Introduction to MARPOL Annex VI

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IMO

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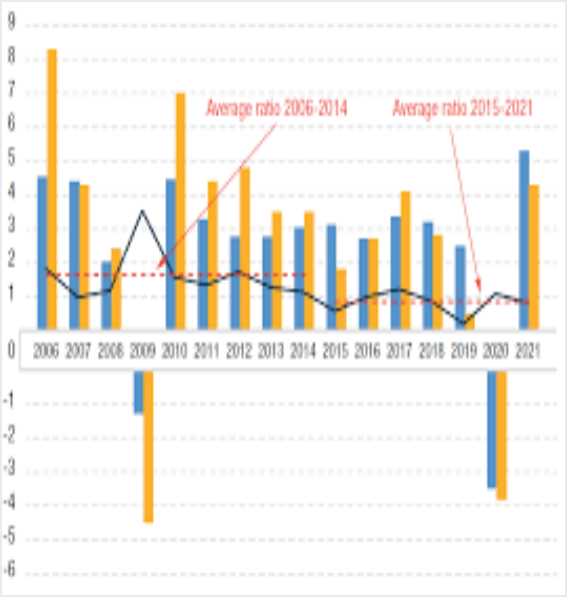
Introduction to MARPOL Annex VI

- **Overview of MARPOL Annex VI:**
  - **Shipping is essential, but regulation is needed**
  - **Introduction to IMO, its structure and decision-making process**
  - **Role and responsibilities of Administrations**
  - **IMO's Integrated Technical Cooperation Programme (ITCP)**
- **MARPOL Annex VI SO_x and PM regulations**
  - **MARPOL Annex VI sulphur regulations, "IMO 2020" and ECAs**
  - **Consistent implementation of the 0.50% sulphur limit**
- **Summary of the recent discussions at MEPC on the sulphur limit, EGCSs and ECAs**

Shipping is essential to the world, but regulation is needed

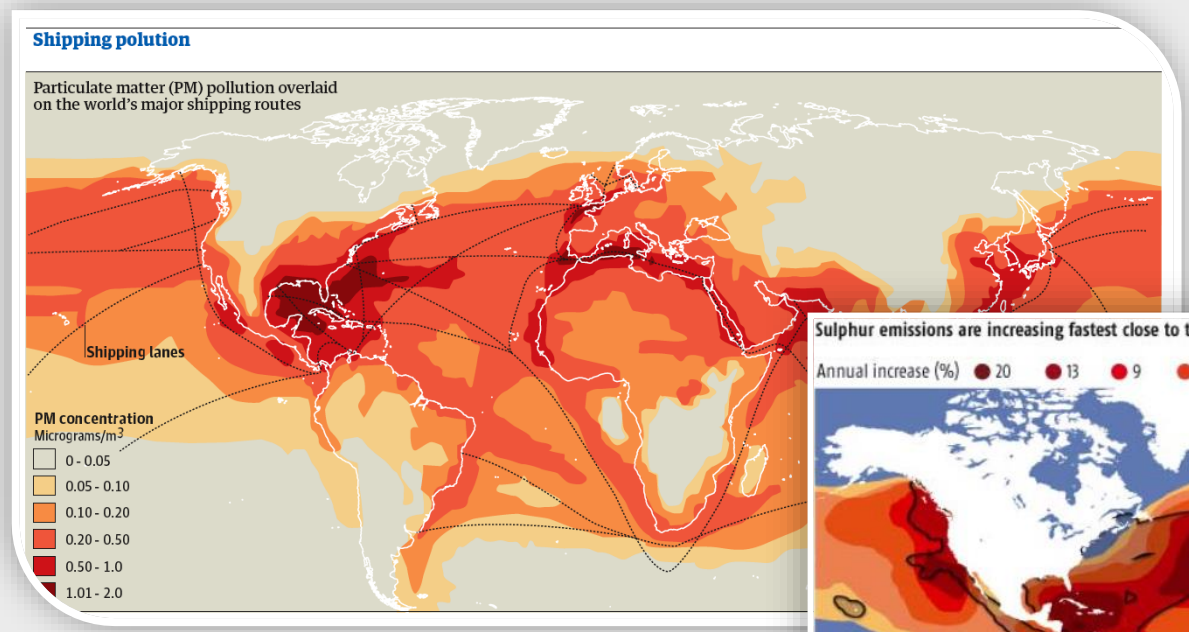
Shipping is essential to the world

- **Over 80% of global trade by volume and more than 70% of its value are carried on board ships**
- **10.65 billion tons transported by ships in 2020**
- World seaborne trade projected to **grow annually by 2.4% between 2022 and 2026,** compared to 2.9% over the last two decades
- UNCTAD identifies **uncertainties** derived from geopolitics, trade tensions, and shifts in globalization patterns (more regionalization)
- Impact of the recession due to **Covid-19** on global trade. In 2020, global trade volumes contracted by 3.8%
- Maritime trade rebounded quicker than expected due to large stimulus packages, increased consumer spending and the fact that unlike the global financial crisis of 2009, the downturn was not synchronized across the world

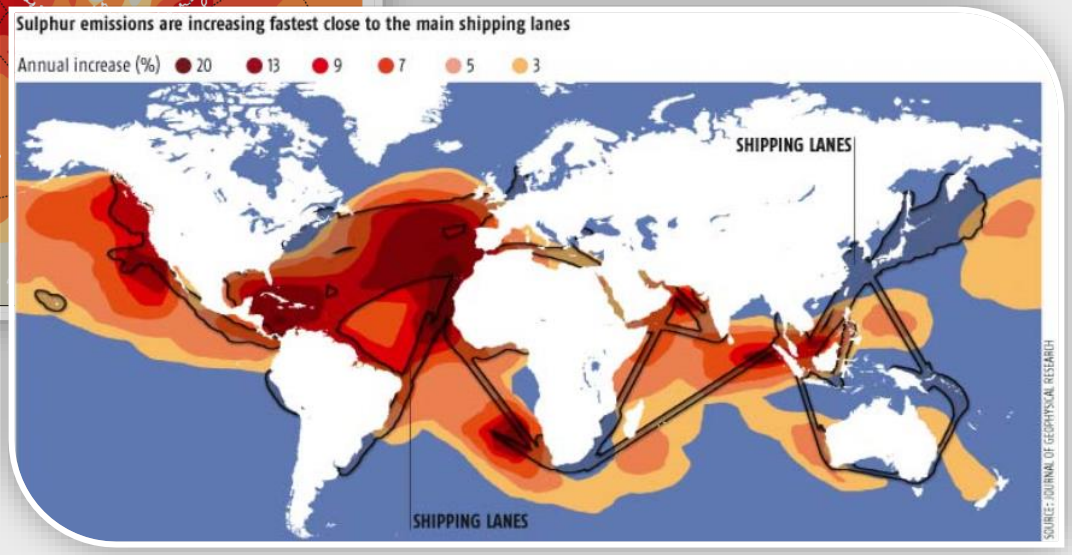


Source: *Review of maritime transport 2021* – UNCTAD, November 2021

Why regulate shipping emissions?



- Impact on human health
- Impact on the environment (e.g. acid rain)
- Impact on the ozone layer
- Climate change



Annual average contribution of shipping to $PM_{2.5}$ concentrations (micrograms/m^3)

Concentration increases from ships range up to 2 µg per cubic meter (µg/m3) and occur primarily over oceans and coastal regions.

Overall consequences and solutions

Significant consequences

- Climate change / damage to environment and eco-system
- Damage to agriculture and properties
- Damage to human health
- Additional cost to society and individuals (healthcare, accidents, etc.) – External costs

Types of solutions (mitigation aspects)

- Reduce air emissions (Technical and Operational Measures);
- Pay for associated costs (Market Based Measures (MBMs));
- A combination of the above two

Mechanisms

- Regulations (e.g. air pollution requirements, carbon content of fuels, etc.)
- Market and economics (MBM such as emission trading system)

Introduction to IMO, its structure and decision-making process

The International Maritime Organization (IMO)

Shipping = international activity => need to be governed by common international standards and not conflicting/varying individual national standards

IMO = specialized agency of the UN

- IMO Convention was adopted in 1948
- In 2022: 175 Member States + 3 associated members
- 85 NGOs with consultative status, 66 IGOs with observer status

"Safe, secure and efficient shipping on cleaner oceans"

- IMO develops and maintains a comprehensive regulatory framework for shipping
- IMO addresses safety, environmental, legal matters, technical co-operation, security and the efficiency of shipping
- IMO developed and adopted more than 50 mandatory instruments and over 1,000 rules and guidelines

IMO Convention

IMO Convention, article 1(a)

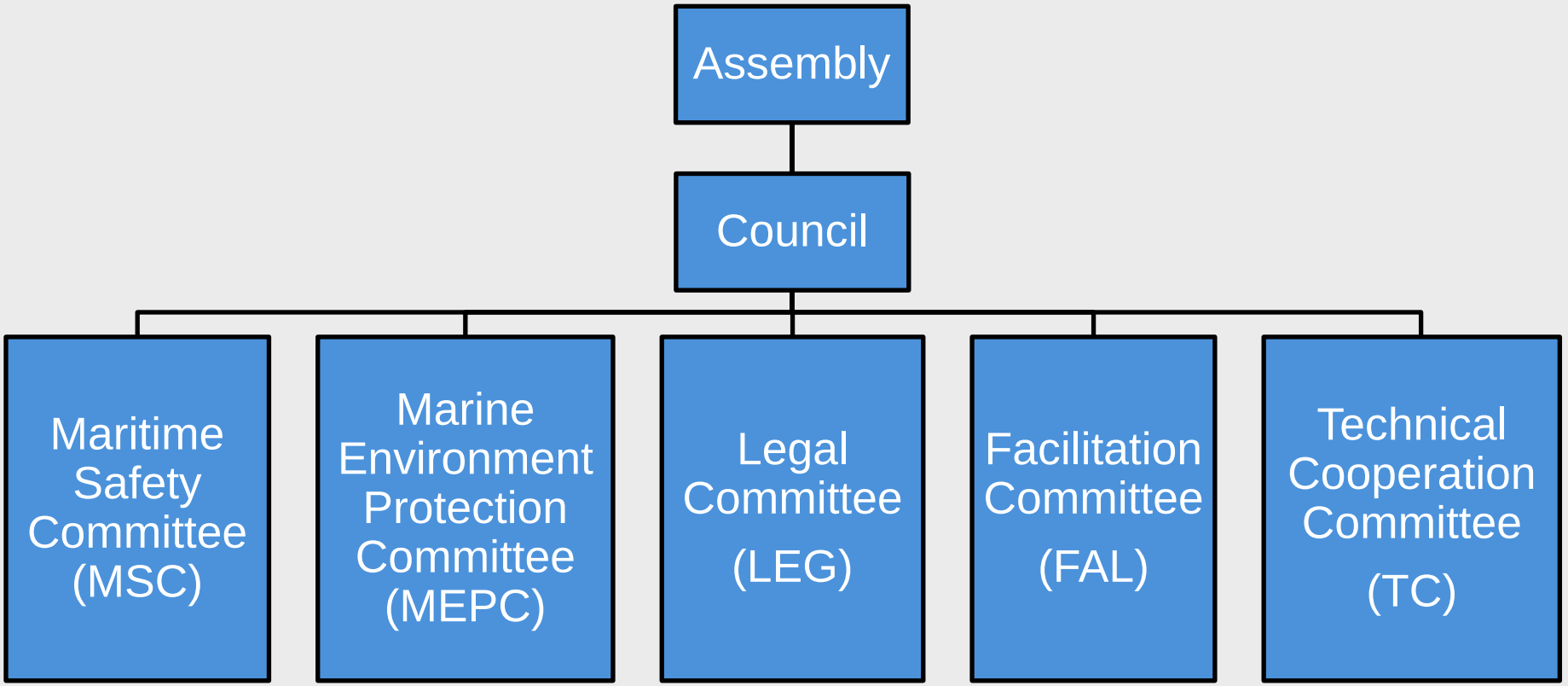
The purposes of the Organization are:

- To provide **machinery for cooperation among Governments in the field of governmental regulation** and practices relating to technical matters of all kinds affecting shipping engaged in international trade;

- to **encourage and facilitate the general adoption of the highest practicable standards** in matters concerning the maritime safety, **efficiency of navigation and prevention and control of marine pollution from ships**; […].

- Functioning of IMO relies on **contributions** made by all Member States (e.g. proposals, information, technical papers, reports, etc.) and their **participation** in the meetings (approximately 30 weeks of sessions per year)
- Best efforts are made to reach decisions by consensus

The structure of IMO



Sub-Committees: HTW, III, NCSR, PPR, SDC, SSE, CCC
(PPR = Pollution Prevention and Response)
Intersessional Working Groups (ex: ESPH, GHG, etc.)

The structure of IMO

Assembly

- Highest Governing Body of the Organization
- Consists of all 175 Member States
- Meets once every two years in regular sessions (32nd session was in December 2021, next session planned in December 2023)
- Responsible for approving work programme and determining financial arrangements
- Elects the Council members

Council

Consists of 40 Member States in 3 categories which serve a term of 2 years

- Set to expand to 52 Member States upon entry into force of amendments to the Convention which were adopted in December 2021
- Executive Organ of IMO. Responsible, under the Assembly, for supervising IMO's work
- Coordinates activities of the IMO organs
- Considers IMO draft work programme and budget estimates (submits them to Assembly)
- Receives reports/ proposals of Committees and submits to Assembly with comments and recommendations as appropriate
- Appoints Secretary-General, subject to approval of Assembly

Set-up

IMO also welcomes participation of:

- Representatives from UN and its specialized agencies (e.g. ILO, WTO, UNFCCC,…)
- Observers from inter-governmental organizations (e.g. IHO, EC,…)
- Observers from non-governmental organizations in consultative status (e.g. ISO, IACS, ICS, etc.)

How is IMO funded?

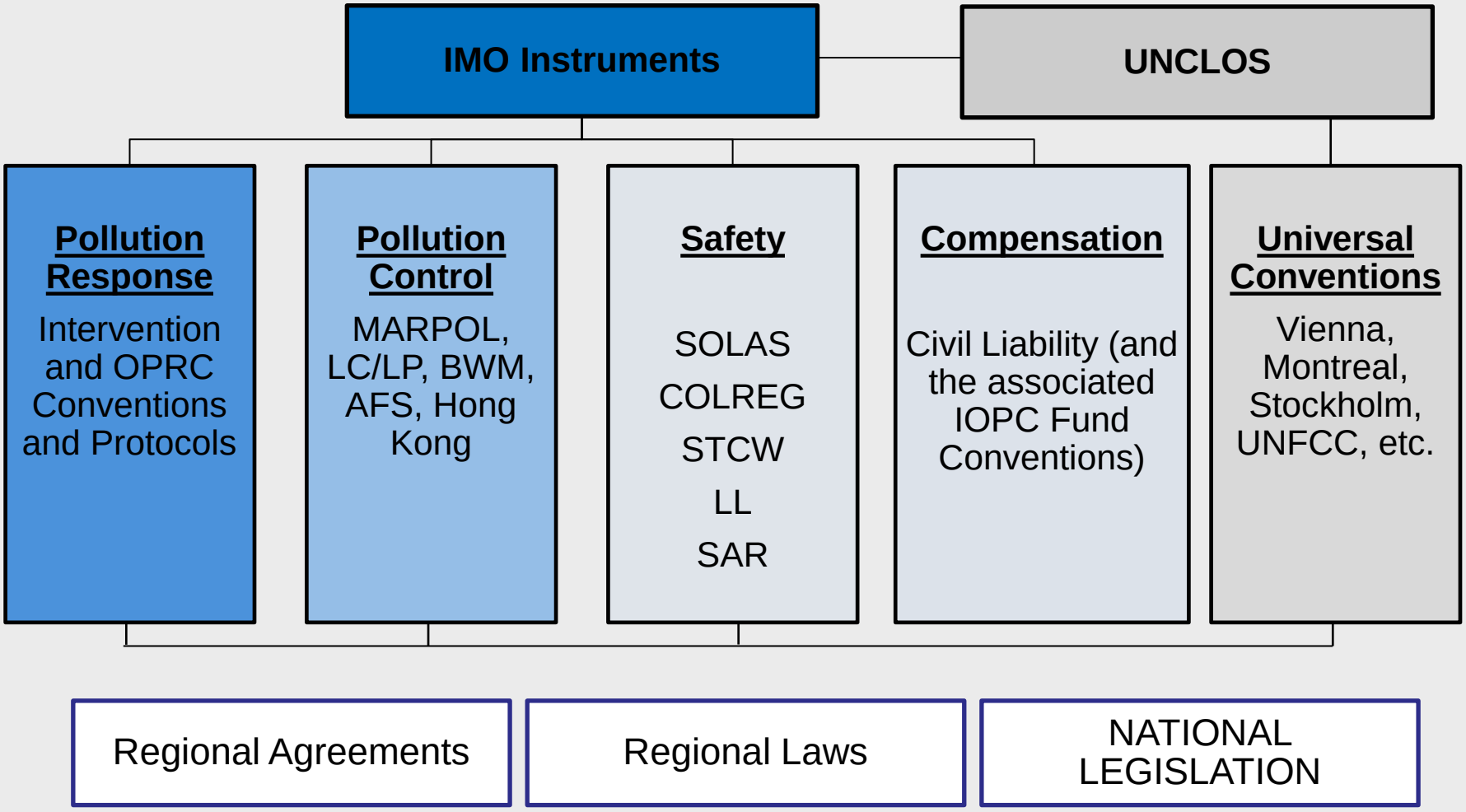
- **Membership charges** (Member States pay charges based inter alia on registered tonnage)

  ⇒ Top three contributors for 2020: Panama, Liberia and Marshall Islands

  ⇒ Voting rights are not linked to the level of financial contribution

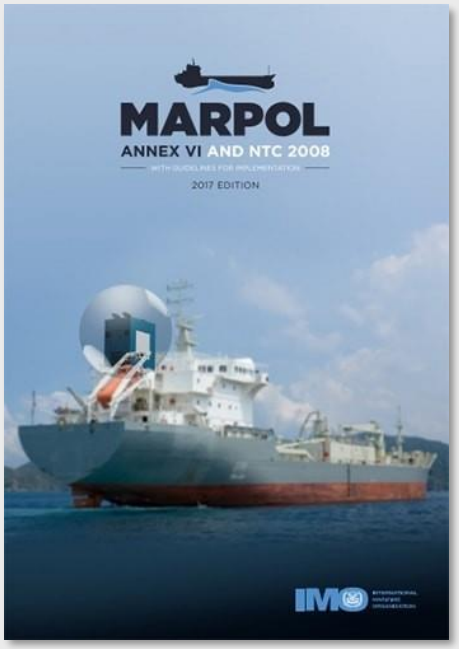
- **Voluntary contributions** from Member States, governmental agencies, intergovernmental bodies (EU, etc.) and other public, private and non-governmental sources (IPIECA, etc.)
- Some projects are funded by **UN** or its specialized agencies (e.g. GEF, UNDP)
- For most technical assistance programs, **countries** provide donations (ITCP, trust funds, etc.)
- **Commercial activities** (including publications, catering and conference services)

Legislative map



Role and responsibilities of Administrations

Ratification of MARPOL Annex VI



- Air Pollution Conference 1997 adopted the Protocol of 1997 to amend the MARPOL Convention, adding a new Annex VI entitled “Regulations for the Prevention of Air Pollution from Ships”
- Protocol of 1997 entered into force on 19 May 2005.
- Number of Contracting States: 104 (as of 26 July 2022)
- The combined merchant fleets of which constitute approximately 96.81 % of the gross tonnage of the world’s merchant fleet
- Accession to MARPOL Annex VI via ratification of the Protocol of 1997.
- Entry into force in the Country 3 months after the date of deposit of the instrument of ratification

MARPOL Annex VI historical evolution

MARPOL Annex VI

- 1997 Protocol adopted 26 September 1997
- Entered into force 19 May 2005

Revisions to Annex VI (NOx Technical Code)

- Adopted October 2008
- Entered into force 1 July 2010

Chapter 4 on Energy Efficiency

- Adopted 15 July 2011
- Entered into force 1 January 2013

2021 Revised MARPOL Annex VI

- Adopted 17 June 2021
- Entry into force: 1 November 2022

Changes to regulations or guidelines take place in almost all MEPC meetings

Why become a Party to MARPOL Annex VI?

- Governments may wish to become Parties to MARPOL Annex VI as result of:
  - Marine environmental concerns for waters under their jurisdiction
  - Air quality concerns as they affect populations or land areas under their jurisdiction
  - Concern for worldwide environment and climate change
  - Benefits to their shipowners (worldwide acceptance of ships)
  - Benefits to the competitiveness of the national naval and maritime industries
  - Benefits to their ports (means to control pollution)
- Parties to MARPOL have the **obligation** not to discharge harmful substances into the sea or to control the discharge of pollutants to the atmosphere
- But they in return have the **privilege** of not being polluted by other Parties (if they are, and the pollution occurs within their territorial waters, they can prosecute)

Parties obligations

- A Party will need to implement a range of monitoring, compliance and enforcement mechanisms to give force and effect to the Convention

MARPOL, article 1(1)
"Parties shall undertake to give effect to the provisions of the present Convention and those Annexes thereto by which they are bound, in order to prevent the pollution of the marine environment by the discharge of harmful substances or effluents containing such substances in contravention of the Convention"

- Compliance with the Convention should primarily focus on preventing pollution, and not simply on apprehending and punishing violators
- The extent to which education, incentives, monitoring and policing programmes are used by a State to ensure compliance with MARPOL depends upon the type of jurisdiction that the State enjoys over a ship
- Subject to mandatory audit under the IMO Instruments Implementation Code (III Code)

Compliance strategy

- Variety of strategies for ensuring compliance:
  - Compliance monitoring through routine **flag inspections or surveys**, using inter alia:
    - the *Survey guidelines under the Harmonized System of Survey and Classification (HSSC), 2021* (resolution A.1156(32))
    - the *Code for Recognized Organizations (RO Code)* (resolution MEPC.237(65)
  - **Port state inspections**, using the *Procedures for Port State Control 2021* (resolution A.1155(32))
  - Detection and policing **patrols**
  - **Reporting procedures and incentives**, including incentives for self-reporting
  - Adequate **investigations** of violations reported or otherwise detected
  - A system of adequate **sanctions** in respect of violations
  - **Education and public awareness** programmes
  - **Cooperation and coordination** with other Parties (e.g. through PSC MoU)

Non-Parties

- Non-Party: does not accept the obligations to place restrictions upon its ships and, therefore, its ships cannot be prosecuted for failing to comply
- Except in territorial waters of a Party:

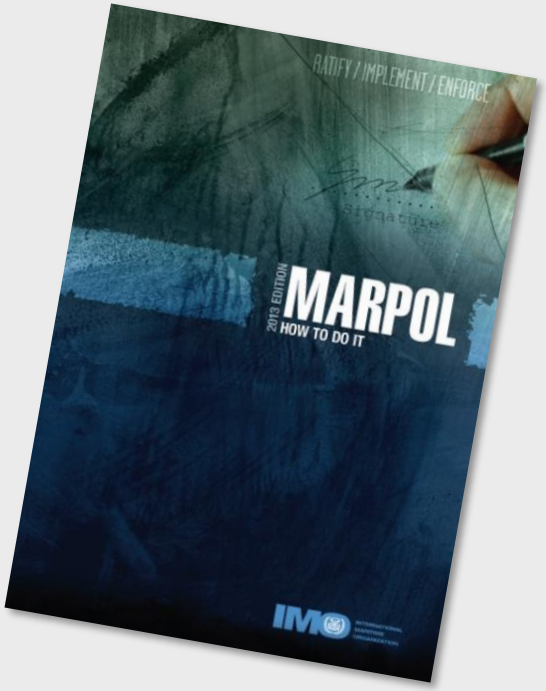
MARPOL, article 5(4)
"With respect to the ship of non-Parties to the Convention, Parties shall apply the requirements of the present Convention as may be necessary to ensure that **no more favourable treatment** is given to such ships."

=> No more favourable treatment ("NMFT principle"): Parties may apply the provisions of the Conventions to Parties' ships as well as non-Parties' ships

- When the shore of a non-Party is polluted or its air quality is affected => it has no privilege under MARPOL to insist upon prosecution of the ship concerned

Means of participation

- Accession to MARPOL and its implementation require the participation of some or all of the following:
  - Government of the State (political body having power to conclude international agreements), including Maritime/Transport/Environment Administration, Legal Administration, etc.
  - Specialized national technical agencies
  - Local authorities, if relevant
  - Port authorities
  - Shipowners
  - Public participation?
- Each sector should know exactly what are its institutional rights and obligations, responsibilities, and the requirements to be imposed on ships and ports



IMO's Integrated Technical Cooperation Programme (ITCP)

IMO's Integrated Technical Cooperation Programme (ITCP)

What is IMO's ITCP?

- Designed to **assist developing countries** improve their ability to comply with international rules and standards relating to maritime safety the protection of the environment.
- Gives priority to **technical assistance programmes** that focus on human resources, development and institutional capacity-building
- Activities mostly delivered by the **IMO Secretariat** and **regional outreach mechanisms**, such as REMPEC or MTCCs, which coordinate and manage regional technical assistance programmes.
- IMO's ITCP can easily respond to specific (emerging) issues; such as: controlling shipping atmospheric emissions, reducing marine plastic litter from ships, promoting energy efficient port operations, etc.

Priorities for IMO's ITCP

- Support countries with ratification and implementation of IMO's environmental instruments
- Can be implemented in a short-term timeframe, thereby responding to emerging issues and high-level political concerns
- Special attention is given to the particular needs of Africa, Small Island Developing States (SIDS) and Least Developed Countries (LDCs)
- Support Member States in addressing MARPOL-related findings of IMSAS-audits
- Support initiatives of other UN organizations/agencies, notably to further strengthen implementation of the United Nations SDGs

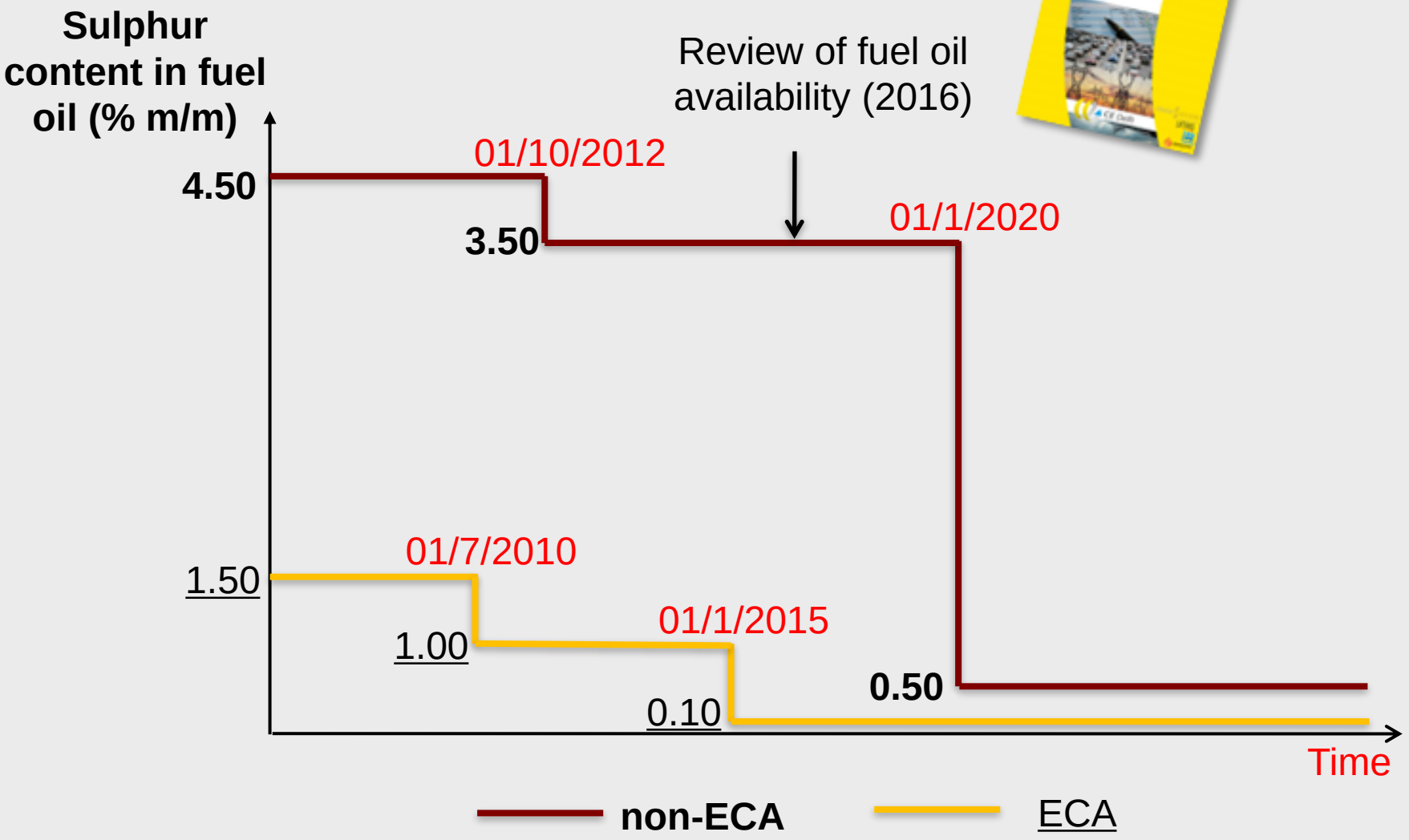
MARPOL Annex VI sulphur regulations, "IMO 2020" and ECAs

How is SO_x produced and what is its impact?

- SO_x is normally Sulphur dioxide (SO_2) and to some extent Sulphur trioxide (SO_3)
- SO_x is produced from combustion (oxidation) of sulphur contained in most fuel-oil
- **SO_x causes**:
  - acid rain
  - sea and soil acidification
  - human health issues
    - A study on the human health impacts of SO_x emissions from ships, submitted to MEPC by Finland in 2016 estimated that by not reducing the SO_x limit for ships from 2020, the air pollution from ships would contribute to more than 570,000 additional premature deaths worldwide between 2020-2025.
- PM (Particulate Matter) is produced due to incomplete combustion of fuel.
- Level of PM is dependent on fuel sulphur level.

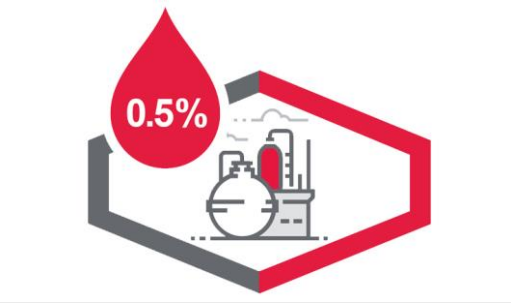
=> **reduction of fuel sulphur will reduce SO_x but also PM**

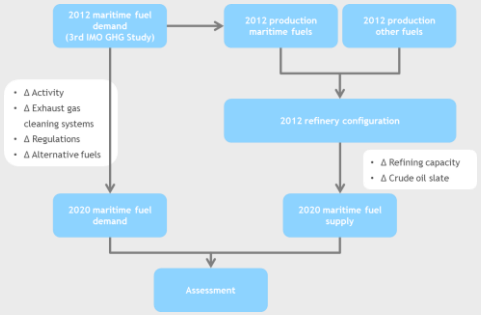
A historical step



2020 Sulphur limit (Regulation 14.1 of MARPOL Annex VI) – overview

- The 0.50% m/m sulphur limit was included in the 2008 amendments to MARPOL Annex VI, along with a review clause.
- MEPC 70 (October 2016) considered and approved a report on “Assessment of Fuel Oil Availability” (documents MEPC 70/5/3 and MEPC 70/INF.6)
  - “In all scenarios, the supply of marine fuels with a sulphur content of 0.50% m/m or less and with a sulphur content of 0.10% m/m or less is projected to meet demand for these products.”
- Following this review, MEPC 70 decided to retain the **1 January 2020 as the date of implementation for the 0.50% m/m sulphur limit** for fuel oil used onboard ships (operating outside ECAs)





2020 Sulphur limit (Regulation 14.1 of MARPOL Annex VI) - overview

- **“Carriage ban” on non-compliant fuel oil** adopted at MEPC 73.

Regulation 14.1 entered into force on 1 March 2020
“The sulphur content of fuel oil used or carried for use on board a ship shall not exceed 0.50% m/m”

- This regulation applies to **all ships**, unless the ship has an equivalent compliance method as per regulation 4.1 (e. g. is fitted with and Exhaust Gas Cleaning System) or is delivered an exemption by the Administration to conduct trials for the development of ship emission reduction and control technologies and engine design programmes, as per regulation 3.2.
- The carriage ban is not applicable to fuel oil carried as cargo

Sulphur ECAs designated under MARPOL Annex VI (Regulation 14.3)

- Emission control areas (ECA) are where the adoption of special mandatory measures for emissions from ships is required to prevent, reduce and control air pollution from NO_x, SO_x and/or particulate matter; while a ship is operating within an SO_x ECA, the sulphur content of fuel oil used on board that ship shall not exceed 0.10%.
- Sulphur ECAs are under regulations 14.3 to 14.7 of MARPOL Annex VI.
- Emissions Control Areas (ECA) limiting the sulphur content to 0.1% are:
  - Baltic Sea ECA (for NO_x and SO_x)
  - North Sea ECA (for NO_x and SO_x)
  - North American ECA (for NO_x and SO_x)
  - United States Caribbean Sea ECA (for NO_x and SO_x)
  - Mediterranean Sea (for SO_x) **enters into effect from 1 May 2025**
- Following consideration, MEPC 81 (March 2024) approved proposals for designating ECAs for the Canadian Arctic waters and the Norwegian Sea and invited submissions to a future session (MEPC 81/16, paragraph 11.13).
- MEPC 80 also noted ongoing work for proposing for the designation of an ECA in the North-East Atlantic Ocean, document MEPC 80/INF.35 (Austria et al.). There are also national regulations, which are not under MARPOL Annex VI for limiting SO_x; these include domestic regulations in the European Union, Turkey Iceland, California, Sydney and South Korea, which limit the sulphur content in fuels.

Consistent implementation of the 0.50% sulphur limit

Issues related to the consistent implementation of the 0.50% sulphur limit

How to encourage ships and companies to be ready on time?

What to do in case of compliant fuel oil non-availability?

Which impact on fuel and machinery systems could result from the change of fuel?

How to keep consistency between the relevant ISO standards on marine fuels?

Which verification and control mechanisms?

Which safety implications?

=> Lot of work undertaken and achieved these past years!

Regulatory amendments adopted by MEPC 75 (April 2020), entered into force on 1 April 2022 (Resolution MEPC.324(75))

- Draft **definitions** prepared as amendments to regulation 2 of MARPOL Annex VI: (regulation numbers were changed in 2021 MARPOL)

  2.1.30 : Sulphur content of fuel oil = the concentration of sulphur in a fuel oil, measured in % m/m as tested in accordance with a standard acceptable to the Organization (refers to ISO 8754 in footnote);

  2.1.20 : Low-flashpoint fuel = gaseous or liquid fuel oil having a flashpoint lower than otherwise permitted under paragraph 2.1.1 of SOLAS regulation II-2;

  2.1.22 : MARPOL delivered sample = the sample of fuel oil delivered in accordance with regulation 18.8.1 of MARPOL Annex VI;

  2.1.16 : In-use sample = the sample of fuel oil in use on a ship; and

  2.1.24 : On board sample = the sample of fuel oil intended to be used or carried for use on board that ship.

- Amendments related to **verification procedure for a fuel oil sample**:
  - regulation 14, on in-use and on board fuel oil sampling and testing and on designation and utilization of oil sampling point by a competent authority of a Party.
  - regulation 18.8.2 and appendix VI, on fuel oil sampling procedure by Parties

2019 Guidelines for consistent implementation of 0.50% sulphur limit under MARPOL Annex VI (resolution MEPC.320(74))

Guidelines intended for use by Administrations, port States, shipowners, shipbuilders and fuel oil suppliers. Main content:

1. **Definitions** (DM, RM, ULSFO, VLSFO, HSHFO)
2. **Ship implementation planning** for 2020 (cf: MEPC.1/Circ.878)
3. **Impact on fuel and machinery systems**: distillate fuels (including distillate fuel with FAME) / Residual fuels / Key technical considerations for shipowners and operators / ISO Standard for residual fuels / Cylinder lubrication
4. **Verification issues and control mechanism and actions**: Survey and certification by Administrations / Control measures by port States / Control on fuel oil suppliers / Information sharing related to non-compliances under MARPOL Annex VI
5. **Fuel oil non-availability**: Guidance and information sharing on fuel oil non-availability / Standard format for reporting fuel oil non-availability (FONAR) – Appendix 1
6. **Possible safety implications** relating to fuel oils meeting the 0.50% m/m sulphur limit – Appendix 2

Potential safety implications of 0.50% compliant fuel oil

- The *2019 Guidelines on consistent implementation of the 0.50% sulphur limit under MARPOL Annex VI* (resolution MEPC.320(74)) provide in Appendix 2 a **Technical review of the following potential safety implications**:
  - stability of blended fuel oil;
  - compatibility issues, including new tests and metrics appropriate for future fuels;
  - cold flow properties;
  - acid number;
  - flashpoint;
  - ignition and combustion quality;
  - cat fines;
  - low viscosity; and
  - unusual components.

- MEPC 74 approved, subject to concurrent approval by MSC 101, the **draft MSC-MEPC circular on delivery of compliant fuel oil by suppliers**

SO_x compliance options

- Use **compliant fuel oil** (Regulation 14):
  - Ultra-low Sulphur fuel oil (ULSFO)
  - Marine Gas Oil, Marine Diesel Oil
- Use an **equivalent compliance method** which is at least as effective in terms of emissions reduction (Regulation 4):
  - Exhaust Gas Cleaning Systems (scrubbers)
  - *2021 Guidelines on Exhaust Gas Cleaning Systems* (resolution MEPC.340(77))
- Use **alternative fuels**
  - Liquefied natural gas (LNG)
  - Others (methanol, biofuels, etc.)
- At berth: use **Onshore Power Supply**

Status of IMO 2020 on 1 May 2022: a successful implementation

- Globally **wide availability of compliant fuel oil**. Only 61 Fuel-oil non availability reports (FONARs) submitted
- **Few non-compliance cases** reported (Singapore: only 2 cases of serious non-compliance by end of March 2020)
- Collapse of **oil prices** supports implementation of IMO2020 – business case for EGCS less attractive
- **COVID-19 impacts**: reduced number of PSC sulphur inspections and delays in installations of EGCS (currently ≈ 2600 installed)

Singapore Found Just Two Cases of IMO 2020 Non-Compliance in First Quarter

by Ship & Bunker News Team
Monday April 27, 2020

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Singapore's authorities found just two ships in what they considered to be non-compliance with the **International Maritime Organization**'s new 0.50% sulfur limit for bunker fuels in the first quarter, according to the country's **Maritime and Ports Administration** (MPA).

The two ships "found to be using non-compliant fuel" without a scrubber were detained at the port and only allowed to leave once they had switched to using a compliant fuel, the MPA said in a statement on its website Monday.

Singapore is the world's largest marine fuels hub. File Image / Pixabay

In addition, **12 ships** were found to be "using fuel that marginally exceeded the sulphur limit," the MPA said.

Rotterdam: VLSFO price evolution
January 2020: ≈ 600 $
May 2020: ≈ 200 $

Wallenius Wilhelmsen Cancels Scrubber Installations to Cut Costs

by Ship & Bunker News Team
Monday March 23, 2020

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Ro-ro shipping company **Wallenius Wilhelmsen** has cancelled four scrubber installations as it seeks to cut costs while the COVID-19 pandemic reduces its income.

The company has withdrawn a proposal for a dividend to shareholders for 2019, and is planning to recycle four ships and place up to ten more in cold layup, it said in an emailed statement Monday.

The company says freight demand may be as much as 10% lower in the first quarter. Image Credit: Wallenius Wilhelmsen

INTERNATIONAL MARITIME ORGANIZATION

Use of compliant fuel oil

95% of ships used this compliance option in 2020 => IMO 2020 compliance will initially rely on switching to VLSFO or MGO (sulphur monitoring programme shows that a majority of ships use compliant fuel oil, instead of using EGCS after 2020)

→ **Multi–fuel bunkering**

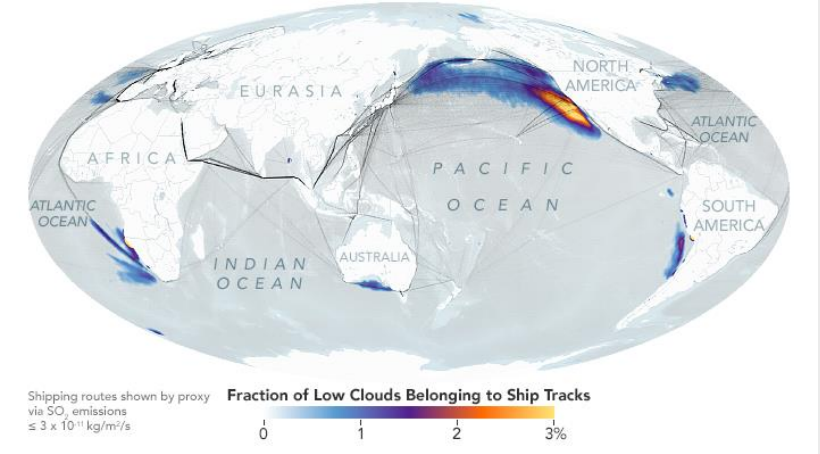
- Fuel system segregation (various tanks as a minimum).
- Segregated cylinder lube oil tanks may be required.
- Fuel change over operation is required prior to entry into an SECA.
- Recording procedures in logbook and monitoring (Reg.14.6).
- More complex system and therefore more rigorous “fuel management”.
- Planning of voyages to ensure correct fuel onboard prior to entering an ECA.
- Cost concerns / availability concerns / fuel quality concerns

Uptake of SO_x scrubbers today

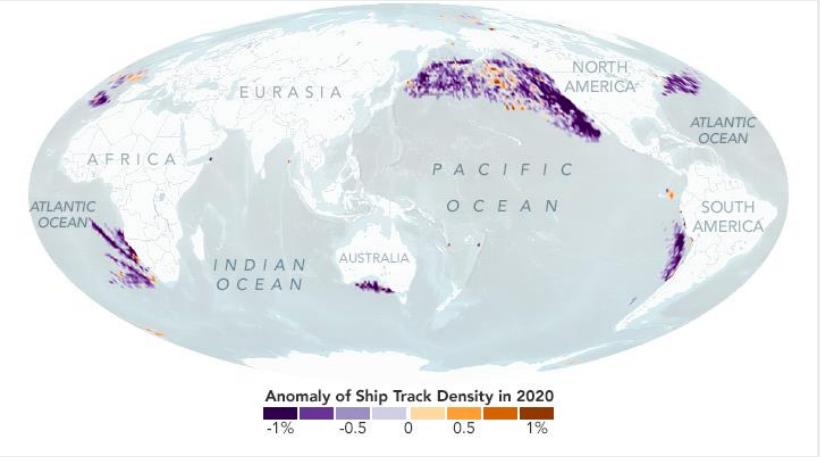
- Some **3,765 ships – about 6% of international ships** – use EGCS as an alternative equivalent means of compliance in 2021 (expect to increase to in the future).
- **Advantages** of scrubbers:
  - allows to continue using 3.5% HFO, on average cheaper than compliant fuel oil (however, spread with LSFO expected to fall in the coming years);
  - payoff periods ranging from 1 to 3 years for a large ship.
- **Disadvantages** of scrubbers:
  - cost (from $3 million to $8 million) and time of installation;
  - additional costs of maintenance (corrosion with sea water,…);
  - closed-loop scrubbers require waste removal / open-loop face bans (see below);
  - using 3.5% HFO gives a comparative advantage which enable ships to go faster and therefore to emit more GHG.

NASA Study finds evidence that fuel regulation reduced Air Pollution from shipping

- Researchers at NASA found that **the global Sulphur limit reduced ship track clouds to record low levels in 2020**.
- Pandemic related disruptions played a secondary role.
- There are now satellites that can track global emissions at a country level, but these satellites do not have a high enough resolution to track individual ships. This was discussed in 2023 with the United Nations Office for Outer Space Affairs.



Ship Tracks from 2003 to 2020, NASA, October 2022



Ship Tracks in 2020, NASA, October 2022

Summary of the recent discussions at MEPC on the sulphur limit, EGCSs and ECAs

Summary of the recent discussions at MEPC on the sulphur limit, EGCSs and ECAs

- From 1 January 2020 the global 0.5% sulphur limit came into force, limiting the sulphur content in fuel oil to 0.5%, unless an Exhaust Gas Cleaning Systems (EGCS) are used.
- Emissions Control Areas (ECA) limiting the sulphur content to 0.1% are as follows:
  - Baltic Sea ECA (for NO_x and SO_x)
  - North Sea ECA (for NO_x and SO_x)
  - North American ECA (for NO_x and SO_x)
  - United States Caribbean Sea ECA (for NO_x and SO_x)
  - Mediterranean Sea (for SO_x) **enters into effect from 1 May 2025**

  There are also proposals for designating ECAs for the Canadian Arctic waters and the Norwegian Sea that are currently being considered by MEPC.
- For EGCS there are the following guidelines:
  - 2021 EGCS Guidelines (MEPC.340(77))
  - EGCS malfunction Guidelines (MEPC.1/Circ.883/Rev.1)
  - Risk assessment Guidelines for EGCS discharge water (MEPC.1/circ.899)
- use of EGCS is increasing, future regulations are more orientated towards CO_2 instead of So_x.
- There are also national/domestic sulphur limits and EGCS regulations.

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