Environmental risk assessment of scrubbers

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EMERGE

Environmental risk assessment of scrubbers

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LATEST: "Ecotoxicity assessment gives open loop scrubbers the all clear"

Independent study undertaken in accordance with IMO GESAMP guidelines indicates risk of open loop scrubbers discharging into a port or into a busy sea lane is well below unacceptable levels.

EGCSA PRESS RELEASE June 08, 2021

Ecotoxicity testing and risk assessment of wash water from open loop scrubbers, DHI (2021).

We challenge that statement and instead I will show you

1) scrubbers are a major source of Polycyclic Aromatic Hydrocarbons and heavy metals to the marine environment
2) the risk assessment procedure used in the DHI-report as well as the proposal by Japan to MEPC is inappropriate.

IMO INTERNATIONAL MARITIME ORGANIZATION **E**

MARINE ENVIRONMENT PROTECTION COMMITTEE
76th session
Agenda item 9

MEPC 76/INF.33
7 March 2021
ENGLISH ONLY
Pre-session public release: ☒

POLLUTION PREVENTION AND RESPONSE

Draft guideline for risk assessment of the discharge water from EGCS

Submitted by Japan

Environmental risk assessment of scrubber discharge water

Exposure assessment

PEC (Predicted Environmental Concentrations)

MAMPEC modelling

Effect assessment

PNEC (Predicted No-Effect Concentrations)

Based on ecotoxicological studies

Risk Characterization

RCR = PEC/PNEC

RCR < 1

Acceptable environmental risk

- MAMPEC was developed to risk assess antifouling products and ballast water techniques.
- The risk assessment is performed in harbor environments, with low ecological values, where typically no other human activities are present that emit biocides and/or other chemicals to the harbor

Environmental risk assessment of scrubbers – proposed by Japan

- Shipping lane scenario is propsed to be used by the Japanase proposal to IMO (also used in the DHI study)
- PEC is compared with PNEC, and if the RCR is below 1 → acceptable environmental risk

This implies:

1. scrubbers alone are "allowed" to pollute an entire shipping lane with PAHs and metals as long as the PEC is slightly below the PNEC value
2. no other industries are assumed to emit PAHs and metals to the specific area

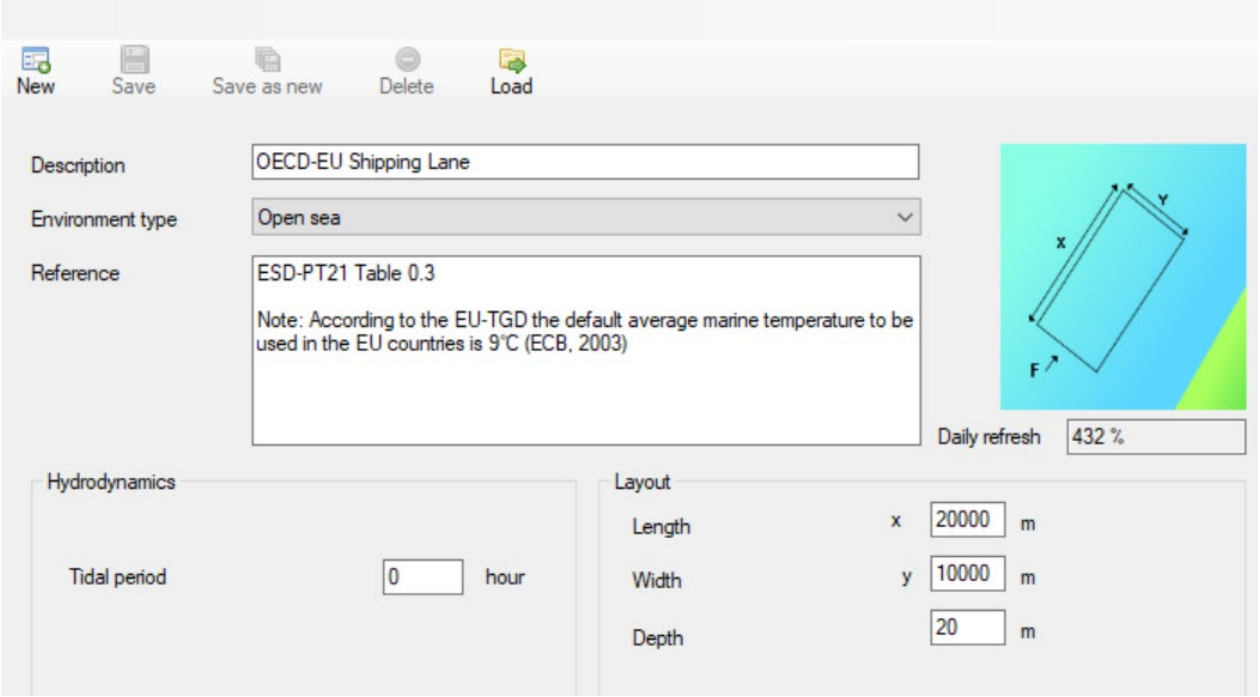
How are we assessing other emissions and impacts, for example climate change?

If the same methodology would have been applied, one would have assessed how much CO_2 ships running on one specific fuel (e.g. MGO) are allowed to emit to the atmosphere without compromising the 1.5-degree climate goal.

During the assessment assume that no other human activity/industry emits CO_2 to the atmosphere.

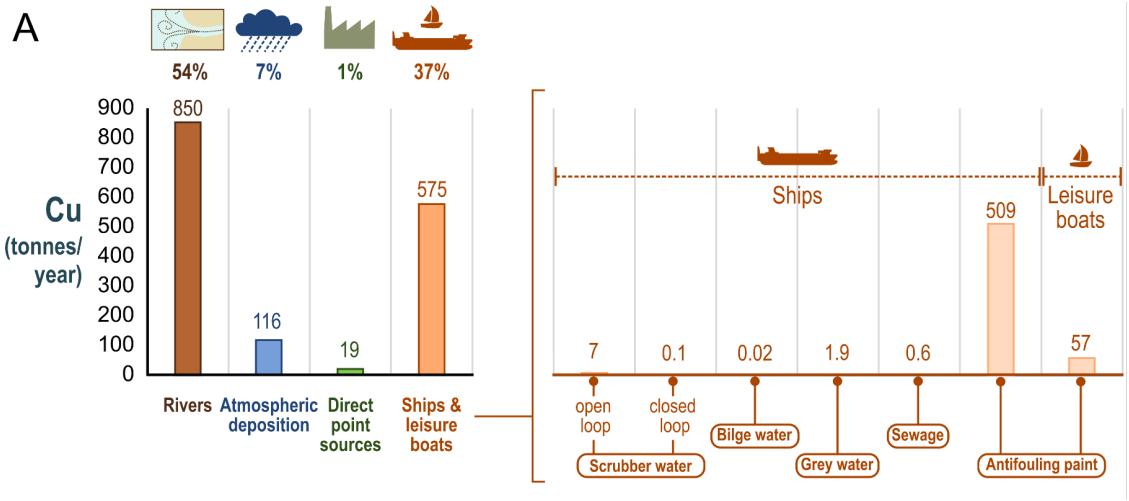
Review of the risk assessment proposal – example copper

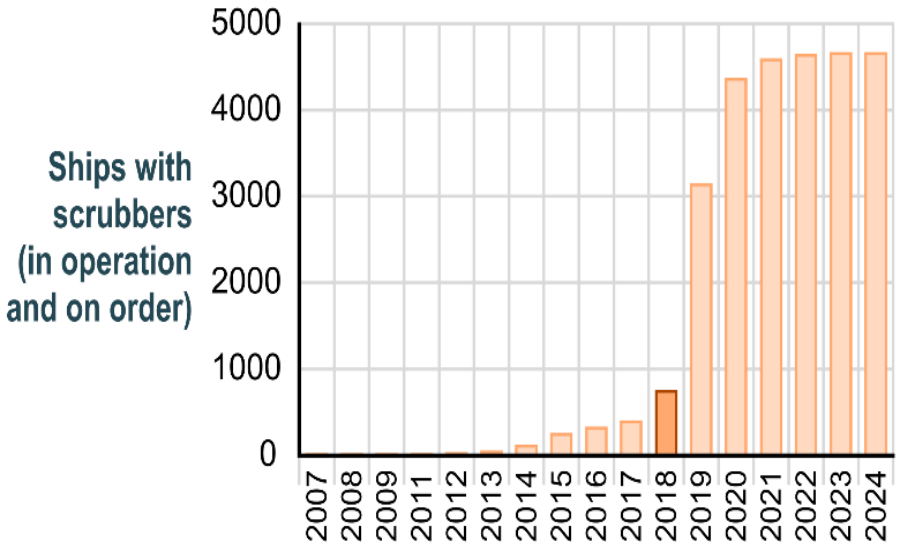
- OECD EU Shipping lane scenario
- PNEC Cu is 2.6 µg/L
- How much Cu can we add to this area to reach a PEC below 2.6 µg/L?
- 10 tons per day will reach a $PEC_{maximum}$ of 2.5 µg/L



3650 tons/year of copper are ”allowed” to be discharged to the shipping lane (20*10 km)

Input of copper to the Baltic Sea



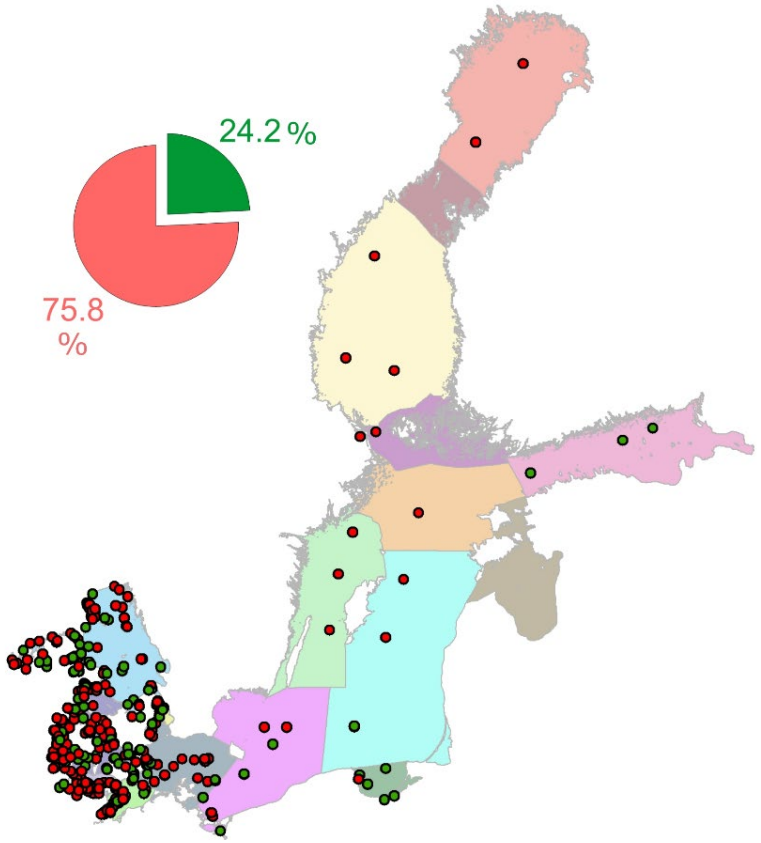


- Total input of copper is 1560 tons per year
- Shipping and leisure boats responsible for 37% av inputs of copper
- Scrubber input based on 2018 activity

Ytreberg, E., Katarina, H., Lunde Hermansson, A., Parsmo, R., Lagerström, M., Jalkanen, J.-P., Hassellöv, I.-M., 2021. Metal and PAH loads from ships and boats, relative other sources, in the Baltic Sea Preprint (Version 1) available at Research Gate DOI: http://dx.doi.org/10.13140/RG.2.2.34937.19046.

Percentage of data points in exceedance of HELCOM established threshold value for copper

- 76% av data points in the Baltic Sea exceeds the threshold value in sediment
- Thus –we need to reduce the inputs of copper to the Baltic Sea and not increase it via a new waste stream (scrubbers)



30 mg/kg dry weight

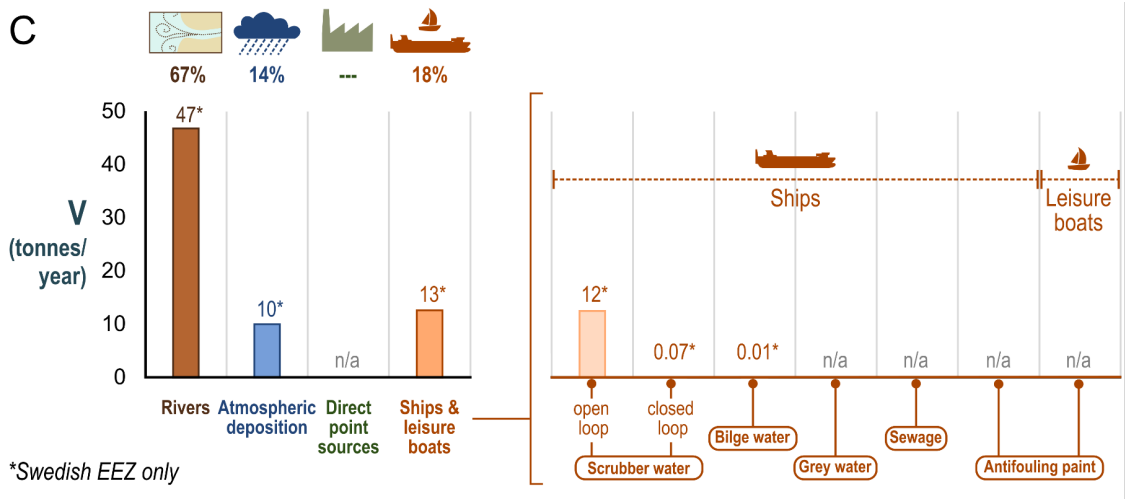
Lagerström, M., Lunde Hermansson, A., Ytreberg, E., 2021. Copper as a HELCOM core indicator. Rapport till Havs- och Vattenmyndigheten

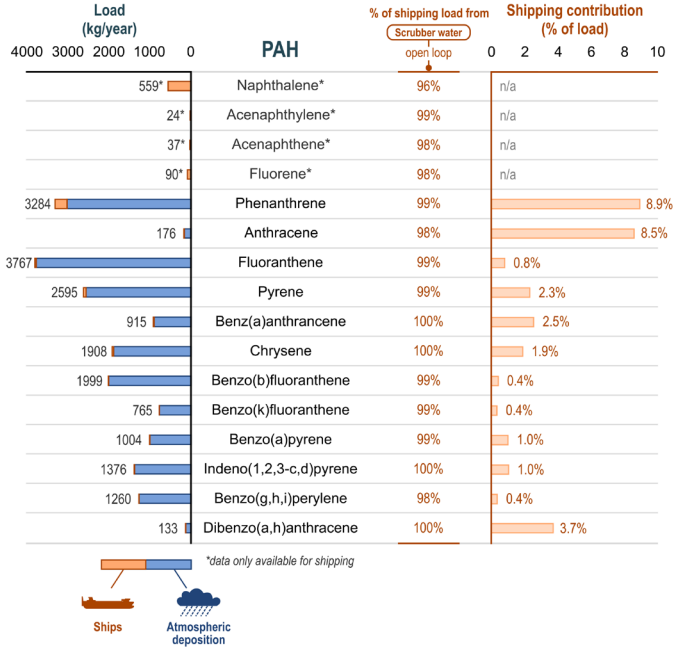
Summary

1. Baltic Sea is not reaching good environmental status with respect to PAHs and metals

2. Emission factors of PAHs are significantly higher from HFO vs MGO (2-22 times higher) (Lunde Hermansson et al. 2021)

3. Scrubbers are a significant source of metals (e.g. vanadium) and PAHs to the Baltic Sea (Ytreberg et al. 2021)
4. With the Japanese propasal almost anything can be discharged from shipping and still pass the risk assesmment





Lunde Hermansson, A., Hassellöv, I.-M., Moldanová, J., Ytreberg, E., 2021. Comparing emissions of polyaromatic hydrocarbons and metals from marine fuels and scrubbers. Transportation Research Part D: Transport and Environment 97, 102912.

Ytreberg, E., Katarina, H., Lunde Hermansson, A., Parsmo, R., Lagerström, M., Jalkanen, J.-P., Hassellöv, I.-M., 2021. Metal and PAH loads from ships and boats, relative other sources, in the Baltic Sea Preprint (Version 1) available at Research Gate DOI: http://dx.doi.org/10.13140/RG.2.2.34937.19046.

SUMMARY OF THE MAJOR CONCERNS REGARDING THE DHI (2021) STUDY

The study claims that scrubber wash water toxicity is low to organisms at three trophic levels

Sampling of scrubber wash water (SWW) from four ships

Glass bottles for organic contaminant analysis and **plastic bottles** for metal analysis

Chemical analysis (original SWW)

Plastic containers for SWW used for ecotoxicity testing

Plastic containers absorb hydrophobic organic contaminants from the water, e.g. PAHs, thus reducing their concentrations in the SWW samples.

Vigorous mixing of the SWW from four ships

During **vigorous mixing** volatile substances, like lighter PAHs, evaporate. Metal species become oxygenated

Chemical analysis (mixed SWW)

Mixed SWW have 26 to 99% lower PAH concentrations and 0 to 50% lower metal concentrations compared to original SWW

Measured pollutant concentrations in the mixed and plastic exposed SWW are much lower than in the original SWW.

Filtration of the mixed SWW through 1.2 µm filter

Filtration removes combustion particles and their associated contaminants, i.e. VOCs, metals and PAHs.

Toxicity testing

On stored in plastic containers, mixed & filtered SWW

Scientific research papers are subject to peer-review to safeguard sound science. Reports are not.

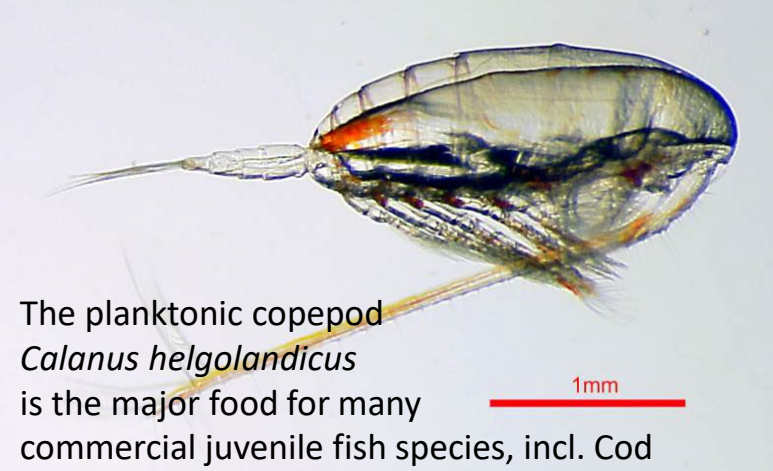
Due to the **fundamental flaws** of scrubber wash water handling it is **not** likely that the DHI (2021) study would have made it through a peer-review, and it is hence not likely that it could have been published in a scientific journal.

Policy making should be based on sound peer-reviewed science to ensure scientific quality.

In all, the tested SWW is not comparable with the original SWW ending up in the sea. Contaminants are removed in several steps and toxicity is substantially reduced by poor experimental handling.

EXAMPLE OF A PEER-REVIEWED STUDY Thor et al. (2021) SHOWING THE OPPOSITE

The study claims that scrubber wash water from open loop scrubbers poses a serious threat to marine life.

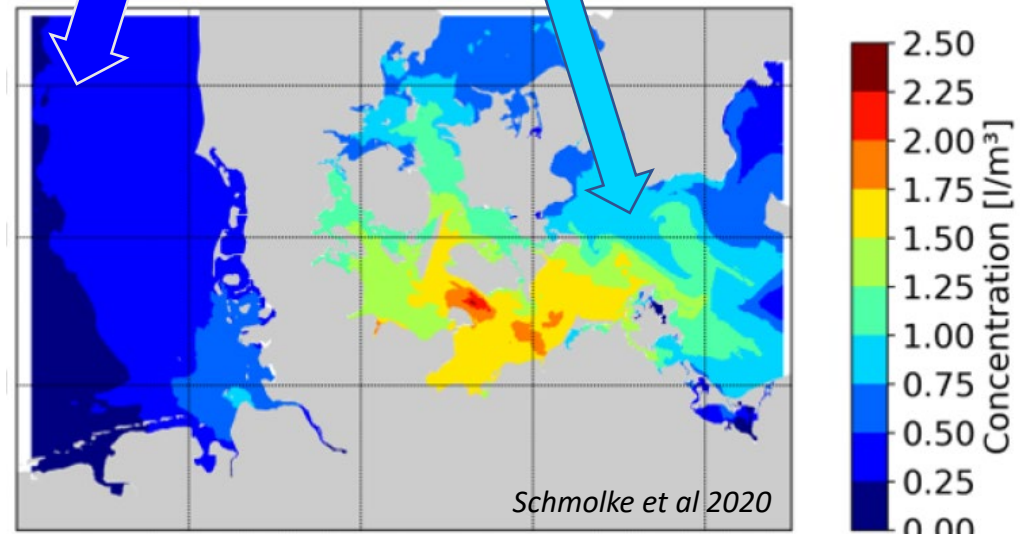


The planktonic copepod *Calanus helgolandicus* is the major food for many commercial juvenile fish species, incl. Cod

LOEC copepods (Thor et al. 2021)	1%	wash water
Risk assessment extrapolation factor EU	100	
Resulting allowable concentration EU	100	mL m^{-3}
Predicted scrubber wash water concentration (light blue area)	986	mL m^{-3}
Predicted scrubber wash water concentration (dark blue area)	493	mL m^{-3}

- Significant toxic effects were found in copepods of open loop scrubber wash water diluted to 1%. Lowest effect concentration (LOEC) = 1%
- Applying EU Extrapolation Factors for risk assessment in single species tests translates into an allowable environmental concentration of 100 mL/m^3
- **Schmolke et al. (2020) predicted chronic wash water concentrations more than 5 times higher in western Baltic Sea and Eastern North Sea**

Predicted 3-year accumulation of scrubber wash water



*Thor, P., M. E. Granberg, H. Winnes, and K. Magnusson. 2021. Environmental Science & Technology **55**:5826-5835.*