IMO News Flash
MEPC 81

The 81st session of Marine Environment Protection Committee (hereinafter referred to as MEPC) was convened as a hybrid meeting from 18th to 22nd March 2024 to discuss a wide range of issues under the purview of the Committee. This news flash briefs on the outcomes of MEPC 81 on major technical issues.

1. Adoption of amendments to mandatory IMO instruments (Agenda 3)

1.1 Amendments to BWM Convention in relation to the use of electronic record book

MEPC 81 adopted Res.MEPC.383(81) containing draft amendments to BWM Convention in relation to the use of electronic record book. Recalling that regulation B-2.1 of the BWM Convention stipulates that ballast water record book may be of an electronic record system, but there is no associated guidance in relation to the use of ballast water electronic record book, last MEPC 80 adopted Res.MEPC.372(80) on the *Guidance for the use of electronic record books under the BWM Convention* to ensure a harmonized approach with the relevant requirements of MARPOL and the NOx Technical Code allowing the use of electronic record book system. As the consequential amendments, the revised regulations A-1 and B-2 of the BWM Convention were introduced to provide a definition of electronic record book, approval requirements of electronic record book and a verification requirement by the ship's master. These amendments will enter into force on 1 October 2025.

1.2 Amendments to Article V of Protocol I of MARPOL Convention in relation to the revised reporting procedures for the loss of containers

MEPC 81 adopted Res.MEPC.384(81) containing draft amendments to Article V of protocol I of MARPOL Convention in relation to the revised reporting procedures for the loss of containers. Recalling that CCC 8 finalized draft amendments to SOLAS chapter V regulation 31 (danger message) and 32 (information required in danger messages) and Article V of Protocol I of the MARPOL Convention in relation to the loss or observation of freight containers, last MEPC 80 approved draft amendments to Article V of Protocol I of MARPOL Convention. Those amendments were introduced to avoid duplication of the SOLAS reporting requirements, stipulating that in case the loss of freight containers, the report required by Article II (1)(b) shall be made in accordance with the provisions of SOLAS regulations V/31 and V/32. Considering that the amendments to regulations 31 and 32 of SOLAS Chater V in relation to the loss of freight container will enter into force on 1 January 2026, for the purpose of aligning with those SOLAS and MARPOL amendments, these amendments will enter into force on 1 January 2026.

1.3 Amendments to MARPOL Annex VI

MEPC 81 adopted Res.MEPC.385(81) containing draft amendments to MARPOL Annex VI in relation to the low-flashpoint fuels and other fuel oil related issues, marine diesel engine replacing a steam system, accessibility of the data in the IMO Ship Fuel Consumption Database (IMO DCS), and inclusion of data on transport work and enhanced level of granularity in the IMO DCS. These amendments will enter into force on 1 August 2025.

low-flashpoint fuels and other fuel oil related issues

While MEPC 79 adopted Res.MEPC.362(79) on the draft amendments to appendix V of MARPOL Annex VI on *Information to be included in the Bunker delivery Note* (regulation 18.5) to include "flashpoint" of fuels, concerns were raised that such amendments do not cover liquid low-flashpoint fuels such as methanol and ethanol due to

the difference of fuel oil defined in between SOLAS II-2 as “oil fuel” based on liquid petroleum fuel and MARPOL Annex VI “fuel oil” containing gas and low-flashpoint fuels. MEPC 80 considered proposals on the further amendments to MARPOL Annex VI to reduce such a regulatory gap between those definitions, and approved draft amendments to regulations 2, 14, 18 and appendix I of MARPOL Annex VI. These amendments include the following elements:

1. In defining "gas fuel" and "low-flashpoint fuels”, it was agreed to add a new definition of “gas fuel” aligning with the definition of “gas” in IGF Code;

2. It was agreed that in-use/onboard sampling point requirements according to regulations 14.10 and 14.11 of MARPOL Annex VI and MARPOL representative sample requirements according to regulation 18.8 of MARPOL Annex VI should not apply to gas/low-flashpoint fuel;

3. Given that the minimum information such as sulphur content for low-flashpoint fuels still need to be documented by means of the bunker delivery note, it was agreed that the BDN requirements apply to low-flashpoint fuels for the purposes of MARPOL Annex VI; and

4. It was agreed to replace references to "for combustion purposes for propulsion" by “for use” in the definition of fuel oil to keep a technology neutral definition.

Marine diesel engine replacing a steam system

The draft amendments to regulation 13.2.2 of MARPOL Annex VI were introduced to clarify that a marine diesel engine replacing a steam system (main boiler and steam turbine) should be considered as a “replacement” of marine engine in terms of “major conversion” implying the applicable Tier standard at the time of the replacement or addition of the engine according to regulation 13.2.2.

As the consequential updates to the relevant Guidelines according to these amendments, MEPC 81 further adopted Res.MEPC.386(81) providing draft 2023 *Guidelines as required by regulation 13.2.2 in respect of non-identical replacement engines not required to meet the Tier III limit* in conjunction with the adoption of the above-mentioned amendments to regulation 13.2.2. The updated guidelines were to provide some points the Administrations should take into account in evaluating that engine should be Tier II compliant as opposed to Tier III in the case where a steam system is to be replaced by a marine diesel engine, as well as a template for Information to be provided to the Organization by the Administration which accepts that the installation of a Tier III non-identical replacement engine was not feasible and accordingly a Tier II engine has been installed.

Accessibility of the data in the IMO Ship Fuel Consumption Database (IMO DCS) and inclusion of data on transport work and enhanced level of granularity in the IMO DCS

The draft amendments to regulation 27 and appendix IX of MARPOL Annex VI were introduced concerning the granularity of reporting fuel consumption and additional data, with the following outstanding elements:

1. On an ad-hoc basis and under strict confidentiality rules, IMO DCS data may be shared for the analysis and research purposes. On the request of a company, the fuel oil consumption reports of the company’s owned ships can be shared to the public in a non-anonymized form; and

2. The amendments set include data granularity for promoting future decision-making in the field of GHG emission reduction, but the matters on the rules for differentiated access preserving confidentiality of DCS data could not be agreed due to the concerns on the administrative burden, inequity of member

States in their ability to exploit data and preserving the confidentiality of commercially sensitive data, notwithstanding the broad support to improving the accessibility of IMO DCS data. Thus, it was agreed to continue this issue at future session of the Committee.

3. It was further agreed to invite the early application of these amendments from 1 January 2025 to avoid double collecting and reporting of the data, and to facilitate the review of short-term measures with the data collected according to the revised format.

2. Ballast Water Management Convention (Agenda 4)

2.1 Basic Approval was granted

- ERMA FIRST FLOW BWMS (Denmark)

2.2 Type approved BWMSs reported to MEPC 81 (total 4 units)

- RADClean® BWMS (Islamic Republic of Iran), Semb-Eco BWMS (Singapore), Cyeco BWMS (Norway) and BalClor® Smart BWMS (Denmark), they were type approved in accordance with BWMS Code adopted by resolution MEPC.300(72).

2.3 Interim guidance on the application of the BWM Convention to ships operating in challenging water quality

It has been discussed that the ships may intake ballast water bypassing the BWMS when entering to a port area with high level of turbidity/total suspended solids (TSS) and then moving to an area where the BWMS can be operated to exchange ballast water using water treated by BWMS. Previous MEPC sessions generally supported for the BWE+BWT approach, while couldn't reach a consensus as there were divergent views with as to challenging water quality conditions such as BWMS not able to operate due to challenging water quality, aspects of BWE+BWT such as port States determines where ballast water exchange could take place and whether operation in PCWQ and BWE+BWT can be considered as a contingency measure or are part of anticipated operation which should be approved in the BWMP.

Moreover, it has also been discussed as to whether a substantial update to the existing guidance BWM.2/Circ.62(Guidance on Contingency Measures under the BWM Convention) should be made or a separate new guidance should be further developed, to address the challenging water quality, tank flushing to make normal operating condition of BWMS after bypass due to challenging water quality, and the locations and areas in which unmanaged ballast water can be discharged during BWE+BWT operation.

With above discussion backgrounds, MEPC 81 further considered some concrete proposals on the development of these guidelines, after extensive discussions, adopted Res.MEPC.387(81) providing an *Interim guidance on the application of the BWM Convention to ships operating in challenging water quality* containing the following outstanding elements:

1. The Guidelines provide recommended steps that can be taken to restore or maintain effective operation of a BWMS when operating in challenging water quality. These include steps to identify when a system is inoperable owing to challenging water quality; actions to avoid bypass of the system; steps to recover from bypass to ensure compliance with the D-2 standard; and planning, record keeping, and communication principles.

2. The guidelines do not address situations in which a BWMS is inoperable for reasons unrelated to challenging water quality, or in which inadequate performance is due to improper installation, operation

or maintenance. Such situations should be addressed on a case-by-case basis in consultation with the Administration of the ship and implicated port States (See also BWM.2/Circ.62).

3. Triggers for implementing challenging water quality procedures should be included in the BWMP and should be based on the performance and self-monitoring of the BWMS. The list of triggers should be developed in conjunction with the BWMS manufacturer, based on BWMS design and operational limitation(s).

4. Challenging water quality triggers should be assessed on a voyage-by-voyage basis because water quality challenges may vary. Following a bypass even in a location with challenging water quality, decontamination to ensure that subsequent discharges meet the D-2 performance standard may include ballast water exchange through a BWMS (BWE+BWT). However, BWE+BWT alone may not be sufficient to meet the standard, the risks associated with BWE+BWT alone may be mitigated by conducting ballast water flushing.

5. Any pre-emptive bypass to manage challenging water quality should be agreed in advance by the Administration of the ship and the port State receiving the ballast water to ensure that the bypassed water is returned to D-2 compliance prior to discharge. Bypass should always be considered as the last resort and the BWMS should be used as much as possible to treat ballast water with challenging water quality.

6. Example decontamination procedure intended to promote a return to compliance with D-2 performance standard after a BWMS has been bypassed as per a ship using the sequential method or flow-through/dilution method and sample procedure diagram for ships ballasting in areas with challenging water quality as per assessment of BWMS operations, challenging water quality process, alternatives to bypass, and decontamination for managing ballast water following a BWMS bypass were also provided in the appendix of the guidelines to assist ships in planning for compliance with the BWM Convention and the D-2 performance standard when a type-approved BWMS has difficulty in meeting operational demand in challenging water quality.

The entire process of these guidelines and the operation with BWE+BWT are shown in figure 1 and 2 below.

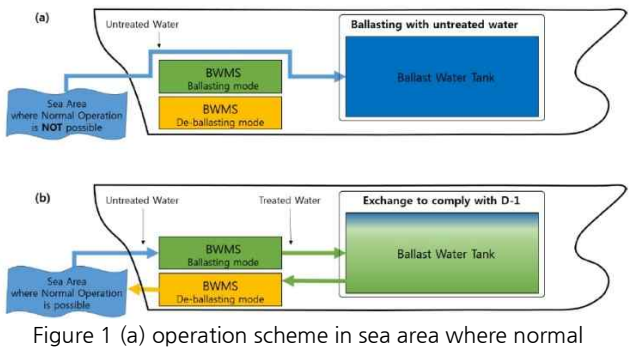

Figure 1 (a) operation scheme in sea area where normal operation is not possible and (b) operation scheme in sea area where normal operational is possible

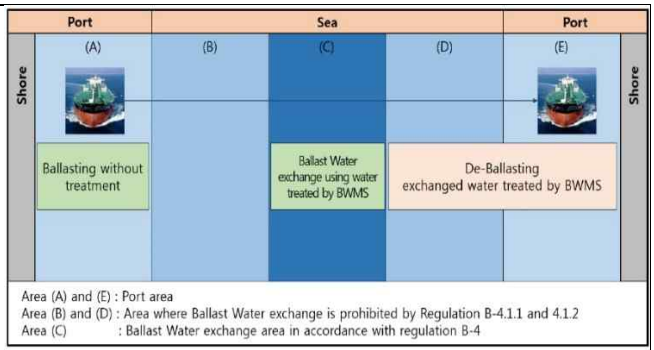

Figure 2 Principle of the operation with Ballast Water Exchange using water treated by BWMS

2.4 Temporary storage of treated sewage and grey water in the ballast water tanks under BWM Convention

Given that many ships in service have a need to store treated sewage or grey water in a ballast water tank due to port State requirements, it has been discussed as to whether temporary storage of treated sewage or grey water in a ballast water tank is permitted or not, if permitted, as to whether it is to be a guidance as an MEPC Circular or amendments to MARPOL Annex IV and BWM Convention to reflect this permission.

In particular, the Committee agreed the need for guidance on temporary storage of treated sewage and grey water in ballast tanks as this practice was not prohibited by the BWM Convention nor by MARPOL Annex IV, and this practice was already taking place. However, the Committee couldn't reach a consensus on the proposed draft guidance due to the complexities in relation to the cross-referenced requirements for the BWM Convention and MARPOL Annex IV and the implication by the ongoing review of MARPOL Annex IV being conducted by the PPR Sub-Committee. Thus, the Committee invited interested member States and international organizations to submit further concrete proposals to the next session for finalizing guidance on the temporary storage of grey water or treated sewage in ballast tanks.

With above discussion backgrounds, MEPC 81 further considered concrete proposals on the development of these guidelines, and approved BWM.2/Circ.82 providing a *guidance for the temporary storage of treated sewage and/or grey water in ballast water tanks*, with the following outstanding elements:

1. For ships with limited spaces to provide adequate tank arrangements for holding treated sewage and grey water generated onboard, the ballast tanks may be temporarily used as treated sewage and/or grey water holding tanks. In doing so, the technical and operational measures should be conducted to avoid the contamination of ballast tanks. Such operational and management method of the temporary storage of the treated sewage and/or grey water in the ballast tanks should be described in the Ballast Water Management Plan (BWMP) of the ship;

2. To avoid possible spread of live organisms, prior to the transfer of treated sewage/grey water into the ballast water, the ballast tank should be properly emptied using BWMS to remove any residual ballast water and sediments as far as practicable. The ballast tank should be fully emptied to remove any residual treated sewage or grey water before being used as a ballast tank again;

3. In case a ship changes the use of a ballast water tank from treated sewage/grey water storage back to ballast water discharge, the contents of the ballast water tanks should be discharged by flushing the ballast water tank, pipes, and dual-purpose pumps with at least the same volume of the temporary stored treated sewage/grey water; and

4. During the period in which the ballast tank is holding treated sewage/grey water, the Ballast Water Record Book (BWRB) should have an entry with the type of water being stored as well as date, time and location of change of the use of a ballast tank.

2.5 Modifications to BWMS after type approval

MEPC 81 considered a proposal on development of a guidance for approval after initial type approval of BWMS due to necessary modifications to the system. While approval of modifications to an already type approved BWMS due to changes or upgrades is not clearly defined in the BWMS Code, it is noted that such modifications to existing BWMS are sometimes carried out for system's upgrade purposes (e.g. a robust BWMS suitable for challenging water quality, or alternative filters), and thus it should be clarified whether the current procedures for type approval in accordance with BWMS Code should be carried out without simplified process (e.g. reduced test scope from BWMS Code such as omissions of land-based and/or shipboard testing, if necessary) or not.

In light of this, there were also considerations as to which type approval actions should be conducted for type approval of modifications to BWMS major components as follows:

1. Filters - removing filter, adding an alternate filter with similar technical specifications, filter micron rating change/lower micron rating (smaller dimension);
2. UV - increasing UV dose, decreasing UV dose, change of UV intensity, change of UB chamber, change of UV lamp manufacturer;
3. Injection of Active Substance - increasing dose, decreasing dose, change of Active Substance used;
4. Electrolysis - increasing dose, decreasing dose, change of electrode;
5. TRO - change or TRO sensor technology; and
6. Control systems - program logic controller, HMI touchscreen, software

During consideration, MEPC 81 particularly noted that while this issue would ultimately be addressed under the Convention review stage, in the interim it should be addressed with guidance to facilitate a consistent process for approval of modifications to BWMS by different Administrations. Moreover, given the various views on detailed technical aspects including testing such as numbers and types of tests, the Committee invited interested Member States and international organizations to submit further concrete proposals to the next session with a view to finalization of guidance on modifications to ballast water management systems with existing type approval.

2.6 Experience Building Phase (EBP) and Convention Review Plan (CRP) under the BWM Convention

Experience Building Phase (EBP) which is constructed as three stages: a data gathering stage, a data analysis stage, and a Convention review stage has been carried out to monitor the overall implementation of the BWM Convention in accordance with BWM.2/Circ.67/Rev.1 on data gathering and analysis plan required for implementing EBP, and its subsequent analysis report was submitted to MEPC 78. In light of this, MEPC 78 agreed to develop a BWM Convention Review Plan to identify the overarching issues, inter alia, areas for improving BWMS performance and reliability, including crew training and maintenance.

A correspondence group was established to develop the details of the Convention Review Plan. MEPC 80 approved BWM.2/Circ.79 on the *Convention Review Plan under the experience-building phase associated with the BWM Convention*, and further agreed to establish a correspondence group to define objectives for changes to specific Convention provisions and/or instruments, or the need for new provisions and/or instruments, to address the issues as follows:

1. How to improve the performance and reliability of BWMS to increase compliance to the D-2 standard;
2. Mechanisms for ship compliance in circumstances in which a BWMS installed on a ship may not be suitable for the intended specific voyage or operations to be undertaken;
3. Mechanisms for ship compliance in cases of BWMS failure need to be agreed to ensure the aims of the Convention are maintained in all situations;
4. Mechanisms for ship compliance in situations other than BWMS failure or challenging water quality need to be agreed to ensure the aims of the Convention are maintained in all situations;
5. BWMS may become temporarily inoperable when encountering challenging water quality; and
6. The current type approval process does not support modifications to BWMS, etc.

MEPC 81 considered the report of the correspondence group on Review of BWM Convention, and finalized the list of the BWM Convention provisions proposed for revision and/or development as follows:

BWM Convention provisions	Revision and/or development
Regulation A-3 (Exceptions)	Amendments to regulation A-3.4 for allowing circumstances when the ship will discharge unmanaged or partially managed ballast water and sediments on the high seas (challenging water quality, contingency measures and/or PSC requirement on BWE+BWT)
Regulation B-1 (BWMP)	Amendments to identify ships with BWMS that are type approved in accordance

	with the BWMS Code as opposed to older version of the G8 guidelines, create a standardized BWMP template and add a new requirement that ships plan for contingency measures, etc.
Regulation B-2 (BWRB)	Amendments to add a new requirement that a BWMS maintenance log be added to the BWRB, reflecting the OEM manual and maintenance schedule and be kept updated and signed by crew involved in each action
Regulation B-6 (Duties)	Amendments to add a new requirement for crew familiarization of BWMS
Regulation D-2 (Ballast performance standard)	Amendments to establish a maximum allowable discharge concentration (MADC) for BWMS that use active substances, to ensure that in-service ships regularly discharge effectively neutralized ballast water, for BWMS utilizing active substances
Regulation D-3 (Approval of BWMS)	Amendments to create a new requirement that any type approved BWMS installed on a ship to meet the D-2 standard shall be maintained in good working order
Regulation E-1 (Surveys)	Amendments to include a requirement that annual surveys confirm required maintenance has been undertaken by verifying the BWRB, including the ballast water maintenance log

In addition, MEPC 81 further identified the associated instruments proposed for revision and/or development such as possible amendments as follows:

1. BWMS Code (Res.MEPC.300(72)) for including some requirements on a mandatory maintenance schedule in Operational, Maintenance and Safety Manual (OMSM) and contemporaneous instructions for the proper operation of BWMS as a basis for the development of approved BWMPs;
2. Guidelines G2 (Res.MEPC.173(58)) for creating a new requirement that CMDs be verified in accordance with BWM.2/Circ.78, and once CMDs are verified, unverified devices should not be supported for commissioning testing;
3. Guidelines G4 (Res.MEPC.127(53) as amended by Res.MEPC.306(73) and 370(80)) for creating a new requirement to update a BWMP when a BWMS is upgraded or retrofitted, and creating ship-specific guidance for conducting onboard sampling which is sufficiently detailed to prevent improper sampling collection (i.e. ship and BWMS particulars that can impact the quality of discharge samples collected);
4. Guidelines (G9) for including the maximum holding time for samples to be analyzed, and creating a new requirement to calibrate sensors in situ to ensure complete TRO sensing is completed as per their design; and
5. Guidelines for PSC under the BWM Convention (Res.MEPC.252(67)) for creating a new requirement for indicative monitoring and sampling to ensure effective operation of BWMS, and creating a new requirement to confirm adequate maintenance and record keeping has been undertaken, etc.

MEPC 81 further agreed to establish a correspondence group to prepare draft text for amendments to provisions of the BWM Convention and to associated instruments, and for new provisions and/or instruments, based on the list of provisions and instruments for revision and/or development as referred above.

3. Air Pollution and Energy Efficiency (Agenda 5 and 6)

3.1 NOx Tier III compliance strategy in low load point of the SCR operation

Last MEPC 80 considered a proposal encouraging the international cooperation to address a concern that the actual NOx emission levels may be exceeding the Tier III standards when ships with IMO NOx Tier III propulsion

engine are operating within ECAs at low loads (below 25% Maximum Continuous Rating (MCR)), such as in port, coastal, and inland areas, ship speed reduction zones. It was based on that a Selective Catalytic Reduction (SCR) system does not work properly below 250˚C of exhaust gas from marine diesel engines. In this respect, a potential modification to the certification scheme was also addressed such as an additional point corresponding to a low-load condition to be tested along with the standard E3(or E2) cycle, and the low-load point (10% or 15% of engine power) could be defined for different types of engines.

In this regard, MEPC 81 further considered a proposal, given the concerns that the NOx and ECA requirements in accordance with regulation 13 of MAPROL Annex VI are not achieving the anticipated reductions in air pollution from marine diesel engines, suggesting various ways to address this issue including additional test cycles or modification to the existing test cycles as follows:

1. The combination of the marine engine test cycle and the MARPOL Annex VI and NTC (NOx Technical Code) auxiliary control device (ACD) could resulting in disabling Tier III NOx technology at low engine loads, leading to little or no NOx reductions in an ECA;
2. The keel laying dates incentivize behavior (early keel-laying) to avoid compliance with the Tier III NOx limits;
3. There are challenges in linking compliance procedures to be real-world operational load-behavior of marine diesel engines; and
4. Remote measurements to be conducted by service suppliers on a regular basis need to be introduced to provide indicative information on in-use emissions and ensure that the engines are compliant with Tier III NOx limits for their whole lifetime.

After consideration, given the views that further research and data collection were needed in terms of identifying the technical feasibility for the NOx engine performance at low loads, and concerns expressed regarding the effectiveness of regulation 13 of MARPOL Annex VI in relation to the compliance with NOx Tier III standards in NOx ECAs, MEPC 81 invited interested Member States and international organizations to continue conducting research on the matter and to consider submitting proposals for a new output on the review of the effectiveness of regulation 13 of MARPOL Annex VI, including the NOx Tier III standard, to a future session of the Committee.

3.2 Implementation and review of the short-term measure

MEPC 81 considered following issues and subsequently made decisions as follows:

1. Considering that CII and its rating system is currently within de facto experience building phase and, a review of the system is currently under way that will be completed by 1 January 2026, a draft MEPC resolution urging member States to advise wider stakeholders (e.g. financiers, insurers, charters, brokers and port State control) not to utilize CII or its metric (AER or cgDIST) for assessment of energy efficiency or regulatory compliance risk was proposed. After consideration, given the views that the review process of short-term measures is now ongoing, and thus, it should not be prejudged until review process of short-term measures is completed by 1 January 2026 in accordance with its work plan agreed at MEPC 80, MEPC 81 could not reach a consensus on this proposal and then invited interested Member States and international organizations to collect data and submit information, recommendations and proposals for improving the CII framework to MEPC 82.

2. In calculating the attained CII, a discrepancy in the definition of “Capacity” for CII calculations between the *2022 Guidelines on operational carbon intensity indicators and the calculation methods* (CII Guidelines, G1) and the *2022 Interim Guidelines on correction factors and voyage adjustments for CII calculations* (CII Guidelines, G5) was identified. The definition of “Capacity” in G1 guidelines is the actual

ship's DWT or GT, while the definition in G5 guidelines[1] is DWT or GT as defined for each specific ship type in the *2022 Guidelines on the reference lines for use with operational carbon intensity indicator* (CII reference lines guidelines, G2). This means that should the ship opt to apply a correction factor or a voyage adjustment, the capacity used in calculating the attained CII values will subsequently change solely due to the application these correction factors or voyage adjustments. Thus, amendments to G5 guidelines were proposed to ensure that individual ship's actual DWT or GT should be used in calculating the attained CII value regardless voyage adjustments or correction factors are applied. After consideration, MEPC 81 agreed to issue a corrigendum to the guidelines to correct the editorial error identified in this proposal.

3.3 Matters related to the IMO DCS, EEDI, EEXI and SEEMP

MEPC 81 considered following issues and subsequently made decisions as follows:

1. Given that the current IMO DCS data as a basis for present and future regulatory GHG measures may present some risks and vulnerabilities associated with legal and cyber security issues, MEPC 81 agreed to instructed IMO Secretariat to conduct a review of the suitability of the IMO DCS for the implementation of current and future regulatory GHG measures, in terms of enhancing data quality and integrity.

2. When developed EEDI reference lines, LNG carriers having conventional propulsion built to Phase 0 were categorized as gas carriers in their IEE Certificate, and LNG carriers with non-conventional propulsion (DFDE, turbine, etc) that were contracted within Phase 0 were also categorized as gas carriers. As a result, fuel oil consumption data from LNG carriers which were categorized as gas carriers were reported to IMO DCS database and used in developing the CII reference lines for LNG carriers and gas carriers. This means that the current CII reference lines for LNG and gas carriers do not clearly distinguish these ship types in terms of implementing CII requirements. Given this historical background for the development of reference lines for gas carrier and LNG carrier, MEPC 81 agreed that all LNG carriers currently categorized as gas carriers be recategorized as LNG carrier for the purposes of IMO DCS reporting and implementation of CII and, the IMO Secretariat recalculate the AER[2] of the LNG and gas carrier fleet for 2021 and 2022 once the recategorization is completed.

3. Recalling that MEPC 81 adopted the draft amendments to appendix IX of MARPOL Annex VI for expanding the range and granularity of data to be reported to the IMO Data Collection System (DCS), MEPC 81 adopted Res.MEPC.388(81) and Res.MEPC.389(81) providing consequential amendments to Part II of the *2022 Guidelines for the development of a Ship Energy Efficiency Management Plan* (SEEMP Guidelines) (Res.MEPC.346(78)) and *2022 Guidelines for Administration Verification of Ship Fuel Oil Consumption Data and Operational Carbon Intensity* (Res.MEPC.348(78)). These updated guidelines provide clarifications as to how to calculate total annual fuel oil consumption and fuel oil consumption per consumer type (through the method using bunker delivery note, flow meters, bunker fuel oil tank monitoring, LNG cargo monitoring and cargo tank monitoring for ships using cargo other than LNG as a fuel), conversion factor, distance travelled, hours underway, total amount of onshore power supplied and total transport work.

4. MEPC.1/Circ.795/Rev.9 providing the modifications to the unified interpretation was approved to explicitly specify the applicable required EEDI of each Phase for the ship types, LNG carrier, cruise passenger ship, ro-ro passenger ship, ro-ro cargo ship (vehicle carrier) and ro-ro cargo ship, delivered on

[1] For example, in accordance with G5 guidelines, for LNG carrier of less than 65,000 DWT, a default value 65,000 is used as the capacity value in calculating the attained CII when voyage adjustments and/or correction factors are applied. This causes distortion in the carbon intensity and its rating.
[2] The metric calculated as 'CO_2 emission / (DWT x Distance Travelled' is referred to as AER (Annual Efficiency Ratio)

or after 1 September 2019. It is because MEPC 66 in 2014 adopted the amendments to MARPOL Annex VI by Res.MEPC.251(66) extending the application of the required EEDI to additional five ship types as referred above, while MEPC.1/Circ.795 does not provide any interpretations as to which EEDI Phases should be applied for those ship types as per when the ship was building contracted, keel laid (constructed) and delivered.

5. Regulation 2.2.15 of MARPOL Annex VI provides a definition of "general cargo ship". This definition does not include specialized dry cargo ships, which are not included in the calculation of reference lines for general cargo ships, namely livestock carrier, barge carrier, heavy load carrier, yacht carrier, nuclear fuel carrier. In this regard, MEPC 81 approved MEPC.1/Circ.795/Rev.9, as well as the amendments to unified interpretation referred to in paragraph 4 above, providing the modifications to the unified interpretation to MARPOL Annex VI to incorporate IACS Recommendation 170 into the MARPOL unified interpretation.

6. MEPC 81 adopted Res.MEPC.390(81) providing modifications to *2021 Guidelines on the shaft/engine power limitation system to comply with the EEXI requirements and use of a power reserve* (Res.MEPC.335(76), as amended by Res.MEPC.375(80)) to require ships to have all shaft or engine power, including power reserve, available for immediate use while in pilotage water for the purpose of ensuring the safe navigation in pilotage water. These guidelines further clarify that the shaft or engine power limitation system is not capable of being immediately overridden, the system should be overridden before a pilot's embarkation and remain overridden until the ship departs pilotage water.

7. MEPC 81 approved MEPC.1/Circ.908 providing a procedure for reporting to the organization uses of power reserve. Recalling that the Administration should report to the IMO Secretariat uses of a power reserve over a 12-month period from 1 January to 31 December for the preceding calendar year with the information recorded in accordance with Res.MEPC.375(80), the Administrations are invited to report uses of a power reserve using the format set out in the procedure.

3.4 Guidance for marine bunkering vessels on carriage requirements for biofuels intended for use as marine fuels

MEPC.1/Circ.975/Rev.6 approved at MEPC 78 interprets that a fuel oil which is a blend of not more than 30%by volume of biofuel should meet the requirements of regulation 18.3.1 of MARPOL Annex VI as fuel oils derived from petroleum sources and a fuel oil which is a blend of more than 30% by volume of biofuel should meet the requirements of regulation 18.3.2 of MARPOL Annex VI as fuel oils derived by methods other than petroleum refining.

Last MEPC 80 further approved MEPC.1/Circ.905 on the interim guidance on the use of biofuels under regulation 26(SEEMP), 27(IMO DCS) and 28(Operational Carbon Intensity) of MARPOL Annex VI (DCS and CII). The guidance outlines that pending the development of the comprehensive method to account for well-to-wake GHG emissions and removals based on the IMO LCA Guidelines, biofuels that have been certified by an international certification scheme, meeting its sustainability criteria, and that provide a well-to-wake GHG emissions reduction of at least 65% compared to the well-to-wake emissions of fossil MGO of 94 gCO_{2eq}/MJ (i.e. achieving an emissions intensity not exceeding 33 gCO_{2eq}/MJ) according to that certification, may be assigned a Cf equal to the value of the well-to-wake GHG emissions of the fuel according to the certificate (expressed in gCO_{2eq}/MJ) multiplied by its lower calorific value (LCV, expressed in MJ/g) for the purpose of regulations 26, 27 and 28 of MARPOL Annex VI for the corresponding amount of fuels consumed by the ship.

With this background, MEPC 81 considered a proposal discussing the issues on the use of biofuels to reduce GHG emissions from international shipping and proposing a draft MEPC circular providing guidance on the carriage requirements of biofuels for marine bunkering vessels certified for the carriage of MAPROL Annex I cargoes.

The use of biofuels as a drop-in fuel solution in IMO's carbon intensity and reduction of GHG emissions is recognized by the LCA guidelines and, therefore, industry is moving towards wider availability and uptake of biofuels. However, it was identified that convention bunkering vessels certified for the carriage of oil, marine residual or distillate fuels oil and MARPOL Annex I cargoes cannot carry biofuels and its blends of more than 25% by volume of biofuels since those bunkering vessels should be certified to comply with the carriage requirements in accordance with the IBC Code and the 2019 *Guidelines for the carriage of MARPOL Annex I cargoes and biofuels* (MSC-MEPC.2/Circ.17) as a chemical tanker. This means that conventional bunkering vessels cannot carry biofuels and its blends from B30 to B100 which are being introduced into the shipping industry for reducing GHG emissions and complying with CII requirements.

After consideration, given that this issue was not directly an issue related to air pollution but rather to carriage requirements, MEPC 81 instructed PPR Sub-Committee and 30th ESPH Working Group to proceed further discussion on the development of carriage requirement on biofuels for conventional bunkering vessels certified for carriage of oil fuels under MAPROL Annex I or the revision of current carriage requirements as provided in the IBC Code and MSC-MEPC.2/Circ.17.

3.5 2022 Report of fuel oil consumption data submitted to the IMO Ship Fuel Oil Consumption Database (DCS) and Report on annual carbon intensity and efficiency of the existing fleet

MEPC 81 noted the reports relating to fuel oil consumption data submitted to the IMO Ship Fuel Oil Consumption Database (DCS) and annual carbon intensity and efficiency of the existing fleet as follows:

2022 Report of fuel oil consumption data submitted to the IMO Ship Fuel Oil Consumption Database (DCS)

1. Data was reported by 28,834 ships (28,171 for 2021) with a combined gross tonnage of 1,289 million gross tonnage (1,255 million gross tonnage for 2021) by 108 Administrations out of a possible 135 Administrations (compared to 109/139 Administrations for 2021);
2. 28,834 ships out of a potential 33,991 ships (84.8%) that were estimated to fall under the scope of regulation 27 of MARPOL Annex VI, submitted data. On the basis of gross tonnage, the reported data represents 93.1% of the ships that are estimated to fall under the scope of regulation 27 of MARPOL Annex VI (compared to 94.4% for 2021); and
3. 213 million tonnes of fuel (212 million tonnes for 2021), on a quantity basis, was used by the 28,834 ships. Total fuel used was slightly higher in 2022 compared to 2021. 94.65% of the fuel used for the 2022 reporting period was either Heavy Fuel Oil, Light Fuel Oil or Diesel/Gas Oil. Fuels that are not in the categories Heavy Fuel Oil, Light Fuel Oil or Diesel/Gas Oil are 5.35% of the fuel used in 2022. The majority of the reported fuel oil was consumed by the following three EEDI ship types (containerships, bulk carriers and tankers).

Report on annual carbon intensity and efficiency of the existing fleet (Reporting years 2019 to 2022)

1. Supply-based carbon intensity in AER/cgDIST[3] demonstrated an overall decrease of up to 4.6% relative to 2019, but the yearly fluctuations and demand-based carbon intensity expressed in EEOI has only very gradually change between years to just below 0.5% in 2022, relative to 2019, but also demonstrating a more consistent value when comparing between reporting years. Supply-based carbon intensity, expressed in AER and cgDIST, and demand-based carbon intensity, expressed in EEOI, are not strongly correlated for all ship types and sizes; and

[3] The metric calculated as 'CO_2 emission / (DWT x Distance Travelled)' is referred to as cgDIST (Capacity Gross Ton Distance)

2. The overall changes in carbon intensity for the global fleet are relatively small, however, when dividing the fleet into Fourth IMO GHG Study 2020 ship types and sizes, larger differences in carbon intensity developments can be observed when comparing between AER/cgDIST and EEOI and for different ship types and sizes. In general, bigger ship size categories showed a bigger reduction in carbon intensity compared to smaller ship size categories.

3.6 MSC-MEPC.1/Circular on Guidelines for the sampling of fuel oil for determination of compliance with the revised MARPOL Annex VI and SOLAS Chapter II-2

Regulation 18 of MARPOL Annex VI requires that the fuel oil supplier shall provide a bunker delivery note, and a representative sample of the fuel oil delivered onboard is to be sealed. MEPC 47 adopted the first version of the sampling guidelines as Res.MEPC.96(47). Following the complete revision of MARPOL Annex VI, adopted as Res.MEPC.178(58), these guidelines were updated to reflect the amended regulation references as Res.MEPC.182(59). Meanwhile, regulation 4.2.1 of SOLAS chapter II-2 sets minimum oil fuel flashpoint limits. MSC 106 adopted amendments to SOLAS chapter II-2 by Res.MSC.520(106), which would require oil fuel flashpoint to be declared on the bunker delivery note and furthermore provided for the action to be taken in confirmed cases where the flashpoint was found to be below the minimum limit of 60°C.

In this regard, MEPC 81 noted that MSC 107 approved the guidelines for the sampling of oil fuel, subject to the concurrent decision by MEPC. After consideration, MEPC 81 approved, subject to concurrent approval by the MSC 108, MSC-MEPC.1/Circular on the *Guidelines for the sampling of fuel oil for determination of compliance with the revised MARPOL Annex VI and SOLAS chapter II-2*. The circular, which is based on the existing *2009 Guidelines for the sampling of fuel oil for determination of compliance with the revised MARPOL ANNEX VI* (Res.MEPC.182(59)), is intended to establish an agreed method to obtain a representative sample of the fuel oil for combustion purposes delivered for use on board ships in relation to the application of both regulation of SOLAS Chapter II-2 and regulation 18 of MARPOL Annex VI. In addition, it was agreed to revoke Res.MEPC.182(59) on the *2009 Guidelines for the Sampling of Fuel Oil for Determination of Compliance with the Revised MARPOL Annex VI* as soon as the joint MSC-MEPC circular enters into effect.

4. Reduction of GHG emissions from ships (Agenda 7)

4.1 Basket of candidate mid-term measures to further reduce GHG emission from international shipping

Last MEPC 80 adopted Res.MEPC.377(80) on the 2023 Revised Strategy on reduction of GHG emissions from ships containing the overarching elements such as 5~10% uptake of zero or near-zero GHG emissions technologies, fuels and/or energy sources to increase by 2030, reaching net-zero GHG emissions by or around, i.e. close to 2050 and reduction of the total annual GHG emission from international shipping by 20~30% by 2030 and 70~80% by 2040.

With that, recalling that it is commenced to develop the measures to be finalized within an agreed target date in accordance with the work plan for development of mid- and long-term measures as a follow-up action of the initial IMO Strategy on reduction of GHG emissions from ships approved by MEPC 76 and the 2023 revised Strategy on reduction of GHG emissions adopted by MEPC 80, ISWG-GHG 16 and MEPC 81 continued to discuss the outstanding elements contained in the proposed basket of candidate mid-term measures as follows:

1. GHG Fuel Standard with a voluntary flexible mechanism, in combination with a Greenhouse Gas Pricing Mechanism covering all GHG emissions
   - Applying the GHG reduction targets and checkpoints (for 2030, 2040 and 2050) from the 2023

revised Strategy to the 2008 WtW GHG emissions to establish a GHG emissions pathway in absolute terms. The attained GFI (GHG Fuel Intensity) will be calculated based on the WtW GHG emissions, as defined in the LCA Guidelines. It also includes a remedial action that allows ships that cannot operate on low-GHG fuels to continue to operate, by using the Flexible Compliance Units (FCU) (Over-compliant ships earn rewards by selling the units to non-compliant ships) or GHG Remedial Units (GRU) (non-compliant ships buy GHG Remedial Units at a certain price from GFS Registry as a last resort compliance option). Pooling compliance[4] is also allowed for non-compliant ships by teaming up with over-compliant ships.

- The purchase of GRU creates revenue, though it will be much lower, as the price of the GRUs should be set never to make them the preferred solution over other compliance methods (use of compliant fuels or purchases of FCUs). The amounts of levies are proposed to range from 2 USD per tonnes of CO2e to 300 USD, subject to the results of the Comprehensive Impact Assessment.

2. International Maritime Sustainiable Fuels and Fund (IMSF&F) mechanism
   - IMSF&F is to set up a required limit to the TtW[5] GHG intensity indicator of fuels/energy used onboard ships (required GFI, in gCO_{2eq}/MJ) and WtT[6] value will not be considered in setting the reference GFI value. The actual GHG emissions of a ship can be calculated by multiplying the actual GFI with the actual annual fuels/energy consumption. It also provides a flexible mechanism allowing over-compliant ships to earn rewards by selling Surplus Units to non-complaint ships. Non-compliant ships can obtain Remedial Units through monetary contributions to the Sustainable Shipping Fund (SSF). Pooling compliance is also allowed for non-complaint ships to receive Surplus Units from over-compliant ships.
   - Under this framework, the application of an independent levy is not required to avoid double taxation. WtT GHG emissions are also addressed to provide the ships using sustainable fuels/energy in terms of lifecycle approach with the incentives and to adjust the attained TtW GFI values based on the WtW GHG emissions reduction potential and other associated sustainability aspect, so that fuels with high WtW emissions will be gradually phased-out whilst the uptake of alternative fuel technologies in new builds will be incentivized.

3. Zero Emission Shipping Fund (ZESF) - Fund and Reward (Feebate) Mechanism
   - In addition to a GHG Fuel Standard as a technical measure, this proposal is for ships to make contributions to the ZESF per tonne of CO_{2eq} emitted, and to receive rewards per tonne of CO2e prevented by using eligible zero/near-zero GHG energy sources. Life-cycle emissions of zero and near-zero GHG fuels (including the biofuel component of blends) can be considered when setting the contribution and reward rate per tonne of these fuels consumed. This mechanism does not use surplus or remedial units to incentivize first movers, but instead, provides rewards to ships using eligible zero/near-zero GHG fuels for the CO_{2eq} emission prevented to reduce the cost difference with conventional fuel.
   - The reward rate per tonne of CO_{2eq} prevented will be guaranteed for a minimum 5 years to incentivize the accelerated production and uptake of zero/near-zero GHG emission fuels with a clear signal to the industry. It also avoids the problems associated with penalizing non-compliant ships through the purchase of remedial units. Subject to the results of the Comprehensive Impact Assessment, a reward rate of around 100 USD per tonne of CO_{2eq} prevented has been proposed to reduce the cost gap with conventional fuels.

[4] The mechanism would permit a ship, or ships, which 'over-comply' with the required GFI - operated by the same or different companies and registered with one or more flag states - to share the 'excess' required GFI with another ship or ships in the 'pool' that may be unable to comply fully with the requirement.
[5] Tank-To-Wake(Propeller) emissions factor, also known as downstream or direct emissions, is an average of all the GHG emission released into the atmosphere from a fuel consumption to operate a ship.
[6] Well-To-Tank emissions factor, also known as upstream or indirect emissions, is an average of all the GHG emissions released into the atmosphere from the production, processing and delivery of a fuel or energy vector.

4. Simplified Global (GHG) Fuel Standard with energy pooling compliance mechanism
   - The [5%] reduction in GFI for 2030 and [30%] reduction in GFI for 2040 were proposed, subject to the review of alternative fuel availability to be undertaken by 2028 which is similar with the approach used for the IMO 2020 sulphur limits. A flat rate contribution from ships as part of a fund and reward measure and the need to narrow the price gap between alternative and conventional fuels via a rewards programme for CO_{2eq} or GHG emissions prevented by ships using eligible alternative fuels were proposed.
   - The simplified GFS does not involve any financial penalties for non-compliance with the required GFI. The simplified GFS includes provisions for an "energy pooling compliance mechanism" that may be used on a voluntary basis by ships to comply with the GFS, and thus it can avoid the need on the trading system for "compliance units" and "remedial units". Bunker Delivery Note (BDN) can be used as a basis for compliance with the required GFI for individual ship. Under this scheme, a ship not able to purchase compliant fuel oil to meet the required GFI is allowed to consider FONAR (Fuel Oil Non-Availability Report) system.

5. Feebate mechanism - mandatory contribution on GHG emissions and reward for zero emission vessels by the Zero Emission Shipping Fund (ZESF)
   - In addition to a Global GHG Fuel Standard as a technical measure, mandatory contribution and reward mechanism are proposed to bridge the cost gap between conventional fuels and zero or near-zero GHG emission fuels. Under this framework, fuels with WtW GHG intensities assessed as below a certain threshold will be defined as eligible fuels for reward. Mandatory contribution will be imposed based on the WtW (or TtW) GHG emissions as assessed under the LCA guidelines.
   - Under the assumptions that a reward rate of 100 USD/CO2eq per GHG reduction is set to avoid over-subsidizing zero or near-zero GHG fuels (eligible fuels) and two billion USD will be raised annually to finance activities to promote a just and equitable transition, the contribution rate of 20 USD/CO2e ton is suggested to be implemented for the first five years (2027-2031) and revenues raised in the same period is estimated as 9 to 10 billion USD annually.

6. Green Balance Mechanism (GBM)
   - Although it does not propose the specific GHG intensity threshold (GFI), the Green Balance GFI to enable the use of green fuel, based on a GFI reference line which is aligned with IMO's net-zero endpoint, was proposed. Incentivization and penalization would be determined by the performance of a ship relative to the GFI and Green Balance GFI reference line. The GBM would use WtW calculations to establish the attained GFI value for the reporting period and allows for the use of flexible compliance mechanisms or pooling of ships.
   - Payment into, and allocation from, the Green Balance Fund would be proportional to the GHG reduction achieved as follows:
     1. Ships which have an attained GFI equal to, or inferior to the GFI value would be required to contribute into the green balance fund;
     2. Ships with a WtW GHG intensity better than the GFI value, but not meeting the GBM GFI threshold (10% more stringent than the GFI) would neither pay into nor receive payment from the green balance fund; and
     3. Ship with a WtW GHG intensity equal to or better than the GBM GFI threshold would receive a green balance allocation from the green balance fund.

7. Universal Mandatory GHG Levy, acting in combination with a Simplified Global GHG Fuel Standard
   - A carbon levy ($ 150) to be introduced in 2027 based on well-to-wake CO_{2eq}, in accordance with

the guidelines on lifecycle GHG intensity of marine fuels (LCA guidelines). The levy contribution of each ship can be defined from data collected in IMO DCS. At each 5-year period the levy rate (per tonne of CO_{2eq}/GHG) will be reviewed and increased as necessary to further reduce or eliminate the price gap between fossil fuels and low- and zero-GHG technologies and fuels.

- A flexibility mechanism involving credit trading such as the FCU/SRU units, equivalent to a cap and trade policy, is not required under this framework. The significant complexity a flexibility mechanism generates, both in its negotiation and its implementation, is therefore unnecessary.

During the discussion, ISWG-GHG 16 and MEPC 81 particularly noted an increased support and convergence for a basket of measures combining technical and economic elements, i.e. a well-to-wake GHG intensity fuel standard in combination with a levy scheme imposing a set price on well-to-wake or tank-to-wake GHG emission. A levy scheme can also be combined with a rebate system where the revenues are provided to the ships using the zero emissions fuel and technologies to cover the price gap between fossil and zero emission fuels.

In particular, ISWG-GHG 16 and MEPC 81 particularly noted the following outstanding issues:

1. Regarding a goal-based marine fuel standard regulating the phased reduction of marine fuel's GHG intensity, while it was agreed to further discuss to develop this standard as part of the basket of mid-term measures based on the well-to-wake GHG emissions of marine fuels, further work remained to frame the GHG fuel intensity baseline and reduction trajectory in line with the levels of ambition and indicative checkpoints set out in the 2023 IMO GHG Strategy;

2. Regarding the flexible compliance strategies and relevant reporting and verification requirements in support of the goal-based marine fuel standard, while there was considerable convergence on the flexible compliance strategies as an element in support of the implementation of the goal-based marine fuel standard based on the trading of over-compliance units, the purchase of remedial units, and pooling, there were oppositions that the flexibility mechanisms would lead to possible unintended consequences and inequal access to such flexible compliance options, in particular, countries without the experience to operate in complex trading markets and which are served by older shipping tonnage, and therefore would result in an economic transfer from least developed countries to the most developed countries. In particular, there were remaining divergences on methodological issues relating to flexible compliance strategies as well as on how to set the price of remedial units to incentivize the transition to zero- and near-zero emission fuels and technologies; and

3. Regarding maritime GHG emissions pricing mechanisms, revenue collection and distribution, it was split on several issues relating to the further development of a maritime GHG pricing mechanism as part of the basket of mid-term measures, in particular, different views were expressed over an integral approach where technical and economic elements would be integrated into the goal-based marine fuel standard versus an approach where a separate economic element would be developed in addition to the goal-based marine fuel standard.

The Committee could not reach a consensus on the various proposals on the basket of mid-term measures, it was agreed to hold a two-day expert workshop (GHG-EW 5) on the further development of the basket of mid-term measures to facilitate the understanding of the preliminary findings of the comprehensive impact assessment, including the modelling of revenue disbursement used as part of the assessment of impacts on States. Moreover, it was further agreed to hold ISWG-GHG 17, to be held back-to-back with MEPC 82, for further consideration of the development of the basket of candidate mid-term measures, taking into account the final report on the comprehensive impact assessment of the basket of candidate mid-term measures and the report of the expert workshop (GHG-EW5) on the further development of the basket of mid-term measures.

4.2 Further development of the Life Cycle Assessment Framework

Last MEPC 80 adopted Res.MEPC.376(80) on the draft Guidelines on Life Cycle GHG Intensity of Marine Fuels, while the Committee agreed to establish the correspondence group to complete the identification of default emission factors for the existing pathways and to further consider specific methodological issues that are relevant for measuring actual emission factors, and further agreed to hold a dedicated expert workshop to consider the more detailed way to implement LCA Guidelines and to facilitate the development of procedures and criteria to recognize certification schemes and guidance for third-party verification as well as the operationalization of the sustainability criteria.

ISWG-GHG 16 and MEPC 81 considered a report of the Correspondence Group on the Further Development of the LCA Framework as follows:

1. Development of a template for tank-to-wake default emission factors for the fuel pathway
   - With respect to the C_{fCH4} and C_{fN2O} emission factors, it was supported to use the current NOx Technical Code test cycles as a reference to establish measurement procedures. However, the need for revision of the NTC test cycles was raised with the aim of being applicable to other technological option such as fuel cell and being more representative of the real-world emissions.
   - Regarding the test cycle (weighted or constant load) to establish a default C_{slip}, there was a preference for weighted test cycle. However, there were other views that a 50% constant load test might be a better way forward considering that C_{slip} is highly dependent on engine load (e.g. higher C_{slip} at lower loads) and the weighted test cycle should consider load points and weights that properly represent current operations for each ship type and size.
   - With respect to the C_{fug} emission factor, it was supported to include C_{fug} emission factor, while it was also raised that there were difficulties and complexity to measure fugitive emissions through onboard measurements.
   - With respect to the Aftertreatment systems, it was noted that the LCA Guidelines did not consider a procedure to properly account for the balance of emissions of aftertreatment system, while the reduction of CH_4 emissions from conversion/oxidation of methane may increase CO_2 emissions, and it may also increase the emissions due to energy consumption from the aftertreatment system as well as the possible emissions of N_2O. Although it was supported that the LCA Guidelines should allow for the possibility to account for the reduction of emissions from aftertreatment/abatement systems, it was opposed to have default emission factors since these systems will have quite varying performance and it should only be allowed the deduction of emission through a certification scheme.

2. Consideration of the methodological elements
   - e_l (annualized emissions (over 20 years) from carbon changes caused by direct land-use change). It was raised that equation (e_l) should include annualized GHG emissions expressed as CO_{2eq} that occurred from the biomass burned during the clearance of native forests or native grasslands before the establishment of new bioenergy crop plantation, while CO_{2eq} emission from the biomass burn should be included if there was evidence of such emissions. It was suggested that amortization period of 20 years be specified for IMO, while the amortization of 25 years was suggested to be in line with ICAO CORSIA. It was supported to use the IPCC values as default values for carbon stocks of cropland and the certified actual values should be allowed with adequate guidance for certification and verification process.
   - e_{sca} (annualized emissions savings (over 20 years) from soil carbon accumulation via improved agricultural management). It was supported that soil carbon accumulation should be encouraged, while the equations should be verified and clarified in terms of the possibility of double counting emissions from other terms of the LCA framework and the inaccuracy/limitations in estimates and

measurements of carbon stock, and the importance of a verification and regular monitoring process.

- C_{fug} (accounting for the fuel which escapes between the tanks up to the energy converter which is leaked, vented or otherwise lost in the system). Regarding the development of the fugitive emission factor, it was recommended not to use the differentiation criteria until there is robust data showing their effect on the amount of fugitive emissions, since the current measurement methods are limited and emissions significantly vary depending on the different operating conditions.
- e_{ccu} (emission credits from the used captured CO_2 as carbon stock to produce synthetic fuels in the fuel production process). In terms of the methodological considerations regarding fuels from Carbon Capture and Utilization pathways, it was supported that when used into a fuel, no specific credit for removal of carbon from the atmosphere can be generated for CCU pathways in the WtT since the final destiny of the carbon source is the atmosphere. Conversely, it is necessary to follow the atmospheric carbon balance logic[7] to determine whether emissions resulting from the combustion of the final fuel have to be considered.
- e_{occs} (emission credit from carbon capture and storage, where capture of CO_2 occurs onboard). The need for extending the system boundaries of the analysis up to the final storage of the CO_2 and considering the long-term storage, when a specific credit for the CCS pathways is generated, would be valid for both on board and on-land pathways. It was also recommended that where capture of CO_2 occur onboard, the calculation boundaries would need to be defined in this equation, and how to provide for the emissions after CO_2 transfer to land. It was also agreed that both the shop tests and the onboard measurements on carbon capture system should be required, while the numerical calculation should not be allowed to estimate the efficiency of carbon capture system.
- C_{fCO2} emission factor for fuels other than those contained in Res.MEPC.364(79). The C_{fCO2} emission factor other than Res.MEPC.364(79) should be calculated by dividing the molar ratio of carbon to CO_2 by the molar ratio of carbon to the fuel. If fuels cannot be represented using chemical formula such as biofuels and fossil fuels, the C_{fCO2} factor can be calculated using actual measurement carbon content.
- C_{fCH4} and C_{fN2O} emission factors. It was noted that C_{fCH4} and C_{fN2O} emission factors depend on the type of fuel, engine and the engine load. These factors for existing fuels and engines can be obtained using reference values from 4th IMO GHG Study, while these need to be measured for a new type of fuel and engines. It was opposed to consider the engine degradation in the shop test, considering that engine degradation had not been implemented for other existing regulations such as NOx and SOx emissions. Instead, it was raised that the methodology of the NOx Technical Code based on either the parameter check method or direct measurements was more appropriate to confirm that engines remain operating in their approved condition.

3. Consideration of the methodological elements on evaluating carbon GHG intensity of electricity (including Onshore Power Supply - OPS) and the Tank-to-Wake methodologies for actual onboard emission factors
   - Technical procedures for evaluating carbon GHG intensity of electricity (including OPS). It was supported to use the average GHG intensity of the national grid to be used as input data for relevant default values and for OPS values. Regarding the actual values, it was agreed that appropriate documented evidence such as Power Purchase Agreement (PPA) and related GHG Intensity should be included.
   - Development of technical procedures for onboard measurements and certification of actual/onboard emission factors. It was agreed to develop technical procedures for onboard

[7] If the carbon used to produce the fuel batch is sourced from biogenic feedstock or directly sourced from the atmosphere, the CO_2 emissions resulting from fuel combustion shall not be included in the TtW GHG emissions. However, the CO_2 emissions resulting from fuel combustion shall not be included in the TtW GHG emissions if the carbon used to produce the fuel batch was obtained from gases or exhaust gases (even if resulting from the use of fossil feedstock), which are produced as an unavoidable and unintentional consequence of the production process in industrial installations, so can qualify as a waste.

measurement based on test cycle approach and onboard continuous monitoring. The procedures should be based on the NOx Technical Code, integrating relevant elements from ISO 8178 regarding measurement procedures for CH_4 and N_2O.

In addition to the report of correspondence group above, MEPC 81 further considered following proposals:

1. **Certification criteria and third party issues,** 1) defining the governance elements for certification, including roles and interactions between parties within the scope of LCA guidelines; 2) challenges encountered to implement the certification and chain of custody schemes based on the social and economic complexities of different countries; and 3) information on chain of custody models (segregated, mass balance and book and claim), indicating the book and claim certification scheme as a good way to get started, and to stimulate the uptake of zero or zero or near-zero GHG emissions fuels.

2. **Methodology to verification and certification of the actual CH_4 and N_2O emission factors,** 1) the need of an acceptable methodology for verification and certification of actual CH_4 and N_2O emissions factors for energy converters, taking into account the different options; 2) suggesting integrating engine testing, certification and methodology standards for methane and nitrous oxide emissions by developing detailed IMO requirements; and 3) a certification procedure for the quantification of TtW CH_4 and N_2O actual emission factors should established based on the existing NOx certification framework.

3. **Aftertreatment systems for emission abatement,** 1) engine testing and certification to be developed should include abatement systems, which can cover not only CH_4 but also N_2O in the future; 2) considering CH_4 abatement systems as a part of the engine/energy converter in the certification of TtW actual emission factors, similar to NOx reducing devices in the engine's NOx certification process; and 3) suggesting to address the reduction of emission from methane aftertreatment systems as a new emission factor rather than a part of the C_{slip}.

4. **Default emission factors,** 1) proposing that, for WtT the upper emission value (among the three reference values) to be selected for non-fossil fuels, the average value to be selected for fossil fuels; and 2) recommending to base the collection of the TtW emission data from representative studies on the test cycle approach in the case of TtW emission factors for C_{slip}, C_{fCH4} and C_{fN2O}.

5. **Fugitive / slip emission,** 1) summary of the key findings of the fugitive and unburned methane emission from ships (FUMES) project. Based on the results of the study, it was proposed to accept at least 6% as the default TtW Cslip value for LPDF 4-stroke engines under the LCA guidelines; 2) proposing to measure and document onboard methane emissions as a part of the EIAPP certification scheme during factory testing and establish limiting regulatory values based on a weighted cycle, similar to the NOx Technical Code; and 3) identifies that there are significant uncertainties in the emission rates of hydrogen within the value chain (from leakage, purging, venting), with both environmental and safety implications. In particular, the research identifies that hydrogen can have a significant indirect global warming impact.

6. **CO_2 capture in the LCA guidelines,** 1) explains that the boundaries of CCS onboard may not necessarily be identical with those on land, the boundary for e_{occs} should be limited onboard, therefore, the e_t and e_{st} should not be considered in the e_{occs} formular.

After consideration, MEPC 81 made the following decisions:

1. Adoption of Res.MEPC.391(81) on the revised Guidelines on life cycle GHG intensity of marine fuels (LCA Guidelines, Res.MEPC.376(80)), resulting from consideration of the methodological elements, in

particular the quantification of parameters related to biofuel production, evaluation of GHG intensity of electricity and the tank-to-wake methodologies for actual/onboard emissions factors;

2. Given the need for a continuous scientific review of the LCA Guidelines to ensure that new technological advances and scientific knowledge are taken into account, it was agreed to establish an GESAMP Working Group on Life Cycle GHG Intensity of Marine Fuel (GESAMP-LCA WG) to review technical issues related to the implementation of the LCA Guidelines such as possible approaches to address Indirect Land Use Change (ILUC), system boundaries of the LCA guidelines in relation to onboard carbon capture systems, whether to reflect regional characteristics where sustainable marine fuels are produced and how to certify actual emission values, etc.;

3. Besides, a more correspondence group was established to further consider "Other social and economic sustainability themes/aspects of marine fuels", as referred to in paragraph 7.1 of the 2024 LCA Guidelines, for possible inclusion in the Guidelines; and

4. Given the various views as to whether a new mandatory requirement related to emissions of CH_4 and N_2O should be developed, and which subsidiary bodies would be appropriate to handle the engine certification regime in relation to the measurements of CH_4 and N_2O, it was agreed that the matters how to develop a framework for the measurement and verification of Tank-to-Wake emissions of CH_4, N_2O and other GHGs along with associated engine certification issues will be further discussed by a correspondence group.

4.3 Onboard CO_2 capture (CO_2 removal)

Previous MEPC sessions considered onboard CO_2 capture system and particularly noted that development of a specific work plan to initiate a holistic consideration on how to best reflect onboard CO_2 capture in various IMO instruments and a careful approach would be required on this issue, such as accounting, storage, disposal, and relevant certification schemes, to ensure effective implementation so that carbon captured would not be released back into the atmosphere.

MEPC 81 considered the proposals relating to the onboard CO_2 capture system as follows:

1. Given the historical background that demonstrates the broad experience that has been gained in the study and development of guidelines for the regulation of EGCS, it is proposed to initiate the study of onboard carbon capture system to develop the relevant regulations for residues and/or emissions, as well as the transportation, storage and disposal at reception facilities;

2. Proposed a new work stream on onboard CO_2 capture, 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. Work plan for the development of a regulatory framework for the use of OCCS contains the various elements as follows:
   - Regulations in MARPOL Annex VI as appropriate;
   - Guidelines for testing, surveying and certification of onboard CO_2 capture systems;
   - Guidelines for the development and approval of a ship CO_2 management plan;
   - Form of the CO_2 record book; and
   - An approval or certification/accreditation scheme for CO_2-terminals to ensure that the CO_2 is not emitted to the atmosphere; and safe storage and utilization of CO_2 which is consistent with international environmental law and international standards.

3. Draft amendments to EEDI and CII related technical guidelines (Res.MEPC.308(73), Res.MEPC.254(67) and Res.MEPC.352(78)) to revise the EEDI and CII calculation formula for reflecting GHG reduction effect from onboard CO_2 capture system;

4. A newly proposed MEPC Circular on sample format for the information to be included in the CO_2 receipt note, providing evidence for the quantity of CO_2 delivered ashore;

5. It was proposed that onboard CO_2 capture and the system's effectiveness for reduction of GHG emission should be reflected in all relevant frameworks relating to the GHG emissions such as EEDI, EEXI, CII as well as LCA guidelines to remove regulatory barriers to innovative technology; and

6. An analysis of technical and economic aspects of onboard CO_2 capture technology applied to different ship types and sizes (container, bulk and tanker) for main carbon-based fuels (LSFO, LNG and Methanol), and partial/full application as part of a retrofit or newbuild. The analysis also concluded that onboard CO_2 capture system with chemical absorption is technically feasible and expected to reach commercial availability by 2030, additional energy consumption for operating onboard CO_2 capture would be up to a 45% increase for maximum carbon capture rate of 82%, the installation of the system is space demanding and may result in loss of cargo space, depending on ship type and size.

After consideration, MEPC 81 couldn't reach a consensus on how to incorporate onboard CO_2 capture in the IMO regulatory framework due to the various views expressed that whilst recognizing that onboard CO_2 capture can play an important role in the reduction of GHG emissions from international shipping, a more holistic approach was needed as part of the further development of the LCA framework due to the technical immaturity with various safety issues with a preference to focus work on ways to incentivize the uptake of zero or near-zero fuels instead of onboard CO_2 capture. Moreover, the committee particularly noted that the use of onboard CO_2 capture could considerably increase the ship's energy demand and associated fuel use, and thus, it was too early to consider integrating onboard CO_2 capture in existing energy efficiency regulations, such as the EEDI, EEXI and CII.

However, given that there was broad support to continue consideration of proposals related to onboard CO_2 capture and some elements would have to be considered as part of the further development of the LCA framework, MEPC 81 agreed to establish a correspondence group to develop a work plan on the development of a regulatory framework for the use of onboard CO_2 capture.

4.4 5th IMO GHG Study

MEPC 81 considered a proposal to initiate 5th IMO GHG Study 2025 (using the relevant data for 2018~2023) and an indicative timeline; and highlighting the importance of such a study for facilitating a comparative analysis of the results after the implementation of short-term measures from 2023, as well as the Initial Strategy and the 2023 IMO GHG Strategy.

After consideration, while having noted the need for further discussion on possible terms of reference and timelines, MEPC 81 agreed that there was general support to initiate a 5th IMO GHG Study, and subsequently instructed the Secretariat to submit a proposal with draft terms of reference, suggested timelines, logistics and administrative arrangements to MEPC 82.

Moreover, MEPC 81 further agreed to instruct ISWG-GHG 17(Inter-sessional Working Group on Reduction of GHG emissions from ships, ISWG-GHG 17) to develop draft terms of reference for 5th IMO GHG Study including other ongoing GHG related works.

5. Marine Plastic Litter from ships (Agenda 8)

Last MEPC 80 noted PPR Sub-Committee's consideration of how to proceed in relation to reducing the environmental risk associated with the maritime transport of plastic pellets. Due to the lack of clarity on the most appropriate mandatory instrument to reduce the environmental risk associated with the maritime transportation of plastic pellets in freight containers, two-step approach was provided: 1) developing a voluntary MEPC circular containing recommendations for the carriage of plastic pellets by sea in freight containers, addressing packaging, stowage and labelling requirement; and 2) developing a mandatory instrument by experience gained from the voluntary measures proposed in the circular following the agreement by MEPC.

In this regard, MEPC 81 noted that PPR 11 finalized a draft MEPC Circular on Recommendations for the carriage of plastic pellets by sea in freight containers, following the review by CCC 9. The circular was developed as a short-term measure for the purpose of reducing the environmental risks associated with the carriage of plastic pellets in packaged from by sea ahead of mandatory instruments being developed. After consideration, MEPC 81 approved MEPC.1/Circ.909 providing guidance containing the following elements:

1. Plastic pellets should be packed in good quality packaging which should be strong enough to withstand the shocks and loadings normally encountered during transport. Transport information should clearly identify, as an addition in the cargo information required by SOLAS regulation VI/2, those freight containers containing plastic pellets; and
2. Freight containers containing plastic pellets should be properly stowed and secured (under deck wherever reasonably practicable or inboard in sheltered areas of exposed decks).

Furthermore, MEPC 81 noted that PPR 11 finalized best practice guidelines to clean up spills of plastic pellets providing practical guidance to member States and relevant stakeholders when responding to the spills of plastic pellets from ships, and then agreed that this guidance will be approved by MEPC 82 after further consideration.

6. Report of other Sub-Committees (Agenda 10)

6.1 Report of SDC 10

As it was being recognized that a significant portion of the underwater noise generated by commercial shipping activities may have negative impacts on marine mammals, Last MEPC 80 approved MEPC.1/Circ.906 on the revised Guidelines for the reduction of underwater radiated noise from shipping to address adverse impacts on marine life. These guidelines focus on identifying primary contributors to underwater radiated noise generated by ships and a general approach that designers, shipbuilders, shipowners and ship operators can undertake.

In this regard, MEPC 81 noted that the work of the SDC Sub-Committee on the review of the 2014 Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life (MEPC.1/Circ.833) and identification of next steps had been completed, and agreed to continue the work on reducing underwater radiated noise from ships by introducing an Experience-Building Phase (EBP) and changing the title of the relevant work to "Experience Building Phase for the Reduction of Underwater Radiated Noise (MEPC.1/Circ.906)".

Furthermore, MEPC 81 endorsed the draft action plan for the reduction of underwater noise from commercial shipping, which outlines overall tasks for implementation by relevant organs and bodies, including:

- Establish an Experience-Building Phase (EBP) for the Revised Guidelines;

- Enhance public awareness, education, and seafarer training;
- Standardize URN Management Planning process;
- Develop URN Targets;
- Create IMO processes/technical groups to share information and take into consideration other IMO regulatory goals;
- Develop tools to collect data and share information;
- Encourage research on URN and GHG/URN and Biofouling;
- Encourage research on impacts of URN on species and habitats

MEPC 81 further agreed to place the revised output on the agendas of MEPC 82 through to MEPC 85 to promote greater access to knowledge and research on URN and the draft guidance on the Experience Building Phase (EBP) for the Revised Guidelines (MEPC.1/Circ.906), which provides key areas for the EBP and process for updating the revised guidelines. An estimated timeline is as follows:

- MEPC 80 (2023) encouraged interested Member States and international organizations to submit to the Committee lessons learned/best practices in the implementation of the Revised guidelines, i.e. an experience-building phase.
- MEPC 82 (2024) will approve MEPC.1/Circ.906/Rev.1 providing the URN planning reference chart and invite member States and international organizations to submit proposals on the action plan's implementation.
- MEPC 85 (2026) will assess the outcomes of the EBP and review the action plan. After assessing the progress made, MEPC will decide whether to extend the EBP duration for another two years to gather additional information on lessons learned.

7. Identification and protection of Special Areas, ECAs and PSSAs (Agenda 11)

7.1 Canadian Arctic waters as an emission control area for nitrogen oxides, sulphur oxides and particulate matter

The Canadian Arctic waters were initially omitted from the North American ECA due to data scarcity and a lack of shipping in this region at the time. However, with improved data access, more summer ice melt, and increased shipping activity in the Arctic, the proposed Canadian Arctic ECA is now a necessary regulation to reduce the disparity of environmental protections between the primarily Indigenous Peoples populated Arctic, and the rest of Canada. With this significant increase in ship traffic through Canada's Arctic waters, ship emissions are contributing significantly to air pollution and climate forcing emissions in the Canadian Arctic.

In this regard, MEPC 81 considered a proposal to designate Canadian Arctic waters as an emission control area for nitrogen oxides, sulphur oxides and particulate matter, which is supplemented by a complete analysis that demonstrates how this proposal satisfies each of the eight criteria for designation of an ECA established under appendix III of MARPOL Annex VI, a detailed description of the proposed ECA boundary, a chart of the proposed area and draft amendments to include the proposed ECA in the relevant paragraphs of regulation 13, 14 and appendix VII of MARPOL Annex VI.

After consideration, MEPC 81 agreed to designate the Canadian Arctic waters as an emission control area for nitrogen oxides, sulphur oxides and particulate matter and approved draft amendments to regulations 13, 14 and appendix VII of MARPOL Annex VI with a view to adoption at MEPC 82. In order to ensure the soonest implementation of the strengthened requirements on NOx, SOx and Particulate Matter in these regions, the effective date of the proposed ECA was agreed to 1 January 2025.

The proposed Canadian Arctic water ECA boundary and 2019 ship density in relation to Inuit communities and First Nations locations are illustrated as follows:

Figure 3 Proposed Canadian Arctic water ECA Boundary

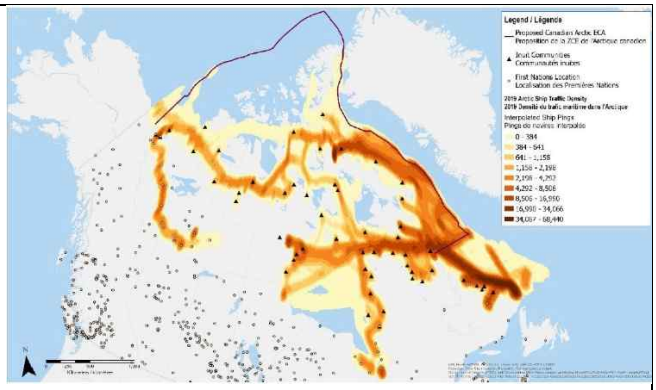

Figure 4 2019 Ship density in relation to Inuit communities and First Nations locations

7.2 Norwegian Sea as an Emission Control Area for nitrogen oxides and sulphur oxides and particulate matter

It was recognized that the Norwegian Sea has a high biological production and houses a very large biomass of organisms. This large biomass contains key species that serve as food for the fish stocks important for fisheries. Lofoten, Vesterålen, and Senja are the spawning grounds of the world's largest stock of cod, which is crucial for both the ecosystems in the sea and us humans. It is also home to the world's largest cold-water coral reef and mainland Europe's largest seabird colony. The Norwegian Sea constitutes of particularly valuable and vulnerable areas (SVOs) that are extremely important for biodiversity and biological production. The status as an SVO signals the importance of showing particular care in these areas even though it places no restrictions on commercial activity.

In this regard, MEPC 81 considered a proposal to designate Norwegian Sea as an emission control area for nitrogen oxides, sulphur oxides and particulate matter, which is supplemented by the proposed amendments to MARPOL Annex VI to designate this area as an ECA and a complete analysis of how the proposal satisfies the criteria for designation of ECAs as set out in appendix III of MARPOL Annex VI.

However, taking into account that when the keel is laid, the ship can be built, delivered and put into operation several years later, and thus this practice delays the positive health and environmental effects represented by new NOx ECA and hampers a level playing field among the new ships operating in the area, in particular, many keels are being lad prior to the entry into force date of a NOx ECA, this proposal particularly suggested the application date including the “three dates criteria” (building contract, keel laid and delivery date) to prevent delay in implementing new regulations.

After consideration, MEPC 81 agreed to designate the Norwegian Sea as an emission control area for nitrogen oxides, sulphur oxides and particulate matter and approved draft amendments to regulations 13, 14 and appendix VII of MARPOL Annex VI with a view to adoption at MEPC 82. In order to ensure the soonest implementation of the strengthened requirements on NOx, SOx and Particulate Matter in these regions, the effective date of the proposed ECA was agreed to 1 March 2026 with “three date criteria” as mentioned above.

The proposed Norwegian sea ECA designation and Density of fuel consumption by ships in the Norwegian Sea 2020 are illustrated as follows:

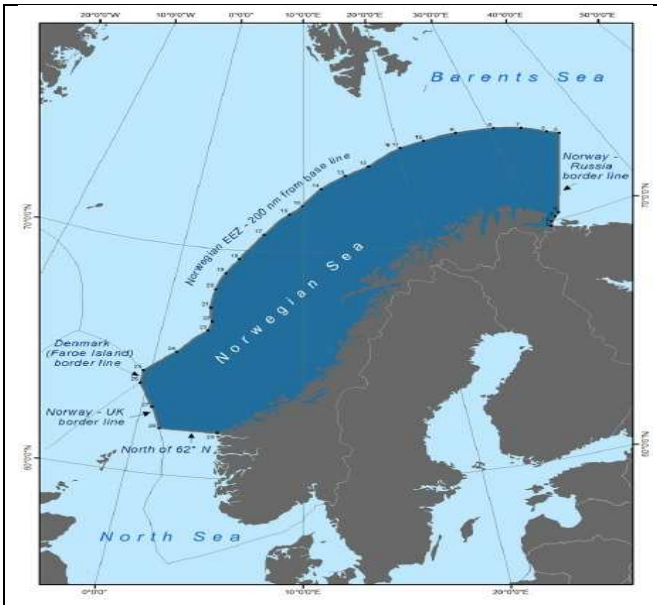

Figure 5 The Norwegian Sea Area proposed for ECA designation

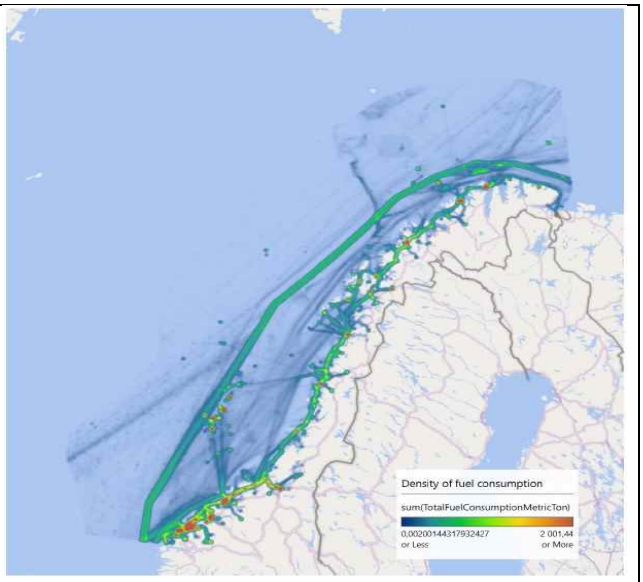

Figure 6 Density of fuel consumption by ships in the Norwegian Sea, 2020

Should you have inquiries, please contact P.I.C. Thank you.

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