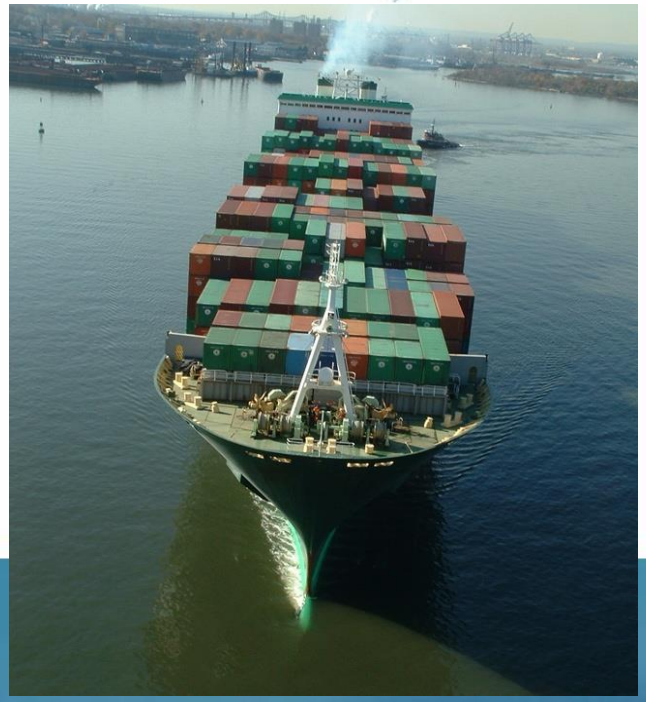
EMSA

European Maritime Safety Agency



Introduction to MARPOL Annex VI

Training for the Turkish Maritime Administration on MARPOL Annex VI and the EU Sulphur Directive

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Turkey,
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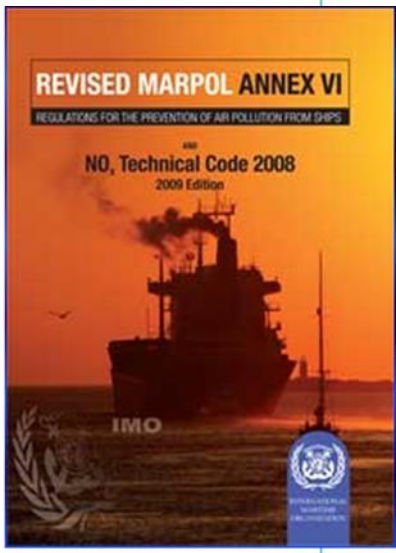
MARPOL Annex VI

- **Air Pollution – No direct cause and effect pollution**
  - **Cumulative effect – environment**
  - **human health**
  - **resources**
  - **climate change**

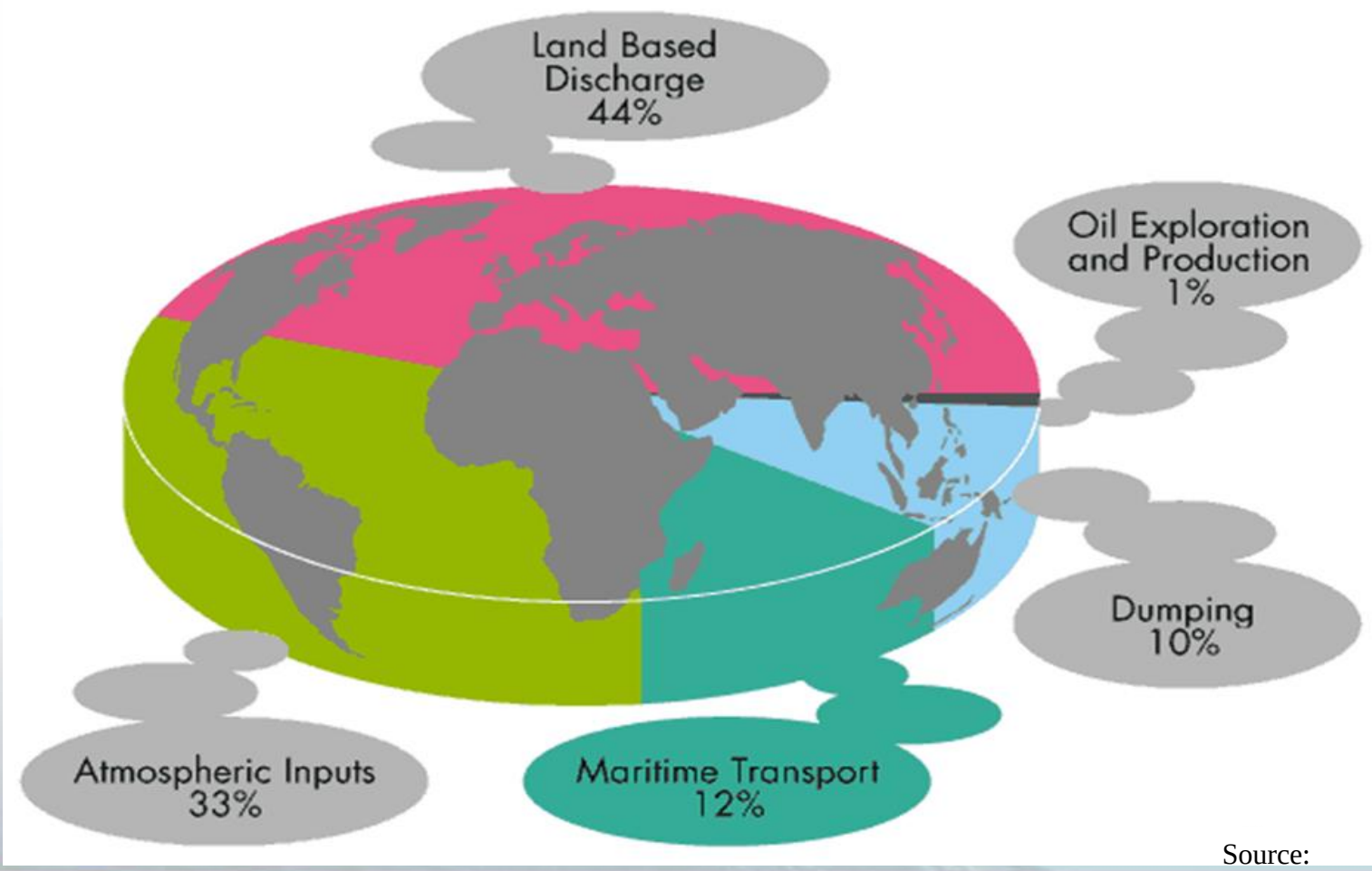
- **MARPOL Annex VI – first adopted in 1997**
  - **Sulphur Oxides (SOx)**
  - **Nitrogen Oxides (NOx)**
  - **Oxone Depleting Substances**
  - **Shipboard Incineration (links with MARPOL Annex V)**
  - **Volatile Organic Compounds (VOC's)**
  - **Energy Efficiency**



MARPOL Annex VI

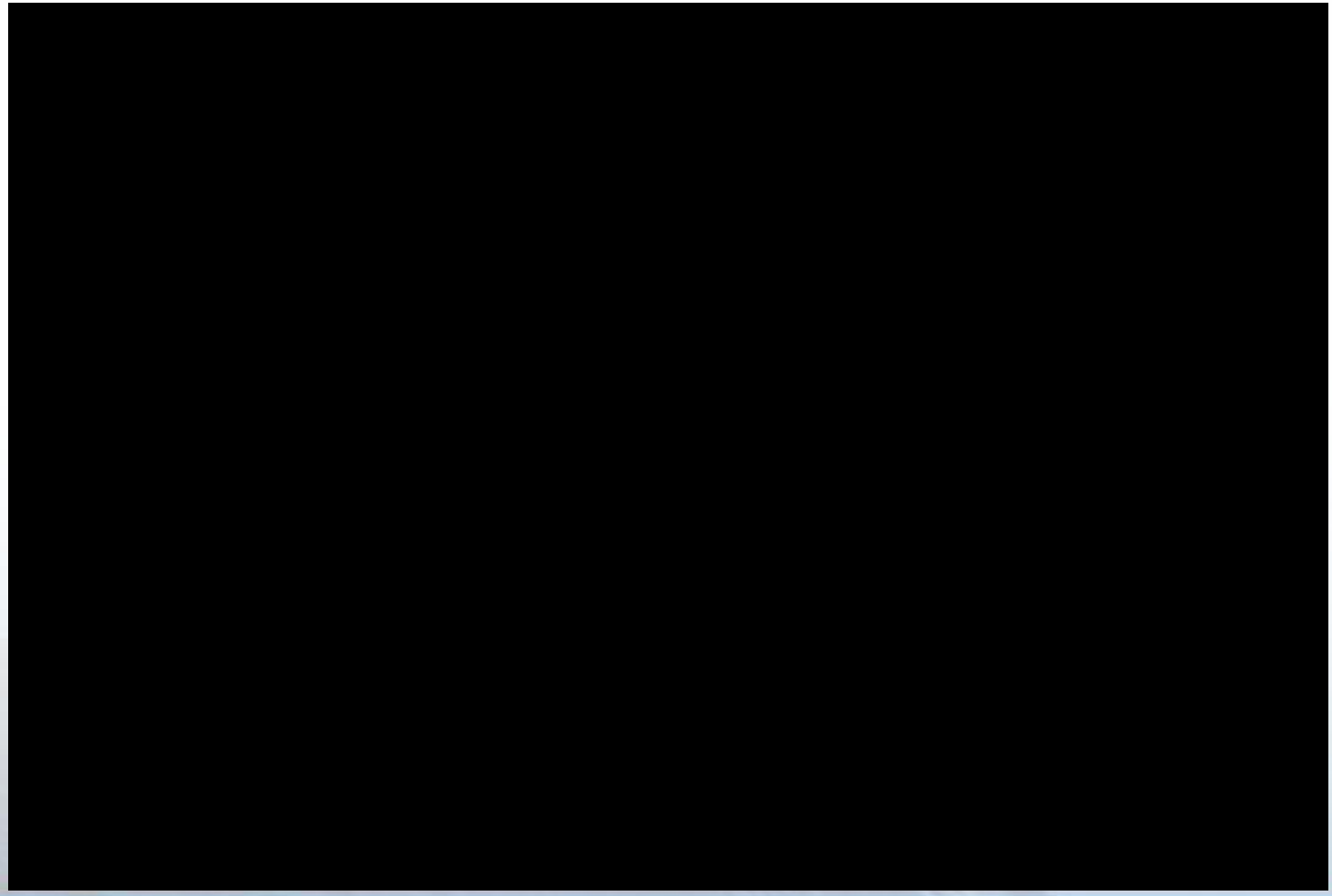
- **Adopted in 1997, entry into force in 2005**
- **Aimed at minimizing airborne emissions from ships**
  (SOx, NOx, ODS, VOC, CO2)
- **Revised Annex VI in October 2008, entry into force in July 2010**
  (with significant tighter emissions limits)
- **94 IMO Parties have so far ratified Annex VI (incl. 24 EU MS)**
  (96.71% of world merchant shipping tonnage).
- **Regulation 4 “Equivalents” - use of alternative compliance methods**
  (at least as effective in terms of emission reductions as required)

Overview of Total Sea Pollution

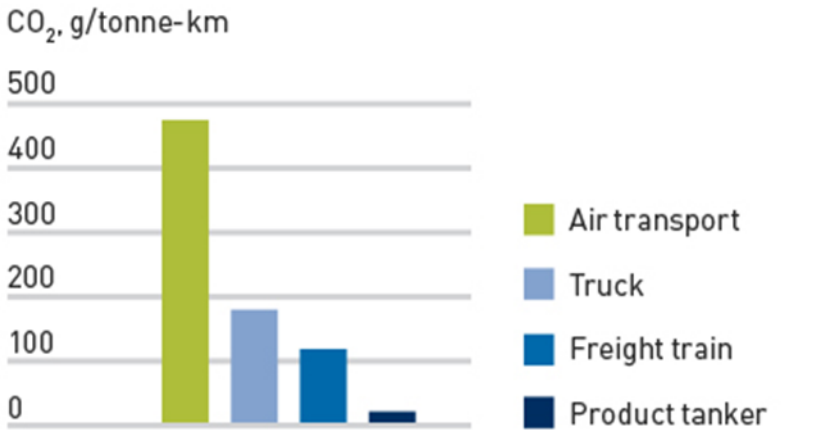


Source: GESAMP

Environmental impact of shipping



Carbon dioxide emissions by transport mode



COMPARISON OF CO_2 EMISSIONS BETWEEN MODES OF TRANSPORT

Grams per tonne-km

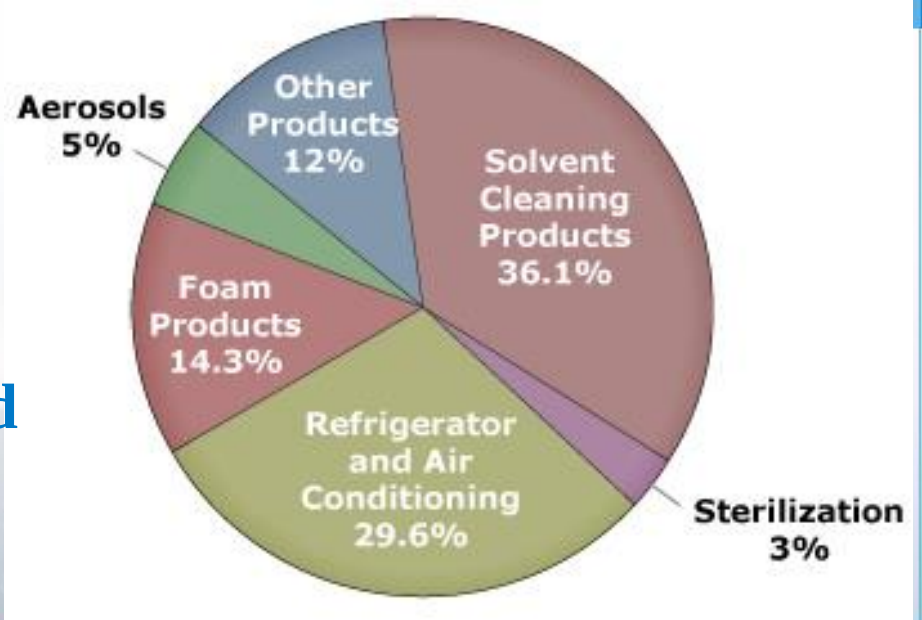
Source: NTM, Sweden

Application:

- **As of MARPOL - all Ships**
- **Not apply to Warships, naval auxiliary ships, other ships operated or owned by a State and used for Governmental non-commercial services.**
- **However exemptions occur for**
  - **Emissions necessary for the purpose of securing the safety of a ship or saving life at sea**
  - **Emissions resulting from damage to a ship or its equipment – providing that all reasonable precautions have been taken after the damage to prevent that emission**
    - **and except if the owner or the master acted recklessly knowing that damage would result.**

Ozone Deleting Substances

- Montreal Protocol
- Deliberate emissions of ODS shall be prohibited
  - Maintaining, servicing, repairing and disposing of equipment
- New installations shall be prohibited from using ODS
  - except those using HCFC's - 1/1/2020
- Need appropriate reception facilities
- Existing facilities can be used
- No Atmospheric Discharge.



Ozone-depleting substances that may be found on board ship include, but are not limited to:

Halon 1211	Bromochlorodifluoromethane
Halon 1301	Bromotrifluoromethane
Halon 2402	1,2-Dibromo-1,1,2,2-tetrafluoroethane (also known as Halon 114B2)
CFC-11	Trichlorofluoromethane
CFC-12	Dichlorodifluoromethane
CFC-113	1,1,2-Trichloro-1,2,2-trifluoroethane
CFC-114	1,2-Dichloro-1,1,2,2-tetrafluoroethane
CFC-115	Chloropentafluoroethane

NOx

Application:

- **each diesel engine with a power output of more than 130 kW which is installed on a ship constructed on or after 1 January 2000; and**
- **each diesel engine with a power output of more than 130 kW which undergoes a major conversion on or after 1 January 2000**

Does Not apply to:

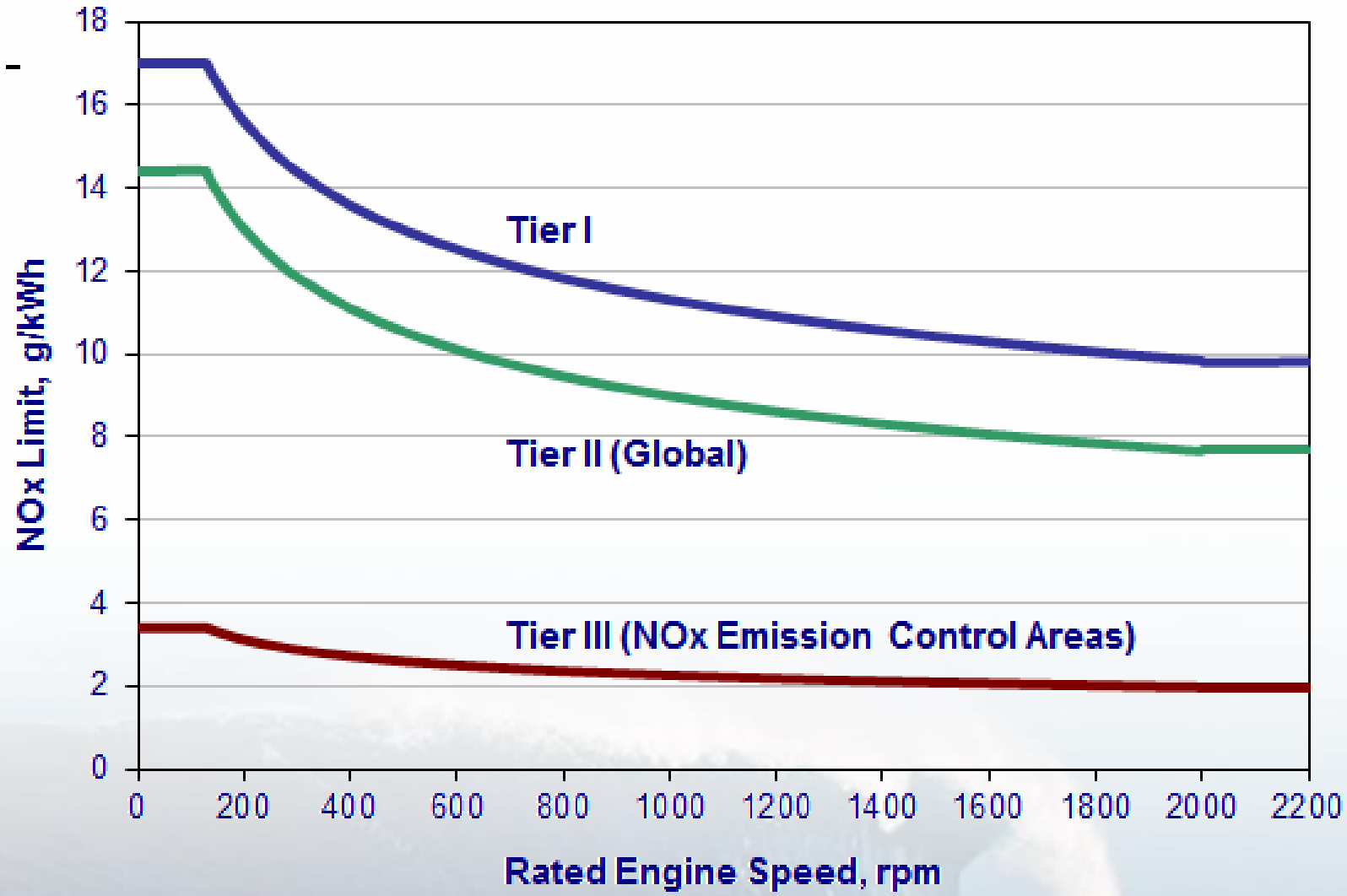
- **emergency diesel engines, engines installed in lifeboats and any device or equipment intended to be used solely in case of emergency; and**
- **engines installed on ships solely engaged in voyages within waters subject to the sovereignty or jurisdiction of the State the flag of which the ship is entitled to fly, provided that such engines are subject to an alternative NO_x control measure established by the Administration.**

Major Conversion

The operation of each diesel engine to which this regulation applies is prohibited, except when the emission of nitrogen oxides (calculated as the total weighted emission of NO_2) from the engine is within the following limits:

Table 1. MARPOL Annex VI NOx emission limits

Tier	Date	NOx Limit, g/kWh		
		n < 130	130 ≤ n < 2000	n ≥ 2000
Tier I	2000	17.0	$45 \cdot n^{-0.2}$	9.8
Tier II	2011	14.4	$44 \cdot n^{-0.23}$	7.7
Tier III	2016†	3.4	$9 \cdot n^{-0.2}$	1.96
† In NOx Emission Control Areas (Tier II standards apply outside ECAs				


NOx Limit, g/kWh
18
16
14
12
10
8
6
4
2
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
Rated Engine Speed, rpm
Tier I
Tier II (Global)
Tier III (NOx Emission Control Areas)

- **Supported by NOx Technical Code**

- **NOx ECA**

- **Exhaust Gas Cleaning System (Equivalency)**

SOx

- Current **global sulphur in fuel cap** from 1/1/2012 is **3.50%** and reduced progressively to **0.50%**, effective from 1 January 2020
- Revised Annex VI also introduced '**Emission Control Areas**' (ECAs)
- The limits of sulphur in fuel applicable in **ECAs** for SOx and particulate matter were reduced to **1.00%** from 1 July 2010 + being further reduced to **0.10%**, effective from 1 January 2015.
- Alternatively, ships must fit an exhaust gas cleaning system or use any other technological method to limit SOx emissions.


Sulfur, %
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Global
SOx ECA
2000
2005
2010
2015
2020
2025
Year

EMSA

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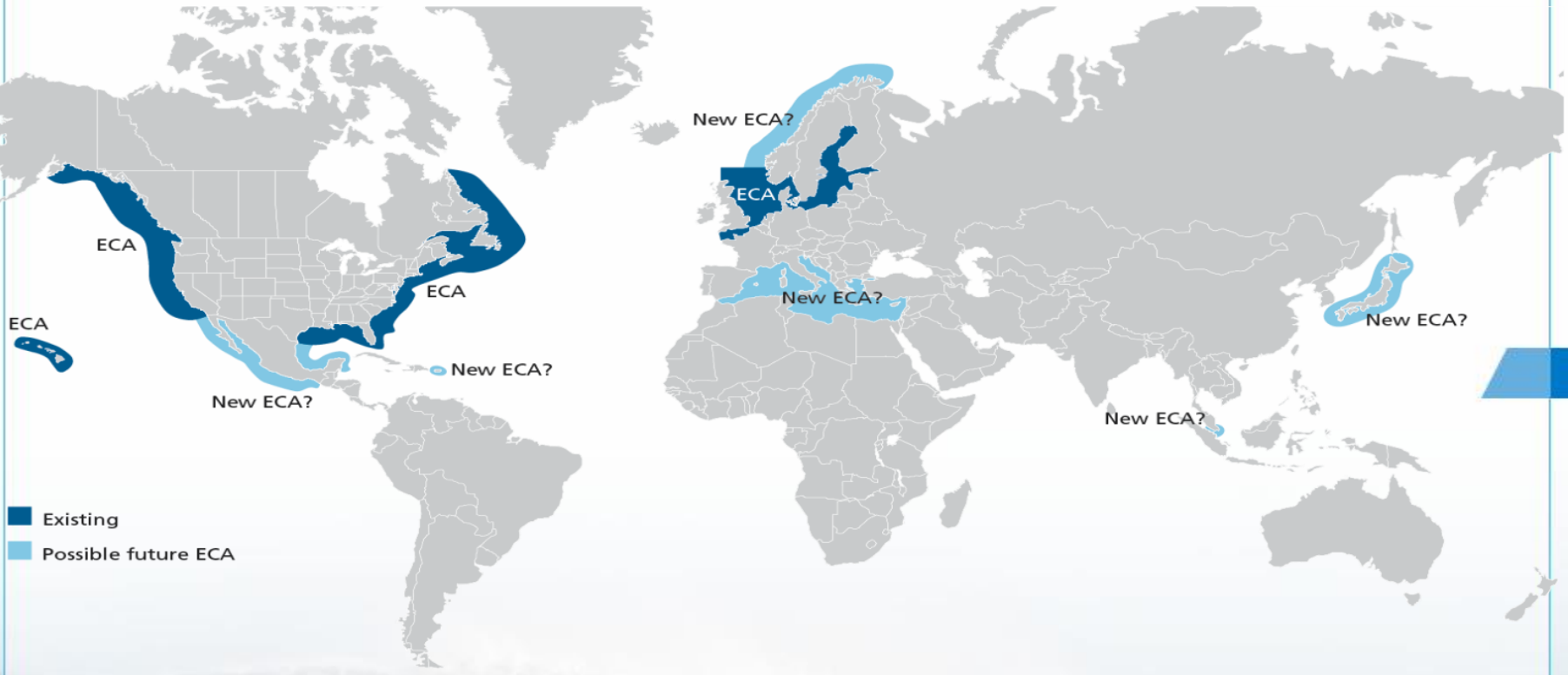
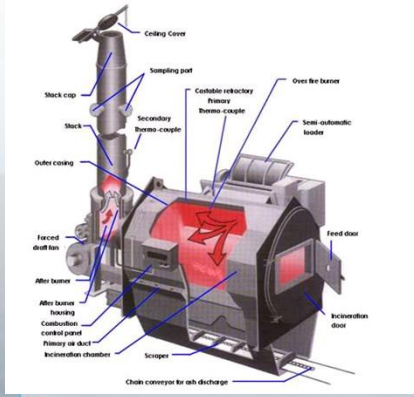


- **Reg. 18: Promote the availability of compliant fuel oil and inform IMO of the availability in its ports and terminals**
- **Reg. 17: Ensure provision of adequate reception facilities for (equipment containing) ODS and exhaust gas cleaning residues from cleaning system (e.g. scrubber sludge)**
- **Reg. 5 + 6: Issue survey, certificate (Int. Air Pollution Prevention Certification - IAPPC) for ships of 400 GT complying with engine and emission requirements.**
- **Reg. 10: Port state control on operational requirements (essential procedures relating to prevention of air pollution from ships), on-board bunker delivery notes + representative sample of the fuel oil (fuel sampling)**

- **Volatile Organic Compounds**
  - **from Tanker Cargo Holds**
  - **regulated in ports or terminals under the jurisdiction of a Party**
  - **Approved Vapour Emission Control Systems**
  - **Tankers must use Vapour Collection System**

- **Shipboard incineration of the following substances shall be prohibited:**
  - **Annex I, II and III cargo residues of the present Convention and related contaminated packing materials;**
  - **polychlorinated biphenyls (PCBs); and polyvinyl chlorides (PVCs);**
  - **garbage, as defined in Annex V of the present Convention, containing more than traces of heavy metals;**
  - **garbage, as defined in Annex V of the present Convention, containing more than traces of heavy metals; and,**
  - **Sewage in ports and harbours**



Fuel Oil Quality

- **Fuel oil for combustion purposes delivered to and used on board ships to which this Annex applies shall meet the following requirements:**
  - **the fuel oil shall be blends of hydrocarbons derived from petroleum refining – allows additives**
  - **the fuel oil shall be free from inorganic acid;**
  - **the fuel oil shall not include any added substance or chemical waste which either:**
    - **jeopardizes the safety of ships or adversely affects the performance of the machinery, or**
    - **is harmful to personnel, or**
    - **contributes overall to additional air pollution**

Fuel Oil Quality

- **fuel oil for combustion purposes derived by methods other than petroleum refining shall not:**
  - **exceed the sulphur content regulations;**
  - **cause an engine to exceed the NO_x emission limits;**
  - **contain inorganic acid; and**
  - **the fuel oil shall not include any added substance or chemical waste which either:**
    - **jeopardizes the safety of ships or adversely affects the performance of the machinery, or**
    - **is harmful to personnel, or**
    - **contributes overall to additional air pollution**

1) .Flag State Requirements

Surveys – Initial Survey –before ship is put into service –
- International Air Pollution Prevention Cert.

- Renewal Survey, not exceeding 5 yrs to renew the IAPP

- Intermediate Survey, 3 months before after 2nd or 3rd anniversary of the certificate (replaces Annual survey)

(ensure that the equipment and arrangements fully comply with the requirements of this Annex and are in good working order)

- Annual Survey - to ensure that the equipment, systems, fittings, arrangement they have been maintained and that they remain satisfactory for the service for which the ship is intended.

- Additional Survey after any repairs.

IAPP applies to ships over 400GT and platforms and drilling rigs engaged in voyages

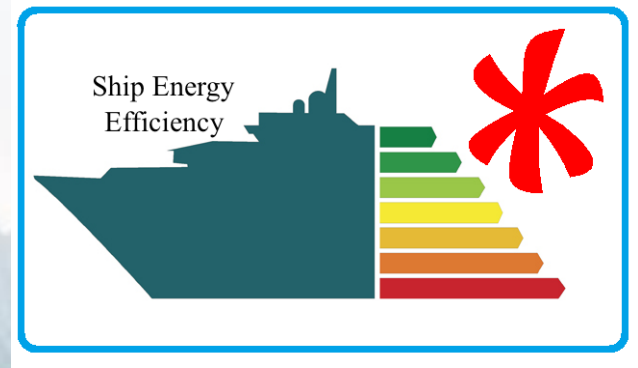
2). Port State Control

Energy Efficiency - EEDI & SEEMP

- The Energy Efficiency Design Index (EEDI) was made mandatory for new ships and the Ship Energy Efficiency Management Plan (SEEMP) for all ships at MEPC 62 (July 2011)
- Resolution MEPC.203(62)).

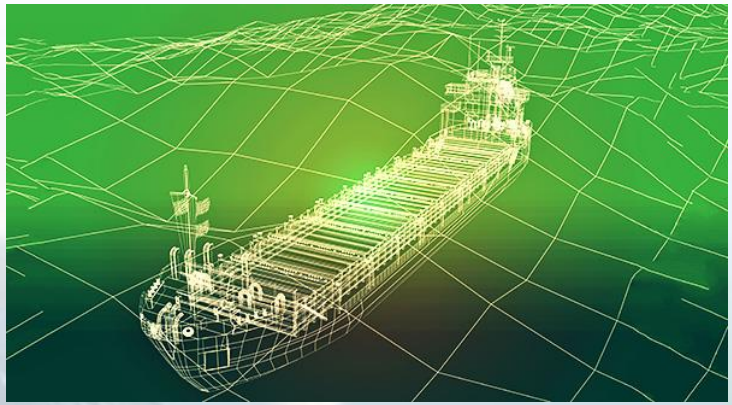
Further Guidance :

- **2012 Guidelines on the method** of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships, resolution MEPC.212(63);
  2012 Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP), resolution MEPC.213(63);
- **2012 Guidelines on survey** and certification of the Energy Efficiency Design Index (EEDI), resolution MEPC.214(63); and
- **Guidelines for calculation of reference** lines for use with the Energy Efficiency Design Index (EEDI), resolution MEPC.215(63).



The EEDI

- promoting the use of more energy efficient (less polluting) equipment and engines.
- requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and sizes.
- From 1 January 2013 new ship design will need to meet the reference level for their ship type
- the level is to be tightened incrementally every five years,
- stimulate continued innovation and technical development in the ships design phase.



- performance-based mechanism
- choice of technologies left to the industry.
- cost-efficient solutions
- expressed in grams of carbon dioxide (CO2) per ship's
- calculated by a formula based on the technical design parameters for a given ship.

- CO2 reduction level is set to 10%
- tightened every five years to keep pace with technological developments
- 30% reduction rates have been established until the period 2025 to 2030

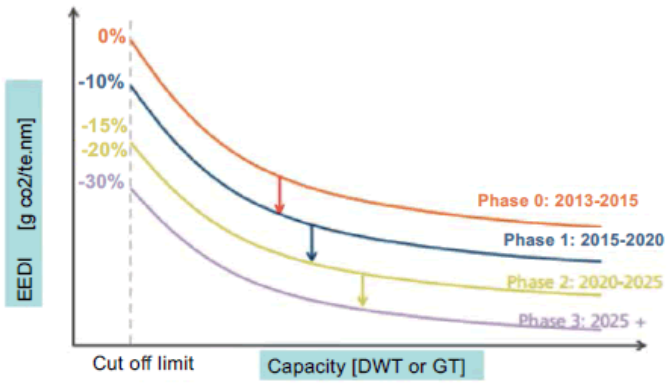


Figure 1: Concept of Required EEDI, reduction factor, cut off limits and EEDI Phases, Note: Reprinted from Module 2 - Ship Energy Efficiency Regulations and Related Guidelines, IMO.

72% of emissions from new ships covering the following ship types:

- oil tankers,
- bulk carriers,
- gas carriers,
- general cargo,
- container ships,
- refrigerated cargo and combination carriers.

- Others - suitable formulas are expected to be developed in the future - largest emitters first.

Ship Energy Efficiency Management Plan

SEEMP - mechanism to improve the energy efficiency of a ship in a cost-effective manner.

- manage ship and fleet efficiency performance over time using, for example, the Energy Efficiency Operational Indicator (EEOI) (voluntary)
- new and existing ships
- guidance on the best practices for fuel efficient ship operation, (MEPC.1/Circ.684).
- improved voyage planning or more frequent propeller cleaning, or introduction of technical measures such as waste heat recovery systems or a new propeller.

New regulation 22A added to chapter 4 of MARPOL Annex VI

- Ships of 5,000 gross tonnage and above will be required to submit to their Administration annual reports on fuel oil consumption and transport work parameters, via a methodology included in the SEEMP
- Administrations to submit aggregated data to IMO, which will maintain an anonymised IMO Ship Fuel Oil Consumption Database
- Regulation 22A is expected to enter into force on 1 March 2018, with first data "calendar year" beginning 1 January 2019

New appendix IX - Information to be submitted to IMO Ship Fuel Oil Consumption Database

- IMO number
- Period of calendar year covered
- Technical characteristics of the ship - Ship type - Gross tonnage (GT) - Net tonnage (NT) - Deadweight tonnage (DWT) - Power output (rated power) of main and auxiliary engines (kW)
- EEDI (if applicable)
- Ice class
- Fuel oil consumption, by fuel oil type, in metric tonnes and methods used for collecting fuel oil consumption data
- Distance travelled (over ground), hours underway

Data collection system for fuel oil consumption of ships

Key references:

MEPC.278(70) Amendments to MARPOL Annex VI - Regulation 22A Collection and reporting of ship fuel oil consumption data -Appendix IX Information to be submitted to the IMO Ship Fuel Oil Consumption Database

MEPC.282(70) 2017 SEEMP Guidelines - PART II : Ship Fuel Oil Consumption Data Collection Plan

Any questions?

Thank you!

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