and 'there is no need to announce the goal or the result to the public, and that neither a company nor a ship are subject to external inspection'.⁹⁹ Thus, the only real incentive for adopting energy efficiency measures under this scheme arises from the economic gains that can be achieved through energy efficiency, rather than a prescriptive requirement in the Regulations. It is for this reason that calls have been made to introduce stricter requirements for the SEEMP that would demand energy efficiency savings from ships.¹⁰⁰

The second requirement of Part IV is the introduction of binding obligations to limit the GHG emissions of ships. However, this obligation only applies to newly constructed ships, which are defined as those 'whose building contract is placed on or after 1 January 2013; or in the absence of a building contract, the keel of which is laid or which is at a similar stage of construction on or after 1 July 2013; or the delivery of which is on or after 1 July 2015'.¹⁰¹ The obligations are also imposed on existing ships to the extent to which they undergo a major conversion that is so extensive that the ship is regarded to be a newly constructed ship by the flag State.¹⁰²

Ships falling within this scheme must meet particular targets based on the Energy Efficiency Design Index (EEDI). Each ship must calculate its individual energy efficiency targets according to a formula contained in the Regulations. While the Regulations set the required EEDI, it is left to individual shipbuilders and shipowners to decide how to meet these targets. The stringency of the energy efficiency targets set by EEDI varies depending on the size and type of the ship.¹⁰³ Originally, the EEDI applied to Bulk Carriers, Gas Carriers, Tankers, Container Ships, General Cargo Ships, Refrigerated Cargo Carriers, and Combination Carriers¹⁰⁴ and it has since been extended to LNG Carriers, Ro-Ro Vehicle Carriers, Ro-Ro

⁹⁹ 2012 Guidelines for the Development of a SEEMP, para. 4.1.7.

¹⁰⁰ See eg *Proposed elements for enhancing implementation requirements for SEEMP and SEEMP Guidelines, submitted by the World Wide Fund for Nature and the Clean Shipping Coalition*, IMO Document MEPC 64/4/33 (27 July 2012). However, see *Report of the 64th Meeting of the Marine Environment Protection Committee*, para. 4.97.

¹⁰¹ MARPOL Convention, Annex VI, Regulation 2.3.

¹⁰² MARPOL Convention, Annex VI, Regulation 20.1. Major conversion is defined in Regulation 2.3. MEPC agreed at its 63rd session that there was a need for a Unified Interpretation of this term and it asked the International Association of Classification Societies to develop a draft Unified Interpretation and submit it to the 64th session.

¹⁰³ MARPOL Convention, Annex VI, Regulation 21.2. See also *2012 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships*, Resolution MEPC.212(63), adopted 2 March 2012; *2012 Guidelines for the calculation of reference lines for use with the Energy Efficiency Design Index (EEDI)*, Resolution MEPC.215(63), adopted 2 March 2012.

¹⁰⁴ See Table 1 in MARPOL Convention, Annex VI, Regulation 21.

Cargo Ships, Ro-Ro Passenger Ships, and Cruise passenger ships having non-conventional propulsion.¹⁰⁵ On the other hand, some vessels have been exempted completely from the EEDI, such as icebreakers and platforms.¹⁰⁶

The requirements of the EEDI are also progressive so that they increase energy efficiency targets over time.¹⁰⁷ The application of the Regulation is divided into four phases¹⁰⁸ with the rates for reducing greenhouse gas emissions increasing in each phase. The assumption behind the progressive nature of the Regulations is that technology will improve over time that will allow ships to emit lower and lower emissions. Indeed, the parties to Annex VI are under a duty to promote the development of technology to this end.¹⁰⁹ However, as with the NOx standards, a safety valve built into the Regulations allows the formula to be changed if this assumption proves to be false.¹¹⁰ Equally, it is also open to the parties to increase the reduction rates if it proves that technology so permits and there is sufficient political will.

One issue that arose during the negotiations was how to address the participation of developing countries. Some countries argued that the IMO should follow the principle of common but differentiated responsibilities, as formulated in the UNFCCC, so that GHG reductions should only apply to ships built in developed countries.¹¹¹ This proposal was resisted by the majority of IMO Members, but it was agreed that some states may need additional time to phase in the requirements of the EEDI. Therefore, an exception was built into the regulations that allows states to 'waive the requirement for a ship of 400 gross tonnage and above from complying with regulation 20 and 21'¹¹² for up to four years. Although this provision was adopted on the understanding that it was primarily aimed at the Administrations of developing countries,¹¹³ there is nothing in the text of the Regulation to prevent a developed country from also relying on this exception. At the sixty-third session of the MEPC in March 2012, an issue arose as to whether states which had taken advantage of the waiver would apply the first phase of the reduction targets after the expiry of the waiver or whether they would still be bound by the targets which were applicable to all other states. The MEPC

¹⁰⁵ See Amendments to MARPOL Annex VI adopted by MEPC at its 66th session; Resolution MEPC.25(66), 4 April 2014.

¹⁰⁶ See Amendments to MARPOL Annex VI and MEPC.1/Circ.795.

¹⁰⁷ MARPOL Convention, Annex VI, Regulation 21.2.

¹⁰⁸ Phase 0 runs from 1 January 2013 until 31 December 2014; Phase 1 runs from 1 January 2015 until 31 December 2019; Phase 2 runs from 1 January 2020 until 31 December 2024; Phase 3 runs from 1 January 2025.

¹⁰⁹ MARPOL Convention, Annex VI, Regulation 23.2. There is also a duty to transfer technology which will be addressed below.

¹¹⁰ MARPOL Convention, Annex VI, Regulation 21.6.

¹¹¹ See IMO, *Report of the 61st Meeting of the Marine Environment Protection Committee*, Document MEPC 61/24, para. 5.46.

¹¹² MARPOL Convention, Annex VI, Regulation 19.4.

¹¹³ See the original proposal from Singapore, Document MEPC 61/24, para. 54.7.

preferred the latter view noting that a waiver under Regulation 19/4 should only be granted to individual ships being built during the waiver period and it did not apply as ‘a general waiver to postpone the implementation of the EEDI requirements for four years’.¹¹⁴ This interpretation would appear to be in line with both the ordinary meaning and the spirit of the provision, although it significantly limits the benefits of the waiver.

Another way in which the new Regulations seek to address the concerns of developing countries is through the introduction of obligations on financial and technical assistance.¹¹⁵ Yet, the language of these provisions is so weak that they would not appear to place any stringent obligations on developed countries to provide specific assistance. The Regulation is supplemented by a Resolution, which was adopted in March 2013, following protracted negotiations.¹¹⁶ The Resolution establishes an Ad hoc Expert Working Group on facilitation of Transfer of Technology for Ships, which is mandated to, *inter alia*, create an inventory of energy efficiency technologies for ships and possible sources of funding.¹¹⁷ It also calls for the working group to develop a model agreement enabling the transfer of financial and technological resources and the IMO Secretary-General is invited to make provisions related to energy efficiency of ships in the integrated Technical Cooperation Programme of the Organization.¹¹⁸ In addition, the Resolution commits ‘Member States with the ability to do so’ to provide support to developing countries with regard to capacity building in relation to energy efficiency for ships.¹¹⁹ Yet, it must be noted that the Resolution is a non-binding instrument and it is worded so as to preserve the discretion of developed countries, making clear that measures to be taken by states are ‘subject to their respective national laws, regulations and policies’.¹²⁰ Thus, states are not compelled to take any specific action and there remain obstacles to technology transfer, such as intellectual property rights.¹²¹ The operationalization of this provision will therefore depend upon further steps being taken by developed states.

The regulations to address energy efficiency of ships are an important milestone in the regulatory framework for combating pollution of the marine environment

¹¹⁴ IMO, *Report of the 63rd Session of the Marine Environment Protection Committee*, Document MEPC 63/23, para. 4.27.

¹¹⁵ MARPOL Convention, Annex VI, Regulation 23.

¹¹⁶ See Statement by the Chairman of the Committee, in MEPC/65/22, Annex 5.

¹¹⁷ *Promotion of Technical Cooperation and Transfer of Technology relating to the Improvement of Energy Efficiency of Ships*, Resolution MEPC.229(65), adopted 17 May 2013, para. 2.

¹¹⁸ Resolution MEPC.229(65), para. 7.

¹¹⁹ Resolution MEPC.229(65), para. 6.

¹²⁰ Resolution MEPC.229(65), para. 6.

¹²¹ See Y Shi, ‘Greenhouse Gas Emissions from International Shipping: The Response from China’s Shipping Industry to the Regulatory Initiatives of the International Maritime Organization’ (2014) 29 *IJMCL* 77, 96–7. See also N Singh Ghaleigh, ‘Barriers to Climate Technology Transfer—the Chimera of Intellectual Property Rights’ (2011) *CCLR* 220–33.

from or through the atmosphere, but they do not represent the conclusion of discussions on air pollution from ships at the IMO. Many states and some industry representatives¹²² are adamant that more needs to be done on this topic, particularly to fill the current lacuna in relation to existing ships. There are a number of options available.

On the one hand, states may negotiate further technical and operational standards for all shipping. This could be achieved through strengthening of the existing regulations through the introduction of stricter requirements for the SEEMP that would demand energy efficiency savings from ships.¹²³ Such measures may fall short of setting targets for existing ships, but they would require shipowners to demonstrate improvements in energy efficiency over time. Alternatively, the IMO could develop mandatory attained efficiency standards for all vessels.¹²⁴

On the other hand, states may prefer a market-based approach to the issue. Market-based Measures (MBMs) would apply to all ships, creating a further economic incentive for ship owners to reduce their emissions. The main two types of MBM under discussion at the IMO, both of which have a number of variants, are an international Greenhouse Gas Fund for Shipping and a Maritime Emissions Trading Scheme. Both of these options have been reviewed in general terms and it has been ascertained that they potentially provide very high environmental effectiveness and very good cost-effectiveness.¹²⁵

An International GHG Fund would work by placing a levy on bunker fuel purchases. The increase in price would create an incentive for shipowners to operate more efficiently by reducing fuel consumption. The creation of an International GHG Fund would not by itself guarantee a reduction in emissions, although the revenues from the Fund could be used to buy offset emissions credits from other sectors. Moreover, the advantage of this option is that costs of ensuring compliance for individual shipowners would be predictable, given that the bunker fuel levy would be fixed for a certain period.¹²⁶ Flag States and port States would be responsible for ensuring that individual ships complied with the requirements to pay the bunker fuel levy. In addition, an international organization may have to be created to manage the Fund.

¹²² See Clean Shipping Coalition, *The Case for further measures to tackle the climate impacts of shipping*, Document MEPC 67/5/9, 22 August 2014; see also International Chamber of Shipping, *Annual Review 2015*, 16–18.

¹²³ See eg *Proposed elements for enhancing implementation requirements for SEEMP and SEEMP Guidelines, submitted by the World Wide Fund for Nature and the Clean Shipping Coalition*, IMO Document MEPC 64/4/33 (27 July 2012). However, see *Report of the 64th Meeting of the Marine Environment Protection Committee*, para. 4.97.

¹²⁴ See Proposal of the United States to enhance energy efficiency in international shipping, Document MEPC/65/4/19, 8 March 2013.

¹²⁵ See IMO, *Second IMO GHG Study* (2009), paras 6.129–6.130.

¹²⁶ IMO, *Second IMO GHG Study* (2009), para. 6.67.4.

A Maritime Emissions Trading Scheme (ETS) would also operate by increasing the price of bunker fuel. Rather than paying a fixed levy, however, shipowners would have to surrender emissions credits to cover their emissions. More energy-efficient ships will therefore have to surrender fewer credits than less energy-efficient ships. Nevertheless, given that the price of credits may fluctuate depending upon supply and demand, the cost of complying for shipowners may be more unpredictable.¹²⁷ At the same time, by limiting the number of credits that are allocated to the shipping sector, an ETS can in theory limit the net emissions of the shipping sector.¹²⁸ It is envisaged in some of the proposals for ETS that shipowners will be able to purchase additional credits from other existing emissions trading schemes. This will allow emissions from shipping to potentially grow, but only through the achievement of reductions in other sectors. It will be up to flag States to manage the surrender of emissions credits by ships flying their flag. However, an international organization may have to be set up to manage the setting of the emissions cap and the distribution of credits. There are several ways in which credits can be distributed. Either they can be allocated to ships based upon former emissions or they can be auctioned. If the latter option is pursued, an ETS could also potentially raise funds for other purposes through the proceeds of the auction.

In relation to both schemes, there are questions about what to do with the collected revenue. Several options have been identified, including:¹²⁹

- offsetting through the purchase of approved carbon reduction credits;
- providing a rebate to developing countries;
- directly financing mitigation and adaptation activities in developing countries;
- directly financing improvement of maritime transport infrastructure in developing countries;
- supporting research and development in the field of energy efficiency of shipping;
- contributing towards the IMO's International Technical Cooperation Programme.

At the fifty-ninth Meeting of the MEPC, it was suggested that there was 'a general preference for the greater part of any funds generated by an MBM under the auspices of IMO to be used for climate change purposes in developing countries, through existing or new funding mechanisms under the UNFCCC or other international organizations'.¹³⁰ Indeed, it has been suggested that the distribution of

¹²⁷ IMO, *Second IMO GHG Study* (2009), para. 6.67.4.

¹²⁸ IMO, *Second IMO GHG Study* (2009), para. 6.67.1.

¹²⁹ IMO, *Report of the 63rd Meeting of the Marine Environment Protection Committee*, para. 5.34.7.

¹³⁰ IMO, *Report of the 59th Meeting of the Marine Environment Protection Committee*, para. 4.129; IMO, *Report of the 63rd Meeting of the Marine Environment Protection Committee*, para. 5.31.

funds in this way would satisfy the principle of common but differentiated responsibilities.¹³¹ Nevertheless, there were still divergent views on the precise use of revenues.¹³² In particular some delegations were opposed to revenues from international shipping being distributed through the Green Climate Fund established under the UNFCCC, as they were of the opinion that this source of funding should come exclusively from developed countries.¹³³ Indeed, representatives of the shipping industry have vehemently argued that 'shipping should not be a "cash cow" in the context of generating funds to counter climate change; . . . any financial contribution should be no more than shipping's share of the total GHG emissions'.¹³⁴ Given that climate finance is a rapidly evolving issue, this is clearly a subject on which the IMO must work closely with other international organizations. Moreover, it would appear that the IMO is still a long way from achieving agreement on the best way to balance the interests of developed and developing countries in the further development and strengthening of the international regime to control GHG emissions from shipping.

6.7 Application and Enforcement of the International Regulations on Air Pollution from Ships

It has been seen in the previous sections that the international community has responded to evidence of air pollution from ships with the adoption of international regulations. However, it must be noted that Annex VI is an optional protocol to the MARPOL Convention and it is therefore necessary to consider the scope of its application.

MARPOL Annex VI entered into force in 2005 and it currently has eighty-six parties representing 95.34% of gross tonnage of the world's merchant fleet.¹³⁵ This makes it the least accepted of the annexes to the MARPOL Convention.¹³⁶ There

¹³¹ See eg IMO, *Report of the third Intersessional Meeting of the working group on greenhouse gas emissions from ships*, IMO Document MEPC 62/5/1 (2011) paras 3.60. See also Chamber of Shipping, *Shipping's Carbon Emissions: Design and implementation of market-based measures Part 1: a cap-and-trade emissions trading system* (2011) 12.

¹³² IMO, *Report of the 63rd Meeting of the Marine Environment Protection Committee*, para. 5.34.1.

¹³³ IMO, *Report of the 63rd Meeting of the MEPC*, para. 5.34.3. See also statements of Brazil and Korea in Annex 16.

¹³⁴ T Skaaild, 'Emissions Reduction and Emissions Trade Systems in Shipping: A BIMCO Perspective' in H-J Koch, D Koenig, J Sanden and R Verheyen (eds), *Climate Change and Environmental Hazards related to Shipping* (Martinus Nijhoff, 2013) 162.

¹³⁵ See IMO, *Status of Multilateral Convention and Instruments in respect of which the International Maritime Organization or its Secretary-General performs depositary functions (as at 05 November 2015)*, 161.

¹³⁶ This begs the question of what is meant by 'generally accepted' international rules and standards. There is no agreed definition to this term and commentators take a variety of views. For a summary of the debate, see Report of the Committee on Coastal State Jurisdiction over Marine Pollution,

are, moreover, some objections to the Regulations on energy efficiency for ships, which mean that they do not apply to the objecting states. Nevertheless, it remains an important instrument. Indeed, the Convention is not only implemented by flag States, but also by port States and coastal States. Both of these mechanisms present the possibility that the standards found in MARPOL Annex VI may be applied to non-parties to that instrument.

As noted above, one of the more important ways in which the regulations are enforced is through port State control¹³⁷ and this is an important mechanism through which the regulations can be applied not only to the ships of parties, but also to non-parties. Indeed, parties to the MARPOL Convention are under an obligation to apply its requirements in a non-discriminatory manner.¹³⁸ Furthermore, Annex VI is enforced through a number of regional port State control agreements, including the Paris Memorandum of Understanding¹³⁹ and the Abuja Memorandum of Understanding.¹⁴⁰

Coastal States may also take some measures to enforce Annex VI against vessels in adjacent waters. Indeed, the MARPOL Convention requires parties to prohibit violations of its provisions 'within their jurisdiction'.¹⁴¹ This provision allows coastal States to enforce Annex VI of the MARPOL Convention against ships within their territorial sea where they have the authority to prescribe discharge standards, provided that they don't interfere with innocent passage.¹⁴² On the other hand, whether coastal States can enforce the regulations in Annex VI against ships in their exclusive economic zone (EEZ) depends on whether the regulations qualify as 'generally accepted international rules and standards'.¹⁴³ Whilst this term remains the subject of controversy,¹⁴⁴ it can be asked whether Annex VI qualifies as generally accepted given that only eighty-six states have accepted the regulations therein, which is only just over half of the parties to the MARPOL Convention. It follows that there remains some uncertainty about the extent of coastal State jurisdiction over air pollution in the EEZ.

available in *Report of the London Conference of the International Law Association* (ILA, 2000) 476–8. The Report itself concludes that 'the central element . . . appears to be the practice of states . . . [and] quantitative as well as functional majorities appear to be important': 479–80.

¹³⁷ MARPOL Convention, Art. 5(2).

¹³⁸ MARPOL Convention, Art. 5(4).

¹³⁹ Paris Memorandum of Understanding on Port State Control, para. 2.1.6.

¹⁴⁰ Abuja Memorandum of Understanding on Port State Control for West and Central African Region, para. 2.1.6.

¹⁴¹ MARPOL Convention, Art. 4(2).

¹⁴² UNCLOS, Art. 211(4). See also Art. 21(2).

¹⁴³ UNCLOS, Art. 211(5).

¹⁴⁴ For a summary of the debate, see Report of the Committee on Coastal State Jurisdiction over Marine Pollution, in *Report of the London Conference of the International Law Association* (International Law Association, 2000) 476–8; J Harrison, *Making the Law of the Sea* (Cambridge University Press, 2011) 171–9.

6.8 Conclusion and Challenges for the Future

The regulation of pollution of the marine environment from or through the atmosphere has achieved increasing attention over the past two decades and a number of international treaties have been negotiated in order to implement the general provisions on cooperation in UNCLOS. In particular, the IMO has taken the lead in ensuring that emissions from shipping are subject to international regulation. The adoption of MARPOL Annex VI in 1997 was described by several delegates as 'a historical response by the IMO to address air emissions from ships and their contribution to air pollution and other environmental problems',¹⁴⁵ although it was only the first step in addressing pollution of the marine environment from or through shipping emissions.

Throughout this chapter, it has been seen that the international regulatory response to air pollution in general and air pollution from ships has been evolutionary in nature. Many of the standards are designed to be incremental, so that the permitted level of emissions will reduce over time. It is recognized that meeting these standards will depend upon there being sufficient developments in pollution control technology and appropriate review mechanisms are built into the regulations in order to ensure that this condition has been satisfied. At the same time, it has been suggested that the promulgation of regulations itself creates an incentive for such technological development.¹⁴⁶

One of the questions that arise in this context is whether the international standards achieve a sufficient balance between the interests of various states. It has been seen that there is some flexibility in Annex VI that allows the regulatory environment to evolve at different speeds depending on regional differences in air pollution. To this end, a number of regional ECAs have been approved by the IMO in order to speed up the reduction in NOx and SOx emissions compared to the general standards found in MARPOL Annex VI and it has been suggested that the number of ECAs may proliferate to apply to areas where there are large centres of population close to busy shipping routes, such as the Pearl River Delta or Shanghai.¹⁴⁷

There is also pressure from individual states or regions to further increase standards without waiting for international agreement. For example, EU Directive 1999/32/EC (as amended by EU Directive 2005/33/EC) on the sulphur content

¹⁴⁵ MARPOL Annex VI—*Proposal to Initiate Review Process, submitted by Finland, Germany, Italy, the Netherlands, Norway, Sweden and the United Kingdom*, Document MEPC 53/4/4 (15 April 2005) para. 4.

¹⁴⁶ H Hyvättinen and M Hildén, 'Environmental Policies and Marine Engines—Effects on the Development and Adoption of Innovations' (2004) 28 *Marine Policy* 491. See also House of Commons Transport Select Committee, *Sulphur Emissions by Ships*, para. 28.

¹⁴⁷ See discussion in International Chamber of Shipping, *Annual Review 2015*, 12.

of marine fuels requires ships at berth in European ports and inland waterway vessels to use fuel with a maximum sulphur content of 0.1 per cent.¹⁴⁸ Thus, on berthing at an EU port for more than two hours, ships are given a reasonable period of time to carry out the necessary fuel-changeover operation.¹⁴⁹ The same Directive also requires Member States to take 'necessary measures to ensure that marine fuels are not used in their territorial seas, exclusive economic zones and pollution control zones by passenger ships operating on regular services to or from any Community port if the sulphur content of those fuels exceeds 1.5% by mass'.¹⁵⁰ The rationale for this requirement is that 'passenger ships need tighter emissions limits because they typically operate close to shore where health effects of emissions are most damaging'.¹⁵¹

Another example is the Californian legislation adopted in 2009, requiring the use of 'low sulfur marine distillate fuels . . . on ocean-going vessels'¹⁵² when they are intending to call at Californian ports or entering Californian internal or estuarine waters.¹⁵³ Under the Vessel Fuel Rules, such ships are prohibited from operating in the Regulated California Waters after 1 August 2012 with marine gas oil with over 1.0 per cent sulphur by weight or marine diesel oil with over 0.5 per cent sulphur by weight.¹⁵⁴ On 1 January 2014, these limits reduce to 0.1 per cent for both types of fuel. This timetable has the effect of accelerating the requirements that will be imposed by the North American SOx ECA from 1 January 2015 by a year.

Such unilateralism is not a problem in itself, provided that states do not exceed the scope of their legislative and enforcement powers under international law.¹⁵⁵ However, unilateralism is often resisted by certain interests groups, particularly industry and shipping representatives, because of the increased costs it imposes but also because it complicates the regulatory framework for shipping.¹⁵⁶ As noted by Tan, 'a proliferation of controlled areas can only be a burden for ship-owners as it is they who will have to bear the direct costs and inconvenience of storing different grades of fuel when entering such areas'.¹⁵⁷ Furthermore, it is possible that such

¹⁴⁸ Directive 1999/32/EC, as amended by EU Directive 2005/33/EC, Art. 4b.1. There are exceptions in Art. 4b.2.

¹⁴⁹ Directive 1999/32/EC, as amended by EU Directive 2005/33/EC, Art. 4b.1.

¹⁵⁰ Directive 1999/32/EC, as amended by Directive 2005/33/EC, Art. 4a.4. It has been proposed to lower this limit to 0.1% from 1 January 2020; see Proposal for a Directive amending Directive 1999/32/EC as regards the sulphur content of marine fuels, Document COM(2011) 439 final, 15 July 2011.

¹⁵¹ House of Commons Transport Committee, *Sulphur Emissions by Ships*, para. 31.

¹⁵² Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline, 17 CCR, section 93118.2.

¹⁵³ CCR, section 93118.2(c)(1).

¹⁵⁴ Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline, 17 CCR, section 93118.2(e)(1)(A).2.

¹⁵⁵ See generally A Boyle, 'EU Unilateralism and the Law of the Sea' (2006) 21 *IJMCL* 15.

¹⁵⁶ House of Commons Transport Select Committee, *Sulphur Emissions by Ships*, paras 29–33.

¹⁵⁷ Tan (n. 16) 160.

action will simply divert polluting ships to other locations not covered by the legislation, thereby shifting the environmental problems onto others.

There are also aspects of air pollution from ships on which strong divisions remain between different interest groups on the right regulatory response. This is the case with the ongoing negotiations on what steps are necessary to further reduce GHG emissions from shipping. Developing countries and developed countries continue to disagree about how the principle of common-but-differentiated responsibilities should be incorporated, if at all, into international regulations. Whilst failure to reach consensus may itself prompt unilateralism,¹⁵⁸ this is an issue that can only really be effectively addressed at the multilateral level and therefore international cooperation is vital.

¹⁵⁸ For example, the unilateral expansion of existing market mechanisms, such as emissions trading schemes, to international shipping by individual states or groups of states; see EU Press Release, *Commission launches consultation to address greenhouse gas emissions from ships*, 19 January 2012; available online: <http://ec.europa.eu/clima/news/articles/news_2012011901_en.htm>.