Global Sulphur Cap 2020 Update

IMO 2020 status update

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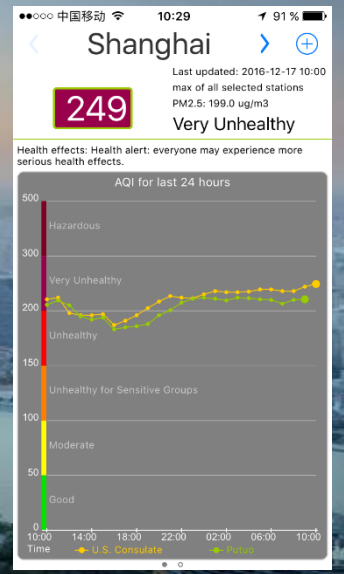
03 September 2019

Motivation: Safe and Sustainable Future

	NOx	SOx	CO_2	PM
Scrubber		👍		👍
SCR	👍			
EGR	👍			
Low sulphur fuels		👍		👍
Low carbon fuels	😐	👍	👍	👍
Energy efficiency	👍	👍	👍	👍

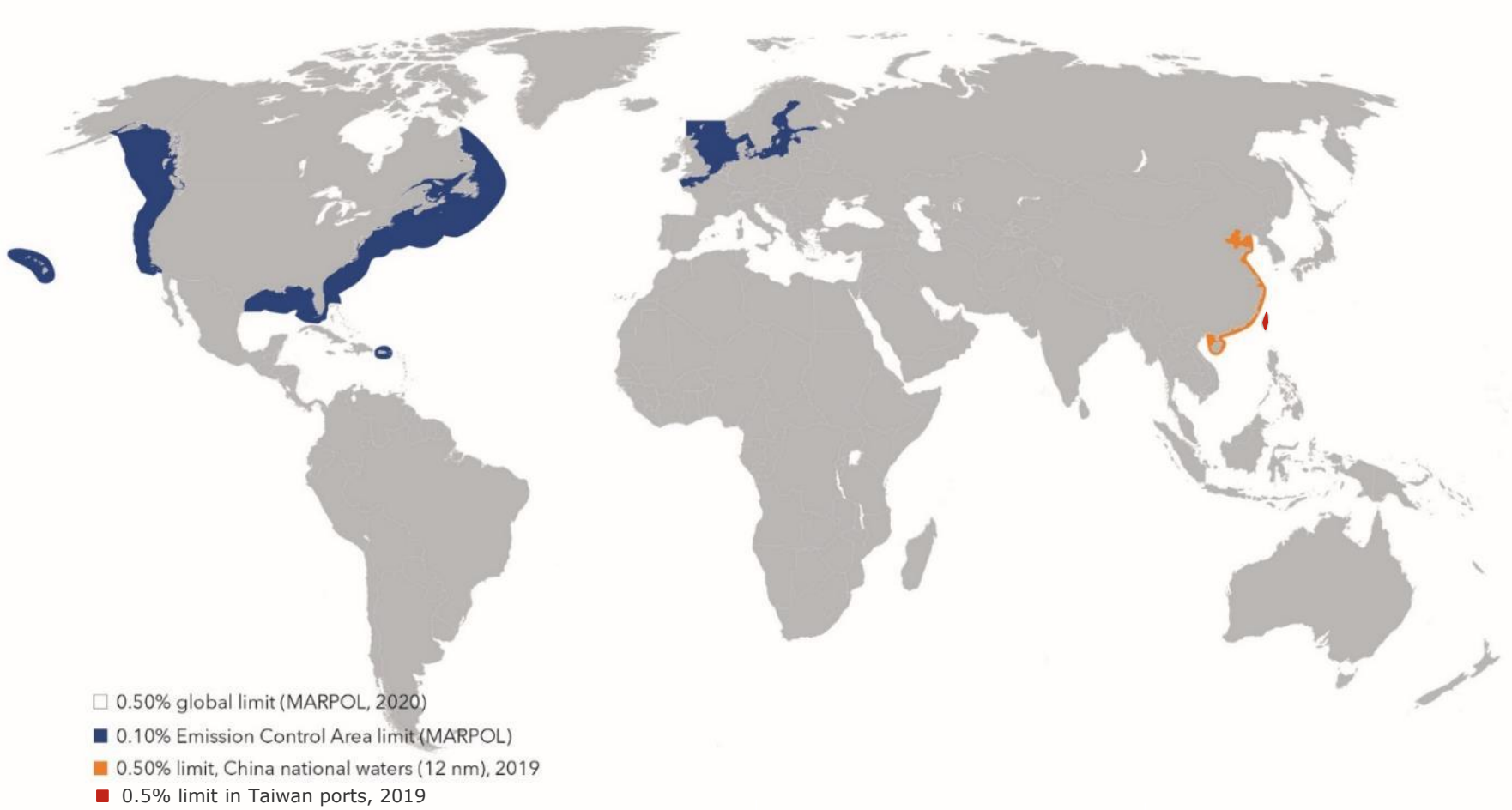


Shanghai: December 17th, 2016: Air Pollution Index (AIP) 250

上海：2016年12月17日 空气污染指数 （AIP）250

Overview & regulatory developments

A paradigm shift in marine fuels is on our door step with the introduction of global sulphur cap of 0.50% Sulphur in 2020



HFO + Scrubber	MGO / MDO	New Compliant Fuels? (0.5%S)	Alternative Fuels

Sulphur content of fuels (used outside ECA)

2020-01-01 (0:00 AM UTC)

2020-03-01 (0:00 AM UTC)

Grace period?

No grace period!

(Reason: IMO adoption procedures)

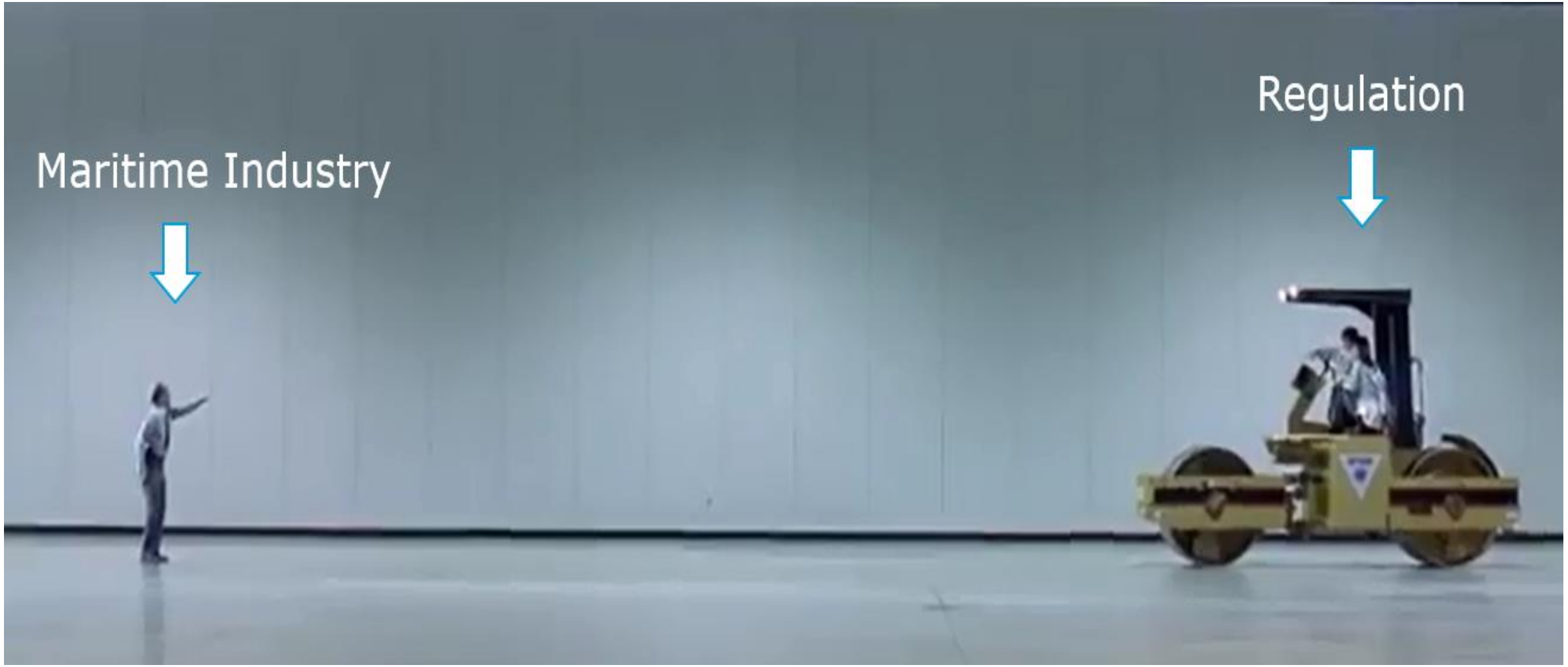
3.5% S

0.50% S

Prohibition of **usage** of <u>any</u> fuel used on board a ship (propulsion <u>and</u> cargo operations) with sulphur content higher than 0.50%

Prohibition of **carriage** of non-compliant fuel oil (in fuel tanks) on ships not fitted with equivalent means of compliance (scrubbers)

How well are we prepared?



How well are we prepared?

Revised MARPOL Annex VI (and the 0.5%S starting from 2020) has been **adopted on 10 October 2008** with a **review** provision only:

Review Provision

8 A review of the standard set forth in subparagraph 1.3 of this regulation shall be completed by 2018 to determine the availability of fuel oil to comply with the fuel oil standard set forth in that paragraph and shall take into account the following elements:

.1 the global market supply and demand for fuel oil to comply with paragraph 1.3 of this regulation that exist at the time that the review is conducted;

.2 an analysis of the trends in fuel oil markets; and

.3 any other relevant issue.

9 The Organization shall establish a group of experts, comprising of representatives with the appropriate expertise in the fuel oil market and appropriate maritime, environmental, scientific, and legal expertise, to conduct the review referred to in paragraph 8 of this regulation. The group of experts shall develop the appropriate information to inform the decision to be taken by the Parties.

10 The Parties, based on the information developed by the group of experts, may decide whether it is possible for ships to comply with the date in paragraph 1.3 of this regulation. If a decision is taken that it is not possible for ships to comply, then the standard in that subparagraph shall become effective on 1 January 2025.

Development

MEPC 68 – May 2015

- Initiated the review of fuel oil availability as required by regulation 14.8.

MEPC 70 – October 2016

- Agreed on **1 January 2020** as the effective date of the implementation.

MEPC 71 – July 2017

- Approved a new output on "Consistent implementation of regulation 14.1.3"

MEPC 72 – April 2018

- Agreed on the **Carriage ban** – prohibiting the carriage of fuel oil with higher sulphur content than 0.50% after **1 March 2020**.

MEPC 73 – October 2018

- Adopted amendments to MARPOL and the IOPP certificate to facilitate the **carriage ban**.

MEPC 74 – May 2019

- Approved amendments to MARPOL, new retroactive requirement for designating, or if necessary fitting, sampling points to facilitate taking *in-use samples*.

IMO Guidelines

Resolution MEPC.320(74)
2019 GUIDELINES FOR CONSISTENT IMPLEMENTATION OF THE 0.50% SULPHUR LIMIT UNDER MARPOL ANNEX VI

- Planning for 2020
- Impact on fuel and machinery
- Verification issues and control mechanisms
- Fuel oil non-availability (FONAR)
- Safety implications

MEPC.1/Circ.878
GUIDANCE ON THE DEVELOPMENT OF A SHIP IMPLEMENTATION PLAN FOR THE CONSISTENT IMPLEMENTATION OF THE 0.50% SULPHUR LIMIT UNDER MARPOL ANNEX VI

- Risk assessment and mitigation plan (impact of new fuels)
- Fuel oil system modifications and tank cleaning (if needed);
- Fuel oil capacity and segregation capability;
- Procurement of compliant fuel;
- Fuel oil changeover plan
- Documentation and reporting

IMO Guidelines

Resolution MEPC.321(74)
2019 GUIDELINES FOR PORT STATE CONTROL UNDER MARPOL ANNEX VI CHAPTER 3

- Discrepancy between the Sulphur content on the bunker delivery note and independent test results of commercial sample
- Exhaust gas cleaning system
- Non-availability of compliant fuel (FONAR)

MEPC.1/Circ.882
GUIDANCE FOR PORT STATE CONTROL ON CONTINGENCY MEASURES FOR ADDRESSING NON-COMPLIANT FUEL OIL

- Actions predetermined in the SIP (if available)
- Discharging non-compliant fuel oil to another ship to be carried as cargo or to an appropriate ship-board or land-based facility, if practicable and available Interim indication of ongoing compliance in the case of sensor failure
- Managing the non-compliant fuel oil in accordance with a method acceptable to the port state
- Operational actions, such as modifying sailing or bunkering schedules and/or retention of non-compliant fuel oil, on board the ship. The port state and the ship should consider any safety issues and avoid possible undue delays.

IMO Guidelines

MEPC.1/Circ.884
GUIDANCE ON INDICATION OF ONGOING COMPLIANCE IN THE CASE OF THE FAILURE OF A SINGLE MONITORING INSTRUMENT, AND RECOMMENDED ACTIONS TO TAKE IF THE EGCS FAILS TO MEET THE PROVISIONS OF THE 2015 EGCS GUIDELINES (MEPC.259(68))

- System malfunction
- Short-term exceedances
- Interim indication of ongoing compliance in the case of sensor failure

MEPC.1/Circ.875
GUIDANCE ON BEST PRACTICE FOR FUEL OIL PURCHASERS/USERS FOR ASSURING THE QUALITY OF FUEL OIL USED ON BOARD SHIPS

MEPC.1/Circ.875/Add.1
GUIDANCE ON BEST PRACTICE FOR FUEL OIL SUPPLIERS FOR ASSURING THE QUALITY OF FUEL OIL DELIVERED TO SHIPS

MEPC.1/Circ.864/Rev.1
2019 GUIDELINES FOR ON BOARD SAMPLING FOR THE VERIFICATION OF THE SULPHUR CONTENT OF THE FUEL OIL USED ON BOARD SHIPS

IMO Guidelines

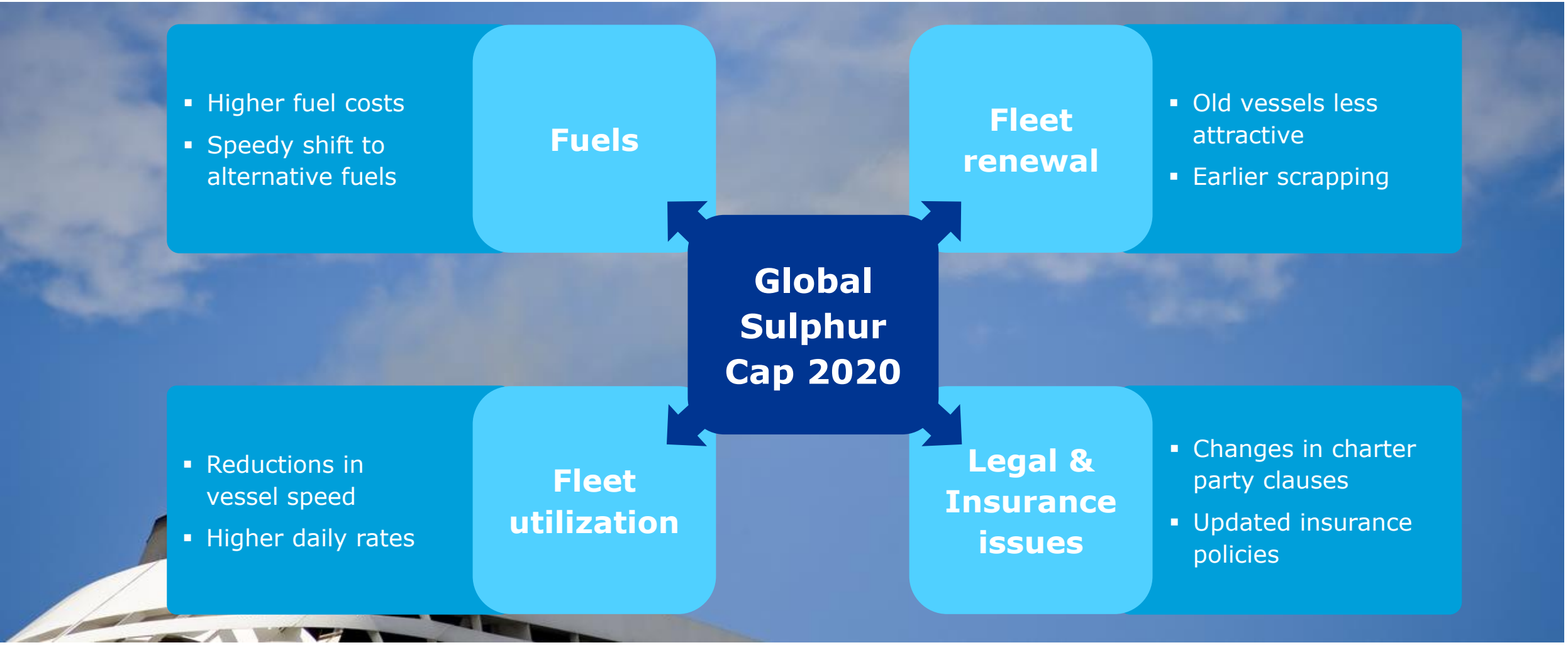
MEPC.1/Circ.795.Rev.4
DRAFT UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI

- Regulation 14.1 of MARPOL Annex VI for the prohibition on carriage of non-compliant fuel oil should be applied to the fuel oil of emergency equipment.

MEPC.1/Circ.883
GUIDANCE FOR BEST PRACTICE FOR MEMBER STATE/COASTAL STATE

MEPC.1/Circ.880
REPORTING OF AVAILABILITY OF COMPLIANT FUEL OILS IN ACCORDANCE WITH REGULATION 18.1 OF MARPOL ANNEX VI

Global Sulphur Cap implications for the entire shipping industry



What are the options?

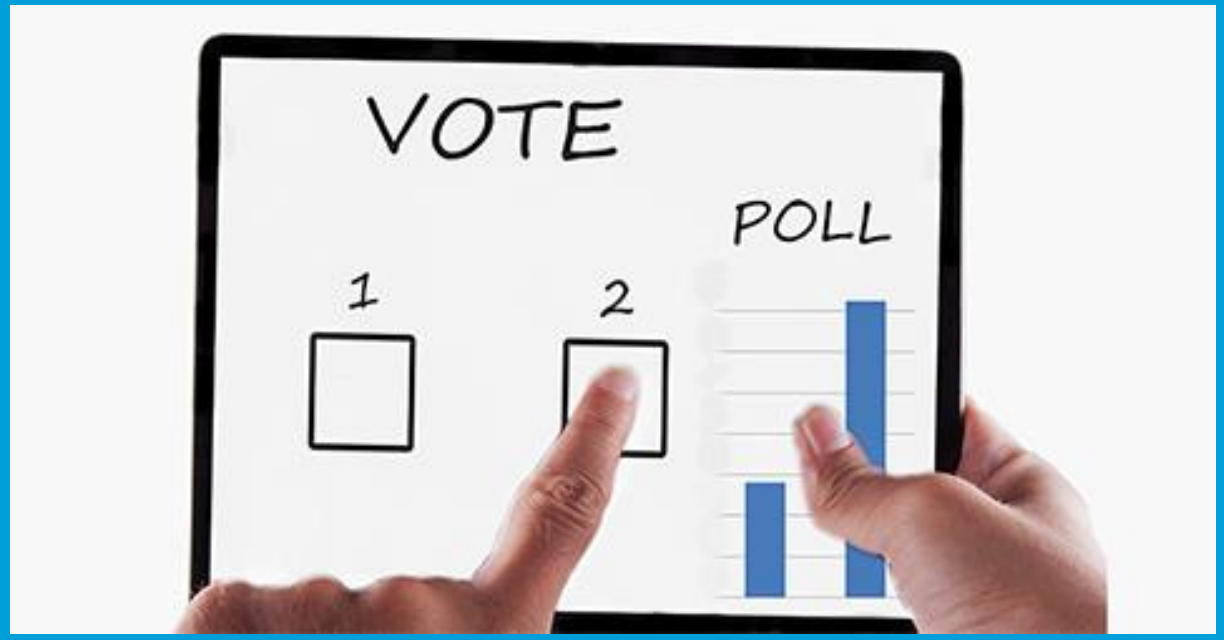
2020-01-01

0.50% S

Compliance options:

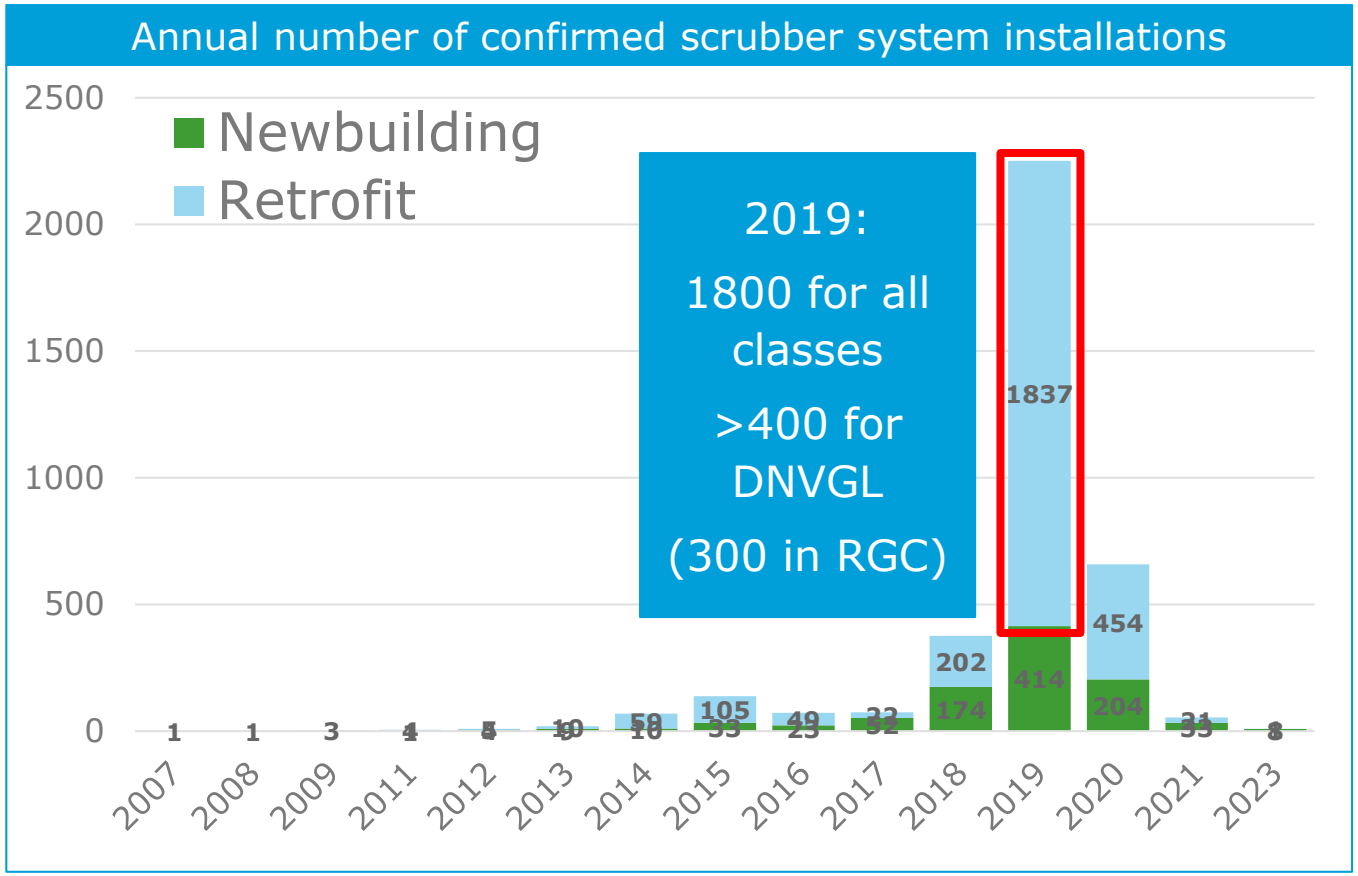
MGO (<0.10% S) **MGO** (0.5% 2020)	**ULSFO** (< 0.10% S) **VLSFO** (0.5% 2020)	**HSFO** +Scrubber	**Alternative Fuels** (LNG, LPG, Methanol, etc)

POLL



Latest update on Scrubbers

Market Volume:
Confirmed orders (all classes): Data from AFI Portal

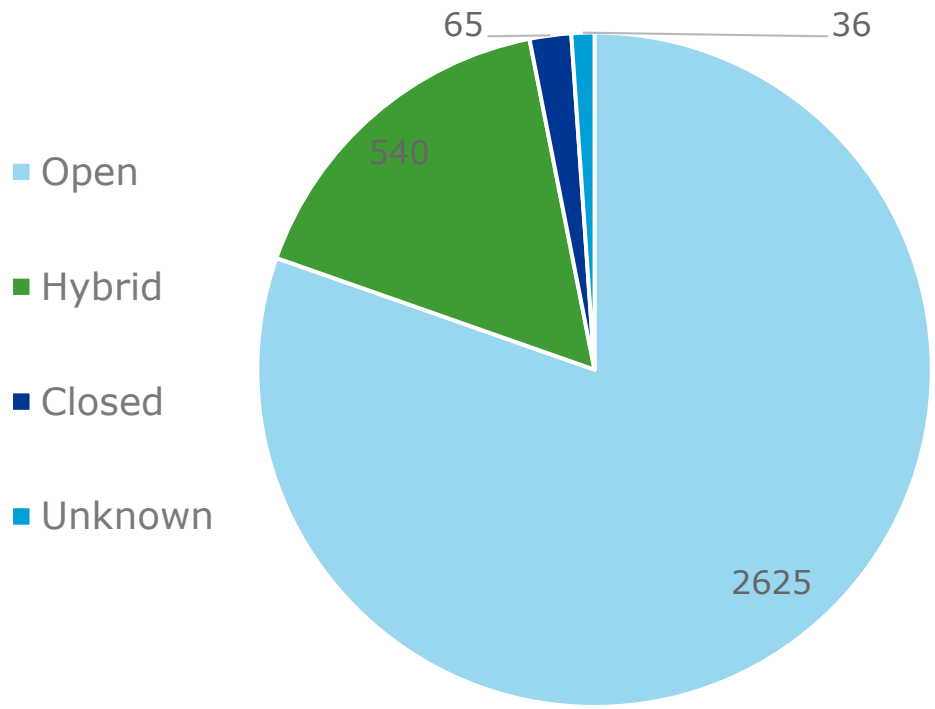


- Predictions estimate max. 4000 installations totally (all classes)
- The "scrubber wave" is now on, with 1800 confirmed retrofit installation in 2019 only (all classes)
- Due to lack of material (stainless steel, GRE piping) the peak of installations is delayed and shifted towards the end of 2019 / beginning of 2020

*"on an average **5 confirmed scrubber conversions per day** for all classes"* in 2019

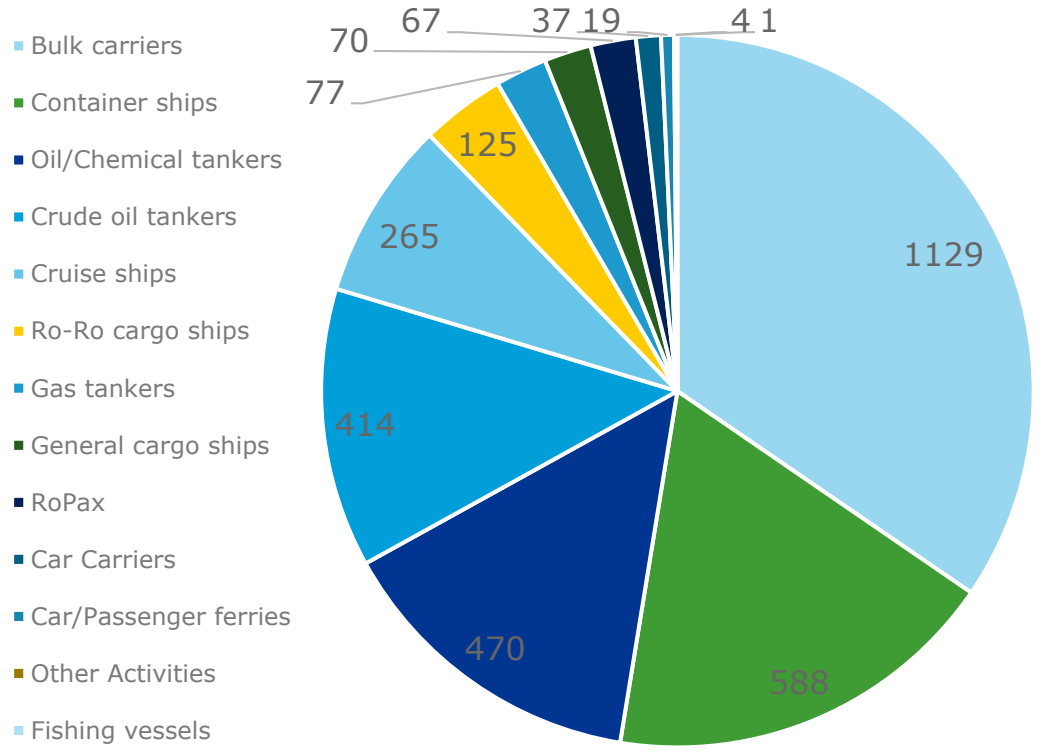
Majority of installations are of Open type, Bulk carriers leading segment

Scrubber Type



- Despite current washwater discussion majority of installations are Open type

Segment distribution

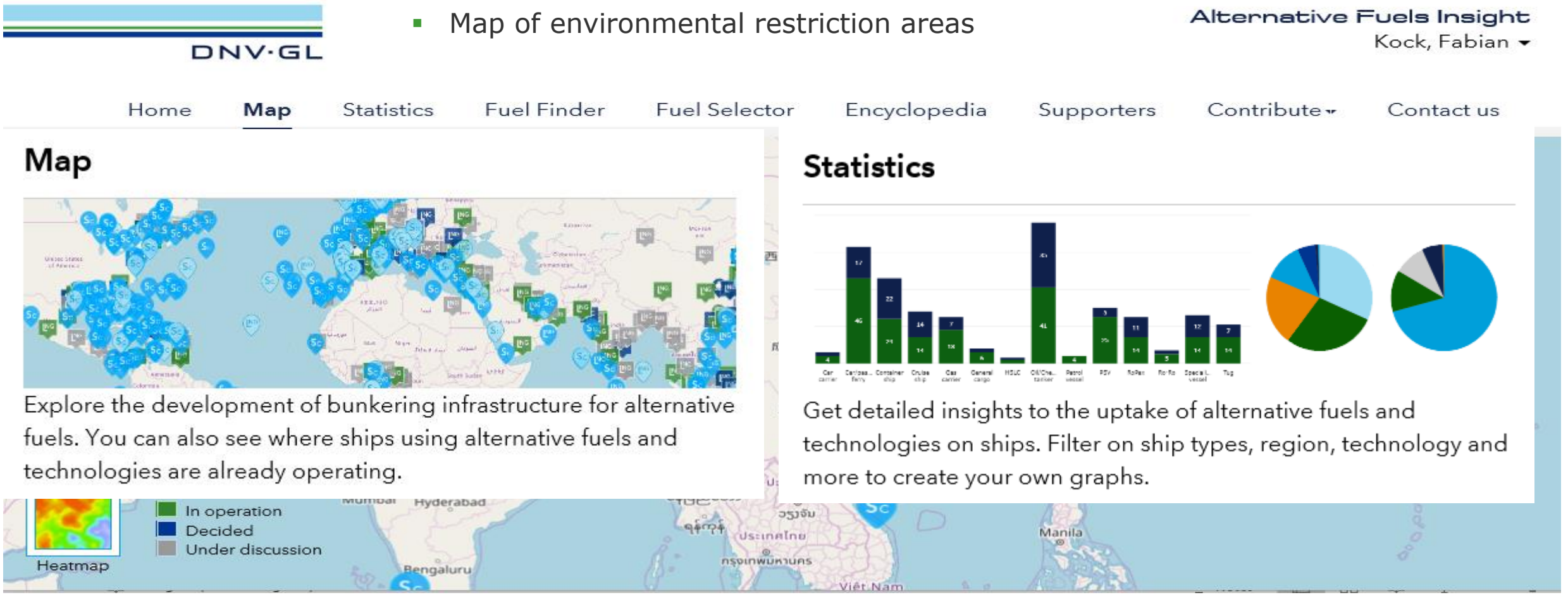


- Cruise and RoPax were initially the largest segments
- Now bulk, containers and tankers are the largest segments

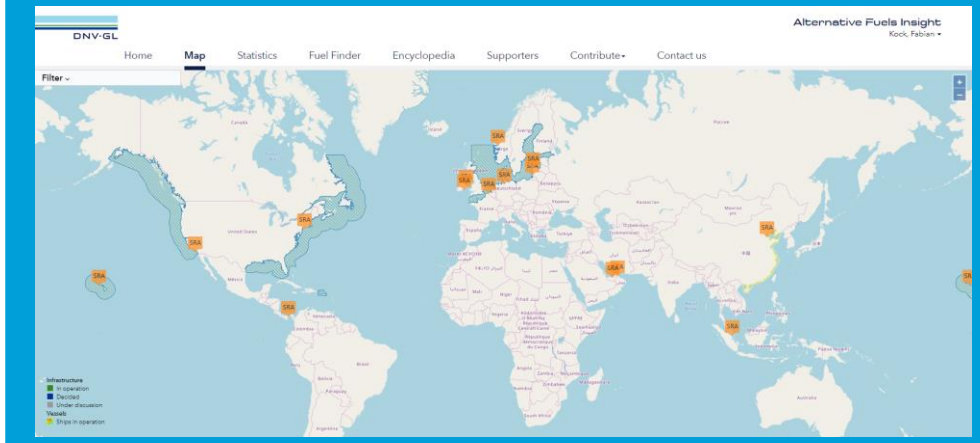
More info on DNV GL Alternative Fuels Insight platform

https://afi.dnvgl.com/

- Statistics
- Live AIS data of ships with Scrubbers, LNG as fuel, Battery power
- Map of environmental restriction areas



Open loop or not open loop?



Global requirements

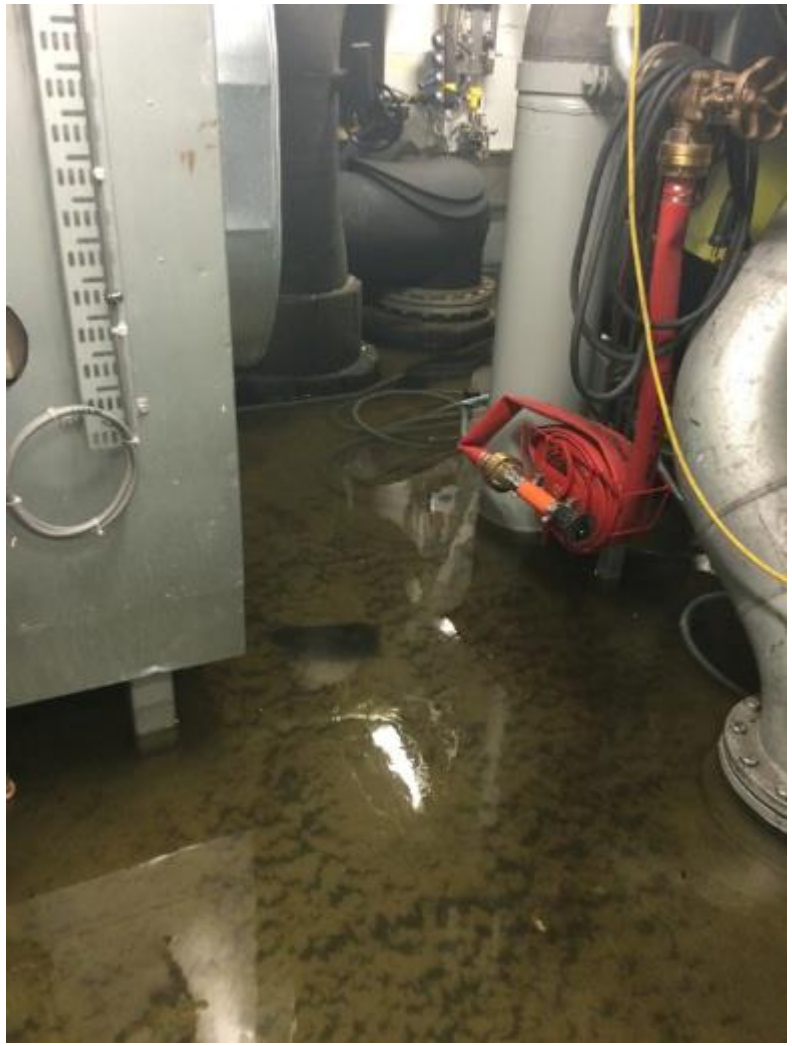
- **No stricter** requirements have been posed by IMO for **international waters**
- MEPC74 approved a new output on "Evaluation and harmonization of rules and guidance on the discharge of liquid effluents from EGCS into waters, including conditions and areas", report at PPR7
- MEPC 74: "Due consideration should be given to early movers who had fitted their vessels with EGCS to avoid penalizing them"

- Coastal states or port authorities with restrictions on wash water discharge
  - US EPA Vessel General Permit, wash water requirement pH ≥6.0 at overboard discharge*
- No wash water discharge
  - Connecticut, USA
- Open Loop ban:
  - Singapore
  - Fujairah
  - China (ports, inland waters and domestic ECA)
  - India (?)
  - Belgium, Germany, Latvia, Lithuania, Ireland
  - Norwegian Heritage Fjords
- Scrubber ban in California, unless research exemption is granted

*with the exception that during manoeuvring and transit, the maximum difference between inlet and outlet of 2.0 pH units is allowed.

Corrosion

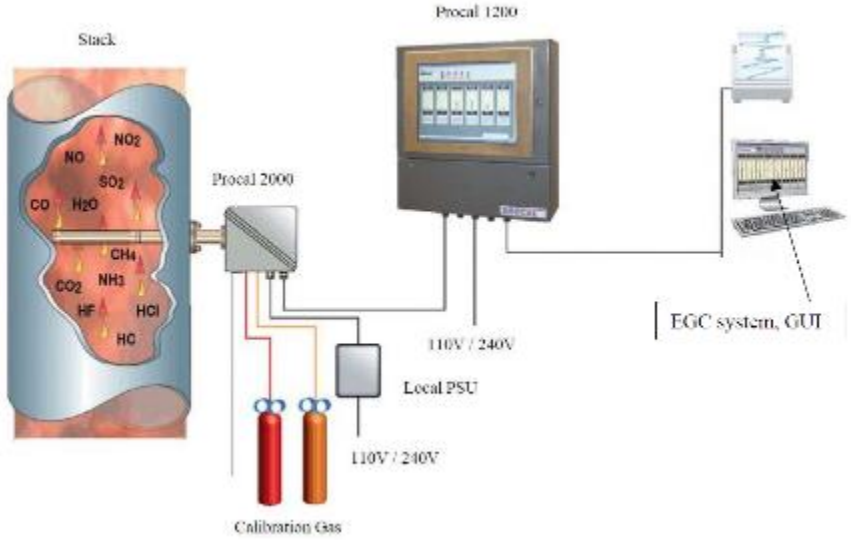
Flooding



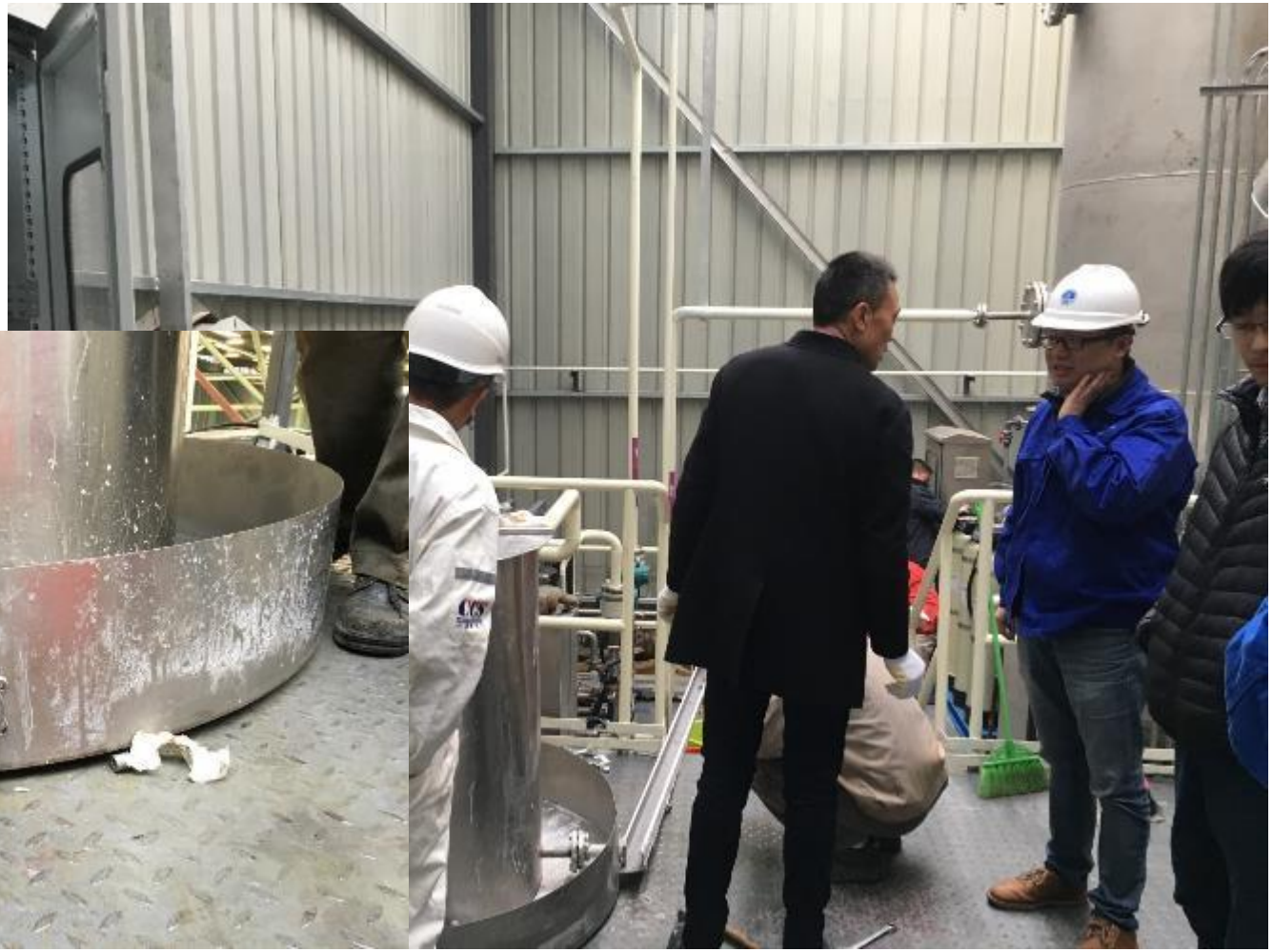
CEMS in bypass

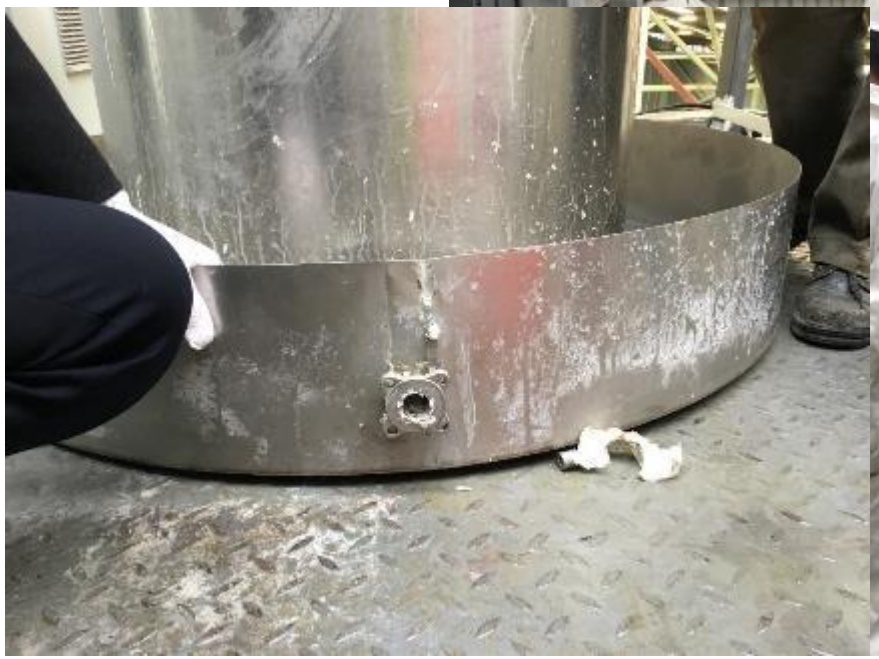
Analyser in Bypass:

Design sketch of Continuous Emission Monitoring Device (CEMS):

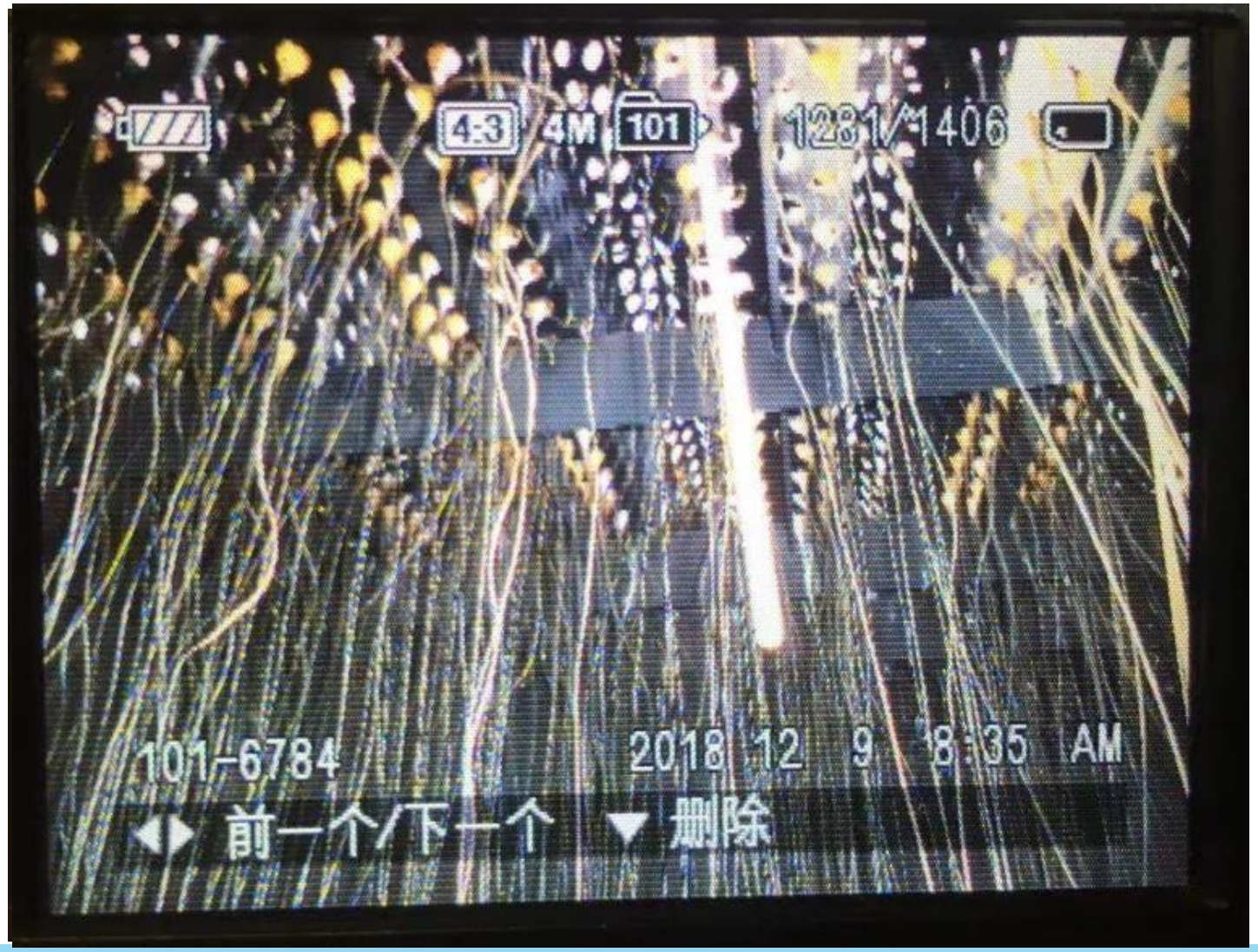


NaOH crystallization

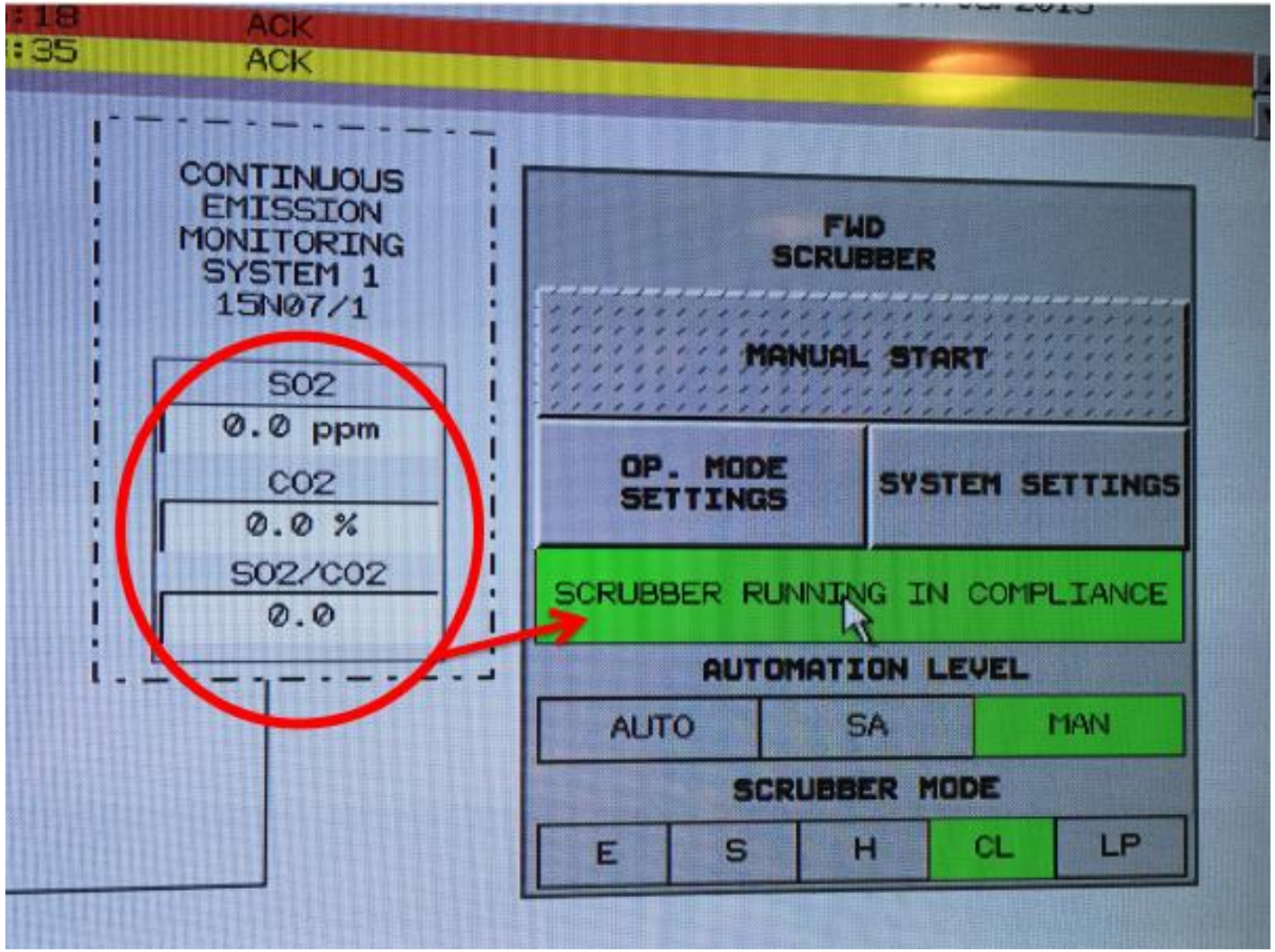




Material selection of packed beds



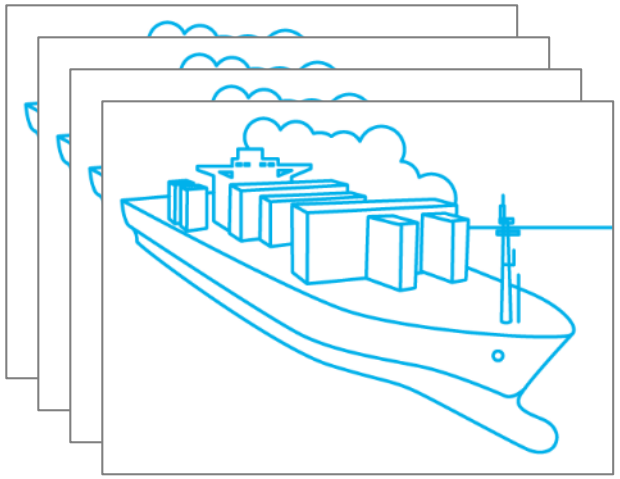
Data recording



Installing one scrubber in 1,5 year is easy, installing 30 to 100 scrubbers in 1,5 year is challenging

Example

32 ships, 4 sister series



A relatively small scrubber retrofit project may require close follow up of 11 stakeholders and management of 392 individual project processes

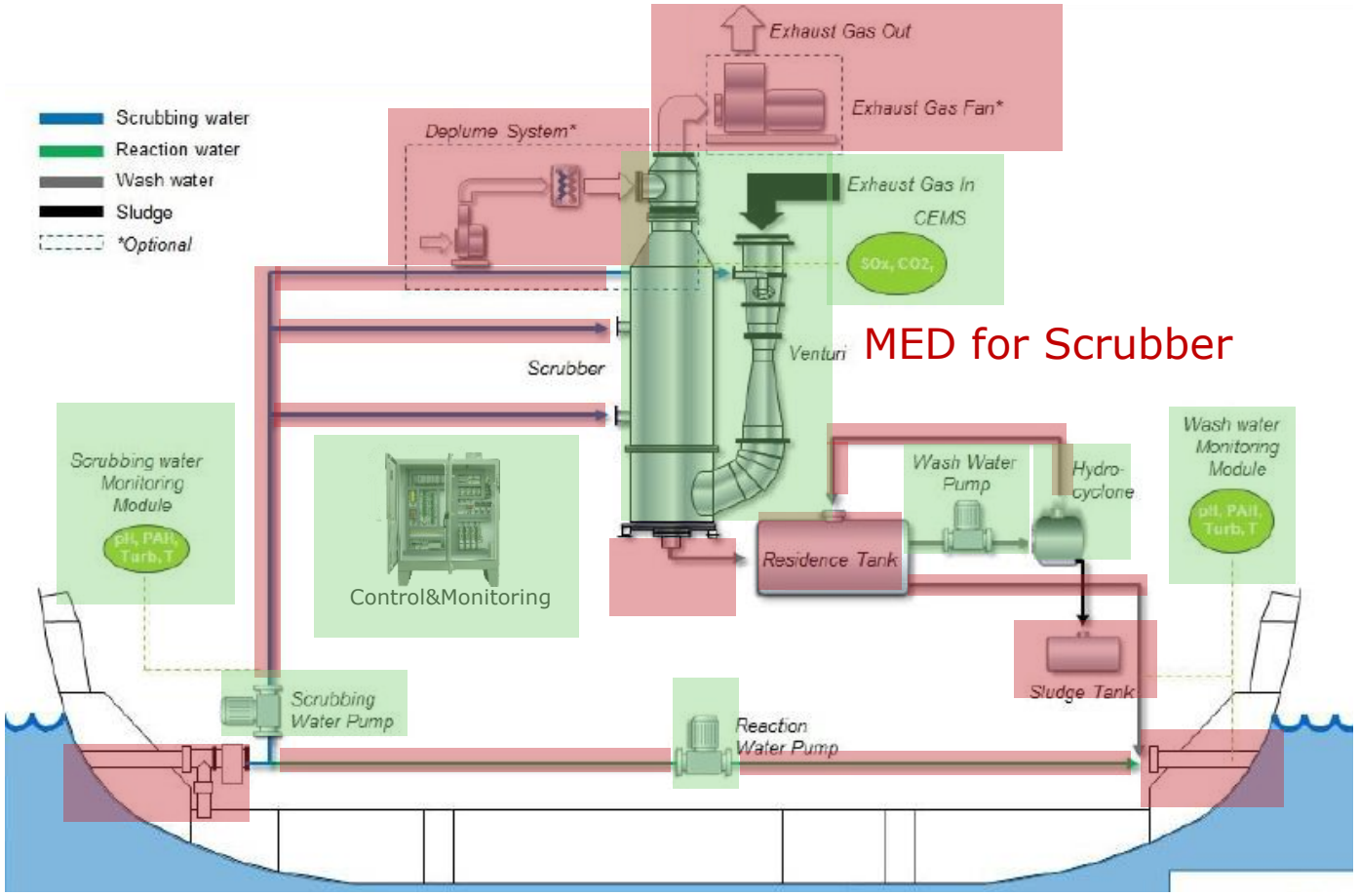
Stakeholder mapping: 11

Sister series	Ships	Technology suppliers	Design house	Class	Yard
Series A	8	Scrubber 1	Design House 1	Class 1	Yard 1 and 2
Series B	8	Scrubber 2	Design House 2	Class 2	Yard 2 and 3
Series C	8	Scrubber 1	Design House 1	Class 1	Yard 1 and 3
Series D	8	Scrubber 2	Design House 2	Class 3	Yard 1 and 4
Sum	**32**	**2**	**2**	**3**	**4**

Project processes: 392

Technical specifications		4			
Basic design			4		
Plan approval			32	32	
Detailed design					32
Construction drawings					32
Planning and purchasing		32			32
Logistic		32			32
Installation					32
Commissioning		32		32	32
Sum		**100**	**36**	**64**	**192**

Approval Documents: Who is responsible for what?



- Scrubber maker:
  - MARPOL Documents
  - MAPROL test plan
  - Control&Monitoring (PC needed)
  - Pumps (PC needed)
- Shipyard/designer (integration into ship): (Governed By **Pt.4 Ch.6 Sec.8)**:
  - Structual (foundations)
  - Tonnage
  - Piping
  - Electrical
  - External/Internal communication
  - Stability and watertight integrity
  - Load line
  - Fire safety

Fuel Quality & Bunkering issues

Blended fuels expected to be big among post-2020 compliant fuels

Large portion of compliant fuel **> 1.1.2020** expected to be **blended fuel**

2020 technical challenges

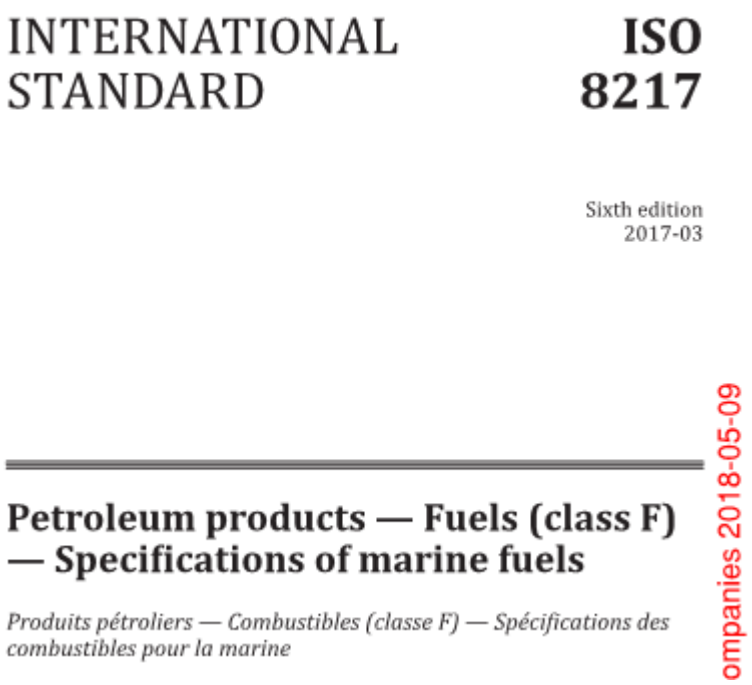
- Catfines → Purification
- Ignition and Combustion
- Stability → Sludging
- Fuel blending and compatibility

catfines (Al+Si)

Ignition and combustion

Stability / compatibility

Fuel Specification



INTERNATIONAL STANDARD

ISO 8217

Sixth edition
2017-03

Petroleum products — Fuels (class F) — Specifications of marine fuels

Produits pétroliers — Combustibles (classe F) — Spécifications des combustibles pour la marine

ompanies 2018-05-09

+

PAS

Publicly Available Specification

Publicly Available Specification (PAS)

- Given that these 0.50% max Sulphur fuel oils will be fully capable of being categorised within the existing ISO 8217 standard, the **PAS will provide guidance as to the application of the existing ISO 8217** standard to such fuel oils.

- The PAS will address specific considerations that relate to the onboard handling and operational aspects of this marine fuels coming on the market and may require more attention”

- Est publication: Aug/Sept 2019

The sulphur limit is clear

0.50%

Above this sulphur content, fuel considered as **non-compliant** by Port State Control (PSC)

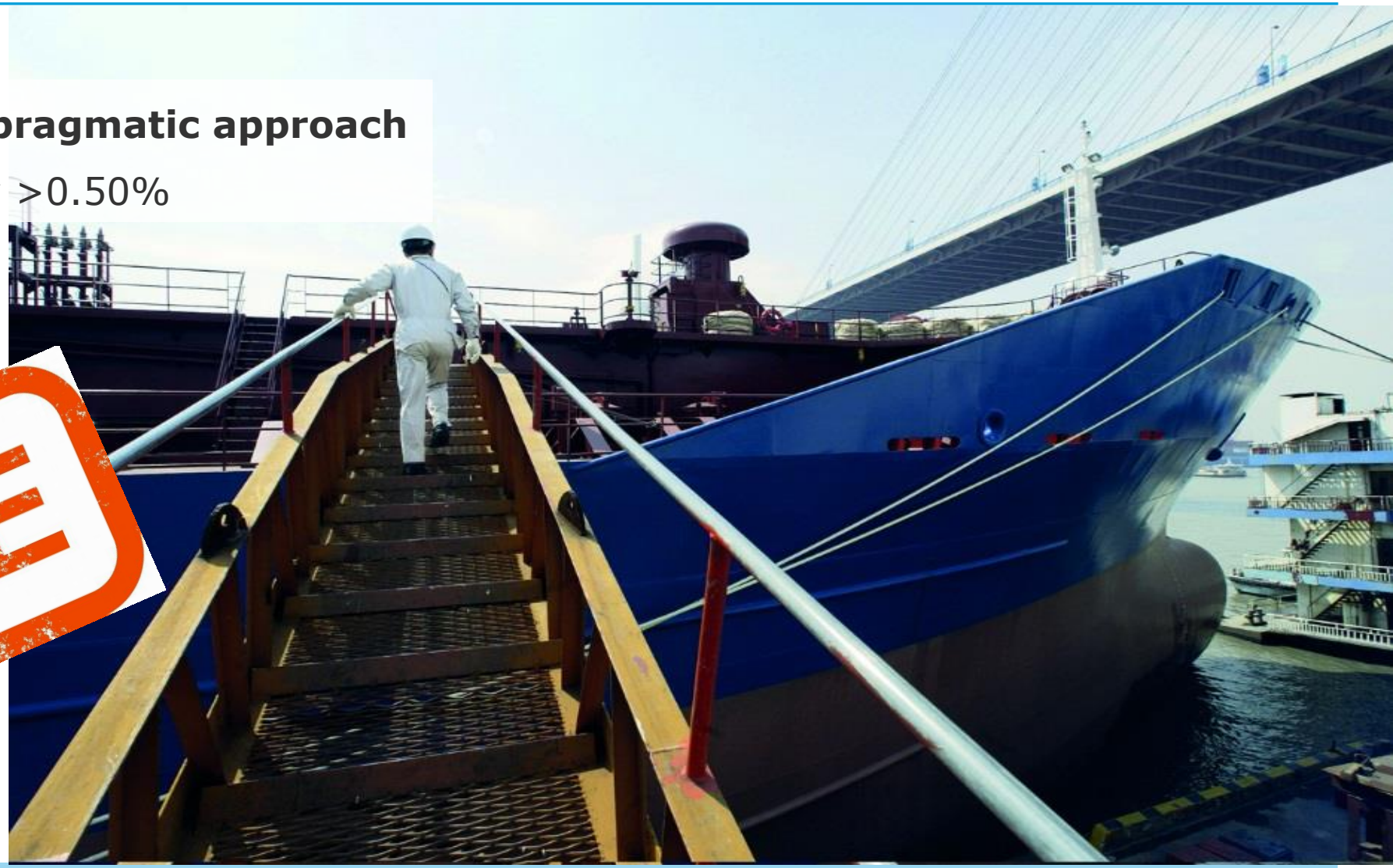
But how exact is the number to be taken?

German

Rest of the world

One can always hope…

PSC officers might have a **pragmatic approach** to blended fuels marginally >0.50%



PSC testing will increase

- PSC officers to obtain & test samples taken directly from ship's fuel oil system
- 'In-use' or 'on-board' samples on top of statutory MARPOL (delivered) sample

  (obtained during bunkering & retained on board as per Regulation 18.8.1 of MARPOL Annex VI)
- PSC may decide based on suspicion of non-compliance gauged from
  - initial checks using portable analysers
  - documentation checks
  - direct emission testing of exhaust fumes

IMO MEPC 74: Amendments to MARPOL Annex VI

- **MARPOL delivered fuel oil sample**: sample of fuel oil taken in accordance with the 2009 Guidelines for the sampling of fuel oil for determination of compliance with the revised MARPOL Annex VI (resolution MEPC.182(59)).

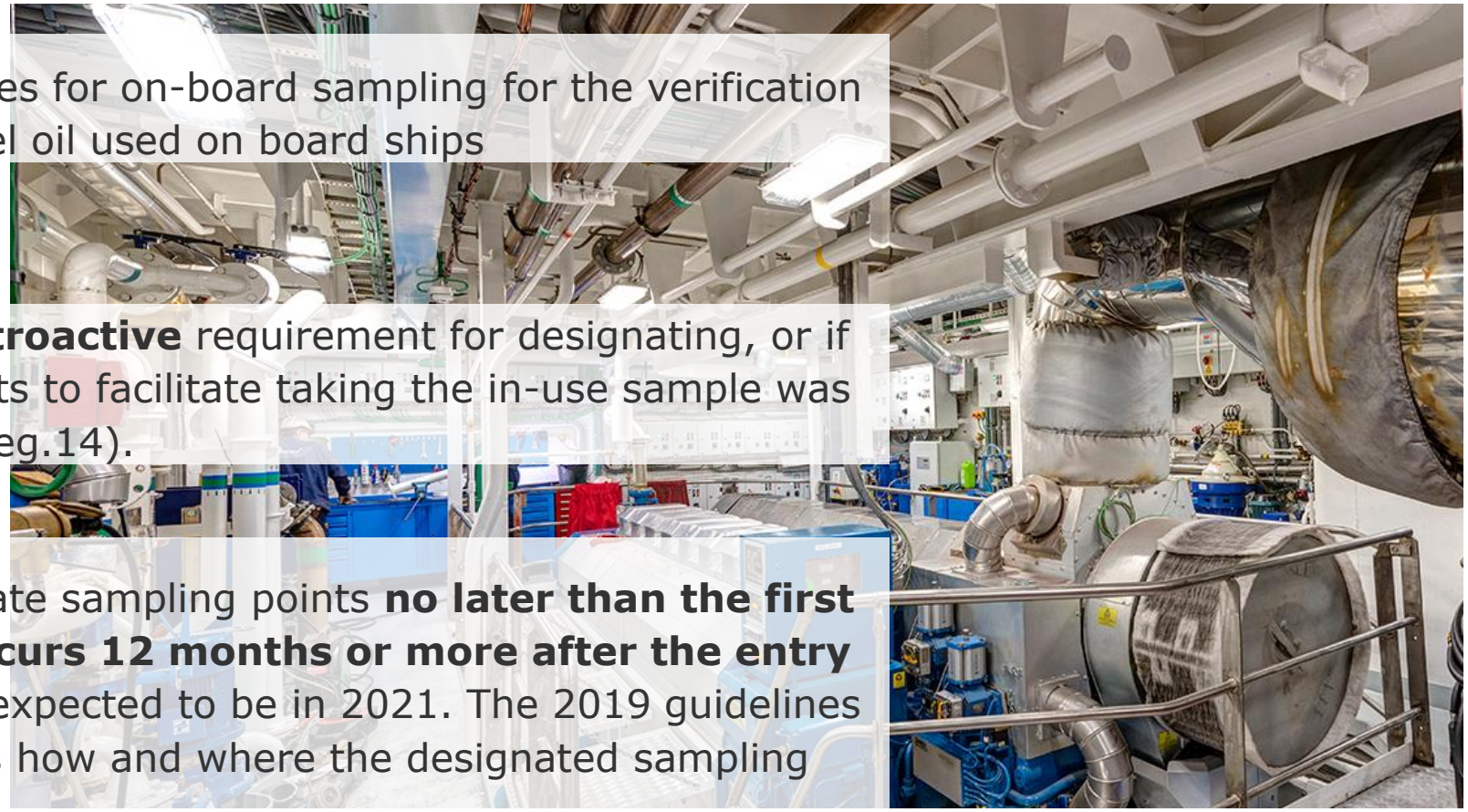
- **MARPOL in-use sample**: sample of fuel oil in use, intended to be used or carried for use on board. Samples taken in accordance with the 2019 Guidelines for on board sampling for the verification of the sulphur content of the fuel oil used on board ships (MEPC.1/Circ.864/Rev.1)

On-board sampling for the verification of the sulphur content

- MEPC.1/Circ.864/Rev.1 Guidelines for on-board sampling for the verification of the sulphur content of the fuel oil used on board ships

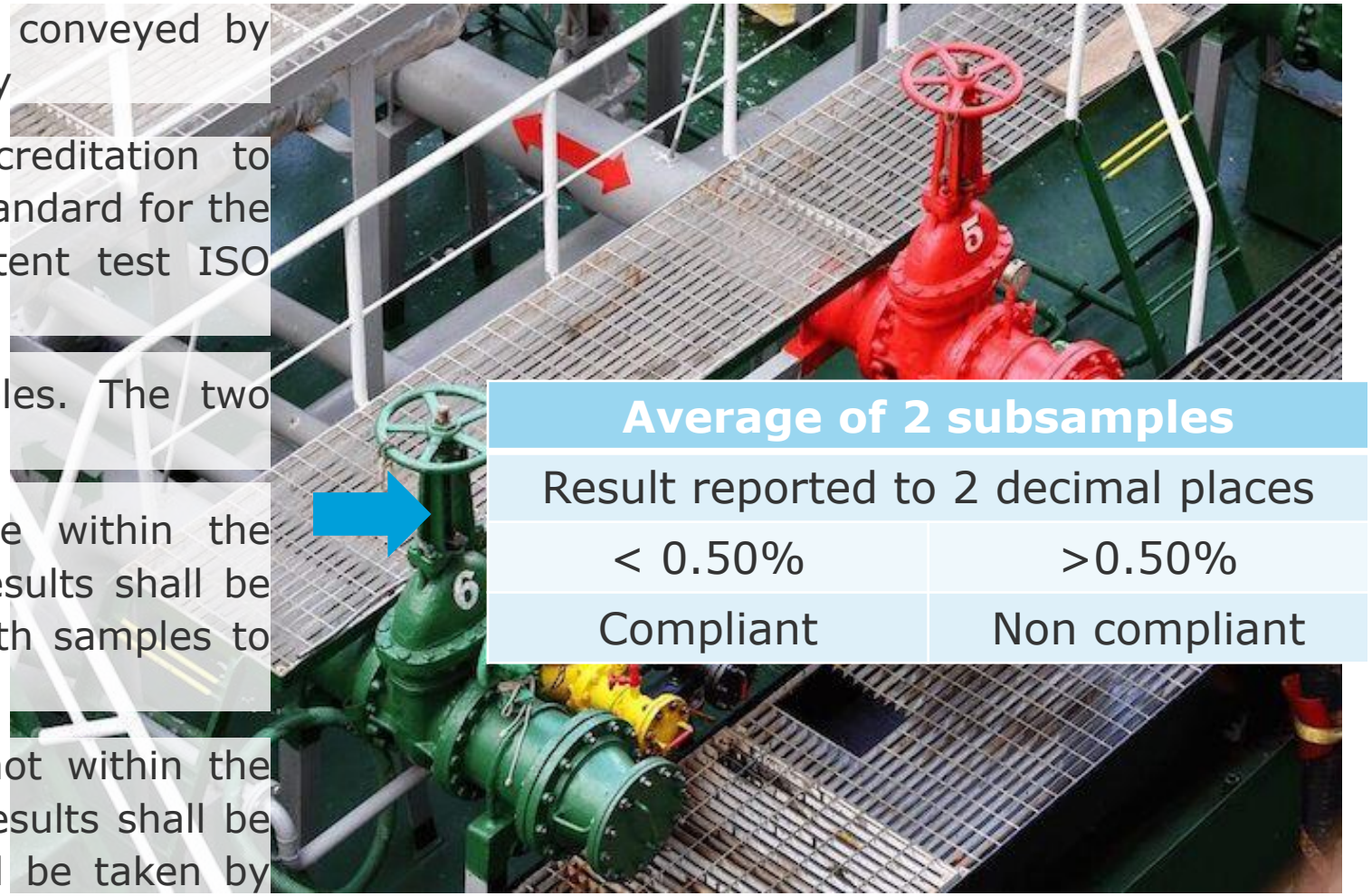
- Amendment imposing a new **retroactive** requirement for designating, or if necessary fitting, sampling points to facilitate taking the in-use sample was approved (MARPOL Annex VI, Reg.14).

- Ships will be required to designate sampling points **no later than the first IAPP renewal survey that occurs 12 months or more after the entry into force of the regulation**, expected to be in 2021. The 2019 guidelines for on-board sampling describes how and where the designated sampling points are to be fitted.



MARPOL delivered sample: Testing procedure and compliance

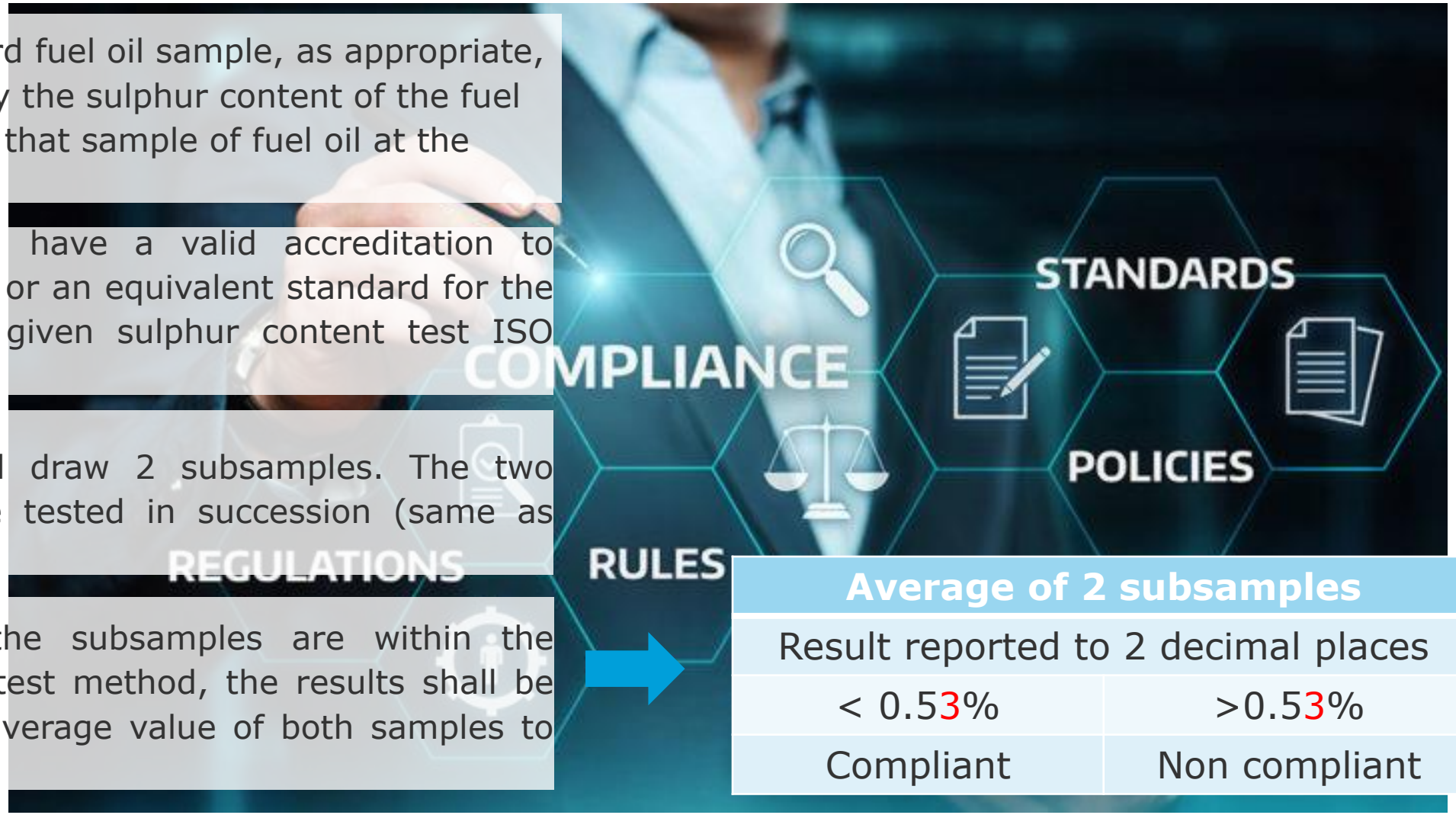
- The MARPOL delivered sample shall be conveyed by the competent authority to the laboratory
- The laboratory shall have a valid accreditation to ISO/IEC 17025:2017 or an equivalent standard for the performance of the given sulphur content test ISO 8754:2003.
- The laboratory shall draw 2 subsamples. The two subsamples shall be tested in succession
- If the results of the subsamples are within the repeatability of the test method, the results shall be considered valid ->average value of both samples to be reported
- if the results of the subsamples are not within the repeatability of the test method, both results shall be rejected and two new subsamples shall be taken by the laboratory and tested.



Average of 2 subsamples	
Result reported to 2 decimal places	
< 0.50%	>0.50%
Compliant	Non compliant

MARPOL in-use sample: Testing procedure and compliance

- The in-use or on board fuel oil sample, as appropriate, shall be used to verify the sulphur content of the fuel oil as represented by that sample of fuel oil at the point of sampling.
- The laboratory shall have a valid accreditation to ISO/IEC 17025:2017 or an equivalent standard for the performance of the given sulphur content test ISO 8754:2003.
- The laboratory shall draw 2 subsamples. The two subsamples shall be tested in succession (same as delivered sample)
- If the results of the subsamples are within the repeatability of the test method, the results shall be considered valid ->average value of both samples to be taken



Average of 2 subsamples	
Result reported to 2 decimal places	
< 0.53%	>0.53%
Compliant	Non compliant

Bunker suppliers must document for fuels exceeding sulphur limits

On BDN if fuel exceeds max. sulphur content stipulated by MARPOL:

- Fuel intended to be used with equivalent means of compliance (e.g. scrubbers), or
- Ship exempted for research purposes (Reg. 3.2. MARPOL Annex VI)

- Licensing scheme of bunker suppliers is recommended by IMO, however is not mandatory

BDN = bunker delivery note

SIP – Ship Implementation Plan

A Veracity application

So, what should owners do?

Evaluate and decide on compliance strategy

1. Use of distillate fuel
2. Use of low-sulphur compliant fuel oil
3. Continue use of high sulphur fuel oil, with scrubber
4. Install engines using alternative fuels

Prepare a ship specific implementation plan (IMO recommendation)

The plan should include:

- Risk assessment
- Fuel oil capacity and segregation capability
- Necessary hardware modifications to fuel storage and handling
- Tank cleaning
- Procurement of compliant fuel oil
- Fuel oil changeover plan

Assess the legal aspects of their charter party obligations

- Time Charters responsible for bunkering
  - Source compliant and appropriate bunkers
  - Bunker price adjustment
  - Re-delivery of vessels
- Operational Issues
  - Planning of cleaning fuel tanks
  - Disposal of high Sulphur bunkers
  - Costs of cleaning / de-bunkering HSFO

GLOBAL SULPHUR CAP TIMELINE

- 0.50% limit, global (MARPOL, 2020)
- 0.10% limit, SECAs (MARPOL)
- 0.50% limit, China national waters (12 nm), 2019

1 JANUARY 2020

PLANNING

1

- Fuel strategy – fuel selection for the fleet, including commercial aspects.
- Commercial risk assessment – fuel price scenarios/availability/ modification costs.
- Discussion with bunker suppliers – availability of different fuel products.
- Start discussion with charterers – bunkering clauses, costs of preparation, fuel specifications.
- Assess impact on machinery systems and fuel – note OEMs' and fuel suppliers' recommendations.
- Prepare plan for modifications, if needed – tank segregation, fuel pumps, fuel treatment systems, engine components, etc.
- Plan for tank cleaning (if applicable) – resources, method, schedule, sludge disposal.
- Bunkering strategy – agreements with fuel suppliers, bunkering locations, fuel specifications, fuel testing.
- Plan for ensuring consumption of all HSFO before 1 January 2020.
- Training plan, crew and shore personnel.

2

- Prepare Ship Implementation Plan (SIP), based on above.

TECHNICAL & OPERATIONAL ACTIVITIES

- Training of crew and shore personnel.
- Modifications of tanks, fuel supply system, etc., as planned.
- Designate sampling points (this will be a future requirement).
- Prepare procedures for FONAR (Fuel Oil Non-Availability Report).
- Tank cleaning.
- Update/prepare ECA Fuel Changeover Procedures (MARPOL Reg. 14.6).
- Prepare procedures to assess fuel compatibility (keep new bunker in separate tank until lab results are available).
- Consider preparing a fuel management plan, including a strategy to address challenges arising out of the variety of new and existing fuel types on the market.

COMMERCIAL PREPARATION

3

- Review charter party agreements.
- Review bunker clauses.
- Identify most frequent ports of call / regions of trade.
- Make agreement with bunker suppliers (if possible/relevant).
- Agree with charterers on commercial terms (bunker clauses) for delivery and redelivery issues before and after 2020.
- Maintain regulatory update, including local regulations.
- Negotiate with charterers on costs related to vessel preparation.

FUEL SWITCH

- Bunker compliant fuel to clean tanks (bunkering strategy for the changeover period to ensure continuous operation with minimal disruptions and costs).
- Flush the fuel oil system.
- Supply appropriate lube oil type.
- Test operation with distillates and/or VLSFO.
- Dispose of non-compliant fuel, if necessary (before carriage ban is enforced, 1 March 2020).

Items of a recommended Ship Implementation Plan

1. Risk assessment and mitigation plan, w.r.t. impact from new fuels
2. Fuel oil system modifications and tank cleaning (if needed)
3. Fuel oil capacity and segregation capability
4. Procurement of compliant fuel
5. Fuel oil changeover plan (conventional residual fuel oils to 0.50% sulphur compliant fuel oil)
6. Documentation and reporting

IMO INTERNATIONAL MARITIME ORGANIZATION

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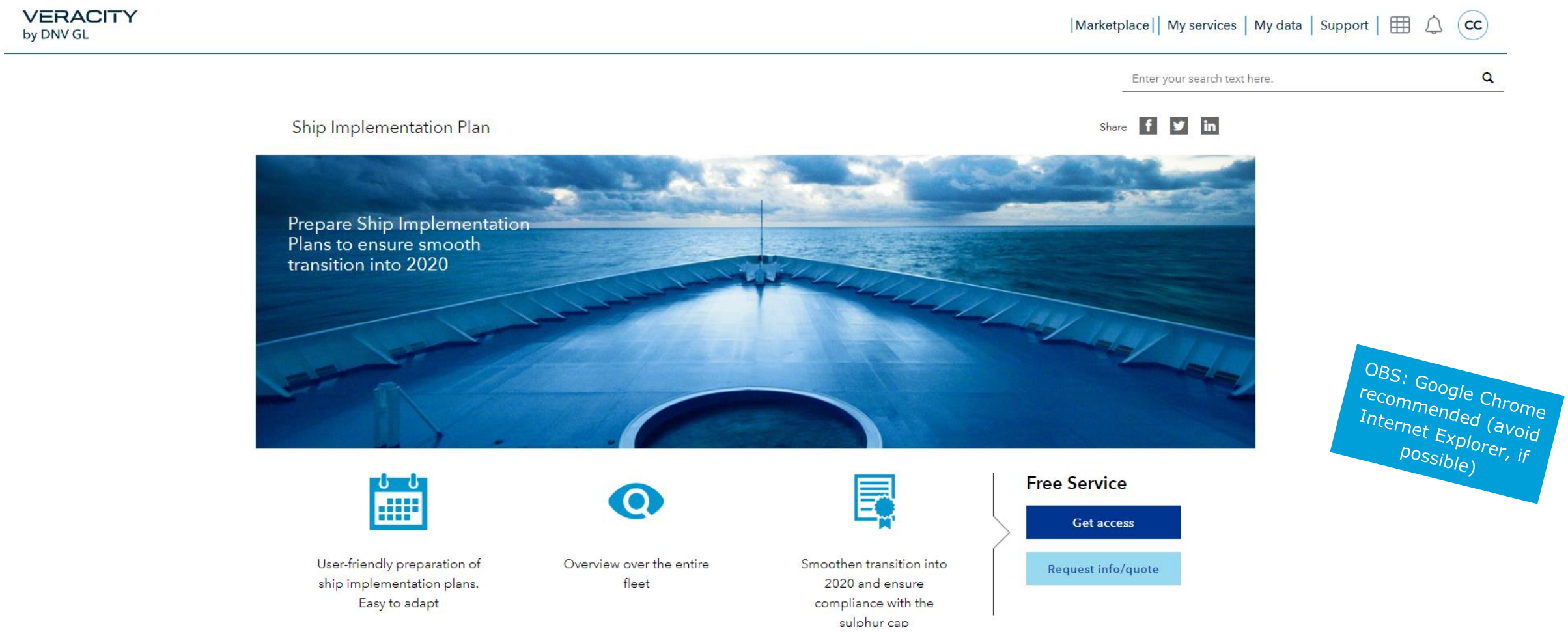
MEPC.1/Circ.878
9 November 2018

GUIDANCE ON THE DEVELOPMENT OF A SHIP IMPLEMENTATION PLAN FOR THE CONSISTENT IMPLEMENTATION OF THE 0.50% SULPHUR LIMIT UNDER MARPOL ANNEX VI

1 The Marine Environment Protection Committee, at its seventy-third session (22 to 26 October 2018), approved the *Guidance on the development of a ship implementation*

SIP on DNV GL Veracity



OBS: Google Chrome recommended (avoid Internet Explorer, if possible)

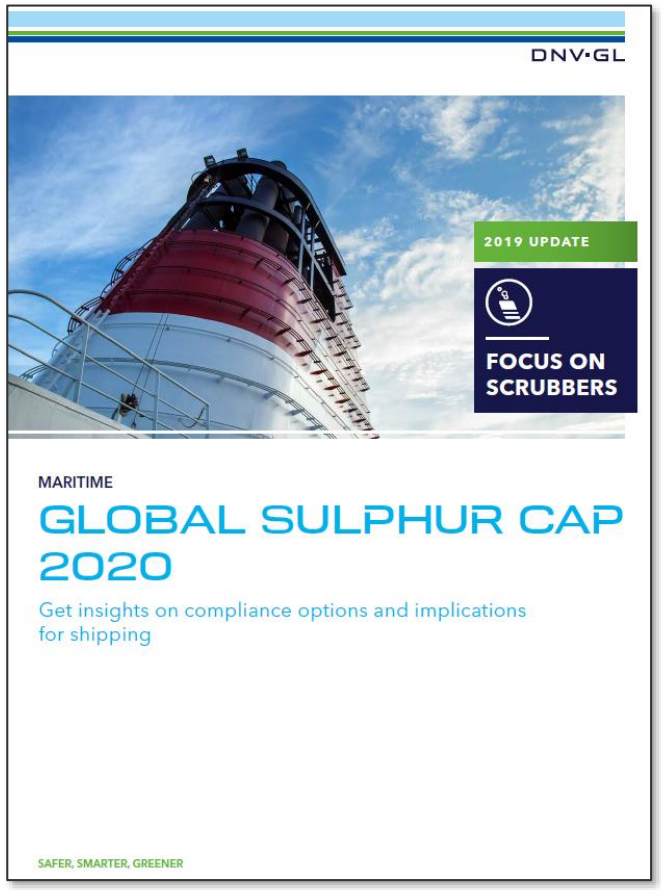
DNV GL Resources

DNV GL Global Sulphur Cap 2020 webpages

https://www.dnvgl.com/maritime/global-sulphur-cap/index.html

DNV GL publications

Scrubbers…



…checklist…

…fuel switch…

https://www.dnvgl.com/maritime/publications/global-sulphur-cap-2020.html

Interested in learning more?

DNV GL Maritime Academy

Courses and qualifications based on your individual needs

Low Sulphur Fuel - Compliance with 2020 requirements

Select your country and course date

- 03.09.2019 Dubai, United Arab Emirates | English
- 10.09.2019 Copenhagen, Denmark | English
- 20.09.2019 Piraeus, Greece | English
- 27.09.2019 Chennai, India | English
- 04.10.2019 Høvik, Norway | English
- 16.10.2019 Singapore, Singapore | English
- 30.10.2019 Genoa, Italy | English
- 06.11.2019 Istanbul, Turkey | English

SOx Scrubber Retrofits

Select your country and course date

- 29.10.2019 Genoa, Italy | English
- 05.11.2019 Istanbul, Turkey | English
- 29.11.2019 Singapore, Singapore | English

DNV GL support

- **Advisory** Services
  - Fuel changeover calculator
  - Remote survey of tank cleaning
  - Ship Implementation Plan (SIP) review
- **Approval** Services
  - Emission Reduction (ER) notation, including a new notation for exhaust gas cleaning systems (EGCS) to cover scrubbers
  - Scrubber Ready notation
- **Inspection** Services
  - State-of-the-art exhaust gas emission measurements directly on site

DNV GL: Offering the broader view on emissions

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