

Prohibition of Scrubber Wash Water Discharge by Nation (Non-Exhaustive)

Prohibited	Belgium	Belize	Bermuda	Brazil	Canada
	China	Croatia	Denmark	Egypt	Finland
	Germany	Ghana	Gibraltar	Ireland	Israel
	Kenya	Malaysia	Mauritius	Mozambique	Netherlands
	Norway	Oman	Pakistan	Panama	Portugal
	Qatar	Romania	Saudi Arabia	Singapore	Slovenia
	Spain	Sweden	Turkey	UAE	
Restricted by Area	Australia	Bahrain	Cyprus	Estonia	Hong Kong
	Lithuania	Trinidad & Tobago		UK	USA
Permitted	Argentina	India	Latvia	New Zealand	

Source – Britannia P&I

- .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.

7.5 An uncertainty analysis can be undertaken by identifying whether the potential adverse effects from discharge water discharges are well understood. This may include the effects on the immediate and downstream environment taking into account both spatial and temporal factors.

7.6 When restricting EGCS discharges, consideration should be given to investments already made by industry to comply with regulation 14 of MARPOL Annex VI and other relevant legislation, also taking, however, into account that the choice of EGCS as an alternative compliance option under regulation 4 of MARPOL Annex VI was primarily based on considerations of favourable economic competitiveness. In any case, not restricting EGCS discharges could also lead to the economic burden on governments (for example in relation to management of dredged materials), due to their need to restore environmental degradation, protect human health and impacts on the fishing or tourism sector deriving from. These impacts should also be overall taken into account. The sooner such measures are taken, the lower the consequent impact will be on industry on Member States.

8 NOTIFICATION TO THE ORGANIZATION

8.1 The Member States that have undertaken risk and impact assessments should notify the Organization of the result of the assessments together with the notification of local regulations on the discharges of discharge water from EGCSs.

Published scientific studies and additional literature

Pacific Environment has summarized 26 scientific studies below that depict the harms from scrubbers utilized on ocean-going vessels.

Devastating air and water impacts from scrubbers

Johnson, K., College of Engineering-Center for Environmental Research and Technology University of California Riverside, Welch, B., Espinoza, C., Castelluccio, V., Asa-Awuku, A., & Miller, W. "Final Report Black Carbon and Other Gaseous Emissions from an Ocean-Going Vessel Auxiliary Engine Equipped with a Scrubber." Prepared for: California Air Resources Board, California Air Resources Board Transportation and Toxics Division Emissions Assessment Branch. (2013). https://ww2.arb.ca.gov/sites/default/files/2019-11/bc_scrubber_ADA_0.pdf

The California Air Resources Board (CARB) and the International Council on Clean Transportation commissioned this report to assess the effectiveness of exhaust gas after-treatment scrubbers at reducing SO_x, PM (including PM_{2.5} and black carbon) and other pollutants at different engine loads. The results found that for black carbon removal, scrubbers' performance depended heavily on engine loads, with low loads removing only 10% of black carbon emissions and higher engine loads achieving up to 80% removal. This report builds on existing research demonstrating the lack of scrubber efficiency when applied in the real world, particularly the Parliament Transport Committee, Evidence from Maritime UK (SES 03b) which reported on several vessels whose scrubbers were unreliable and performed very short of the performance standards criteria. The evidence in this report helped support CARB's decision to prohibit the use of scrubbers to meet sulfur emission restrictions.

Hermansson, A. L., Hassellöv, I., Jalkanen, J., & Ytreberg, E. "Cumulative environmental risk assessment of metals and polycyclic aromatic hydrocarbons from ship activities in ports." *Marine Pollution Bulletin*, 189, 114805. (2023). <https://doi.org/10.1016/j.marpolbul.2023.114805>

This study uses a ship traffic model, coupled with the marine antifoulant model Marine Antifoulant Model to Predict Environmental Concentrations (MAMPEC) to calculate the predicted environmental concentrations of metals and polycyclic aromatic hydrocarbons (PAH) at four different ports. The study found unacceptable risk at three out of the four ports, with antifouling and scrubbers being the main sources of cumulative risk. Their assessment demonstrates that the MEPC's guidelines for environmental risk assessment would fail to adequately protect the marine environment, as these guidelines suggest only looking at the surrounding, not port, environment. Additionally, their assessment stresses the need to account for multiple contaminant sources when looking at how one contaminant might affect the marine environment.

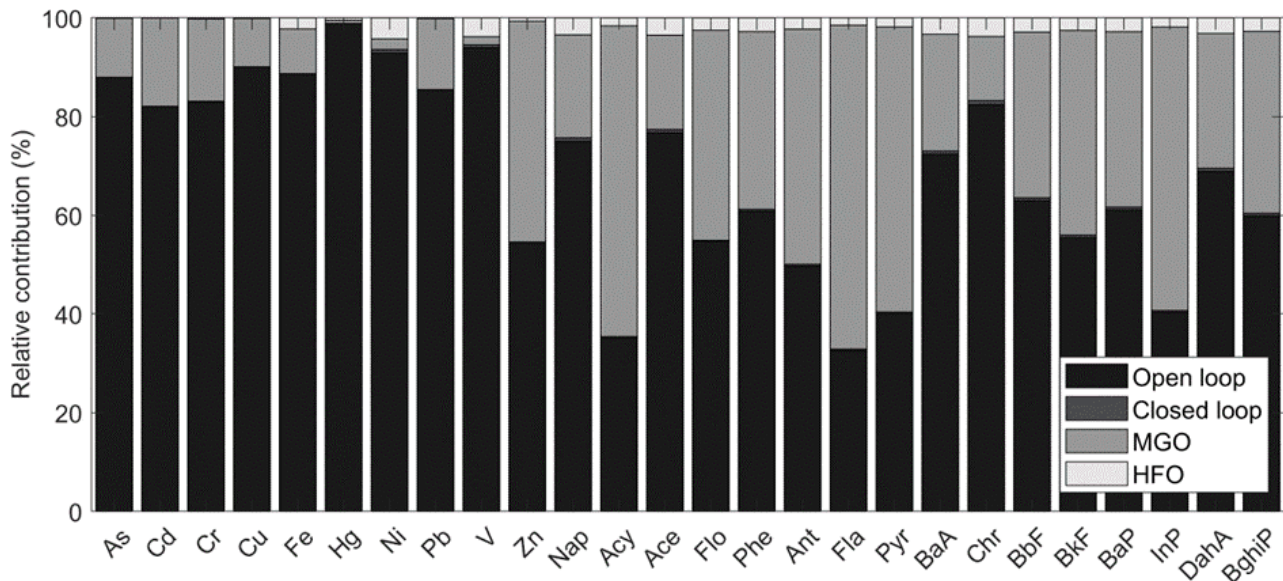
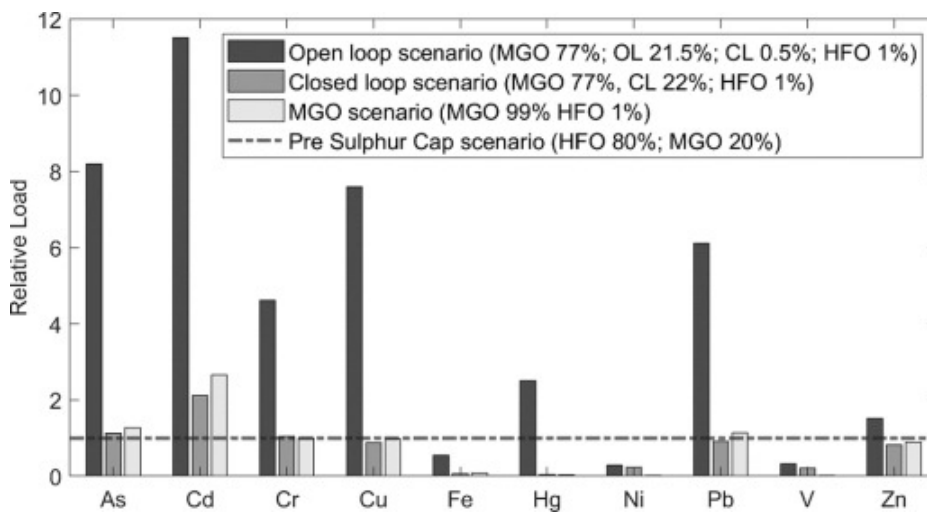
Hermansson, A. L., Hassellöv, I., Moldanová, J., & Ytreberg, E. "Comparing emissions of polyaromatic hydrocarbons and metals from marine fuels and scrubbers." *Transportation Research. Part D, Transport and Environment*, 97, 102912. (2021). <https://doi.org/10.1016/j.trd.2021.102912>

Hermansson et al. modeled four marine fuel demand scenarios under the IMO 2020 fuel sulfur regulation — a baseline pre-sulfur cap scenario consisting of 80% HFO use within the market and 20% MGO fuel use — along with three alternate scenarios to meet the regulation:

1. MGO scenario (99% MGO use, 1% HFO use)
2. A closed loop scenario (22% market using closed loop scrubbers
3. 77% using MGO, and 1% using HFO, and lastly,
4. An open loop scrubber scenario (21.5% market uses open loop scrubbers, 0.5% uses closed loop, 77% use MGO, and 1% uses HFO).

The environmental load (including air and water emissions) of metals and PAHs were compared in the four scenarios, with open loop scrubbers (at a 21.5% market share) leading to a significantly higher impact than any other scenario, including the baseline 80% HFO use scenario.

The authors found scrubbers likely play an additional polluting role to the marine environment even beyond a baseline HFO pre-sulphur cap scenario, given the increased Chromium emitted to the marine environment due to increased corrosion of scrubber pipes and use of seawater within the scrubbing system. The study concludes that the results suggest that allowing discharge of scrubber water to the marine environment is in direct conflict with the European Union Water Framework Directive's goals to achieve good environmental status in European waters.



previously been reported from analysis of crude oils, where the PAH content were (up to 30 times lower), when alkylated PAHs were omitted from the analysis (Yim et al. 2011).

Osipova, L., Georgeff, E., & Comer, B. "Global scrubber washwater discharges under IMO's 2020 fuel sulfur limit." (2021). <https://theicct.org/wp-content/uploads/2021/06/scrubber-discharges-Apr2021.pdf>

This study is the first of its kind to estimate the amount and location of wastewater discharges from ships with scrubbers globally. Because of heterogeneous shipping traffic patterns, scrubber discharges will be high in certain areas with greater impacts localized further based on ecological characteristics. The authors estimate ships to emit at least 10 gigatonnes (Gt) of scrubber wastewater in a year (based on pre-pandemic 2019 data). For context, the global shipping sector carries about 11 Gt of cargo each year.

Importantly, **about 80% of scrubber discharges occur within 200 nautical miles of shore, with hot spots occurring in heavily trafficked regions, including the Baltic Sea, North Sea, Mediterranean Sea, the Strait of Malacca and the Caribbean Sea.** Away from shore, scrubber discharges occur along major shipping routes.

The paper also summarizes recent findings of harm and impacts from scrubbers in the literature:

- A number of studies have shown that wastewater influx can damage marine ecosystems. High concentrations of PAHs and heavy metals in wastewater accumulate in sediments, especially in coastal areas, and also increase water toxicity in aquatic ecosystems (Koski, Stedmon, & Trapp, 2017; Teuchies et al., 2020; Winnes et al., 2016).
- Bioconcentration of PAHs and heavy metals has been linked with reproductive dysfunction and cancer in marine mammals (Georgeff et al., 2019; Martineau et al., 2002).
- PAHs and heavy metals also have a high likelihood of bioaccumulation in the marine food web, including in fish consumed by humans (Chouvelon et al., 2019; Valavanidis et al., 2008).

- Stips et al. (2016) found that seawater acidification from wastewater influx in the coastal areas of the North Sea could double the annual impact of greenhouse-gas induced acidification.
- A recent study by Dulière, Baetens, and Lacroix (2020) estimated that if 15% to 35% of the merchant fleet (by tonnage) operating in and near the English Channel were outfitted with open-loop or hybrid scrubbers, the rate of ocean acidification would double or quadruple in that area compared with how much it is expected to acidify due to climate change. Near Rotterdam, the annual acidification from these ships could be 50 times that expected from climate change.
- Comer et al. (2020) showed that all scrubbers (open, closed, and hybrid) discharge water that is more acidic and turbid than ambient seawater.
- Also, all scrubbers emit PAHs and heavy metals that have been linked to cancers and reproductive dysfunction in marine mammals, including threatened and endangered species like northern and southern resident killer whales and belugas.

Ports may be particularly affected by scrubber discharges. When the ambient water alkalinity is low, which is often the case in harbors situated in estuaries, less of the acidity of the wastewater is neutralized. Moreover, PAHs and heavy metals are discharged in shallow water, where they can be more concentrated and accumulate in sediments, which could lead to human health risks in addition to threats to marine life.

The prevalence of water pollution near coastal areas can be explained by the fact that scrubber-equipped ships spend approximately 40% to 50% of their time at anchor or at berth in or near ports. Given its prominence as a cruise vessel port, Port Everglades in Florida receives 1.1% of global in-port discharges (based on 2019 data) and is ranked in #10 globally for scrubber discharge levels.

The U.S. experiences the highest volume of scrubber discharge with 147 Mt in 2019 estimated.

The authors outline actions that could be taken at various levels of authority, from port/local level to national and global IMO actions. Outside of global scrubber bans, the most impactful action would be required use of zero-discharge mode scrubbers within national waters. The United States, the United Kingdom, and Italy all are expected to receive more than 300 Mt per year of wash water discharges and yet do not currently prohibit the use of scrubbers in their national waters.