

Chapter 14

Protection of the Marine Environment

Introduction

The marine environment is vulnerable to different kinds of pollution emanating from various sources as depicted in Fig. 14.1. It is well-known that land-based sources of pollution are the most damaging to the marine environment both in terms of quantity as well as severity. There is also pollution coming from the seabed itself incidental to oil exploration and exploitation activities. Air-borne pollution resulting from land-based carbon dioxide (CO₂) emissions entering the sea in the form of acid rain is another source. Finally there is ship-source marine pollution, the harmful effects of which are relatively less whether they enter the sea directly from the ship or through the atmosphere as air pollution in the form of NO_x or SO_x. Be that as it may, this chapter is mainly concerned with ship-generated pollution and the focus is largely on oil pollution. The pollution types and their sources are best explained graphically and diagrammatically. The marine pollution continuum diagram and the marine pollution spectrum chart (Fig. 14.2) depict not only the philosophy of combating marine pollution but also the international convention regimes designed and articulated to address the pertinent issues respecting ship-generated marine pollution.

The Regime of Ship-Source Oil Pollution in Public Law

Legal Framework Under UNCLOS

The caption “Protection and Preservation of the Marine Environment” is a comprehensive and appropriate description of the regime of marine pollution as it pertains to public international law. The legal framework is found in Part XII of UNCLOS. Prior to the advent of UNCLOS there was no finite and systematic body of customary law on the subject of marine pollution. Part XII consists of Articles

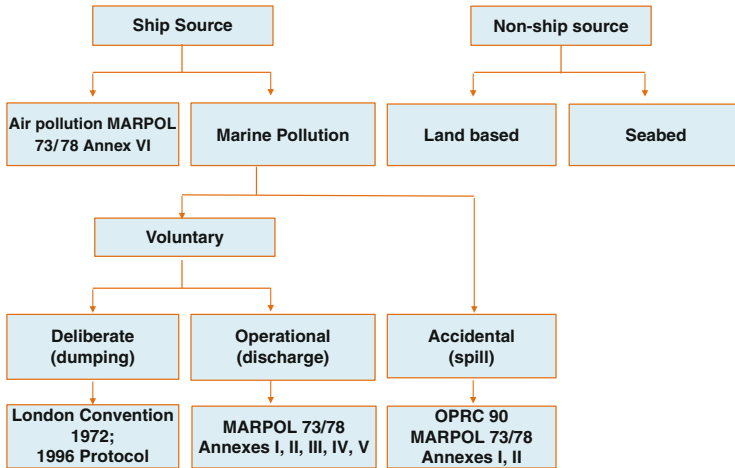


Fig. 14.1 Sources of marine pollution

192–237 arranged under 11 Sections. The discussion in this chapter is confined to ship source oil pollution and associated matters. In the first part of the text those salient provisions will be highlighted which provide the blueprint for various detailed preventive and remedial conventions. Most of these have been generated by IMO but there are also others which are independent of the IMO family of instruments but are closely correlated through UNCLOS Part XII. Even at the risk of reiteration it is perhaps useful to recall that UNCLOS being the global framework convention for all matters maritime is often referred to as the constitution of the seas.

In Section 1, Articles 192 and 193 set out the fundamental principles that states are obliged to protect and preserve the marine environment. Under Article 194, states must take measures to prevent, reduce and control marine pollution from any source, and ensure that pollution does not spread beyond the areas of national jurisdiction. The measures must be designed to minimize, *inter alia*, ship source pollution and must extend to preventing accidents, dealing with emergencies, ensuring maritime safety and regulating intentional and unintentional discharges. Article 195 prohibits the transfer of pollution from one sea area to another or the transformation of pollution from one form to another. Article 196 requires states to take preventive and remedial action against the transportation of harmful alien species.

Pursuant to Section 2 of Part XII states are required to co-operate on a global and regional basis for the purpose of developing international rules and standards. States are required to promptly notify each other when danger of pollution is imminent. Article 199 requires states to develop contingency plans for responding to pollution incidents. This article represents the blueprint for the Oil Pollution Preparedness and Response (OPRC) Convention of 1990.

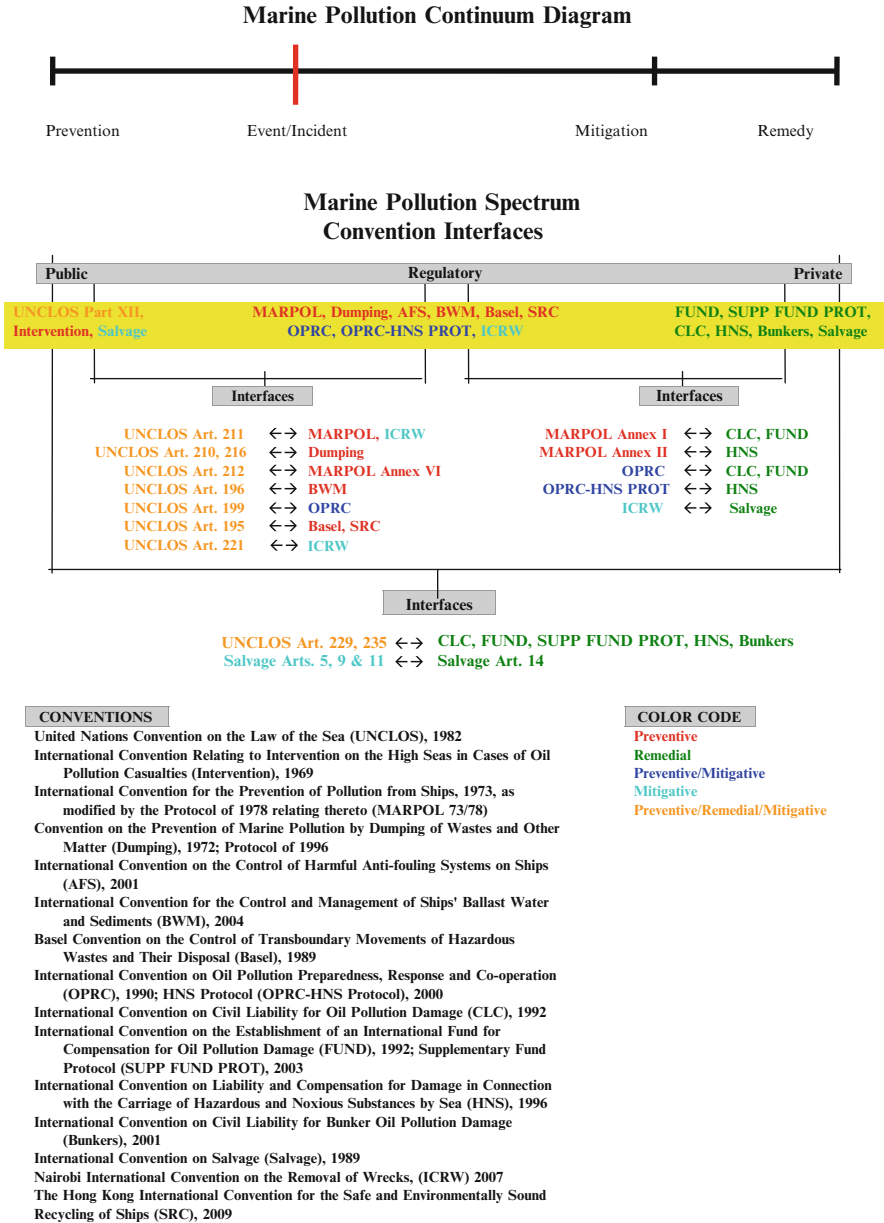


Fig. 14.2 Marine pollution continuum diagram and marine pollution spectrum chart

Section 5 contains the prescriptions for establishing international rules and domestic legislation by States for the purpose of preventing, reducing and controlling marine pollution. This Section is important in terms of the setting of

certain basic principles. Of particular significance are Articles 210, 211 and 212. They consist of provisions dealing with ship-source pollution issues that are germane to the analytical treatment of the regulatory law on the subject. Article 210 bears the caption “pollution by dumping”. It serves as the blueprint for the more particularized instrument generally known as the London Dumping Convention. This Article provides that states must make laws and take other related measures to minimize and control the dumping of wastes at sea. It prescribes a regime under which dumping activities can only be carried out subject to permission given by the competent authorities of a state.

Article 211 contains a detailed blueprint pertaining exclusively to regulation of ship-source marine pollution. In that regard it is perhaps the most important provision setting the basic principles for the control of operational discharges from ships. There are seven paragraphs in Article 211. The first paragraph provides that states must establish international rules and standards for the prevention, reduction and control of ship-generated pollution and to achieve that, design routing systems to prevent accidents if it is appropriate to do so. States are required to do so under the auspices of the competent international organization or through diplomatic conference. While it is not expressly so stated, the relevant body in this context is IMO. The measures adopted are in contemplation of preventing pollution damage to a coastal state and its related interests. Pursuant to paragraph 2, flag states are required to generate domestic legislation reflecting those rules and standards to be applicable to their ships. Undoubtedly, these provisions represent the legal foundation for the MARPOL Convention.

Paragraph 3 of Article 211 recognizes the coastal state’s right to impose regulatory requirements regarding ship-source pollution on foreign ships. The requirements must be given due publicity and must be communicated to IMO, the competent international organization. States are expected to harmonize their policies and enter into co-operative arrangements with each other. Without prejudice to the right of innocent passage provided under UNCLOS, ships navigating in the territorial seas of states participating in such co-operative arrangements must furnish such information as may be demanded of them. In paragraphs 4 and 5, the sovereignty of a coastal state in its territorial seas and its enforcement rights in the exclusive economic zone regarding marine pollution are expressly recognized.

Paragraph 6 of Article 211 is concerned entirely with the notion of the “special area”. This paragraph provides the blueprint for that regime elaborated in the MARPOL Convention although there is a subtle distinction between the respective regimes in the two instruments. Sub-paragraph (a) of paragraph 6 provides that if within the exclusive economic zone of a coastal state, special mandatory measures are needed for the prevention of ship-source pollution, then subject to a determination by the IMO, special legislative measures may be adopted in respect of these special areas. Any such special legislation, however, cannot require foreign vessels to comply with design, construction, manning or equipment standards other than those established internationally through relevant instruments of the competent international organization. Article 212 deals with pollution from and through the

atmosphere. It basically provides the blueprint for the regime now contained in Annex VI of MARPOL with regard to ship-source air pollution.

In Section 6 there are ten Articles. The principal area of focus of this Section is enforcement of laws relating to pollution emanating from various sources. Enforcement from the perspectives of the flag state, the port state and the coastal state are addressed. Article 216 speaks to pollution by dumping and requires laws and regulations on the subject to be enforced by coastal states and flag states. Article 217 contains detailed provisions dealing with flag state enforcement of pollution laws. Under paragraph 2 of this Article, flag states are required to prevent defaulting vessels from sailing until they are fit to proceed to sea in compliance with the relevant rules and standards, including those concerning design, construction, manning and equipment. Paragraph 3 requires states to ensure that a proper and effective certification regime is put into place pursuant to the relevant international rules and standards, and that vessels are periodically inspected to verify that the actual physical condition of a ship is in conformity with what is stated in a particular certificate. Under paragraph 4, flag states enjoy a prerogative but also have an obligation to investigate violations of rules and standards by their ships. Where appropriate, they may commence proceedings against violating ships regardless of the location of the violation or where the pollution has been observed. Paragraphs 5–7 provide for the carrying out of investigations and institution of proceedings. Once satisfactory and sufficient evidence is collected, flag states are required to commence proceedings expeditiously. Paragraph 8 provides that penalties must be severe enough to discourage violations regardless of where they occur. It is apparent that the object of this provision is to discourage the institution of nominal penalties by flag state laws.

Article 218 deals specifically with enforcement by port states. This Article is unique in UNCLOS for a number of reasons, not the least of which is the establishment in UNCLOS of the topical notion of what has come to be known as port state control (PSC). It is notable that in UNCLOS, the regime of PSC is addressed only in respect of marine pollution. By contrast, this regime is provided for in express terms in regulatory conventions dealing specifically with maritime safety and seafarers' matters. As such PSC forms an integral part of those conventions. Be that as it may, UNCLOS being the constitution of the oceans, it can be said that PSC provisions entrenched in Article 218 represents a codification of the legal concept of port state jurisdiction (PSJ) in international maritime law at least with respect to marine pollution. The central core of this jurisdiction is that it is exercisable only when a ship is voluntarily in a port or offshore terminal of a state. Furthermore, PSJ allows the port state to enforce international rules and standards established through the instrumentality of a competent international organization against a violating ship voluntarily visiting a port or offshore terminal of that state even if the location of the violation falls outside that state's maritime zones. Where, however, a discharge violation occurs in waters under the jurisdiction of another state, the port state is precluded from bringing proceedings against an offending ship unless the other state or the ship's flag state so requests; or unless the violation causes pollution in waters of the state instituting the proceedings.

Under Article 219 a foreign vessel can be detained if it has committed a violation which has rendered it unseaworthy; and as a result, it is a marine environmental threat. The Article contemplates relevant administrative measures to be taken and release from detention is only permissible if the vessel proceeds to the nearest repair yard.

Article 220 deals with enforcement by states in their capacity as coastal states. Whereas enforcement by flag and port states is also covered in more detail by other treaty instruments, such as MARPOL, enforcement by coastal states is only addressed in UNCLOS. This is a unique feature of this Article the substance of which is in many respects similar to the regime in the previous Article. First, the coastal state may institute proceedings for a violation committed in waters under its jurisdiction if the offending foreign vessel is voluntarily within its port or offshore terminal. Second, where there are clear grounds for believing that a vessel during its passage through the territorial seas of the coastal state has committed a violation, then the coastal state is empowered to carry out a physical inspection of the vessel. However, if there are similar clear grounds in respect of a violation in the exclusive economic zone or territorial seas of the coastal state by a vessel navigating such zone, then that state can require the vessel to provide information regarding its identity and port of registry, its last and next port of call and any other relevant information. If, in such a case, there is a substantial discharge resulting in or threatening a significant amount of pollution, the coastal state may undertake physical inspection of the vessel if the vessel refuses to give the requested information or if the information is not consistent with the evident factual situation. In a similar navigational situation, if a violation is committed which results in a discharge causing major environmental damage or threat of such damage to the coastline or related interests of the coastal state, or to its resources in the territorial sea or exclusive economic zone, the coastal state can institute proceedings and detain the ship. However, in such case the threshold of evidence provided for is different; it must be clear and objective.

Under Article 221 coastal states are entitled to take measures to protect their coastline and related interests such as fisheries resources from pollution threats resulting from a maritime casualty. They could include enforcement measures which may be taken under convention law as well as customary law. It would appear that the provision tacitly assumes the existence of the Intervention Convention. States can take these measures beyond their territorial seas. In appropriate circumstances that would include the high seas. There is a definition of the term "maritime casualty" in this Article which includes collisions and strandings. Article 222 provides for enforcement relating to air pollution. This is characterized as "pollution from and through the atmosphere" generated by ships and aircraft. The Article is directed to both coastal as well as flag states and evidently provides the blueprint for Annex VI of MARPOL.

Section 7 provides for safeguards against excessive use of enforcement powers or abusive actions of states. Safeguards are important measures from the viewpoint of the ship against which enforcement actions are contemplated. The measures are directed towards coastal and port states. Article 226 is an elaboration of the

procedures to be followed in the course of investigation of foreign vessels by port states and coastal states. A vessel must not be delayed beyond the time that is necessary for inspection and the physical inspection must, in the first instance, be limited to an examination of the documentation which the ship is required to carry under the relevant international law. If there are clear grounds for belief that the physical condition of the vessel is not consistent with what the documentation purports to state or there is inadequate information, then only can further physical inspection be carried out. It is the flag state's prerogative to take measures under its laws including institution of proceedings and imposition of penalties against its ships in the event of a pollution violation. This is confirmed by Article 228. A coastal or port state that has commenced proceedings in respect of a violation committed beyond its territorial seas by a foreign vessel must suspend such action if within 6 months the flag state of the vessel also institutes proceedings.

Article 230 is of particular importance; adherence to it is often lacking by over-enthusiastic coastal and port states. With respect to sanctions, if a foreign vessel commits a violation beyond the territorial seas, only monetary penalties are permitted. The same rule applies within territorial seas except for cases of willful and serious acts of pollution. In any proceedings, judicial or administrative, the recognized rights of the accused must be respected. Under Article 231, whenever any enforcement measures are taken by a coastal state against foreign vessels the flag state and any other affected state must be promptly notified. Article 232 provides that a state which takes unlawful or unreasonably excessive measures is liable for any loss or damage that may result, and legal recourse must be provided in its courts for actions in relation to such loss or damage.

Section 9 contains a single Article which restates the responsibility of each state to fulfill its international obligations regarding protection and preservation of the marine environment. Under this Article states are also required to ensure the provision of adequate compensation under their laws. States must co-operate in the implementation and further development of international law on liability and compensation for pollution damage and consider such mechanisms as compulsory insurance and compensation funds. This Article provides, through the vehicle of a public international law convention, the framework and principle for the institution and enhancement of an appropriate private law regime to address pollution damage.

The Intervention Convention

In the field of marine pollution, apart from UNCLOS there is one other public international law convention. It is the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution, 1969, generally referred to as the Intervention Convention in short. This Convention was one of two adopted at the diplomatic conference held in Brussels in the wake of the *Torrey Canyon* disaster. The international maritime community at the time felt the need for a public international law as well as an international private law convention to

cover the two dimensions of ship-generated oil pollution damage. The corresponding private law convention was the Civil Liability Convention, 1969 (CLC 1969). At the time the only other international convention dealing with oil pollution was the 1954 Oil Pollution Prevention Convention which was a regulatory convention. The two 1969 conventions emerging from the deliberations at Brussels marked the beginning of a new generation of marine pollution conventions. One of them dealt with public international law and the other with the private law implications of liability for an oil spill unprecedented together with a compensation regime for its victims.

The adoption of the Intervention Convention was at once a landmark event and groundbreaking in maritime history. For the first time the unbridled pre-eminence of the flag state over its ships on the high seas was put under a severe constraint. The convention conferred on the coastal state the right to intervene on the high seas in cases of imminent threat of oil pollution damage to the coast or related interests. The impetus for the creation of an international regime through this convention came from the unilateral actions taken by the British Government in reaction to the damage caused by the incident to its national interests. Ironically, the action taken by the British Government of sinking the polluting ship by bombing it was contrary to existing international law. At the time of the incident the ship was located beyond 3 nautical miles from the British coast, that is, it was on the high seas. The United Kingdom had not yet instituted the emerging international regime of a 12 nautical mile territorial sea.

In the face of widespread criticism at home and abroad, the British Government referred the matter to what was then the Intergovernmental Maritime Consultative Organization known by the acronym IMCO. The Legal Committee of IMCO (now IMO) was established in response to the *Torrey Canyon* disaster. Its task at the time was to clarify and specify through the relevant legal process, the rights and responsibilities of coastal states in such circumstances. The Legal Committee recommended that a diplomatic conference be convened to, *inter alia*, define the rights of coastal states in the event of an oil spill threatening pollution damage to their coasts and related interests.

The Intervention Convention which eventually came into force in 1975 after the required number of ratifications were deposited gives to coastal states the right to intervene when there is an actual or threatened incident of pollution giving rise to grave and imminent danger to the coastline or its related interests. Under Article 1 (1), the right of intervention may be exercised on the high seas and any measure deemed suitable in the circumstances may be taken by the coastal state to prevent, mitigate or eliminate the grave and imminent danger.

The definition of “related interests” contained in Article II (4) encompasses interests of the coastal state directly affected or threatened by a maritime casualty. The term “maritime casualty” is defined in Article II(1) to include marine collisions, strandings and other such incidents of navigation, or other occurrences resulting in actual or threatened damage to a ship or its cargo. Examples of related interests are maritime activities in coastal, port or estuarine areas including fisheries activities that are necessary for persons involved in those activities to maintain their

livelihoods. Other examples are tourist attractions in the affected areas, the health of the population in the coastal zone and the well-being of the affected areas in general including the conservation of living resources.

Under Article III of this Convention, the coastal state is required to consult with other states affected by the casualty, before taking any intervention action. In particular the flag state of the polluting vessel must be consulted. The coastal state must also consult with independent experts. They must be selected from a list of names established and maintained by the IMO pursuant to Article IV. A coastal state can only preclude such consultation in a case of extreme urgency where immediate action needs to be taken. Member states of IMO and state parties to the Intervention Convention may nominate persons to the list of experts referred to in Article IV who are entitled to payment for their services. The coastal state must notify any person or corporate entity whose interests may be affected by its actions and take into account their views if they are made known. The coastal state must use its best endeavors to avoid risk to human life and it must provide assistance to people in distress. In appropriate cases, the coastal state must facilitate the repatriation of crew members of the ship concerned.

Article V requires the intervention measures to be proportionate to the actual or threatened damage. The measures must be restricted to what is reasonably necessary to achieve the end objective and the actions undertaken must be discontinued upon those objectives being reached. Unnecessary interference with the rights and interests of others is prohibited. Under Article VI, if the intervention action results in damage to others, the coastal state is obligated to pay compensation to them.

The rights, duties, privileges or immunities enjoyed by any person and any remedy otherwise applicable are preserved under Article VII. Pursuant to Article VIII, if there are disputes between parties to the Convention regarding any matter under the Convention every effort must first be expended to settle by negotiation, failing which, the parties must attempt conciliation. If that does not succeed, then the dispute must be submitted to arbitration. The procedures for conciliation and arbitration are set out in Chapters I and II, respectively, of the Annex to the Convention.

In summary, the foregoing are the substantive provisions of the Convention of 1969. In 1973, a Protocol to the Convention was adopted to include pollution or threat of pollution from substances other than oil. A list of such substances is contained in the Annex to the Protocol. The list has been updated subsequently through a Supplement to the Annex adopted in 1996.

Regulatory International Law Framework

As shown in the spectrum diagram above, there are a number international conventions dealing with marine pollution that are regulatory in scope. The most important of these is MARPOL 73/78. The OPRC Convention is also important. Both these conventions are examined below in some detail.

Overview of MARPOL 73/78

The MARPOL Convention was adopted in 1973. It was intended to replace the earlier International Convention for the Prevention of Pollution from Oil (OILPOL) of 1954 which addressed only oil as a ship-source pollutant. MARPOL, at its very inception was far more comprehensive in scope. It dealt with five types of pollutants through its five original Annexes. In 1996, a Sixth Annex was added to cover ship-source pollution entering the sea from the air and through the atmosphere. Thus at present there are six Annexes to the Convention that regulate six different types of ship-source pollutants. They are the following:

- Annex I—Oil;
- Annex II—Noxious Liquid Substances;
- Annex III—Packaged Harmful Substances;
- Annex IV—Sewage;
- Annex V—Garbage; and
- Annex VI—Air Pollution

The MARPOL Convention is the instrument that regulates ship source pollution from operational discharges. Furthermore, it deals exclusively with preventive measures as can be gleaned from its title—International Convention for Preventing Pollution from Ships. By comparison, the OPRC Convention is regulatory as well, but it embodies preventive, mitigative as well as remedial elements. The CLC and Fund Convention, on the other hand, are exclusively remedial in scope as explained through the continuum chart and the spectrum diagram (Fig. 14.2). Although MARPOL is directed primarily to regulating operational discharges, there are several provisions that deal with design and construction of tankers and address such matters as damage control and subdivision and stability pertaining to accidental spills of oils and chemicals. These are, of course, strictly speaking, non-operational matters, but nevertheless they fall within the scope of the object and purpose of the convention, namely, to prevent ship-generated pollution.

As mentioned above, marine pollution emanates mainly from land based sources such as industrial by-products, pesticides and herbicides and other effluents resulting largely from daily urban activities. Even so, considerable pollution is generated by ships, and in terms of quantity entering the oceans, oil undoubtedly remains the most important pollutant.

It is also mentioned above that the 1954 OILPOL Convention dealt only with oil as is evident from its title. But it is significant that much of it has been drawn into Annex I of MARPOL. Of course, the regulatory regime is not static and amendments continue to be adopted as and when updating becomes necessary.

The MARPOL Convention of 1973 went through a major revision through its 1978 Protocol. The Protocol adopted was the result of the deliberations of the Tanker Safety and Pollution Prevention (TSPP) Conference of 1978 which took place in the wake of the *Amoco Cadiz* disaster. The provisions of the Protocol were merged with the original text and the Convention thenceforth came to be known as

the MARPOL 73/78 Convention. It is now simply referred to as “MARPOL”. The main body of the Convention as it stands now consists of 20 Articles. It contains the basic principles and the contractual elements of the Convention. There are two Protocols to the main body of the Convention. Protocol I contains provisions concerning procedures to be adopted for reporting incidents involving harmful substances pursuant to Article 8 of the Convention. Protocol II provides the arbitration procedures applicable to disputes between state parties which are to be settled in accordance with Article 10 of the Convention.

The following is a list of some of the important articles in the Convention proper:

Article 2 – Definitions

(2) Harmful Substances:

- (i) Human health
- (ii) Living resources and marine life
- (iii) Interference with other legitimate sea uses.

(3) Discharge: Release of effluent from ship howsoever caused—escape, disposal, spilling, leaking, pumping, emitting or emptying.

Note: does not include:

- (i) “dumping” within the meaning of the London Convention
- (ii) Release of harmful substances from offshore exploration
- (iii) Legitimate MSR for pollution abatement.

(4) Ship—includes fixed or floating platform

Article 4 – Violation: Flag State jurisdiction regardless of place of violation.

Coastal State has jurisdiction—if violation occurs within jurisdiction.

Article 12 – Casualty Investigation—Where there is a major deleterious effect on the marine environment. Obligation similar to SOLAS, Ch. 1 Part C. Reg. 21.

Article 15 – Entry into force: Compulsory Annexes—12 months following date on which 15 States comprising 50 % of world tonnage became parties.

Article 16 – Amendments.

Paragraph (2)(d)—adoption by 2/3rds majority of Parties present and voting.

Paragraph (2)(f)—acceptance

- (i) Convention Article—date on which 2/3rds of Parties comprising at least 50 % of GT of world fleet.
- (ii) Annex—either by the “2/3rds – 50%” rule as above or by tacit acceptance on date determined at time of adoption (not less than 10 months) unless objection by not less 1/3rd Parties or by Parties whose combined fleets comprise not less than 50 % of GT of world fleet.
- (iii) Appendix to Annex—only tacit procedure.
- (iv) Protocol I—same procedure as for Annexes.
- (v) Protocol II—same procedure as for Convention Article.

Paragraph (2)(g)—entry into force of amendment 6 months following acceptance in each case; not applicable to Parties who have expressly declined to accept or have declared that their express approval is required.

The substance of the Convention is essentially the regulatory law. This is contained in the Annexes which consist of Regulations. Annexes I and II are compulsory. For a state to be a party to MARPOL it must ratify or accede to those two Annexes. The remaining Annexes are optional but state parties are encouraged to subscribe to all of them for the sake of harmonious and globally consistent application of the convention. The remaining Annexes also make the convention comprehensive and complete. These are added reasons for states to consider acceding to or accepting all the Annexes. The salient features of the MARPOL Annexes are summarized below.

IMO publishes up to date Consolidated Editions of the MARPOL Convention, from time to time. These, of course, are supplemented by amendments, if any, that are adopted in the interim periods between these editions. The Consolidated Editions contain a unique feature, namely, the so-called “Unified Interpretations” which appear at the end of each of the respective texts of Annexes I, II and III and VI. These are not, in strict terms, part of the Convention. However, they contain valuable explanatory elaborations of the highly technical regulations. If used selectively and judiciously, these detailed supplementary texts can be very useful in the drafting of domestic legislation aimed at implementing the MARPOL Convention. They are of great practical utility for professional users of the convention such as surveyors, inspectors, maritime administrators and shipboard personnel. As well, the unified interpretations serve as an interpretive tool for tribunals charged with the task of applying relevant provisions of the Convention, whether in the context of passing judgment regarding a casualty or in the event of litigation of a dispute.

Common Features of the Annexes

For the purposes of setting discharge standards, the concept of special areas is a significant feature of MARPOL. As mentioned in the discussion above on UNCLOS, the notion of special areas is also addressed in that convention, but there are differences between the two respective concepts in the two conventions. Under MARPOL, discharges are totally prohibited in special areas under Annexes I, II and V. There is no mention of special areas in the other Annexes because of the particular characteristics of the pollutants and the ways in which they are regulated under those Annexes. The generic definition of “special area” is:

... a sea area where for recognized technical reasons in relation to its oceanographic and ecological condition and to the particular character of its traffic the adoption of special mandatory methods for the prevention of sea pollution is required. [**Note:** See Annex I Regulation 1 (11) and Annex V Regulation 1 (3)]

The special areas under the convention are the Mediterranean Sea area, the Baltic Sea area, the Black Sea area, the Red Sea area, the Gulfs area, the Gulf of Aden area, the Antarctic area, The North Sea area, the North-West European waters and the Wider Caribbean Region. They are identified by reference to geographical co-ordinates or other descriptive features circumscribing their respective perimeters. Not all the above-mentioned areas are included in each Annex. With respect to Annex I, the North Sea area and the Wider Caribbean Region are not special areas. The only special areas under Annex II were the Baltic Sea, and Black Sea and the Antarctic. But now all seas are special areas (see p.281). Under Annex V all except the Gulf of Aden area and the North-West European waters are special areas. Annex VI contains something akin to a special area known as “special emission control area” (SECA). At present there are two designated SECAs, namely, the Baltic Sea and the North Sea.

Since all discharges are prohibited in special areas, vessels are required to contain their respective wastes on board and discharge them to shore based reception facilities. Complementary to this requirement, state parties are required to provide adequate reception facilities at locations ashore designated by them. It is recognized that providing waste reception facilities is a costly affair, especially so for the developing countries. Over the years since MARPOL was adopted in 1973, this has been an issue for discussion within and outside of the IMO regarding how such facilities are to be financed. The financial implications of this important preventive prescription in the Convention can be considerably burdensome for some countries, but equally, without adequate reception facilities a major objective of the convention will remain unfulfilled. Compliance with the discharge standards under all Annexes may be excepted if the non-compliance is necessary for saving life at sea or for securing the safety of the ship.

Annexes I, II and IV and VI contain another important preventive feature. These are the provisions requiring vessels to be properly surveyed and accordingly certificated. These provisions have been now harmonized with corresponding requirements under the SOLAS and LOADLINE Conventions. The relevant certificates are the International Oil Pollution Prevention (IOPP) Certificate under Annex I, the International Pollution Certificate for the Carriage of Noxious Liquid Substance in Bulk, otherwise referred to as the NLS Certificate under Annex II, the International Sewage Pollution Certificate under Annex IV and the International Air Pollution Prevention (IAPP) Certificate under Annex VI. Record Books are required to be maintained under Annexes I, II and V known respectively as the Oil Record Book, the Cargo Record Book and the Garbage Record Book. Under Annex V there is also a requirement for each vessel to have a Garbage Management Plan. The Convention requires member states to treat violations of the Convention as offences and provide for appropriate sanctions.

A significant feature of MARPOL is the “tacit acceptance” procedure for amending the Convention found in Article 16. This methodology provides that following the adoption of an amendment, it is deemed to be accepted if no objections from a specified number of member states are received by IMO within a pre-established period of time allocated for the purpose. Once it is accepted, the amendment enters into force on a date fixed by the relevant IMO Committee. It

cannot enter into force if it is rejected by one-third or more of the state parties whose combined merchant fleets represent at least 50 % of global gross tonnage.

When a foreign ship is in a port or off shore terminal of a state party to the Convention, that state can exercise port state jurisdiction over that ship and exercise port state control. The general requirements are provided for in Article 5 of the Convention and the detailed control procedures in relation to operational requirement are set out in the respective Annexes. For Annex I the relevant provision is Regulation 8A, for Annex II it is Regulation 15, for Annexes III and V, the provision resides in the respective Regulation 8 of each of those Annexes, and in Annex VI it is Regulation 10. A detailed depiction of all the Annexes of the Convention, even in summary form, would be somewhat disproportionate given the generality of scope of this Chapter and the book as a whole. However, it is considered expedient and useful to provide some description of the salient features of Annex I given that oil is the most common ship-generated pollutant of all. Also, some of the important changes need to be pointed out in view of the fact that a revised new version of this Annex was adopted on 15 October 2004 and entered into force on 1 January 2007.

Originally, there were 26 Regulations in Annex I. At present the total number is 39 including new Regulations adopted over the years. It is notable that the present Annex I reflects recent changes in form but not in substance. As such, provisions have been mixed and matched with new numberings but without any substantive alterations of the regulatory requirements or standards. The Regulations are grouped under seven chapters. The first Chapter contains general provisions. Chapter 2 deals with procedures pertaining to surveys and certification. Chapter 3 prescribes the requirements for control of pollution from machinery spaces of all ships. Requirements for control of pollution from the cargo areas of oil tankers are contained in Chapter 4. Chapter 5 consists of only one Regulation prescribing requirements for the carriage on board of a shipboard oil pollution emergency plan (SOPEP). In Chapter 6 there are requirements for reception facilities, and in Chapter 7 there is a single Regulation prescribing special requirements for fixed or floating platforms.

In the aftermath of the infamous *Erika* oil spill, decisions were made by the Marine Environment Protection Committee (MEPC) at its 45th and 46th sessions, to expedite the phasing out of single hull tankers and bring the double hull requirements into effect sooner than originally contemplated. Considerable pressure was exerted on the IMO by the member states of the EU to that effect. Eventually, the final phasing-out date for Category 1 tankers was brought forward from 2007 to 2005, and the final phasing-out date for Category 2 and 3 tankers, from 2015 to 2010 (the categorization of tankers is contained in the Regulations).

The incorporation of the double hull requirement in MARPOL generated extensive debate within IMO. Its supporters pointed to the Oil Pollution Act, 1990 (OPA 90) of the United States to advance their position. It is notable in this context that other technologies are available that are equally if not more effective such as the Coulombi-Egg design. However, the predominant view appears to be that the double hull alternative is the most feasible technologically as well as financially.

A synopsis of the important Regulations of Annex I is set out below; on a selective basis some are expanded.

Regulation 1. Definitions

1. “Oil” means petroleum in any form including, *inter alia*, refined products but not petrochemicals under Annex II and includes substances listed in Appendix I.
5. “Oil tanker” means a ship constructed or adapted primarily to carry oil in bulk in cargo spaces; includes combination carrier, NLS tanker and gas carrier if carrying cargo or part cargo of oil in bulk.
10. “Nearest Land” – territorial sea baselines except for North East Australia identified by geographical coordinates.
11. “Special Area” – four factors taken into consideration, i.e. technical reasons, oceanographic condition, ecological condition and traffic density/character.
Note: As per Paragraphs 11.1–11.9, Annex I special areas are: Mediterranean Sea area, Baltic Sea area, Black Sea area, Red Sea area, Gulfs area, Gulf of Aden area, Antarctic area, North West European waters and Oman area of the Arabian Sea.
17. “Clean ballast” – no visible sheen
 – 15 p.p.m. reading if discharged through ODMACS even if there is sheen.
18. “Segregated ballast”—ballast water in tank permanently allocated for that purpose and completely separated from cargo oil and oil fuel system.

Regulation 3. Exemptions and waivers

1. Exemptions—hydrofoil, air-cushion vehicle, near-surface craft, submarine craft.
4. Waivers—oil tankers exclusively on voyages up to 72 h and within 50 nm from nearest land within a State Party in respect of Regulations 29 (Slop tanks), 31 (ODMACS) and 32 (Oil/Water interface detector).

Regulation 4. Exceptions

- Granted in respect of Regulations 15 and 34 (Control of discharge of oil from all ships and oil tankers, respectively)
- For safety of ship or life at sea, discharge resulting from damage to ship or equipment, and discharge for combating specific pollution incidents

Regulation 6. Surveys and certification

- Oil tanker 150 GT and above and other ship 400 GT and above: initial, renewal, intermediate, annual and additional surveys
- Surveys may be delegated to recognised organizations

Regulations 7–10. IOPP Certificate

- Issue, endorsement, form, duration and validity

Regulation 11. PSC on operational requirements

Regulation 12. Oil residues (sludge) from machinery spaces

- All ships of 400 GT and above

Regulation 14. Oil filtering equipment

- For machinery spaces of all ships from 400 to less than 10,000 GT

Regulation 15. Standards for operational discharges from machinery spaces of all ships

A (outside special areas) and B (in special areas) for ships 400 GT and above

- *En route*;
- Oil filtering equipment
- Oil content less than 15 p.p.m.
- Not from cargo, pump room, bilges on oil tanker
- Not mixed with oil cargo residues

C ships less than 400 GT in all areas except Antarctic

- May retain oil and oily mixtures on board to go to reception facilities; or
- Discharge if all items above are met except that substitute for oil filtering equipment allowed if approved by Administration

Regulation 17. Oil record book**Regulation 18. Segregated ballast tanks and protective location for such spaces****Regulation 19 and 20. Double hull and double bottom requirements for oil tankers delivered on or after 6 July 1996, and those delivered before that date****Regulation 22.**

- Double bottom requirements for pump room

Regulation 27. Intact stability**Regulation 28. Subdivision and damage stability****Regulation 29. Slop tanks****Regulation 31. ODMACS for oil tankers 150 GT and above**

Regulations 33 and 35. COW requirements and operations for crude oil tankers of 20000 DWT and above

- COW operations and equipment manual

Regulations 34. Standards for operational discharges from cargo area of oil tankers

A (outside special areas)

- Tanker not within a special area
- 15 nm from nearest land
- *En route*
- Instantaneous rate
- No more than 30 l per nm
- Quantity discharged no more than 1/15,000 of total quantity (pre-31 December 1979) and 1/30,000 (post-31 December 1979)

B (in special areas)

- No discharges allowed

Note: discharge restrictions not applicable to clean or segregated ballast

Regulations 38. Reception facilities.

A (outside special areas); B (within special areas)

There are three Appendices to Annex I, one containing a list of oils and the other two containing standard forms for the IOPP Certificate and the Oil Record Book. The text on Unified Interpretations to Annex I contains five Appendices.

Important changes to Annex II are summarized below. Needless to say, to fully appreciate the import and significance of these changes, one must review the whole Annex in light of its previous version.

- No special areas; in effect all seas are special areas
- Chemical tankers must comply with Annex II (environmental regulation and operation) and BCH or IBC Codes (design and other operational requirements)
- Design, construction, equipment and operations (Regulation 11)
- NLS categories are X, Y, Z and “other substances” (Regulation 6)
- Discharge restrictions and standards according to categories (Regulation 13)
- Vegetable oil carriers exempted from Regulation 11 requirements under Regulation 4.3

The OPRC Convention

As can be gleaned from the spectrum diagram above, the International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990 (OPRC), is at once preventive, mitigative and remedial in scope. It sits on the mitigative platform and

straddles the preventive regimes of the Intervention and MARPOL Conventions on the one hand, and the remedial regimes of the CLC and Fund Convention on the other.

In 1989, the IMO Assembly, recognized the seriousness of a number of then recent oil pollution incidents and requested the MEPC to draft a convention for consideration at a diplomatic conference. The subject matter was to embrace the development of an international framework for cooperation in combating major oil pollution incidents. These were the large oil spills resulting from serious casualties such as collisions and groundings. The initiative launched was to take account of the experience gained for dealing with these matters, from existing regional institutions such as the Regional Marine Pollution Emergency Response Centre (REMPEC) located in Malta in the Mediterranean region, which was previously known as the Regional Oil Combating Centre (ROCC). Incidentally, this was the first such centre in the world established under the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP) pursuant to the Barcelona Convention. Subsequently, other similar centres were established in other regions such as REMPEITEC located in Curacao for the Caribbean and Central American region under the Cartagena Convention. These centres are operated by and under the direction of IMO as an executing agency. Eventually, the diplomatic conference for the planned convention was convened at IMO in November 1990, and the OPRC Convention was adopted together with ten Conference Resolutions attached to the Final Act. The salient features of the convention include the following:

The Preamble to the convention refers to “the need to preserve the human environment in general and the marine environment in particular” and to “serious threat by . . . oil pollution incidents involving ships, offshore units, sea ports and oil handling facilities”. It also refers to the “polluter pays” principle as a general principle of international environmental law and alludes to the connection with the CLC/Fund private law regime.

Articles 1 and 2 contain, respectively, the general provisions and definitions. Article 3 requires the carriage of shipboard oil pollution emergency plans (SOPEP) on ships of state parties. Operators of offshore units are required to have similar plans which need to be coordinated with the coastal state’s national system for preparedness and response required under Article 6. The national system must be devised to include a national contingency plan. The procedures to be followed in reporting any event involving a discharge or probable discharge of oil or an observed presence of oil at sea are set out in Article 4. In Article 5 the actions to be taken by states when such a report is received are outlined. International cooperation among state parties for responding to oil pollution incidents is provided for in Article 7. Article 8 calls for cooperation among state parties for research and development activities in relation to preparedness and response. Such cooperation contemplates promotion and exchange of results of research and development of state of the art technologies, surveillance techniques, containment, recovery, dispersion and cleanup of oil pollution as well as mitigation of damage and restoration of the affected marine environment. In connection with the above items, Article 9

calls for technical cooperation among state parties for training and transfer of technology. Promotion of bilateral and multilateral cooperation in preparedness and response is contemplated in Article 10. Article 12 provides for IMO to undertake certain functions and activities; these include providing information, technical services, technical assistance and promoting education and training. Article 14 provides for procedures for amending the convention which include the tacit amendment method.

Other Contemporary Regulatory Law on Ship-Source Pollution

It was indicated at the beginning of this chapter that the focus of discussion is on ship-source pollution, and furthermore, only certain convention regimes have been selected for detailed consideration in the foregoing text. It is recognised, however, that there are a number of contemporary issues that are currently of concern in the field of regulatory ship-source pollution law which need to be mentioned in relative detail even though a comprehensive discussion of them is beyond the intended scope of this chapter. It will be recalled from the spectrum diagram depicted earlier in this chapter that there are some nine convention instruments that fall under the “regulatory” segment of the spectrum. Except for Basel, which is an UNEP convention, the remainder are all IMO instruments. Among them, the original depositary of the London Convention on Dumping of Wastes and Other Matter at Sea, 1972 (London Convention) was the Government of the United Kingdom. The Convention was serviced by a separate secretariat although it was physically located in the IMO premises. It was later subsumed into the IMO family of conventions and is presently a part of the IMO in terms of its administrative and secretariat functions.

Dumping of Wastes at Sea

Whereas MARPOL deals primarily with operational discharges, the London Convention, as explained above in the flow chart on marine pollution sources, deals with deliberate dumping of wastes at sea. In the definition of “dumping” in that convention an express distinction is made with “discharge” as defined in MARPOL. It should be noted that a ship carrying wastes from land to be dumped at sea is under a dual regime. It is subject to the rules of the London Convention in so far as dumping is concerned, but it is also subject to MARPOL in terms of its operational discharges. The original London Convention of 1972 underwent a major revision in 1996 through a protocol which reversed the underlying philosophy for the regulation of dumping of wastes at sea. Originally, dumping was subject to the specific prohibitions articulated in the convention; now all dumping is prohibited excepted those substances which are allowed to be dumped under the convention pursuant to a permit regime.

Transboundary Movement of Hazardous Wastes and Ship Recycling

The Basel Convention of 1989, which is an UNEP convention, deals primarily with transboundary movement of hazardous wastes and their environmentally sound management. It is basically designed to control and regulate the export and import of hazardous and other wastes. If wastes are loaded on board a ship from land for disposal at sea, the governing regime is the London Convention; if hazardous wastes are similarly loaded where the wastes are destined for disposal in another country, the Basel Convention is the applicable regime. Both conventions contain similar clauses under which the conventions do not apply to wastes generated on board as a result of normal shipboard operations. Such wastes are obviously governed by MARPOL. One important attribute of the Basel Convention is that in practical terms it is also the current international regime that can govern ship-breaking operations to the extent that a ship on its “end of life” voyage can be treated as a piece of hazardous waste carrying out a transboundary movement. Notably, the newly adopted Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (SRC), 2009, although not yet in force, provides a comprehensive “cradle to grave” regime for a ship’s life addressing both environmental as well as human health factors involving ship-recycling.

Anti-fouling Systems

Another important marine environmental phenomenon is the accumulation of marine organisms on a ship’s hull while it is traversing the world’s oceans through varieties of biological and oceanographic environments. Generically known as “marine growth” or colloquially as “weed”, they can cause a reduction in ship speed which in turn can have a serious commercial impact on the ship’s earnings. To combat the problem of marine growth, ships have for many decades used anti-fouling paints on ships’ hulls which contain organotin compounds acting as biocides that are harmful to the marine environment. Such anti-fouling systems pose a substantial risk of toxicity and other chronic impacts on marine organisms and are ecologically harmful and also detrimental to human health. The International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), 2001 was adopted to promote the substitution of such environmentally harmful systems by ones that are less harmful or preferably harmless.

The AFS Convention entered into force on 17 September 2008.

Invasive Alien Species

The phenomenon of alien species travelling in ballast tanks of ships has been recognised as an environmental problem since the advent of steel-hulled vessels over a century ago. While sea water used as ballast is essential for the safety, stability and efficiency of ships, ballasting also results in invasive species entering the ship in one marine environment and being discharged into the waters of another causing serious ecological, economic and health hazards. To combat this problem, scientists, mainly in certain developed countries, have been engaged in research and development on a continuing basis. The traditional method of ballast water interchange has not been entirely successful in resolving the problem. In the absence of a universal regulatory framework to address this issue several states have unilaterally introduced their own legal regimes. Initially a proposal was made at IMO to add a seventh Annex to MARPOL to introduce a regulatory regime that would apply globally, but after considerable debate it was decided that a new and separate convention was the better approach. Thus, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) was adopted in February 2004. It is not yet in force. IMO initiated the "Globallast" project to provide technical assistance to developing countries to prepare for the legal and practical implementation of the convention when it enters into force for the state concerned.

Ships' Exhaust Emissions

Exhaust emissions from ships have long been viewed as a serious threat to the atmospheric environment and also to the marine environment through their entry to the oceans via the atmosphere. The regulation of pollution emanating from ships' exhausts is regulated by Annex VI of MARPOL which was adopted through a Protocol in 1997. Originally, this Annex regulated the emissions of SO_x and NO_x which primarily cause acid rain but there were no provisions dealing with CO₂, a greenhouse gas (GHG) which is a major contributor to the phenomenon of global warming. Annex VI substantially tightened provisions on the maximum sulphur content allowed in marine fuels. It essentially covers emissions of sulphur oxides (SO_x), nitrogen oxides (NO_x) and other emissions believed to impact the ozone layer. At IMO active debate continues on whether CO₂ and GHG are pollutants and should therefore be included in Annex VI. The following discussion focuses on SO_x, NO_x, GHGs and other airborne pollutants including particulate matter (black carbon) and volatile organic compounds.

Sulphur Oxides (SO_x)

Oxides of sulphur form during the combustion process by a combination of sulphur in the fuel with oxygen, the prime constituent of SO_x being SO₂. The amount of SO_x formed in an engine depends mainly therefore on the concentration of sulphur in the fuel. A study conducted in 2007 indicated that reducing sulphur levels in marine fuels globally could save as many as 40,000 deaths per annum in coastal regions from cardiopulmonary and lung cancer mortalities. The findings were recognised by the IMO in 2008 when a substantial amendment to Annex VI was adopted providing tougher standards for maximum allowable sulphur content in marine fuels.

The regulations pertaining to SO_x emissions from international shipping are laid down in Regulation 14 of Annex VI. It sets a 4.5 % global cap on sulphur emissions by all ships and also makes provisions for specially designated Sulphur Emission Control Areas (SECAs) where the sulphur content in fuel oil must not exceed 1.5 %. The Baltic Sea and the North Sea (incorporating the full length of the English Channel) became SECAs as from May 2005 and November 2007 respectively. A North American ECA (out to 200 nm around the coasts of the USA, including Hawaii, and Canada) came into force in August 2012 and an ECA around Puerto Rico comes into force in 2015.

The 2008 revision of Annex VI set out more stringent limits on sulphur content in fuel:

- Reduction in the global cap to 3.5 % from 1 January 2012 followed by a further reduction to 0.5 % from 1 January 2020 subject to a fuel availability study
- Reduction in SECAs to 1 % from 1 July 2010 and then a further reduction to 0.1 % from 1 January 2015

In the EU, Directive 1999/32/EC established the maxima for sulphur content in marine fuels. The Directive served as the legal instrument for incorporating international sulphur provisions into the EU regional legislation. Once MARPOL Annex VI came into force, the Directive was amended by Directive 2005/33/EC. The EU law, however, went beyond the international instrument and imposed additional requirements. In particular, it introduced:

- 0.1 % maximum sulphur requirement for fuels used by ships at berth in all EU ports from January 2010
- 1.5 % maximum sulphur content for fuels used by all passenger ships in EU waters from August 2006 (in addition to the international requirement of 1.5 % maximum in SECAs prior to 2015)

In 2012 the Directive was once again amended, requiring that all passenger ships operating in EU waters will be required to operate as if in SECAs, i.e. limited to 0.1 % sulphur. To try to ameliorate fuel availability issues, this regulation will be delayed by 5 years and thus come into force in 2020. However, the future global

standard of 0.5% will come into force in all European waters in 2020, irrespective of the outcome of the fuel availability study.

Despite the ever tightening SO_x regulations, enforcement is becoming an issue. Dutch authorities released figures for 2010 showing that 46 % of ships failed to meet sulphur standards within the North Sea SECA. It appears this is mainly a reflection of poor fuel standards rather than attempts at evasion by ship operators. However, this clearly needs to be addressed if these regulations are to be rigorously enforced. There are serious concerns within the shipping industry as to how both the SECA (0.1 % in 2015) and global (0.5 % in 2020) regulations are going to be met in terms of cost, fuel availability and accessibility of sufficiently reliable abatement and alternative technologies.

The sulphur content in fuels depends on the sulphur content in the crude from which it was refined. In sweet crude oil, the sulphur content is less than 0.5 %. Heavy fuel oil (HFO) containing less than 0.5 % sulphur is derived from crude with a sulphur content of less than about 0.15 % as most of the sulphur in the crude that is refined ends up in the HFO which is distilled residue oil. However, the average global crude sulphur content is currently about 1.2 % and is expected to rise to 1.4 % by 2020.

Low-sulphur fuels can only be produced by one of three methods;

1. Re-blending very low sulphur HFOs. This is the cheapest option but supplies are limited;
2. Processing sweeter crudes. This is the most cost-effective method but again is constrained by the availability of crude with a sulphur content of less than 0.2 % and by competition with land users (road and power stations);
3. Catalytic hydro-treatment of HFO. This is both expensive and energy intensive.

A number of studies have concluded that the cost of low-sulphur Marine Gas Oil (MGO) is likely to be 80–100 % more than HFO. Though some will be able to pass these costs on, ultimately of course to consumers, some sectors will be very vulnerable, especially short-sea shipping which may see a strong modal shift from sea to land. The consequences of this would be most unwelcome in a broader environmental sense as it would greatly increase the numbers of vehicles on roads, with associated congestion and higher carbon emissions.

Availability of fuel is another key concern; whereas there probably will be enough fuel to meet the 2015 0.1 % SECA requirements, it is almost certain that even by 2020 refining capacity will be nowhere near sufficient to provide the global fleet with 0.5 % low-sulphur fuel. MARPOL Annex VI calls for a fuel availability study in 2018 and if, as expected, it demonstrates a shortfall, the 0.5 % global regulation will be delayed by 5 years until 2025. However, this uncertainty only further exacerbates the reluctance by oil refineries to make the necessary investment to increase capacity for the production of marine distillates. Their reluctance is understandable given the scale of investment required—up to \$95 billion according to some analysts.

Availability of reliable abatement technologies and alternative fuel technologies is the third area of concern. A variety of different types of “scrubbers” have been

developed to remove SO_x from emissions (they generally also remove NO_x and greatly reduce CO_2 as well) but confidence is low within the shipping industry that any of them are yet reliable enough to meet the regulations 99 % of the time. If a ship is reliant upon a scrubber to meet the regulations, then any malfunction would force the ship into harbour with the associated loss of income and potential contractual penalties. The reliability, therefore, of these units has to be extremely high. This technology is also expensive and therefore ship owners are unlikely to invest until they absolutely have to. However, after the 2015 introduction of the 0.1 % SECA regulation, the price differential of low-sulphur fuel (probably at least \$300 or \$400 per tonne) will be the spur for owners to make the investment. This, of course, would also suit refiners who will then continue to have a market for off-loading HFO. Alternative fuels (LNG, electric power etc.) suit some sectors (short-sea and local ferries mainly) better than others and some companies are investing heavily in this area, but the global fleet is relatively young and it will take time before this usage becomes significant. There are also regulatory, safety and environmental issues that need to be resolved with LNG in particular.

Nitrogen Oxides (NO_x)

Oxides of nitrogen are formed during the combustion process due to the combination of atmospheric nitrogen and oxygen at the very high temperatures within the combustion chamber. Diesel combustion produces relatively high levels of NO_x and fuel properties only have a minor influence on the amount produced. Atmospheric NO_x leads to the formation of acid rain, the destruction of ozone at high levels as well as the formation of ozone at lower levels, both of which add to global warming, severe respiratory health problems and the eutrophication of seas. Eutrophication is a condition in an aquatic ecosystem where high nutrient concentrations stimulate excessive algal growth leading to oxygen depletion and hence the death of fish. NO_x from shipping represents about 15 % of global NO_x emissions and 40 % of emissions from transport of freight.

The regulations pertaining to NO_x emissions from international shipping are laid down in Regulation 13 of Annex VI. Additionally, there is a NO_x Technical Code (2008) that provides mandatory procedures for the testing, survey and certification of marine diesel engines that enable engine manufacturers, ship-owners and administrations to meet the requirements of Regulation 13.

The IMO NO_x emission standards are commonly referred to as Tier I, Tier II and Tier III and apply retrospectively to new engines greater than 130 kW installed on vessels constructed on or after 1 January 2000, or which undergo a major conversion after that date. The regulation also applies to fixed and floating rigs and drilling platforms. They do not apply to engines intended solely for emergency use. The NO_x emission limits imposed by each Tier are relative to the operating speed (rpm) of the engine concerned, noting that slow-running large engines that tend to be more efficient, also produce more NO_x . The limits are depicted in Fig. 14.3.

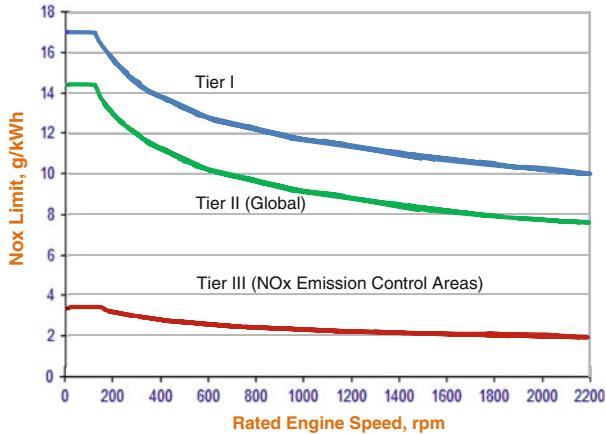


Fig. 14.3 MARPOL Annex VI NO_x emission limits

Tier I applies to the operation of an engine installed on a ship constructed on or after 1 January 2000 but prior to 1 January 2011. This was a weak initial starting point for these regulations and achieves little reduction in overall NO_x emissions, as most modern engines would comply in any event.

Tier II applies to the operation of an engine installed on a ship constructed on or after 1 January 2011. Tier II represents a 16–22 % reduction in NO_x emissions relative to Tier I.

Tier III applies to the operation of an engine installed on a ship constructed on or after 1 January 2016 but only when the vessel is operating within a NO_x Emission Control Area (NECA). Tier III represents an 80 % reduction in NO_x emissions relative to Tier I.

It is apparent that the only NECAs that may be in force in 2016 will be the North American ECA (out to 200 nm around the coasts of the USA, including Hawaii, and Canada, coming into force in August 2012) and an ECA around Puerto Rico which will come into force in 2015. There are also strong moves from HELCOM (Helsinki Commission) countries to get the Baltic Sea which is already a SECA, designated as a NECA as well.

Carbon Dioxide (CO₂) and Greenhouse Gases (GHG)

Through its deliberations within the Marine Environment Protection Committee (MEPC), the IMO has developed standards for ships' operational efficiency and design with the object of further reducing emissions of GHG from international shipping, including CO₂.

In May 2000, the organisation banned the use of perfluorocarbons (PFCs) onboard ships. The 1997 MARPOL Conference adopted Resolution 8 on CO₂ from ships, inviting the IMO:

1. To co-operate with UNFCCC in the exchange of information on the GHG issue;
2. To undertake a study of GHG emissions from ships; and
3. Through the MEPC, to consider feasible GHG emissions reduction strategies.

Following this resolution, the IMO produced a comprehensive study on GHG emissions from ships in 2000 and, after further debate and studies, it was agreed at MEPC 55 in 2006 that the threat from global warming was too serious to be ignored and that the shipping industry must take action. Thus Resolution A.963(23) called for measures to limit or reduce the emissions from international shipping.

In 2009 the IMO GHG study was updated by a second study and this is now widely accepted as the industry benchmark. The study concluded that in 2007 international shipping emitted 870 million tonnes of CO₂, or about 2.7 % of global CO₂ emissions; including domestic shipping and fishing, these figures rise to 1,046 million tonnes, equating to 3.3 % of the global total. Furthermore, mid-range estimates suggest that these emissions will grow by between 150 % and 250 % by 2050 as a result of the predicted growth in shipping. Though 3.3 % sounds small, particularly as shipping carries over 90 % of world trade and is by far the most energy-efficient means of transportation, when compared to emissions from countries, shipping ranks fifth in the world, producing more CO₂ than either Germany or Japan.

The Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) has not mentioned shipping in its deliberations so far which may prompt regional action unless the political impasse at IMO is somehow broken.

The 2009 IMO GHG study suggests that, by the application of known technology and practices, shipping could be 25–75 % more energy-efficient, depending upon the ship type and degree of compromise. The challenge therefore is to find the most appropriate policy levers to accelerate new technology and innovation to deliver improvements in energy efficiency. The overall magnitude of CO₂ emissions from a growing shipping industry means that further industry initiatives and international policy action are both inevitable and desirable. The study identified five types of measures that might be implemented to reduce GHG emissions, and most if not all schemes that have subsequently been put forward by states and industry associations are essentially variants and/or amalgams of these five.

1. **Energy Efficiency Design Index (EEDI).** This has been formulated by the MEPC as a measure of the CO₂ emission performance of ships. The ship EEDI is calculated on the characteristics of the vessel at build and incorporates parameters including ship capacity, engine power and fuel consumption.
2. **Ship Energy Efficiency Management Plan (SEEMP).** The purpose of a SEEMP is to establish a mechanism for a company and/or ship to improve the energy efficiency of a ship's operation. This covers a range of operational methods to reduce ship GHG emissions, including slow steaming, virtual

arrivals, weather routing, hull maintenance and optimised ship handling. The plan works through a cycle of four steps; planning, implementation, monitoring and self evaluation.

3. **Energy Efficiency Operational Indicator (EEOI).** Use of the EEOI provides an example of a transparent and recognised approach for the assessment of the GHG efficiency with respect to CO₂ emissions. Simply, it is an expression of efficiency in the form of CO₂ emitted per unit of transport work.
4. **Emissions Trading Scheme (ETS).** An ETS is a cap-and-trade mechanism which establishes cap on net CO₂ emissions and allows market forces of supply and demand to drive the allocation of emission rights so as to achieve reductions in the most cost-effective manner. The aim of any ETS for shipping is to reduce the industry's contribution to atmospheric CO₂ levels by accelerating the cost-effective delivery of improvements in the energy efficiency of individual ship operators.
5. **International Contribution Fund through a Levy.** The fund would collect revenues as a fixed surcharge per tonne of bunker fuels. The primary goal of such a system would be to reinforce incentives for companies to develop and adopt fuel-saving technologies which lead to a reduction of GHG emissions from ships.

Progress within the IMO has been painfully slow. The political divide in the MEPC between developed and developing countries has, at times, been almost unbridgeable and prevented acceptance in 2010 of mandatory implementation of the energy efficiency measures, thus reflecting divisions in the wider UN debates. This has held back progress on environmental and climate change regulation in shipping. At the heart of the dispute is the IMO's fair treatment principle which is at odds with the UNFCCC principle of "common but differentiated responsibilities" (CBDR). Specifically, developing countries have argued that measures could only be mandated in developed countries and left voluntary in developing countries. Such an approach would, of course, lead to a large market distortion.

Frustration is felt by many outside shipping at this lack of progress within the industry to address one of the key issues of our generation. The EU has threatened to go its own way and other countries or regional groupings may do the same. This would be the worst possible outcome for international shipping, skewing world trade and probably leading to large-scale re-flagging and carbon leakage.

After considerable debate, certain control measures relating to CO₂ emissions were agreed at the 62nd session of MEPC held in July 2011. Eventually, these will appear as amendments to Annex VI referred to as the GHG amendments. Among other things, the amendments will make it mandatory for new ships to adhere to the Energy Efficiency Design Index (EEDI) and the Energy Efficiency Operation Index (EEOI) and have a Ship Energy Efficiency Management Plan (SEEMP) which also applies to existing ships. The objective is to adopt best practices for fuel efficiency in relation to ship operations. At MEPC 62 criteria for EEDI and EEOI were adopted which are intended to be mandatory. However, the EEDI formula has proven to be problematic in terms of its application to larger vessels such as VLCCs

and Ro–Ro ships because the speed factor has not been taken into account in the current formula. At present, therefore, it will apply only on a voluntary basis to “suitable” ships pending revision of the formula.

The EEDI is non-prescriptive; it is a performance-based mechanism which allows industry to choose an appropriate technology consistent with a specific ship design so as to use the most cost-efficient solution to ensure compliance with the regulations. The SEEMP is a parallel mechanism which enables shipowners and operators to enhance the energy efficiency of a ship. Furthermore, consideration is being given to introduce market-based measures (MBM) to reduce GHG emissions from ships. The proposals being reviewed are recognised to have implications for developing countries in terms of adaptation and capacity building, which, among other issues are on the table for discussion. An expert Group has been established for evaluating proposals submitted by various countries. It is recognised that further in-depth examination of the impact of MBM on developing countries will be necessary. The MBM proposals being reviewed range from the imposition of a levy on CO₂ emissions from ships operating internationally through emission trading systems to schemes based on actual efficiency in terms of efficiency and operation, namely, by application of the EEDI, EEOI and SEEMP mechanisms. Attempts to regulate CO₂ emissions from ships have progressed, no doubt, but the exercise is still incomplete.

It was agreed that the amendments would include a new Chapter IV to Annex VI of MARPOL on energy efficiency for ships to make mandatory the EEDI for new ships and the SEEMP for all ships. The regulations apply to all ships of 400 gross tonnes and above and entered into force on 1 January 2013. However, an Administration may waive this requirement for a period—the waiver may only apply to ships for which the building contract is placed no later than 4 years after the entry into force date of Chapter IV; the keel of which is laid no later than 4 years and 6 months after entry into force; delivery is no later than 6 years and 6 months after the entry into force; or, in the cases of a major conversion, than 4 years after the entry into force date.

The new chapter also includes a regulation on promoting technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships. Administrations, through the IMO, will be obliged to respond to states requesting technical assistance. This, of course, is subject to national laws. There remains much work to be done in terms of developing guidelines for methods of calculating EEDI for new ships, the development of SEEMP, survey and certification of SEEMP and determining minimum propulsion power and speed to ensure safe manoeuvring in adverse weather. There is also the need to include those ship types not already within the EEDI guidelines. There is also no doubt that the proposed chapter is weak, particularly as—given the current commercial pressures (fuel prices etc.)—it is likely that many of the proposed efficiency measures will be incorporated into newbuilds as a matter of course. But that should not diminish the political importance of this first major step towards a global solution for emissions from shipping.

The European Commission has made it clear for some time that it wishes shipping to be included in its carbon targets for the EU. While its public position is that it would prefer a global solution through the IMO, there can be little doubt that it will impose a regional solution if it feels the IMO is not delivering enough sufficiently quickly. The EU Transport White Paper published in 2011 states that:

In maritime, the need for a global level-playing field is equally pronounced. The EU should strive – in cooperation with IMO and other international organisations – for the universal application and enforcement of high standards of safety, security, environmental protection and working conditions, and for eliminating piracy. The environmental record of shipping can and must be improved by both technology and better fuels and operations: overall, the EU CO₂ emissions from maritime transport should be cut by 40% (if feasible, 50%) by 2050 compared to 2005 levels.

Given that the EEDI will, at best, achieve a saving of about 30 %, it remains a risk that the EU will try to incorporate shipping into a more rigorous European regime, possibly an ETS in line with what is in place already for other European industries. As a first step, the EU intends to introduce a mandatory system of “monitoring, reporting and verifying” (MRV) carbon emissions for all ships operating in European waters.

Though the IMO has achieved at least limited success in getting the EEDI adopted in 2011, this can only be a first step. Efficiency and operational measures alone will only reduce carbon emissions by about 30 % at most. To achieve more will almost certainly require some form of economic instrument—Market Based Measure (MBM), as outlined under policy measures earlier in this Section—in order to raise funds both to further incentivise the industry and for offsetting. Furthermore, if and when the UN High Level Advisory Group on Climate Change Financing introduces a Green Fund and if shipping has to contribute as expected, then this will also require an MBM to raise the required amount. Given the political nature of the GHG debate during recent years within the MEPC, the endeavour to gain consensus to adopt an MBM will ensure that future MEPCs will remain difficult for years to come.

Particulate Matter

Particulate matter mainly refers to what is generally known as black carbon, or soot, which is fine carbon particles emitted from engines. There is increasing environmental concern that black carbon could be having a disproportionately high impact on global warming. The black carbon particles absorb the radiation from the sun and thus while airborne can warm the atmosphere and, if they settle on snow and ice, may increase the speed of melting. Black carbon only remains in the atmosphere for a matter of days or weeks before falling to earth and thus, if reduced, will have a fast impact on global warming. The majority of industries are now being regulated but, while it has been a subject of debate in the IMO since MEPC 58, there is little progress for shipping.

The majority of black carbon is originating from developing countries and this is leading to another impasse within the IMO between developed and developing countries. There was agreement during MEPC 62 (2011) for a sub-committee to develop a definition for black carbon from shipping, consider methods of measuring black carbon and investigate appropriate control methods to reduce black carbon from shipping in the Arctic. This will therefore effectively delay any progress by 2–3 years, achieve little and only address the impact of Arctic shipping whilst it is recognised that the black carbon deposited on Arctic ice can originate from as far away as south of the Equator.

Volatile Organic Compounds (VOCs)

VOCs are organic chemicals that have a high vapour pressure at ordinary, room-temperature conditions. They can be dangerous to both the environment and to human health. Measures to limit VOC emissions from chemical and oil tankers are set out in Regulation 15 of MARPOL Annex VI. Tankers carrying crude are obliged to carry a management plan for VOCs which must be approved by each Administration. However, tankers are only required to use a vapour collection system to return VOCs to shore when undertaking cargo operations in ports that have notified the IMO at least 3 years beforehand. To date no ports have notified the IMO. However, the US Coast Guard Code of Federal Regulations requires that a vapour recovery system be installed, though only a few US ports actually use it. At least one port in Norway also requires its use.

A vapour recovery system is installed in most tankers at build and this has been the case for at least the last 10 years. Few tankers now do not have a vapour recovery system except perhaps those that were constructed with a view that they would never trade in the US.