



G U I D A N C E N O T E S O N

The Prevention of Air Pollution from Ships

M A R C H 1 9 9 9

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GUIDANCE NOTES ON

PREVENTION OF AIR POLLUTION FROM SHIPS

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These Guidance Notes are intended to address sources of air pollution from ships and other marine structures, and options for prevention and/or reduction of such emissions. ABS assumes no responsibility for the use of or failure to use these Guidance Notes. The Guidance Notes provide information for consideration in the design and operation of ships both before and after entry into force of Annex VI of MARPOL 73/78 on Regulations for the Prevention of Air Pollution from Ships. Nothing in these Guidance Notes shall be deemed to relieve any naval architect, designer, builder, owner or other entity or person of the need to exercise professional judgement, nor of any warranty, expressed or implied. Nothing in these Guidance Notes replaces or alters any IMO Guidelines or the statutes and regulations of the flag Administrations.

FOREWORD

In September 1997 a Diplomatic Conference was held at the International Maritime Organization (IMO) in London which resulted in the adoption of a sixth Annex to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78). Annex VI is concerned with the prevention of air pollution from ships but, unlike the other Annexes to MARPOL, may not always be bound by the traditional requirements for entry into force, namely "12 months after the date on which not less than 15 States, the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant shipping, have become parties to the 1997 Protocol".

The new Annex has been under development at the IMO for a period in excess of 8 years but the subject of ship generated air pollution has been a topic of discussion for much longer. Environmentalists have long argued that shipping should be held accountable for its share of global pollution but it is only recently, as a direct result of the imposition of increasingly more stringent land-based air pollution reduction strategies in many parts of the world, that shipping's overall contribution to global air pollution has become more significant.

Annex VI differs from the other Annexes to MARPOL in so much as the effects of air pollution are not necessarily evident at their point of discharge, as is the contamination of the sea by oil, chemicals, garbage or raw sewage. Indeed, the effects of air pollution may be felt many hundreds of miles from its source and even land-locked countries are not immune to it, as they are to other forms of marine pollution. Because of this transboundary effect of air pollution, and the compelling need for many countries to tackle the growing problems of its effects on human health and terrestrial/aquatic ecosystems, the IMO has agreed to recommend the early implementation of controls to reduce both emissions of nitrogen oxides (NO_x) from new marine diesel engines, and harmful discharges from shipboard incinerators. It has also been agreed that, in order to avoid unacceptably long delays in the entry into force of Annex VI (as is the case with Annex IV of MARPOL on the Prevention of Pollution by Sewage which has still not entered into force some 25 years after its adoption), the Marine Environment Protection Committee of the IMO will review the standard entry into force requirements and the contents of the Annex if it has not entered into force by 31 December 2002.

The aim of these Guidance Notes is to identify those regulations in the new Annex which require to be addressed immediately as against those which should be considered in the medium to long term. Types of pollution which have been omitted from the Annex, but which are being actively discussed at the IMO are also identified as are those pollutants which are already controlled but where more stringent controls are likely to be introduced in the medium to long term.

This guide will be of interest to owners and operators of ships, offshore platforms, drilling units and other marine structures as well as surveyors, builders, designers and manufacturers of marine equipment. It should be read in conjunction with the IMO publication "Annex VI of MARPOL 73/78, Regulations for the Prevention of Air Pollution from Ships and NO_x Technical Code" available from the IMO Publications Department, Sales No. IMO-664E.

Finally, ABS would like to express its gratitude to the Institute of Marine Engineers for granting permission to include extracts of a previous paper by Colin S. Brookman, the Author, entitled "Exhaust Gas Monitoring" which was presented at the Tenth International Maritime and Shipping Conference (IMAS 96) on "SHIPPING AND THE ENVIRONMENT – Is Compromise Inevitable". Copies of the Conference Proceedings are available from the Institute of Marine Engineers reference ISBN 0-907206-77-8.



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ABBREVIATIONS AND SYMBOLS

(As used in the Guidance Notes)

ABS	American Bureau of Shipping
Annex I	(of MARPOL 73/78) on the Prevention of Pollution by Oil
Annex II	(of MARPOL 73/78) on the Control of Pollution by Noxious Liquid Substances in Bulk
Annex III	(of MARPOL 73/78) on the Prevention of Pollution by Harmful Substances carried by Sea in Packaged Form
Annex IV	(of MARPOL 73/78) on the Prevention of Pollution by Sewage
Annex V	(of MARPOL 73/78) on the Prevention of Pollution by Garbage from Ships
Annex VI	(of MARPOL 73/78) on the Prevention of Air Pollution from Ships
BDC	Bottom dead center
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations (US)
Circ.	Circular
CO	Carbon monoxide
COC	Certificate of Compliance
CO₂	Carbon dioxide
DE	Design & Equipment Sub-Committee (of the IMO)
EGR	Exhaust gas recirculation
EIAPPC	Engine International Air Pollution Prevention Certificate
EMEP	Co-operative Programme for Monitoring & Evaluation of Long Range Transmission of Air Pollutants in Europe
FCCC	Framework Convention on Climatic Change
FPSO	Floating production, storage & offloading (facility)
FSU	Floating storage unit
g/kWh	Grams per kilowatt hour
GWP	Global warming potential
HAM	Humid air motor
HC	Hydrocarbon
HCFC	Hydrochlorofluorocarbon
HCl	Hydrogen chloride
HF	Hydrogen fluoride

Hg	Mercury
IAPPC	International Air Pollution Prevention Certificate
IMO	International Maritime Organization
ISO	International Standards Organization
kW	Kilowatt
LNG	Liquefied natural gas
LRTAP	Convention on Long Range Transboundary Air Pollution
m	Meter
m³	Cubic meter
m/m	Mass per unit mass
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)
MEPC	Marine Environment Protection Committee (of the IMO)
mg	Milligram
MJ	Megajoule
MSC	Maritime Safety Committee (of the IMO)
n	Engine speed in rpm
NH₃	Ammonia
nm	Nanometer
NO	Nitric oxide
NO₂	Nitrogen dioxide
NO_x	Nitrogen oxides
O₂	Oxygen
O₃	Ozone
ODP	Ozone depleting potential
PCB	Polychlorinated biphenyl
PFC	Perfluorocarbon
PM	Particulate matter
ppm	Parts per million
PSC	Port State control
PVC	Polyvinyl chloride
R11, R115 etc	Standard refrigerant identification numbers
rpm	Revolutions per minute
SCR	Selective catalytic reduction



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SECTION 1 Introduction

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GUIDANCE NOTES ON PREVENTION OF AIR POLLUTION FROM SHIPS

SECTION 1 Introduction

1 Background

1.1

Whilst there are many sources of air pollution in the modern world, the continuing use of fossil fuels remains the largest single contributor to atmospheric pollution. Ever since sail gave way to mechanical power, as the predominant method of propulsion, shipping has contributed to this pollution; in the past this has largely been ignored because, compared to land-based sources, shipping's contribution was considered negligible. It is only in the last ten years or so, as a direct result of increasingly stringent abatement technology being applied ashore, that ships' emissions, particularly exhaust gases, are no longer considered insignificant.

1.3

Recent studies have indicated that ships exhaust emissions may now be responsible for up to 14% of the worldwide nitrogen oxides (NO_x) emissions and approximately 8% of sulfur oxides (SO_x) emissions although these figures have been disputed by the international shipping community based on the annual consumption of bunker oil fuel which, at some 140 million tonnes, only accounts for approximately 4% of the world's total oil fuel consumption. However, earlier publicity given to somewhat lower estimates of NO_x & SO_x emissions, coupled with evidence of damage to human health and terrestrial/aquatic ecosystems resulting from other pollutants such as Halons, Chlorofluorocarbons (CFCs), Volatile Organic Compounds (VOCs) and the products of combustion from shipboard incinerators, prompted the International Maritime Organization (IMO) to place air pollution on the agenda of the Marine Environment Protection Committee (MEPC) towards the end of the 1980s.

1.5

After some 8 years of often passionate arguments a new Air Pollution Annex was finally adopted by a MARPOL Diplomatic Conference in September 1997. The adoption of the Annex was by means of the Protocol of 1997 to amend MARPOL 73/78 and, at the same time, a number of Conference Resolutions were also adopted including four which are likely to have a profound effect on the operation of shipping over the coming years, they are:

Section 1 Introduction

1.5.1

Resolution No. 2 on the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (The NO_x Technical Code);

1.5.2

Resolution No. 3 on Review of Nitrogen Oxides Emission Limitations;

1.5.3

Resolution No. 7 on the Restriction on the Use of Perfluorocarbons (PFCs) on board Ships; and,

1.5.4

Resolution No. 8 on Carbon Dioxide (CO₂) emissions from Ships.

3 Contents of the new Annex

3.1

Annex VI is split into three sections or chapters; Chapter I covers general requirements, Chapter II deals with survey, certification and means of control whilst Chapter III provides requirements for control of emissions from ships. Chapters I & II closely follow the format of previous MARPOL Annexes with regard to the titles and content of the regulations with only minor changes reflecting emissions to the atmosphere rather than discharges to the sea. The regulations contained in Chapter III will effectively control the discharge or emission of a number of substances, which presently contribute to global air pollution, and will apply to both new and existing ships depending on the type of pollutant being controlled.

3.1.1

Halons, such as are found in fire extinguishing systems, will be banned in all new installations (including portable extinguishers) although existing installations remain unaffected at present.

3.1.2

Chlorofluorocarbons (CFCs) and other ozone depleting substances, such as are used in refrigeration plants and for the production of certain types of insulation material, will be banned in all new installations although existing installations remain unaffected at present. New installations containing hydrochlorofluorocarbons (HCFCs) will, however, be permitted until 1 January 2020.

3.1.3

Nitrogen oxides (NO_x) emissions, which contribute to acid deposition and result in the formation of ground level ozone (which can cause breathing problems in some vulnerable people and is formed in varying amounts during the combustion process in petrol and diesel engines, gas turbines, boilers and incinerators) will only initially be regulated in new diesel engines.

3.1.4.

Sulfur oxides (SO_x) emissions, which are the other main cause of acid deposition, will be regulated in all ships.

Section 1 Introduction

3.1.5

Volatile organic compounds (VOCs), which are mainly given off during cargo operations on certain oil, gas and chemical tankers, will only be regulated when so required by individual Administrations for ports and terminals under their jurisdiction.

3.3

In addition to legislation on the substances noted above, the design and operation of shipboard incinerators will be further regulated whilst the quality of fuel oil supplied to ships will also be controlled and monitored, the combustion of sub-standard fuel being one of the prime causes of certain types of air pollution. The provision of adequate reception facilities and application of the new Annex to Platforms and Drilling Rigs are also addressed. For ease of reference a copy of Chapter III of Annex VI, Regulations 12 through 19, is included as appendix 1 to these Guidance Notes.

5 Effects on Shipping**5.1**

Unlike the three "optional" Annexes to MARPOL (III, IV & V) which have been adopted by the IMO (only two of which have thus far entered into force), Annex VI has been introduced by means of a Protocol and, upon entry into force, will require all Convention ships of Parties to MARPOL 73/78 to be issued with an International Air Pollution Prevention Certificate. Prior to the issuance of this statutory certificate the flag State, or a Recognised Organization acting on its behalf (e.g. a Classification Society such as ABS), will need to confirm compliance with the applicable regulations contained within the Annex; the certificate's continuing validity will require annual, intermediate and renewal surveys to be satisfactorily carried out and, being a statutory certificate, it will come under the scrutiny of port State control inspectors wherever the ship plies her trade.

5.3

Whilst the majority of Annex VI will only apply to new and existing ships after entry into force of the 1997 Protocol there are two regulations which will be applied retrospectively from 01 January 2000, namely Regulation 13 on NO_x and Regulation 16 on shipboard incinerators, where a new ship will be defined as one constructed on or after that date. For further details refer to section 2 of these Guidance Notes.

7 Why Shipping**7.1**

Why the sudden interest in shipping which, after all, is considered by many to be the most environmentally friendly method of transporting cargoes around the world; as has been stated earlier, this is in no small way due to the pressures that have been placed upon industry ashore to demonstrate compliance with increasingly more stringent emission standards.

7.3

Many countries have legislation in place to control or prevent air pollution, some of which is internally driven but most being as a direct result of international Conventions and their associated Protocols: for the protection of the ozone layer there is the Vienna Convention and its related Montreal Protocol; the Framework Convention on Climatic Change (FCCC) is primarily concerned with greenhouse gas emissions whilst some 40 States in and around the European landmass, together with the USA and Canada, are signatory to the Convention on Long Range Transboundary Air Pollution (LRTAP). This latter Convention has five related Protocols which have also been ratified

Section 1 Introduction

by various parties to that Convention and have now entered into force, namely: the 1984 Protocol on the Co-operative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe (EMEP); the 1985 Sulfur Protocol; the 1988 NO_x Protocol; the 1991 VOC Protocol; and, the 1994 Sulfur Protocol. A further two Protocols to the Convention have been approved and are presently open for signature by contracting Parties, these are the 1998 Heavy Metals Protocol and the 1998 Persistent Organic Pollutants Protocol.

7.5

It is interesting to note that the LRTAP Convention and existing Protocols do not address shipping although this may change with the development of the second step to the NO_x Protocol where a multi-pollutant approach will be applied, addressing photochemical pollution, acidification and eutrophication a draft Protocol could be tabled by the end of 1999 and it is envisaged that it will contain technical annexes on emissions from mobile sources, including shipping. In the mean time the United Nations Convention on Law of the Sea (UNCLOS), which acts as an “umbrella” treaty for international shipping, remains the sole guardian of the atmosphere but only up to 200 miles from a coastal State’s coastline.



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GUIDANCE NOTES ON PREVENTION OF AIR POLLUTION FROM SHIPS

SECTION 2 Retrospective Regulatory Compliance (Early compliance from 01 January 2000)

1 General

1.1

Whilst Annex VI is not enforceable, internationally, until such time as it enters into force there are two regulations which will be retrospectively applied in many areas of the world on the date of entry into force of the Annex. These regulations concern NO_x emissions from “new” and “substantially modified” diesel engines (Regulation 13) and “new” Shipboard Incinerators (Regulation 16), both of which refer to a compliance date of **01 January 2000** regardless of the date of entry into force of Annex VI. Actual compliance with the pertinent parts of these regulations after 01 January 2000, whilst not mandatory, is recommended for the following reasons:

1.1.1

It is far easier, and more cost effective, to order equipment to be supplied in accordance with new specifications, than attempt to upgrade existing equipment to meet standards for which it was not originally designed;

1.1.2

The time scale between the Annex meeting the entry into force requirements and its actual date of entry into force is only 12 months, which may well be insufficient to arrange compliance with those regulations and/or standards;

1.1.3

A flag State’s introduction of domestic legislation, prior to entry into force, to enable it to become a Party to the Protocol of 1997 by “signature without reservation, acceptance or approval” may mean its own vessels being required to fully comply before entry into force of the Annex; and,

Section 2 Retrospective Regulatory Compliance

1.1.4

Non-compliance after entry into force of Annex VI may well result in a port State detention, and/or prohibition from trading to and from that port or coastal State until such time as compliance can be demonstrated.

1.3

Irrespective of the above, it is ultimately the Owner's responsibility to ensure that his vessel complies with the national regulations of the State, the flag of which his ship is entitled to fly; this may well include early compliance with Regulations 13 & 16, and may also require interim measures to be taken to reduce emissions of other pollutants covered by the Annex. For those flag States who have authorized ABS to act on their behalf instructions on the degree of compliance required will be available through the local ABS Office. Early confirmation of a flag State's requirements, either directly, or through ABS, is therefore strongly recommended.

3 New diesel engines and the NO_x Technical Code

3.1

The NO_x Technical Code was developed by a small group of experts within the IMO and is of a highly technical nature, being based on the relevant parts of the International Standards Organization publication ISO 8178 and providing a common basis for the NO_x testing of marine diesel engines. It also includes information on certification procedures for different types of engines as well as onboard verification procedures for demonstrating continuing compliance with the applicable NO_x emissions limits. **Due to the size of the NO_x Technical Code it has not been reproduced as an appendix to these Guidance Notes.**

3.3

Regulation 13 of Annex VI basically requires that all diesel engines with individual power outputs greater than 130 kW, which are installed on ships operating internationally and constructed on or after 01 January 2000, comply with the applicable NO_x emission limits as set out in Regulation 13(3)(a) and chapter 3 of the NO_x Technical Code. Engines undergoing major conversion after 01 January 2000, as defined in Regulation 13(2)(a) and 1.3.2 of the NO_x Technical Code, are also included but diesel engines for emergency use, and those installed on vessels solely engaged in domestic trade are exempt providing they meet the requirements laid down in sub-paragraphs (b) & (c) of Regulation 13(1). The Annex **does not** address NO_x emissions from ships boilers, gas turbines or incinerators although this may change in the future. For further information on future emission controls refer to section 5 of these Guidance Notes.

3.5

As has already been explained, until such time as the Annex enters into force its regulations are unenforceable; this means that for Regulation 13, although an engine may have been certified as being NO_x compliant at the time of its manufacture, evidence of continuing compliance may not be required until such time as the initial survey for issuance of the International Air Pollution Prevention Certificate (IAPPC) is carried out. The issuance of such a certificate to ships constructed before the date of entry into force of the Annex, as per MARPOL VI/6(2), may be delayed by up to 3 years.

Section 2 Retrospective Regulatory Compliance**ACTION**

In order to avoid the retrospective regulatory compliance problems associated with NO_x emissions, prudent Owners should ensure that diesel engines installed on ships constructed on or after 01 January 2000, and diesel engines which undergo a major conversion on or after that date, are:

- *"certified" in accordance with the NO_x Technical Code;*
- *supplied with an "approved Technical File"; and,*
- *maintained in continuing compliance with the relevant NO_x emission limits including "documentary evidence" of same.*

Note 1: The term "certified", as used in the above context, is taken to mean that an engine has been pre-certified and/or certified **by an authorized Authority such as the vessel's flag Administration or a Recognised Organization¹ acting on its behalf** in accordance with the requirements of 2.2 and 2.3 respectively of the NO_x Technical Code. Prior to entry into force of Annex VI this "certification" should take into consideration the contents of MEPC/Circ.344.

Note 2: The term "approved Technical File" is taken to mean a Technical File meeting the requirements of 2.4.1 of the NO_x Technical Code and approved **by an authorized Authority such as the vessel's flag Administration or a Recognised Organization¹ acting on its behalf.**

Note 3: The term "documentary evidence" is taken to mean a properly completed Record Book of Engine Parameters, or records of onboard emission testing either by the simplified measurement method or by direct measurement and monitoring, all in accordance with the relevant sections of chapter 6 of the NO_x Technical Code.

3.7

Further information on options for the control of NO_x emissions, as well as brief descriptions on the certification of engines, the Technical File, the Record Book of Engine Parameters and onboard NO_x measurement can be found in section 4.7.3 of these Guidance Notes.

5 Incinerators**5.1**

Regulation 16 of Annex VI requires that all shipboard incinerators installed on ships on or after **01 January 2000** are approved by the Administration based on the requirements contained in IMO Resolution MEPC 76(40) on Standard Specification for Shipboard Incinerators; such incinerators must also be operated within the limits laid down in section A1.5 of Annex 1 of MEPC 76(40), which is reproduced in section 4.7.9.1 of these Guidance Notes. Regulation 16(4) prohibits the incineration of MARPOL Annex I, II & III cargo residues and related contaminated packing materials, polychlorinated biphenyls (PCBs), garbage contaminated with heavy metals and refined petroleum products containing halogen compounds. The incineration of sewage sludge and sludge oil, generated during the normal operation of the ship, is allowed in main or auxiliary power plant or boilers as per Regulation 16(5) but incineration by such methods is banned in ports, harbours and estuaries.

¹ ABS is a Recognised Organization and is authorized to issue statutory certification for most Administrations; the local ABS Office will be able to advise whether ABS has been authorized by a specific flag Administration to issue the relevant certification for Annex VI and the NO_x Technical Code.

Section 2 Retrospective Regulatory Compliance

5.3

Incinerators installed on board ships prior to 01 January 2000, the vast majority of which have already been approved in accordance with the earlier version of the Standard Specification for Shipboard Incinerators contained in IMO Resolution MEPC 59(33), may still be used after entry into force of the Annex although the incineration of polyvinyl chlorides (PVCs) in them will be prohibited by Regulation 16(6). Incinerators installed on vessels solely engaged in domestic trade may be exempted from the 01 January 2000 deadline but only up to entry into force of the Annex.

5.5

As with the NO_x regulation, until such time as the Annex enters into force Regulation 16 is unenforceable; this means that although an incinerator may have been type approved in accordance with MEPC 76(40) at the time of its manufacture, evidence of its operation within the prescribed limits and operator training may not be required until such time as the initial survey for issuance of the IAPPC is carried out.

ACTION *In order to avoid the retrospective regulatory compliance problems associated with incinerators, prudent Owners should ensure that incineration equipment "installed" on board ship on or after 01 January 2000 is:*

- *"approved" in accordance with resolution MEPC 76(40);*
- *supplied with a manufacturer's operating manual;*
- *operated only by competent personnel; and,*
- *maintained in a condition which allows operation within the prescribed limits at all times.*

Note 1: The term "approved", as used in the above context, means type approved **by an authorized Authority such as the vessel's flag Administration or a Recognized Organization acting on its behalf.**

Note 2: The term "installed", as used in the above context means that for existing ships the incinerator is completely connected and ready for light-off. For new ships the term "installed" is taken to mean installed on ships constructed on or after 01 January 2000.

Note 3: Incinerators with capacities greater than 1500 kW cannot, by definition, be type approved in accordance with the current version of MEPC 76(40). However, experience has shown that where such incinerators are installed on vessels, flag Administrations have been agreeable to a "Statement of Compliance" with MEPC 76(40) being issued in lieu of the required IMO type approval certification.



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SECTION **3 Control of Other Pollutants**
(Before & after entry into force of
Annex VI)

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SECTION 3 Control of Other Pollutants (Before & after entry into force of Annex VI)

1 General

1.1

Regardless of the type of pollutant being considered, control measures to reduce or prevent the local effects of an individual, or group of pollutants will very much depend on national legislation already enacted within the territories of a flag State, usually as a result of regional problems and/or international regulations. We have already identified, in section 1, the various Conventions and Protocols which cover the majority of the pollutants regulated in Annex VI; however, the international shipping community may be forgiven if it is unaware of many of these restrictions because, to date, shipping has been excluded from the direct controls imposed on land-based industry. This scenario will change with entry into force of the new Annex but in the interim period some of those pollutants, although not directly regulated on a world-wide basis, will be controlled by virtue of regional market forces; a good example of this is ozone depleting substances which are gradually being phased out because of a ban on their production in the major industrial nations.

1.3

As with other pollutants already discussed in these Guidance Notes the prudent shipowner will ascertain, either through the flag Administration or local ABS Office, which pollutants are the subject of regional or local control prior to ordering equipment containing or producing same. Indeed, depending on the source of such equipment, national legislation within the country of origin may well dictate lower levels of certain controlled pollutants than those to be imposed by MARPOL Annex VI.

3 Ozone Depleting Substances

3.1

Regulation 12 of Annex VI, upon entry into force, will prohibit the deliberate emission of ozone depleting substances such as halons and chlorofluorocarbons (CFCs) unless the safety of the ship and its passengers and/or crew is likely to be jeopardized, for example where a halon system is discharged for fire fighting purposes. Deliberate emissions do not include minimal releases of ozone depleting substances associated with system commissioning, maintenance or decommissioning; however leaks, whether deliberate or otherwise, may be regulated by flag or coastal States. The regulation also requires that all of the substances covered by the regulation, as well as machinery and equipment containing same, should be delivered to appropriate reception facilities upon removal from ships. The provision for reception facilities is covered by Regulation 17 of Annex VI and is further discussed in section 4.7.11 of these Guidance Notes.

3.3

The cut-off dates referred to in Regulation 12 are based on those contained in the relevant sections of the Montreal Protocol (as amended); the use of Halon in **new** fixed fire fighting installations has already been banned under SOLAS as of 1st October 1994 (SOLAS II-2/5.3.1), and IMO is considering similar action for portable halon extinguishers. The use of CFCs (mainly utilized in air conditioning and refrigeration units) will be prohibited in all new installations after entry into force of Annex VI although many areas of the world have already banned their use in land based industrial and non-industrial machinery, this in many cases includes marine applications as well. Hydro-chlorofluorocarbons (HCFCs) will be permitted in new installations until 01 January 2020, but again there are areas in the world, for example the European Union, where these gases may become unavailable earlier due to a more severe regional phase-out schedule than that required by international regulation.

CAUTION

Whilst some equipment containing or utilizing CFCs will still be available for use in new installations prior to entry into force of Annex VI, prudent Owners should take into consideration the likely availability of replacement gases in the areas of operation of their vessels. Consideration should also be given to any impending legislation from a vessel's flag State, or indeed coastal States, should a vessel be employed on a dedicated service or route. As the production of ozone depleting substances is reduced and eventually ceases, the only reliable source of replenishment for existing plant is likely to be an ever dwindling stock of recycled gases available from the Halon and CFC International Banking Systems which have been developed to conserve existing stocks of the gases for essential users.

5 Sulfur Oxides (SO_x)

5.1

Regulation 14 on the control of emissions of SO_x will, unlike the NO_x regulation, apply to all ships upon entry into force of Annex VI and will also apply to every type of combustion equipment regardless of its end use, whether that be propulsion, power generation, auxiliary machinery or for emergency purposes. There will, however, be a period of grace to allow vessels time to comply with this regulation where, for instance, structural alterations are required to account for changes in onboard fuel oil tank arrangements and fuel oil distribution systems.

Section 3 Control of Other Pollutants

5.3

Regulation 14(1) mandates a global cap of 4.5% m/m for the sulfur content of any oil fuel intended for use on board ships; Regulation 14(4) places additional controls on designated Special Areas, which are to be known as SO_x Emission Control Areas (SO_xECAs), where the maximum sulfur content of any fuel oil used will be further limited to 1.5% m/m (or, where post combustion treatment is utilized, the emission rate will be limited to a maximum of 6.0 g SO_x/kWh). The sulfur content of each parcel (bunker lifting) of oil fuel intended for use on board ship will also require to be documented by means of a "Bunker Delivery Note" which must be kept on board for a period of 3 years after delivery of the fuel to which it relates. Information to be included in the bunker delivery note required by Regulation 18(3) is included as appendix V to Annex VI and reproduced as appendix 2 to these Guidance Notes.

5.5

SO_x Emission Control Areas will be strictly controlled by Annex VI with criteria and procedures for their designation contained as appendix III to that Annex. At the time of adoption of the new Annex in September 1997 the only area designated as a SO_x Emission Control Area was the Baltic Sea; however, the North Sea States are presently preparing a case for the designation of the North Sea which, if successful, is likely to become effective upon entry into force of the new Annex. As has already been stated, options for compliance with the emission limits of a SO_xECA are presently limited to the use of low sulfur fuel, or utilization of an exhaust gas cleaning system as per Regulation 14(4)(b) of the Annex. Where fuel switching is to be used for compliance with the lower limits, change-over to the lower sulfur fuel will have to be carried out in such a manner as to ensure that all the higher sulfur fuel is flushed out of the system prior to entry into the SO_xECA as per Regulation 14(6). For further details refer to section 4.7.5 of these Guidance Notes.

5.7

There is also a requirement, at Regulation 14(2), to monitor the world-wide average sulfur content of residual fuel oil which, whilst not directly affecting the shipowner, will initially be calculated based on the results of fuel oil samples submitted, by owners, to the three major bunker fuel oil testing companies, of which **ABS Oil Testing Services** is one.

CAUTION

Whilst the regulation pertaining to SO_x ECAs will not become effective until at least 12 months after entry into force of the Annex prudent Owners, when considering specifications for future new buildings, may wish to take into account the likely areas of operation of those new vessels with respect to existing or proposed SO_x Emission Control Areas. For those vessels which will be trading in and out of ports within SO_x ECAs, on more than an occasional basis, an early review of fuel oil storage and distribution systems to cater for high and low sulfur fuels, or of alternative exhaust gas cleaning systems, should be carried out. Methods of compliance with this regulation are more fully discussed in section 4.7.5 of these Guidance Notes.

7 Volatile Organic Compounds (VOC's)

7.1

Regulation 15 deals with the control of emissions of Volatile Organic Compounds (VOC's) **from oil, chemical and gas tankers only** but, unlike other pollutants covered by the Annex, VOC's are not to be universally controlled. In order for a port or terminal to be designated as a VOC control area it will be necessary for the relevant coastal State Administration to declare that port or terminal as such to the Organization (IMO), provided of course that the Administration is signatory to the 1997 Protocol (Annex VI). Not all ports and terminals under the jurisdiction of an Administration may be