



EUSBSR EU STRATEGY FOR THE BALTIC SEA REGION

**Wednesday
17th of June
2026**

Riga, Latvia / Online

**First Informal Consultation Workshop on
Scrubber Waste Management:
Sharing Best Practices
across the Baltic Sea Region
with EUSBSR PA Ship**

WELCOME!

- Ieva Demjanenko, Latvian Maritime Academy RTU

EU Strategy for the Baltic Sea Region (EUSBSR) est. 2009

- One of the four EU Macro-Regional Strategies

- ✓ 3 main objectives
- ✓ 14 interconnected Policy Areas



EUSBSR
EU STRATEGY
FOR THE BALTIC
SEA REGION

What is this all about?

EU Strategy for the Baltic Sea Region Policy Area Ship
Coordinators *Sami Vesterinen & Milla Harju*

EU Strategy for the Baltic Sea Region +
Policy Area for Sustainable Shipping +
Action Items = this Workshop

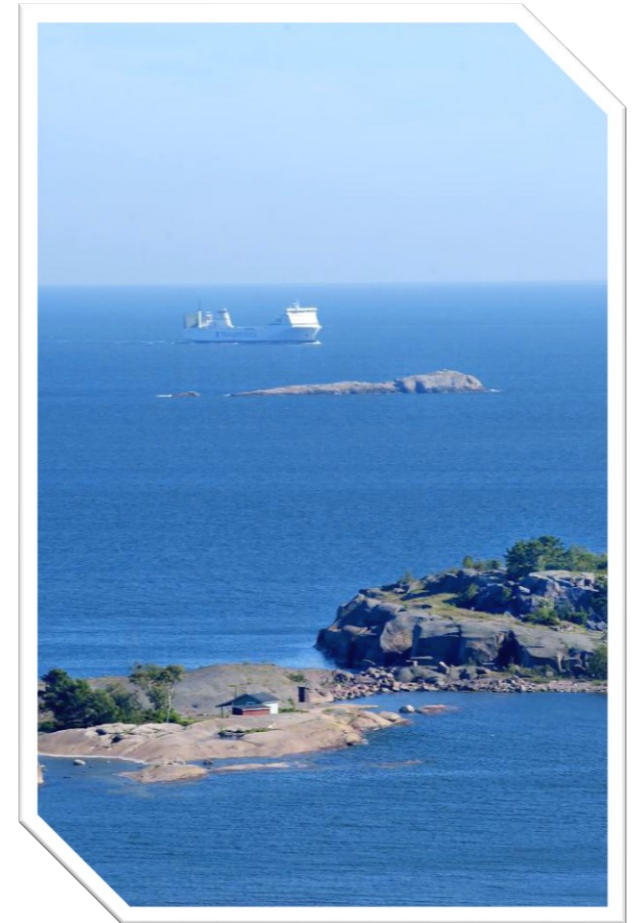


Focus on making actions real: current action items

Action 1: Support the development of an environmentally sustainable shipping sector.

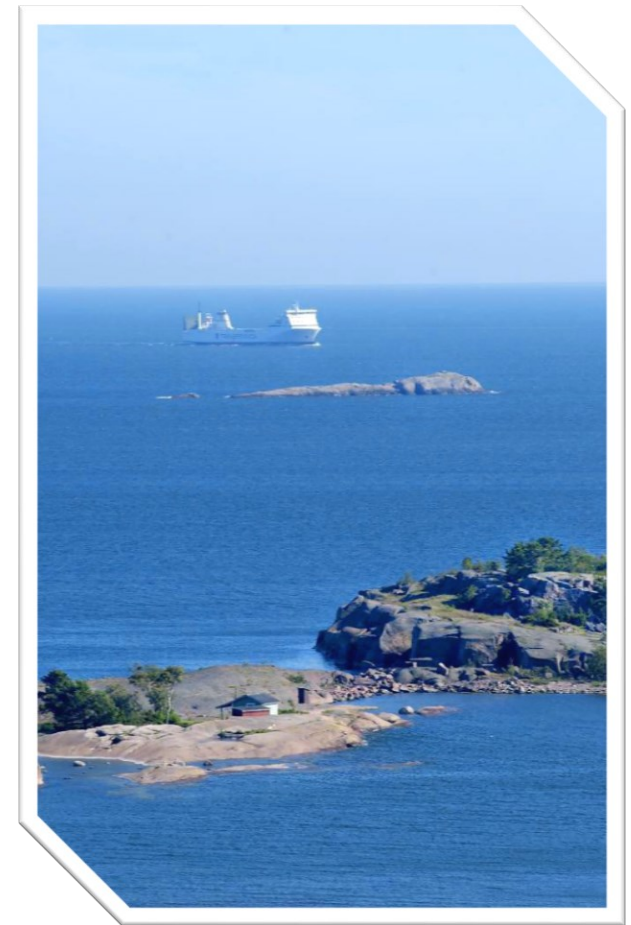
Action 2: Support research on challenges related to current shipping practices and their impact on the marine environment and its biota.

Action 3: Support development of shore side facilities to enable sustainable shipping practices.



Relevance to the Baltic Environmental Protection Commission/ HELCOM

Associate Professional Secretary Marta Ruiz / HELCOM



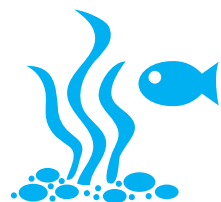
HELCOM work addressing the input of pollutants from Exhaust Gas Cleaning Systems

IC WS SCRUBBER 1-2026

17 June 2026

The HELCOM vision

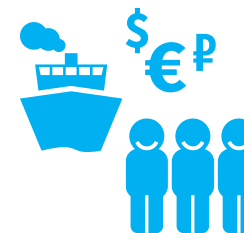
For a healthy Baltic Sea environment...



*... with diverse
biological components
functioning in balance,*

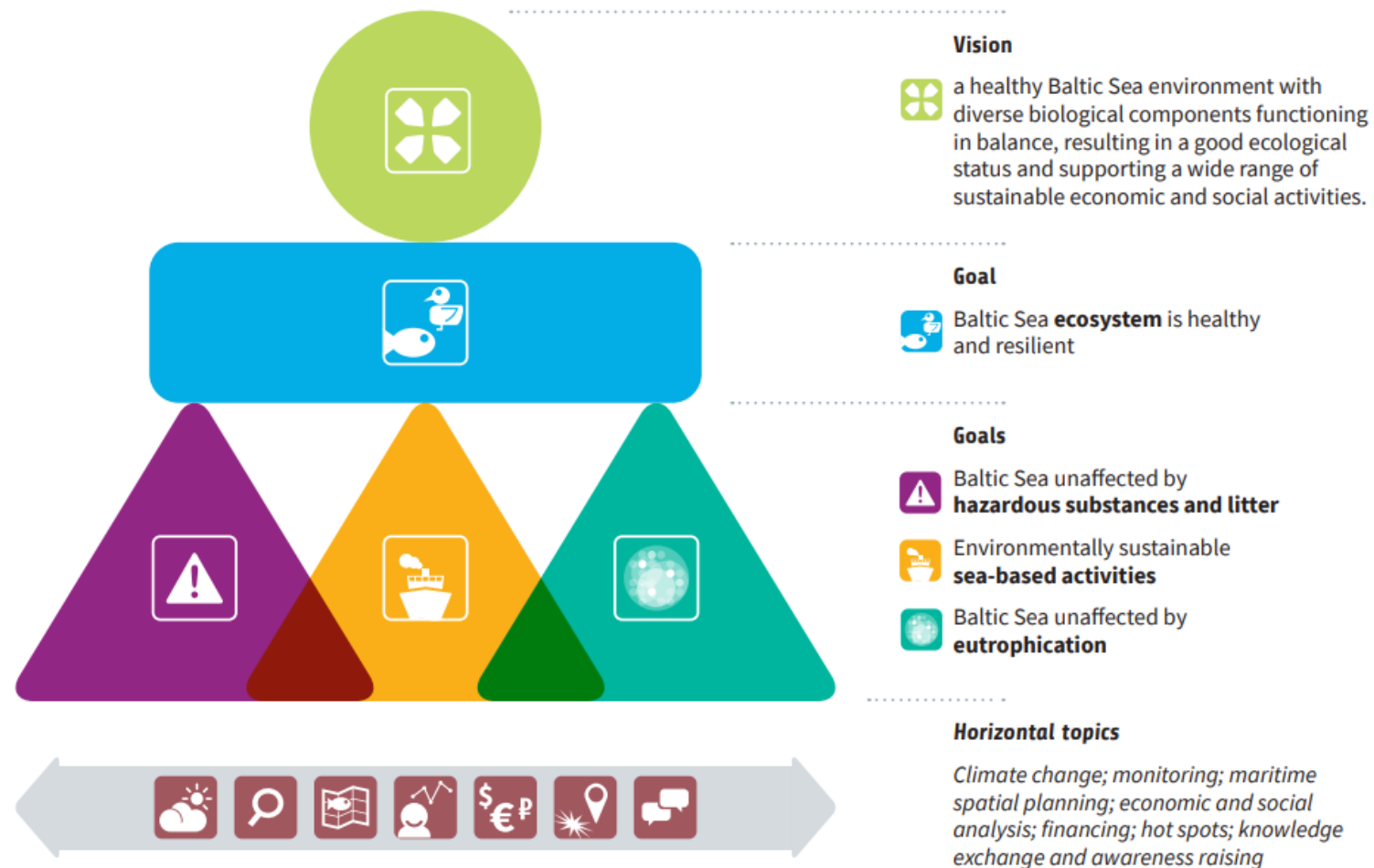


*... resulting in a good
ecological status,*



*...and supporting a
wide range of
sustainable economic
and social activities.*

The Baltic Sea Action Plan



The Baltic Sea Action Plan



Sea-based
activities goal

*“Environmentally
sustainable sea-based
activities”*



Ecological
objectives

- No or minimal disturbance to biodiversity and the ecosystem
- Activities affecting seabed habitats do not threaten the viability of species' populations and communities
- No or minimal harm to marine life from man-made noise



Management
objectives

- Minimize loss and disturbance to seabed habitats
- Minimize noise to levels that do not adversely affect marine life
- No introductions of non-indigenous species
- Minimize the input of nutrients, hazardous substances and litter from sea-based activities
- Enforce international regulations – no illegal discharges
- Safe maritime traffic without accidental pollution
- Effective emergency and response capabilities
- Minimize harmful air emissions
- Zero discharges from offshore platforms
- Ensure sustainable use of the marine resources

Themes:

Maritime activities (29 actions)

- Discharges from offshore platforms
- Maritime safety
- Non-indigenous species
- Recreational boating
- Pollution from ships

Response

Fisheries management

- By-catch
- Fish stock management

Underwater noise

Seabed loss and disturbance



Maritime BSAP actions (1/2 summary)

- **Sewage** from cargo ships
- Enforce **MARPOL Annex IV** special area and ensure adequate Port Reception Facilities (PRF)
- Grey water and food waste
- Roadmap to reduce input from **Exhaust Gas Cleaning Systems (EGCS) discharge waters**
- Strengthening implementation and enforcement of NOx Emission Control Area (**NECA**) (Roadmap)
- **MARPOL Annex II** cargo tank washing waters
- **MARPOL Annex V** cargo residues
- Nutrient loss from dry bulk fertilizer storage and handling in ports
- Harmonized implementation of IMO **Biofouling** Guidelines, Biofouling Roadmap, Early Warning System, AFS solutions



Maritime BSAP actions (2/2 summary)

- Contribute to **IMO** work on **GHG emission** reduction and ensure that **ice navigation** and its special requirements are taken duly into account
- Enhancing the use of **alternative fuels** and sources of energy
- Ship financing, innovation funding, enabling **onshore power**
- **Economic incentives** to reduce pollution from ships
- **Underwater noise**
- Promote environmentally sustainable **recreational boating**, BEP, green marinas etc.
- Work on the regional HELCOM AIS system as well as e.g. VHF Data Exchange System (VDES) and other e-navigation services in order to increase **safety of navigation** and gain environmental benefits
- Completion of the re-surveys for CAT. I, II and III



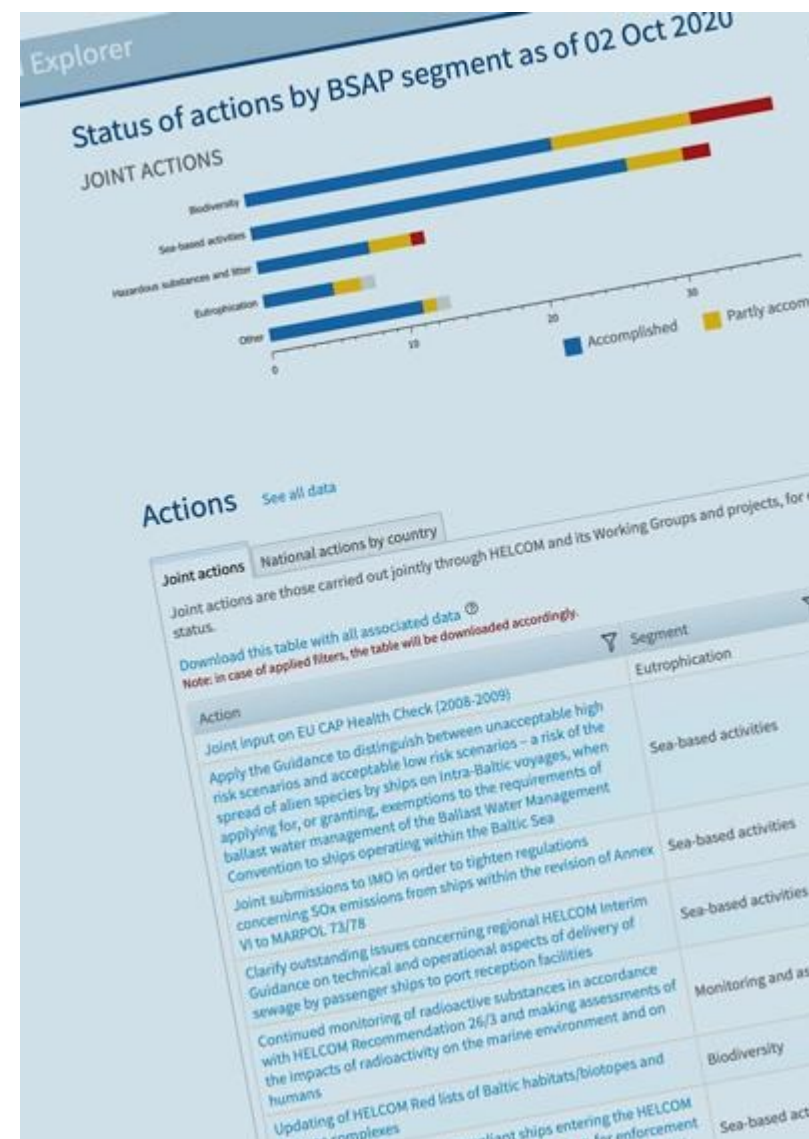
Some context: HELCOM and IMO



- In addition to harmonizing implementation of IMO regulations, HELCOM has been proactive and successful in amending these regulations through joint proposals negotiated within HELCOM
- Major achievements:
 - 2005 Baltic Sea (excluding those marine areas within the sovereignty of the Russian Federation) is designated as a **Particularly Sensitive Sea Area (PSSA)**
 - 2006 Baltic Sea was designated an **Emission Control Area for SO_x (SECA)** under MARPOL Annex VI
 - 2011 Baltic Sea is designated a **special area** for **sewage discharges** from passenger ships under MARPOL Annex IV
 - 2016 Baltic Sea is designated an **Emission Control Area for NO_x (NECA)** under MARPOL Annex VI

Implementing the BSAP

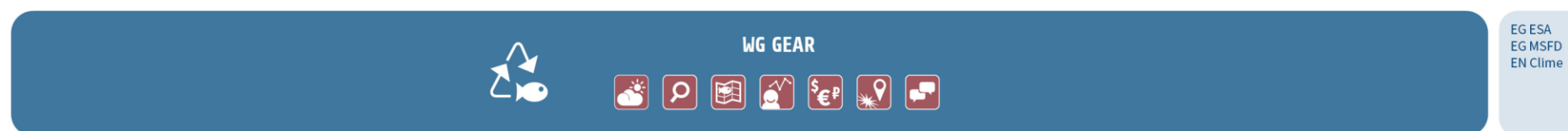
- **Lead country** approach
- Assessment of the implementation of the Working Groups' workplans, including relevant BSAP actions towards the publication of the **2025 BSAP implementation report** in connection to the **2026 HELCOM Ministerial Meeting (4 November 2026)** in Warsaw, Poland)
- **HELCOM Explorer** serves to follow-up on the implementation of the actions



Political level



Policy coordination level



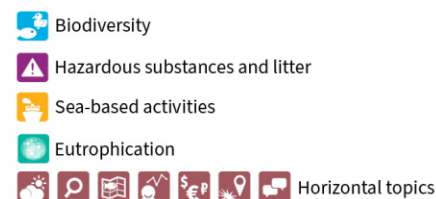
Working groups: management / policy level



Expert groups and networks: scientific / technical level



BSAP focus:



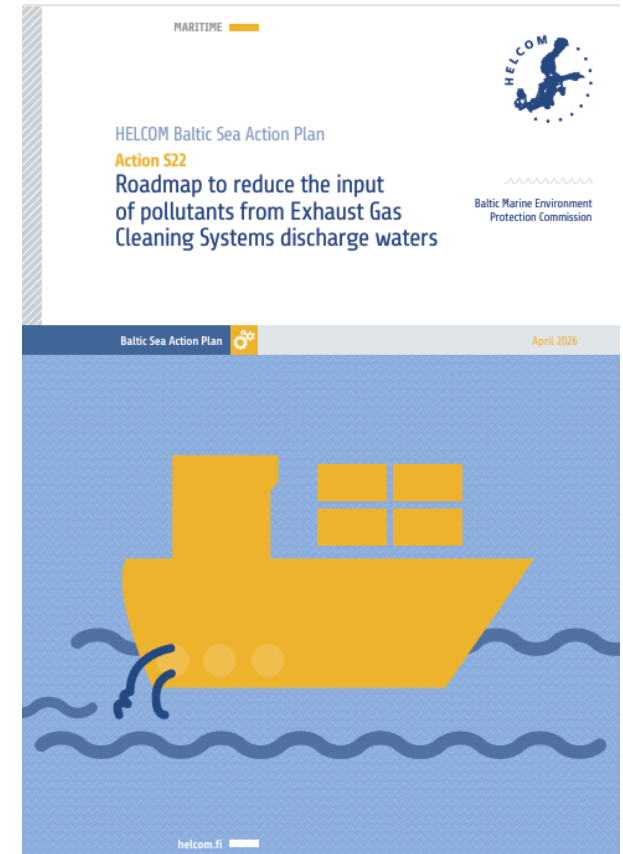
Full names of the working groups:

WG GEAR = HELCOM Working Group for the Implementation of the Ecosystem Approach
 WG BioDiv = HELCOM Working Group on Biodiversity, Protection and Restoration
 WG Source to Sea = HELCOM Working Group on the Source to Sea Management of Nutrients and Hazardous Substances and Sustainable Agricultural Practices
 WG Fish = HELCOM Working Group on Ecosystem-based Sustainable Fisheries
 WG Sea-based pressures = HELCOM Working Group on Reduction of Pressures from Sea-based Sources
 WG Maritime = HELCOM Maritime Working Group
 WG Response = HELCOM Response Working Group
 WG HELCOM-VASAB MSP = Joint HELCOM-VASAB Maritime Spatial Planning Working Group

Action S22

“Develop a Roadmap by 2025 to reduce the input of pollutants from Exhaust Gas Cleaning System discharge waters, as a minimum in line with existing legislation, taking into consideration the precautionary principle and the outcome of the work of the International Maritime Organization (IMO).”

Rational: “After introduction of more stringent sulphur limits for ships’ fuel through MARPOL Annex VI, the use of Exhaust Gas Cleaning Systems (EGCS) has become more common. EGCS discharge water can have negative impacts on sensitive Baltic Sea ecosystems which is indicated in a number of studies, showing that discharge water contains heavy metals such as vanadium, nickel, copper, zinc and lead. In addition, EGCS discharge.”



<https://helcom.fi/publications>

HELCOM Roadmap

Declaration

“The HELCOM Contracting Parties commit to working together, in line with this roadmap, to urgently reduce the input of pollutants from Exhaust Gas Cleaning Systems (EGCS) into the Baltic Sea.”

Background

Rational of the Roadmap

HELCOM Roadmap

Actions

1 Sweden and Germany leading

EGCS water **discharge ban** in **territorial seas, internal waters and ports**

Develop a **HELCOM Recommendation** aiming at a harmonized approach in territorial seas, internal waters and ports to implement a discharge ban on discharge water from EGCS with a view to ensure consistency and legal clarity in the Baltic Sea as a whole.

By 2026



Draft HELCOM Recommendation to
IC WG MARITIME 5-2026 (Sept.)

HELCOM Roadmap

Actions

2

EU (EU Commission) leading

EGCS water **discharge ban** in the **Baltic Sea area, covering EEZ and inter national straits**.

Step 1 (completed by **mid-2027**): Work together within the framework of the IMO to enable an EGCS water discharge ban in the Baltic Sea, including the establishment of a legal basis for such a measure. In parallel, an assessment of the socioeconomic impacts shall be conducted, drawing on existing research and reports in order to substantiate the adoption of such a measure in the Baltic Sea.

Step 2 (completed by **2029**): Based on step 1 and taking into account the precautionary principle, the necessary measures shall be undertaken through the IMO with the objective of implementing an EGCS water discharge ban in the Baltic Sea. This may, for example, take the form of a new Associated Protective Measure (APM) in the Baltic Sea PSSA or a regulatory measure in MARPOL Annex VI.

HELCOM Roadmap

Actions

3

All leading

Contribution to the work at **IMO**.

Work together to actively contribute to the ongoing and future work at the IMO on this issue and report about HELCOM activities and measures as appropriate.

Actions

4

DK, FI & SE to support

Exchange of **knowledge** and experiences

regarding the topics listed below to ensure consistent implementation and enforcement of the environmental protective measures (action 1 and 2):

- **National policy implementation** from a regulatory point of view, including sanctioning;
- **Compliance monitoring** through the inspection of vessels fitted with EGCS technology, including sharing insights on effective methods for verifying compliance and exploring alternative monitoring tools; and
- **On-shore disposal capabilities** (adequate PRF) for EGCS discharge water.

Deliverables

- A **workshop** during spring **2026** and a follow-up workshop during spring **2028**. The outcome should be reported to HELCOM Maritime and HELCOM Sea-based Pressures;
- Development of a best practice guidance; and
- Reporting of inspections, experiences and sanctions during HELCOM Maritime Meetings.

Actions

5

All

Exchange of experience with **OSPAR** and the **Barcelona Convention**

Exchange experiences with the 'scrubber expert group' within OSPAR and the OSPAR Secretariat, to foster, as appropriate, a coordinated approach with the North-East Atlantic region on EGCS technology and related environmental measures.

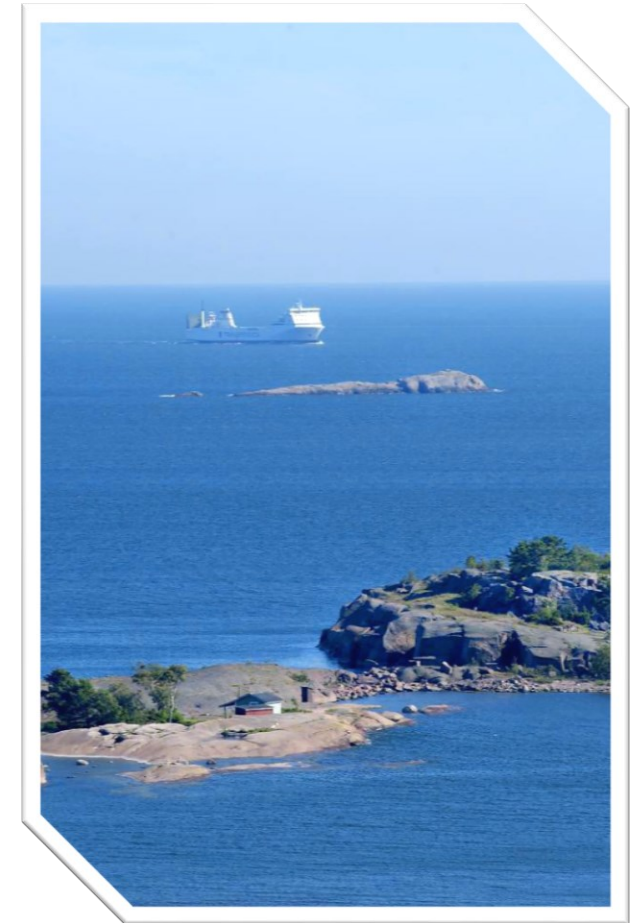
Exchange experiences with the Mediterranean region and in the framework of Barcelona Convention, as appropriate.



Thank
you!

Workshop Objectives today

1. **Listen:** To latest scientific research and experience from the field
2. **Learn:** From others' trials (and errors)
3. **Share:** Best Practices



Today's Agenda

1. Welcome, Workshop objectives & Relevance to HELCOM's Baltic Sea Action Plan 09.00-09.30

2. Setting the Scene: Scrubber Wastewater's impact on the marine environment 09.30 - 10.00

3. Operational view from a Shipping Company 10.00 - 10.30

Coffee break 10.30 - 10.40

4. Practice from the Ports 10.40 - 11.10

5. Cleaning the Mess: Insights from the Technology Provider 11.10 - 11.30

6. Workshop in World Café format: 11.30 - 12.30

Lunch 12.30 - 13.30

7. World Café findings: Discussion 13.30 - 14.00

8. Real World example: Best Practices from the field 14.00 - 14.30

9. Summary and final words 14.30 - 15.00

Setting the Scene: Scrubber Wastewater's impact on the marine environment

Speaker: *Associate Professor & Reseacher Erik Ytreberg, Swedish Environmental Research Insitute (IVL)*

Scrubber Wastewater's impact on the marine environment

Erik Ytreberg

Associate Professor

Swedish Environmental Research Institute (IVL)

About me

Biologist and ecotoxicologist specialising in pollution from shipping and leisure boating.

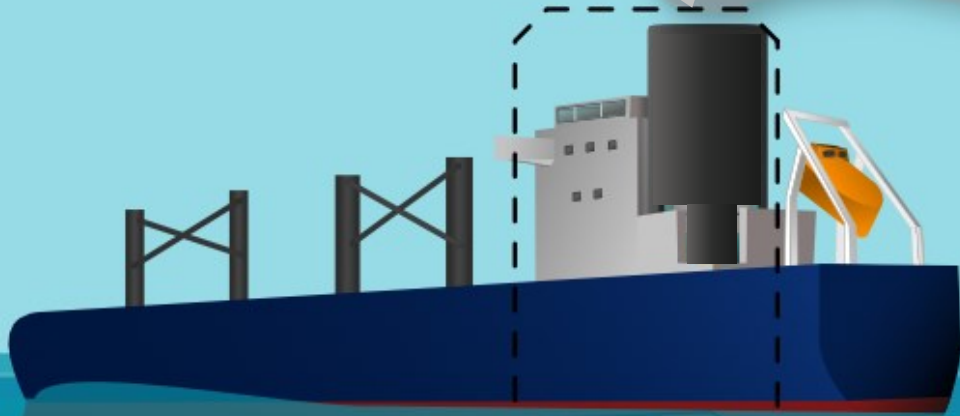
Main focus: scrubber wastewater and antifouling strategies



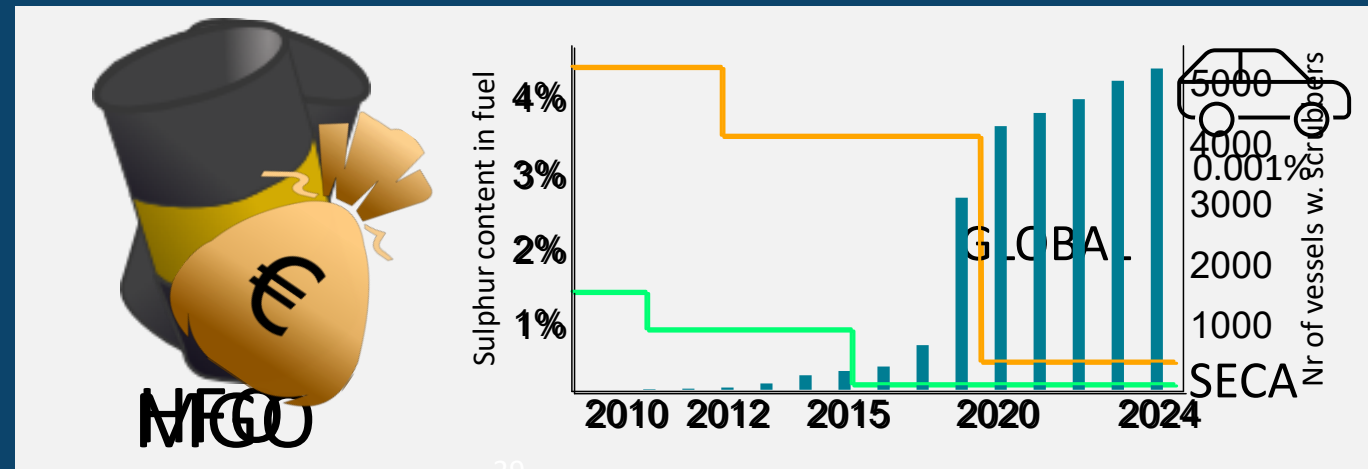
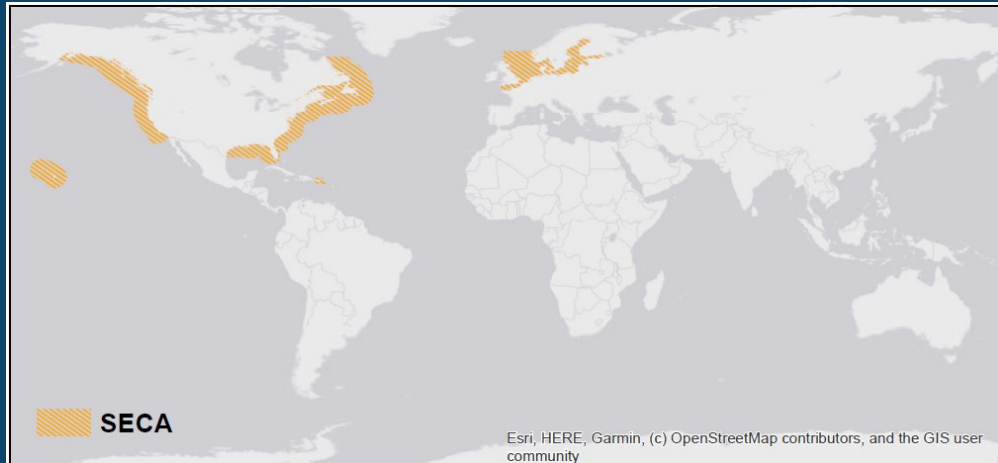
- **2011** **PhD, Applied Environmental Science**
Stockholm University
- **2013–2025** **Postdoc, Associate Professor in Maritime Environmental Sciences**
Chalmers University of Technology
- **2025–** **Researcher and project leader**
IVL Swedish Environmental Research Institute

What is a ship scrubber and why are they used?

Installation of scrubbers

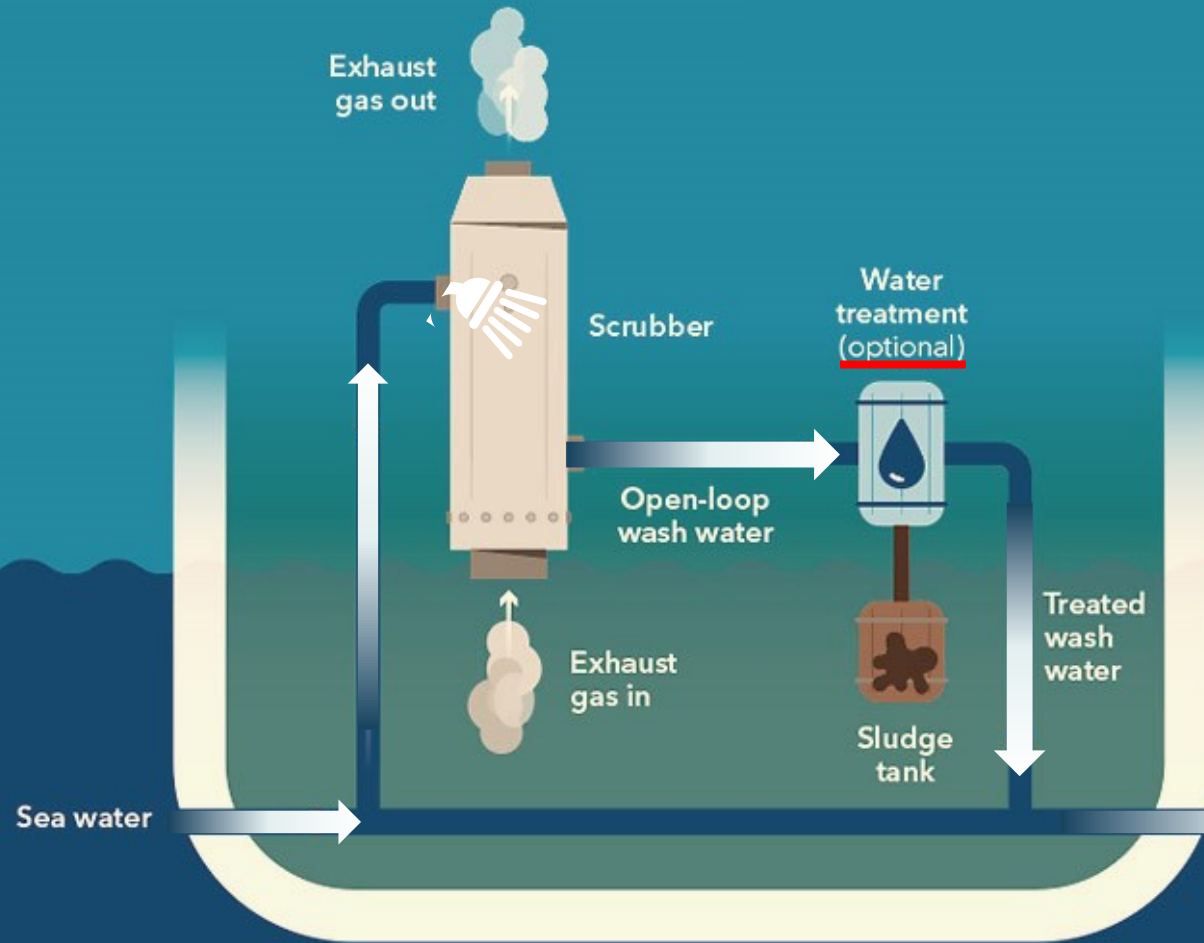


Stricter regulations on sulphur content in fuel January 2020

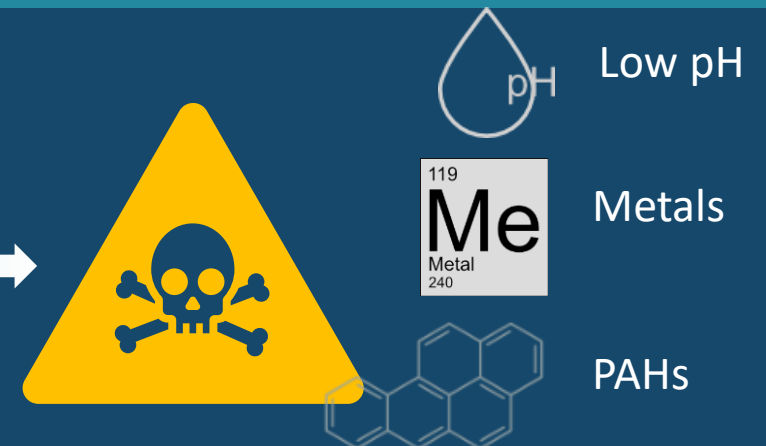




How a scrubber works



<https://www.dnvgl.com/expert-story/maritime-impact/Scrubbers-at-a-glance.html>



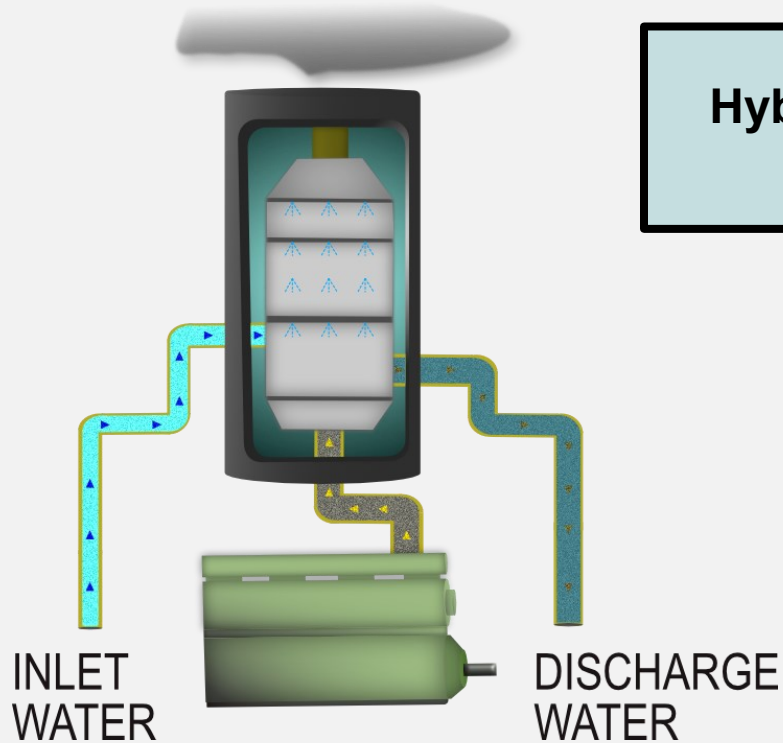
(=polycyclic aromatic hydrocarbons)

>83% of market share



Open loop scrubber system

90 m³/MWh = **1000 m³/h**



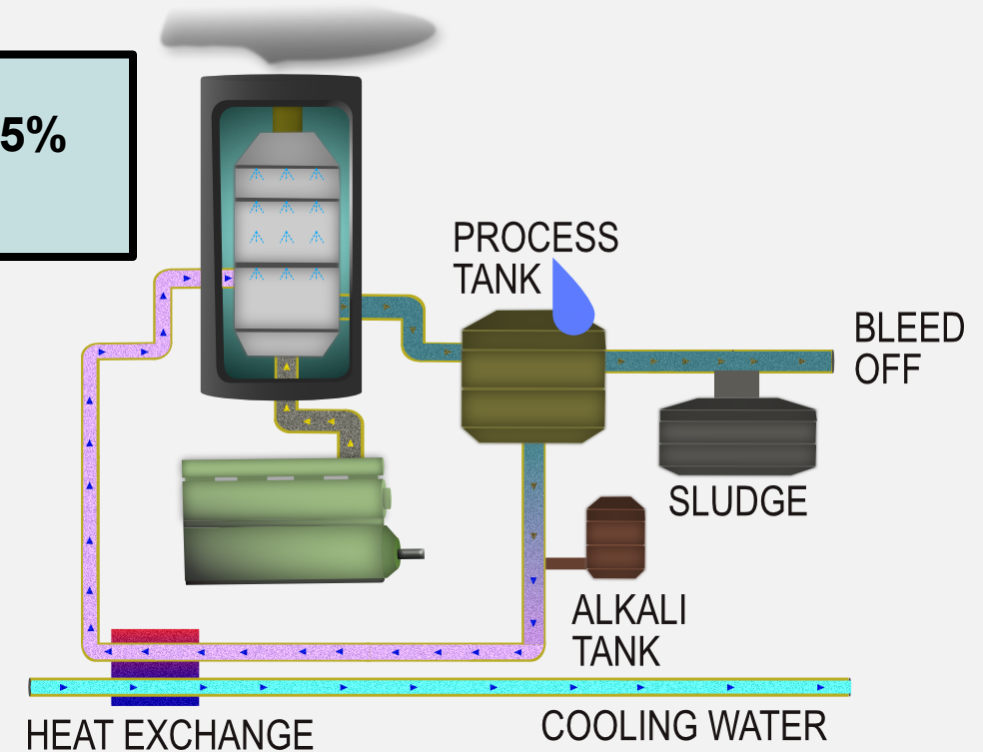
**Hybrid systems 15%
market share**

1% of market share

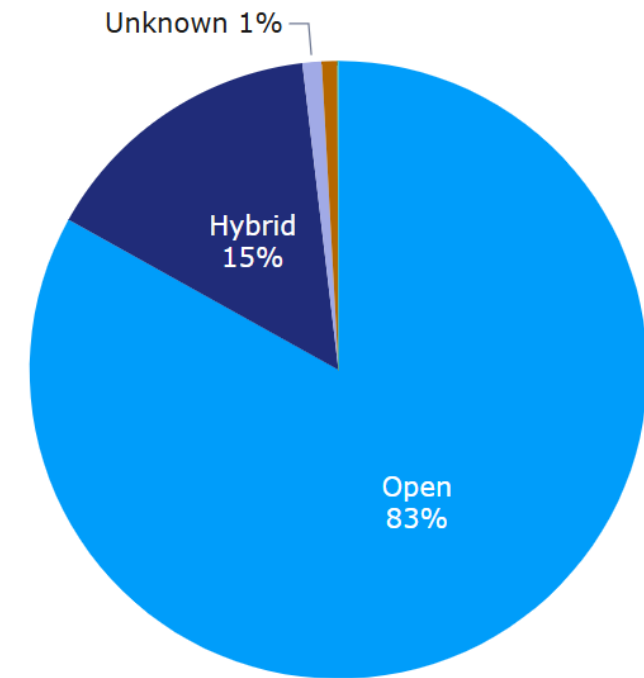
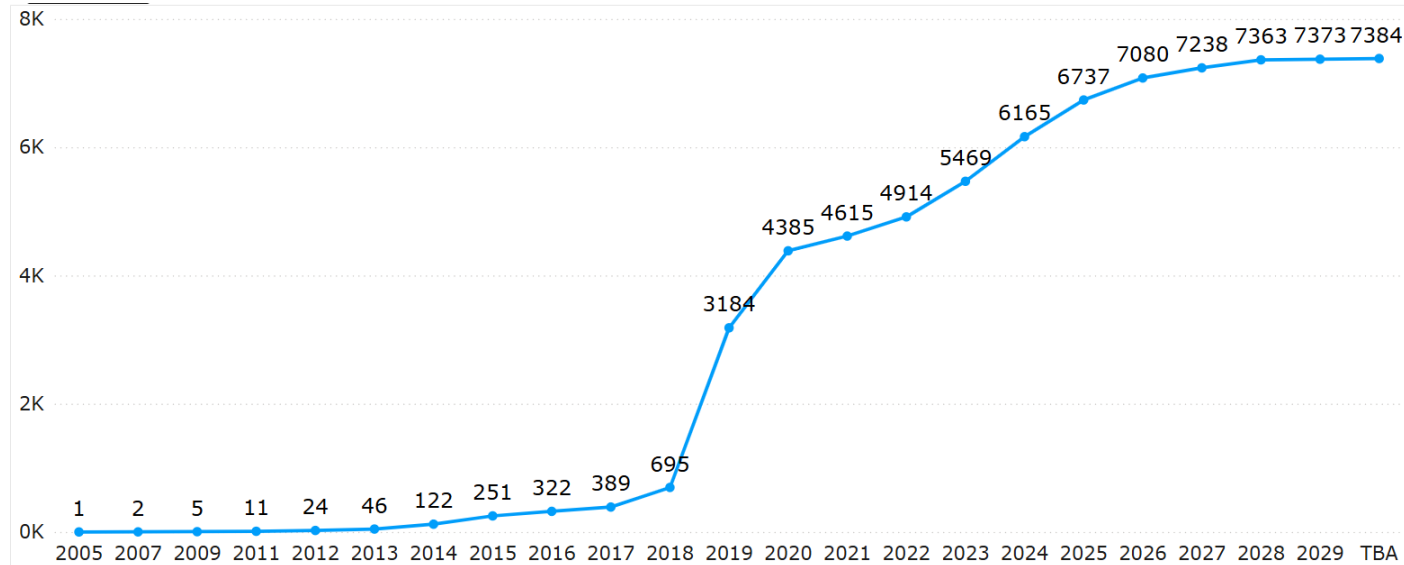


Closed loop scrubber system

0.45 m³/MWh = **5 m³/h**



Global installations of EGCS (scrubbers)



Stats from DNV, Alternative Fuels Insight, <https://afi.dnv.com/statistics>

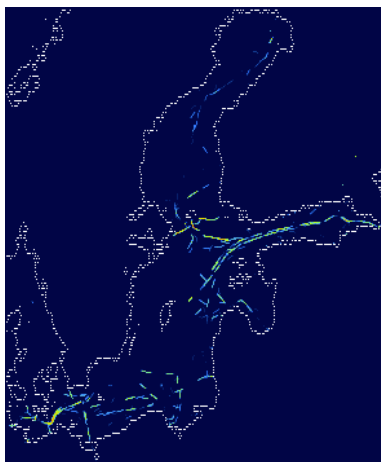
DIRECT EMISSIONS FROM SHIPPING

Ship types



Ship type discharge
volumes or amounts:
Bilge water
Grey water
Antifouling, etc.

Activity (AIS) data



STEAM
model



**Shipping
emissions**

Discharge volumes

Bilge water
Grey water
Sewage
Open loop scrubber
Closed loop scrubber

Amounts

Antifouling

Baltic Sea installations of EGCS (scrubbers)

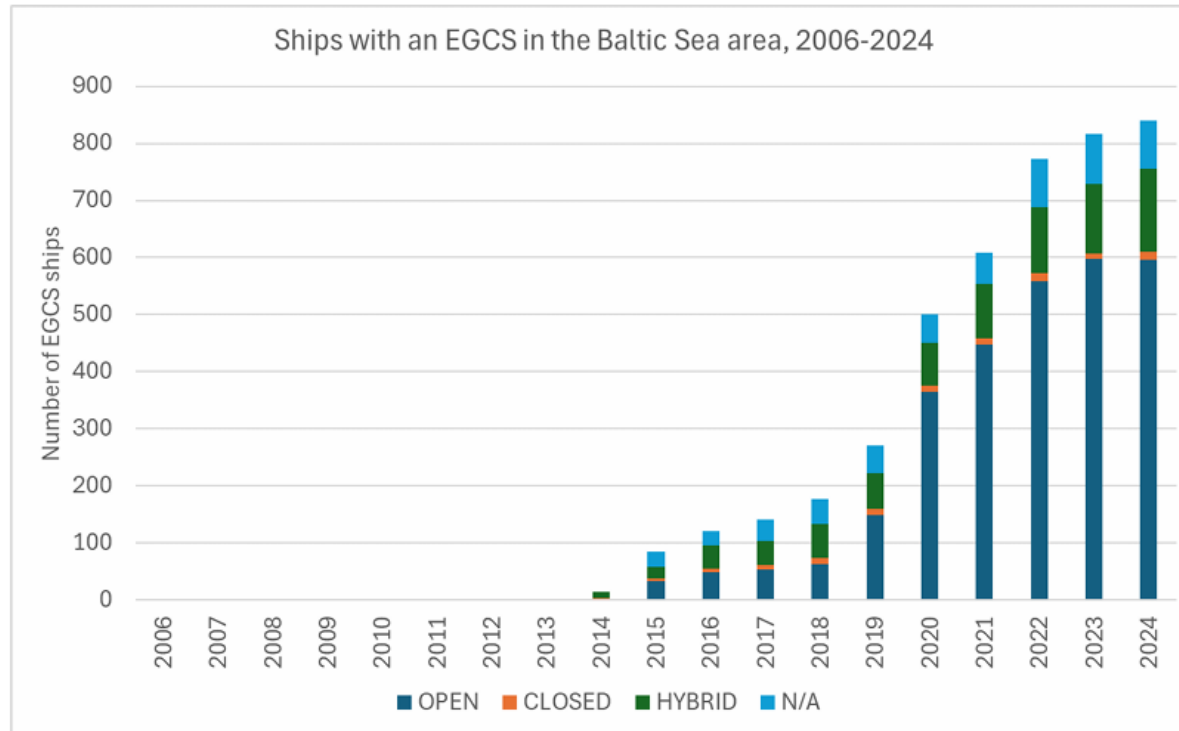


Figure 1 Development of the EGCS equipped fleet in the Baltic Sea area during 2006-2024. Unknown equipment type is listed, but for modeling purposes an Open Loop system is assumed for these cases.

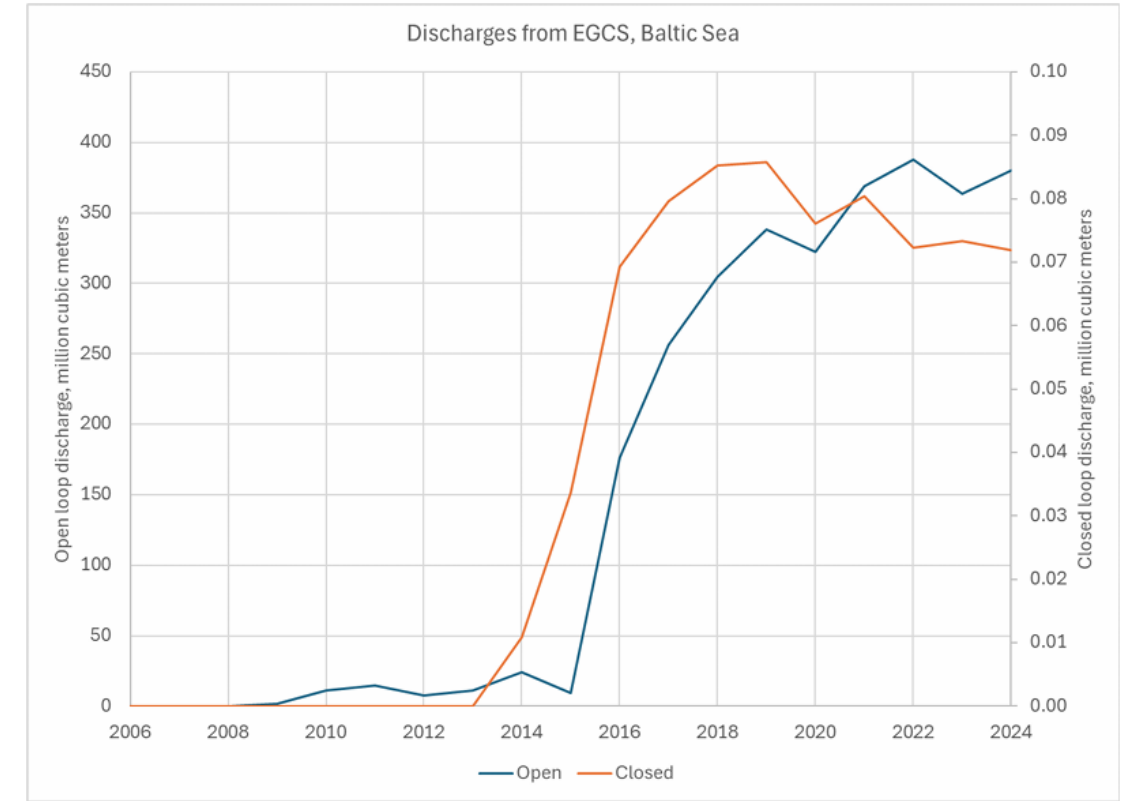
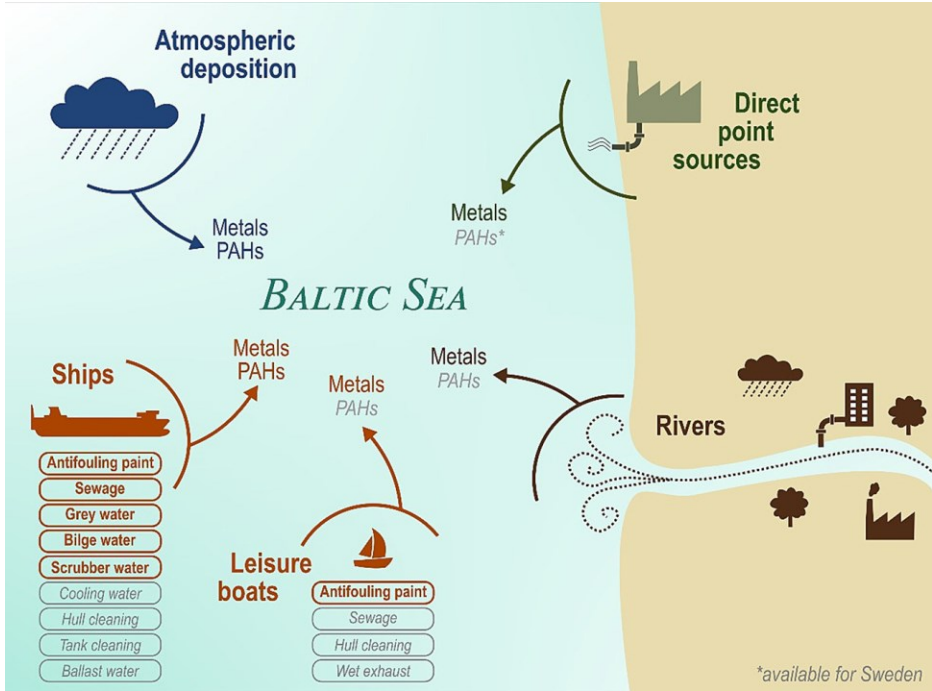


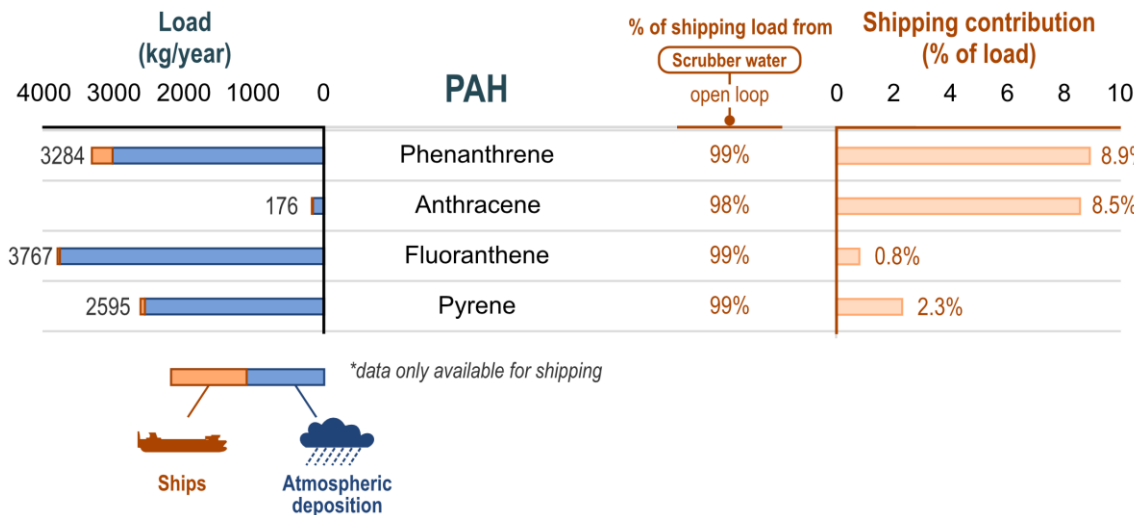
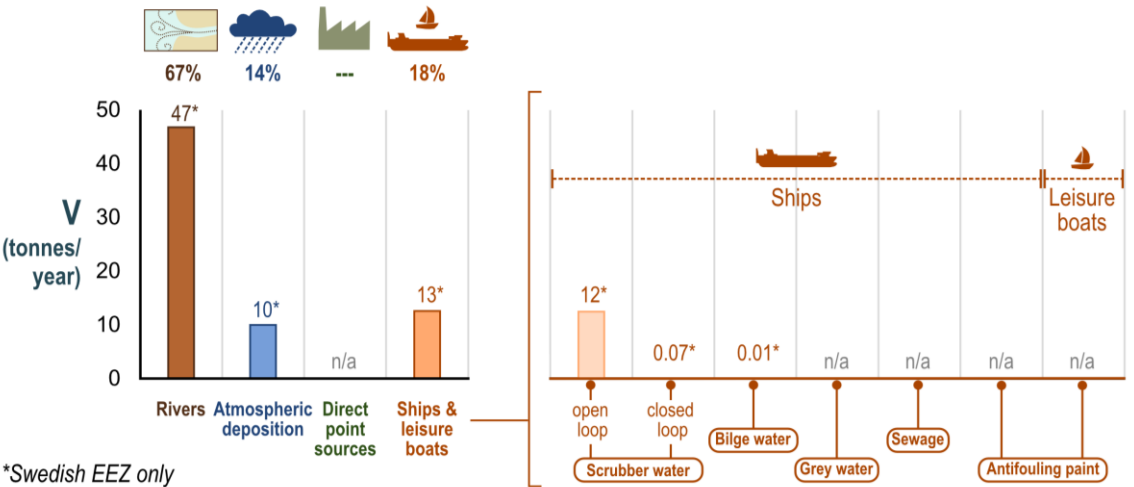
Figure 3 EGCS effluent discharges in the Baltic Sea area during 2006-2024. The blue line represents the Open loop discharge volumes (left vertical axis) and the orange line indicates the Closed loop effluent discharge volume (right side vertical axis). Note the difference of units between the axes.

The total volume of discharge water from EGCSs was about 380 million cubic meters. This was almost completely (99.99%) from open loop scrubbers. During the year 2024, there were 840 vessels operating the Baltic Sea area using scrubbers.

Inputs of hazardous substances to Baltic Sea



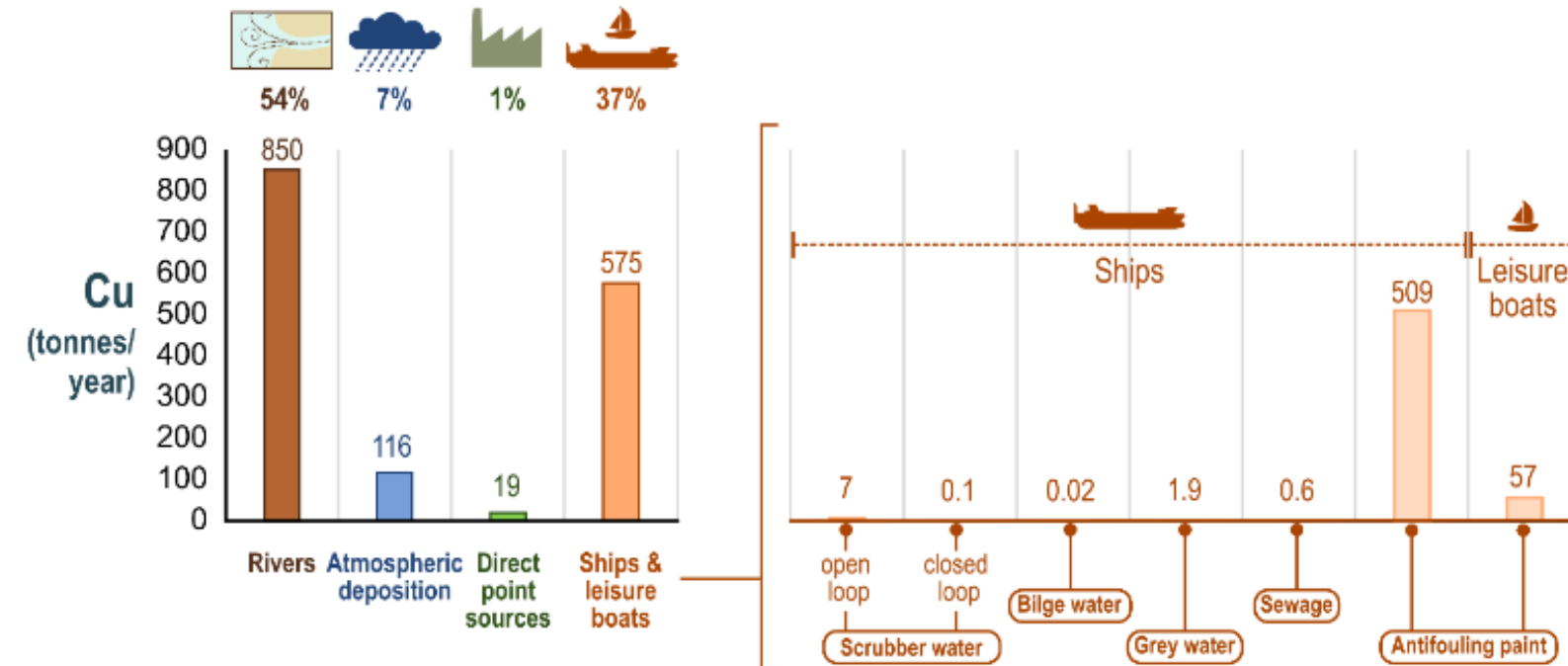
- Based on data from 2018, only 178 ships equipped with scrubbers
- Open loop scrubbers, large source of metals and PAHs



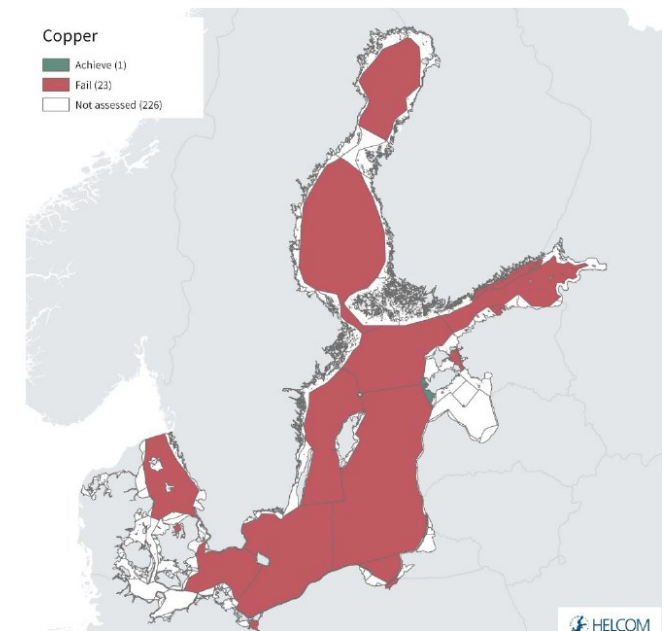
Ytreberg et al (2022). Metal and PAH loads from ships and boats, relative other sources, in the Baltic Sea, MPB, <https://doi.org/10.1016/j.marpolbul.2022.113904>.

Pressure and State of copper

Antifouling paints is the largest anthropogenic source of copper



Environmental status is poor with respect to Cu



Ytreberg, E., Hansson, K., Lunde Hermansson, A., Parsmo, R., Lagerstrom, " M., Jalkanen, J.P., Hasselov, " I.M., 2022. Metal and pah loads from ships and boats, relative other sources, in the Baltic Sea. Mar. Pollut. Bull. 182, 113904.



E

4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: +44 (0)20 7735 7611

Fax: +44 (0)20 7587 3210

MEPC.1/Circ.899
10 June 2022

2022 GUIDELINES FOR RISK AND IMPACT ASSESSMENTS OF THE DISCHARGE WATER FROM EXHAUST GAS CLEANING SYSTEMS

1 The Marine Environment Protection Committee, at its seventy-eighth session (6 to 10 June 2022), approved the *2022 Guidelines for risk and impact assessments of the discharge water from exhaust gas cleaning systems*, as set out in the annex.

Risk assessment under IMO (MEPC.1/Circ.899)

- Risk assessment is based on exposure (PEC) vs. hazard threshold (PNEC)
- Unacceptable risk is indicated when $PEC/PNEC \geq 1$ ($RCR \geq 1$)

Two complementary approaches

1. Substance-based (cumulative) approach

- Identify target substances (metals, PAHs, etc.)
- Estimate Predicted Environmental Concentrations (PEC) using emission scenarios and MAMPEC modelling
- Compare to PNEC for each substance
- Account for mixture effects by summing $PEC/PNEC$ (RCR)

2. Whole Effluent Toxicity (WET) approach

- Assess toxicity of actual discharge water (mixture)
- Derive PNEC (as dilution threshold) from WET tests
- Compare with modelled environmental dilution (PEC)
- Captures combined and interaction effects ("cocktail effects")

Limitations of substance-based approach

- Current ERA focuses on ~24 substances (metals + 16 US EPA PAHs)
- Assumes mixture toxicity can be explained by known components (CA approach)

However:

- Scrubber water contains many additional compounds (e.g. alkylated PAHs)
- Toxicity data is missing for many of these substances
- Unknown or unmeasured substances are not included in ERA

Result: Systematic underestimation of mixture toxicity

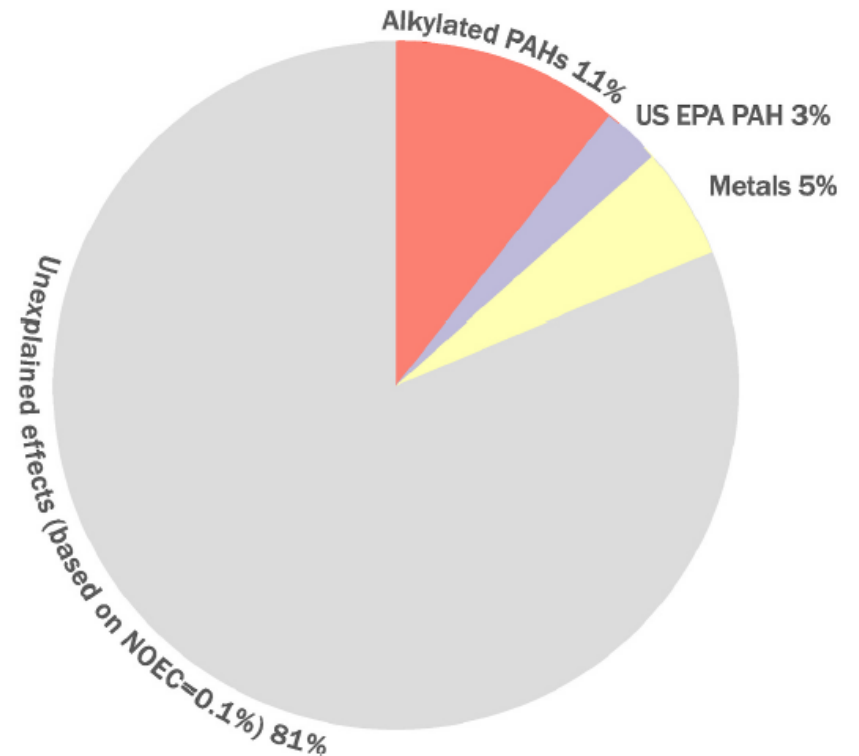


Fig. 2. Relative contribution to observed response based on toxic units (TUs) of alkylated polycyclic aromatic hydrocarbons (PAHs), 16 US-EPA PAHs and metals. Reported concentrations were retrieved and averaged from measurements in open loop scrubber water as reported in [García-Gómez et al. \(2024\)](#). The critical values are determined in this study based on all available measured and modelled data. Additional, unexplained, toxicity is required to reach a NOEC of scrubber water corresponding to a dilution down to 0.1%.

Whole Effluent Toxicity (WET) approach

2022 GUIDELINES FOR RISK AND IMPACT ASSESSMENTS OF THE DISCHARGE WATER FROM EXHAUST GAS CLEANING SYSTEMS

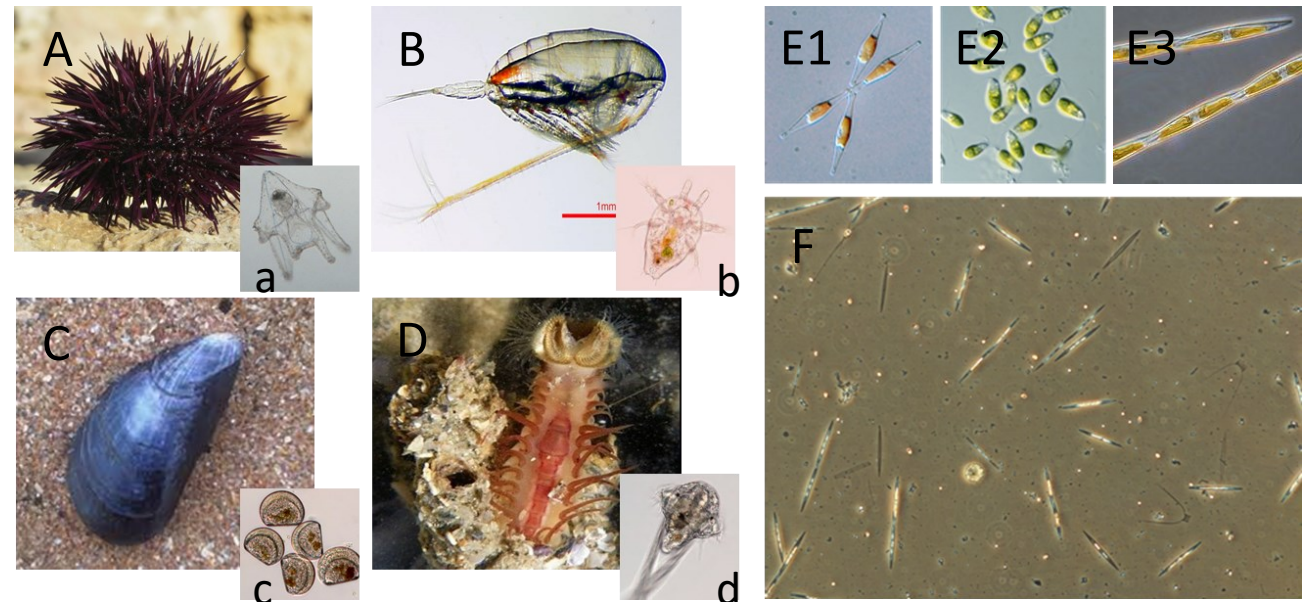
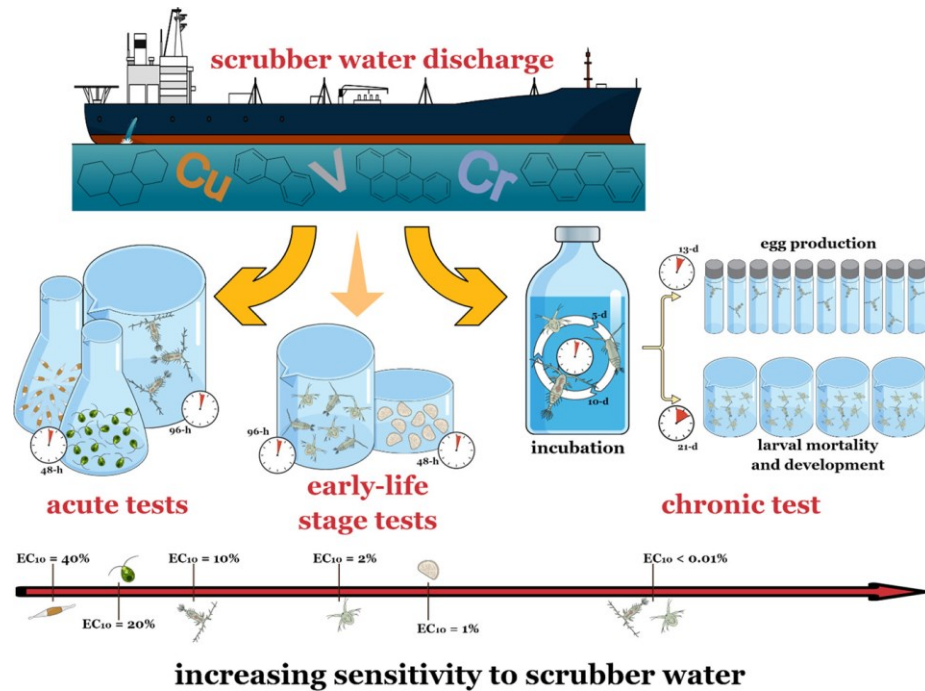
6 RISK CHARACTERIZATION

6.7.12 From the long-term viewpoints, the ratio between the resulting dilution ratio from the long-term calculation of PECs and the $PNEC_{\text{general}}$ from chronic WET tests should be calculated, and where the result is below 1, the assumption is that no unacceptable risk will result from exposure to the aggregated ecotoxicity of the discharge water from EGCS.

Whole Effluent Toxicity (WET) approach

- Systematic review of WET studies
 - 862 records → 23 studies included
- CRED screening → ensures reliable and relevant ecotoxicity data (standardised framework used in European regulatory assessments)
- Compiled ecotoxicity data (NOEC, LOEC, EC10/50) → multi-species, endpoints, life stages
- SSD-based hazard assessment → 14 species across taxa
- Exposure from dilution modelling + literature data → linked to hazard via PAF (potentially affected fraction)

Ecotoxicological whole effluent tests



Picone et al (2023) Impacts of exhaust gas cleaning systems (EGCS) discharge waters on planktonic biological indicators, MPB, <https://doi.org/10.1016/j.marpolbul.2023.114846>.

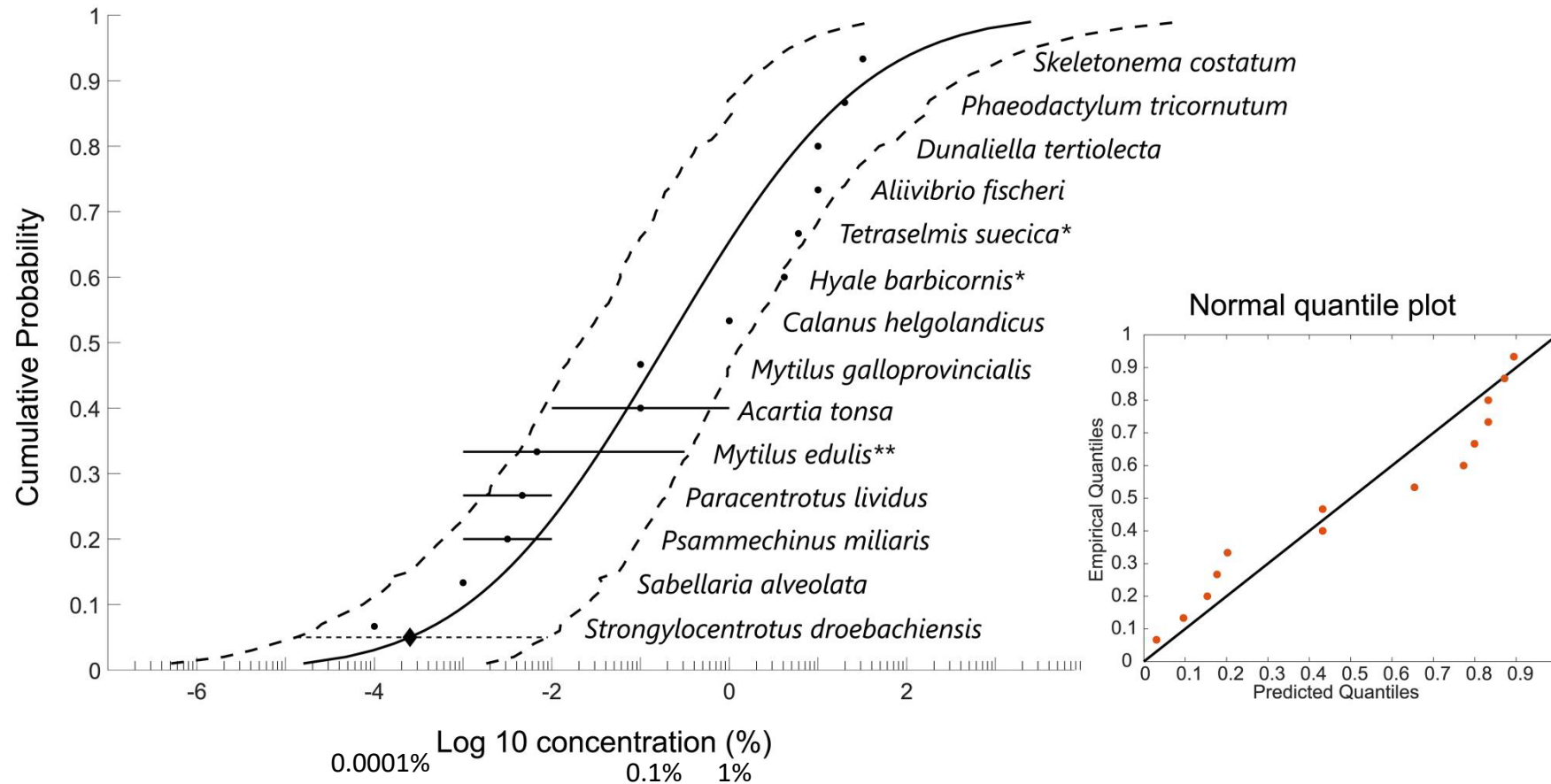
EMERGE Deliverable 2.3.

<https://www.ivl.se/download/18.5ae47fd818530c6f06024d0a/1676036161374/D2.3.%20E2%80%9CReport%20on%20scrubber%20water%20whole%20effluent%20toxicity%20testing,%20at%20different%20geographical%20regions%20E2%80%9D.pdf>

Marin-Enriquez et al (2023) Results from a German research project on the discharge water from exhaust gas cleaning systems (final report ImPex) (PPR 10/INF.15)

<https://www.umweltbundesamt.de/en/publikationen/environmental-impacts-of-discharge-water-from#:~:text=The%20results%20show%20that%2C%20depending,been%20detected%20in%20ecotoxicological%20analyses.>

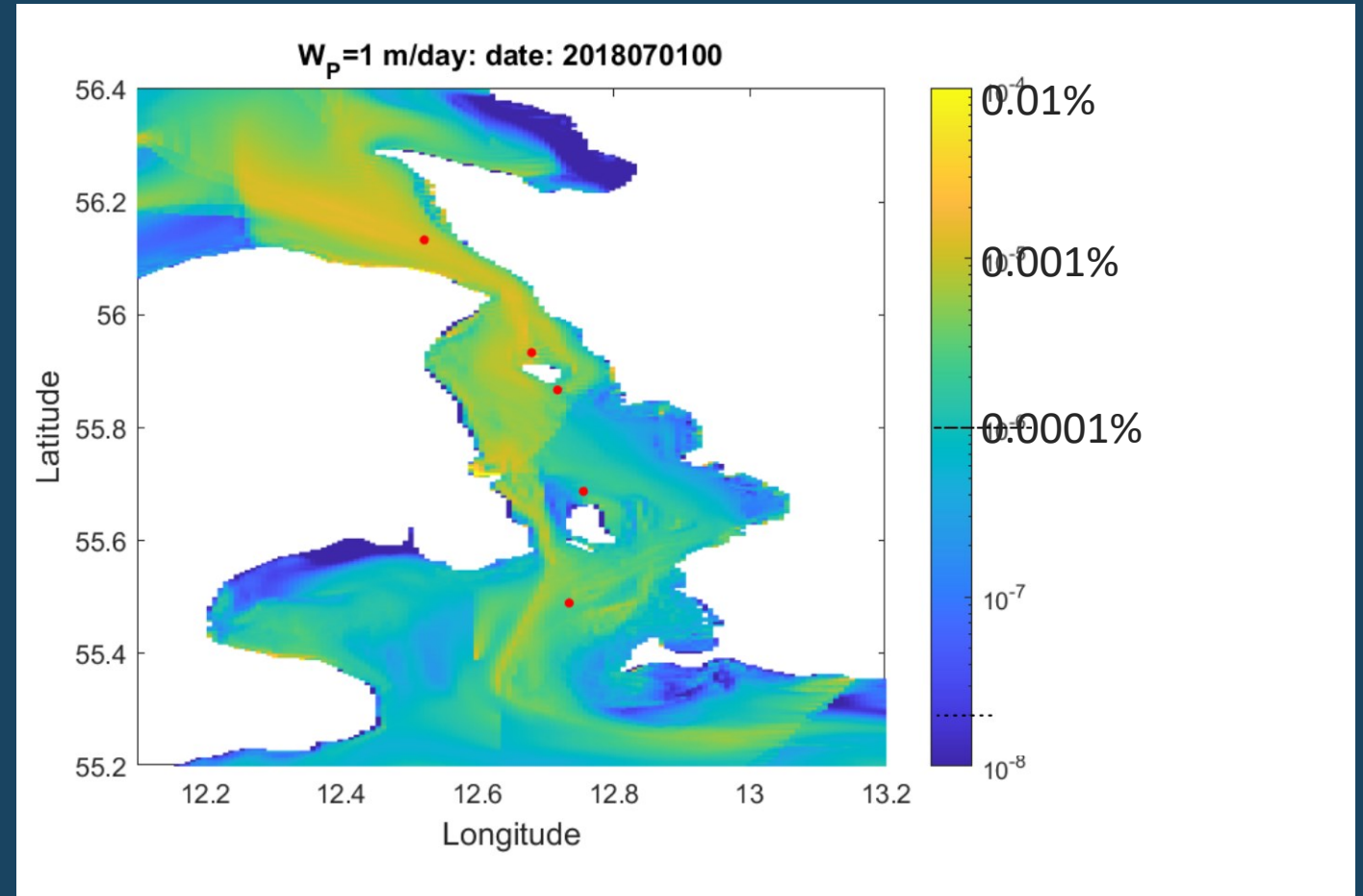
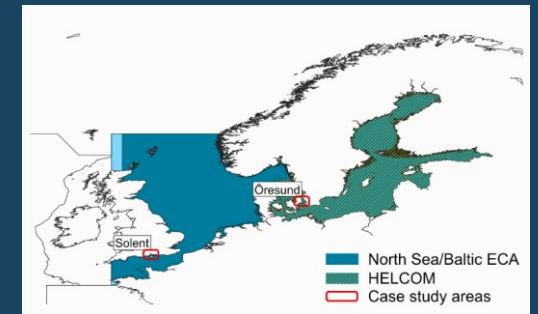
Baltic Sea installations of EGCS (scrubbers)



The open loop scrubber dataset (including laboratory-based scrubbers) comprises chronic endpoints of 14 species, representing bacteria, microalgae, crustaceans, mollusks, polychaetas, and echinoderms.

Environmental risk assessment show unacceptable risks of using open loop scrubbers in Öresund 2018

- Open loop scrubber water discharge in July 2018
- Surface water concentration predicted as dilution
- 0.0001% = 1 part in 1 million (10^{-6})
- Effects occur at these levels
- Environmental concentrations are of similar magnitude



Baltic Sea installations of EGCS (scrubbers)

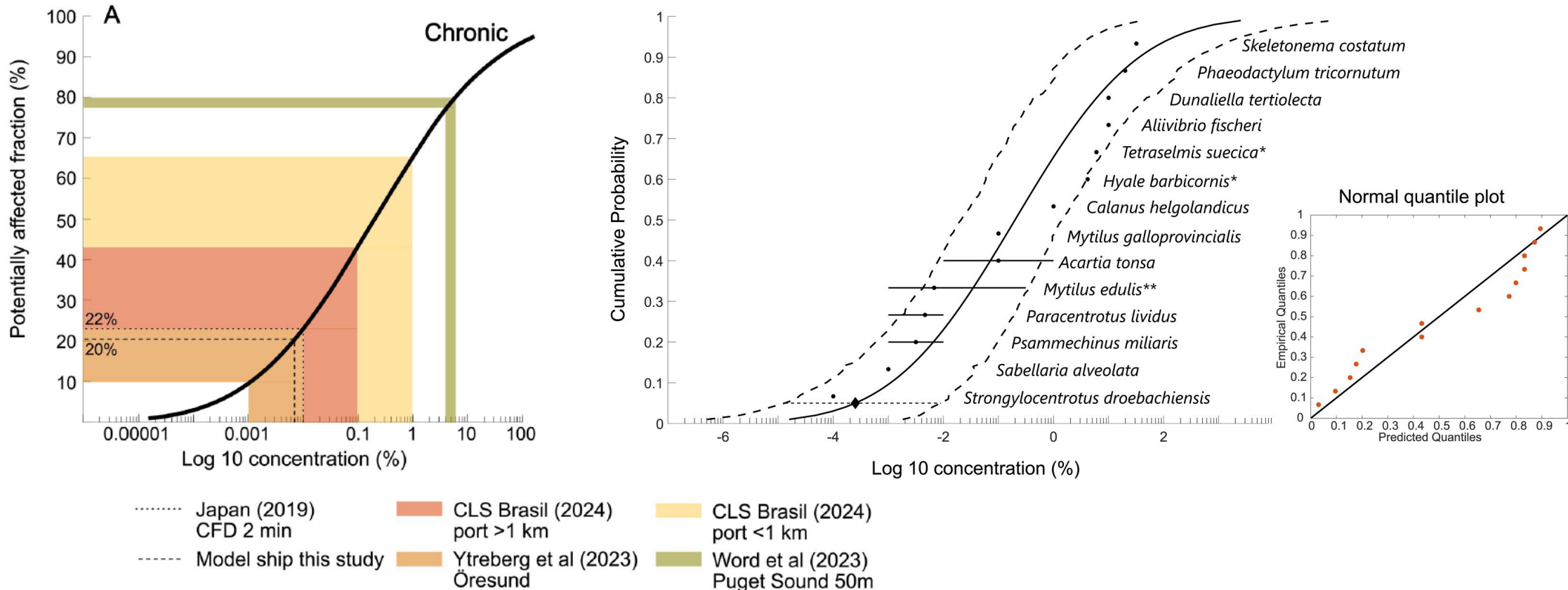


Figure 3. Scrubber water concentrations from dilution modeling results (x-axis) related to the potentially affected fraction of species based on the species sensitivity distribution curve constructed from (A) the chronic NOEC/LOEC values (including the converted EC50; Figure 1) and (B) the acute EC50 (including the converted NOEC/LOEC) from the whole effluent toxicity test. Table 2 lists information about the specific studies and references. EC50 = effect concentration of 50% of the tested species; NOEC/LOEC = no/lowest observed effect concentration.

Impact assessment chapter Regulation 7.4:

...the adoption of restrictions or a ban on discharge water from EGCSs should be considered in areas where any of the following indicative criteria are fulfilled:

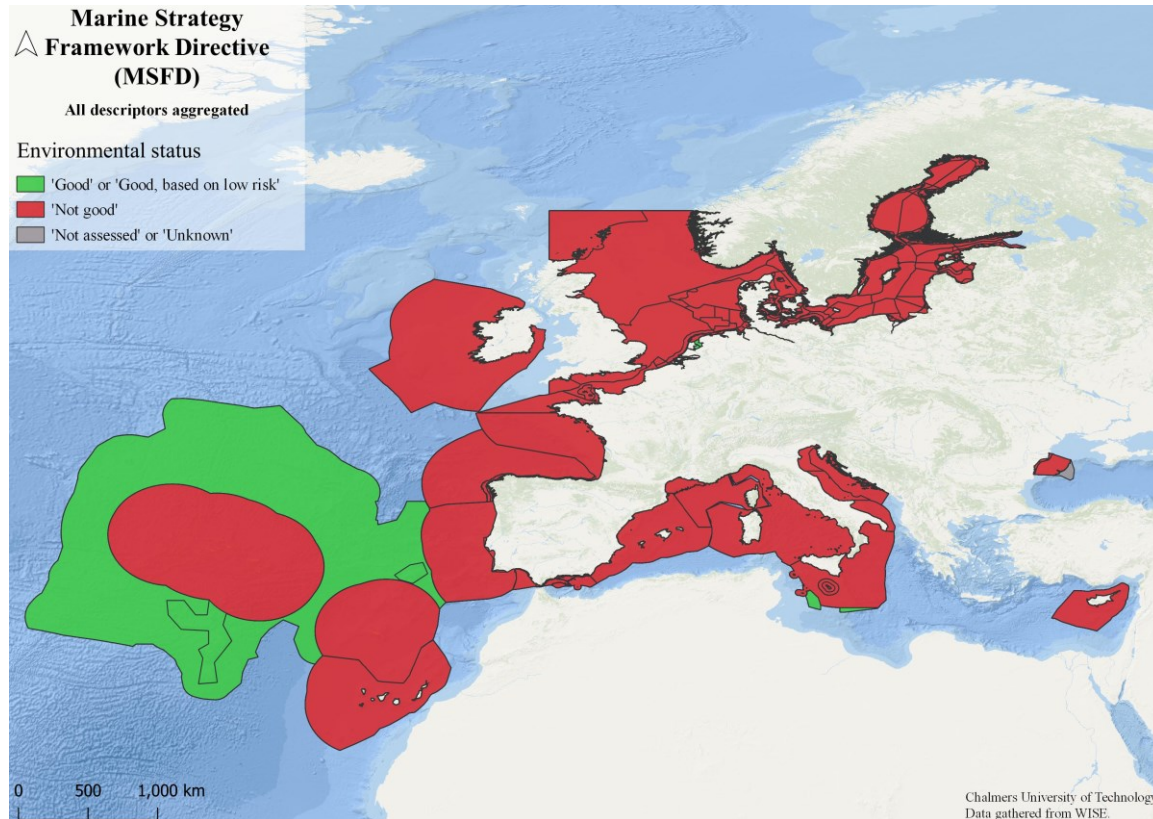
.1 environmental objectives in the areas are not met, e.g. good chemical status, good ecological status or good environmental status are not achieved under applicable legislation;

.2 the discharge of EGCS effluents represents an additional risk of deteriorating the environment and the resiliency of the climate system;

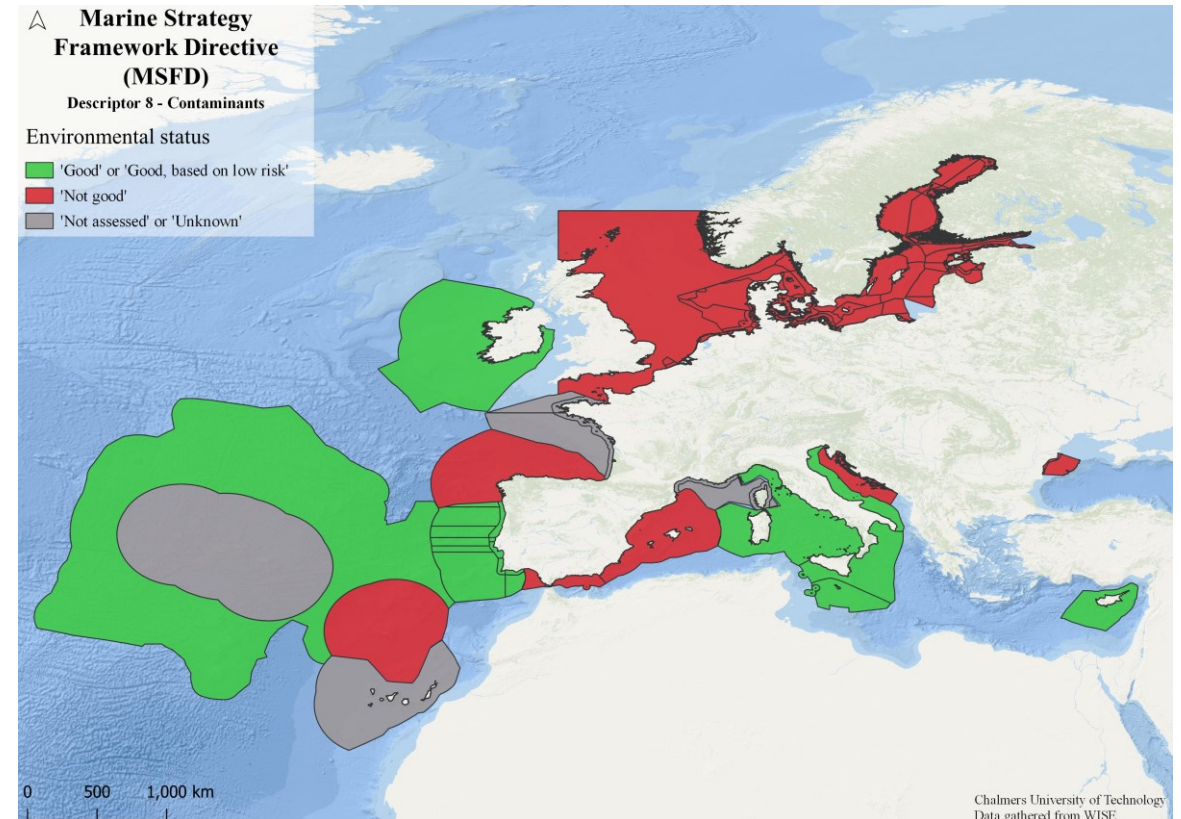
.3 the EGCS discharge water conflicts with the conventions and regulations formulated to protect the marine environment (see UNCLOS Article 195, etc.); and

.4 the EGCS discharge effluent represents an increase in the costs of management of dredged materials in ports.

EMERGE Impact assessment, following MEPC guidelines (MEPC, 2022a), show that a ban on discharge water from scrubbers should be considered in the entire Baltic and North Sea region



All descriptors aggregated – one out all out



Descriptor 8 – Contaminants.

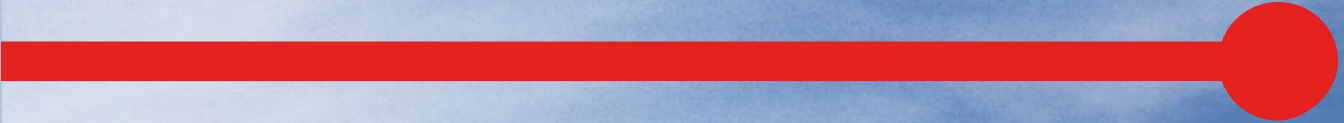
Conclusion

- Scrubber wastewater is a significant source of metals, PAHs and other hazardous compounds to the marine environment.
- Substance-based risk assessments likely underestimate toxicity because many mixture components remain unmeasured or lack toxicity data.
- Whole Effluent Toxicity studies show effects at environmentally relevant concentrations, including sensitive species and life stages.
- Risk assessments indicate unacceptable environmental risks in vulnerable sea areas such as Öresund

Thank you for listening!

Operational view from a Shipping Company

Speaker: *Fleet Superintendent Olegs Jevglevskis, Stena Line*



SCRUBBER waste utilisation

September 2026



Agenda (safety and security)

- Fleet with Exhaust Gas Cleaning system (EGCS)
- Regulations / STATUTORY limitations
- EGCS type
- Type of waste / water treatment
- Waste Utilization
- Operational impact
- Potential alternatives

STENA LINE «BALTIC SEA North» Fleet

June 2026



Stena Baltica / Stena Scandica



Cantiere Navale Visentini SRL, Porto Viro, Italy
LBP: 213.91m
Beam: 25.6
Service speed: 22kts
Engines:
Main engines: 2xMAN 9L48/60B 10800kW
Auxiliary Engines; 3x CAT3516B 1800kW
Fuel consumption 82MT/Day at service speed.





STATUTORY limitations / challenges



Marine legislations / statutory requirements

Global scrubber rules in force right now:

- ❖ 1.1 MARPOL Annex VI sulfur regime
- Scrubbers / EGCS remain an accepted “equivalent” compliance route under Regulation 4 of MARPOL Annex VI

Current IMO technical framework for EGCS

- ❖ MEPC.340(77) (2021 EGCS Guidelines)
 - ❖ 2022 Guidelines for Risk and Impact Assessments of EGCS Discharge Water (MEPC.1/Circ.899)
 - Key document for environmental friendly company.
- ✓ Switch to closed-loop / zero discharge in ports
 - ✓ Define port-specific SOP
 - ✓ Maintain wash-water monitoring + records



Exhaust GAS CLEANING EQUIPMENT

June 2026

Ship Emissions: SO_x, NO_x, CO₂, Particulate Matter, Soot, Ash



Main Pollutant: Fuel - IFO 380 (e.g. 2.5–3.5% S → high SO₂ concentration)

- Sulphur oxides (SO_x) Mainly SO₂ (dominant) + small SO₃
- Nitrogen oxides (NO_x) NO and NO₂ Formed at high combustion temperatures
- Particulate matter (PM)
 - Soot (carbon particles),
 - Ash
 - Unburned hydrocarbons (Includes black carbon and heavy metals)
- Carbon monoxide (CO) (Product of incomplete combustion)
- Unburned hydrocarbons (HC / VOCs), PAH

MITIGATING ACTIONS

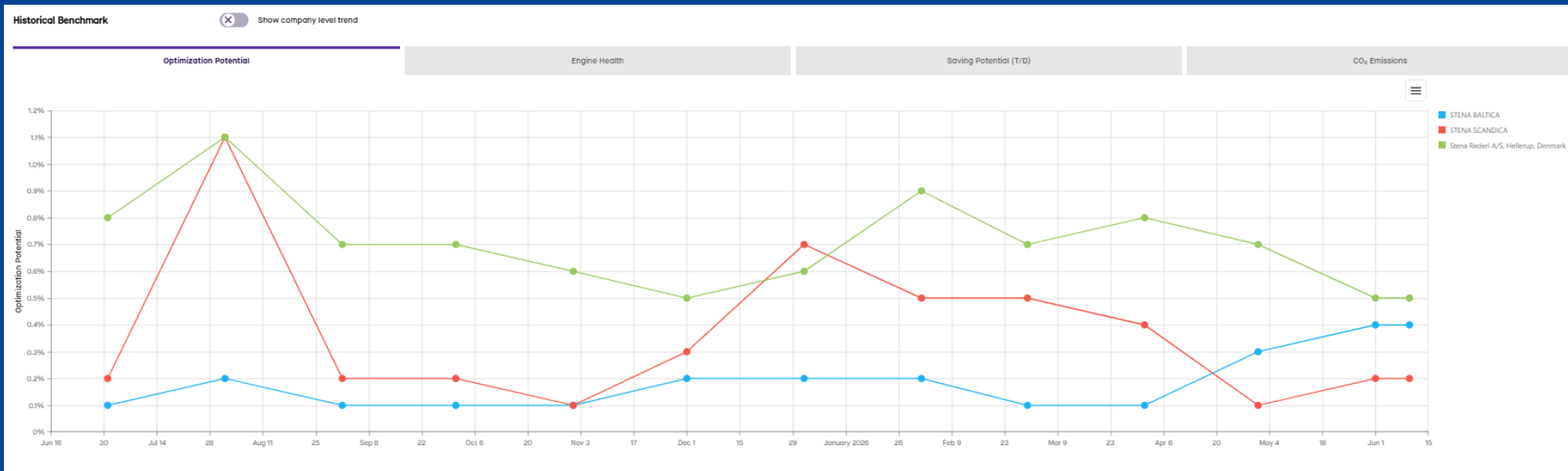
FUEL combustion PROCESS

Main ENGINE PERFORMANCE

- ENGINE CONDITION
- MAINTENANCE
- MONITORING
- Engine load

POST-combustion TREATMENT

EXHAUST GAS TREATMENT
DRY / WET SCRUBBERS
De-SULPHURISATION SYSTEMS



Hybrid Exhaust Gas Cleaning (EGC) System

Main Purpose:

Remove harmful pollutants—primarily sulphur oxides (SOx)—from ship exhaust gases, so the vessel complies with IMO emission regulations and reduces environmental impact.

HYBRID –

OPEN loop

CLOSE Loop (Chemical treatment), treated water discharge.

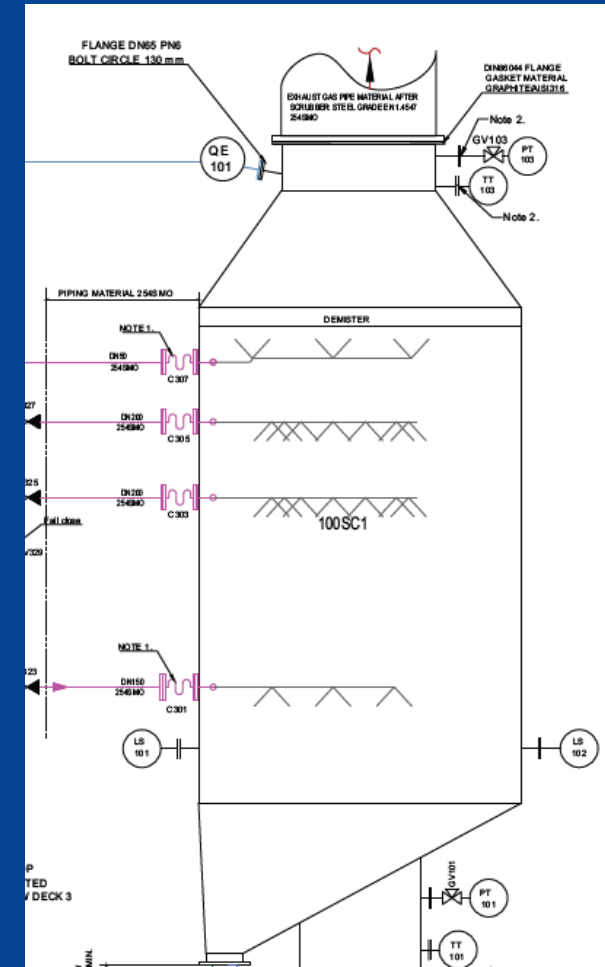
zero discharge mode

No discharge

REMOVAL METHOD

The SOx are captured and neutralized inside the scrubber tower by means of alkali water spray.

PM, Soot, Ash, - accumulated in the process water for further treatment.





Water treatment WASTE Handling on board

Waste Management

Scrubber sludge - what MARPOL category?

Main MARPOL classification

Scrubber sludge is classified as:→ “Exhaust Gas Cleaning System (EGCS) residue”

This falls under:

MARPOL Annex VI (Air Pollution)

👉 Defined as:

Material removed from washwater / bleed-off water during treatment.

Disposal requirements (important operational point) Under Annex VI:

- ✗ Discharge to sea: NOT allowed
- ✗ Incineration onboard: NOT allowed
- ✓ Must be: Stored onboard / Delivered to port reception facilities

TYPES OF OPERATIONAL WASTE

Process water :

Not really water, it is a mix:

- Water (seawater, fresh water)
- Alkali
- Soot
- Ash
- Unburned fuel



Dry waste:

- From water cleaning process
- From Scrubber tower cleaning



Semi-dry:

- Sludge
- Slurry



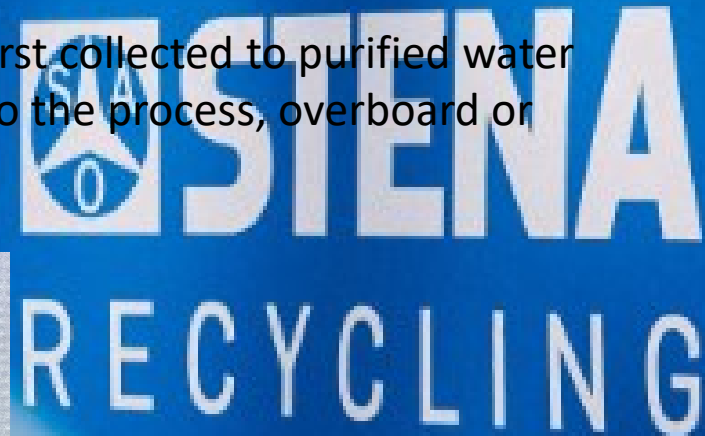
Waste Management

All accumulated waste are collected on board and discharged to a shore facilities.

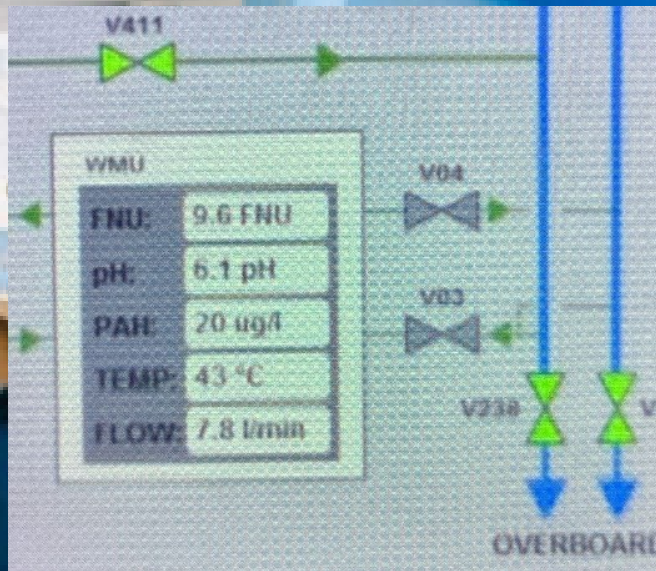
STENA RECYCLING

Treated water.

Water from membrane unit is first collected to purified water tank and then is directed back to the process, overboard or collected as required.



Vanadium	IP 501	mg/kg	350 Max	83
Sodium	IP 501	mg/kg	100 Max	25
Aluminium	IP 501	mg/kg	-	1
Silicon	IP 501	mg/kg	-	< 1
Aluminium + Silicon	Calc	mg/kg	60 Max	< 2
Calcium	IP 501	mg/kg	30 Max	< 1
Phosphorus	IP 501	mg/kg	15 Max	< 1
Zinc	IP 501	mg/kg	15 Max	< 1
Iron	IP 501	mg/kg	-	11
Nickel	IP 501	mg/kg	-	13
Magnesium	IP501 (Mod)	mg/kg	-	< 1
Lead	IP501 (Mod)	mg/kg	-	< 1
Potassium	IP501 (Mod)	mg/kg	-	< 1



OPERATIONAL INDIRECT LOSS

WASTE UTILISATION COST MARPOL I vs MARPOL VI

25% higher when Marpol I waste, with volume five times less when TOTAL MARPOL I
300m³ cost more than 1500m³
Technical reliability – STENA VESSEL Target 100%
Must keep ULSFO for 48 hours – 60MT
EXTRA WEIGHT:
ALKALI Reserve
PROCESS WATER
DIRTY WATER
Additional operation weight – 80MT
Total 140MT – 4 trucks (-3600Eur every departure)

Additional human resources
Extra engineer on board for system Maintenance.



ALTERNATIVES

Solution	SOx	NOx	CAPEX	OPEX	Regulatory future
Wet scrubber	☑	✗	High	Medium	Increasing restrictions (washwater)
Dry scrubber	☑	✗	High	Medium	More robust vs bans
SCR	✗	☑	Medium	Medium	Required for Tier III
VLSFO/MGO	☑	✗	None	High	Stable baseline
LNG	☑	partial ☑	High	Medium	Strong transition fuel
Methanol	☑	partial ☑	Medium	Medium	Rapid growth
Ammonia/H ₂	☑	☑	Very high	Unknown	Long-term solution
Electrification	☑	☑	High	Low	Strong for short routes



Thank you



Practice from the Port

Speaker: *Environmental Manager Anton Airas, Port of Helsinki*

Scrubber Waste in Helsinki

Anton Airas
Environmental Manager
Port of Helsinki



|| PORT OF ||
|| HELSINKI ||



Topics

- Port perspective on scrubber waste
- Procedure in Helsinki
- Potential challenges

Port perspective

- Exhaust gas cleaning systems, also known as scrubbers, are widely used by ships to comply with sulphur emission limits while continuing to use fuel with higher sulphur content.
- According to MARPOL Annex VI Ports have to arrange waste handling for Air-pollution-related waste and Exhaust gas-cleaning residues like scrubber waste, so the port receives scrubber waste on request
- Scrubber waste is hazardous operational waste, which is charged from the waste producer based on actual costs (price list available to vessels in advance). It is not included in the waste management fee.
- Most of the waste is treated in high temperature combustion on land at a hazardous waste facility.
- Some really mild closed-cycle waters can be treated with slightly lighter treatment, such as evaporation or similar, and only the evaporation residue can be burned, but often, due lack of more accurate information or analyses and schedule pressure, these are burned.



Procedure in Helsinki

- The vessel submits a ship waste notification no later than 24 h before arriving at the port
 - The earlier the information is received, the better. The 24 h notification requirement can sometimes be tight for arranging sufficient equipment; for weekend port calls, information is needed by Friday at the latest (by 3 p.m.).
- The port asks for the pH of the scrubber waste to be received
 - Possible need for an acid-resistant tanker truck (fewer are available, so this must be known in advance)
- Volumes can be large: above 20 m³ needs a combination vehicle or several vehicles → Largest amounts discharged at once has been around 130 m³
- The Port orders the required reception equipment to the berth at the agreed time accordingly
- After reception is completed, the port waste service provider informs the Port of the volume received and the time used
- The information is added to the ship waste receipt issued by the Port
- The cost is charged from the ship agent
- Reception facility fairly nearby, <80 km
- In Port of Helsinki the price is the same regardless of equipment and destination (elsewhere it may have an impact, for example the reception facility may be far away).



Volumes and influencing factors (potential issues)

- Approx. 300 m³/year
- Calls by large cruise ships are increasing
- Open-loop discharge restrictions already apply from 1 July 2025
- Closed-loop discharge restrictions apply from 1 January 2029
- All of these will increase the amounts of scrubber wastewater in ports
- What will be the role of scrubbers in reducing sulphur emissions vs. LNG and/or other possible alternative fuels?
- Will waste-treatment facilities have sufficient reception capacity?
- If notification is not received early enough, do we need acid-resistant equipment, and does the reception facility have capacity? → an alternative facility may be far away, or waiting may be required
- Obtaining the pH information has sometimes been difficult. If volumes discharged at once increase, could there be a shortage of acid-resistant equipment?
 - Theoretical possibility that equipment might not be available; however, this has not yet happened in Helsinki.



Key takeaways

Helsinki can receive scrubber waste — reliable planning depends on early, complete information.

1 Notify early

2 Provide pH and volume

3 Ready for growth of volume

Most important: • Estimated volume and pH • Notification as early as possible

THANK YOU!



|| PORT OF ||
|| HELSINKI ||

Anton Airas
Environmental Manager
Port of Helsinki Ltd.
anton.airas@portofhelsinki.fi

Practice from the Port

Speaker: *Edvard Molitor, Port of Gothenburg*

Cleaning the Mess: Insights from the Technology Provider

Speaker: *Service Manager Priit Saarlaid, Lanh Tech*



LANGH TECH

Insights from the Technology Provider



 Langh Tech	 Hans Langh	 Langh Cargo Solutions	 Langh Ship
SOX SCRUBBERS AND WATER TREATMENT	CLEANING SERVICES FOR SHIPS, BUILDINGS AND INDUSTRY	SPECIAL CONTAINER SALES AND RENTAL	A FINNISH SHIPPING COMPANY
			
Langh Tech Oy Ab designs and produces scrubbers for SOx removal from exhaust gases and water treatment units for closed loop scrubbers and other marine applications.	Industrial and Ship Cleaning Services Hans Langh has produced cleaning services for the shipping, building and manufacturing industries since 1973 continuously creating new and more efficient solutions to serve the clients.	Langh Cargo Solutions sells and leases a wide selection of special containers for sea, road and rail transports.	Langh Ship Oy Ab is a ship owning company with ten multipurpose cargo vessels.



- Removal of sulphur oxides, PAH and CO₂ from ship's engine and boiler exhaust gases.
- Main usage in sulphur reduction due to the environmental legislation (IMO 2020).
- Goal in improving air quality which preserves the environment and protects human health.



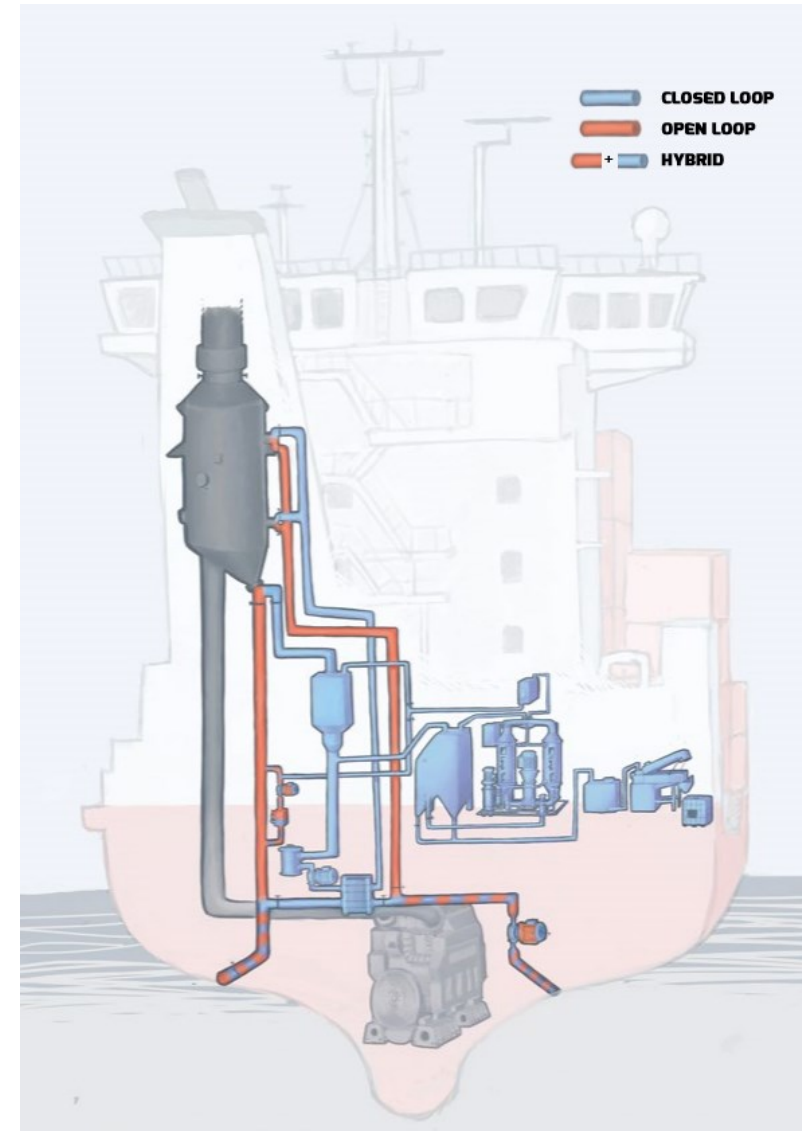


- IMO placed sulphur limit regulations that would become worldwide in 2020.
- In 2012 Langh Ship began to investigate the possibility of making their own scrubber system, utilizing the water treatment know-how gained from land-based systems used in industrial cleaning. First installation was made in 2013. After successful testing, four more systems were installed on all Langh Ship vessels.





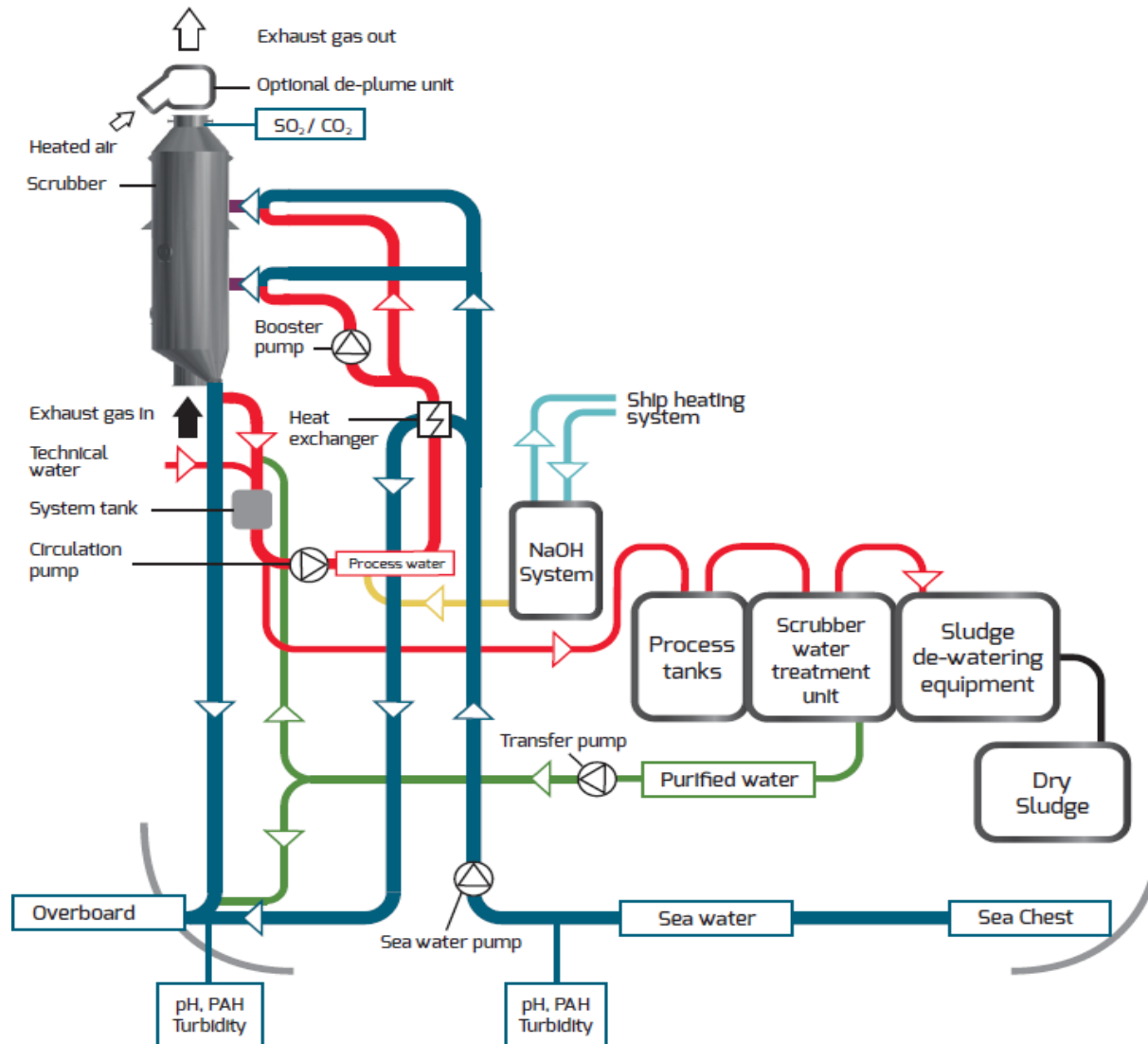
- Langh Tech designs and produces scrubbers for SO_x removal from exhaust gases and water treatment units for closed loop scrubbers.
 - Open loop scrubbers
 - Closed loop scrubbers
 - Hybrid scrubbers





Langh Tech scrubber and water treatment systems have been fitted on all kinds of vessels: Containerships, bulkers, general cargo vessels, Ro-Ro vessels, cruise vessels, car carriers, oil and chemical tankers etc.

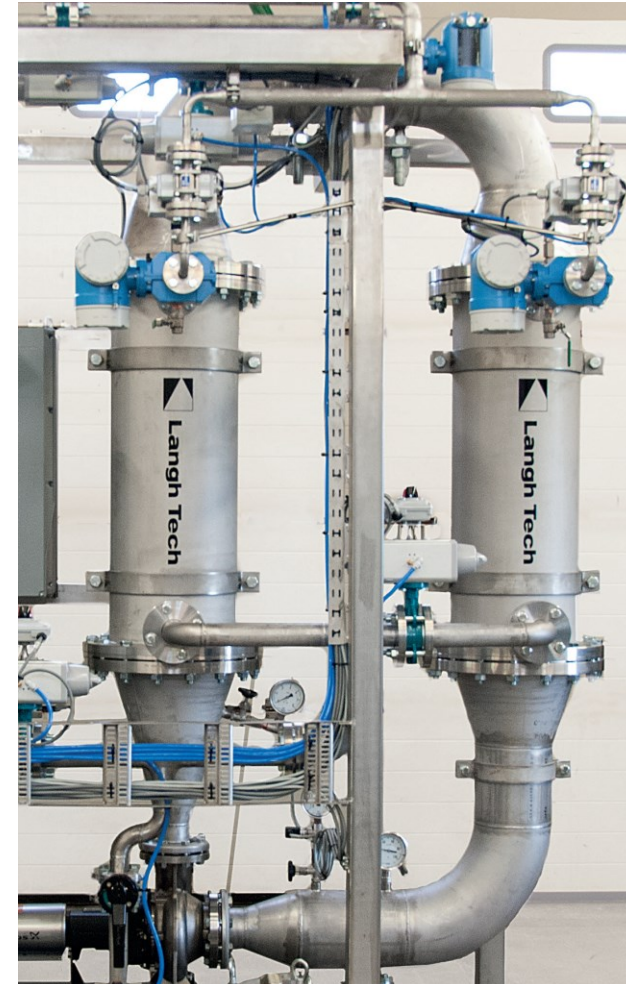
Over 150 Scrubber System installations- more that 40 Hybrid type.



System working principle

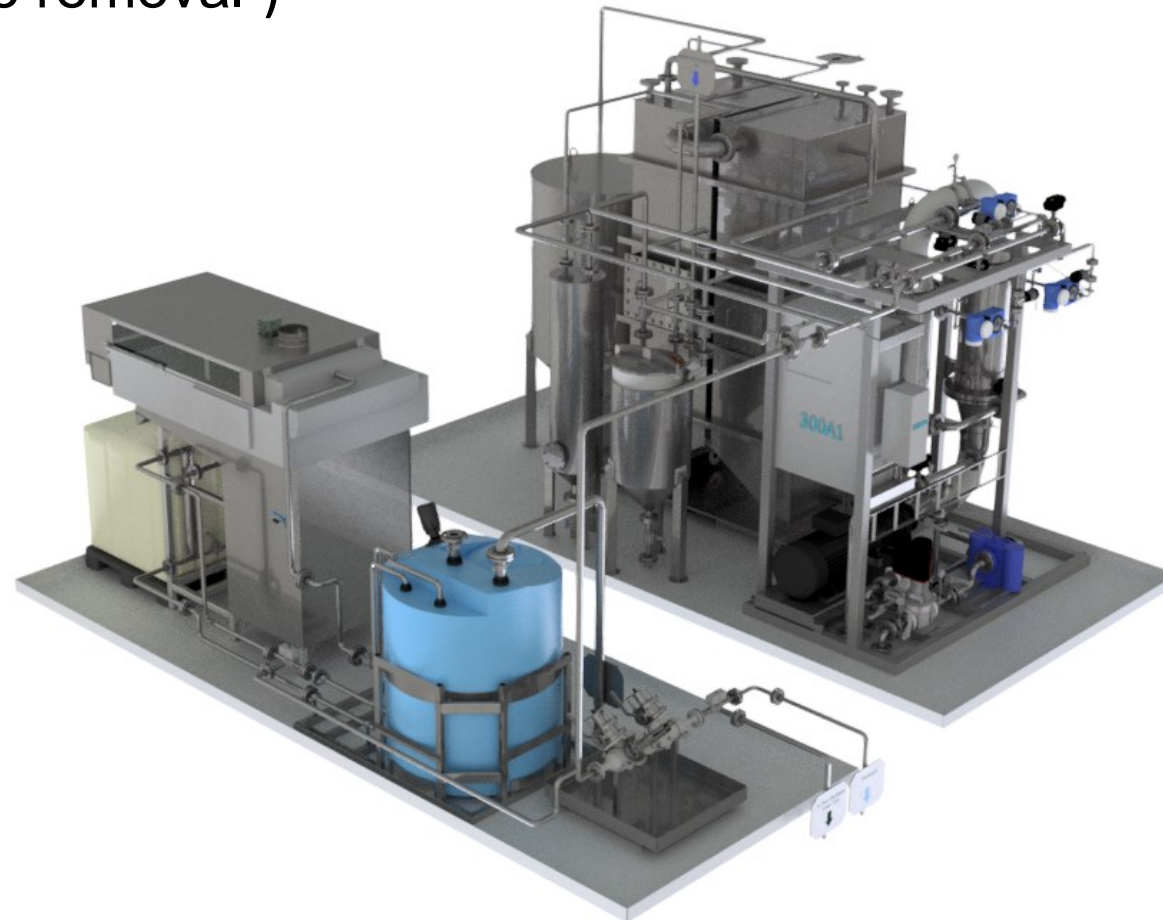


- Langh companies have 25 years experience of membrane filtration.
- Modular closed loop water treatment system that can be adapted to different engine powers and installation spaces
- Unique Langh Tech closed loop water treatment system can also be combined with other manufacturer's scrubbers





Membrane Unit together with Belt filter system (sludge removal)





Sludge removal with belt filter system



Example:

HSFO 380cSt , sulphur content 3,5%

Engine power 8500 kW

Fuel consumption 1,2Mt/ h with 85% ME load

Sludge formation 2,8kg / HFO Mt
(80kg per 24h continues CL operation)

NaOH consumption up to 100 l/h

Fresh water consumption 500l/h

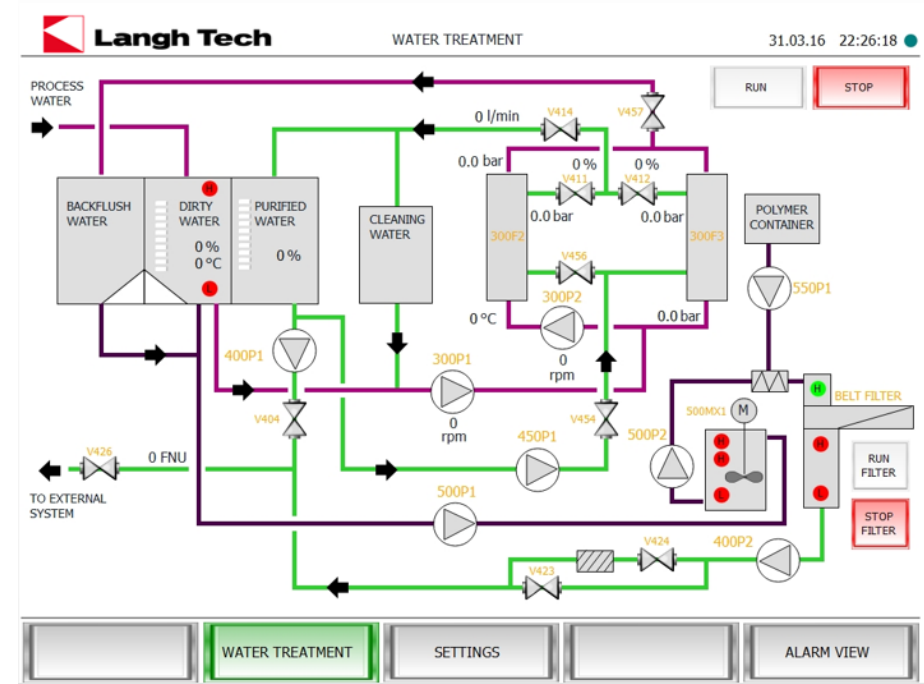
Cleaned effluent to sea 0,3-1m³/h





User point of view

- Automated control system easy to operate
- Automatic switch over between open and closed loop modes
- Well defined control mimics for water treatment unit.

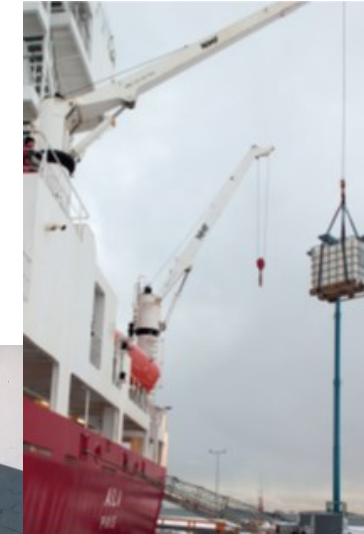




- Minimal amount of dry sludge waste to be disposed ashore
 - Belt filter removes 90% of the sludge's water content
 - Minimal amount of dry waste that is disposed ashore > lower operational cost.
1800 EUR/ Mt
(Mediterranean Area)
- In the end of the water treatment process the waste drops into barrels (or IBC containers) which are then lifted ashore



Sample of closed loop process water and sample of the residues after clean water has been separated.





- Expectations for Ports:
 - Larger reception network
 - Clear and easy hand-over from vessel to shore.

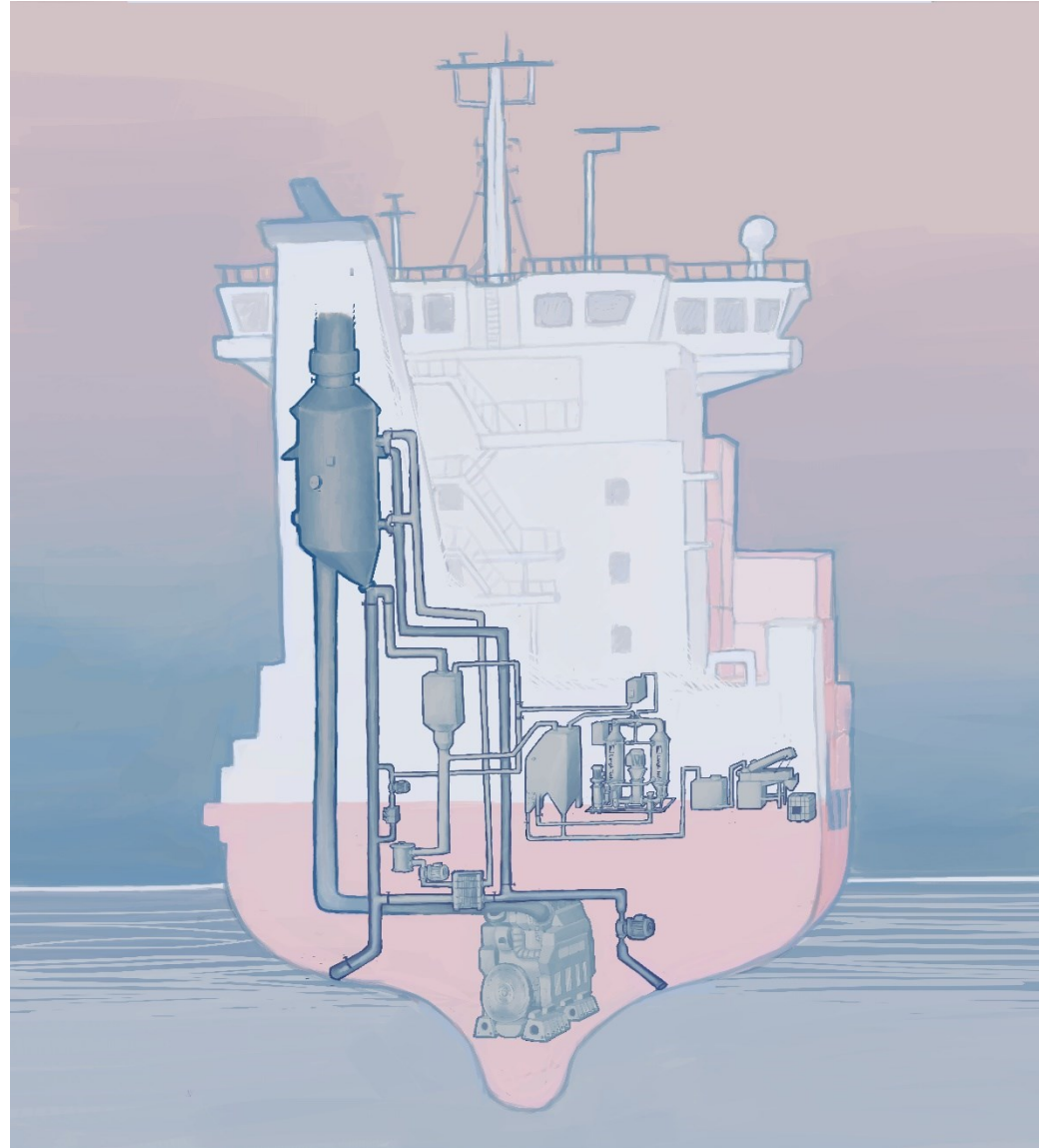
Possible usage:

- Fertilizer manufacturers
- Chemical industry





Thank you!



World Café

- You will be divided into groups
- Three discussions per table/room
- The Table host will be leading the discussion and gathering notes

LUNCH!

Continue the work at 13.30

World Café

Findings & Discussion

World Café findings: Table 1/ Operational view from a Shipping Company

- first point
- Second point

World Café findings: Table 2/ Practice from the Port

- first point
- Second point

World Café findings: Table 3 / Insights from the Technology Provider

- first point
- Second point

Best Practices from the Field

Speaker: *Senior Director Maritime Policy Jose Gonzales and Valerie Chatterley, CLIA*



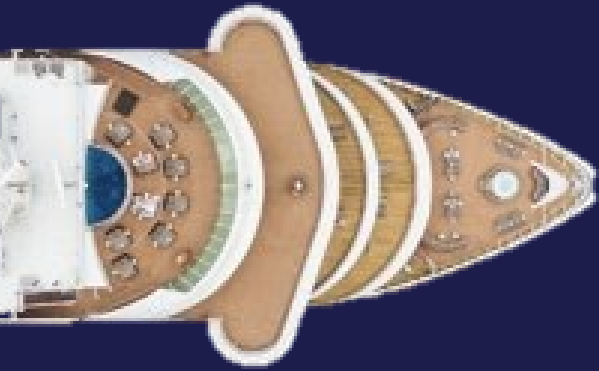
Cruise Industry Best Practices

1st Informal Consultation Workshop on EGCS
Washwater Discharges

Riga, Latvia, 17th June 2026



Agenda



About CLIA
Best Practices
Conclusions

About Cruise Lines International Association



Cruise Lines International Association (CLIA) provides a unified voice for the industry as the leading authority of the global cruise community. Together with its members and partners, CLIA supports:

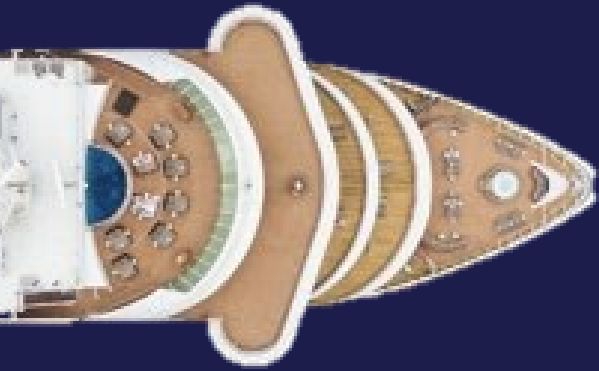
- Policies and practices that foster safe, healthy and sustainable cruise operations;
- Tourism strategies that maximize the socio-economic benefits of cruise travel; and
- Environmental technologies, practices, and innovations that support responsible cruise operations



Cruise lines are pursuing net-zero emissions by 2050

- Reducing emissions at berth and at sea
- Pursuing fuel flexibility, conducting multiple trials
- Making substantial and concrete investments in environmental technologies and practices

Agenda



About CLIA
Best Practices
Conclusions

Open Loop EGCS Best Practices



Cruise Industry Best Practices

- OL EGCS are internationally recognized equivalent compliance technologies authorized by Flag States
- Continuous monitoring and data sharing
- Supporting Science and Evidence-Based decision making
- Operational Excellence and Continuous Improvement

International Context

- OL EGCS operate within an internationally recognized regulatory framework and guidelines
- OL EGCS use naturally occurring seawater alkalinity to remove the sulphur oxides and generate Washwater discharges consistent with IMO guidelines
- Cruise lines operate in accordance with IMO requirements as well as applicable Flag State, national and regional regulations
- Discharge criteria has been developed through years of scientific review and international consensus

Data Monitoring and Science Based Approach



Continuous Monitoring and Data Transparency

- System performance is verified through continuous monitoring, routine sampling and transparent reporting
- Discharge water is continuously monitored and automatically recorded against international guidelines and national or local requirements
- In addition to that, CLIA members routinely collect and analyze water samples
- All these data provide one of the most comprehensive operational datasets available

Supporting Science and Evidence-Based Decision Making

- Operational data collected by the cruise industry contributes to independent scientific research and environmental risk assessments
- CLIA members voluntarily share discharge water data with a range of stakeholders
- Industry data have supported projects including DNV GL, CE Delft, the Puget Sound Ecological Risk Assessment, AMSA, Transport Canada, and the IMO GESAMP Task Team
- Collaboration and data sharing help improve scientific understanding and support evidence-based environmental policy
- Responsible EGCS operation depends on technology, training, standardized procedures, and continual oversight

Managed Waste Streams

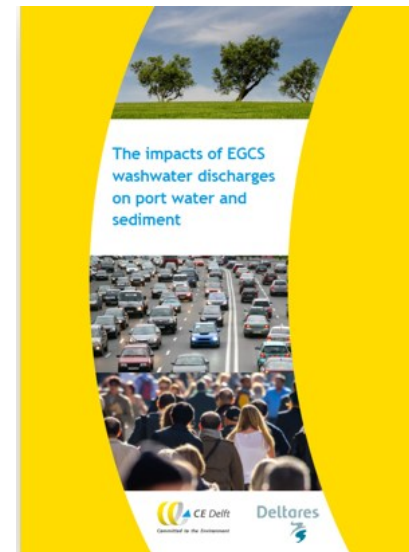
- Closed-loop and hybrid systems generate managed waste streams, including bleed-off water and sludge, which are handled separately from open-loop discharge water
- These waste streams are collected, stored onboard, and managed in accordance with applicable IMO, Flag State, and port reception facility requirements
- CLIA members operating these systems continue to work with ports, technology providers, and regulators to identify practical and effective waste management solutions

Examples of Studies

DNV-GL Carnival study compares laboratory analysis of 281 EGCS washwater samples from 53 ships worldwide with major national and international water quality standards



Provision of a method for evaluating the impacts of using open-loop EGCS in ports on water and sediment and to test the methodology conservatively in a series of model ports, using empirical data of almost 300 washwater samples as inputs for the MAMPEC-BW model



Commissioned by EGCSA, who appointed research group DHI to undertake the ecotoxicity assessment in accordance with generally accepted methods and IMO GESAMP guidelines.

Washwater was taken from 4 ships operating in northern Europe with open loop scrubbers



Puget Sound EGCS Washwater Ecological Risk Assessment



■ Goal:

The goal of this study was to provide empirical and modeled data

It helped to better understand the potential ecological risks from buffered EGCS discharge waters released to the Puget Sound in Washington related to cruise ships operating open-loop EGCS

■ Partners:

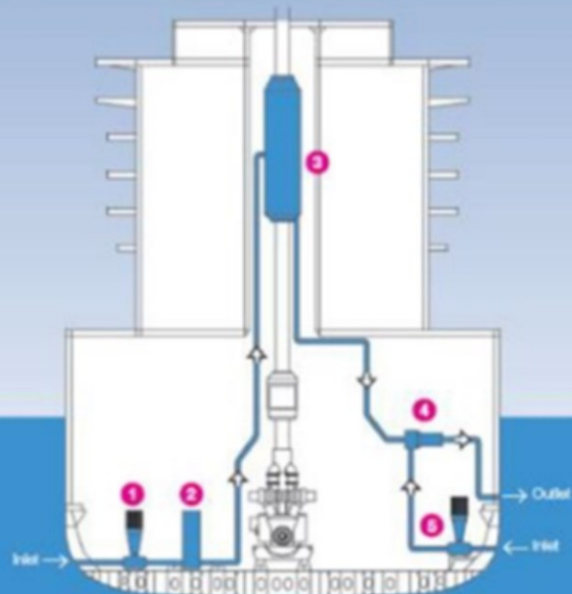
The study was originated in consultation with the Port of Seattle, the Washington State Department of Ecology, CLIA, and the Study Team (Oregon State University and three consultancy firms)



Source: USGS website

Scope of the study

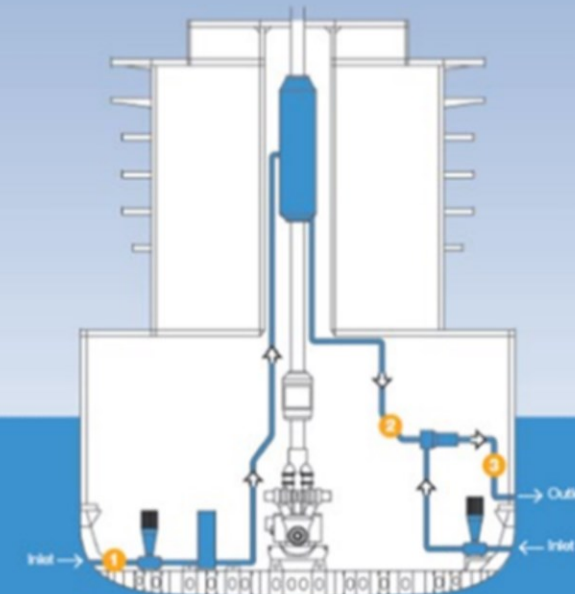
Exhaust Gas Cleaning System



- 1 SW Pump
- 2 SW Filter
- 3 DeSOx Tower
- 4 Static Mixer
- 5 Dilution Pump

- Combination of analytical determinations (PAHs and metals) in pre- and post-EGCS waters
- Modeling of overboard discharge toxicity
- Pre-discharge evaluation of environmental toxicity
- and post-discharge evaluation of environmental concentrations were employed
- Differences in the composition of the discharge waters attributed to engine load were included as an experimental variable.

Sampling Points



- 1 SW Inlet
- 2 DeSOx Outlet
- 3 Overboard Discharge

Methodological considerations



- The potential differences attributable to fuel type were controlled by limiting the study vessels to a single HFO source
- Two engine loads were evaluated, low load ($\leq 50\%$, represents “in port operations”) and high load ($\geq 70\%$ represents normal transit operations)
- A representative set of samples were collected from six ships operated under low and high engine loads (total of 12 sampling scenarios)
- Environmental samples were collected from the seawater intake, post-EGCS waters, and overboard discharge for each scenario. Although the low engine load was meant to provide an assessment for what these discharges would be in port
- The study washwater samples collection happened while in transit from Victoria BC to Seattle WA
- Water samples were collected from cruise ships from July 23 to September 6, 2022

- The report provides a comprehensive set of results in different sections and appendixes
- Several discuss the sampling schedule and procedures (Section 3.1), the results of the chemical analysis (Section 3.2) and the results of the WET testing (Section 3.4)
- Measured seawater intake and buffering pump flows were relatively consistent across all ships with flows under high engine loads typically exceeding those during low engine loads
- The results of the chemical analysis have been provided by fuel, PAHs, metals, and other parameters
- WET (Whole Effluent Toxicity Test) tests were conducted for each round of EGCS water analysis. All individual tests passed control performance criteria (Algae, Inland Sliverside, Mysid, Sand dollar), and minimal toxicity was noted among the WET tests
- MAMPEC* modeling for both the "in-transit" and the "in-port" scenarios showed no significant increase of predicted environmental concentrations above the background concentrations of receiving waters in either scenario

Outcomes Reported to IMO



Oregon State University – Puget Sound EGCS washwater ecological risk assessment - [Link](#)



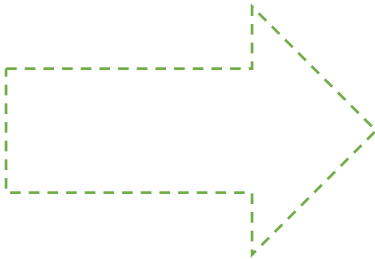
PUGET SOUND EXHAUST GAS CLEANING SYSTEM (EGCS) WASHWATER ECOLOGICAL RISK ASSESSMENT

Prepared for
The Cruise Line International Association
The Port of Seattle
The Washington State Department of Ecology

Prepared by
Jay Word - EcoAnalysts, Inc.
Cindy Wang - Exponent
Joy McGrath – McGrath Consulting
William Stubblefield - Oregon State University

Date
January 2024

Report ID:
PG1632.01
Copyright 2024 by the Authors. All Rights Reserved



E

MARINE ENVIRONMENT PROTECTION
COMMITTEE
81st session
Agenda item 5

MEPC 81/INF.38
12 January 2024
ENGLISH ONLY
Pre-session public release: ☒

AIR POLLUTION PREVENTION

Puget Sound Exhaust Gas Cleaning System (EGCS) washwater ecological risk assessment

Submitted by CLIA

SUMMARY

Executive summary: This document provides information on a risk assessment of open loop exhaust gas cleaning system (EGCS) washwater discharges from cruise ships within the Puget Sound region of the United States as presented by the study team based on the recommended methodology provided in the 2022 *Guidelines for risk and impact assessments of the discharge water from exhaust gas cleaning systems* (MEPC.1/Circ.899).

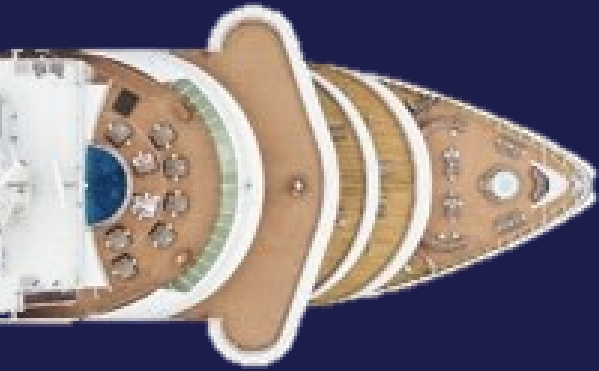
Strategic direction, if applicable: 1

Output: 1.23

Action to be taken: Paragraph 15

Related documents: PPR 7/INF.23; PPR 9/10/1; MEPC 74/14/8, MEPC 74/INF.24; MEPC 76/9/2 and MEPC 76/INF.33

Agenda



About CLIA
Best Practices
Conclusions

Conclusions



- The use of EGCS and discharge of washwater is highly regulated; with EGCS, cruise ships can sail while meeting or exceeding water quality standards around the world, including those set by International Maritime Organization (IMO)
- The output of EGCS is continuously monitored with the discharge of washwater recorded in a logbook (noting date, time and location of disposal)
- It is important to not penalize early adopters of technologies and solutions, and to protect significant industry investment
- To maintain a coherent regulatory framework is paramount. CLIA supports science and data-driven implementation of IMO regulations and guidelines
- Cruise industry has one of the most extensive data sets that we provide to IMO working groups to develop robust and realistic regulatory frameworks
- CLIA members remain committed to collaborating with other stakeholders



Cruise Industry Best Practices

1st Informal Consultation Workshop on EGCS
Washwater Discharges

Riga, Latvia, 17th June 2026



Closing up

Summary





EUSBSR
EU STRATEGY
FOR THE BALTIC
SEA REGION

Thank you!