OPEN LOOP SCRUBBERS – 11th May 2020

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Introduction

The original version of this note has been prepared for the CEDA Environment Commission (CEC) by Tom Matthewson (HR Wallingford, UK) for their meeting on 23 April 2020, as a subject of increasing concern by ports regularly conducting maintenance dredging as it affects sediments to be dredged and relocated. The note has been subsequently finalised for dissemination to the CEDA membership with review comments from Benny Mestemaker (Royal IHC, the Netherlands). CEC will keep a watching brief on the topic and will decide at a later stage whether the topic should be discussed further by a CEDA working group with a view of producing a CEDA information paper.

Background

In July 2010, the International Maritime Organization (IMO)'s International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI Regulations came into force. These regulate the prevention of air pollution from ships including sulphur oxides and nitrogen oxides and prohibit the deliberate emission of ozone-depleting substances.
Under the current regulations, the amount of sulphur in fuel oil used on board ships outside of sulphur oxide emission control areas is limited to 0.50% m/m from 1 January 2020. The two main methods to comply are:

- switching to low-sulphur fuels; and/ or
- apply alternative methods to reduce sulphur emissions, e.g. installing an Exhaust Gas Cleaning System (EGCS).

Issue

Exhaust Gas Cleaning Systems, commonly called scrubbers, are a widely adopted means to reduce sulphur exhaust for carriers, tankers, RO-RO vessels, cruise ships and container lines. There are three main types of scrubber:

- Open-loop scrubbers, that release treated wash-water back into the sea,
- Closed-loop scrubbers, that retain the sulphur emissions for disposal at port, and
- Hybrid scrubbers are a combination of the two systems mentioned above and can change operational mode depending on the local requirements.

Open loop scrubbers make up about 81% of the market, hybrid scrubbers: 17% and closed loop scrubbers about 2% (DNV GL, 2020).

Open-looped systems are often preferred because they are easier to install, are cheaper to operate as they do not require caustic soda, require less maintenance and need less storage of waste materials. However, as the wash water is discharged into the sea after use, it may contain pollutants such as Polycyclic Aromatic Hydrocarbons (PAHs) and heavy metals.

The water discharge does have to meet limits as specified in an IMO resolution (IMO, 2015). The emission thresholds this IMO resolution relates to are pH, PAHs and turbidity. However, heavy metals also present in scrubber releases are not subject to emission thresholds. Also, the thresholds defined by the IMO for PAHs appear

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high compared to the available Environmental Quality Standards even when allowing for dilution. Many ports are concerned that the discharge of wash water from open-loop scrubbers will result in a build-up of pollutants in sediments in areas with frequent ship visits, such as navigation channels, turning circles and berths. The accumulations of polluted sediment may increase the environmental risks of dredging these areas and require specific mitigation measures to avoid and prevent the resuspension of contaminants.

As a result, some Governments and ports are already restricting the use of open-loop scrubbers in their waters, necessitating either the use of scrubbers capable of operating in a closed loop or low sulphur (marine) fuels (North, 2020). Several countries have banned the use of open-loop scrubbers within their inland waters and most of their coastline. These countries include Bahrain, Belgium, China, Egypt, Germany, Ireland, Pakistan, Panama, Singapore, and parts of the US. Other countries do not have an outright ban (e.g. Australia), or leave port authorities to take decisions on acceptability of scrubber wash water discharge (e.g. United Kingdom).

Evidence

There has been widespread concern about the impact of wash water discharges from open loop scrubbers on sediment contamination levels. However, there is relatively little information available.

CE Delft performed the latest study with support from Deltares. This study analysed the long-term impacts of scrubber discharge on the concentrations of eleven metals and sixteen PAHs in the water and the sediment (CE Delft, 2019). Their comparison of the increase in concentration in the sediment, assuming zero background concentrations, with different national standards showed that the increase is below 0.5% of any standard. The modelling results did however suggest that local hydrodynamic circumstances as well as background concentrations of priority substances should be taken into account when assessing the impacts of the use of open-loop scrubbers at a specific port.

Similarly, a study for the Danish Environmental Protection Agency also found that the releases from scrubbers can be expected to be considerably below the levels of ecological concern with regard to water quality (Kjølholt et al., 2012). The study did not examine sediment effects in detail. It recommended that a risk assessment for any specific area should also take existing contamination levels and releases from other sources into account. The report also recommended a precautionary approach to allow only the use of closed-loop scrubbers or low sulphur fuels on ships in ports.

A Japanese Government study evaluated both short- and long-term environmental risks caused by discharge water from open loop scrubbers to the marine environment and the marine aquatic organisms (Koyama et al., 2018). This study concluded that the risks to the marine environment and marine aquatic organisms are in the acceptable range.

However, an earlier study by the US EPA found that, based on limited field trials, several metals and PAHs were measured in scrubber wash water discharges at end-of-pipe concentrations that exceeded the national water quality criterion for that chemical. Scrubber therefore had the potential to contribute to an exceedance of water quality standards on a localized scale (US EPA, 2011). This study also cast doubt on whether the discharge limits as given in the IMO resolution

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(MEPC.259(68)) are sufficiently protective (IMO, 2015).

An EU technical study (Stips et al., 2016) provided an initial assessment on the potential impact of open loop scrubbers on the seawater quality. The impact on the pH decrease in the open North Sea region from discharging the acid wash water into the seawater was found to be small generally. The study did identify the potential for problems related to the acidification of surface water quality in ports, estuaries and coastal waters. This study did not consider other water quality or sediment parameters.

There is therefore variability internationally to the acceptance of the scientific evidence for the environmental effects of open-loop scrubbers on sediments in harbour areas and enclosed waterways. The acceptability of this emissions control method and its implications for dredging activities is therefore also variable.

As a consequence, the IMO Sub-Committee on Pollution Prevention and Response has agreed to look at the evaluation and harmonization of rules and guidance on the discharge of scrubber wash water into the marine environment (February 2020). The aim will be to report in 2021.

Recommendations

CEDA Members who are ship owners and operators will already be aware of the requirements of the MARPOL Annex IV for their ship operations. However, CEDA Members also need to be aware of the potential implications of open-loop scrubber systems for sediment management within ports and waterways, especially in enclosed areas.

It is recommended that the CEDA's approach should be one of encouraging an internationally harmonized approach that is based on scientific evidence, covering emission standards and the technologies to be adopted. Depending on developments in this area, a position paper may be produced for CEDA members.

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References

CE Delft, 2019. The impacts of EGCS washwater discharges on port water and sediment. December 2019.

DNV-GL, 2020. Alternative Fuels Insight – Scrubber Statistics. Accessed at: https://afi.dnvgl.com/Statistics?repId=2

International Maritime Organization, 2010. IMO Briefing 36/2010, July 1, 2010.

International Maritime Organization, 2015. Resolution MEPC.259(68) (adopted on 15 May 2015). 2015 Guidelines For Exhaust Gas Cleaning Systems. Accessed at: http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Marine-Environment-Protection-Committee-(MEPC)/Documents/MEPC.259(68).pdf

Kjølholt, J., Aakre, S., Jürgensen, C., Lauridsen, J., 2012. Assessment of possible impacts of scrubber water discharges on the marine environment. Environmental Project No. 1431, 2012. Danish Environmental Protection Agency. 2012.

Koyama et al. 2018. Report by the expert board for the environmental impact assessment of discharge water from Scrubbers (Japan). July 2018. Chairman: Prof. Jirou Koyama, Kagoshima University. Translation accessed at: http://carnivalaaqs.com/files/Report-by-the-expert-board-for-the-environmental-impact-assessment-of-discharge-water-from-Scrubbers-Japan[1][3].pdf

North, 2020. No Scrubs: More Ports Declare Ban on EGCS Discharges *Update*. 11 March 2020. Accessed at: https://www.nepia.com/industry-news/no-scrubs-more-ports-declare-ban-on-egcs-discharges-update/

Stips, A., Bolding, K., Macias, D., Bruggeman, J., Coughlan, C. 2016. Scoping report on the potential impact of on-board desulphurisation on the water quality in SOx Emission Control Areas. EUR 27886 EN; doi:10.2788/336630

US EPA, 2011. Exhaust Gas Scrubber Washwater Effluent. November 2011. Accessed at: https://www3.epa.gov/npdes/pubs/vgp_exhaust_gas_scrubber.pdf

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