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PREVENTION OF AIR POLLUTION FROM SHIPS

Proposals to ensure robust and uniform application of regulation 4 of MARPOL Annex VI

Submitted by Norway

SUMMARY

Executive summary:	This document is submitted in order to ensure robust and uniform application of regulation 4 of MARPOL Annex VI. The document identifies issues to be solved from a technical and operational point of view as well as from a legal and enforcement point of view.
Strategic direction:	7.3
High-level action:	7.3.1
Planned output:	7.3.1.1
Action to be taken:	Paragraph 14
Related documents:	MEPC 59/4/19 and MEPC 59/24

Introduction

1 MEPC 59 adopted "2009 Guidelines for Exhaust Gas Cleaning Systems" by resolution MEPC.184(59), and in doing so agreed that the washwater criteria should be revised in the future as more data becomes available on the contents of discharge and its effects, taking into account advice provided by GESAMP (MEPC 59/4/19).

2 In the follow-up to this decision by the Committee, Norway has examined regulation VI/4 and the EGCS guidelines. This examination resulted in the identification of several legal, technical and environmental aspects which need to be addressed by the Committee. In the view of Norway, this is needed in order to ensure uniform understanding and application of regulation 4 of the revised MARPOL Annex VI, robust enforcement, sufficient environmental protection, and sufficient guidance to Administrations.

Elements to consider if a Party wants to apply regulation 4 of MARPOL Annex VI

3 If a Party considers application of regulation 4 of MARPOL Annex VI, certain actions are required. The primary evaluation a Party is **required** to undertake, is to ensure that the equivalent method is at least as effective in terms of emissions reductions as that required by Annex VI. In doing so, the Party **should** take into account relevant guidelines developed by the Organization. Furthermore, the Party **shall** endeavour not to impair or damage its environment, human health, property or resources, or those of other States. A Party allowing an equivalent method **shall** communicate this to the Organization.

4 It is observed that at present there are no required or recommended procedures towards consulting other States for an Administration which considers allowing a ship to use an equivalent method. There are examples of other IMO frameworks where requirements which might have an effect on the environment of other States have procedures to consult other States or make use of the Organization. The discharge of EGC washwater is an example which could benefit from procedures for making use of the Organization in order to consult other States. The Committee should consider amending the guidelines to include such procedures.

5 MARPOL Annex VI defines one vital part of the present situation when it comes to environmental protection requirements established by IMO. If the use of the equivalence clause has negative effects which is not intended by the main approach defined in Annex VI, caution should be exerted. Since the main approach defined in Annex VI does not have any discharges to the marine environment, it is of particular importance, in light of Article 195 to UNCLOS, to examine the effects of the washwater when using an EGC system.

6 In the ensuing paragraphs three issues are discussed in further detail.

Can equivalence with regulation 14 be ensured from a technical and operational viewpoint?

7 In the EGCS guidelines, paragraph 1.3, equivalency with the emissions of a fuel with a required sulphur content relies upon a SO_2(ppm)/CO_2 emission ratio calculation rather than a direct SO_x emission calculated from the sulphur content of the fuel.

8 Having identified this difference from the existing regulations, it is to be noted that for equivalency compliance both SO_x (as Sulphur Dioxide – SO_2) and the CO_2 exhaust emission concentrations have to be measured in order to comply with the required ratio for the sulphur content of the fuel in use. This requirement applies to both Scheme A (paragraph 4.4.8) and Scheme B type EGCS (paragraph 5.4.2) but more so, obviously, with Scheme B and continuous monitoring. The problem here relates to the theoretical gas specie, as calculated, for the exhaust stream and the actual specie as the exhaust stream that exits the scrubber unit for release to the atmosphere. In this regard and as examples of this issue, the following brief observations are provided:

.1 SO_x (as Sulphur Dioxide – SO_2) is but one form of sulphur specie in an exhaust gas stream. The alternative type that can be formed when excess air is available is Sulphur Trioxide (SO_3). When either of these compounds contacts water they will easily create the acidic compound of either Sulphurous Acid (H_2SO_3) or, more importantly due to its subsequent behaviour in the atmosphere, Sulphuric Acid (H_2SO_4). The testing system within the EGCS guidelines requires that the final analysis result is recorded as "dry" SO_2 so that it can be standardized for application to the limiting ratio. This procedure is possible with Sulphurous Acid. However, it is necessary to question the described detection procedure with respect to

Sulphuric Acid due to its stability and behaviour as a vapour. In this regard and due to the potential for inaccuracies to occur for equivalency purposes, it is recommended that this issue is further considered with regard to detection accuracy.

.2 Carbon Dioxide (CO_2) is the other gas to be monitored for the control ratio. In this regard, and taking into consideration alternative technology designs such as scrubbing with a fresh water/Sodium Hydroxide (Caustic soda) mixture (ref. paragraph 3.1.1), it is important to recognize that CO_2 will react with Sodium Hydroxide to form Sodium Carbonate, but to a lesser extent when in the presence of Sulphur Dioxide, being the more acid and thus reactive gas type. However, a reverse reaction can also take place with carbonates (mostly bicarbonates) which are found naturally in seawater at concentrations of approximately 150 mg/ltr and, when exposed to acids, will decompose to CO_2 and water. Thus, in a scrubber using a seawater medium, being exposed to and absorbing acid gases, it will cause the seawater's natural bicarbonate content to decompose and thus add CO_2 to the exhaust gas concentration. Given this scenario it is recommended that the impact of this reaction also be reconsidered where it is possible that it may also impact the sensitivity of the SO_2/CO_2 ratio for monitoring and control purposes.

9 From an operational and safety aspect Norway observes the following:

.1 Exhaust gases from combustion of marine fuel oils contain a selection of individual gases in varying proportions dependent upon the form of combustion (engine or boiler).

.2 These proportions of gases will be emitted from the engine/turbo charger at a temperature of approximately 200 to 300°C. These gases will enter the scrubber unit at approximately the same temperature and will be partially quenched before entering the water flow in the base of the scrubber unit. It is estimated that on exiting scrubber units the gases will have been cooled to approximately 50°C. An indication of the proportions of the gases in the seawater cleansed gas stream may be seen as being similar to the Inert Gas stream[1]. The mixture could be represented by table 1.

Table 1 – Quality of Inert Gas from seawater scrubber

Component	Concentration
Nitrogen	83%
Carbon Dioxide	13%
Carbon Monoxide	present
Sulphur Dioxide	300 ppm
Water Vapour @ 50°C	92 grams/m^3

.3 As will be noted, an additional component is added to the components in the exhaust gas when leaving the scrubber, namely the water vapour concentration. On entering the scrubber process the hot exhaust gas will readily absorb water and become a water saturated gas mixture. The degree of saturation is dependent upon the exit temperature of the gas as some condensation will occur within the scrubber unit during the cooling process of the gas as it transits the scrubber.

[1] Liquefied Gas Handling Principles on Ships and in Terminals – SIGTTO 1986.

.4 The higher the temperature of the exhaust gas exiting the scrubber unit, the greater the degree of saturation and more water vapour will be contained in the exhaust gas stream. This water vapour should be clearly distinguished from condensed water droplets in the gas stream that should be removed by the scrubber's demister. As the cleaned gas stream exits the funnel, further cooling of the gas will take place until it reaches the ambient air temperature. During this process the water content of the gas will decrease and cause precipitation of "entrained" water in the local area. Assuming an external air temperature of 20°C this further cooling in the external atmosphere will cause a precipitation of 50 grams/m^3 of exhaust gas emission. Thus, by use of engine data, the following precipitation can be recorded for the differing engine powers:

Table 2 – Calculated condense water from a scrubber

Power (kWatt)	Exhaust Gas (m^3/hr)	Exhaust Gas Water precipitation (kg/hr)
1,665	4,020	201
15,820	24,120	1,206
25,040	42,660	2,133

.5 The quality of the water will be similar to that found in the scrubber bath; namely sulphur acidic. This phenomenon is well recorded in literature – "Wet scrubbers may increase the proportion of water in the gas, resulting in a visible stack plume, if the gas is sent to a stack"[2]. To avoid this situation for the safety of the crew and the surrounding environment, it would be necessary to cool the exit exhaust gas to the same or lower temperature than the surrounding external environmental temperature, and this situation should be addressed in the guidelines.

Potential environmental problems associated with Exhaust Gas Cleaning including the washwater discharge

10 Potential environmental problems, as raised by GESAMP (MEPC 59/4/19), in relation to application of an equivalence, need to be properly addressed. Regarding EGC these are:

.1 A review has been undertaken as to the content of the Onboard Monitoring Manual (OMM) as defined in paragraph 8 of the guidelines. Although the author or provider of this manual remains unclear, it is this manual that will guide the control and use of the EGC system and will be the one referred to regularly by the vessels' crew and visiting surveyors to confirm the correct operation of the relevant unit. This manual's required content is silent on the issue of intervention and corrective actions in the event of exceedances of the allowed discharge water quality criteria that GESAMP is most concerned about and is very operational/ship specific.

2 http://en.wikipedia.org/wiki/Scrubber.

.2 The four recommendations put forward by GESAMP under the subtitle "QC and Standards" all relate to the fact that the washwater criteria testing do not have a recognized standard method, procedure for testing and calibration of instrumentation, e.g., an ISO testing Standard. Within the revised EGCS guidelines these recommendations have been partially addressed where, under paragraph 10.2 of the EGCS guidelines, the equipment for measurements of pH and turbidity have been attributed with an ISO standard requirement. However the outflow parameter criteria testing, together with temperature measurement and the very sensitive measurement of Nitrate remains outstanding for recognized test methods.

.3 With respect to the items listed in Appendix III to the EGCS guidelines some extra parameters are considered necessary for review and regulatory consideration during the envisaged period for washwater data collection. Before considering this data collection, and to provide for meaningful, comparative test results to be collected; standard (preferably ISO) test methods should be adopted for each parameter to be tested. In addition to the existing list the following additional parameters should be added due to their impact upon the environment and seawater quality:

.1 Sulphate concentration;

.2 Sulphite concentration;

.3 Polychlorinated biphenyl (PCB) concentration;

.4 Polychlorinated dibenzodioxines (PCDD) concentration; and

.5 Dissolved Oxygen (DO) and/or Chemical Oxygen Demand (COD) values as recommended by GESAMP.

Are adequate enforcement provisions in place regarding application of regulation 4?

11 Examining the regulations of Annex VI the most fundamental provision regarding flag State enforcement is in place, i.e. the equivalence used is also subject to the survey and certification regime required under Annex VI. This is clear from paragraph 2.6 in the supplement to the IAPP certificate. The other element which is crucial regarding compliance is whether or not the ship operates in accordance with the regulations. A ship not making use of the equivalence will be met with a list of requirements in regulations 14 and 18 which shall ensure compliant operation and a possibility to enforce compliant operation. If, on the other hand, the ship makes use of regulation 4, crucial operational provisions are, as Norway perceives the situation, only established in the form of recommendations. This is relevant for entries in the Record Book as well the use of waste reception facilities. It is only recommended not to discharge residues into the sea. These elements should be clarified in order to ensure an equivalent level of control when regulation 4 is applied.

12 The issue of equivalent level of control should also be reflected in the port State control guidelines adopted by resolution MEPC.181(59). As Norway perceives those guidelines, it is only when a more detailed inspection is undertaken, i.e. when there are clear grounds for believing that the condition of the ship or its equipment do not correspond substantially with the particulars of the certificates or the documents, a check is undertaken as to whether or not the equivalent approved means have been applied. If this is the case, equivalent levels of control should be ensured by correcting this and inspect the actual use of the EGC system in the initial inspection.

Proposal

13 In light of the points raised above, the Committee should from a technical, legal and environmental point of view, further examine the total framework regarding the use of regulation 4 of Annex VI and the current content of the EGCS Guidelines. This is needed to ensure a uniform application, including relevant procedures for involving other States, robust enforcement and the needed environmental protection. Because of the technical nature of this task, and because of the workload of the Committee, this task may be given to the BLG Sub-Committee.

Action requested of the Committee

14 The Committee is invited to consider the information and proposals contained in this document and take action as appropriate.

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