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REDUCTION OF GHG EMISSIONS FROM SHIPS

The use of onboard carbon capture systems within IMO's regulatory framework

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SUMMARY

Executive summary:	This document proposes that the Committee agree to a new work stream on onboard CO_2 capture and that as, the first step, a structured review of the current IMO regulatory framework should be undertaken as part of the development of a work plan to accommodate onboard CO_2 capture within IMO's regulatory framework.
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 34
Related documents:	MEPC 79/7/4, MEPC 79/7/6, MEPC 79/7/7, MEPC 79/7/16, MEPC 79/7/22 and resolutions MEPC.307(73) and MEPC.340(77)

Introduction

1 At MEPC 79, the Committee had for its consideration six documents related to onboard CO_2 capture. In the ensuing discussions, several delegations stressed that a holistic approach and careful consideration would be required on this complex issue. However, owing to time constraints, the Committee agreed to further consider proposals related to onboard CO_2 capture set out in the documents mentioned above at MEPC 80. Interested Member States and international organizations were thus invited to submit further information, comments and proposals on onboard CO_2 capture to that session.

2 In this document, the co-sponsors outline some preliminary ideas on how to incorporate onboard CO_2 capture in the Organization's regulatory framework and propose that the Committee agree to initiate a new work stream on onboard CO_2 capture on the basis of the draft terms of reference as suggested in paragraph 31 of this document.

3 This document also identifies and discusses various elements that could constitute a technical regulatory framework and proposes that the Committee continue this process by undertaking a regulatory scoping exercise to identify elements that are deemed necessary to ensure a robust framework for the use of onboard CO_2 capture systems. Further, the Committee may agree to a work plan to accommodate onboard CO_2 capture within IMO's regulatory framework.

Guidelines for testing, survey and certification of onboard CO_2 capture systems

4 As an equivalent to using a fuel oil that complies with the requirements for sulphur content as given in regulation 14 of MARPOL Annex VI, ships can use a certified exhaust gas cleaning system (EGCS) in accordance with regulation 4. The Organization has developed guidelines for EGCS (resolution MEPC.340(77) on *2021 Guidelines for Exhaust Gas Cleaning Systems*) the purpose of which is to specify the criteria for the testing, survey, certification and approval of EGCS in order to ensure that such systems are effective equivalents to low-sulphur fuels fulfilling the requirements in regulation 14.

5 The co-sponsors support the development of similar guidelines for onboard CO_2 capture systems ("OCC Guidelines") that describe how testing, survey and certification of such systems should be conducted. However, the use of onboard CO_2 capture could be made directly applicable with respect to different requirements in MARPOL Annex VI, which means that an equivalent approach applicable to EGCS might not be necessary. The EGCS Guidelines may be used as the basis for the development of defined criteria for testing, survey and certification of onboard CO_2 capture systems.

6 There might be discharges to the sea associated with the use of onboard CO_2 capture systems as pre-scrubbing or quenching units might be employed to clean the exhaust gas prior to CO_2 capture. In such cases, relevant parts for the EGCS Guidelines or the *2018 Guidelines for the Discharge of Exhaust Gas Recirculation (EGR) Bleed-Off Water* (resolution MEPC.307(73)) should be used in order to provide guidance on the quality of the discharge water. With reference to UNCLOS article 195 it is important that any future activity for onboard CO_2 capture does not result in other negative environmental effects.

7 When considering which items the OCC Guidelines should cover, one should take into account any discharges from onboard CO_2 capture systems and the possible provisions such systems may have to comply with. Possible provisions could be, but are not limited to:

.1 design requirements based on a one-off certification (the EEDI/EEXI);

.2 operational requirements directly related to the amount of CO_2 emitted (the CII and any possible market-based measure); and

.3 a requirement related to CO_2 or GHG emission from the energy that is consumed onboard a ship (e.g. a possible IMO GHG Fuel Standard).

8 While EGCS needs to be fully operational at all times in order to be an equivalent to using a compliant fuel oil, OCC Guidelines could be made simpler as the performance of the system is verified by the amount of CO_2 captured and delivered for storage or other purposes. Therefore, it seems unnecessary to require Continuous Emission Monitoring Systems (CEMS) or to be prescriptive on which key parameters to monitor, except as noted above where pre-scrubbing or quenching units are employed. Also, it may be technically difficult to accurately measure only the amount of CO_2 from collected exhaust gas using CEMS.

9 If carbon capture credits are given for a design requirement such as the EEDI or EEXI which is based on a one-off certification, one might argue that onboard CO_2 capture systems should be operational at all times and be fitted with CEMS in order to demonstrate ongoing compliance. However, such a requirement might be regarded as too onerous for this purpose as a ship with an onboard CO_2 capture system will possibly have other incentives for continuous operation of the onboard CO_2 capture system. Depending on how onboard CO_2 capture is accounted for in the EEDI or EEXI calculations, the efficiency of the system when it comes to carbon capture rate could be included in a certification scheme for onboard CO_2 capture systems and be combined with an availability factor that is to be used in the EEDI or EEXI calculations.

10 This is similar to how the EEDI and EEXI handle ships with dual fuel LNG engines. The criterion for using the CO_2 conversion factor for LNG is that the ship needs to have a fuel tank capacity for LNG which in terms of fuel energy is at least larger than the tank capacity to run on liquid fuel.

11 For operational requirements, such as the CII and any possible future market-based measure where demonstration of compliance is directly related to the amount of CO_2 emitted, the effectiveness of the system is proven by the amount of CO_2 that is captured and then delivered for storage or otherwise is utilized for making a new product [or from simple measurement on board a ship].

12 The Correspondence Group on Marine Fuel Life Cycle GHG Analysis is considering how to take into account carbon capture, storage and utilization (CCS and CCU) when calculating the marine fuel life cycle GHG emissions. In this regard, emissions associated with the process of capturing, processing, transporting and storing the CO_2 may be taken into account in the life cycle GHG emissions, pending further consideration by experts. For ships with onboard CO_2 capture systems, it might be necessary to certify the additional energy consumed at a specific capture rate so that the GHG intensity (g CO_2e/MJ) of the energy used on board such ships can be estimated.

13 Once an Administration has approved a CO_2 capture system on board a ship, this information could be communicated to the Organization for circulation to the Parties to the Convention for their information, if deemed necessary.

Ensuring the environmental integrity when using onboard carbon capture systems

14 The environmental integrity when using an onboard CO_2 capture system should be the same as for CO_2 capture systems used in land-based industry when it comes to requirements to ensure that the CO_2 that is captured is not emitted to the atmosphere.

15 To ensure a safe management of CO_2, ships using an onboard CO_2 capture system to comply with any relevant regulations could develop and keep onboard approved CO_2 management plan describing how the captured CO_2 is to be handled in a safe manner, consistent with international environmental laws and standards[1] in order to prevent that the gas is emitted to the atmosphere.

[1] For storage in geological formations, the provisions of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, as amended (London Convention), and the 1996 Protocol thereto (London Protocol), or other requirements thereof, will apply. For utilization in the production of products or services, the CO_2 should be handled according to international regulations or standards.

16 The CO_2 that is captured on board a ship will at some point be discharged to a CO_2-terminal for onward storage or utilization. The quantity of CO_2 transferred could be detailed through a receipt or certificate from the operator of the CO_2-terminal and then be recorded in, e.g. a CO_2 record book.

The inclusion of onboard CO_2 capture in the LCA Guidelines

17 The Correspondence Group on Marine Fuel Life Cycle GHG Analysis has considered how to include and take into account onboard CO_2 capture when developing the formulas to be used when calculating the marine fuel life cycle GHG emissions. Land-based CO_2 capture systems could be applied in the production phase of a marine fuel and, for the purpose of LCA calculations, any emissions associated with the process of capturing, compressing and temporarily storing CO_2 (operating the system) are accounted for in the "Well-to-Tank" phase when calculating the GHG intensity of marine fuel.

18 When using an onboard CO_2 capture system, the final GHG intensity of the marine fuel is not known at the time when the fuel is consumed as the onboard CO_2 capture system might not be operated at all times, the capture rate might vary and so the credits equivalent to the CO_2 captured are not known until after the fuel oil is consumed and the CO_2 is delivered to a receiving terminal for storage or utilization.

19 The co-sponsors are of the view that further considerations are needed on how to reflect the use of onboard CO_2 capture systems in the life cycle GHG analysis.

The "legal classification" of CO_2 captured on board ships

20 CO_2 could have different "legal classifications", depending on the stage in the value chain and the end destiny of the substance. Whether this would have any implications when developing a framework for the use of onboard CO_2 capture in international shipping is not clear, however, some observations are provided below for the Committee's consideration.

21 CO_2 that is captured and temporarily stored on board and intended to be utilized to manufacture a product or provide a service could be regarded as a cargo that the ship carries.

22 When CO_2 is captured for the purpose of permanent geological storage in accordance with annex 1 of the London Protocol, it would be defined as "wastes or other matter" that may be considered for dumping (Article 4.1 to the London Protocol).

23 At what stage in the value chain the different "legal classifications" of CO_2 would apply could be considered further, as appropriate.

Safety considerations associated with the use of onboard CO_2 capture systems

24 There are various safety matters that should be considered when developing a framework for the use of onboard CO_2 capture. Some requirements might be handled in Class Rules and others might be handled by IMO. There could be occupational hazards associated with the use of, e.g. amines or other chemicals in the carbon capturing process that need to be addressed. Also, it will be important to ensure a safe processing and storage of liquefied CO_2 on board, where some of the requirements for "CO_2" in the IGC Code may be relevant.

25 In this context, the co-sponsors note that during CCC 8, the Sub-Committee agreed to consider CO_2 as a toxic cargo (based on risk for asphyxiation) and that this may have consequential impact on the requirements in the IGC Code or other IMO instruments. The considerations on the toxic cargo requirements are to be considered by the Correspondence Group on Amendments to the IGF Code and Review of the IGC that will report to CCC 9 (20 to 29 September 2023).

Responsibility for different parts of the value chain

26 In this document, the co-sponsors have focused on a possible framework which may accommodate the use of onboard CO_2 capture. The framework may build concepts familiar to the Committee and could be developed using existing MARPOL regulations and guidelines as templates. However, when it comes to the responsibility for CO_2 throughout the value chain it becomes more challenging. The co-sponsors propose that the Organization carefully monitor the development of applicable regulations applicable to onshore facilities and processes for handling CO_2 captured and stored on board ships.

27 As an example, the Norwegian Government's full-scale carbon capture and storage project called "Longship" consists of the two carbon capture operators, namely Heidelberg Materials (ETS sector) and Hafslund Oslo Celsio (non-ETS sector) and the transport and storage operator, Northern Lights. These three industrial operators are responsible for monitoring and reporting to Norwegian authorities, but they are responsible for different parts of the value chain. Norwegian authorities must then report on this in line with applicable international agreements.

28 For the application of onboard CO_2 capture, there are also expected to be various industrial operators: the ship being the carbon capture operator, the operator of terminals receiving and delivering CO_2 for onward storage and the storage operators. Longship is the first project of its kind which presents challenges regarding laws and regulations. In this respect, the Norwegian State enterprise Gassnova has issued a report, "Regulatory lessons learned from Longship"[2], summarizing the regulatory issues and challenges facing the project and how these have been resolved.

Work plan for the development of a regulatory framework for the use of OCCS

29 Below is a summary of the various elements identified and discussed in this document, requiring further work, in the form of possible guidelines and regulations:

.1 regulation(s) in MARPOL Annex VI as appropriate;

.2 guidelines for testing, survey and certification of onboard CO_2 capture systems;

.3 guidelines for the development and approval of a ship CO_2 management plan;

.4 form of the CO_2 record book; and

.5 an approval or certification/accreditation scheme for CO_2-terminals in order to ensure that the CO_2 is not emitted to the atmosphere; and safe storage and utilization is consistent with international environmental law and international standards.

[2] https://ccsnorway.com/publication/regulatory-lessons-learned/

30 In addition to the new elements identified above, it would also be necessary to amend existing regulations in MARPOL Annex VI and associated guidelines as appropriate:

.1 form of International Energy Efficiency Certificate (appendix VIII);

.2 guidelines in relation to the IMO Ship Fuel Oil Consumption Database (DCS);

.3 information to be submitted to the DCS (appendix IX)

.4 guidelines in relation to the Energy Efficiency Design Index (EEDI);

.5 guidelines in relation to the Energy Efficiency Existing Ship Index (EEXI);

.6 guidelines in relation to the Carbon Intensity Indicator (CII); and

.7 guidelines on life cycle GHG intensity assessment of marine fuels (LCA).

Proposal

31 The co-sponsors suggest that the Committee agree to initiate a dedicated work stream on onboard CO_2 capture with the following draft terms of reference:

.1 review the current IMO regulatory framework in a structured manner;

.2 consider how to incorporate onboard carbon capture in the Organization's regulatory framework, including possible options for the accounting, verification and certification of CO_2 captured on board ships engaged in international voyages;

.3 review the status of technological development of onboard carbon capture applications, including their potential in reducing GHG emissions from ships; and

.4 consider the issues related to different parts of the value chain, such as monitoring the development of applicable regulations applicable to onshore facilities.

32 Based on and in parallel with the review referred to in paragraph 31.1, a work plan could be developed containing the necessary elements that would constitute a robust regulatory framework for the use of onboard CO_2 capture systems, including any safety considerations, together with an associated timeline.

33 To develop such a work plan, the co-sponsors suggest that the Committee instruct the Working Group on Air Pollution and Energy Efficiency, if established, to embark on initial discussion on the aforementioned items (paragraphs 31.1 to 31.4), and if appropriate, consider draft terms of reference of a correspondence group to further consider matters related to onboard CO_2 capture.

Action requested of the Committee

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