Subject

Summary of the outcomes of MEPC 83

ClassNK
Technical Information

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To whom it may concern

The eighty-third session of the International Maritime Organization (IMO) Marine Environment Protection Committee (MEPC 83) was held from 7 to 11 April 2025. A summary of the discussions and the decisions taken at MEPC 83 is provided as below for your information.

1. Reduction of Greenhouse Gas (GHG) emissions from ships
   Draft regulations on the mid-term measures for reduction of greenhouse gas (GHG) have been approved.

   At MEPC 80 in 2023, the IMO adopted the 2023 IMO Strategy on Reduction of GHG Emissions from Ships (2023 IMO GHG Strategy), which sets out the IMO's levels of ambition (see the table below) including the aim to reach net-zero GHG emissions from international shipping by or around 2050. Further discussions continued in developing "Mid-term measures for reduction of GHG emissions" for achieving the levels of ambition set out in the 2023 IMO GHG Strategy. At this session, MEPC 83 approved draft regulations on the mid-term measures and also held discussions on the review of short-term measures etc.

Target year	Levels of ambition and indicative checkpoints (as of 2023)
2030	・ To reduce CO2 emissions per transport work by at least 40% (compared to 2008) ・ To reduce total annual GHG emissions by at least 20% (striving for 30%) (compared to 2008) ・ Uptake of zero GHG emission fuels etc. to represent at least 5% of the energy used (striving for 10%)
2040	・ To reduce total annual GHG emissions by at least 70% (striving for 80%) (compared to 2008)
2050	・ To reach net-zero GHG emissions by or around 2050 at the latest

(To be continued)

(1) Mid-term measures for reduction of GHG emissions

At this session, the draft amendments to MARPOL Annex VI on the mid-term measures was approved, comprising the concepts of "regulating GHG fuel intensity of the fuel used by a ship (GFI regulations)" and "accelerating decarbonization through the IMO Net-Zero Fund" as the two pillars. The draft amendments were circulated for adoption by MEPC (Circular Letter No. 5005); and if they are adopted at the extraordinary session of MEPC in October 2025, then the amendments will enter into force at the earliest in March 2027.

The summary of the mid-term measures approved at this session is as follows.

I. Regulating GHG fuel intensity of the fuel used by a ship (GFI regulations)

For ships of 5,000 GT and above engaged in international voyages, the GHG fuel intensity (GFI) of the fuel used, i.e. the GHG emissions per unit of energy from the fuel used, will be regulated. These regulations are drafted for implementation by January 2028. By progressively tightening the required GFI values, the consequential acceleration in decarbonization of ship fuels and reduction in GHG emissions from ships are expected.

The GFI regulations set two levels of targets, "Base Target" and "Direct Compliance Target" as below, with different reduction levels from the average GHG intensity of fuel used in international shipping in 2008, which was 93.3 gCO2eq/MJ (refer to Attachment 12).

Base Target: Based on the 2008 reference GHG intensity value (93.3 gCO2eq/MJ), Base Target annual values are set to achieve 4% reduction in 2028, 8% reduction in 2030, and 30% reduction in 2035. In addition, 65% reduction from the 2008 reference value in 2040 is also stipulated.

Direct Compliance Target: Based on the 2008 reference GHG intensity value (93.3 gCO2eq/MJ), Direct Compliance Target annual values are set to achieve 17% reduction in 2028, 21% reduction in 2030, and 43% reduction in 2035.

If a ship is in direct compliance by utilizing fuels such as zero-emission fuels, the ship will be eligible to receive surplus units equal to its positive compliance balance, which can be transferred to another ship to balance that ship's "base target" compliance deficit or banked for use in the following reporting periods*.

*up to two calendar years after the calendar year of its issuance

If the ship is not in direct compliance but meets the "base target", a deficit corresponding to the GHG emission exceeding the "direct compliance target" (i.e. Payment ①) shall be paid to the IMO Net-Zero Fund.

(To be continued)

If the ship does not meet the "base target", the deficit corresponding to the GHG emission exceeding the "base target" (i.e. Payment ②) shall be paid in addition to Payment ① to the IMO Net-Zero Fund or otherwise receive surplus units from other ships to balance the compliance.

The unit price of Payment ①, to be collected and utilized for disbursements such as rewarding "accelerating the uptake of Zero or Near-Zero GHG emission technologies, fuels and/or energy sources (ZNZs)" (refer to II.) etc., is set relatively less expensive. On the other hand, the unit price of Payment ②, to be taken in a sense of penalty, is set relatively more expensive.

Further work to be pursued by MEPC includes development of guidelines related to calculation of GHG fuel intensity and verification scheme of fuels etc. so as to set out detailed procedures prior to the entry into force of the GFI regulations.

II. Accelerating decarbonization through the IMO Net-Zero Fund
The aforementioned payments from the GFI regulations will be collected by the IMO Net-Zero Fund to be established. The fund will disburse collected revenue for the purposes such as rewards for the use of ZNZs or supporting the energy transition of developing countries, in particular least developed countries (LDCs) and small islands developing States (SIDS), etc.

Accelerating the uptake of ZNZs
Ships of 5,000 GT and above engaged in international voyages and using ZNZs may receive rewards for partial reimbursement of the costs associated with the use of such fuels. This is expected to accelerate the early transition to ZNZs. A threshold for the GHG intensity of the fuel is set out in the regulations. The specific scale of this reward will continue to be discussed at MEPC.

(2) Review of short-term measures for reduction of GHG
MARPOL Annex VI prescribes that a review of the EEXI (Energy Efficiency Existing Ship Index) and CII (Carbon Intensity Indicator) rating regulations, introduced by IMO as short-term measures, shall be completed by 1 January 2026 to assess their effectiveness.

At the previous session, a consolidated list of challenges and gaps in the short-term measures was developed, which is used as the base document for ensuing discussions. The tasks were then categorized into two phases by the relevant Correspondence Group: priority tasks to be completed by 2026; and tasks to be pursued continuously beyond 2026. At this session, discussions focused on the priority tasks aimed for completion by 2026.

(To be continued)

I. Amendments to the CII reduction factors Guidelines (G3)

Under the CII rating scheme, the annual CII reduction factor used to determine the required annual operational CII has been set to increase by 2% each year until 2026. However, the reduction factors beyond 2027 were to be decided in the review of the short-term measures.

At this session, discussions were held on the reduction factors for the period after 2027. As a result, it was agreed that the reduction factor would increase by 2.625% annually, reaching 21.5% by 2030. Accordingly, amendments to the "Guidelines on the CII reduction factors (G3)" were adopted. The annual CII reduction factors through 2030 are shown in the table below.

Year	CII reduction factor (relative to 2019)
2023	5 %
2024	7 %
2025	9 %
2026	11 %
2027	**13.625 %**
2028	**16.250 %**
2029	**18.875 %**
2030	**21.500 %**

These reduction factors are aligned with the level of ambition of the 2023 IMO GHG Strategy to reduce CO2 emissions per transport work by at least 40% by 2030, compared to 2008.
(Refer to Res. MEPC.400(83) as Attachment 4)

II. Amendments to the Guidelines for development of SEEMP

IMO Ship Fuel Consumption Database (IMO DCS), from 1 January 2026, introduces additional reporting items such as the total fuel oil consumption by each fuel-consuming equipment and the total fuel consumption during non-operational (non-voyage) periods.

At this session, the amendments to the "Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP)" were adopted, providing clear definitions for the terms "under way" and "not under way."
(Refer to Res. MEPC.401(83) as Attachment 5)

III. Accessibility to the IMO DCS database

The IMO DCS data reported annually to the IMO is utilized by the IMO Secretariat to analyze the effectiveness of GHG emission reduction efforts by the maritime industry. By anonymizing and publicly disclosing this data, more diverse and in-depth analyses are expected to become possible.

(To be continued)

At this session, draft amendments to Regulation 27 of MARPOL Annex VI were approved, enabling the following with respect to the access to the IMO DCS data.

- Access by Parties to non-anonymized data for all ships
- Public user access to anonymized data for all ships

Consideration of revisions to the relevant guidelines will follow in order to enhance the data anonymization measures.

(3) Practical application of the Guidelines on Life Cycle GHG Intensity of Marine Fuels (LCA Guidelines)

Low and zero carbon fuels such as hydrogen, ammonia and biomass-based fuels are expected to become widely used in the future to decarbonize ships, and there is a growing interest in GHG emissions from the whole life cycle of these fuels, from their production to distribution stages in addition to the combustion of the fuel.

At MEPC 80, the IMO adopted Guidelines (LCA Guidelines) that specify the methodology for calculating the GHG fuel intensity of fuels used on ships over their whole life cycle from feedstock extraction to processing, fuel production, transport, bunkering and onboard use, as well as default values for the GHG fuel intensity for various fuels. While the IMO at MEPC 81 adopted the amendments to the Guidelines, the default values of GHG fuel intensity for only five types of marine fuel, e.g. fossil based heavy fuel oil and biofuels, were set out, needing for further work in order to put the Guidelines into practical applications.

At this session, based on the scientific review and advice provided by GESAMP working group on life cycle GHG intensity of marine fuels (GESAMP-LCA WG), the IMO agreed to the procedures for proposing and reviewing default values of GHG fuel intensity. It was also agreed to continue discussions on improving the emission calculation methodology, sustainability criteria and certification of GHG intensity in the LCA Guidelines.
(Refer to MEPC.1/Circ.916 as Attachment 9)

(4) Measurement of methane and nitrous oxide emissions from ships and onboard carbon capture and storage

In addition to CO2 emitted upon fuel combustion, emissions of methane (CH4) and nitrous oxide (N2O) are also gaining increased attention as they are considered as greenhouse gases (GHG) with global warming effects. At MEPC 81, a Correspondence Group was established and began discussing relevant topics: methods for measuring methane and nitrous oxide emissions from ships; and a regulatory framework for the use of onboard carbon capture and storage (OCCS), which reduces GHG emissions from ships through the separation, capture, and storage of CO2.

(To be continued)

At this session, the "Guidelines for Test-Bed and Onboard Measurements of Methane and/or Nitrous Oxide Emissions from Marine Diesel Engines" was adopted. Moreover, the IMO developed a work plan on the development of a regulatory framework for the use of the OCCS, including consideration of legal barriers and the development of guidelines on testing, survey, and certification of the OCCS. It was agreed that these agenda items require further study and that the Correspondence Group is re-established to continue discussions on these issues.
(Refer to Res. MEPC.402(83) as Attachment 6)

(5) Amendments to the Guidelines on survey and certification of EEDI
The calculation of the EEDI (Energy Efficiency Design Index) requires determination of the ship's speed based on speed trial results, assuming calm weather conditions with no wind or waves. The current "Guidelines on Survey and Certification of the EEDI" refers to the ITTC Recommended Procedure 7.5-04-01-01.1 Speed and Power Trials 2017, 2021 or 2022 (hereafter referred to as the ITTC Procedure) or ISO 15016:2015 for determining ship speed taking into account the external effects (wind, current, waves, shallow water, displacement, water temperature and water density).

Given the amendments to the ITTC Procedure and ISO 15016 in 2024 and 2025 respectively, MEPC 83 adopted the amendments to the "Guidelines on Survey and Certification of the EEDI" to refer to the amended 2024 ITTC Procedure and ISO 15016:2025.

In addition, ISO 15016:2025 will be applied to sea trials conducted on or after 1 May 2026, in recognition of the need to allow adequate time for preparation in accordance with the updated standard.

ClassNK is currently in the process of updating the progressive speed trial analysis software "PrimeShip-GREEN/ProSTA" to ensure compliance with ISO 15016:2025.
(Refer to Res. MEPC.403(83) as Attachment 7)

2. Air pollution
(1) Addition of North-East Atlantic Ocean as Nitrogen Oxides (NOx), Sulphur Oxides (SOx) and Particulate Matter (PM) Emission Control Area (ECA)
Regulation 13 of MARPOL Annex VI specifies the NOx emission regulations for marine diesel engines installed on board ships. Regulation 13.6 designates NOx Emission Control Areas (ECA), in which the NOx Tier III emission limit is applied.

Regulation 14 of MARPOL Annex VI sets out control measures to reduce emissions of SOx and PM from ships, where the sulphur content in fuel oil used has been limited to 0.50% in open sea area since 2020. Regulation 14.3 designates SOx and PM ECAs, in which the sulphur content in fuel oil used is further limited to 0.10%.

(To be continued)

The following sea areas have been designated as ECAs so far:

Sea area	Type of ECA	
	NOx	Sox and PM
North America	✓	✓
US Caribbean Sea	✓	✓
Baltic Sea	✓	✓
North Sea	✓	✓
Mediterranean Sea		✓
Canadian Arctic Waters*	✓	✓
Norwegian Sea*	✓	✓

* Amendments adopted at MEPC 82, designating Canadian Arctic Waters and Norwegian Sea area as ECAs

At this session, draft amendments to MARPOL Annex VI were approved, newly designating the North-East Atlantic Ocean (refer to Attachment 13) as ECA.

Assuming the adoption of the draft amendments at the extraordinary session of MEPC in October 2025 with the application date of March 2027, it is expected that the sulphur content in fuel oil used for ships operating in North-East Atlantic ECA will be limited to 0.10% at the earliest from March 2028. Furthermore, the NOx Tier III emission limit will be applied to the following ships operating in North-East Atlantic ECA:

- Ships for which the building contract is placed on or after 1 January 2027
- In the absence of a building contract, ships the keels of which are laid or which are at a similar stage of construction on or after 1 July 2027
- Ships delivered on or after 1 January 2031

(2) Revision of SCR Verification Guidelines

Selective Catalytic Reduction (SCR) systems for NOx emission reduction need to be certified in accordance with the "2017 Guidelines for SCR Systems".

At this session, the revised "2025 Guidelines for SCR Systems" was adopted, which clarifies the methods for monitoring catalyst condition and degradation. The amended guidelines isare applicable to the following SCR systems:

- SCR systems installed on ships the keels of which are laid or which are at a similar stage of construction on or after 1 November 2025
- SCR systems installed on ships the keels of which are laid or which are at a similar stage of construction before 1 November 2025, which have a contractual delivery date of SCR systems to the ship on or after 1 May 2026 or, in the absence of a contractual delivery date, the actual delivery of the SCR system to the ship on or after 1 May 2026

(Refer to Res. MEPC.399(83) as Attachment 3)

(To be continued)

3. Others

(1) Carriage of blends of biofuels by conventional bunker ships

The "Interim Guidance on the Carriage of Blends of Biofuels and MARPOL Annex I Cargoes by Conventional Bunker Ships" was approved, which allows transportation of blends of not more than 30% by volume of biofuel by conventional bunker ships (i.e. oil tankers as defined in Regulation 1.5 of MARPOL Annex I that are engaged in the transport and delivery of fuel oil for use by ships).

(Refer to MEPC.1/Circ.917 as Attachment 10)

(2) In-water cleaning of ships' biofouling

The "Guidance on In-water Cleaning of Ships' Biofouling" was approved, which sets out guidance for operationalizing in-water cleaning operations for minimizing transfer of invasive aquatic species attached to ships' hull, including specifications and performance standards for in-water cleaning systems and guidance for planning and conducting in-water cleaning operations.

(Refer to MEPC.1/Circ.918 as Attachment 11)

(3) Amendments to the Guidelines for the Development of the Inventory of Hazardous Materials

With respect to the restriction of the use of cybutryne as anti-fouling system since January 2023, the use or non-use of cybutryne is required to be recorded in the Inventory of Hazardous Materials (IHM) in accordance with the "2023 Guidelines for the Development of the Inventory of Hazardous Materials" adopted at MEPC 80.

At this session, the amendments to the "2023 Guidelines for the Development of the Inventory of Hazardous Materials" were adopted, clarifying the threshold values of cybutryne in anti-fouling system coating samples, either taken from wet paint containers or taken directly from hull.

(Refer to Res. MEPC.405(83) as Attachment 8)

(4) Review of BWM Convention

When BWM Convention entered into force in 2017, it was agreed to monitor the application and to review the effectiveness of the Convention through the experience building phase (EBP), and the review work has been conducted based on the Convention Review Plan (CRP) approved at MEPC 80, which comprises the list of issues that need to be finalized.

At this session, with the aim to finalize the draft amendments to the BWM Convention and BWM Code by MEPC 84 in spring 2026 in line with the work plan, it was agreed to continue the work at the Correspondence Group. Assuming the approval of the draft amendments at MEPC 84 followed by adoption at MEPC 85 in autumn 2026, the amendments are expected to enter into force in summer 2028 at the earliest.

(To be continued)

4. Amendments to mandatory instruments
MEPC 83 adopted amendments to mandatory instruments as follows:

(1) Amendments to NOx Technical Code on certification of marine diesel engines subject to substantial modification, etc.
The amendments to the NOx Technical Code 2008 were adopted, which includes the onboard NOx certification procedures for marine diesel engines subject to substantial modifications or being certified to a Tier to which the engine was not certified at the time of its installation. These amendments clarify the onboard NOx certification process for marine diesel engines, which went under a modification for reasons such as environmental measures for GHG emission reduction.
(Refer to Res. MEPC.398(83) as Attachment 2)

Entry into force: 1 September 2026

The Parties were further invited to consider early application of these amendments.

(2) Amendments to NOx Technical Code on NOx regulations for marine diesel engines
The amendments to the NOx Technical Code 2008 were adopted, which includes the procedures for demonstrating compliance of "off-cycle" NOx emissions (specific area within the power or torque and speed area of a marine engine to which NOx emission measurement is not required under the current Convention, but still within the limit area of the not to exceed zone that the engine is certified to operate within under steady-state conditions) and NOx regulations applicable to marine diesel engines with multiple engine operational profiles. These amendments may lead to an increased number of load points for NOx emission tests and additional submission of technical documents related to NOx emission characteristics by engine manufacturers, etc.
(Refer to Res. MEPC.397(83) as Attachment 1)

Entry into force: 1 March 2027

The new requirements apply to a new parent engine to which EIAPP Certificates are issued on or after 1 January 2028. In the case of an engine family or engine group for which the parent engine was certified prior to 1 January 2028, the new requirements apply when an EIAPP Certificate is issued for the relevant member engine on or after 1 January 2030.

A summary of the outcomes of MEPC 83 is also available on the IMO website.
https://www.imo.org/en/MediaCentre/MeetingSummaries/Pages/MEPC-default.aspx

(To be continued)

For any questions about the above, please contact:

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Attachment:

1. Res. MEPC.397(83): Amendments to the NOx Technical Code 2008 (Use of Multiple Engine Operational Profiles for a Marine Diesel Engine, Including Clarifying Engine Test Cycles)
2. Res. MEPC.398(83): Amendments to the NOx Technical Code 2008 (Certification of an Engine Subject to Substantial Modification or Being Certified to a Tier to which the Engine Was Not Certified at the Time of Its Installation)
3. Res. MEPC.399(83): 2025 Guidelines on Selective Catalytic Reduction (SCR) Systems
4. Res. MEPC.400(83): Amendments to the 2021 Guidelines on the Operational Carbon Intensity Reduction Factors Relative to Reference Lines (CII Reduction Factors Guidelines, G3) (Resolution MEPC.338(76))
5. Res. MEPC.401(83): Amendments to the 2024 Guidelines for the Development of a Ship Energy Efficiency Management Plan (SEEMP) (Resolution MEPC.395(82))
6. Res. MEPC.402(83): Guidelines for Test-Bed and Onboard Measurements of Methane (CH4) and/or Nitrous Oxide (N2O) Emissions from Marine Diesel Engines
7. Res. MEPC.403(83): Amendments to the 2022 Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI)
8. Res. MEPC.405(83): Amendments to the 2023 Guidelines for the Development of the Inventory of Hazardous Materials (Resolution MEPC.379(80))
9. MEPC.1/Circ.916: Methodology for Submission, Scientific Review and Recommendation of Proposed Default Emission Factors by GESAMP-LCA WG
10. MEPC.1/Circ.917: Interim Guidance on the Carriage of Blends of Biofuels and MARPOL Annex I Cargoes by Conventional Bunker Ships
11. MEPC.1/Circ.918: Guidance on In-Water Cleaning of Ships' Biofouling
12. 2-tier GFI values【Illustrative purpose】
13. Illustration of the North-East Atlantic ECA

ANNEX 1

RESOLUTION MEPC.397(83)
(adopted on 11 April 2025)

AMENDMENTS TO THE NO_x TECHNICAL CODE 2008

(Use of multiple engine operational profiles for a marine diesel engine, including clarifying engine test cycles)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto (MARPOL), which specifies the amendment procedure and confers upon the appropriate body of the Organization the function of considering amendments thereto for adoption by the Parties,

RECALLING FURTHER regulation 13 of MARPOL Annex VI, which makes the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (hereafter "NO_x Technical Code 2008") mandatory under that Annex,

HAVING CONSIDERED, at its eighty-third session, draft amendments to the NO_x Technical Code 2008 concerning the use of multiple engine operational profiles for a marine diesel engine, including clarifying engine test cycles, as appropriate, approved at its eighty-second session and duly circulated in accordance with article 16(2)(a) of MARPOL,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to the NO_x Technical Code 2008, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with articles 16(2)(f)(ii) and (iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 September 2026 unless prior to that date not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of MARPOL, the said amendments shall enter into force on 1 March 2027 upon their acceptance in accordance with paragraph 2 above;

4 ALSO INVITES the Parties to note that the said amendments shall enter into effect as follows:

(a) for a new individual engine or a parent engine of an engine family or engine group that has not been previously certified, the said amendments apply no later than 1 January 2028, based on the issue date of the EIAPP Certificate for the individual engine or parent engine;

(b) in the case of a new member engine to an engine family or engine group for which the parent engine was certified before 1 January 2028, prior to the certification of that member engine it would need to be shown that the engine family or engine group complied with the said amendments no later than 1 January 2030 based on the issue date of the EIAPP Certificate for that member engine;

(c) the said amendments do not apply to a marine diesel engine which already has an EIAPP Certificate except:

(i) in the case of an engine that is subject to substantial modification on or after 1 January 2028, the said amendments would apply as specified in the definitions of "substantial modification" set out in amended paragraph 1.3.2 of the NO_x Technical Code 2008 based on the issue date of the EIAPP Certificate for that engine; and

(ii) in the case of an identical replacement engine installed on or after 1 January 2028, the version of the NO_x Technical Code 2008 at the time of issuance of the EIAPP Certificate to the original engine applies, unless the replaced engine is already equipped with multiple engine operational profiles, in which case the provisions of the new chapter 8 of the NO_x Technical Code 2008 apply;

5 REQUESTS the Secretary-General, for the purposes of article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to MARPOL;

6 ALSO REQUESTS the Secretary-General to transmit copies of the present resolution and its annex to Members of the Organization which are not Parties to MARPOL.

ANNEX

AMENDMENTS TO THE NO_x TECHNICAL CODE 2008

(Use of multiple engine operational profiles for a marine diesel engine, including clarifying engine test cycles)

Chapter 1 – General

1.3 Definitions

1 Paragraph 1.3.2 is replaced by the following:

"1.3.2 *Substantial modification of a marine diesel engine* means:

.1 For engines installed on ships constructed on or after 1 January 2000, *substantial modification* means any modification to an engine that could potentially cause the engine to exceed the applicable emission limit set out in regulation 13. Routine replacement of engine components by parts specified in the technical file that do not alter emission characteristics shall not be considered a "substantial modification" regardless of whether one part or many parts are replaced. For the recertification of such an engine following a substantial modification, the version of this Code that was used for the original certification shall apply except if the engine was or is now equipped with an auxiliary control device or has multiple engine operational profiles. Where an auxiliary control device is fitted, the requirements of 2.5 and 3.3 of this Code shall apply. Where there are multiple engine operating profiles, the requirements of chapter 8 of this Code shall apply.

.2 For engines installed on ships constructed before 1 January 2000, *substantial modification* means any modification made to an engine that increases its existing emission characteristics established by the simplified measurement method as described in 6.3 in excess of the allowances set out in 6.3.11. These changes include, but are not limited to, changes in its operations or in its technical parameters (e.g. changing camshafts, fuel injection systems, air systems, combustion chamber configuration, or timing calibration of the engine). The installation of a certified approved method pursuant to regulation 13.7.1.1 or certification pursuant to regulation 13.7.1.2 is not considered to be a substantial modification for the purpose of the application of regulation 13.2 of the annex. For recertification of such an engine following a substantial modification, 2.5, 3.3 and, where that engine has multiple engine operating profiles, chapter 8 of this Code shall apply."

2 New paragraphs 1.3.21 to 1.3.37 are added as follows:

"1.3.21 *Engine operational profile* means a particular set of NO_x influencing settings applied in the base emission control strategy which influences the NO_x emission performance. Those settings may relate to, but are not limited to, fuel injection, inlet and exhaust valve operation, charge air management, exhaust bypass/wastegate or exhaust after-treatment controls and auxiliary control devices.

1.3.22 *Multiple engine operational profiles* means that more than one engine operational profile is available for selection on a marine diesel engine.

1.3.23 *Auxiliary control device* means a system, function or control strategy installed on a marine diesel engine that is used to protect the engine and/or its ancillary equipment against operating conditions that could result in damage or failure, or that is used to facilitate the starting of the engine. An auxiliary control device may also be a strategy or measure that has been satisfactorily demonstrated not to be a defeat device. An auxiliary control device includes any element of design that includes sensors, or other arrangements which, by an action of the control system, can activate, modulate, delay or deactivate the operation of any part of the base emission control system. Any device or strategy the activation of which causes a non-progressive change in emissions is also an auxiliary control device. An auxiliary control device not declared at the time of the first certification of a marine diesel engine shall be considered a defeat device.

1.3.24 *Defeat device* means a device that measures, senses or responds to operating variables (e.g. engine speed, temperature, intake pressure or any other parameter) for the purpose of activating, modulating, delaying or deactivating the operation of any component or the function of the emission control system such that the effectiveness of the emission control system is reduced under conditions encountered during normal operation, unless the use of such a device is substantially included in the applied emission certification test procedures. An auxiliary control device accepted as part of the Administration's review of the NO_x certification pack is not a defeat device.

1.3.25 *Base emission control strategy* means the emission control strategy active at any time an auxiliary control device is not active. It consists of any parameter, element of design, or operating control that is designed to modulate as a function of engine load and/or speed in a manner that affects the emission performance of the engine. The modulation of parameters is to be progressive and shall not result in a disproportionate change in emissions.

1.3.26 *Rational emission control strategy* means the base emission control strategy applied to a marine diesel engine which ensures that the emission values at the individual mode points as used to give the weighted specific emission value are representative of the emission values during normal operation of the engine.

1.3.27 *Irrational emission control strategy* means any strategy or measure that, when a marine diesel engine is operated under normal conditions of use, reduces the effectiveness of an emission control system to a level below that expected from the applicable emission test procedures.

1.3.28 *Not-to-exceed emission limit value* means the maximum permitted NO_x emission value at a given operating condition as determined in accordance with 3.3 of this Code within the not-to-exceed zone of the engine.

1.3.29 *Not-to-exceed zone* means the power or torque and speed area of a marine diesel engine within the limit area of the not-to-exceed zone as declared by the applicant that the engine is certified to operate within under steady-state conditions. In the case of the C1 cycle, as given by 3.2 of this Code, the not-to-exceed zone corresponds to the whole of the limit area of the not-to-exceed zone.

1.3.30 *Limit area of the not-to-exceed zone* means the power or torque and speed boundaries of the not-to-exceed zone at and above 25% rated power for all test cycles as given by 3.2 of this Code except for the C1 cycle where it is at and above 50% engine load.

1.3.31 *Point emission value* means the NO_x emission value expressed in terms of g/kWh at the reference conditions of humidity and temperature given by this Code at a particular power or load and speed point.

1.3.32 *NO_x certification pack* means the package of information supplied by the applicant to the Administration as required to be submitted by 2.5 and 3.3 of this Code.

1.3.33 *Propulsion engine* means a marine diesel engine that is used for direct or indirect propulsion. A propulsion engine may additionally perform non-propulsion duties during or separately to propulsion duties.

1.3.34 *Non-propulsion engine* means a marine diesel engine that is not a propulsion engine. An engine that solely or in part provides athwartships movement of a ship is not a propulsion engine.

1.3.35 *Constant-speed engine* means a marine diesel engine that is limited to constant-speed operation.

1.3.36 *Constant-speed engine operation* means a marine diesel engine regulated by a speed control device that automatically controls the operator demand to maintain engine's nominal speed across the load range.*

Additionally, an idle speed setting may be provided that can be used during start-up or shutdown.

* In service, such a speed control device may either maintain a fixed speed or a load dependent speed such that at maximum load the speed could be up to around 10% lower than at zero load.

1.3.37 *Variable-speed engine* means an engine that is not a constant-speed engine."

Chapter 2 – Surveys and certification

3 A new section 2.5 is added as follows:

"**2.5 Rational emission control strategy**

2.5.1 In addition to 2.2, the requirements of this section shall apply.

2.5.2 A rational emission control strategy shall be applied to each marine diesel engine across the whole of its operating load and speed range. The means by which that is achieved shall be documented by the applicant to the Administration within a NO_x certification pack. The information included in that pack shall be such as to demonstrate to the satisfaction of the Administration that a rational emission control strategy is applied during normal operation of the engine.

2.5.3 For an engine where one or more auxiliary control devices are applied, each of those shall be declared to the Administration within the NO_x certification pack irrespective of whether those operate under steady-state or transient conditions. An auxiliary control device which is not so declared shall be considered a defeat device and hence invalidate the NO_x certification of an engine to which such an undeclared device is applied.

2.5.4 For screening of the base emission control strategy, the NO_x certification pack shall include:

.1 a list of all NO_x emission influencing setting and operating values controlled by an engine's base emission control strategy, for example fuel injection, inlet and exhaust valve operation, charge air management, exhaust bypass/wastegate or exhaust after-treatment controls;

.2 a record of the reference values for the settings and operating values identified in 2.5.4.1 at each of the mode points of the applicable test cycle;

.3 documentation that whenever the engine is operating between two mode points as identified in 2.5.4.2, the emission control strategy interpolates progressively between the mode points;

.4 documentation to show that, along lines of constant power and varying speed from the line between the mode points to the limit area of the not-to-exceed zone of the engine, the base emission control strategy shall ensure that any variation in the point emission values is progressive and justified from the value at that power on the line between the mode points, unless rationalized by an auxiliary control device or explained by a physical limitation of the engine;

.5 a declaration that the engine's base emission control strategy only reacts to changes in engine load and speed;

.6 any other information the applicant considers relevant; and

.7 any other information the Administration requests.

2.5.5 For each auxiliary control device which may operate under steady-state conditions, the NO_x certification pack shall include:

.1 a justification of the need for that device; and

.2 a description for that device, including:

.1 details of the conditions under which that device will operate and the functioning of that device;

.2 how each modulated parameter of the emission control system achieves the stated purpose of the base emission control strategy;

.3 the process used to ensure that the modulation is limited to the conditions where the stated purpose of the auxiliary control device operational strategy arises and to set the modulation to be the minimum necessary to achieve that stated purpose;

.4 the effect of the application of that device on the engine's base emission control strategy;

.5 for auxiliary control devices that operate above 25% engine power, the effect on the point emission values shall be documented;

.6 for auxiliary control devices that operate within the declared not-to-exceed zone, an estimate of the effect on the point emission values shall be documented;

.7 any other information the applicant considers relevant; and

.8 any other information the Administration requests.

.3 Auxiliary control devices that only operate during transient conditions need not be included in the NO_x certification pack for screening.

2.5.6 The technical file as required by 2.3.4 shall contain the following information:

.1 identification of those auxiliary control devices declared under 2.5.3;

.2 for those auxiliary control devices covered under 2.5.5, the operating conditions which will cause those devices to function;

.3 the means by which the operation of those auxiliary control devices under 2.5.5 may be verified as part of the onboard NO_x verification procedure; and

.4 where the provisions of 2.3.6 apply, the means by which it is to be verified that the required quantities of additional substance used are consistent with achieving the engine's intended base emission control strategy shall be included as part of the onboard NO_x verification procedure.

2.5.7 Where acceptable to the Administration, the documentation requirements of 2.5.4 and 2.5.5 may alternatively be made by reference to that in respect of marine diesel engines comparable, in terms of NO_x emissions characteristics, to the engine to be certified.

2.5.8 The provisions of this section only apply to a marine diesel engine which is installed in a ship as an identical replacement engine if the requirements of this section applied at the time the engine family or engine group to which that engine belongs was first certified."

Chapter 3 – Nitrogen oxides emission standards

3.1 Maximum allowable NO_x emission limits for marine diesel engines

4 Paragraph 3.1.4 is replaced by the following:

"3.1.4 In the case of a marine diesel engine to be certified in accordance with paragraph 5.1.1 of regulation 13, the specific emission at each individual mode point shall not exceed the applicable NO_x emission limit value by more than 50% except as follows:

.1 The 10% mode point in the D2 test cycle specified in 3.2.4.

.2 The 10% mode point in the C1 test cycle specified in 3.2.5.

.3 The idle mode point in the C1 test cycle specified in 3.2.5."

3.2 Test cycles and weighting factors to be applied

5 Section 3.2 is replaced by the following:

"**3.2 Test cycles and weighting factors to be applied**

3.2.1 For every individual engine or parent engine of an engine family or engine group, one or more of the relevant test cycles specified in 3.2.2 to 3.2.5 shall be applied for verification of compliance with the applicable NO_x emission limit contained in regulation 13. Appendix IX provides guidance on the selection of the appropriate test cycle but where discrepancies exist the text of chapter 3 takes precedence.

3.2.2 For a fixed pitch propeller propulsion engine or a propeller-law operated non-propulsion engine, test cycle E3 shall be applied in accordance with table 1.

3.2.3 For a propulsion engine that does not operate with a fixed pitch propeller, including an engine fitted as part of a diesel-electric installation or an engine operated with a controllable-pitch propeller, test cycle E2 shall be applied in accordance with table 2.

3.2.4 For a non-propulsion engine that is a constant-speed engine, test cycle D2 shall be applied in accordance with table 3.

3.2.5 For a non-propulsion engine that operates as a variable-speed engine, not included above, test cycle C1 shall be applied in accordance with table 4.

Table 1 – Test cycle for a marine diesel engine meeting paragraph 3.2.2

Test cycle E3	Speed	100%	91%	80%	63%
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

Table 2 – Test cycle for a marine diesel engine meeting paragraph 3.2.3

Test cycle E2	Speed	100%	100%	100%	100%*
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

* There are exceptional cases, including large bore engines intended for E2 applications, in which, owing to their oscillating masses and construction, engines cannot be run at low load at nominal speed without the risk of damaging essential components. In such cases, the engine manufacturer should make an application to the Administration that the test cycle as given in table 2 above may be modified for the 25% power mode with regard to the engine speed. The adjusted engine speed at 25% power, however, should be as close as possible to the rated engine speed, as recommended by the engine manufacturer and approved by the Administration. The applicable weighting factors for the test cycle should remain unchanged.

Table 3 – Test cycle for a marine diesel engine meeting paragraph 3.2.4

Test cycle D2	Speed	100%	100%	100%	100%	100%
	Power	100%	75%	50%	25%	10%
	Weighting factor	0.05	0.25	0.3	0.3	0.1

Table 4 – Test cycle for a marine diesel engine meeting paragraph 3.2.5

Test cycle C1	Speed	Rated				Intermediate			Idle
	Torque	100%	75%	50%	10%	100%	75%	50%	0%
	Weighting factor	0.15	0.15	0.15	0.1	0.1	0.1	0.1	0.15

3.2.6 The torque figures given in test cycle C1 are percentage values that represent for a given test mode the ratio of the required torque to the maximum possible torque at this given speed.

3.2.7 The intermediate speed for test cycle C1 shall be declared by the manufacturer, taking into account the following requirements:

.1 For engines that are designed to operate over a speed range on a full load torque curve, the intermediate speed shall be the declared maximum torque speed if it occurs between 60% and 75% of rated speed.

.2 If the declared maximum torque speed is less than 60% of rated speed, then the intermediate speed shall be 60% of the rated speed.

.3 If the declared maximum torque speed is greater than 75% of the rated speed, then the intermediate speed shall be 75% of rated speed.

.4 For engines that are not designed to operate over a speed range on the full load torque curve at steady-state conditions, the intermediate speed will typically be between 60% and 70% of the maximum rated speed.

3.2.8 If an engine manufacturer applies for a new test cycle application on an engine already certified under a different test cycle specified in 3.2.2 to 3.2.5, then it may not be necessary for that engine to undergo the full certification process for the new application. In this case, the engine manufacturer may demonstrate compliance by recalculation, by applying the measurement results from the specific modes of the first certification test to the calculation of the total weighted emissions for the new test cycle application, using the corresponding weighting factors from the new test cycle."

6 A new section 3.3 is added as follows:

"3.3 Not-to-exceed emission values within the limit area of the not-to-exceed zone

3.3.1 The boundaries, in terms of power or torque and speed, of the not-to-exceed zone at or above 25% power shall be declared to the Administration by the applicant as part of the NO_x certification pack. Operation outside these not-to-exceed zone boundaries, within the limit area of the not-to-exceed zone, shall only be permitted during starting, stopping, accelerations, deceleration, load pick-up or load rejection. However, operation below 25% power and at or above 63% speed for the E3, E2, and D2 test cycles and below 50% load for the C1 test cycle shall be permitted subject to it being shown in accordance with the requirements of 2.5 that a rational emission control strategy continues to be applied.

3.3.2 The technical file as required by 2.3.4 shall additionally contain the following information:

.1 the power or torque and speed boundaries, as given by 3.3.1, within which the engine is certified to operate; and

.2 the onboard NO_x verification procedure shall include means to verify that the engine only operates within the power or torque and speed boundaries as given by 3.3.1.

3.3.3 Additional to the emission testing under 3.2 the Administration may, at its discretion, require that up to three point emission values be determined at load points within the not-to-exceed zone in order to verify that the not-to-exceed zone requirements are complied with. The load points to be tested shall be agreed between the applicant and the Administration as part of the review of the NO_x certification pack. Point emission values are to be determined in accordance with the procedures given by chapter 5 and appendix X. To be acceptable each of those point emission values so determined shall not exceed the respective not-to-exceed emission limit value, N_{Lz}, as determined using the procedure in appendix X.

Point emission value ≤ emission limit value, N_{Lz}, at that point

3.3.4 Alternative means by which it is to be shown that a point emission value may be determined or the not-to-exceed zone requirements are complied with may be used subject to their acceptability to the Administration.

3.3.5 For member engines of engine families or engine groups first certified prior to the effective date of the requirements under this section, demonstration of compliance with the requirements of this section may be on the basis solely of documentation which is to be acceptable to the Administration."

Chapter 4 – Approval of serially manufactured engines: Engine family and engine group concepts

7 In paragraph 4.3.8.2, sub-paragraphs 4.3.8.2.12 to 4.3.8.2.14 are added, after the existing sub-paragraph 4.3.8.2.11, as follows:

".12 multiple engine operational profiles as covered by chapter 8.

.13 base emission control strategy.

.14 auxiliary control devices."

8 Paragraph 4.3.10.5 is deleted.

Chapter 6 – Procedures for demonstrating compliance with NO_x emissions on board

9 In paragraph 6.2.2.3, at the end of sub-paragraph 6.2.2.3.15, the word "or" is deleted, at the end of sub-paragraph 6.2.2.3.16, "." is replaced with ",", and new sub-paragraphs 6.2.2.3.17 to 6.2.2.3.19 are added after sub-paragraph 6.2.2.3.16 as follows:

".17 list of identification references of all engine operational profiles available for the engine and, if applicable, the conditions under which each is to be used (see chapter 8 of the Code);

.18 list of auxiliary control devices accepted for the engine and the operating conditions under which those devices function; or

.19 the engine power or engine load and speed boundaries above 25% engine power within which the engine is certified to operate."

10 A new chapter 8 is added as follows:

"**Chapter 8 – Multiple engine operational profiles**

8.1 Acceptance of multiple engine operational profiles

8.1.1 The switching between engine operational profiles under onboard conditions is permitted, subject to the provisions of this chapter, in the following cases:

.1 for a marine diesel engine certified to be in-service switchable between emission tiers;

.2 for a marine diesel engine certified to more than one test cycle application in accordance with 3.2 where the engine operational profile is in-service switchable based on the duty the engine is performing; or

.3 for a marine diesel engine certified to the same emission standard, the same rated power, same rated speed and the same test cycle which is in-service switchable between multiple engine operational profiles.

8.1.2 A marine diesel engine certified in accordance with 8.1.1.1 and/or 8.1.1.2 may additionally be switchable, at a particular tier and or duty, between multiple engine operational profiles in which cases the provisions of 8.1.1.3 also apply.

8.1.3 Each engine operating profile shall be identified in the technical file as required by 2.3.4 together with the conditions, if applicable, under which each engine operating profile is to be used.

8.2 Certification of multiple engine operational profiles

8.2.1 For a marine diesel engine to which 8.1.1.1 applies, the parent engine test report for each tier shall be included in the technical file as required by 2.4.1.5. The parent engine specific emission value for each tier shall be entered under 1.9.6 of the Supplement to the EIAPP Certificate.

8.2.2 For a marine diesel engine to which 8.1.1.2 applies, the parent engine test report for each test cycle shall be included in the technical file as required by 2.4.1.5. The test cycles for which the engine is certified shall be shown on the EIAPP Certificate. The parent engine specific emission value for each test cycle shall be entered and identified under 1.9.6 of the Supplement to the EIAPP Certificate.

8.2.3 For a marine diesel engine to which 8.1.1.3 applies:

.1 the engine test report for each engine with the parent engine features and characteristics identified in 4.3.9 or 4.4.8, for each engine operational profile, shall be determined in accordance with the provisions of chapter 5 of this Code. Where there is a mode point condition which is the same among the different engine operational profiles, that is not required to be repeated for each test cycle. The required testing may not necessarily be undertaken on the same physical engine;

.2 the specific emission value determined in accordance with 5.12.6.1 for each engine operational profile shall not exceed the applicable limit value as given by regulation 13;

.3 the multiple engine operational profile parent engine specific emission value shall be determined in accordance with 5.12.6.1 from the highest NO_x emission rate, q_{mgasi} as per 5.12.5.2, at each mode point across all the engine operational profiles for which the engine is to be certified;

.4 the parent engine test report for each engine operational profile for which the engine is to be certified shall be included in the technical file as required by 2.4.1.5 together with the determination of the multiple engine operational profile parent engine specific emission value;

.5 the multiple engine operational profile parent engine specific emission value shall be entered under 1.9.6 of the Supplement to the EIAPP Certificate; and

.6 Section 2.2.1 of the Supplement to the IAPP Certificate shall be completed to identify which engines installed on a ship are approved to operate with multiple engine operational profiles.

8.3 Use of multiple engine operational profiles

8.3.1 An engine operational profile shall only be used in accordance with the associated conditions as given in the technical file.

8.3.2 The identification reference of the engine operational profile in use shall be recorded as part of the onboard NO_x verification procedure together with data that demonstrates that the conditions attached to the use of that engine operational profile were being complied with.

8.3.3 On change from one engine operational profile to another, the date and time of the completion of that change shall be recorded as part of the onboard NO_x verification procedure for that engine."

Appendix V – Parent engine test report and test data

11 The title of appendix V is replaced by the following:

"**Parent engine test report, test data, and determination of the highest composite specific emission value**"

12 The title of section 1 is replaced by the following:

"**Section 1 – Parent engine test report**
(see 5.10 and 8.2 of the Code)"

13 The title of section 2 is replaced by the following:

"**Section 2 – Parent engine test data to be included in the technical file, additionally, for marine diesel engines to which 8.1.1.3 applies, the relevant test data for all engine operational profiles for which the engine is certified which are to be included in the technical file** *(see 2.4.1.5 and 8.2 of the Code)*"

14 A new section 3 is added after the existing section 2 as follows:

"**Section 3 – Multiple engine operational profile parent engine, determination of the composite specific emission value to be included in the technical file for engines with those multiple engine operational profiles**
(see 8.2 of the Code)

Calculation of the highest composite specific emission value in accordance with 8.2.3.3."

Appendix VII – Checklist for an engine parameter check method

15 In paragraph 1, at the end of sub-paragraph 1.14.1, "." is replaced with ";", and sub-paragraphs 1.15 to 1.17 are added after the existing sub-paragraph 1.14 as follows:

"1.15 list of identification references of all engine operational profiles available for the engine and associated conditions, if applicable, under which each is to be used (see chapter 8 of the Code);

1.16 list of auxiliary control devices accepted for the engine and the operating conditions under which those devices function;

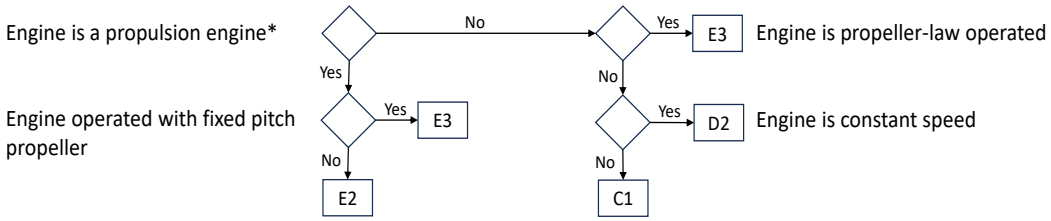
1.17 the engine power or engine load and speed boundaries within which the engine is certified to operate."

16 A new appendix IX is added as follows:

"**Appendix IX – Flow chart for engine certification test cycle determination**

(refer to 3.2 of the Code)

Test cycle selection flowchart



* A propulsion engine may additionally perform non-propulsion duties during or separately to propulsion duties. An engine that solely or in part provides athwartships movement of a ship is not a propulsion engine.

"

17 A new appendix X is added as follows:

"**Appendix X – Calculation of not-to-exceed emission limit value within not-to-exceed zone**

(refer to chapters 3 and 5 of the Code)

1 This appendix describes the method for determining the not-to-exceed emission limit value, N_{Lz}, at any point within the not-to-exceed zone for comparison with a determined point emission value as set out in 3.3 of this Code.

2 Where engine test results are used to determine a point emission value, formula (1) shall be used to generate that value. At that point, the tolerance requirements of 5.9.6.2 of this Code apply:

$$N_{Mn} = \frac{q_{mNOx}}{P_{Mn}} \quad (1)$$

where:

N_{Mn} = NO_x at the point *Mn* in g/kWh

P_{Mn} = Power at the point *Mn* (brake plus auxiliary) in kW

q_{mNOx} = Mass flow rate of NO_x in g/h – see 5.12.5.2 of this Code

q_{mNOx} is to be corrected for humidity and temperature consistent with the method used for the engine test from 5.12.4 of this Code.

3 Designation of not-to-exceed zone for E2, E3 and D2 test cycles in limit area of the not-to-exceed zone

3.1 The limit area of the not-to-exceed zone for engines certified to the E2 and E3 test cycles is defined by a speed boundary of equal to or greater than 63% and a power boundary of equal to or greater than 25%. The limit area of the not-to-exceed zone for the D2 cycle is defined by a power boundary of equal to or greater than 25%, at the nominal speed of the engine.

3.2 For the E3 and variable-speed application of the E2 cycle certified engines, the applicant is to define, in accordance with 3.3.1 of this Code, the not-to-exceed zone within the limit area of the not-to-exceed zone as wide or as narrow as applicable for their intended applications of the engine. The applicant-defined not-to-exceed zone shall encompass all normal steady-state speed load combinations within the limit area of the not-to-exceed zone for the applications of the engine.

3.3 The applicant's designated not-to-exceed zone can be defined by any mathematical formula(e), lists of coordinates or other method of defining the boundary. The not-to-exceed zone does not need to extend to the boundary of the limit area of the not-to-exceed zone.

3.4 For D2 and constant-speed E2 cycle certified engines, the not-to-exceed zone shall be a line of power greater than 25% at the nominal speed.

4 Determination of not-to-exceed emission limit value for E2, E3 and D2 test cycles

4.1 The not-to-exceed emission limit value at each NO_x checkpoint shall be determined in accordance with the requirements of this section.

Note: If there is an auxiliary control device that causes a NO_x discontinuity within the not-to-exceed zone, follow the additional procedure in section 6 to insert proxy NO_x emission points to address the area(s) of discontinuity.

4.2 Interpolated NO_x value N_y at power P_y between mode points as determined using formula (2):

$$N_y = N_{Ma} + \left(P_y - P_{Ma}\right) \cdot \frac{(N_{Mb} - N_{Ma})}{(P_{Mb} - P_{Ma})} \quad (2)$$

where:

N_y = Interpolated NO_x value at power P_y

N_{Ma} = Measured point emission value according to formula (1) at nearest measured mode point at power below checkpoint power

N_{Mb} = Measured point emission value according to formula (1) at nearest measured mode point at power above checkpoint power

P_y = Power at checkpoint

P_{Ma} = Power at mode point below checkpoint

P_{Mb} = Power at mode point above checkpoint

4.3 Determine the not-to-exceed emission limit value at power P_y between the mode points, to the Tier, as applicable.

.1 For Tier II

The not-to-exceed emission limit value at power P_y is given by formula (3)

$$N_{Lv} = N_y \cdot 1.2 \quad (3)$$

where:

N_{Lv} = Not-to-exceed emission limit value at power P_y

N_y = Interpolated NO_x value at power P_y

.2 For Tier III

The not-to-exceed emission limit value, N_{Lv}, at power P_y shall be either set by 3.1.4 of this Code or as determined in accordance with formula (4), whichever is the lower.

N_{Lv} is the lower of N_{cap} or N_{LV},

with:

$$N_{LV}, = N_y + 0.25 \cdot N_{LC} \quad (4)$$

$$N_{cap} = 1.5 \cdot N_{LC} \quad (5)$$

where:

N_{LC} = NO_x cycle limit for engine

N_{Cap} = the maximum mode point value for the engine according to 3.1.4 of this Code

4.4 If the checkpoint power P_y is on the propeller law curve for an E3 certified engine or the nominal speed line for a constant-speed E2 or a D2 certified engine:

$$N_{Lz} = N_{Lv} \quad (6)$$

For this situation the determination of the not-to-exceed emission limit value, N_{Lz}, is complete for that checkpoint. Otherwise, continue with 4.5.

4.5 For E3 and variable-speed application of the E2 cycle certified engines, where the checkpoint power P_y is located at a speed not on the line between the measured mode points, carry out the additional procedure in 4.5.1 to 4.5.4.

.1 Determine the NO_x limit at either edge of the not-to-exceed zone, N_{Le}, for the selected checkpoint power P_y along a line of constant power, in accordance with formula (7):

$$N_{Le} = N_y \cdot F_\beta \cdot 1.5 \quad (7)$$

with:

$$F_\beta = \frac{N_{LC}}{N_C} \quad (8)$$

where:

N_{Le} = NO_x limit at edge of not-to-exceed zone

N_{LC} = NO_x cycle limit for engine

N_C = NO_x specific emission value for the engine from 5.12.6.1 of this Code

.2 Determine the not-to-exceed emission limit value at a checkpoint power P_y which is on the constant power line between the mode point line and the edge of the not-to-exceed zone in accordance with formula (9):

$$N_{Lz\prime} = N_{Lv\prime} + (n_z - n_v) \cdot \frac{(N_{Le} - N_{Lv\prime})}{(n_e - n_v)} \quad (9)$$

with:

For tier II, $N_{Lv\prime} = N_{Lv}$ from formula (3)

For tier III, $N_{Lv\prime}$ is from formula (4)

where:

$N_{Lz\prime}$ = NO_x limit at required checkpoint

N_{Le} = NO_x limit at edge of not-to-exceed zone

n_z = Speed at required checkpoint

n_e = Speed at edge of applicants selected not-to-exceed zone at checkpoint power (may be on lower or higher side of mode line as required for value of n_z)

n_v = Speed on measured mode line at selected power

For engines certified to the E2 test cycle, the speed on the measured mode line, n_v, is the nominal speed.

For engines certified to the E3 test cycle, the speed on the measured mode line, n_v, is determined by the cube law propeller curve:

$$n_v = n_{MCR} \cdot \sqrt[3]{\frac{P_y}{P_{MCR}}} \quad (10)$$

where:

n_{MCR} = Rated speed from 1.3.12 of this Code
P_y = Power at checkpoint

P_{MCR} = Rated power from 1.3.11 of this Code

.3 Determine the not-to-exceed emission limit value at power P_y as applicable:

.1 For Tier II

The NO_x limit is the interpolated result:

$$N_{Lz} = N_{Lz'} \quad (11)$$

.2 For Tier III

The not-to-exceed emission limit value at power P_y shall be set by 3.1.4 of this Code or as determined in accordance with 4.5.3.1 whichever is lower:

N_{Lz} is the lower of N_{cap} or $N_{Lz'}$

5 Determination of not-to-exceed emission limit value for the C1 test cycle

5.1 For the C1 test cycle within the limit area of the not-to-exceed zone, screening is conducted between the measured mode points of 100%, 75%, and 50% load at both intermediate speed (mode points 5, 6 and 7 respectively) and rated speed (mode points 1, 2 and 3, respectively).

This creates two zones, Zone A and Zone B, where double linear interpolation or extrapolation is carried out between the nearest mode points:

.1 Zone A uses mode points 5, 1, 6 and 2. Zone A may extend above the torque line from mode point 5 and mode point 1 or beyond the speed line from mode point 1 to mode point 5.

.2 Zone B uses mode points 6, 2, 7 and 3. Zone B may extend beyond the speed line from mode point 2 to mode point 3.

.3 The applicant may request that the Administration exclude operating points from the limit area of the not-to-exceed zone screening if the applicant can demonstrate that the engine is not capable of operating at steady state at those points when installed on a ship. Otherwise, the not-to-exceed zone consists of the entire limit area of the not-to-exceed zone.

5.2 Determine if the checkpoint is in Zone A or Zone B by determining if the checkpoint torque, T_z, is higher or lower than the torque on the boundary between Zone A and Zone B (75% load line) for the checkpoint speed.

$$T_v = T_{M6} + (n_z - n_I) \cdot \frac{(T_{M6} - T_{M2})}{(n_I - n_R)} \quad (12)$$

where:

T_v = Torque at checkpoint speed on a straight line between mode point 6 and mode point 2 (75% load line)

T_{M6} = Torque at mode point 6 (75% of torque at intermediate speed)

T_{M2} = Torque at mode point 2 (75% of torque at rated speed)

n_z = Checkpoint speed

n_I = Intermediate speed

n_R = Rated speed

5.3 Determine the interpolated/extrapolated NO_x value at desired checkpoint:

.1 If the checkpoint torque, T_z, is greater than T_v, use equation (13) and (14) for the interpolation or extrapolation.

$$N_z = N_u + (T_Z - T_u) \cdot \frac{(N_u - N_v)}{(T_u - T_v)} \quad (13)$$

with:

$$T_U = T_{M5} + (n_z - n_I) \cdot \frac{(T_{M5} - T_{M1})}{(n_I - n_R)} \quad (14)$$

where:

T_{M1} = Torque at mode point 1 (100% of torque at rated speed)

T_{M5} = Torque at mode point 5 (100% of torque at intermediate speed)

T_v = Torque at checkpoint speed on a straight line between mode point 6 and mode point 2 (75% load line) from formula (12)

T_u = Torque at checkpoint speed on a straight line between mode point 5 and mode point 1 (100% load line) from formula (14)

T_z = Torque at checkpoint

N_u = Interpolated NO_x at checkpoint speed on 100% load line

N_v = Interpolated NO_x at checkpoint speed on 75% load line

n_z = Checkpoint speed

n_I = Intermediate speed

n_R = Rated speed

.2 If the checkpoint torque, T_z, is less than T_v use equation (15) and (16) for the interpolation or extrapolation.

$$N_z = N_v + (T_Z - T_v) \cdot \frac{(N_v - N_w)}{(T_v - T_w)} \quad (15)$$

with:

$$T_w = T_{M7} + (n_z - n_I) \cdot \frac{(T_{M7} - T_{M3})}{(n_I - n_R)} \quad (16)$$

where:

T_{M3} =Torque at mode point 3 (50% of torque at rated speed)

T_{M7} =Torque at mode point 7 (50% of torque at intermediate speed)

T_v =Torque at checkpoint speed on a straight line between mode point 6 and mode point 2 (75% load line) from formula (12)

T_w =Torque at checkpoint speed on a straight line between mode point 7 and mode point 3 (50% load line) from formula (16)

T_z =Torque at checkpoint

N_v =Interpolated NO_x at checkpoint speed on 75% load line

N_w =Interpolated NO_x at checkpoint speed on 50% load line

n_z = Checkpoint speed

n_I =Intermediate speed

n_R =Rated speed

5.4 Determine the not-to-exceed emission limit value at checkpoint:

.1 For Tier II

The not-to-exceed emission limit value is given by formula (17):

$$N_{Lz} = N_z \cdot 1.2 \quad (17)$$

where:

N_{Lz} = Not-to-exceed emission limit value at checkpoint
N_z = Interpolated NO_x value at power P_z

.2 For Tier III

The not-to-exceed emission limit value shall be either set by 3.1.4 of this Code or as determined in accordance with 5.3, whichever is the lower:

N_{Lz} is the lower of N_{cap} or N_{Lz},

with:

$$N_{Lz'} = N_z + 0.25 \cdot N_{LC} \quad (18)$$

$$N_{cap} = 1.5 \cdot N_{LC} \quad (19)$$

where:

N_z = Interpolated NO_x value at checkpoint

N_{LC} = NO_x cycle limit for engine

N_{Cap} = the maximum mode point value according to 3.1.4 of this Code

6 Method to address discontinuity in the operation zone due to an auxiliary control device

6.1 For each approved auxiliary control device, where there is operation in the not-to-exceed zone that causes a discontinuity in the NO_x emissions it can be necessary to introduce additional proxy mode points to account for the discontinuity in the area of engine operation where that auxiliary control device is active.

6.2 There will be two or more proxy mode points to cover the action of an auxiliary control device.

6.3 N_y is calculated in the same manner as 4.2 using the proxy points where necessary in the interpolation.

6.4 Use good engineering judgement that may include simulation or in-house testing to determine the appropriate NO_x level and location of the proxy points.

6.5 The engine power of the proxy mode points may overlap to account for hysteresis that may occur as a result of approaching the points from rising or falling power. The overlap should also take into account any variation in the operating point of the auxiliary control device based on engine speed.

6.6 Include the proxy mode points as part of the auxiliary control device documentation supplied to the Administration in the NO_x certification pack."

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ANNEX 2

RESOLUTION MEPC.398(83)
(adopted on 11 April 2025)

AMENDMENTS TO THE NO_x TECHNICAL CODE 2008

(Certification of an engine subject to substantial modification or being certified to a Tier to which the engine was not certified at the time of its installation)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto (MARPOL), which specifies the amendment procedure and confers upon the appropriate body of the Organization the function of considering amendments thereto for adoption by the Parties,

RECALLING FURTHER regulation 13 of MARPOL Annex VI, which makes the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (hereafter "NO_x Technical Code 2008") mandatory under that Annex,

HAVING CONSIDERED, at its eighty-third session, draft amendments to the NO_x Technical Code 2008 concerning the certification of an engine subject to substantial modification or being certified to a Tier to which the engine was not certified at the time of its installation, as appropriate, approved at its eighty-second session and duly circulated in accordance with article 16(2)(a) of MARPOL,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to the NO_x Technical Code 2008, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 16(2)(f)(ii) and (iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 March 2026 unless prior to that date not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of MARPOL, the said amendments shall enter into force on 1 September 2026 upon their acceptance in accordance with paragraph 2 above;

4 ALSO INVITES the Parties to consider the early application of the amendments to the NO_x Technical Code 2008 concerning the certification of an engine subject to substantial modification or being certified to a Tier to which the engine was not certified at the time of its installation;

5 REQUESTS the Secretary-General, for the purposes of article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to MARPOL;

6 ALSO REQUESTS the Secretary-General to transmit copies of the present resolution and its annex to Members of the Organization which are not Parties to MARPOL.

ANNEX

AMENDMENTS TO THE NO_x TECHNICAL CODE 2008

(Certification of an engine subject to substantial modification or being certified to a Tier to which the engine was not certified at the time of its installation)

Chapter 7 – Certification of an existing engine

1 Chapter 7 is split into two sections with the following titles:

"7.1 Certification of an existing engine under regulation 13.7"

and

"7.2 Certification of an engine subject to substantial modification or being certified to a Tier to which the engine was not certified at the time of its installation"

2 Existing paragraphs 7.1 to 7.6 are renumbered as sub-paragraphs 7.1.1 to 7.1.6.

3 New sub-paragraphs 7.2.1 to 7.2.12 are added as follows:

"7.2.1 Further to 2.1.1.4, 2.1.2.2 and 4.4.4, the procedures as given in this section shall be followed where an installed marine diesel engine:

.1 has been subject to substantial modification; or

.2 is to be certified to a Tier to which it was not certified at the time of its installation.

7.2.2 The requirements of this Code apply other than as specifically provided for by this section.

7.2.3 The procedures given by this section may be accepted for an Individual Engine or for an Engine Group represented by the Parent Engine. It shall not be accepted for Engine Family certification.

7.2.4 Where, as a result of the substantial modification, the rated power and/or the rated speed of the engine is altered from the original condition the engine nameplate shall be replaced accordingly.

7.2.5 In setting the load points of the test cycle to be followed the provisions of 6.4.6.7 shall apply. In the case of the 100% load point this shall, subject to the Engine Emission test plan, be allowed to be no lower than 85% of rated power. If that value cannot be achieved, then the test shall be deferred to such time that at least that power level can be achieved. The test cycle 100% power weighting factor under 3.2 shall be applied irrespective of actual power developed at that load point.

7.2.6 At each load point of a test cycle, the provisions of 6.4.6.8 shall apply rather than those of 5.9.6.2.

7.2.7 In the case of the E3 test cycle, if the actual propeller curve differs from the E3 curve, the load point used shall be set using the measured engine power.

7.2.8 Engine performance and ambient condition monitoring equipment requirements shall be in accordance with the requirements of 6.4.5.1.

7.2.9 In terms of the NO_x correction for humidity and temperature, the provisions of 6.4.13 shall apply.

7.2.10 The Engine Emission test plan as prepared by the applicant shall be agreed with the Administration before scheduling that test.

7.2.11 The certification of a Member Engine of the Engine Group as established following the provisions of this section shall follow the procedures specified in 2.2.2.

7.2.12 Guidance in respect of the certification of a marine diesel engine subject to substantial modification or being certified to a Tier to which the engine was not certified at the time of its installation is given by figure 4 of appendix II of this Code. Where discrepancies exist, the text of the NO_x Technical Code 2008 takes precedence."

Appendix II

Flow charts for survey and certification of marine diesel engines (refer to 2.2.9 and 2.3.11 of the NO_x Technical Code 2008)

4 The existing title of appendix II is replaced with the following:

"Flow charts for survey and certification of marine diesel engines (refer to 2.2.9, 2.3.11 and 7.2.12 of the NO_x Technical Code 2008)"

5 In the chapeau, reference to chapter 7 and figure 4 are inserted, to read:

"Guidance for compliance with survey and certification of marine diesel engines, as described in chapters 2 and 7 of this Code, is given in figures 1, 2, 3 and 4 of this appendix."

6 In the chapeau, a new line "Figure 4: Certification of an engine subject to substantial modification or being certified to a Tier to which the engine was not certified at the time of its installation" is added after the line of "Figure 3: Renewal, annual or intermediate survey on board a ship".

7 A new figure 4 is added after figure 3 as follows:

"

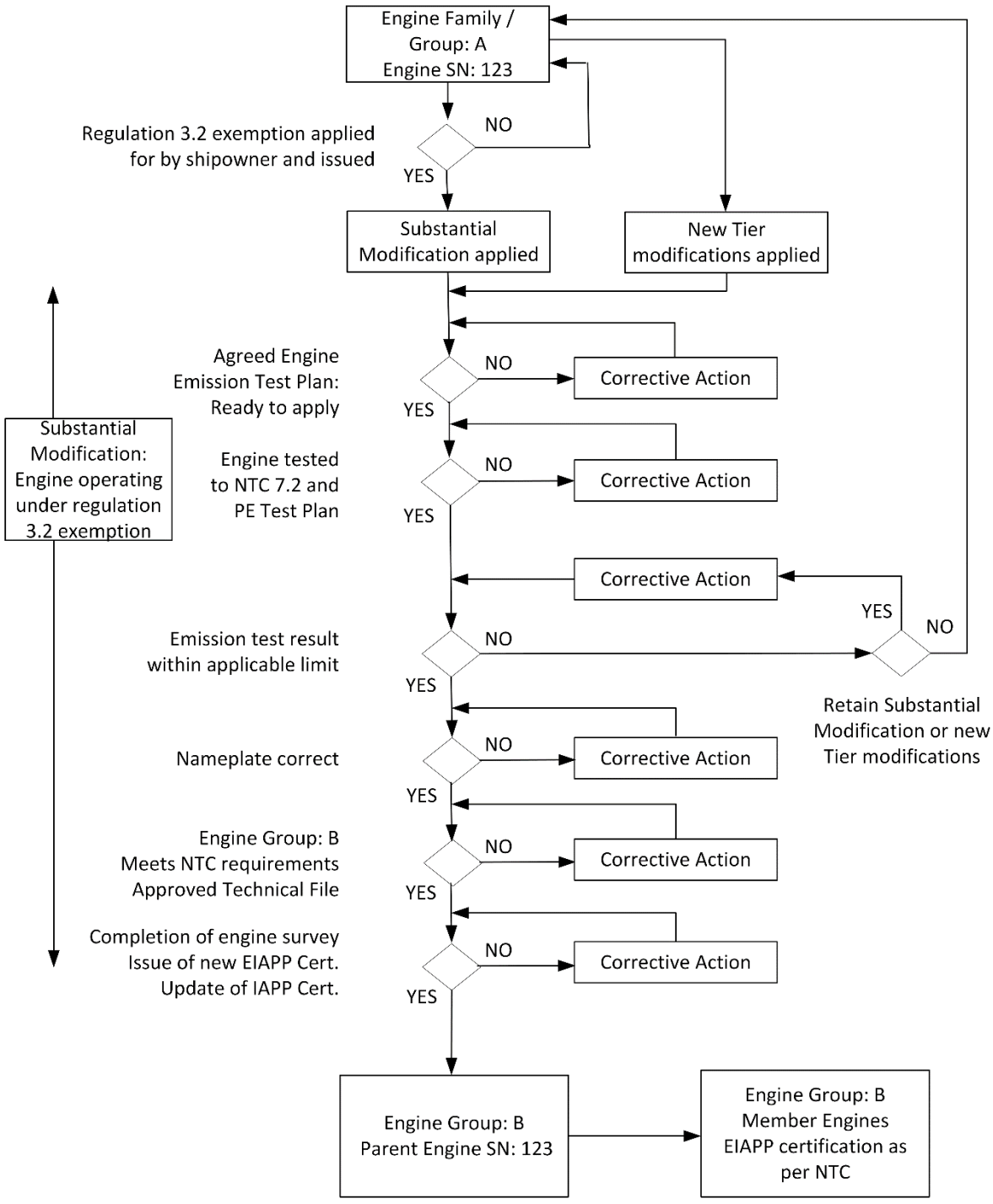

Figure 4: Certification of an engine subject to substantial modification or being certified to a tier to which the engine was not certified at the time of its installation in accordance with 7.2 of this Code

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ANNEX 3

RESOLUTION MEPC.399(83)
(adopted on 11 April 2025)

2025 GUIDELINES ON SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEMS

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO that, at its fifty-eighth session, it adopted, by resolution MEPC.176(58), a revised MARPOL Annex VI (hereinafter "MARPOL Annex VI") and, by resolution MEPC.177(58), a revised Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (hereinafter "NO_x Technical Code 2008"),

NOTING regulation 13 of MARPOL Annex VI, which makes the NO_x Technical Code 2008 mandatory under that Annex,

NOTING ALSO that the use of NO_x-reducing devices is envisaged in the NO_x Technical Code 2008 and that selective catalytic reduction (SCR) systems are such NO_x-reducing devices for compliance with the Tier III NO_x limit,

NOTING FURTHER that, at its seventy-first session, it adopted, by resolution MEPC.291(71), the *2017 Guidelines addressing additional aspects to the NO_x Technical Code 2008 with regard to particular requirements related to marine diesel engines fitted with Selective Catalytic Reduction (SCR) Systems* (2017 SCR Guidelines), and, at its seventy-fourth session, by resolution MEPC.313(74), amendments thereto,

RECOGNIZING the need to update the 2017 SCR Guidelines in line with the latest developments,

HAVING CONSIDERED, at its eighty-third session, a draft revision of the 2017 SCR Guidelines, prepared by the Sub-Committee on Pollution Prevention and Response,

1 ADOPTS the *2025 Guidelines on selective catalytic reduction (SCR) systems*, as set out in the annex to the present resolution;

2 INVITES Administrations to implement the 2025 SCR Guidelines and apply them to SCR systems installed on ships the keels of which are laid or which are at a similar stage of construction on or after 1 November 2025; or SCR systems installed on ships the keels of which are laid or which are at a similar stage of construction before 1 November 2025 which have a contractual delivery date of SCR systems to the ship on or after 1 May 2026 or, in the absence of a contractual delivery date, the actual delivery of the SCR system to the ship on or after 1 May 2026;

3 REQUESTS Parties to MARPOL Annex VI and other Member Governments to bring the annexed Guidelines to the attention of shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested parties;

4 AGREES to keep these Guidelines under review in light of experience gained with their application, with a view to incorporating them into the NO_x Technical Code 2008;

5 ALSO AGREES that these Guidelines supersede the 2017 SCR Guidelines, adopted by resolution MEPC.291(71) and amended by resolution MEPC.313(74).

ANNEX

2025 GUIDELINES ON SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEMS

TABLE OF CONTENTS

1 INTRODUCTION

1.1 The use of NO_x-reducing devices is envisaged in section 2.2.5 of the NO_x Technical Code 2008 (NTC 2008) and a Selective Catalytic Reduction (SCR) system is one of such devices.

1.2 The NTC 2008 contains two ways for pre-certification of engine systems fitted with NO_x-reducing devices:

.1 engine fitted with SCR: approval in accordance with paragraph 2.2.5.1 and test in accordance with chapter 5 of the NTC 2008; and

.2 a simplified measurement method in accordance with section 6.3 of the NTC 2008 as regulated in paragraph 2.2.5.2 (Primary failure case) of the Code.

1.3 According to paragraph 2.2.5.1 of the NTC 2008, where a NO_x-reducing device is to be included within the EIAPP certification, it must be recognized as a component of the engine, and its presence shall be recorded in the engine's Technical File.

1.4 Administrations are invited to take these Guidelines into account when certifying engines fitted with SCR.

2 GENERAL

2.1 Purpose

The purpose of these Guidelines is to provide guidance in addition to the requirements of the NTC 2008 for design, testing, surveys and certification of marine diesel engines fitted with an SCR system to ensure its compliance with the requirements of regulation 13 of MARPOL Annex VI.

2.2 Application

These Guidelines apply to marine diesel engines fitted with SCR for compliance with regulation 13 of MARPOL Annex VI.

2.3 Definitions

Unless provided otherwise, the terms in these Guidelines have the same meaning as the terms defined in regulation 2 of MARPOL Annex VI and in section 1.3 of the NTC 2008.

2.3.1 "Engine system fitted with SCR" means a system consisting of a marine diesel engine, an SCR chamber and a reductant injection system. When a control device on NO_x-reducing performance is provided, it is also regarded as a part of the system.

2.3.2 "Catalyst block" means a block of certain dimension through which exhaust gas passes and which contains catalyst composition on its inside surface to reduce NO_x from the exhaust gas.

2.3.3 "SCR chamber" means an integrated unit which contains the catalyst block(s) and into which flow exhaust gas and reductant.

2.3.4 "Reductant injection system" means a system which consists of the pump(s) to supply reductant to the nozzle(s), the nozzle(s) spraying reductant into the exhaust gas stream and control device(s) of the spray.

2.3.5 "AV (area velocity) value" means a value of the exhaust gas flow rate passing through the catalyst blocks (m^3/h) per total active surface area of the catalyst blocks in the SCR chamber (m^2). Therefore, the unit of AV value is (m/h). The exhaust gas flow volume is the volume defined at 0°C and 101.3 kPa.

2.3.6 "SV (space velocity) value" means a value of the exhaust gas flow rate passing through the catalyst block(s) (m^3/h) per total volume of the catalyst block(s) in the SCR chamber (m^3). Therefore, the unit of SV value is (1/h). The exhaust gas flow volume is the volume defined at 0°C and 101.3 kPa.

2.3.7 "Total volume of the catalyst block" means the volume (m^3) based on the outer dimensions of the catalyst block.

2.3.8 "LV (linear velocity) value" means a value of the exhaust gas flow rate passing through the catalyst blocks (m^3/h) per catalyst block's section (m^2) in a normal direction of exhaust gas flow. Therefore, the unit of LV value is (m/h). The exhaust gas flow volume is the volume defined at 0°C and 101.3 kPa.

2.3.9 "Block section" means the cross-sectional area (m^2) of the catalyst block based on the outer dimensions.

2.3.10 "NO_x reduction rate η" means a value deriving from the following formula. Unit of η is (%):

$$\eta = \frac{(c_{inlet} - c_{outlet})}{c_{inlet}} \cdot 100$$

Where: c_{inlet} is NO_x concentration (ppm) as measured at the inlet of the SCR chamber;

c_{outlet} is NO_x concentration (ppm) as measured at the outlet of the SCR chamber.

2.3.11 "Catalyst block casing or frame" means a casing or frame of an assembly (module) of several catalyst blocks.

3 PRE-CERTIFICATION PROCEDURE

3.1 General

3.1.1 Engine systems fitted with SCR should be certified in accordance with chapter 2 of the NTC 2008. The procedures provided by Scheme A or Scheme B of these Guidelines should be applied.

3.1.2 The applicant for certification should be the entity responsible for the complete engine system fitted with SCR.

3.1.3 The applicant should supply all necessary documentation, including the Technical File for the complete system, a description of the required onboard NO_x verification procedure and, where applicable, the description of the confirmation test procedure.

3.2 Technical File and onboard NO_x verification procedures

In addition to the information supplied in paragraph 3.1.3 of these Guidelines and items in section 2.4 of the NTC 2008, engine systems fitted with SCR should include the following information in the Technical File:

.1 reductant: component/type and concentration;

.2 reductant injection system including critical dimensions and supply volume;

.3 design features of SCR specific components in the exhaust duct from the engine exhaust manifold to the SCR chamber. The design features are to be specified by the applicant and may include, but are not limited to:

.1 any restrictions specified by the applicant relating to exhaust duct configuration/design, including the position and number of bends in the exhaust duct along with orientation and geometry, exhaust duct changes of diameter and arrangements fitted to manipulate exhaust flow, where applicable;

.2 minimum distance between reductant injection point(s) and SCR chamber;

.3 position of reductant injection equipment within the duct and the direction of reductant injection, e.g. counter flow or parallel flow;

.4 reductant mixing arrangements;

.5 reductant lances, nozzles, atomizing arrangement;

.6 inlet plenum design, top entry or bottom entry;

.7 where an SCR bypass arrangement is stipulated by the applicant, the control specifications, identification of the bypass valve and its control device; and

.8 where an integrated reductant injection and SCR chamber arrangement is supplied as a packaged item to be fitted into an exhaust duct, the parameters of such a unit which may affect NO_x emissions;

.4 catalyst block specification and arrangement in the SCR chamber. The details of the catalyst block specification and the arrangement of catalyst blocks within the SCR chamber may include, but are not limited to:

.1 installation of blocks within the SCR chamber, including the number of blocks, number of layers and the SCR chamber casing and frame to prevent exhaust gas slip;

.2 catalyst block geometry;

.3 limiting characteristics such as CPSI (cells per square inch) and ranges for physical parameters such as the space velocity (SV), area velocity (AV) and linear velocity (LV), or a part number or specification number specified by the applicant on the catalyst block;

.4 catalyst material: this may be identified by means of a part number or specification number. The means to ensure a correct catalyst block installed on board against the Technical File, where a part number or specification number specified by the applicant on the catalyst block casing or frame is acceptable;

.5 arrangement of soot-blowing equipment;

.6 inspection and access arrangements. The inspection of the SCR chamber should be limited to ensuring that the correct catalyst blocks are fitted during assembly of the SCR and the inspection of spare catalyst blocks can be accepted to demonstrate compliance at surveys other than at the initial assembly of the SCR; and

.7 any baffle plates or other devices installed within the SCR chamber for exhaust gas and reductant flow distribution;

.5 inlet parameters, including allowable exhaust gas temperature (maximum and minimum) at the inlet of the SCR chamber;

.6 cross-unit parameters: allowable pressure loss (Δp) between inlet and outlet of the SCR chamber and in the exhaust duct caused by SCR components. Where there is any element of the SCR system upstream and/or downstream of the SCR chamber which affects the allowable pressure loss, then this allowable pressure loss (Δp) is to be based on the entire SCR system;

.7 aspects related to the fuel oil quality resulting in continued compliance of the engine with the applicable NO_x emission limit to assure continued NO_x reduction may include, but are not limited to:

.1 the maximum allowable sulphur content of fuel oil which can be combusted, while maintaining compliance; and

.2 guidance on applicable fuel oil composition and fuel oil contaminants under operational conditions;

.8 factors related to the deterioration rate of SCR performance, e.g. exchange condition for SCR catalyst blocks and recommended exchange time of SCR catalyst blocks:

.1 where a reductant control strategy incorporates a NO_x measurement device, this is acceptable as a means of monitoring catalyst condition/degradation. A NO_x measurement device, incorporated in an SCR feedback or feed-forward reductant control system, should not be required to be in compliance with appendix III of the NTC 2008 if the suitability of this NO_x measurement device is proven by a comparison with measurements according to chapter 5 of NTC 2008.

The applicant should specify a procedure and/or calculation routine that utilizes the readings of the NO_x measurement device to generate criteria for the determination of the catalyst condition/ degradation.

The applicant should demonstrate that the outcome of the proposed method is sufficiently accurate to adequately monitor the catalyst condition/degradation. This may be achieved by comparing the outcome of the proposed method with the results from the same method, calculated with the readings from an analyser complying with 3.4 of appendix III of the NTC 2008, during an exhaust emission test conducted in accordance with chapter 5 of NTC 2008. The applicant should specify the accuracy of the NO_x measurement device based on a defined calibration procedure and/or exchange requirements for the device. The justified frequency of monitoring should be stated by the applicant.

The exchange criteria of catalyst blocks against the reading of the NO_x measurement device are to be specified by the applicant as well as the maintenance, service and calibration requirements for the NO_x measurement device. The criteria should ensure timely exchange of the catalyst blocks.

Depending on the proposed onboard verification procedure for the assessment of catalyst condition/degradation, an allowance may be given according to section 7.5 of these Guidelines. Generated alarms or failure codes, in case of exceeded threshold values as defined by the applicant, are to be provided;

.2 where a strategy without a NO_x measurement device is applied, the applicant should additionally specify periodical spot checks as the method to assess the NO_x reduction rate as an indicator for catalyst condition/degradation. The applicant is to provide the details of:

.1 the expected deterioration curve under expected operating conditions or the life of the catalyst under expected operating conditions;

.2 factors which can influence catalyst NO_x reduction efficiency; and

.3 guidance on how to assess catalyst NO_x reduction efficiency based on periodical spot checks or monitoring as specified by the applicant, if applicable; records are to be kept for inspection during annual, intermediate and renewal surveys. The frequency of periodical spot checks is to be defined by the applicant considering the expected deterioration of the catalyst. The frequency for spot-checks should be after installation and at least once every 12 months.

Periodical spot checks do not need to be witnessed by the Administration. In cases where spot checks are required, the checks should be performed at least at 50% of the rated power (for propulsion engines, 75% is preferable), and the guidance on how to assess catalyst condition/degradation should include the following items:

.1 procedure for spot checks:

.1 details of NO_x measurement device including calibration requirements. NO_x measurement device should meet the requirements of appendix III of the NTC 2008;

.2 performance of zero and span check;

.3 test condition (e.g. power and speed setting ranges as well as other applicable engine and SCR settings);

.4 a test report template for the data to be recorded;

.5 sampling probe position(s) for NO_x measurement;

.6 test procedures including time duration for "engine with SCR" stabilization and the NO_x emission measurement; and

.7 records and results of spot checks should be kept and logged in the record book of engine parameters and should be made available during the initial, annual, intermediate and renewal surveys.

.2 criteria to assess catalyst NO_x reduction rate in accordance with the specification as provided by the applicant; and

.3 other strategies on monitoring the catalyst condition/degradation are subject to the approval of the Administration. These strategies should be accepted only if they cover the entire SCR chamber with all catalyst blocks installed. Testing of single catalyst blocks after removing them from the SCR chamber should not be considered as representative for the entire SCR system;

.9 controlling arrangements and settings of the SCR, e.g. model, specification of control device. This is to include, but not be limited to:

.1 the reductant injection control strategy should include whether it is a feed-forward reductant injection control or feedback reductant injection control strategy;

.2 instrumentation and sensors which are part of the SCR control arrangement, as applicable;

.3 crew instructions for allowable adjustment of control parameters including details of how to prevent unauthorized alteration of the system configuration parameters, programmable logic controller (PLC) data, and central processing units (CPU) as applicable;

.4 where a NO_x measurement device is used, the following details should be included:

.1 type/model (identification number);

.2 calibration, zero and span check procedures and the periodicity of such checks, if applicable;

.3 zero and span gases to be carried on board if applicable; and

.4 servicing, maintenance and/or exchange requirements;

.5 where the engine system fitted with SCR has different operating modes (e.g. modes for Tier II and Tier III compliance separately), details of the control philosophy for selecting different modes of operation and recording the mode of operation together with means of changing between modes; and

.6 auxiliary control devices, as mentioned in regulation 13.9 and defined in regulation 2.4 of MARPOL Annex VI, respectively, may be used on engine systems fitted with SCR, covering starting and stopping, low load operation and reversing operation, subject to the approval of the Administration;

.10 measures to minimize reductant slip. The maximum reductant slip may be specified by the applicant. Supporting information, including reductant injection rates under certain engine loads, the catalyst temperature or exhaust gas temperature when reductant injection occurs, etc. may be included in order to prevent reductant slip from exceeding the specified maximum level. Reductant slip monitoring in the exhaust duct downstream of the SCR or an equivalent means may be accepted as a means to minimize reductant slip. Alternatively, means of alleviating reductant slip (for example, through the use of an ammonia slip catalyst or active catalyst thermal management) may be accepted as a means to minimize reductant slip;

.11 where the parameter check method is used as the verification procedure:

For systems without NO_x measurement devices, the applicant should provide details of the relationship between engine load and reductant consumption and the means of checking that reductant flow is appropriate. The Technical File should include proposals for maintaining records of reductant consumption and also reductant composition and quality. Records of reductant composition and quality may be based on delivery notes where these delivery notes include reductant concentration and quality parameters.

Reductant delivery notes may also be accepted for the purposes of verifying that the system has been operated by using reductant. In such cases, the reductant delivery notes should be made available at annual, intermediate and renewal surveys.
Where it is proposed to produce aqueous reductant on board, the recording system should consider records of feedstock deliveries and quality;

.12 any other parameter(s) as specified by the applicant; and

.13 a description of a method of storing records should be included for the purpose of maintenance, surveys and inspections:

.1 if paragraph 3.2.8.1 is applied as a means for monitoring catalyst condition/degradation, the readings from the NO_x measurement device documenting the deterioration rate of SCR performance, including threshold values, alarms or failure codes; or

.2 if paragraph 3.2.8.2 is applied as a means for monitoring catalyst condition/degradation, records and results of spot checks should be available on board; and

.3 for the parameter check method as described in paragraph 3.2.8.11, records of reductant composition and quality may be based on delivery notes where these delivery notes include reductant concentration and quality parameters. Reductant delivery notes may also be accepted for the purposes of verifying that the system has been operated using reductant. Where it is proposed to produce aqueous reductant on board, the recording system should consider records of feedstock deliveries and quality.

3.3 Measures to minimize reductant slip

When SCR uses urea solution, ammonia solution or ammonia gas as reductant, measures to prevent reductant slip should be provided to avoid the supply of an excessive amount of reductant in the system. The reductant injection system should be designed to prevent emissions of any harmful substance from the system.

3.4 Pre-certification procedure

Test and pre-certification of an engine system fitted with SCR should be conducted either by Scheme A (as given in section 5 of these Guidelines), or by Scheme B (as given in sections 6 and 7 of these Guidelines), as appropriate.

3.5 EIAPP certificate

3.5.1 An Engine International Air Pollution Prevention (EIAPP) certificate (see appendix I of NTC 2008) should be issued by the Administration after approval of the Technical File.

3.5.2 When an applicant chooses Scheme B for pre-certification, the IAPP initial survey should not be completed until the onboard initial confirmation test provides compliant results. The applicant remains the responsible entity until final acceptance of the system.

3.5.3 When the engine is to be certified to both Tier II and Tier III, the EIAPP certificate should be completed for both Tier II and Tier III with a single Technical File covering both Tier modes.

3.5.4 In the context of the EIAPP certificate the term "Engine manufacturer" is the applicant for the certification of a system consisting of a marine diesel engine, an SCR chamber and a reductant injection system in accordance with the provisions of paragraph 4.4.4 of NTC 2008.

4 FAMILY AND GROUP CONCEPTS FOR ENGINE SYSTEMS FITTED WITH SCR

4.1 The requirements in chapter 4 of NTC 2008 apply equally to engine systems fitted with SCR.

4.2 The parent engine is to be the engine system fitted with SCR with the highest NO_X emission value of the group/family as specified in paragraphs 4.3.9.1 and 4.4.8.1 of NTC 2008. In cases where there is more than one combined engine/SCR system with the same highest NO_x emission value given to two decimal places (cycle value in g/kWh) within an engine family or an engine group, the parent engine is the system with the highest raw NO_x value emitted from the engine.

4.3 The parent engine for Tier II compliance is not necessarily the same parent of the combined engine/SCR system for Tier III compliance.

5 TEST PROCEDURES FOR SCHEME A

5.1 General

5.1.1 A test for a combined system of an engine fitted with an SCR in Scheme A is to ensure compliance with the applicable NO_x emission limits of MARPOL Annex VI, as required. The test bed measurement procedures of chapter 5 of NTC 2008 should apply.

5.1.2 Notwithstanding paragraph 5.1.1, the applicant may choose to test the combined system of an engine fitted with an SCR with a bypass arrangement without that bypass installed for the purpose of test bed measurement. Any effect on the fluid dynamics or reductant distribution caused by the absence of the by-pass arrangement is to be presented by the applicant.

5.2 Calculation of gaseous emissions

5.2.1 The calculation method in section 5.12 of NTC 2008 is also applied to engine systems fitted with SCR. No allowance is made for the reductant solution injected into the exhaust gas stream in respect of its effect on exhaust gas mass flow rate calculation (appendix VI) or dry/wet correction factor (equation (11), paragraph 5.12.3.2.2 of NTC 2008). The NO_x correction factor for humidity and temperature (equations (16) or (17), paragraphs 5.12.4.5 and 5.12.4.6, respectively, of NTC 2008) should not be applied.

5.2.2 For an engine system fitted with SCR, the following parameters should be measured and recorded in the engine test report in accordance with section 5.10 of NTC 2008:

.1 injection rate of reductant at each load point (kg/h);

.2 exhaust gas temperature at the inlet and outlet of the SCR chamber (°C);

.3 pressure loss (kPa): it is necessary to measure the pressure at the inlet and at the outlet of the SCR chamber and to calculate pressure loss Δp. It would also be permissible to measure the pressure loss Δp of the SCR chamber with a differential pressure sensor. The allowable Δp limit should be confirmed; and

.4 other parameter(s) as specified by the Administration.

6 TEST PROCEDURES FOR SCHEME B

6.1 General

6.1.1 A test for an engine system fitted with SCR in Scheme B is to ensure that the system complies with the applicable NO_x emission limits in MARPOL Annex VI, as required. The test procedures in Scheme B are as follows:

.1 an engine is tested to obtain the NO_x emission value (g/kWh) in accordance with paragraph 6.2.1 of these Guidelines;

.2 the SCR NO_x reduction rate may be calculated by modelling tools, taking into account geometrical reference conditions, chemical NO_x conversion models as well as other parameters to be considered;

.3 for every type of catalytic element, an SCR chamber, not necessarily to full scale, is to be tested in accordance with section 6.3 of these Guidelines in order to generate data for the calculation model as that used in paragraph 6.1.1.2 of these Guidelines;

.4 the NO_x emission from the engine system fitted with SCR, which is calculated in accordance with section 6.4 of these Guidelines using the NO_x emission value from the engine and the NO_x reduction rate of the SCR chamber; at this point the Technical File will be completed and this NO_x emission value will be entered into the supplement of the EIAPP certificate; and

.5 the NO_x emission performance of the engine combined with the SCR is verified by a confirmation test in accordance with the procedure in paragraph 7.5 of these Guidelines.

6.1.2 The calculation of gaseous emissions in paragraph 6.1.1.1 of these Guidelines should be undertaken in accordance with paragraph 5.2.1 of these Guidelines.

6.2 Verification test procedures for an engine

6.2.1 The purpose of the test of an engine is to establish the emission values for use in section 6.4 of these Guidelines. These measurements should be in accordance with chapter 5 of NTC 2008.

6.2.2 Paragraph 5.9.8.1 of the NTC 2008 requires engine conditions to be measured at each mode point, for an engine system. This equally applies in the case of an engine fitted with SCR. Additionally, exhaust gas temperature at the intended inlet of the SCR chamber should be determined and recorded in the test report as required by section 5.10 of NTC 2008.

6.3 Test procedures for SCR chambers

6.3.1 General

6.3.1.1 The SCR chamber for validation testing may be either a full-scale SCR chamber or a scaled version. A SCR chamber should demonstrate the reduction in NO_x concentrations (ppm) expected in exhaust gas measured in section 6.2 of these Guidelines. Therefore, the NO_x reduction rate of the SCR chamber should be determined for each individual mode point. Where undertaken on a scaled version of the SCR chamber the scaling process should be validated to the satisfaction of the Administration.

6.3.1.2 The scaling process is to correspond with the modelling tool of paragraph 6.1.1.2 of these Guidelines, and take into account geometrical reference conditions, and chemical NO_x conversion models, and other parameters which have an influence on the NO_x conversion rate in the modelling tool. If the scaling process could not be validated satisfactorily by theoretical analysis or calculations taking into consideration the complex conditions in the SCR chamber, such as uniformity of gas speed and reductant, a combined engine and SCR system validation test in accordance with Scheme A should be undertaken.

6.3.1.3 The modelling tool of paragraph 6.1.1.2 of these Guidelines is acceptable for use in other engine groups which operate within the same defined boundary conditions.

6.3.2 Test conditions at each mode point

Exhaust gas, catalyst, reductant and an injection system should satisfy the following conditions at each mode point:

.1 **Exhaust gas flow**
Exhaust gas flow rate for the test should be scaled accordingly to account for the dimension of the catalyst model.

.2 **Exhaust gas component**
Exhaust gas for the test should either be diesel engine exhaust gas or simulated gas.

Where diesel exhaust gas is used, it should correspond, in terms of concentrations, to the exhaust gas in section 6.2 of these Guidelines, in terms of NO_x, O_2, CO_2, H_2O and SO_2 (±5% of the required concentration for each emission species).

Where simulated gas is used, it should correspond, in terms of concentrations, to the exhaust gas in section 6.2 of these Guidelines, in terms of NO, NO_2, O_2, CO_2, H_2O and SO_2 (±5% of the required concentration for each emission species) balance N_2.

An exemption for one or more of the above-mentioned gas species' concentration requirements may be allowed subject to a demonstration test showing that the gas or gases do not affect the NO_x reduction rate by more than 2%.

.3 **Exhaust gas temperature**
The temperature of exhaust gas used for the test should correspond to the temperatures obtained from testing in section 6.2 of these Guidelines, ensuring that the SCR chamber is activated at every load point, other than as provided for by 3.1.4 of the NTC 2008, and that no ammonia bisulphate formation, or reductant destruction, takes place.

.4 **Catalyst blocks and AV, SV value**
The catalyst blocks used in the test should be representative of the catalyst blocks to be used in the SCR chamber in service. AV, SV or LV value should, in the case of full scale tests, be within -5% or above of the required value as obtained in testing from section 6.2 of these Guidelines. In the case of scaled tests it should correspond to the above.

.5 **Reductant**
The reductant concentration on the surface of the tested catalyst should be representative of the reductant concentration on the surface of the catalyst during actual engine operation. Ammonia gas may be used as a reductant for the SCR chamber test, provided that it results in an equivalent concentration on the catalyst surface.

6.3.3 Stability for measurement

All measurements should be recorded after they have stabilized.

6.3.4 List of data to be derived from the model

6.3.4.1 Operating data which is to be given in the Technical File should be derived from the modelling process or otherwise justified.

6.3.4.2 Exhaust gas analysers should be in accordance with appendix III and appendix IV of NTC 2008 or otherwise to the satisfaction of the Administration.

6.3.5 Test report for SCR chamber

Data recorded under paragraph 6.3.1.1 of these Guidelines should be recorded in the test report as required by section 5.10 of NTC 2008.

6.4 Calculation of the specific emission

6.4.1 The NO_x emission value of the engine system fitted with SCR should be calculated as follows:

$$\text{gas}_x = \frac{\sum_{i=1}^{i=n} \left((100 - \eta_i)/100 \right) \cdot q_{mgas_i} \cdot W_{F_i}}{\sum_{i=1}^{i=n} \left(P_i \cdot W_{F_i} \right)}$$

Where: η_i NO_x reduction rate (%) derived in accordance with section 6.3 of these Guidelines;

q_{mgas_i} = Mass flow of NO_x gas measured in accordance with section 6.2 of these Guidelines;

W_{F_i} = Weighting factor;

P_i = Measured power at individual mode points in accordance with section 6.2 of these Guidelines.

The weighting factors and number of modes (n) used in the above calculation shall be according to the provisions of section 3.2 of the NTC 2008.

6.4.2 The NO_x emission value (g/kWh) calculated in accordance with paragraph 6.4.1 of these Guidelines should be compared to the applicable emission limit. This emission value is entered into 1.9.6 of the Supplement to the EIAPP certificate (appendix I of NTC 2008).

6.5 Test report to be submitted to the Administration

The test report referenced under paragraphs 6.2.2 and 6.3.5 of these Guidelines, together with the data from section 6.4 of these Guidelines should be consolidated into the overall documentation to be submitted to the Administration.

7 ONBOARD CONFIRMATION TEST FOR SCHEME B

7.1 After installation on board of an engine system fitted with SCR and before entry into service an initial confirmation test should be performed on board.

7.2 The engine system fitted with the SCR should be verified as corresponding to the description given in the Technical File.

7.3 The confirmation test should be undertaken as close as possible to 25%, 50% and 75% of rated power, independent of test cycle.

7.4 At each mode point of the confirmation test the operating values as given in the Technical File should be verified.

7.5 NO_x emission concentrations should be measured at the inlet and outlet of the SCR chamber. The NO_x reduction rate should be calculated. Both values should either be dry or wet. The value obtained for NO_x reduction rate should be compared to the initial confirmation test required value at each mode point as given in the Technical File. Reduction efficiency values obtained at each of the test points should not be less than the corresponding values as given in the Technical File by more than 5%.

7.6 The NO_x analyser should meet the requirements of chapter 5 of NTC 2008.

7.7 When an engine system fitted with SCR is in a group defined in chapter 4 of these Guidelines, the confirmation test should be conducted only for the parent engine system of the group. Where the parent engine system of the group is not the first one to complete the onboard confirmation test as required by chapter 7 of these Guidelines, the onboard confirmation test is to be done for all installed engine systems within the engine group unless it is an identical NO_x specification member engine or the parent engine system has been installed and tested successfully. Where the parent engine system is not available to be installed on board, the first installed member engine system of the engine group can be chosen and adjusted to the worst-case NO_x emission for confirmation test on board instead. The test results should be verified as described in the Technical File.

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ANNEX 4

RESOLUTION MEPC.400(83)
(adopted on 11 April 2025)

AMENDMENTS TO THE 2021 GUIDELINES ON THE OPERATIONAL CARBON INTENSITY REDUCTION FACTORS RELATIVE TO REFERENCE LINES (CII REDUCTION FACTORS GUIDELINES, G3) (RESOLUTION MEPC.338(76))

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING that regulation 28.5 of MARPOL Annex VI requires CII reduction (Z) factors to be established for each ship type to which regulation 28 is applicable,

RECALLING that, at its seventy-sixth session, it adopted, by resolution MEPC.338(76), the *2021 Guidelines on the operational carbon intensity reduction factors relative to reference lines (CII reduction factors guidelines, G3)*, in which Z factors for the years 2027 to 2030 were not specified at the time of adoption,

NOTING that regulation 28.11 of MARPOL Annex VI requires that the review of CII regulations shall be completed by the Organization by 1 January 2026,

HAVING CONSIDERED, at its eighty-third session, draft amendments to the *2021 Guidelines on the operational carbon intensity reduction factors relative to reference lines (CII reduction factors guidelines, G3)*,

1 ADOPTS amendments to the *2021 Guidelines on the operational carbon intensity reduction factors relative to reference lines (CII reduction factors guidelines, G3)*, as set out in the annex to the present resolution;

2 INVITES Administrations to take the aforementioned amendments into account when developing and enacting national laws which give force to and implement requirements set forth in regulation 28.4 of MARPOL Annex VI;

3 REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the annexed Guidelines to the attention of masters, seafarers, shipowners, ship operators and any other interested parties;

4 AGREES to keep the Guidelines under review in light of experience gained with their implementation and in light of the further review of the CII framework.

ANNEX

AMENDMENTS TO THE 2021 GUIDELINES ON THE OPERATIONAL CARBON INTENSITY REDUCTION FACTORS RELATIVE TO REFERENCE LINES (CII REDUCTION FACTORS GUIDELINES, G3)

4 The reduction factors for the required annual operational CII of ship types

1 Table 1 is replaced by the following:

"Table 1: Reduction factor (Z%) for the CII relative to the 2019 reference line

Year	Reduction factor relative to 2019
2023	5%
2024	7%
2025	9%
2026	11%
2027	13.625%
2028	16.250%
2029	18.875%
2030	21.500%

"

***

ANNEX 6

RESOLUTION MEPC.401(83)
(adopted on 11 April 2025)

AMENDMENTS TO THE 2024 GUIDELINES FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP)
(RESOLUTION MEPC.395(82))

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING that regulation 26 of MARPOL Annex VI requires each ship to keep on board a Ship Energy Efficiency Management Plan (SEEMP), to be developed and reviewed, taking into account the guidelines adopted by the Organization,

RECALLING that, at its eighty-second session, it adopted, by resolution MEPC.395(82), the 2024 *Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP)*,

HAVING CONSIDERED, at its eighty-third session, draft amendments to the *2024 Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP)*,

1 ADOPTS amendments to the *2024 Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP)*, the text of which is set out in the annex to the present resolution;

2 INVITES Administrations to take the annexed Guidelines as amended into account when developing SEEMP Part II in accordance with the amendments to appendix IX of MARPOL Annex VI as adopted by resolution MEPC.385(81) on information to be submitted to the IMO Ship Fuel Oil Consumption Database;

3 REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the annexed Guidelines to the attention of masters, seafarers, shipowners, ship operators and any other interested parties.

ANNEX

AMENDMENTS TO THE 2024 GUIDELINES FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP) (RESOLUTION MEPC.395(82))

7 GUIDANCE ON METHODOLOGY FOR COLLECTING DATA ON FUEL OIL CONSUMPTION, DISTANCE TRAVELLED AND HOURS UNDER WAY AND OTHER ITEMS

1 In paragraph 7.1, the term "boilers" is replaced by "fired boilers".

2 In the chapeau of paragraph 7.3, the term "boilers" is replaced by "fired boilers".

3 A new section "Under way and not under way" is added after the existing section "Conversion factor C_F" and before the section "Distance travelled", as follows:

"**Under way and not under way**

7.6 Under way is defined as the period between full ahead on passage (FAOP) and end of sea passage (EOSP) as per the *Guidelines for setting up a maritime single window* (FAL.5/Circ.42/Rev.3).

Full ahead on passage is more commonly referred to in performance monitoring systems as begin of sea passage, which is also defined in the *IMO Compendium on facilitation and electronic business* (IMO Compendium) under IMO 0597 (Code EV10).

"Not under way" is therefore the period between end of sea passage and full ahead on passage.

Note that canal passage, that is the period between begin canal passage (EV08) and end canal passage (EV09) which are also defined in the IMO Compendium under IMO 0597 should be considered not under way due to frequent manoeuvring, acceleration and deceleration."

Distance travelled

4 Existing paragraphs 7.6 and 7.7 are renumbered as 7.7 and 7.8 respectively, and the renumbered sub-paragraph 7.7.2 is replaced by the following:

".2 the distance travelled while the ship is under way should be included in the aggregated data of distance travelled for the calendar year; and"

Hours under way

5 Existing paragraph 7.8 is renumbered as 7.9 and replaced by the following:

"7.9 Appendix IX of MARPOL Annex VI specifies that hours under way should be submitted to the Administration. Hours under way should be an aggregated duration while the ship is under way."

6 Existing paragraphs 7.9 to 7.12 are renumbered as 7.10 to 7.13 respectively.

APPENDIX 2 SAMPLE FORM OF SHIP FUEL OIL CONSUMPTION DATA-COLLECTION PLAN (PART II OF THE SEEMP)

7 Section 4 is replaced by the following:

"**4 Ship engines and other fuel oil consumers and fuel oil types used**

	Engines or other fuel oil consumer type	Power	Fuel oil types
1	Type/model of main engine	(kW)	
2	Type/model of auxiliary engine	(kW)	
3	Fired boiler	(…)	
4	Inert gas generator	(…)	
5	Others (Specify)	(…)	

"

8 Section 6 is replaced by the following:

"**6 Method to measure fuel oil consumption**

The applied method for measurement of total fuel consumption for this ship is given below. The description explains the procedure for measuring data and calculating annual values, measurement equipment involved, etc.

Method	**Description**

The applied methods for measurement for each consumer type of this ship are given below. The description explains the procedure for measuring data and calculating annual values, measurement equipment involved, etc.

Engines or other fuel oil consumer type	**Method**	**Description**
Type/model of main engine		
Type/model of auxiliary engine		
Fired boiler		
Others (Specify)		

"

***

ANNEX 7

RESOLUTION MEPC.402(83)
(adopted on 11 April 2025)

GUIDELINES FOR TEST-BED AND ONBOARD MEASUREMENTS OF METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O) EMISSIONS FROM MARINE DIESEL ENGINES

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO that, at its eightieth session, it adopted, by resolution MEPC.377(80), the *2023 IMO Strategy on Reduction of GHG Emissions from Ships* (2023 IMO GHG Strategy) setting out the levels of ambition for the international shipping sector in reducing GHG emissions,
NOTING that the 2023 IMO GHG Strategy provides that in order to support the global availability and uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources, the Organization may consider and analyse measures to address emissions of methane (CH_4) and nitrous oxide (N_2O),

HAVING CONSIDERED, at its eighty-third session, draft guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines,

1 ADOPTS the *Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines*, as set out in the annex to the present resolution;

2 INVITES Member States to encourage shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested groups to voluntarily apply these Guidelines when undertaking measurements, calculation and reporting of CH_4 and/or N_2O emission values from marine diesel engines;

3 ALSO INVITES Member States to share data gathered in applying these Guidelines to future sessions of the Committee;

4 AGREES to keep these Guidelines under review in light of the experience gained with their implementation.

ANNEX

GUIDELINES FOR TEST-BED AND ONBOARD MEASUREMENTS OF METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O) EMISSIONS FROM MARINE DIESEL ENGINES

1 Introduction

1.1 The purpose of these Guidelines is to specify the protocol for test-bed and onboard measurements, calculation and reporting of methane (CH_4) and/or nitrous oxide (N_2O) emission values from marine diesel engines, as well as documentation and verification of CH_4 and/or N_2O emission values.

1.2 The measurements, calculations and reporting for CH_4 and/or N_2O emission values should be carried out in accordance with the NO_x Technical Code 2008 as amended, (NTC 2008) other than as specifically provided for in the protocol set out in appendix 1 of these Guidelines. All references in appendix 1 are to NTC 2008.

1.3 For onboard measurements, the protocol set out in appendix 1 may be accepted for an Individual Engine or for an Engine Group represented by the Parent Engine. It should not be accepted for an Engine Family without further justifications. For test-bed measurements, the protocol may also be accepted for an Engine Family.[1]

2 Information to be included in the CH_4 and/or N_2O file

2.1 The applicant for the establishment of the emission values should prepare a CH_4 and/or N_2O file that should contain the following information:

.1 details of the engine as tested should include but are not limited to:

.1 model and designation;

.2 rated power and rated speed;

.3 listing of NO_x critical components as fitted and settings / operating values as applied including, for CH_4, NO_x certified maximum liquid-to-gas fuel ratios across load range; and

.4 other components and settings / operating values which affect CH_4 and/or N_2O emissions;

.2 details, including drawings of exhaust system, showing sampling position(s);

.3 where C_{slip} is reported, including crankcase emissions, details of how that was determined should be provided;

.4 a copy of the relevant engine test data, as given in appendix 2 of these Guidelines and any additional data to fully define the engine performance and enable calculation of the gaseous emissions of CH_4 and/or N_2O. For test-bed measurements, this information can also be provided in the test report as referred to in section 5.10 of the NTC 2008;

[1] The composition of an Engine Family or an Engine Group as defined in NTC 2008 is set solely by factors affecting NO_x emissions; those cannot be assumed to be equally applicable to CH_4 and/or N_2O emissions. In some instances, such as liquid-to-gas fuel ratio, the requirements for highest NO_x will tend to result in lowest CH_4.

.5 where a CH_4 and/or N_2O reducing device or system is used, the CH_4 and/or N_2O file should contain documentation on the emission abatement device, giving details of its intended purpose, manner of operation, critical components and settings / operating values together with information on any consumables necessary for its operation. Where exhaust gas samples are to be drawn from both before and after the device, details of analyser changeover arrangements and sequencing should be given if only one set of analysers is to be used.

3 Verification of the CH_4 and/or N_2O emission values

3.1 In order to confirm that the emission values have been established in accordance with these Guidelines, the CH_4 and/or N_2O file should be submitted to the Administration for verification.

3.2 On receipt of the CH_4 and/or N_2O file from the applicant and satisfactory completion of the verification, a Statement of emission values for CH_4 and/or N_2O should be issued by the Administration. The form of Statement of emission values for CH_4 and/or N_2O is set out in appendix 3 of these Guidelines.

APPENDIX 1

PROTOCOL FOR TEST-BED AND ONBOARD MEASUREMENTS OF CH_4 AND/OR N_2O EMISSIONS FROM MARINE DIESEL ENGINES BASED ON THE NO_x TECHNICAL CODE 2008

Explanatory note:
This protocol does not amend mandatory provisions in NTC 2008. Measurements, calculations and reporting of CH_4 and/or N_2O emission values should be carried out in accordance with NTC 2008, other than as specifically provided for in the protocol.

<table>
<tr><th>Paragraph of NO_x Technical Code 2008</th><th>Addition to NTC 2008</th></tr>
<tr><td>Abbreviations, subscripts and symbols</td><td></td></tr>
<tr><td></td><td>In table 1, the definitions of N_2O and NMHC are added as follows:
<table>
<tr><th>Symbol</th><th>Definition</th></tr>
<tr><td>N_2O</td><td>Nitrous oxide</td></tr>
<tr><td>NMHC</td><td>Non-methane hydrocarbons</td></tr>
</table></td></tr>
<tr><td></td><td>In table 2, abbreviations for FTIR, NDUV, NMC are added as follows:
<table>
<tr><th>Symbol</th><th>Definition</th></tr>
<tr><td>FTIR</td><td>Fourier transform infrared (analyser)</td></tr>
<tr><td>NDUV</td><td>Non-dispersive ultraviolet (analyser)</td></tr>
<tr><td>NMC</td><td>Non-methane cutter</td></tr>
</table>
Note: NMC = FID with non-methane cutter</td></tr>
<tr><td></td><td>In table 3, symbols and terms for C_{fCH4}, C_{fN2O} and $C_{slip\text{-}CH4}$ are added as follows:
<table>
<tr><th>Symbol</th><th>Term</th></tr>
<tr><td>C_{fCH4}</td><td>g CH_4 / g fuel[2]</td></tr>
<tr><td>C_{fN2O}</td><td>g N_2O / g total fuel (applies to both gas and liquid fuels)</td></tr>
<tr><td>$C_{slip\text{-}CH4}$</td><td>% (of the mass of the methane containing fuel used by the energy converter)</td></tr>
</table>
Note: $C_{slip\text{-}CH4}$ is a factor accounting for CH_4 (expressed in % of mass of methane containing fuel consumed in the energy converter) which is emitted from the energy converter (including fuel from combustion chamber/oxidation process and from crankcase, as appropriate).</td></tr>
</table>

[2] For methane containing fuels, the $C_{slip\text{-}CH4}$ is covering the role of C_{fCH4}, so C_{fCH4} is set to zero for these fuels. For the purpose of these Guidelines, non-methane gas fuels should be regarded as liquid fuels.

Chapter 3	
3.2 Test cycles and weighting factors to be applied	For the test cycles E2 and E3, the specific emission at the 10% mode point or the lowest mode point at which gas fuel would be used should be measured and reported in addition to the existing mode points. **For onboard measurements only**: In setting the load points of the test cycle to be followed the provisions of 6.4.6.7 should apply. In the case of the 100% load point this should, subject to the engine emission test plan, be allowed to be no lower than 85% of rated power. If that value cannot be achieved, then the test should be deferred to such time that at least that power level can be achieved. The test cycle 100% power weighting factor under 3.2 should be applied irrespective of the actual power developed at that load point.
Chapter 5	
5.2.5.3 Positioning of abatement device or system	Requirements do not necessarily apply to CH_4 and/or N_2O abatement device or system. The installation requirements of the device should be respected and provided in the CH_4 and/or N_2O file.
5.6.1 Permissible deviations of instruments for engine-related parameters and other essential parameters	**For onboard measurements only**: Engine performance and ambient condition monitoring equipment requirements should be in accordance with the requirements of 6.4.5.1.
5.9.2	CH_4 and/or N_2O should be added to the list of main exhaust components. In the case of CH_4, this means CH_4 as reported by the measurement device before correction for NMC efficiency.
5.9.3.2 Exhaust gas temperature at sample probe for HC	For the measurement of CH_4 and/or N_2O, there are no minimum temperature requirements.
5.9.6.2 Test sequence	**For onboard measurements only**: At each load point of a test cycle the provisions of 6.4.6.8 should apply rather than those of 5.9.6.2. In the case of the E3 test cycle, if the actual propeller curve differs from the E3 curve, the load point used should be set using the measured engine power.
5.11 Data evaluation for gaseous emissions	In addition to the concentrations for the species to be determined as specified by 5.11 of NTC 2008, the concentrations of CH_4 and/or N_2O are to be determined. The averaged results are to be given in ppm.
	Where the NMC methane efficiency is not 0% and/or the NMC ethane efficiency is not 100% the CH_4 concentration to be used in equation 18a is calculated as follows: $$c_{NMHC} = \frac{c_{HC\,(w/oCutter)} \cdot (1 - Em) - c_{HC\,(wCutter)}}{Ee - Em}$$

Where:

c_{HC} *(wCutter)* HC concentration with sample gas through NMC (ppmC1)

c_{HC} *(w/oCutter)* HC concentration with NMC bypassed – i.e. usual HC reading (c_{HC}) (ppmC1)

Em NMC methane efficiency – appendix IV, 8.5.1

Ee NMC ethane efficiency – appendix IV, 8.5.2

CH_4 concentration:

$$c_{CH4} = c_{HC} - c_{NMHC}$$

5.12.5.1 Calculation of the emission mass flow rates

For the calculation of the emission mass flow rates in 5.12.5.1, u_{gas} values for N_2O and/or CH_4 should be calculated using table 5 as extended:

Gas		HC	CH_4	N_2O
ρ_{gas} kg/m^3		*	0.716	1.9631
	ρ_e†	Coefficient u_{gas}‡		
Liquid fuel**	1.2943	0.000479	0.000553	0.001517
Rapeseed Methyl Ester	1.2950	0.000536	0.000553	0.001516
Methanol	1.2610	0.001133	0.000568	0.001557
Ethanol	1.2757	0.000805	0.000561	0.001539
Natural gas	1.2661	0.000558*	0.000565	0.001551
Propane	1.2805	0.000512	0.000559	0.001533
Butane	1.2832	0.000505	0.000558	0.001530

* In the case of HC emissions when using natural gas as the fuel, the given u_{gas} value of 0.000558 should be used for NMHC on the basis of CH2.93. For total HC, the u_{gas} of CH_4 should be used.

5.12.5.2 The CH_4 and/or N_2O concentration to be entered into equation 18a is the value from 5.11 on a wet basis.

5.12.6 Calculation of the specific emission	Calculate C_{fCH4} (g/kg fuel and g/kWh), C_{fN2O} (g/kg fuel and g/kWh) and $C_{slip\text{-}CH4}$ (% of the mass of the methane containing fuel used by the engine) for each load point where emissions are measured. $C_{fgas} = q_{mgas} / fuel\ flow$ $C_{slip\text{-}CH4} = (q_{mCH4} / fuel\ flow) \cdot 100$ Calculate the average weighed emissions $C_{fgas} = \sum\_i=1...n\ (q_{mgas} \cdot W_{Fi}) / sum\_i=1..n\ (q_{fuel,i} \cdot W_{Fi})$ With $q_{fuel,i}$ being the fuel flow at each mode point. $C_{slip\text{-}CH4} = \sum\_i=1...n\ (\ q_{mCH4} \cdot W_{Fi}) / 10 / sum\_i=1..n\ (q_{fuel,i} \cdot W_{Fi})$ q_{mgas} (g/h): see section 5.12.5.2 of the NTC 2008, equation 18a Fuel flow (kg/h) as measured.
Appendix III	
	Section 1.1 CH_4 and/or N_2O are added to the list of components included in the exhaust gas analysis system.
	Figure 1 • For arrangements of exhaust gas analysis measurement systems for the measurement of CH_4, refer to ISO 8178-1 section 7.4.4. • NMC and N_2O analyser should be arranged, installed and operated in accordance with the respective manufacturer's recommendations.
	Section 1.2 Analysers for CH_4 and N_2O: see section 3
	Section 3 **3.6 Methane (CH_4) analysis** The reference method for CH_4 should be FID + NMC. Other principles / systems should be accepted if proven against FID+NMC with exhaust gases of the compositions to be measured. It should be ensured that the HC / CH_4 analyser(s) to be used have duly calibrated ranges for the respective concentrations to be measured. The NMC should have the capacity to handle the expected CH_4 and NMHC concentrations.

	3.7 Nitrous oxide (N_2O) analysis An FTIR analyser, an NDIR (non-dispersive infrared) analyser, laser infrared analyser or NDUV analyser may be used in accordance with the instrument supplier's instructions. Note: According to sections 5.4.2 and 5.4.3 of the NTC 2008, other systems or analysers may, subject to the approval of the Administration, be accepted if they yield equivalent results to that of the equipment referenced.
Appendix IV	**Calibration of the analytical and measurement instruments**
	Requirements of table 1 or table 3 regarding fuel measurement device apply separately to both liquid fuel meter and gas fuel meter.
	In addition to the calibration procedures of appendix IV of the NTC 2008, relevant parts of ISO 8178-1 for calibration of CH_4 and/or N_2O measurement instruments should be applied. FID should be calibrated with NMC bypassed with NMC efficiencies E_e and E_m determined separately.
	Section 2 "C_2H_6 and purified synthetic air" is added to 2.2.1.5. A new sub-paragraph "2.2.1.6 N_2O and purified nitrogen" is added after the existing 2.2.1.5.
	Section 5 N_2O is added to the list of analysers in the first sentence of 5.4.2.
8.4	For measurement of N_2O, a new section 8.4 applies
8.4.1	The interference should be checked prior to first use of an analyser and after major servicing or updating of software.
8.4.2	In those cases where the analyser applies compensation algorithms which use as inputs the concentrations of other measured gases those measurements should be undertaken concurrently with this verification check.
8.4.3	For NDIR - The potential for cross interferences effects of CO, CO_2, H_2O, CH_4 and SO_2 as applicable should be checked.
8.4.3.1	Apart from H_2O the interference species are dependent on the selected N_2O absorption band used by the device which should be known. From that knowledge good engineering judgement should be used to determine the interference gases to be used based on those which may be expected to be present in the exhaust gases to be measured.

8.4.4	For FTIR or Laser Infrared – The inference gases depend on the selected N_2O absorption band used by the device which should be known. Based on that knowledge good engineering judgement should be used to determine the interference gases to be used.
8.4.5	The combined effect of the interference gases should not be more 1.0 µmol/mol.
8.4.6	Verification procedure: .1 The concentrations of the interference span gases as identified from 8.4.3 or 8.4.4 should be at least as high as the maximum values to be encountered in service. Those interference gases may be presented in the form of a multi-component span gas. .2 The N_2O analyser is started, operated, zeroed and spanned as in service. .3 Humified interference test gas should be fed into the analyser. That test gas should be generated by bubbling the multi-component span gas through distilled H_2O in a sealed container. If the sample is not treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum when in service. If the sample is treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum based on the dryer outlet temperature when in service. .4 The water mole fraction of the test gas should be determined from measurements taken as close as possible to the analyser inlet. Those measurements may be dew point and absolute pressure. .5 Condensation in the piping leading from the container generating the humidified test gas to the analyser should be minimized by maintaining an adequate minimum temperature. .6 Following stabilization, the analyser output should be recorded for 30 s. The arithmetic mean response over that period should be compared with the limit in 8.4.5.
8.4.6.1	As an alternative to the multi-component span gas in 8.4.6 individual span gases may be run separately. Where an interference gas concentration is higher than that to be measured in service the determined interference value should be scaled down by the ratio of in-service maximum / span concentration. Where the H_2O concentration is below that to be measured in service, but not below 0.025 mol/mol H_2O content, the determined

	interference may be scaled up by the ratio of maximum in-service value / the value used. The sum of the individual interferences should be compared with the limit in 8.4.5.
8.4.7	An interference verification check report documenting the procedure as followed, including the rational for the interference gases used and their concentrations, and the outcomes of that procedure is to be prepared and should be available as may be required.
8.4.8	Alternative approaches to the verification of N_2O analyser interference may be acceptable. Where so used the justification for the approach taken should be included in the report as required by 8.4.7. Irrespective of the procedure followed the limit given by 8.4.5 remains applicable.
8.5	**Efficiency of the non-methane cutter (NMC)**
	The NMC is used for the removal of the non-methane hydrocarbons from the sample gas by oxidizing all hydrocarbons except CH_4. Ideally, the conversion rate for CH_4 is 0% and for the other hydrocarbons, as represented by ethane, is 100%. Since the performance of NMC can deteriorate rapidly and without warning if operated outside certain ranges of gas concentrations and temperature ranges, the efficiency of the NMC should be checked as part of the pretest verification procedures under 6.1 and again on completion of the measurement exercise (at the time of rechecking the analysers in accordance with 5.9.9 of NTC 2008) with the average of the two *Em* and *Ee* values so obtained being used to correct the measured CH_4 concentrations. For onboard measurement, the efficiency of the NMC may be assessed in a laboratory before and after the measurement exercise. With the agreement of the Administration, alternative approaches to the assessment of NMC efficiency may be accepted. Methane efficiency < 15% Ethane efficiency > 98%
8.5.1	**NMC methane efficiency**
	Methane calibration gas at a concentration typical of that to be measured is flowed through the FID analyser with and without the NMC bypassed. The methane efficiency, *Em*, is determined as: $$Em = 1 - \frac{C_M\,(wCutter)}{C_M\,(w/oCutter)}$$

	Where: C_M *(wCutter)* HC concentration with CH_4 flowing through the NMC (ppmC1) C_M *(w/oCutter)* HC concentration with CH_4 bypassing NMC (ppmC1)
8.5.2	**NMC ethane efficiency**
	Ethane calibration gas at a concentration typical of the expected non-methane hydrocarbon concentration to be measured is flowed through the FID analyser with and without the NMC bypassed. The ethane efficiency, *Ee*, is determined as: $Ee = 1 - \frac{C_E\ (wCutter)}{C_E\ (w/oCutter)}$ Where: C_E *(wCutter)* HC concentration with C_2H_6 flowing through the NMC (ppmC1) C_E *(w/oCutter)* HC concentration with C_2H_6 bypassing NMC (ppmC1)

APPENDIX 2

ENGINE TEST REPORT AND TEST DATA – CH_4 AND/OR N_2O CALCULATIONS

Engine	
Manufacturer	
Engine type	
Emission abatement device	
Engine family or Engine group identification	
Serial number	
Rated power	
Rated speed	

Emissions test results:					
Test cycle					
C_{fCH4} weighted					g/kg fuel
$C_{slip\text{-}CH4}$ weighted					% (of the mass of the methane containing fuel used by the engine)
N_2O (weighted)					g/kg total fuel
Test identification					
Date/time					
Test site					
Test number					
Company					
Date and place of report					
Signature					

Measurement equipment					
	Manufacturer	Model	Measurement ranges	Calibration	
				Span gas conc.	Deviation of calibration
Analyser					
HC / CH_4 Analyser*			ppm		%
N_2O Analyser			ppm		%
CO Analyser			ppm		%
CO_2 Analyser			%		%
O_2 Analyser			%		%
Speed			rpm		%

Torque			Nm		%
Power, if applicable			kW		%
Fuel flow-liquid					%
Fuel flow-gas					%
Air flow					%
Exhaust flow					%
Temperatures					
Charge air coolant inlet			°C		°C
Exhaust gas			°C		°C
Inlet air			°C		°C
Charge air			°C		°C
Fuel-liquid			°C		°C
Fuel-gas			°C		°C
Pressures					
Exhaust gas			kPa		kPa
Charge air			kPa		kPa
Atmospheric			kPa		kPa
Vapour pressure					
Intake air			kPa		%
Humidity					
Intake air			%		%

* For FID+NMC

Make and model of NMC		
	Before measurement	After measurement
NMC CH_4 gas concentration	ppmC	ppmC
HC with CH_4 through NMC	ppmC	ppmC
HC with CH_4 bypassing NMC	ppmC	ppmC
NMC methane efficiency *Em*		
NMC C_2H_6 gas concentration	ppmC	ppmC
HC with C_2H_6 through NMC	ppmC	ppmC
HC with C_2H_6 bypassing NMC	ppmC	ppmC
NMC ethane efficiency *Ee*		

Liquid fuel characteristics

Fuel type				
Fuel properties:			**Fuel elemental analysis:**	
Density	ISO 3675	kg/m^3	Carbon	% m/m
Viscosity	ISO 3104	mm^2/s	Hydrogen	% m/m
Water	ISO 3733	% V/V	Nitrogen	% m/m
Lower heating value/Hu		MJ/kg	Oxygen	% m/m
			Sulphur	% m/m

Gas fuel characteristics

Fuel type:				
Fuel properties			**Fuel elemental analysis**	
Methane number	EN16726:2015		Carbon	% m/m
Lower heating value		MJ/kg	Hydrogen	% m/m
Boiling point		°C	Nitrogen	% m/m
Density at boiling point		kg/m³	Oxygen	% m/m
Pressure at boiling point		Bar (abs)	Sulphur	% m/m
			Methane, CH_4	mol%
			Ethane, C_2H_6	mol%
			Propane, C_3H_8	mol%
			Isobutane, i C_4H_{10}	mol%
			N-Butane, n C_4H_{10}	mol%
			Pentane, C_5H_{12}	mol%
			C_6+	mol%
			CO_2	mol%

Gaseous emissions data

Mode	1	2	3	4	5	6	7	8	9	10
Power/Torque (%)										
Speed (%)										
Time at beginning of mode										

Gaseous emissions data:										
Sampling position										
HC concentration (ppmC)										
CH_4 concentration (ppmC)* recorded#										
CH_4 concentration (ppmC)* - corrected#										
N_2O concentration (ppm)*										
CO concentration (ppm)										
CO_2 concentration (%)										
O_2 concentration (%)										
CH_4 mass flow (kg/h)*#										
N_2O mass flow (kg/h)*										
CO mass flow (kg/h)										
CO_2 mass flow (kg/h)										
O_2 mass flow (kg/h)										
CH_4 (g/kg)*#										
CH_4 (g/kWh)* #										
N_2O (g/kg)*										
N_2O (g/kWh)*										

* As applicable.

As applicable to either liquid or gas fuel.

Engine parameters to be measured and recorded

Mode	1	2	3	4	5	6	7	8	9	10
Power/Torque (%)										
Speed (%)										
Time at beginning of mode										

Engine data										
Speed (rpm)										
Power (kW)										
Mean effective pressure (kPa)										
Fuel rack/gas admission duration** (mm/sec)										
Liquid-to-gas fuel ratio (on mass basis)										
Liquid Fuel flow (kg/h or m^3/h*)										
Gas Fuel flow (kg/h)										
Exhaust flow (q_{mew}) (kg/h)										
Exhaust temperature at the sampling point (°C)										
Charge air coolant temperature in (°C)										
Charge air coolant temperature out (°C)										
Charge air temperature (°C)										
Charge air reference temperature (°C)										
Charge air pressure (kPa)										
Fuel-liquid temperature before the engine (°C)										
Fuel-gas temperature before the engine (°C)										

Ambient data										
Atmospheric pressure (kPa)										
Intake air temperature (°C)										
Intake air humidity (g/kg)										
Relative humidity (RH) of intake air* %										
Air temperature at RH sensor* (°C)										
Dry bulb temperature of intake air* (°C)										
Wet bulb temperature of intake air* (°C)										

* As applicable.
** Only for engines to be tested with gas fuel.

Abatement device:

The report should state whether reported data before or after device- hence the gaseous emission data page will need to be repeated, if both are to be given.

Additionally, if both before and after data given, the analyser data should, if relevant, be repeated to cover all analysers used.

For each Mode Point, the following device data should additionally be recorded: Settings, Operating values and Consumption (specified rates).

APPENDIX 3

FORM OF STATEMENT OF EMISSION VALUES FOR METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O)

Issued in accordance with the *Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines* (resolution MEPC.402(83)) under the authority of the Government of:

……
(full designation of the country)

by.....
(full designation of the competent person or organization authorized)

Particulars of applicant

Name of applicant……

THIS IS TO DECLARE THAT:

1 the applicant has submitted to this Administration the information recommended by the Guidelines for test-bed and onboard measurements of CH_4 and/or N_2O emissions from marine diesel engines (resolution MEPC.402(83));

2 the emission value(s) have been established in accordance with the Guidelines for test-bed and onboard measurements of CH_4 and/or N_2O emissions from marine diesel engines (resolution MEPC.402(83));

3 the engine weighted verified emissions value(s) are as follows:

1	Engine manufacturer and model	
2	Engine serial number	
3	Abatement device manufacturer and model	
4	Device serial number	
5	Use (applicable test cycle(s) – NTC 3.2)	
6	C_{fCH4} (g/kg fuel)*	
7	$C_{slip\text{-}CH4}$ % (of the mass of the methane containing fuel used by the engine)*	
8	C_{fN2O} (g/kg fuel)*	

* Include as appropriate

Issued at……...
(place of issue of the Statement)

(dd/mm/yyyy): ....
(date of issue) *(signature of duly authorized official issuing the Statement)*

(seal or stamp of the authority, as appropriate)

***

ANNEX 9

RESOLUTION MEPC.403(83)
(adopted on 11 April 2025)

AMENDMENTS TO THE 2022 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING that regulation 5 (Surveys) of MARPOL Annex VI, as amended, requires that ships to which chapter 4 applies shall also be subject to survey and certification taking into account guidelines developed by the Organization,

RECALLING that, at its seventy-ninth session, it adopted, by resolution MEPC.365(79), the *2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*,

RECALLING ALSO that, at its eightieth session, it adopted, by resolution MEPC.374(80), amendments to the *2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*,

HAVING CONSIDERED, at its eighty-third session, draft amendments to the *2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, as amended,

1 ADOPTS the amendments to the *2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, as set out in the annex to the present resolution;

2 REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the amendments to the attention of shipowners, ship operators, shipbuilders, ship designers and any other interested groups;

3 AGREES to keep these Guidelines, as amended, under review, in light of the experience gained with their application.

ANNEX

AMENDMENTS TO THE *2022 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFINCIENCY DESIGN INDEX (EEDI)* (RESOLUTION MEPC.365(79), AS AMENDED BY RESOLUTION MEPC.374(80))

1 Paragraph 4.3.5 is replaced by the following:

"4.3.5 Sea conditions should be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 *Preparation, Conduct and Analysis of Speed/Power Trials* 2024 or ISO 15016:2025.[*]"

2 Paragraph 4.3.6 is replaced by the following:

"4.3.6 Ship speed should be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 *Preparation, Conduct and Analysis of Speed/Power Trials* 2024 or ISO 15016:2025,[*] and at more than two points of which range includes the power of the main engine as specified in paragraph 2.2.5 of the EEDI Calculation Guidelines."

3 Paragraph 4.3.8 is replaced by the following:

"4.3.8 The submitter should develop power curves based on the measured ship speed and the measured output of the main engine at sea trial. For the development of the power curves, the submitter should calibrate the measured ship speed, if necessary, by taking into account the effects of wind, current, waves, shallow water, displacement, water temperature and water density in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 *Preparation, Conduct and Analysis of Speed/Power Trials* 2024 or ISO 15016:2025.[*] Upon agreement with the shipowner, the submitter should submit a report on the speed trials including details of the power curve development to the verifier for verification."

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[*] Until 1 May 2026, ISO 15016:2015 may also be used.

ANNEX 13

RESOLUTION MEPC.405(83)
(adopted on 11 April 2025)

AMENDMENTS TO THE 2023 GUIDELINES FOR THE DEVELOPMENT OF THE INVENTORY OF HAZARDOUS MATERIALS (RESOLUTION MEPC.379(80))

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO that the International Conference on the Safe and Environmentally Sound Recycling of Ships held in May 2009 adopted the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (the Hong Kong Convention) together with six Conference resolutions,

NOTING that regulations 5.1 and 5.2 of the annex to the Hong Kong Convention require that ships shall have on board an Inventory of Hazardous Materials which shall be prepared and verified taking into account guidelines, including any threshold values and exemptions contained in those guidelines, developed by the Organization,

RECALLING that, at its sixty-second session, it adopted, by resolution MEPC.197(62), the *Guidelines for the development of the Inventory of Hazardous Materials*,

RECALLING ALSO that, at its sixty-eighth session, it adopted, by resolution MEPC.269(68), the *2015 Guidelines for the development of the Inventory of Hazardous Materials*, which superseded the Guidelines adopted through resolution MEPC.197(62), to improve the guidance on threshold values and exemptions,

RECALLING FURTHER that, at its eightieth session, it adopted, by resolution MEPC.379(80), the *2023 Guidelines for the development of the Inventory of Hazardous Materials* (2023 Guidelines), which superseded the Guidelines adopted through resolution MEPC.269(68), as a consequence of the introduction of controls on cybutryne through the amendments to annex 1 to the *International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001* (AFS Convention) (resolution MEPC.331(76)), which entered into force on 1 January 2023,

RECOGNIZING the need for amendments to the 2023 Guidelines to clarify the relevant threshold values in respect of cybutryne when samples are directly taken from the hull or when samples are taken from wet paint containers,

HAVING CONSIDERED, at its eighty-third session, the recommendation made by the Sub-Committee on Pollution Prevention and Response at its twelfth session,

1 ADOPTS amendments to the *2023 Guidelines for the development of the Inventory of Hazardous Materials* as set out in the annex to this resolution;

2 INVITES Member Governments to apply the 2023 Guidelines, as amended, as soon as possible, and no later than 26 June 2025;

3 AGREES to keep the 2023 Guidelines, as amended, under review in the light of experience gained with their application.

ANNEX

AMENDMENTS TO THE 2023 GUIDELINES FOR THE DEVELOPMENT OF THE INVENTORY OF HAZARDOUS MATERIALS (RESOLUTION MEPC.379(80))

Appendix 1
Items to be listed in the Inventory of Hazardous Materials

1 Row A-4 of table A is replaced by the following:

"

A-4	Anti-fouling systems containing organotin compounds as a biocide	x			2,500 mg total tin/kg[7]
	Anti-fouling systems containing cybutryne	x			1,000 mg/kg[8] or 200 mg/kg[8]

7 This threshold value is based on the *2022 Guidelines for brief sampling of anti-fouling systems on ships* (resolution MEPC.356(78)).

8 These threshold values are based on appendix I of the *2022 Guidelines for survey and certification of anti-fouling systems on ships* (resolution MEPC.358(78))."

Appendix 6
Form of Material Declaration

2 The last row of table A is replaced by the following:

"

Table	Material name	Threshold value	Present above threshold value	If yes, material mass		If yes, information on where it is used
			Yes / No	Mass	Unit	
Table A (materials listed in appendix 1 of the Convention)	Anti-fouling systems containing cybutryne	200 mg/kg [20]				

20 This threshold value is based on appendix I of the *2022 Guidelines for survey and certification of anti-fouling systems on ships* (resolution MEPC.358(78)) for samples taken from wet paint containers."

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MEPC.1/Circ.916
29 April 2025

METHODOLOGY FOR SUBMISSION, SCIENTIFIC REVIEW AND RECOMMENDATION OF PROPOSED DEFAULT EMISSION FACTORS BY GESAMP-LCA WG

1 The Marine Environment Protection Committee (MEPC), at its eighty-third session (7 to 11 April 2025), approved the *Methodology for submission, scientific review and recommendation of proposed default emission factors by GESAMP-LCA WG*, as set out in the annex.

2 Member Governments and international organizations are invited to bring the annexed Methodology to the attention of Administrations, industry, fuel producers, technology manufacturers, relevant shipping organizations, shipping companies and other stakeholders concerned.

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ANNEX

METHODOLOGY FOR SUBMISSION, SCIENTIFIC REVIEW AND RECOMMENDATION OF PROPOSED DEFAULT EMISSION FACTORS BY GESAMP-LCA WG

1 General

1.1 The Marine Environment Protection Committee (MEPC), at its eighty-first session (April 2024) adopted the *2024 Guidelines on life cycle GHG intensity of marine fuels* (2024 LCA Guidelines) (resolution MEPC.391(81)), and agreed to the establishment of a Technical Group under the auspices of GESAMP, the GESAMP Working Group on Life Cycle GHG Intensity of Marine Fuels (GESAMP-LCA WG), to review and provide scientific and technical advice on specific issues related to the implementation of the 2024 LCA Guidelines and advise the Committee accordingly.

1.2 Section 9 of the 2024 LCA Guidelines provides the general description of principles and the procedure for the determination of well-to-tank (WtT) and tank-to-wake (TtW) GHG default emission factors.

1.3 The GESAMP-LCA WG developed this Methodology to facilitate the submission, scientific review and recommendation of proposed default emission factors in a standardized and transparent way.

1.4 This Methodology should be suitable for use as technical guidance by Member States submitting proposed default emission factors to the GESAMP-LCA WG for review and recommendation to MEPC. A flow chart describing this process is provided in appendix 1.

1.5 The goal of this Methodology is to ensure proper assessment of the proposed default emission factors. As such, the Methodology will be updated as the state of knowledge and technology, as well as best practices, lessons learned and experience gained during the evaluation process, may require.

1.6 This Methodology complements, and does not pre-judge, the application of the 2024 LCA Guidelines.

2 Definitions

2.1 For the purposes of this Methodology, the following definitions are intended to facilitate a consistent evaluation of default emission factors:

.1 **GESAMP** is the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection, an advisory and multidisciplinary body consisting of specialized experts. Experts working for GESAMP act independently in their individual capacity. For more information, see: http://www.gesamp.org/.

.2 **GESAMP-LCA WG** is the GESAMP Working Group on Life Cycle GHG Intensity of Marine Fuels, also referred to as GESAMP WG 46 or the Group.

.3 **Default emission factor** represents the outcome of the assessment of a specific marine fuel pathway or value chain for well-to-tank (WtT) and/or tank-to-wake (TtW) expressed in $gCO_{2eq}/MJ_{(LCV)}$ and recommended for approval by MEPC.

.4 **Proposal** means proposed default emission factors submitted by a Member State for scientific review and recommendation by the Group, along with supporting documentation.

.5 **Template** means the standardized layout for submission of proposed default emission factors based on appendices 4 (template for WtT default emission factor submission) and 5 (template for TtW default emission factor submission) of the 2024 LCA Guidelines. This template aims at collecting and presenting in a clear and structured manner the input data used to calculate a proposed default emission factor.

.6 **Excel tool** is a locked spreadsheet in Excel format developed by the Group to standardize the reporting of parameters and the calculation of proposed default emission factors, based on the templates in appendices 4 and 5 of the 2024 LCA Guidelines.

2.2 These definitions are aimed at harmonizing the process of submission and review of proposed default emission factors by GESAMP-LCA WG and should not be considered as an interpretation of the LCA Guidelines.

3 Submission of proposed default emission factors

3.1 Member States may submit WtT and/or TtW proposed default emission factors using the template and the Excel tool. The proposing Member State should check the quality and completeness of any application against the template before its formal submission; and clearly indicate in the submission whether the proposal is for a new default emission factor or for the revision of an existing default emission factor to reflect the latest scientific knowledge and reliable data availability.

3.2 Several proposed default emission factors for a given fuel pathway can be submitted simultaneously by one or more Member States. However, only one default emission factor should be proposed per template form (e.g. to submit two proposed default emission factors, two separate template forms should be filled). The template provides full coverage of all elements necessary to define a default emission factor. It can be adapted and complemented with additional information. Proposing Member States should clearly indicate when no information is provided for specific steps of the pathway or when a specific pathway is not applicable. Member States should use the Excel tool developed by the Group to standardize the reporting of parameters and the calculation of proposed default emission factors.

3.3 Alongside a filled template, additional details and relevant information (e.g. LCA model/tool and respective data, peer-reviewed literature, primary data, official statistics or scientific/engineering simulation used for establishment of proposed default emission factors) should be provided.

3.4 Submissions for scientific review and recommendation of proposed default emission factors and underlying data that need to be evaluated by GESAMP-LCA WG should be addressed to the Technical Secretary of the GESAMP-LCA Working Group, in digital format:

Contact details:
Ms. Laura Aguilera
Technical Secretary of the GESAMP-LCA Working Group
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Email: LAguiler@imo.org and ghg@imo.org

3.5 GESAMP-LCA WG aims to hold two in-person meetings per calendar year, well before the MEPC session is expected to decide on the approval of the proposed default emission factors. Consequently, a deadline of at least 28 weeks before the relevant MEPC session has been established for the submission of proposals for scientific review and recommendation. However, submissions of proposed default emission factors can be presented at any time. GESAMP-LCA WG may also work by correspondence and hold virtual meetings, as necessary. An indicative timeline used for planning the activities related to the GESAMP-LCA WG meetings is shown in appendix 2.

3.6 If due to time constraints GESAMP-LCA WG is not able to evaluate all the proposals for scientific review and recommendation submitted by the deadline (see paragraph 3.5), an additional meeting of GESAMP-LCA WG may be convened.

4 Procedure for review of proposed default emission factors

4.1 The review of proposed default emission factors should adhere to the following steps:

Step 1 Upon receipt of the submission of proposed default emission factors, the Technical Secretary and the Chair of GESAMP-LCA WG should determine whether all the data elements required in the template(s) are filled. GESAMP-LCA WG may ask proposing Member States to provide further information before the proposed default emission factors are further considered by the Group. For the WtT part, the Group should assess if the pathway description corresponds to the given fuel pathway code, and if it corresponds to an existing fuel pathway code or if it is a new one.

Step 2 If a large number of proposals are submitted, the Group may have to prioritize its work by evaluating the relevance/urgency of assessing a fuel pathway. The prioritization may be done following guidance provided by the Committee or by using criteria such as: the technology readiness level (TRL) of the proposed fuel pathway, current market availability of the proposed fuel for international shipping, expected volumes, etc.

Step 3 For each proposed WtT default emission factor, the Group should assess the quality of data used for the calculation in terms of relevance, adequacy, completeness, consistency, reliability, transparency, and accessibility.

The Group may also identify any missing information and ask the proposing Member State to provide further information. Proposing Member States may submit additional information, such as the underlying LCA calculations and the pedigree matrix.

Step 4 The Group should assess whether, for a specific pathway code, at least three separate analyses/studies have been performed for WtT and TtW, respectively.

Step 5 The Group should analyse the reliability of the proposed values by verifying the accuracy of entries in the filled Excel tool and the calculated proposed default emission factors, as well as the completeness of the background information provided.

4.2 Clarification of certain aspects of a proposal identified during the preparation for, or in the process of, an evaluation of a proposal may be requested by the Group via email communication. The clarifications should be received in a timely manner so that the Group is able to take the information into account during the review process. Member States may wish to designate a technical representative to provide clarifications on request during the Group's review meeting. Additionally, one or more contacts from the proposing Member State will be copied on all communications. Member States are requested to provide names and email addresses of all these contacts in electronic copy to the Technical Secretary at the time of their submission, specifying technical and administrative representatives.

5 Identification and recommendation of default emission factors

5.1 Having reviewed and validated the submitted proposals for default emission factors, GESAMP-LCA WG should identify which proposals fulfilled all the steps described in section 4.

5.2 WtT default emission factors should be calculated using representative and conservative assumptions, which encompass variable performance of feedstock-fuel pathways across world regions and States. To establish a WtT default emission factor for a fuel pathway, at least three reference values from three different, representative analyses/studies should be considered. To ensure conservativeness, among the three (or more) emission factors considered, the highest value should be selected as default and recommended to the Committee to be added to the LCA Guidelines. The range of available values should be provided for informative purposes.

5.3 TtW default emission factors should be calculated using representative and conservative assumptions, which encompass variable conditions on board the ships and performance of energy converters. To establish a TtW default emission factor for a fuel pathway (with the exception of C_{fCO2}), at least three reference values, from three different representative analyses/studies, should be considered among the three (or more) emission factors to be considered; to ensure conservativeness the highest value should be selected as default and recommended to the Committee to be added to the LCA Guidelines. The range of available values should be provided for information purposes.

5.4 After completion of the GESAMP-LCA WG report, relevant annexes containing the outcome of the review of proposed default emission factors should be sent to the respective Member State for information and to check if any confidential information appears in the report. Unless the Member State advises otherwise before the deadline indicated in the request for confirmation (normally one week), the Technical Secretary will assume that the respective evaluation does not contain any confidential information and can be processed along with the report according to the indicative timeline shown in appendix 2.

5.5 The report of GESAMP-LCA WG should be peer-reviewed by GESAMP. If GESAMP provides comments on the findings of the Group, the Chair of GESAMP-LCA WG, in consultation with the members of the Group, as appropriate, will address the respective comments. GESAMP will provide confirmation of peer review and approval to the Technical Secretary, for the information of MEPC.

5.6 Any supplementary data regarding a proposal that was submitted to GESAMP-LCA WG after the completion of its review meeting will be considered as a new proposal, subject to a new deadline for evaluation according to the procedure described in this Methodology.

5.7 On the basis of the report of GESAMP-LCA WG, MEPC will be invited to consider the recommended default emission factors for approval and to determine how to reflect them in the LCA Guidelines, as appropriate.

6 Confidentiality issues and disclosure of information

6.1 The proprietary data, information, materials, notes and reports obtained or generated in carrying out the work of GESAMP-LCA WG should be treated as confidential. However, all information related to safety and environmental protection should be treated as non-confidential.

6.2 The confidential information in submitted documents should be clearly identified by the proposing Member State.

6.3 Reports to MEPC, including recommended default emission factors, should be made publicly available.

6.4 After evaluation by the Group, information and materials obtained or generated in carrying out the work of the Group should be safely stored by the Technical Secretary.

6.5 The Organization and the members of GESAMP-LCA WG will make every reasonable effort to prevent the disclosure of information which is clearly and prominently identified as being subject to an intellectual property right, subject to the condition that sufficient detail must be provided to MEPC to enable it to perform its functions and, in particular, to approve the recommended default emission factors.

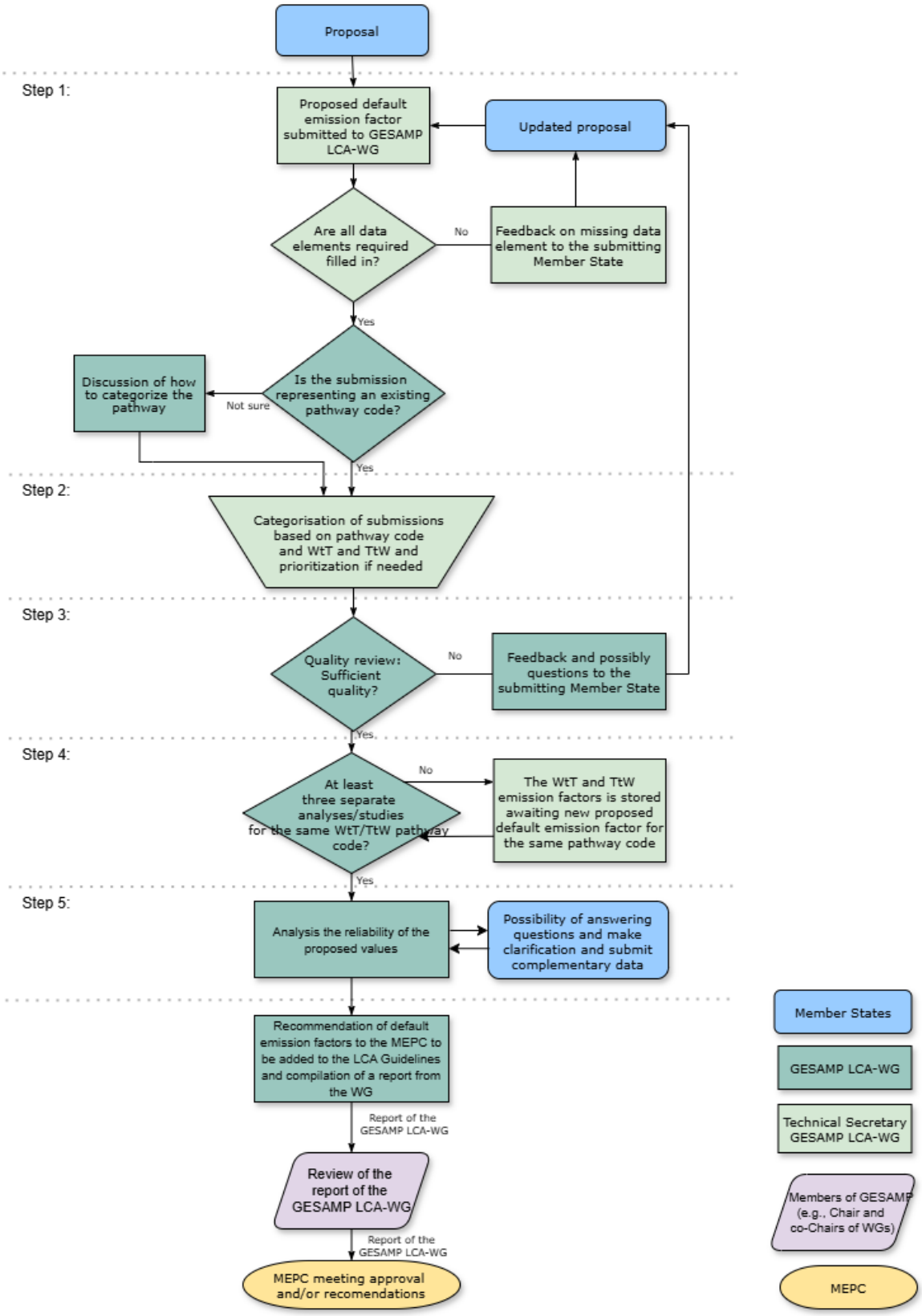
Appendix 1 Flow chart describing the submission, scientific review and recommendation process of default emission factors

Appendix 2 Timeline for activities related to GESAMP-LCA WG meetings

Appendix 3 Illustrative screenshots of the Excel tool

APPENDIX 1

Flow chart describing the submission, scientific review and recommendation process of default emission factors



APPENDIX 2

Indicative timeline for activities related to GESAMP-LCA WG meetings*

Timeline	Activity
At least 28 weeks before the MEPC	Deadline for submission of proposed default emission factors to be reviewed by GESAMP-LCA WG
(Eight weeks)	Preparation of the review meeting, including circulation of any relevant information among Group members
At the latest 20 weeks before the MEPC	GESAMP-LCA WG review meeting
(One week)	Editing and completion of the draft report of the review meeting on recommended default emission factors
(Three weeks)	Review and approval of the report by GESAMP, including response/ clarification by the Group
(One week)	Proposing Member State to confirm that no confidential data are contained in the report
(One week)	Produce the final report addressing the comments by the GESAMP
Thirteen weeks before the MEPC	Submission of the report of the review meeting of GESAMP-LCA WG in accordance with the 13-week deadline (bulky documents) for MEPC

* MEPC 83 noted that the IMO Secretariat, in consultation with GESAMP and GESAMP-LCA WG, would review the timeline for the preparation, conduct and reporting of the meetings, so as to allow for the timely review of proposals for default emission factors.

APPENDIX 3

Illustrative screenshots of the Excel tool

GESAMP-LCA WG developed an Excel tool to standardize the reporting of parameters and the calculation of proposed default emission factors, based on the templates in appendices 4 and 5 of the 2024 LCA Guidelines.

The **Instructions** tab (figure 1) presents the description of the spreadsheet and a list of the tabs with cross-references to the 2024 LCA Guidelines, when applicable.

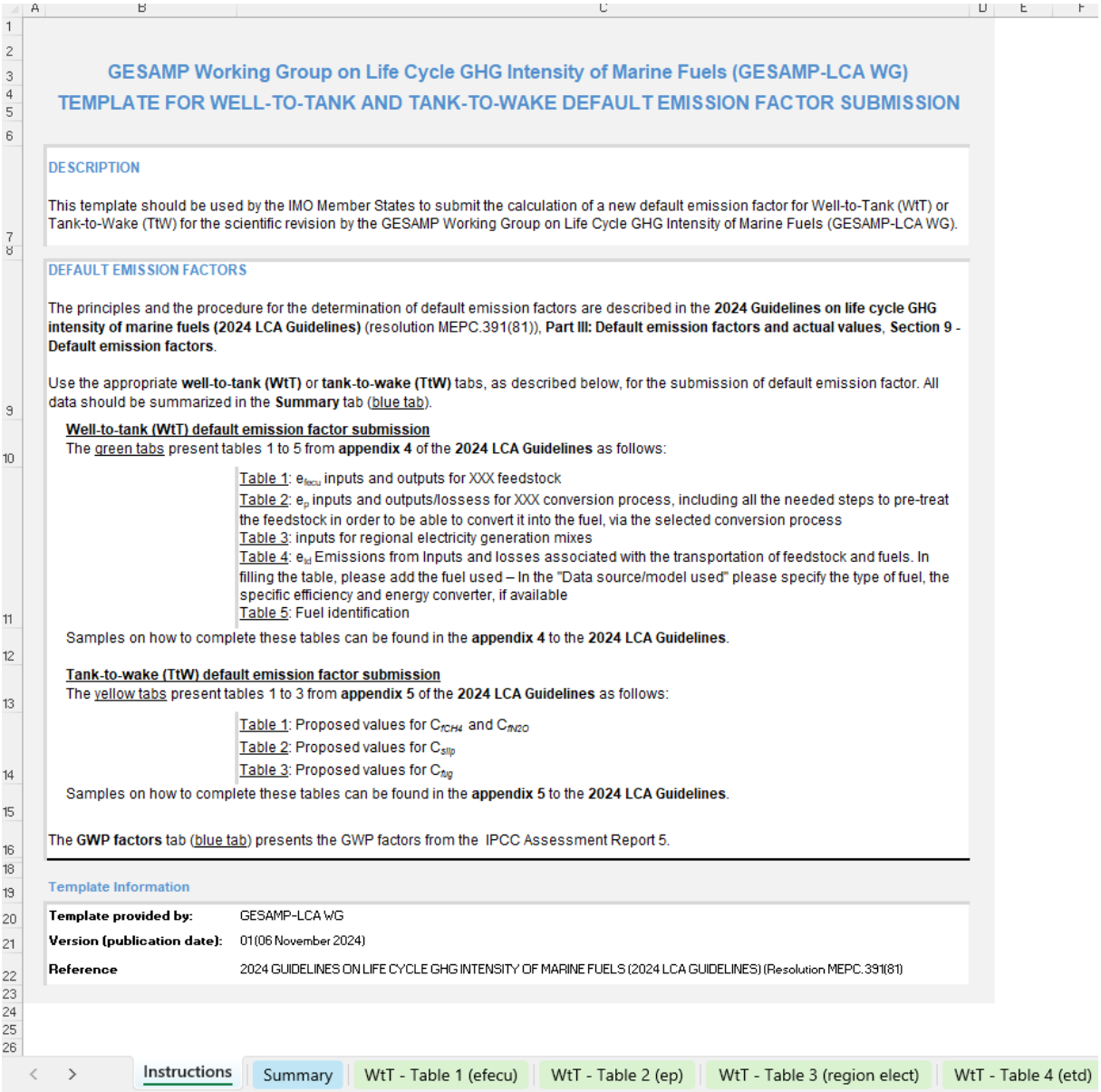


Figure 1: Instructions tab

The appropriate WtT or TtW tabs should be used for the submission of the default emission factor. A full list of the tabs is presented in figure 2. Samples on how to complete the tables can be found in appendices 4 and 5 to the 2024 LCA Guidelines.

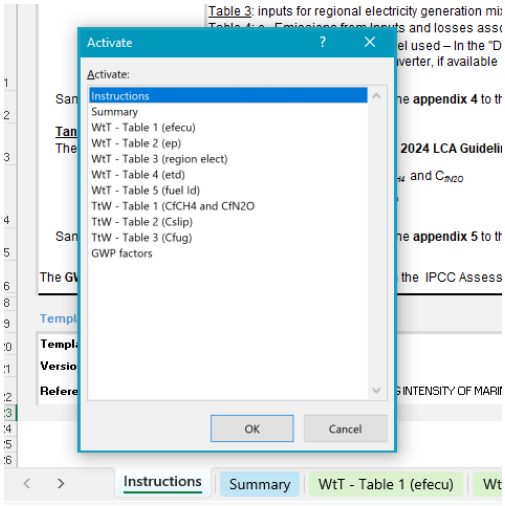
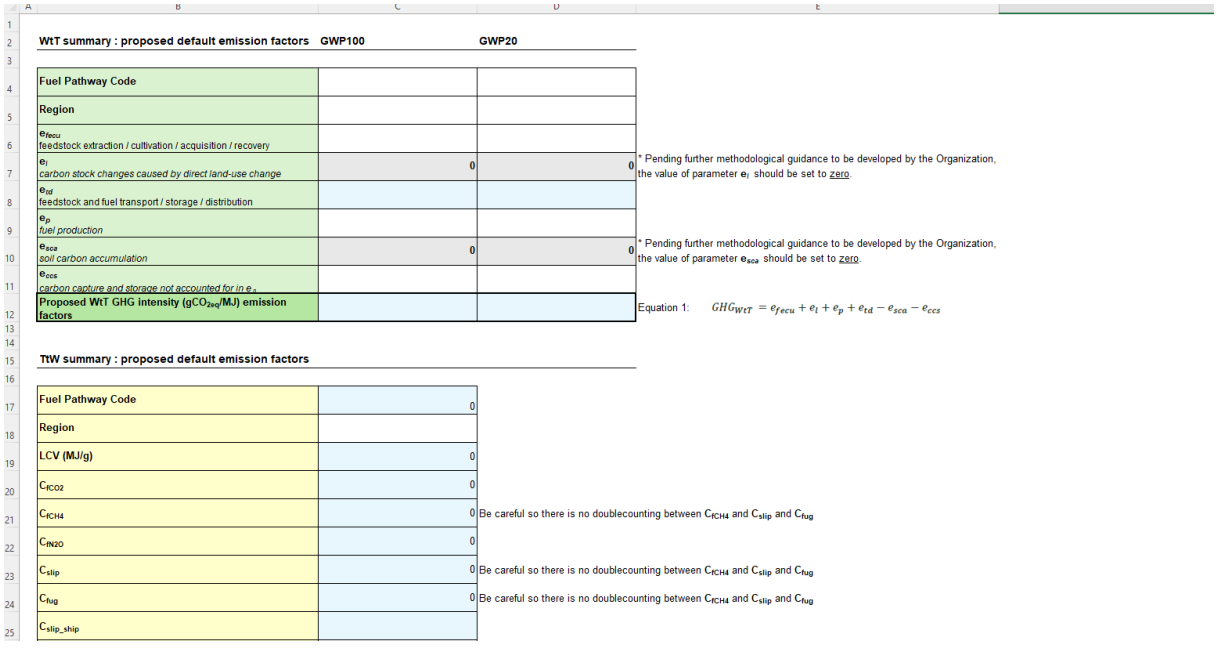


Figure 2: Full list of tabs in the Excel tool

All data is summarized in a **Summary** tab (see figure 3).

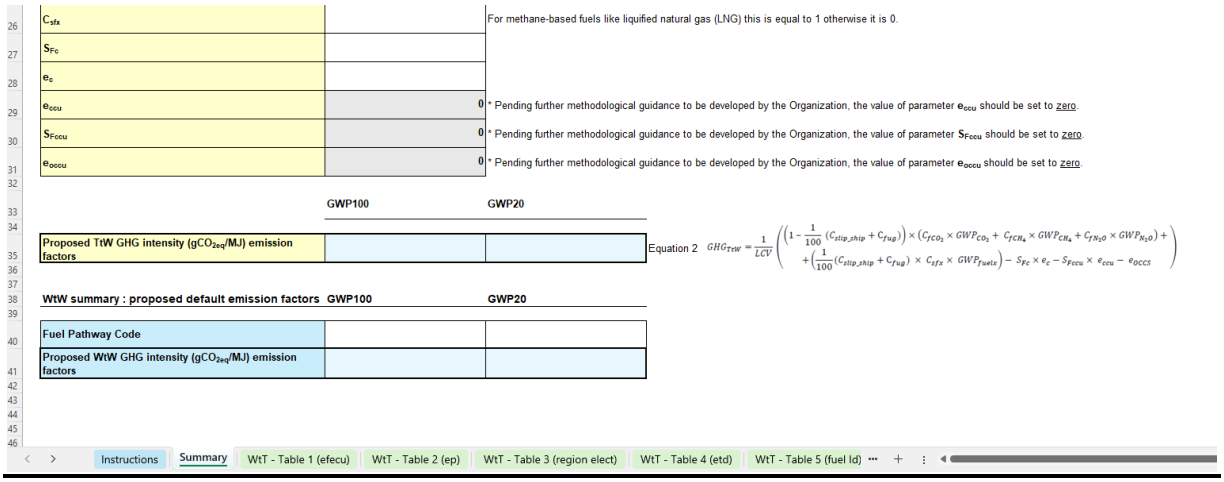


WtT summary : proposed default emission factors

	GWP100	GWP20	
Fuel Pathway Code			
Region			
e_{fecu} feedstock extraction / cultivation / acquisition / recovery			
e_l *carbon stock changes caused by direct land-use change*	0	0	* Pending further methodological guidance to be developed by the Organization, the value of parameter e_l should be set to zero.
e_{td} feedstock and fuel transport / storage / distribution			
e_p *fuel production*			
e_{sca} *soil carbon accumulation*	0	0	* Pending further methodological guidance to be developed by the Organization, the value of parameter e_{sca} should be set to zero.
e_{ccs} *carbon capture and storage not accounted for in* e_p			
Proposed WtT GHG intensity (gCO_{2eq}/MJ) emission factors			Equation 1: $GHG_{WtT} = e_{fecu} + e_l + e_p + e_{td} - e_{sca} - e_{ccs}$

TtW summary : proposed default emission factors

Fuel Pathway Code	0	
Region		
LCV (MJ/g)	0	
C_{fCO2}	0	
C_{fCH4}	0	Be careful so there is no doublecounting between C_{fCH4} and C_{slip} and C_{fug}
C_{fN2O}	0	
C_{slip}	0	Be careful so there is no doublecounting between C_{fCH4} and C_{slip} and C_{fug}
C_{fug}	0	Be careful so there is no doublecounting between C_{fCH4} and C_{slip} and C_{fug}
C_{slip_ship}		



C_{sfx}		For methane-based fuels like liquified natural gas (LNG) this is equal to 1 otherwise it is 0.
S_{Fc}		
e_c		
e_{eccu}	0	* Pending further methodological guidance to be developed by the Organization, the value of parameter e_{eccu} should be set to zero.
S_{Feccu}	0	* Pending further methodological guidance to be developed by the Organization, the value of parameter S_{Feccu} should be set to zero.
e_{occcu}	0	* Pending further methodological guidance to be developed by the Organization, the value of parameter e_{occcu} should be set to zero.

	GWP100	GWP20
Proposed TtW GHG intensity (gCO_{2eq}/MJ) emission factors		

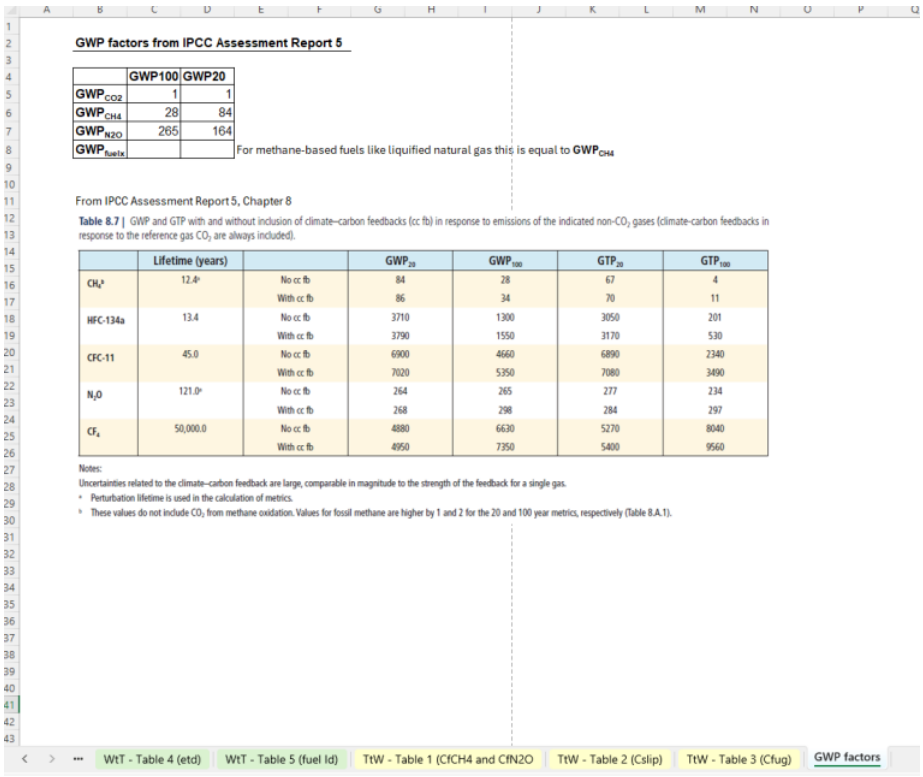
Equation 2 $GHG_{TtW} = \frac{1}{LCV}\left(\begin{array}{l}\left(1-\frac{1}{100}(C_{slip\_ship}+C_{fug})\right)\times(C_{fCO_2}\times GWP_{CO_2}+C_{fCH_4}\times GWP_{CH_4}+C_{fN_2O}\times GWP_{N_2O})+\\ +\left(\frac{1}{100}(C_{slip\_ship}+C_{fug})\times C_{sfx}\times GWP_{fuelx}\right)-S_{Fc}\times e_c-S_{Feccu}\times e_{eccu}-e_{occcs}\end{array}\right)$

WtW summary : proposed default emission factors	GWP100	GWP20
Fuel Pathway Code		
Proposed WtW GHG intensity (gCO_{2eq}/MJ) emission factors		

Instructions | Summary | WtT - Table 1 (efecu) | WtT - Table 2 (ep) | WtT - Table 3 (region elect) | WtT - Table 4 (etd) | WtT - Table 5 (fuel ld)

Figure 3: Summary tab

The **GWP factors** tab (see figure 4 below) presents the GWP factors from the IPCC Assessment Report 5.



GWP factors from IPCC Assessment Report 5

	GWP100	GWP20
GWP_{CO2}	1	1
GWP_{CH4}	28	84
GWP_{N2O}	265	164
GWP_{fuelx}		

For methane-based fuels like liquified natural gas this is equal to GWP_{CH4}

From IPCC Assessment Report 5, Chapter 8

Table 8.7 | GWP and GTP with and without inclusion of climate–carbon feedbacks (cc fb) in response to emissions of the indicated non-CO_2 gases (climate-carbon feedbacks in response to the reference gas CO_2 are always included).

	Lifetime (years)		GWP_{20}	GWP_{100}	GTP_{20}	GTP_{100}
CH_4[a]	12.4[a]	No cc fb	84	28	67	4
		With cc fb	86	34	70	11
HFC-134a	13.4	No cc fb	3710	1300	3050	201
		With cc fb	3790	1550	3170	530
CFC-11	45.0	No cc fb	6900	4660	6890	2340
		With cc fb	7020	5350	7080	3490
N_2O	121.0[a]	No cc fb	264	265	277	234
		With cc fb	268	298	284	297
CF_4	50,000.0	No cc fb	4880	6630	5270	8040
		With cc fb	4950	7350	5400	9560

Notes:
Uncertainties related to the climate–carbon feedback are large, comparable in magnitude to the strength of the feedback for a single gas.
[a] Perturbation lifetime is used in the calculation of metrics.
[b] These values do not include CO_2 from methane oxidation. Values for fossil methane are higher by 1 and 2 for the 20 and 100 year metrics, respectively (Table 8.A.1).

WtT - Table 4 (etd) | WtT - Table 5 (fuel ld) | TtW - Table 1 (CfCH4 and CfN2O | TtW - Table 2 (Cslip) | TtW - Table 3 (Cfug) | GWP factors

Figure 4: GWP factors tab

The editable Excel tool is available on the IMO website at: https://www.imo.org/en/OurWork/Environment/Pages/Lifecycle-GHG---carbon-intensity-guidelines.aspx.

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MEPC.1/Circ.917
12 May 2025

INTERIM GUIDANCE ON THE CARRIAGE OF BLENDS OF BIOFUELS AND MARPOL ANNEX I CARGOES BY CONVENTIONAL BUNKER SHIPS

1 The Marine Environment Protection Committee, at its eighty-third session (7 to 11 April 2025), approved *Interim guidance on the carriage of blends of biofuels and MARPOL Annex I cargoes by conventional bunker ships* (Interim Guidance) set out in the annex.

2 The Interim Guidance does not intend to prejudge or delay the process of developing technically reliable and robust carriage requirements for bunker ships engaged in the carriage of blends of biofuels and MARPOL Annex I cargoes intended for use on board a ship and will be revoked immediately upon implementation of the comprehensive carriage requirements for such bunker ships.

3 Member Governments and international organizations are invited to provide information to the Organization on:

.1 typical arrangements of conventional bunker ships and other similar ship types, subject to SOLAS and MARPOL; and

.2 the requirements of the competent authorities for conventional bunker ships and other similar ship types operating within territorial waters, carrying blends of biofuels.

4 Member Governments and international organizations are also invited to bring the annexed Interim Guidance to the attention of Administrations, recognized organizations, port authorities, shipowners, ship operators and other parties concerned.

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ANNEX

INTERIM GUIDANCE ON THE CARRIAGE OF BLENDS OF BIOFUELS AND MARPOL ANNEX I CARGOES BY CONVENTIONAL BUNKER SHIPS

1 The MEPC.2 circular on *Provisional categorization of liquid substances in accordance with MARPOL Annex II and the IBC Code* (updated every December[1]) sets out, in its annex 11, the list of approved biofuels, as covered by the *2019 Guidelines for the carriage of blends of biofuels and MARPOL Annex I cargoes* (MSC-MEPC.2/Circ.17), and includes tert-Amyl ethyl ether, Ethyl alcohol, Fatty acid methyl esters (FAME) and Vegetable fatty acid distillates. MSC-MEPC.2/Circ.17 provides that biofuel blends containing more than 1% but less than 75% of a MARPOL Annex I cargo are subject to MARPOL Annex II, with carriage requirements as set out in chapter 17 of the IBC Code.

2 The *Guidelines for the carriage of energy-rich fuels and their blends* (MEPC.1/Circ.879) set out that energy-rich products and their blends may be carried in conventional bunker ships subject to MARPOL Annex I when containing 75% or more of the energy-rich fuels, which are of biological origin or originate from non-petroleum sources, e.g. algae, vegetable oils, gas-to-liquid (GTL) process and hydrotreated vegetable oils (HVO).

3 The unified interpretations to regulation 18.3 of MARPOL Annex VI (MEPC.1/Circ.795/Rev.9, section 15) provide, inter alia:

.1 the interpretation that "a fuel oil which is a blend of not more than 30% by volume of biofuel or synthetic fuel" should meet the requirements of regulation 18.3.1 of MARPOL Annex VI, which covers blends of hydrocarbons derived from petroleum refining;

.2 the definition of a biofuel as "a fuel oil which is derived from biomass and hence includes, but is not limited to, processed used cooking oils, fatty acid methyl esters (FAME) or fatty acid ethyl esters (FAEE), straight vegetable oils (SVO), hydrotreated vegetable oils (HVO), glycerol or other biomass to liquid (BTL) type products"; and

.3 the application of NO_x requirements to biofuel, synthetic fuel and blends of these fuels.

4 Within the scope of this Interim Guidance, a "conventional bunker ship" refers to an oil tanker, as defined in regulation 1.5 of MARPOL Annex I, that is engaged in the transport and delivery of fuel oil for use by ships.

5 Pending further development of carriage requirements on biofuels for conventional bunker ships certified for carriage of oil fuels under MARPOL Annex I or the revision of the current carriage requirements as provided in the IBC Code and circular MSC-MEPC.2/Circ.17, conventional bunker ships may transport blends of not more than 30% by volume of biofuel, as long as all residues or tank washings are discharged ashore unless the oil discharge monitoring equipment (ODME)[2] is approved for the biofuel blend(s) being shipped.

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1 MEPC.2/Circ.30 was issued in December 2024.

2 *Revised guidelines and specifications for oil discharge monitoring and control systems for oil tankers* (resolution MEPC.108(49), as amended by resolution MEPC.240(65)).

6 The international Oil Pollution Prevention certificate (IOPP certificate) issued to a conventional bunker ship carrying blends between 25% and 30% by volume of biofuel or synthetic fuel does not need to be modified.

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MEPC.1/Circ.918
29 April 2025

GUIDANCE ON IN-WATER CLEANING OF SHIPS' BIOFOULING

1 The Marine Environment Protection Committee, at its eighty-third session (7 to 11 April 2025), approved *Guidance on in-water cleaning of ships' biofouling*, as set out in the annex, developed by the Sub-Committee on Pollution Prevention and Response, at its twelfth session (27 to 31 January 2025).

2 Member Governments are invited to bring the Guidance to the attention of all parties concerned.

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ANNEX

GUIDANCE ON IN-WATER CLEANING OF SHIPS' BIOFOULING

TABLE OF CONTENTS

1 INTRODUCTION

1.1 The purpose of this document is to provide guidance on matters relating to in-water cleaning of ships, in line with the *2023 Guidelines for control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (resolution MEPC.378(80)) (hereafter the "2023 Biofouling Guidelines"). In part, this document is intended to support the global availability of safe and environmentally responsible in-water cleaning services so as to support the universal application of the 2023 Biofouling Guidelines.

1.2 This document provides guidance to:

.1 shipowners, charterers, operators, crews and in-water cleaning service providers on safely planning and conducting in-water cleaning operations while addressing risks to the environment and ship coatings, including the conduct of pre-cleaning and post-cleaning inspections, as well as record-keeping and reporting (chapter 4);

.2 relevant authorities in jurisdictions that choose to assess service providers before approving their operations and/or choose to approve the in-water cleaning of individual ships (chapter 5, which may also inform service providers on relevant matters);

.3 manufacturers of in-water cleaning systems (IWCS) on the design, specifications and minimum performance that should be expected of such systems (sections 6.1 and 6.2);

.4 relevant authorities in jurisdictions that choose to assess IWCS before approving their use in local waters, concerning the testing of such systems (section 6.3); and

.5 coating manufacturers, IWCS manufacturers, service providers and ships with respect to determining compatibility between coatings and IWCS, taking into account the fouling ratings of areas to be cleaned (section 6.4).

1.3 Should one entity play multiple roles, the recommended approaches in this Guidance remain the same, with suitable adaptation. For example, in the case of in-water cleaning conducted by the ship’s crew using onboard equipment, the crew may need to undertake those aspects of planning, inspection, monitoring, reporting and record-keeping associated with the service provider's role. Guided by the operation, maintenance and safety manual (OMSM) of the IWCS (see paragraph 6.1.5), the Biofouling Management Plan (BFMP) of such a ship should address these matters as appropriate.

1.4 This Guidance should also be used by classification societies; ship repair, dry-docking and recycling facilities; and any other interested parties as appropriate.

1.5 Even in cases where in-water cleaning would remove biofouling that does not pose a risk of introducing non-native organisms (because it has been accumulated in the same waters as the location of cleaning), following this Guidance mitigates risks to the coatings in the areas being cleaned and limits the release of coating substances to the local environment.

1.6 This Guidance welcomes, and is not intended to limit, the development and use of effective, safe and environmentally responsible in-water cleaning technologies. This Guidance focuses on IWCS that are designed to remove organisms from ship surfaces and does not address systems that are designed to treat organisms without removing them from ship surfaces.

1.7 A separate document contains guidance on matters relating to in-water cleaning of recreational craft less than 24 metres in length, using terminology appropriate for that sector (*Guidance for minimizing the transfer of invasive aquatic species as biofouling (hull fouling) for recreational craft* (MEPC.1/Circ.792)).

2 DEFINITIONS

2.1 For the purposes of this guidance, the following definitions apply in addition to the definitions in the 2023 Biofouling Guidelines:

.1 **Coating damage** means visible defects or harm to a coating, and may include peeling, blistering, flaking, pitting, delamination, brush marks or swirls, scrapes, scratches, linear traction damage, exposed metal, polish-through, and blemishes;

.2 **Compatibility** means that an IWCS can operate on a coating without causing damage, which may vary with the fouling rating of the coated area;

.3 **In-water cleaning system (IWCS)** means a system for removing biofouling from the hull and/or niche areas of a ship that is in the water, with or without capture of waste substances, including any associated equipment;

.4 **Recent inspection** means an inspection that reflects the ship's current condition, having been undertaken within the last 28 days, provided that the ship has not remained in one location (other than in the same waters where cleaning will occur) for more than 7 days since the inspection;

.5 **Relevant authority** means an official or organization that is responsible for approving IWCS, in-water cleaning service providers and/or the cleaning of individual ships as authorized by the State having jurisdiction at the location of cleaning (or an official or organization designated, delegated or recognized for this purpose);

.6 **Same waters** means a zone near a location of cleaning that has been scientifically determined to contain the same aquatic species as that location, to the satisfaction of the relevant authority; and

.7 **Service provider** means an organization that undertakes the in-water cleaning of ships, which may be a separate organization from IWCS manufacturers.

2.2 For greater clarity, in this guidance:

.1 the term "area" refers to a part of a ship or surface (e.g. a part of the hull or a niche area), the term "location" refers to a geographical position (e.g. globally or within a specific port) and the term "local" refers to a jurisdiction in which cleaning takes place (e.g. a State and/or any sub-national jurisdiction);

.2 the term "coating substances" is used when it is necessary to refer to waste substances other than removed biofouling;* and

.3 the term "niche areas" is inclusive of rudders and propellers (see figure 2 of the 2023 Biofouling Guidelines).

3 BACKGROUND

3.1 Anti-fouling coatings

3.1.1 An anti-fouling coating (AFC) is a surface coating or paint designed to prevent, repel or facilitate the detachment of biofouling from hull and niche areas that are typically or occasionally submerged. AFCs are applied during new-build or dry-docking. AFCs are designed to either prevent biofouling attachment (using biocides) or reduce adhesion (fouling release) to wetted surfaces. AFCs may be one part of the anti-fouling system (AFS) of a ship.

3.1.2 In general, most current AFCs may be divided into two major groups: self-polishing AFCs and fouling release AFCs. With respect to these AFCs:

.1 self-polishing AFCs may have biocides that are released as the coating polishes, for example owing to surface hydrolysis, surface erosion or a combination of the two; and

.2 fouling release AFCs, which may be biocidal or non-biocidal, reduce the adhesion strength of biofouling, which is dislodged by hydrodynamic forces as the ship moves through the water.

3.1.3 AFCs may not consistently prevent biofouling accumulation on all ship surfaces over the course of their service lives, particularly if the selected coating is not the optimal product for the ship and its operational profile, or if the ship has extended stationary periods or otherwise varies from its expected operational profile. Even when AFCs are used, there are areas of ships' immersed surfaces that are more prone to biofouling because they:

.1 are not painted (e.g. anodes);

.2 are prone to damage (e.g. bulbous bow, tug and fender points, area below anchor chain);

.3 are challenging to coat (e.g. dry-dock blocking areas); or

.4 are sub-optimal for AFC performance (e.g. gratings, rudders and sea chests).

3.1.4 If biofouling occurs on an AFC, the removal of biofouling through in-water cleaning may renew the coating's anti-fouling effects in addition to removing non-native species that may pose threats to human, animal and plant life, economic, recreational and cultural activities, and the aquatic environment.

* The term "waste substances", as defined in the 2023 Biofouling Guidelines, means "dissolved and particulate materials that may be released or produced during cleaning or maintenance, and may include biocides, metals, organic substances, removed biofouling, pigments, microplastics or other contaminants that could have a negative impact on the environment". In this Guidance, the term "coating substances" refers to all "waste substances" except removed biofouling.

3.2 In-water cleaning

3.2.1 In-water cleaning, described in chapter 9 of the 2023 Biofouling Guidelines, is the removal of biofouling from a ship's hull and niche areas while in the water. In general, in-water cleaning may be conducted proactively (i.e. removing microfouling from a ship's hull and niche areas periodically to prevent or minimize attachment of macrofouling) or reactively (i.e. removing micro- and macrofouling from a ship's hull and niche areas as a corrective action).

3.2.2 IWCS typically involve the use of diver-operated or remotely operated vehicles (i.e. cleaning carts) that remove biofouling from the ship. Different equipment may be used to remove biofouling depending on whether surfaces are flat or curved, or on niche areas.

3.2.3 In general, in-water cleaning with capture of waste substances, which may be used for both proactive and reactive cleaning, is intended to protect the environment from the release of coating substances and non-native organisms in removed biofouling. In-water cleaning without capture should only be used to clean areas with a fouling rating less than 2 (see table 1 of the 2023 Biofouling Guidelines).

3.2.4 This Guidance addresses inadvertent environmental harms that may still arise when cleaning with capture is used, due to (a) incomplete capture of waste substances by the cleaning unit; and (b) release of untreated or incompletely treated effluent from processing of captured waste substances.

3.2.5 More specifically, the main environmental and AFC performance risks addressed in this Guidance include:

.1 discharge of biocides, plastics and microplastics to ambient waters;

.2 release of biofouling organisms, their propagules, or pathogens, into the aquatic environment; and

.3 negative effects on AFC condition and service life (e.g. reduction in dry-film thickness or coating damage).

3.2.6 Hard, inert coatings with no anti-fouling properties are commonly used in cold climates because they are relatively resistant to mechanical damage (e.g. from ice). Such coatings may foul relatively quickly and can withstand frequent cleaning as a fouling prevention strategy. Despite paragraph 3.2.3, some jurisdictions may allow macrofouling that has accumulated in the same waters to be cleaned from such coatings without capture because of a reduced risk of releasing coating substances.

3.2.7 Other risks of in-water cleaning that are addressed by this guidance include occupational health and safety risks (e.g. of diving operations) and risks associated with other damage to the ship and its equipment.

3.2.8 This Guidance emphasizes that IWCS, with or without capture, should be compatible with the coating on the surface being cleaned (see section 6.4). This will assist in mitigating risks identified in paragraphs 3.2.3 to 3.2.5. The fouling rating, the condition of the coating and the prevailing conditions at the cleaning location (e.g. visibility, currents and water depth) should also be taken into account. Some coatings require a curing time during operation before they are compatible with cleaning, which should be noted in the BFMP.

4 IN-WATER CLEANING OPERATIONS

4.1 Arranging for in-water cleaning

4.1.1 In-water cleaning is a management action that may be taken in line with the BFMP when biofouling is identified during scheduled inspections (chapter 8 of the 2023 Biofouling Guidelines) or as a contingency action (chapter 7 of the 2023 Biofouling Guidelines). Cleaning should be done in a safe and responsible manner, avoiding unnecessary wear or damage to coatings, and minimizing the release of waste substances. Cleaning should conform to all local regulations and requirements, including the approval of the relevant authority where required.

Selection of IWCS

4.1.2 Cleaning with capture may be used to remove microfouling or macrofouling, as it may pose lower environmental risks than cleaning without capture. Cleaning without capture should only be performed if allowed by local regulations and requirements, if any, in a location accepted by the relevant authority:

.1 on ship areas with a fouling rating less than 2, or

.2 on ship areas with a fouling rating greater than 1, provided that the BFMP and Biofouling Record Book (BFRB) establish, to the satisfaction of the relevant authority, that:

.1 such areas are coated with a non-biocidal hard coating that is in good condition; and

.2 the biofouling was accumulated in the same waters as defined in paragraph 2.1.6.

4.1.3 Selected IWCS, with or without capture, should:

.1 be well-suited to the ship's type, BFMP, operational profile and availability (i.e. time at berth or anchorage), as well as the location of cleaning and the prevailing environmental conditions (e.g. wave surges, wind speeds, flow velocities, weather, visibility);

.2 be compatible with the surface material, coating type and fouling rating of areas to be cleaned (see paragraph 6.4.10), or, in the case of areas with no coating installed (e.g. propeller, anodes), be suitable for the fouling rating of the area;

.3 not cause unnecessary wear or damage to ship coatings, considering the biofouling to be removed; and

.4 be suitable for the geometry, coating, AFS and fouling rating of any niche areas to be cleaned (which may be coated differently from other parts of the ship).

Information exchange between ship and service provider

4.1.4 When the decision to clean the ship's hull and/or niche areas has been taken, the shipowner should provide the following information to a potential service provider:

.1 date, time and location (e.g. port berth or anchorage), and amount of available time for cleaning;

.2 details of AFS on board and coatings in use, including the type of any coating, date of application, service life, records of prior damage, and its manufacturer's advice on cleaning;

.3 the area(s) to be cleaned and avoided, including a drawing of relevant areas (e.g. anodes and instruments, differing coating types), and details of any prior partial cleaning;

.4 if niche areas need to be cleaned, information should be provided in the following categories:

.1 niche areas present on the vertical side or the bottom of the ship that can be readily cleaned; and

.2 niche areas that need special in-water cleaning equipment and procedures (e.g. propellers);

.5 latest inspection, cleaning and dry-dock reports;

.6 other operations planned by the ship, such as maintenance activities, repairs, bunkering, storing, etc.;

.7 any planned transfer of the ship within the port location, alongside and at anchorage, if relevant; and

.8 any other relevant information, such as idle periods, special safety precautions to be taken while cleaning, etc.

4.1.5 The service provider should inform the shipowner about the following:

.1 areas that the service provider can clean, taking into account the coatings and AFS of the ship, such as:

.1 hull and niche areas present on the vertical side or the bottom of the ship; and

.2 any niche areas or hull areas that need special cleaning equipment and/or procedures (e.g. bends, turns, propellers, rudder blades);

.2 the equipment that will be used for cleaning the ship's hull and/or niche areas such as the IWCS model, configuration and components (e.g. cleaning units, brushes, blades, water jets, umbilical, control unit, separation and treatment unit), including an outline of any capture, separation, treatment and the use of any active substances;

.3 arrangements for disposal of captured waste substances;

.4 any local regulations and requirements, any local in-water cleaning permit needed (issued by the relevant authority) and/or information on the environmental performance of the IWCS (e.g. IWCS testing results);

.5 logistical information, including: the specific location of cleaning (e.g. alongside and/or anchorage), the required length of time to conduct the cleaning, and any environmental conditions in which the service provider can or cannot operate (e.g. tides, currents, weather conditions, visibility, under-keel clearance, night operations);

.6 any support required by the service provider from the ship (e.g. footprint and weight of any IWCS equipment to be brought on board, requirements for ship power, and use of any auxiliary equipment such as cranes);

.7 limitations associated with performing the cleaning (e.g. areas the IWCS may not be able to clean); and

.8 any other relevant information.

4.1.6 Where local regulations and requirements require that in-water cleaning be approved on a case-by-case basis (see section 5.2), the service provider should request the necessary approval and/or permits from the relevant authority. A sample form for conveying the cleaning request is provided in the appendix. In the case of an in-water cleaning to be conducted by the ship's crew using onboard equipment, the approval should be requested by the master, the shipowner or their local representative as appropriate.

4.2 Pre-cleaning preparations and inspection

4.2.1 The areas to be cleaned should be clearly identified during the pre-work communications and the scope of work should be documented so that all stakeholders are informed of the intended operation.

4.2.2 Prior to the cleaning, the ship and the service provider should coordinate to:

.1 determine appropriate safety parameters and relevant information, including on how to access niche areas;

.2 consider the condition of the coating and its compatibility with the IWCS (see section 6.4);

.3 agree upon a plan of cleaning specific to the ship and circumstances which, inter alia, minimizes the risks of pollution and introduction of non-native species;

.4 identify and agree upon contingency measures for the cleaning operation; and

.5 address any other relevant issues, including coordination with any other planned maintenance or repair work.

Planning

4.2.3 The service provider should plan the cleaning to ensure that the process is undertaken efficiently, safely and in an environmentally sound manner. The plan should ensure the safety of personnel, equipment and the ship during the entire operation, taking into account the safety management system of the ship. Resources should be planned to avoid/minimize breakdowns/interruptions.

4.2.4 The service provider should submit a copy of the plan to the ship and the relevant authority, including at least the following information:

.1 with respect to the cleaning operation:

.1 the specific location of cleaning, which should be selected with regard to expected environmental conditions (e.g. weather conditions, wave height, current, tidal patterns and depth) and local regulations and requirements;

.2 areas to be cleaned, including for each area: the expected fouling rating (to be verified during the pre-cleaning inspection), the IWCS to be used, the condition of the coating and a rationale for compatibility between the ship's coating and the IWCS (see paragraph 6.4.10);

.3 areas to be avoided and the reason for avoidance, which might include areas with: increased fouling, damaged coating, coating types incompatible with the IWCS, unsuitable geometry for the IWCS, risks to equipment or divers, and/or boundaries outside of the scope of work;

.4 communication between the ship and personnel controlling the cleaning unit, including procedures for tracking the position of the cleaning operation on the hull relative to the cleaning route and areas to be cleaned and avoided; and

.5 in the case of cleaning with capture, a plan for the disposal of waste substances in accordance with local regulations and requirements;

.2 with respect to safety:

.1 procedures (including a timeline) for securing key systems and equipment during cleaning activities (e.g. immobilizing the propeller, powering off any cathodic hull protection system) and for protecting personnel, the IWCS, associated equipment and underwater fixtures and surfaces of the ship;

.2 safety checklists dependent on diving equipment and local regulations and requirements;

.3 procedures to ensure that all systems and equipment, including personal protective equipment, are functional and still within their operational life;

.4 approach to mitigate specific risks and hazards associated with any cleaning of niche areas of the ship; and

.5 procedures for the conclusion of the cleaning activity, to ensure that the ship is safely reinstated to normal operational status; and

.3 with respect to contingency measures, plans and procedures for informing and cooperating with relevant stakeholders to:

.1 respond to diver safety risks, incidents or accidents (e.g. measures to shut down or decrease suction);

.2 address operational factors that may affect the cleaning operation, such as weather-related risks, tidal factors influencing clearance under the ship, simultaneous operations (e.g. bunkering, ballasting/ deballasting, movement of cranes), cargo operations (including related emergencies), ship schedule changes and the mooring, movement or operation of other ships;

.3 monitor, prevent and mitigate the exceedance of any safety and/or environmental parameters (including any conditions imposed by a relevant authority), and ensure that the cleaning operations are suspended and remain suspended until such parameters are safely restored;

.4 respond to observations during the cleaning of damage to the ship's AFS or changes in fouling that were not identified in prior inspections and/or reports;

.5 address equipment malfunctions and implement emergency shutdowns, including measures to prevent or mitigate any unintended release of waste substances; and

.6 any other factor that could delay the completion of cleaning or the ship's departure.

4.2.5 The underwater cleaning route should be well-planned to avoid losing orientation underwater and take into consideration as a minimum: water visibility, current, tidal variations, weather conditions, simultaneous operations (e.g. bunkering, ballasting/deballasting, movement of cranes), obstructions at the quay such as fenders, mooring dolphins, other ships at the location, pinch points and location of surface support (e.g. for diver's emergency evacuation).

4.2.6 Cameras used for video and photographs during cleaning and inspections should be able to obtain high-definition colour digital images of the relevant process while underwater (i.e. at least 1280 x 720 pixels), and to time- and date-stamp images or capture this information in the digital file. Ship-specific markings (e.g. draught marks) should be included in photos and videos to identify the ship and area. Videos should be taken at a slow enough pace to ensure blurring does not occur.

Inspection

4.2.7 Prior to cleaning any surfaces of the ship, a pre-cleaning inspection of the areas to be cleaned should be conducted by the service provider to verify the condition of the hull and identify any additional areas to be avoided. Alternatively, the service provider should review the report of a recent post-cleaning inspection (or the report of a recent inspection in line with paragraphs 7.5 or 8.2 of the 2023 Biofouling Guidelines) that is equivalent to a pre-cleaning inspection.

4.2.8 The service provider should ensure that the condition of the coating is acceptable for cleaning, so as to mitigate the risk of coating damage and the release of coating substances at the location of cleaning. Areas found to have a fouling rating greater than 1 should not be cleaned without capture (except as described in paragraph 4.1.2.2). The plan should be amended accordingly based on the result of the inspection.

4.2.9 Biofouling and coating substances should not be dislodged from ship surfaces during inspections.

4.2.10 The pre-cleaning inspection should include appropriately angled photographs and/or videos that clearly depict biofouling and the condition of the coating in the entirety of the area to be cleaned. In order for the fouling rating and the condition of the coating to be determined, sufficient lighting and footage quality should be provided, as well as a clear size reference scale.

4.2.11 With the approval of the relevant authority, the pre-cleaning inspection may be carried out simultaneously with the cleaning operation (by the diver performing the cleaning, an operator assessing live video, or automatically by the IWCS). In such cases:

.1 the ship and service provider should coordinate and take care to ensure that there are no safety risks associated with a simultaneous inspection and cleaning (e.g. surface structure of the hull, open gratings, presence of special attachments such as fishing nets);

.2 the inspection should be conducted systematically, having regard to its orientation and position on the ship;

.3 the inspection should be of sufficient quality to document the condition of all surfaces prior to their cleaning;

.4 the inspection should be closely monitored, and effective procedures should be in place to ensure that the cleaning operation is immediately and safely suspended whenever warranted during the inspection; and

.5 in the case of cleaning without capture:

.1 recent inspection reports and/or the BFMP and BFRB of the ship should establish, to the satisfaction of the relevant authority, that the areas to be cleaned are expected to have a fouling rating less than 2 (except as described in paragraph 4.1.2.2); and

.2 if any macrofouling is found to be present, then cleaning operations in those areas should be suspended until a separate inspection can be completed.

4.2.12 In some cases, very low underwater visibility (or other conditions, such as short distances between ship and sediment, or when the deepest point of the hull is in the fluid mud) limits the ability of the service provider to distinguish between fouling ratings, to identify damaged coatings, or to adequately visualize and record the hull condition and plan the cleaning. As cleaning without an adequate pre-inspection should not be performed, alternatives may include:

.1 relying upon the report of a recent post-cleaning inspection (or the report of a recent inspection in line with paragraphs 7.5 or 8.2 of the 2023 Biofouling Guidelines);

.2 conducting a non-visual inspection using a suitable alternative technology (i.e. one validated to provide a representative assessment of the fouling rating and coating condition of the areas to be cleaned);

.3 conducting the inspection at a more favourable location; or

.4 rescheduling the inspection to a different time (e.g. later tide, next day, next trip).

4.2.13 All relevant regulations and requirements in relation to underwater work should be strictly adhered to.

4.2.14 The service provider should not clean any area if it suspects that the type or coverage of biofouling on that area is outside the capability of its IWCS.

Pre-cleaning checks

4.2.15 Functional checks and pre-dive checks of the cleaning and capture system plus the associated ancillary equipment should be conducted by the service provider before the planned operation. An approved pre-dive checklist developed by the service provider should be used and cross-checked with the record of any defects and recent repairs.

4.2.16 The condition of the equipment should be verified and corrected by the service provider, if required, so as to minimize coating wear or the risk of coating damage (e.g. rough edges on wheels or other parts of the equipment that touch the ship's coating during cleaning).

4.2.17 Recording equipment, such as video cameras, should be function tested by the operator, including the media where the recording will be stored.

4.2.18 Immediately prior to beginning any cleaning, the ship representative and cleaning service provider should coordinate and deconflict any operations as necessary to ensure the timely completion of cleaning. Points of contact, emergency protocols and pre-arranged conditions requiring the shutdown of operations should be reviewed prior to commencement of cleaning.

4.2.19 Lock-out and tag-out procedures should be conducted in accordance with both the ship's safety procedures and the safety requirements of the service provider. The diver and/or dive supervisor, if present, should witness the locking and tagging of equipment prior to entering the water.

4.2.20 For cleaning that extends over more than one day, operations coordination as outlined in this section should be conducted each day before the start of cleaning.

4.3 Conducting in-water cleaning

4.3.1 Cleaning should be conducted in accordance with local regulations and requirements, and with the approval of the relevant authority, if applicable (section 5.2).

4.3.2 During the implementation of the cleaning plan, the service provider should actively monitor all aspects of the cleaning operation, continuously evaluate the operational location, and maintain situational awareness with respect to environmental conditions and nearby operations. This will maximize cleaning efficacy and minimize the risk to any in-water personnel, the risk of coating damage and the risk of unintended release of waste substances into the aquatic environment.

4.3.3 This monitoring should at least:

.1 establish that safe conditions for cleaning are present, including:

.1 suitable visibility and environmental conditions (e.g. weather, waves and currents);

.2 enough clearance to clean the side of the ship (e.g. quay side clearance, fenders, barge operations);

.3 enough under-keel clearance throughout the operation (taking into consideration the expected rise and fall of tide and change in the draught of the ship); and

.4 that potential movements of other ships will not affect the cleaning operation.

.2 ensure the normal functioning of the IWCS (e.g. suction pressure, flow rate, filters and discharge water, capture process, separation and treatment unit, influent and effluent water);

.3 track progress in the sequence of cleaning, noting any areas of concern identified during cleaning and deviations from planned procedures; and

.4 assess and record the cleaning itself using live video, with a view to documenting it and identifying new areas to be avoided, such as by:

.1 identifying any discrepancies between the records on the ship and the actual condition of underwater hull or niche areas of the ship;

.2 identifying instances of AFS or coating damage, including establishing if the cleaning should proceed; and

.3 ensuring that only areas or zones with a fouling rating less than two are cleaned, in the case of cleaning without capture (except as described in paragraph 4.1.2.2).

4.3.4 The service provider should post appropriate signage, maintain communication with the ship, port and other relevant authorities throughout the cleaning operation and comply with any instructions in accordance with operational protocols specific to the ship and the port. The service provider should maintain communication with the ship and divers during any diving operations.

4.3.5 The service provider should exercise due diligence and care in operating the IWCS and related equipment to avoid environmental risks, and in order to avoid any impact to areas not being cleaned, including proper handling of hoses and cleaning units. This includes minimizing the risk of loss of waste substances when cleaning with capture in complex areas, e.g. in the vicinity of bends, turns, etc.

4.3.6 The service provider should implement plans to stop operations if unexpected conditions occur (see paragraph 4.2.4.3).

4.3.7 The service provider should notify the ship and the relevant authority of any deviations from the plan.

4.4 Post-cleaning activities

Inspection

4.4.1 A post-cleaning inspection should be conducted by the service provider to document the outcome of cleaning. The post-cleaning inspection may be carried out simultaneously with the cleaning operation (by the diver performing the cleaning, an operator assessing live video, or automatically by the IWCS). If a simultaneous post-cleaning inspection cannot be achieved, then the service provider should conduct a post-cleaning inspection after the cleaning activity is completed.

4.4.2 The inspection should include appropriately angled photographs and/or videos that clearly depict any remaining biofouling and the condition of the coating in the entirety of the cleaned area, for the purpose of collecting and retaining evidence of the cleaning activity, the condition of ship surfaces, and demonstrating that effective removal of biofouling has taken place. In order for the cleanliness of the surface and the condition of the coating to be determined, sufficient lighting and footage quality should be provided, as well as a clear size reference scale.

4.4.3 In some cases, very low underwater visibility (or other conditions, such as short distances between ship and sediment, or when the deepest point of the hull is in the fluid mud) limits the ability of the service provider to adequately visualize and document the post-cleaning condition of the ship. In such cases, alternatives (which should be noted in the BFRB) may include:

.1 conducting a non-visual inspection using a suitable alternative technology (i.e. one validated to provide a representative assessment of the fouling rating and coating condition of the areas to be cleaned);

.2 conducting the inspection at a more favourable location; or

.3 rescheduling the inspection to a different time (e.g. later tide, next day, next trip).

Ship operations

4.4.4 Post-cleaning communication between the service provider and the ship should confirm that the planned procedures for concluding the cleaning have been completed and that the ship's equipment and machinery can be reinstated to normal operational status.

4.4.5 At least the following should be checked and confirmed before locked out or tagged out systems are released and the ship subsequently returns to normal operations:

.1 all underwater gratings have been safely restored to their original state;

.2 all personnel are out of the water; and

.3 all relevant equipment has been removed from the water.

Cleaning equipment

4.4.6 The IWCS and associated cleaning equipment (including hoses, separation and treatment units) should be checked, cleaned and properly stored to avoid the risk of returning residual waste substances into the aquatic environment.

4.5 Reporting and record-keeping

Reporting

4.5.1 The service provider should prepare a biofouling cleaning report and provide it to the ship in line with paragraph 9.13 and appendix 2 of the 2023 Biofouling Guidelines. In line with the introduction to table 4 of appendix 2 of the 2023 Biofouling Guidelines, that table should form a part of the cleaning report, if applicable. The items relevant to paragraph 4.4.5 should be noted in the report.

4.5.2 If the cleaning activity did not cover the entire planned area or areas, the report should indicate where the cleaning started, where it stopped and why it was not completed. This documentation should be sufficiently detailed to enable another service provider to continue the cleaning. Any areas avoided within the overall areas being cleaned (e.g. owing to the condition of coatings) should also be identified in the report.

Record-keeping

4.5.3 The service provider should maintain appropriate records for at least two years after a cleaning and make them available for official inspection by relevant authorities as appropriate, including at least:

.1 records of operational coordination between stakeholders (e.g. cleaning request, contract, cleaning plan, written records associated with the cleaning process, post-cleaning inspection results and any cleaning report);

.2 recorded video and photographs from the pre-cleaning inspection, cleaning process and post-cleaning inspection of sufficient quality to identify the fouling rating and any damage or deterioration of coatings, individually labelled to indicate the ship name, date and area of the ship shown in the image; and

.3 documentation associated with the disposal of waste substances in accordance with all local regulations and requirements.

4.5.4 The ship should make appropriate entries in its BFRB in line with paragraph 9.14 and appendix 4 of the 2023 Biofouling Guidelines, including retaining references to any supporting evidence/reports of the cleaning (e.g. report from supplier, photographs/videos and/or receipts).

4.5.5 Full inspection reports with photos and separate video files should be stored on board the ship or by the ship owner or ship operator until a new hull coating is applied.

4.6 Partial cleanings

4.6.1 In the case of a cleaning operation that is planned to be conducted in parts across multiple separate occasions (e.g. through partial cleanings conducted during successive port calls):

.1 either a single cleaning plan may be prepared for the overall cleaning operation, or a separate cleaning plan may be prepared for each occasion, as appropriate;

.2 the area to be cleaned on any specific occasion should have been the subject of a recent pre-cleaning inspection, or a new pre-cleaning inspection of the area to be cleaned should be undertaken at the time of cleaning to ensure the fouling rating and the condition of the coating are appropriate to the planned operation;

.3 post-cleaning inspections of the areas cleaned should be undertaken as part of each occasion to document the outcome of cleaning and the condition of the coating;

.4 separate post-cleaning reports may be prepared for each occasion, or a single report may be developed over time by aggregating date-stamped information from successive occasions;

.5 the BFRB of the ship should be updated on each occasion so that it remains a reliable source of information on the current state of the ship (including the progress of the overall cleaning operation); and

.6 the retention period of records associated with any occasion should be measured from the date of completion of the cleaning plan referred to in sub-paragraph 1.

4.6.2 A ship that regularly manages its biofouling through partial cleanings should describe this process in its BFMP, taking into account paragraph 4.6.1.

5 APPROVAL OF CLEANING OPERATIONS

5.1 In-water cleaning service providers

5.1.1 In some jurisdictions, a relevant authority assesses service providers before approving their operations. This section contains considerations that such authorities may take into account. In jurisdictions where this is not the case, service providers should consider this section in planning their operations.

5.1.2 A service provider should:

.1 utilize IWCS tested in line with section 6.3 of this guidance, maintaining copies of the system's testing report demonstrating that the discharge meets all local regulations and requirements (see chapter 6);

.2 operate in a suitable location, considering factors such as:

.1 the specifications and limitations of the IWCS, taking into account prevailing environmental conditions;

.2 the availability of facilities to store and/or appropriately dispose of waste substances;

.3 the ability to contain a spill or release of waste substances on land or in the aquatic environment;

.4 existing water contamination levels (based on the best available information); and

.5 proximity to threatened species and populations (based on the best available information), sensitive habitat, Particularly Sensitive Sea Areas and/or Marine Protected Areas;

.3 make arrangements to mitigate environmental risks and meet all local regulations and requirements for the storage, treatment and proper disposal of waste substances, including preparing to control and mitigate any accidental spills of such substances;

.4 only offer and conduct cleaning of ship surfaces whose fouling rating, coating type and coating condition are compatible with the provider's IWCS and cleaning procedures (see section 6.4.9);

.5 develop and use a service quality management plan (see paragraph 5.1.4);

.6 develop and use a safety management plan for its entire operation, including divers and operators; and

.7 employ personnel with suitable training, qualifications and experience regarding the procedures, methods and equipment used (e.g. divers, remotely operated vehicle operators, and/or their supervisors), and maintain suitable records accordingly.

5.1.3 The relevant authority should request and consider at least the following documentation:

.1 a description of the services for which approval is sought;

.2 the service quality management plan (see paragraph 5.1.4);

.3 the testing reports for each IWCS to be used by the provider (see paragraph 6.3.19); and

.4 the service provider's prior experience regarding in-water cleaning, including with respect to specific ship types, hull forms, coating types, propellers and niche areas, as well as a summary of cleaning operations undertaken over the past year.

5.1.4 The service quality management plan should include at least:

.1 an outline of the organization, management structure and quality assurance system of the service provider, including any subsidiaries, together with information on agreements, arrangements and oversight of any parts of the service provided by subcontractors, including quality management;

.2 a description of the IWCS (including its capabilities, specifications, operational requirements and limitations) and associated equipment used in the cleaning process (including but not limited to IWCS components such as cleaning units, hoses, cables, surface units, separation and treatment units; communication devices; and recording devices such as cameras) together with the manufacturer's technical documentary evidence where applicable to the operations being carried out (e.g. filter sizes);

.3 an environmental, health and safety plan;

.4 a procedure for assessing compatibility between IWCS and ship coatings (see paragraph 6.4.10);

.5 operational procedures for cleaning, including at least:

.1 procedures for communication between all stakeholders (e.g. cleaning personnel, the ship, relevant authority, port officials);

.2 procedures for using cleaning equipment, guiding divers along the hull, avoiding areas unsuitable to the IWCS and for camera and/or video operation;

.3 procedures for the operation of any remotely operated vehicle, including methods and equipment to ensure the operator can determine its position and orientation in relation to the ship;

.4 in the case of cleaning with capture, procedures for handling captured waste substances, including disposal or alternative arrangements in accordance with all local regulations and requirements;

.5 a supervision and verification process to ensure compliance with operational procedures; and

.6 contingency plans based on risk analysis for breakdowns, accidental discharges and any other untoward incident that the service provider anticipates during the cleaning process;

.6 procedures for record-keeping and reporting, including at least:

.1 provisions for recording and reporting of information such as IWCS equipment settings and modes, collection of photographs of AFS condition, fouling rating, development of cleaning and service reports;

.2 a standard biofouling cleaning report form that aligns with section 3 of appendix 2 of the 2023 Biofouling Guidelines, as well as table 4 of that appendix when applicable; and

.3 the process for issuance, maintenance and control of documents;

.7 maintenance and calibration procedures for equipment being used in accordance with the instructions of the manufacturer, including procedures for reducing risk using any available self-checks and/or testing or monitoring of the IWCS on an ongoing basis, together with associated reporting;

.8 training, qualifications and experience requirements for operators, technicians, inspectors and divers, including regarding:

.1 technical understanding of the IWCS and its principles of operation, as well as the processes and procedures necessary to operate it to reach the manufacturer's specified levels of performance;

.2 the prevention of biological and chemical contamination of the environment, including contingency response and any local regulations and requirements;

.3 knowledge of and ability to assess biofouling encountered during the normal course of operation;

.4 awareness of AFS types and working knowledge of associated cleaning procedures;

.5 equipment and procedures necessary to conduct the work safely (e.g. cranes, barge operations, storage units, ship-to-ship transfer);

.6 operation of any underwater communication system as well as underwater video monitoring systems (e.g. still cameras, video cameras, TV monitors on deck); and

.7 the operation and maintenance of the IWCS and its components (e.g. surface units, separation and treatment units); and

.9 a periodic review of near misses, work processes, procedures, complaints, corrective and preventive actions.

5.1.5 A relevant authority that approves service providers to operate should issue suitable documentation certifying that local regulations and requirements are met to its satisfaction, based on equipment test results and assessment of relevant documentation. The validity period, specifics of the authorized services, IWCS to be used and any limiting conditions should be noted. In cases when such approval is not provided, or should an approval be suspended or withdrawn, a rationale should be provided in writing.

5.1.6 Service providers should notify the relevant authority of any material changes to plans and procedures outlined in this section to prompt any necessary reassessment and reapproval required by the relevant authority.

5.2 Ship cleaning requests

5.2.1 In some jurisdictions, a relevant authority assesses in-water cleaning requests on a case-by-case basis, considering factors specific to the service provider and the ship, to minimize the release of any waste substances during cleaning. When operating in other jurisdictions, a service provider should take this section into account in considering its capacity to clean a ship safely and with minimal risk to the aquatic environment.

5.2.2 In considering requests for in-water cleaning, the relevant authority should be provided with and take into account the following information:

.1 pertinent information relating to the ship, including:

.1 its type, size and operating profile;

.2 ports of call since the last cleaning, including, if applicable, the dates and locations where the ship was stationary for more than 7 days (e.g. in open anchorage or berthed at a port);

.3 its BFMP and BFRB;

.4 the report of the last cleaning, or the report of the last inspection in line with paragraphs 7.5 or 8.2 of the 2023 Biofouling Guidelines;

.5 its coatings, their service life and condition, the type of any biocides in use, safety data sheets and any required International Anti-Fouling System Certificate of the ship; and

.6 the rating and degree of coverage of the biofouling in the areas to be cleaned, and whether the biofouling accumulated in the same waters as the location of cleaning;

.2 pertinent information relating to the service provider, including:

.1 the date and location of proposed cleaning;

.2 IWCS to be used, together with documentation of compatibility with the fouling rating and the coating type and condition of the areas of the ship to be cleaned (see paragraph 6.4.10); and

.3 in the case of cleaning with capture, information on the separation capacity and secondary treatment method of the IWCS and arrangements for the storage and disposal of waste substances;

.3 the cleaning plan (see paragraph 4.2.4); and

.4 any other relevant information.

5.2.3 A sample form that may be considered by relevant authorities for requesting information on proposed in-water cleaning activities is provided in the appendix.

5.2.4 The relevant authority should review the information provided by the ship and service provider to ensure that:

.1 the information is complete and valid supporting documentation is provided;

.2 the ship's coating in the area to be cleaned is within its manufacturer-recommended service life and is compatible with the IWCS (see paragraph 6.4.10);

.3 cleaning without capture will only be performed in line with paragraph 4.1.2;

.4 the location is appropriate for in-water cleaning (see paragraph 5.1.2.2); and

.5 the expected environmental conditions at the time of cleaning are appropriate to the capabilities and limitations of the IWCS and the cleaning operation to be performed, taking into account matters such as safety (e.g. nearby ships, port operations, dredging), weather conditions (e.g. height of waves, visibility) and any ecological or environmental concerns (e.g. higher than normal pollution levels, nearby marine mammals).

5.2.5 If a ship to be cleaned without capture only has microfouling on the hull but has macrofouling on niche areas, the relevant authority should consider whether the niche areas are likely to be affected by the IWCS.

5.2.6 In response to a request for ship cleaning, the relevant authority should convey any notice of approval, rejection, postponement, or request for additional information in writing to the master of the ship and the service provider. If the response is other than approval, this notice should include an explanation.

6 IN-WATER CLEANING SYSTEMS

6.1 System design and specification

6.1.1 IWCS may be composed of several units:

.1 a **cleaning unit** or method that removes biofouling from submerged surfaces of a ship, and includes any equipment for the capture of waste substances;

.2 a **storage unit** (e.g. a barge) that is used by some IWCS to hold captured waste substances and seawater for subsequent separation and/or treatment;

.3 a **separation unit** that filters and removes captured waste substances from influent seawater; and

.4 a **treatment unit**, separate or integral to the separation unit, that further treats the influent water after the separation unit (e.g. using heat, biocides or sorbent media) to comply with the minimum performance standard of this guidance and all local regulations and requirements.

6.1.2 IWCS may be located on a floating platform, on a jetty or pier, or installed on board a ship. Cleaning units may be either diver-operated, remotely operated vehicles or fully autonomous systems.

6.1.3 The IWCS manufacturer is expected to ensure that an IWCS intended to be used in connection with the 2023 Biofouling Guidelines should:

.1 be designed and constructed for robust and suitable operation in its intended operating environment, using materials compatible with the substances used and the environmental conditions and working conditions to which it will be subjected;

.2 be designed and constructed so as not to endanger the health and safety of personnel;

.3 not contain or use any substance of a dangerous nature, unless adequate risk mitigation measures are incorporated for storage, application, installation and safe handling;

.4 be provided with simple and effective means for its operation and control;

.5 include any necessary operating parameters for removing specific fouling ratings;

.6 include a continuous self-monitoring function that records the proper functioning or failure of the IWCS (including capture and other processes) together with facilities to produce (e.g. display, print or export) a report for maintenance purposes or later review by the relevant authority;

.7 give audible and visual alarms at all stations from which the IWCS may be controlled to signal any failure that may compromise the proper operation of the IWCS, including any failure that may lead to accidental discharge of waste substances where applicable, together with a means to minimize such discharges (e.g. automatic shutdown);

.8 be designed and constructed to minimize possible damage to coatings; and

.9 be provided with an OMSM that includes, inter alia, routine maintenance and troubleshooting procedures, and which documents any settings and operational modes for varying biofouling, environmental and ship-specific conditions.

6.1.4 An IWCS with capture should mechanically, physically, chemically and/or biologically process effluent released to the environment, in order to minimize the risk of introducing non-native organisms.

6.1.5 Certain IWCS are intended to be installed on board a ship and operated by the crew independently of any service provider (see paragraph 1.3). In such cases, the OMSM of the IWCS should include information and guidance needed by the crew to address matters otherwise within the service provider's role (e.g. appropriate locations and conditions for cleaning, proper disposal of waste substances, addressing local regulations and requirements). The information and guidance in the OMSM should support the inclusion of procedures within the ship's BFMP regarding at least:

.1 crew training;

.2 relevant matters from paragraphs 5.1.2 and 5.1.4;

.3 compliance with any local regulations and requirements (e.g. relating to approvals, permits, cleaning, IWCS effluent and the disposal of waste substances);

.4 pre-cleaning and post-cleaning inspections; and

.5 record-keeping in the BFRB.

6.2 Minimum performance standard

6.2.1 IWCS used in connection with the 2023 Biofouling Guidelines should:

.1 produce clean surfaces having a fouling rating less than or equal to 1;

.2 not visibly damage compatible coating types (paragraph 6.2.4);

.3 in the case of cleaning without capture, not significantly increase dissolved biocides, particulate biocides, plastics or microplastics near the cleaning unit, relative to ambient levels; and

.4 in the case of cleaning with capture:

.1 not significantly increase suspended solids, dissolved biocides, particulate biocides, plastics or microplastics near the cleaning unit or in any released effluent, relative to ambient levels; and

.2 only release captured particles, including organisms, that are less than 10 µm in all dimensions.

6.2.2 The phrase "not significantly increase" in paragraph 6.2.1 refers to a one-tailed statistical comparison establishing, to the satisfaction of the relevant authority, that there is no statistically significant difference between the levels of a substance measured at a specified location and ambient levels.

6.2.3 The term "ambient levels" refers to levels of the same substance measured during the cleaning and at the ship surface where levels of that substance are not impacted by the cleaning.

6.2.4 IWCS, with or without capture, should only be used on compatible coating types. The compatibility between an IWCS and a coating, or a type of coating, should be determined and documented based on independent testing at specified fouling ratings (see section 6.4).

6.3 System approval

6.3.1 In some jurisdictions, a relevant authority assesses the testing of IWCS before approving the use of such systems in local waters. Developers of IWCS should take this section into account when designing their systems and documenting their testing with a view to demonstrating that systems clean ships safely and with minimal risk to the aquatic environment.

6.3.2 In general, the assessment of an IWCS should unfold through the following steps:

.1 the relevant authority should assess the readiness of the IWCS for in situ testing, based on documentation, including the results of ex situ tests;

.2 in situ testing of an IWCS should be planned by an independent test organization;

.3 with the approval of the relevant authority, the independent test organization should carry out the testing, evaluate the results and prepare a report; and

.4 the report should be reviewed by the relevant authority to ensure that local regulations and requirements are met to its satisfaction prior to the issuance of any approval and/or certificates.

Readiness

6.3.3 To prevent unintended release of waste substances, IWCS should be pre-tested ex situ (i.e. in laboratory or land-based testing) before being tested in the natural aquatic environment. During ex situ testing, visual observation as well as quantitative sampling and analysis should indicate that:

.1 in the case of cleaning with capture, the system effectively captures waste substances associated with the cleaning of an underwater surface without returning it to the aquatic environment; and

.2 in the case of cleaning without capture, the system does not significantly increase the coating substances listed in paragraph 6.2.1.3, relative to pretest conditions.

6.3.4 The relevant authority should evaluate the readiness of the IWCS to be approved, which should include reviewing the following documents provided by the system manufacturer:

.1 drawings and descriptions of the IWCS and its components and associated equipment (including but not limited to any cleaning, storage, separation and treatment units and their components, hoses, cables and recording devices such as cameras) in sufficient detail to support the testing (however, proprietary and commercially sensitive information regarding the design of the IWCS may be omitted);

.2 an OMSM for the IWCS, including safety provisions for the operator and any divers and the information in paragraph 6.1.5;

.3 a declaration of the capabilities, specifications and operational requirements of the IWCS covering at least the following topics, together with supporting documentation:

.1 the fouling ratings the system is designed to clean, specifying the range of parameters and equipment used to remove various fouling ratings;

.2 the coating types the system is designed to be compatible with;

.3 the areas of ships that the system is designed to clean;

.4 in the case of cleaning with capture, the minimum flow rate necessary to ensure proper capture;

.5 any special requirements, adaptations or equipment necessary for cleaning specific areas (e.g. niche areas and/or propellers) where the system is designed to do so;

.6 any limitations regarding the above capabilities that should be taken into account, such as ship types, areas (e.g. surface curvatures, distances to bilge keels), hull materials, fouling ratings and/or coating types that are not to be cleaned using the system; and

.7 any operational limitations regarding the use of the system, such as visibility, or its appropriateness to port, coastal, or open sea conditions; and

.4 the results of any ex situ testing, and any relevant results on the performance of the IWCS during research and development phase to support the readiness of the IWCS for testing.

Planning

6.3.5 Testing of an IWCS should be planned and undertaken by a third-party laboratory or facility (the "testing organization") that is independent of the service provider and the manufacturer, vendor or supplier of the IWCS (or its major components) and the coatings being tested and that is approved, certified and audited by an independent accreditation body to conform to relevant standards (e.g. ISO/IEC 17025).

6.3.6 In general, testing of an IWCS should be planned to establish that the standards in section 6.2 and the declared capabilities of the system are achieved. While it is not feasible to test all possible conditions, parameters and variables that can impact cleaning performance, testing should assess system performance in different operations, applications and environmental conditions to the extent practicable.

6.3.7 The experimental design, planning and execution of testing may take into account any relevant standards acceptable to the Administration (e.g. ISO 20679 or other recognized standards).

6.3.8 All IWCS should undergo in situ testing on surfaces of at least three different ships. Each ship is considered to be a separate test. On each ship, the system should be tested on each type of surface that it is designed to clean. If a system is capable of cleaning both with and without capture, both modes should be tested on each ship and appropriate surface type. The set of test ships should present:

.1 distinct coating types, including the softest type of coating the technology is designed to clean, and a hard non-biocidal coating if applicable to the IWCS;

.2 various levels of biofouling, including areas fouled to the highest level that the technology is designed to clean; and

.3 different environmental conditions, including the most challenging conditions for which the technology is designed (e.g. peak tidal flow), and, if possible, different temperatures and salinities.

6.3.9 A detailed Test Quality Assurance Plan (TQAP) should be prepared by the testing organization and be approved by the relevant authority for the specific IWCS, ship and occasion of testing. The TQAP should at least:

.1 identify all organizations involved in the test;

.2 outline the experimental design for validating the performance claims and limitations of the IWCS;

.3 specify the number, position, dimension, coating type and cleaning duration of test areas, which should include the following areas if relevant to the IWCS:

.1 areas of flat hull;

.2 curved areas (e.g. the turn of bilge and angles where the orientation of the surface changes abruptly, such as the chine, keel and skegs); and

.3 niche areas (e.g. propellers, propeller shafts, rudders, anodes and gratings);

.4 specify the suspended solids, dissolved biocides, particulate biocides, plastics or microplastics to be assessed with respect to paragraphs 6.2.1.3 and 6.2.1.4.1, which should at least include copper and zinc if present in the coating;

.5 include a methodology for qualifying and quantifying impacts on the coating of test areas caused by the cleaning (e.g. observation of visible damage and dry-film thickness testing);

.6 govern the identification, collection, preservation, integrity, chain of custody, transportation and processing of samples, including the cleanliness of any containers used and procedures relating to compromised samples;

.7 set out quality assurance procedures for written and electronic data, including the quantitative and qualitative data to be recorded and data analyses to be undertaken (including appropriate statistical analysis);

.8 identify any environmental or other conditions that should be verified at the time of testing to ensure that results will be representative (e.g. background levels of suspended solids and plastics);

.9 be sufficient to establish that the discharge will meet all local regulations and requirements of jurisdictions where cleaning may take place, including with respect to biological and chemical parameters; and

.10 identify how results will be reported.

6.3.10 During each cleaning event, each test area should be cleaned for at least 90 minutes with the IWCS operating in a normal, defined cleaning mode for the conditions presented. In the case of niche areas having shorter cleaning times, at least 30 minutes of cleaning should be conducted, whenever possible. For all tests during each cleaning event, there should be no repeated cleaning of the test area, beyond that which is part of normal operations.

6.3.11 At least one test area on one test ship should be representative of the expected typical application of the IWCS and involve the cleaning of a substantial area (e.g. at least one third of the test ship) over a realistic time frame (e.g. several hours).

Testing

6.3.12 The testing organization should independently conduct the testing of IWCS in accordance with the approved TQAP and with the permission of the relevant authority. During testing, the IWCS should be operated by the intended system user (i.e. a trained service provider, or a trained ship's crew, as appropriate).

6.3.13 The following information should be documented in a report by the testing organization for each ship tested:

.1 an executive summary;

.2 the time, date, location and duration of the test cleaning;

.3 information about the testing organization, including any relevant accreditations;

.4 a list of the people taking part in the test and operation (e.g. handlers, workers, controllers and/or divers), including their roles and responsibilities and operator/diver skill and experience;

.5 information regarding the ship, including at least:

.1 ship type, together with details of its design and niche areas;

.2 coating types, date of application, remaining service life and condition;

.3 description, type, rating and coverage of biofouling on relevant surfaces (e.g. hull and niche areas);

.4 operational profile, together with its history of cleaning since last dry-docking; and

.5 whether the ship underwent a full or partial clean;

.6 information regarding the environmental conditions during the test, including at least:

.1 water depth and under-keel clearance;

.2 water visibility;

.3 currents, wind and waves;

.4 water quality parameters referenced in paragraph 6.2.1 and additional parameters of interest (e.g. salinity, temperature, total organic carbon); and

.5 ambient levels of suspended solids, biocides, plastics and microplastics;

.7 information regarding the IWCS, including at least:

.1 IWCS design, including any mode of attachment to and movement over the ship, and associated equipment or attachments (e.g. cleaning brushes, blades or water jets and type, amount, configuration);

.2 the diameter of the hose from the cleaning unit to any treatment and/or separation unit and the declared flow rate;

.3 IWCS mode of operation (capture or non-capture), various preset modes of operations and operational adjustments during cleaning, together with the details of any capture methods (e.g. cleaning unit shroud and suction); and

.4 IWCS operations, including procedures followed during set up, planned and actual rate of movement of cleaning unit over the test area, number and overlap of passes (accuracy of surface coverage), whether a diver or remotely operated vehicle undertook the cleaning, and procedures for winding down of the test;

.8 information regarding the actual performance of the IWCS, including at least:

.1 actual flow rate of influent water including waste substances;

.2 the claimed maximum curvature and the maximum curvature where cleaning was carried out successfully during the test without loss of waste substances into the water column;

.3 a characterization of any effluent to be released by the IWCS, including with respect to the number and size of organisms and the substances referenced in paragraph 6.2.1.4.1; and

.4 any implementation of contingency plans and response to IWCS failures;

.9 information regarding the conduct and outcome of cleaning in each test area, including at least:

.1 description of any variations or deviations in application of the test relative to the TQAP;

.2 the duration of cleaning of the area, as well as the rate of cleaning expressed in m^2/unit time;

.3 the fouling rating and coating film thickness, before and after cleaning;

.4 all raw data and logged instrument data (regarding the IWCS, the cleaning or the environment) that was collected;

.5 results of the tests and analyses referred to in paragraph 6.3.9.7, including the methods of analysis and detection limits;

.6 a description and evidence of residual biofouling (microfouling or macrofouling) observed in images of each treated area;

.7 the assessment of the impact of cleaning on the coating in each test area referred to in paragraph 6.3.9.5, including images and documentation of wear and/or damage to the coating; and

.8 a discussion of the efficacy of the IWCS;

.10 an itemized assessment of the IWCS against the standards in section 6.2 and the declared capabilities of the system (paragraph 6.3.4.3), including whether or not the system passed each criterion assessed during the test; and

.11 any safety issues encountered during the test, which should be addressed before any further testing occurs.

6.3.14 In the case of a system capable of cleaning both with and without capture, results for both modes should be presented and discussed separately in reports.

6.3.15 All data including video footage and still photographs taken during the test should be archived for reporting.

6.3.16 Should damage to a ship's coating occur during a test, a correction plan should be developed, accepted by the relevant authority and implemented before any further testing takes place.

Evaluation and reporting

6.3.17 The data archived during the verification phase should be processed and analysed by the testing organization to assess the claims and limitations of the IWCS.

6.3.18 Testing should culminate in a full, clear and transparent final report that includes the qualitative and quantitative data gathered during the process regarding the cleaning and capture efficacy, as well as a discussion. The rationale for any deviation from the approved TQAP should be reported.

6.3.19 A final report should be prepared by the testing organization and should include at least the following information:

.1 an executive summary;

.2 a description of the testing organization;

.3 an overview of the approach taken to testing the IWCS;

.4 the executive summary of the report of the cleaning of each test ship (paragraph 6.3.13.1);

.5 an overall discussion of the efficacy and operation of the IWCS across the tests;

.6 an itemized assessment of the IWCS against the minimum performance standard (section 6.2), including whether or not the system passed each criterion;

.7 an itemized assessment of the declared capabilities of the IWCS (paragraph 6.3.4.3), including whether the testing established that each capability was or was not met;

.8 any limitations identified regarding the IWCS; and

.9 relevant annexes, including at least:

.1 the TQAP (paragraph 6.3.9);

.2 the report of the cleaning of each test ship (paragraph 6.3.13); and

.3 an itemized list of supporting information provided along with the report, including archived photos and videos.

Approval and certification

6.3.20 A relevant authority that approves the use of an IWCS in its jurisdiction should issue a suitable document certifying that local regulations and requirements are met to its satisfaction, based on the documentation provided by the manufacturer and the test report. In cases when such approval is not provided, or should an approval be suspended or withdrawn, a rationale should be provided in writing. The relevant authority should review any future system alterations that would affect the test results.

6.3.21 The certification document issued by the relevant authority should at least state the fouling ratings, areas (e.g. flat and/or curved hull surfaces, niche areas) and coating types that the IWCS is approved to clean and any limiting conditions. It should also state a validity period (normally no longer than five years).

6.3.22 A relevant authority considering the approval of an IWCS in its jurisdiction should take into account the report of any relevant testing carried out under the supervision of another State.

6.4 Coating compatibility

6.4.1 During in-water cleaning, IWCS used should be compatible with the ship's coating and fouling rating to minimize the risk of coating damage, which could lead to environmental impacts (e.g. from waste substances released during cleaning) and reduced coating performance and service life. This section explains the roles of coating manufacturers, IWCS manufacturers, service providers and ships in establishing compatibility before cleaning takes place.

Coating manufacturers

6.4.2 Coating manufacturers should make key information on each coating widely available to IWCS manufacturers, service providers, ships, relevant authorities and the public in line with paragraphs 6.3.2 and 6.3.5 of the 2023 Biofouling Guidelines.

6.4.3 This information should include information on biocides used and coating type, together with recommended methods and techniques for cleaning the coating, methods and techniques that should not be used for cleaning, and any contraindications to cleaning (e.g. owing to the actual condition of a ship's coating).

6.4.4 This information should be based on the knowledge and expertise of the coating manufacturer and any necessary tests. The level of detail provided should be consistent with the needs of IWCS manufacturers, service providers, ships and relevant authorities as described in this guidance. However, the information provided by coating manufacturers is not expected to be specific to individual IWCS or ships. Coating manufacturers should remain aware of developments in the IWCS market and update the information they provide accordingly.

In-water cleaning system manufacturers

6.4.5 IWCS manufacturers should make information on each IWCS widely available to coating manufacturers, service providers, ships and relevant authorities through public guidance in line with paragraphs 6.3.2 and 6.3.5 of the 2023 Biofouling Guidelines.

6.4.6 The guidance provided by the IWCS manufacturer should include information on the coatings and fouling ratings on which that manufacturer's equipment has been independently tested, the results of the testing, and recommendations as to the compatibility of the IWCS with coatings of the same type. In the interests of protecting ships and the environment, the recommendations should reflect various IWCS cleaning tools and modes, various coating types, and should be impartial with respect to coating manufacturers. The level of detail provided should be consistent with the needs of service providers, ships and relevant authorities as described herein. However, the guidance provided by IWCS manufacturers is not expected to be specific to individual ships or to cover every coating.

6.4.7 While it is not practicable to test an IWCS on every coating, the IWCS manufacturer should commission independent in situ or ex situ compatibility testing for a variety of coating types on surfaces with various fouling ratings.

6.4.8 IWCS manufacturers should remain aware of developments in the coatings market and in particular the relevant safety and technical information published by coating manufacturers (paragraph 6.4.2). IWCS manufacturers should also remain aware of reports from service providers of unexpected coating damage. The guidance provided by an IWCS manufacturer should be revised and/or additional compatibility testing should be undertaken when appropriate.

Service providers

6.4.9 The service provider should remain familiar with, and retain on file, the most recent safety and technical information provided by coating manufacturers (paragraph 6.4.2) and the most recent guidance provided by manufacturers of the IWCS used by the service provider (paragraph 6.4.5).

6.4.10 When considering or planning the cleaning of a specific ship, the service provider should consider at least the following information in documenting the areas with which an IWCS is compatible:

.1 the information provided by the coating manufacturer (paragraph 6.4.2) establishing that the provider's cleaning methods and techniques are suited to the coating and that there are no contraindications to cleaning;

.2 the guidance provided by the IWCS manufacturer (paragraph 6.4.5) establishing that the IWCS has been tested on the coating, or the type of coating, used on the ship; and

.3 relevant information submitted by the ship (paragraph 4.1.4.2) and the results of the pre-cleaning inspection (paragraph 4.2.7) establishing that the actual condition of the coating and fouling rating are suitable for cleaning using the IWCS.

Ship

6.4.11 The ship should consider the information provided by the coating manufacturer (paragraph 6.4.2), the guidance provided by the IWCS manufacturer (paragraph 6.4.5), and the documentation from the service provider (paragraph 6.4.10) in connection with the ship's decision to proceed with cleaning.

APPENDIX

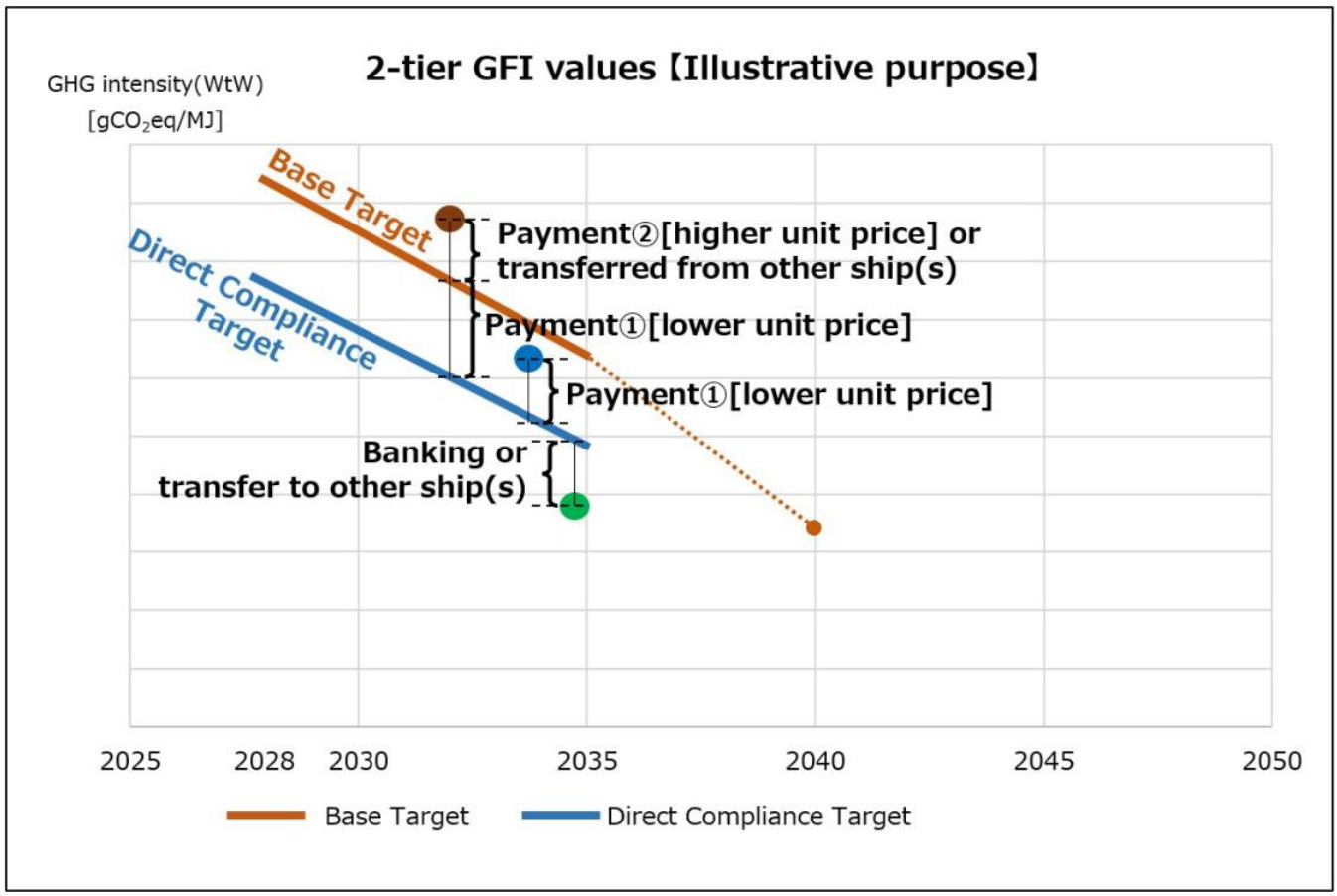
IN-WATER CLEANING REQUEST FORM

This form can help relevant authorities apply the *2023 Guidelines for control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (resolution MEPC.378(80)) and process cleaning requests in their jurisdiction. For more information about this form, please refer to the *Guidance on in-water cleaning of ships' biofouling* (MEPC.1/Circ.918, as may be amended).

<table>
<tr><th colspan="4">A - TO BE COMPLETED BY THE MASTER ON BEHALF OF THE SHIPOWNER/OPERATOR</th></tr>
<tr><td colspan="4">GENERAL INFORMATION</td></tr>
<tr><td colspan="2">Proposed location of cleaning
Click here to enter text.</td><td colspan="2">Proposed date of cleaning
Click here to enter a date.</td></tr>
<tr><td colspan="4">SHIP INFORMATION</td></tr>
<tr><td>Name of ship
Click here to enter text.</td><td>Flag
Click here to enter text.</td><td>IMO Number, Official Number (if applicable), or other distinctive number or letter Click here to enter text.</td><td>Type of ship
Click here to enter text.</td></tr>
<tr><td>Shipowner or operator or ISM Company Number (if applicable)
Click here to enter text.</td><td>Ship's agent
Click here to enter text.</td><td>Length overall
Click here to enter text.</td><td>Beam or ship's breadth
Click here to enter text.</td></tr>
<tr><td colspan="4">Choose the best description for the ship's operating profile:
☐ Domestic ☐ Transoceanic ☐ International coastal ☐ Other, please specify: Click here to enter text.</td></tr>
<tr><td colspan="4">ATTACHED DOCUMENTATION</td></tr>
<tr><td colspan="4">Which of the following are included in this request? Select all that apply:
☐ Biofouling Management Plan ☐ Biofouling Record Book ☐ International Anti-fouling System Certificate
☐ Photos or videos from recent inspection ☐ Reports from previous cleanings
☐ Documentation from recent inspection
☐ Ports of call since the last complete cleaning (including dates and locations of any stationary period over 7days)
☐ Other, please specify: Enter text.</td></tr>
<tr><td colspan="4">BIOFOULING INFORMATION</td></tr>
<tr><td colspan="2">Date of delivery, last complete cleaning or dry-docking (whichever is more recent) Choose an item.
Click here to enter a date.</td><td colspan="2">Date of last underwater hull inspection
Click here to enter a date.</td></tr>
<tr><td>Type of fouling in area that will be cleaned
☐ Microfouling ☐ Macrofouling</td><td>Origin of fouling
☐ Same waters ☐ Other (if same waters, provide supporting information)</td><td colspan="2">By percentage, estimated amount of the ship covered in macrofouling
Click here to enter text.</td></tr>
<tr><td colspan="4">PRIMARY COATING INFORMATION</td></tr>
<tr><td>Manufacturer
Click here to enter text.</td><td>Type/name of commercial product
Click here to enter text.</td><td colspan="2">Primary biocidal compound (if any)
Click here to enter text.</td></tr>
<tr><td>Date of application
Click here to enter a date.</td><td>Remaining service life (in months)
Click here to enter text.</td><td colspan="2">Did most recent inspection find the coating in good condition?
☐ Yes ☐ No</td></tr>
<tr><td>Area of application
☐ Whole hull ☐ Other, please specify: Enter text.</td><td>Does the ship have more than one coating?
☐ Yes ☐ No</td><td colspan="2">Details of secondary coating (if any)
Click here to enter text.</td></tr>
<tr><td colspan="4">MASTER'S DECLARATION</td></tr>
<tr><td colspan="4">I certify that the information listed in section A is true and correct</td></tr>
<tr><td>Name of master
Click here to enter text.</td><td>Signature
Click here to enter text.</td><td colspan="2">Date
Click here to enter a date.</td></tr>
<tr><td colspan="2">Email: Click here to enter text.</td><td colspan="2">Phone number: Click here to enter text.</td></tr>
</table>

B - TO BE COMPLETED BY THE SERVICE PROVIDER		
CLEANING SPECIFICATIONS		
Manufacturer and model of IWCS to be used: Click here to enter text. Date the relevant authority gave approval to operate (attach documentation): Click here to enter a date.	Type of service: ☐ Cleaning with capture ☐ Cleaning without capture Will niche areas be cleaned? ☐ Yes ☐ No	
If performing cleaning with capture, are particles over 10 µm separated from the effluent during treatment? ☐ Yes ☐ No ☐ N/A		
If particles smaller than 10 µm are separated from the effluent during treatment, to what size (in µm) Click here to enter text.		
Type of secondary treatment is used to reduce the risk of introducing non-native organisms: ☐ None ☐ UV ☐ Chemical ☐ Heat ☐ Other: Enter text.		
Is the cleaning plan attached to this form? ☐ Yes ☐ No		
COATING COMPATIBILITY		
Does *information provided by the coating manufacturer* establish that the cleaning methods and techniques are suited to the coating and that there are no contraindications to cleaning? ☐ Yes ☐ No, explain: Click here to enter text.		
Does *guidance provided by the IWCS manufacturer* establish that the IWCS has been independently tested on the coating, or the type of coating, used on the ship? ☐ Yes ☐ No, explain: Click here to enter text.		
What information establishes that the *actual condition of the coating and fouling rating* are suitable for cleaning using the IWCS? ☐ Information submitted by the ship ☐ Completed pre-cleaning inspection ☐ Pre-cleaning inspection to be done during cleaning ☐ Other, explain: Click here to enter text.		
SERVICE PROVIDER DECLARATION		
I certify that the information listed in section B is true and correct		
Name of service provider Click here to enter text.		Name of staff Click here to enter text.
Job title Click here to enter text.	Signature	Date Click here to enter a date.
Email: Click here to enter text.		Phone number: Click here to enter text.

C - TO BE COMPLETED BY RELEVANT AUTHORITY			
☐ Cleaning request approved	☐ Cleaning request rejected	☐ Need more details - resubmit	☐ Postpone cleaning
Notes: (Any conditions of approval. Reasons why a cleaning request was rejected, needs resubmission, or has been postponed.) Click here to enter text.			
Name of relevant authority Click here to enter text.		Name of staff Click here to enter text.	
Job title Click here to enter text.	Signature	Date Click here to enter a date.	


2-tier GFI values【Illustrative purpose】
GHG intensity(WtW)
[gCO2eq/MJ]
Base Target
Direct Compliance Target
Payment②[higher unit price] or transferred from other ship(s)
Payment①[lower unit price]
Payment①[lower unit price]
Banking or transfer to other ship(s)
2025
2028
2030
2035
2040
2045
2050
Base Target
Direct Compliance Target

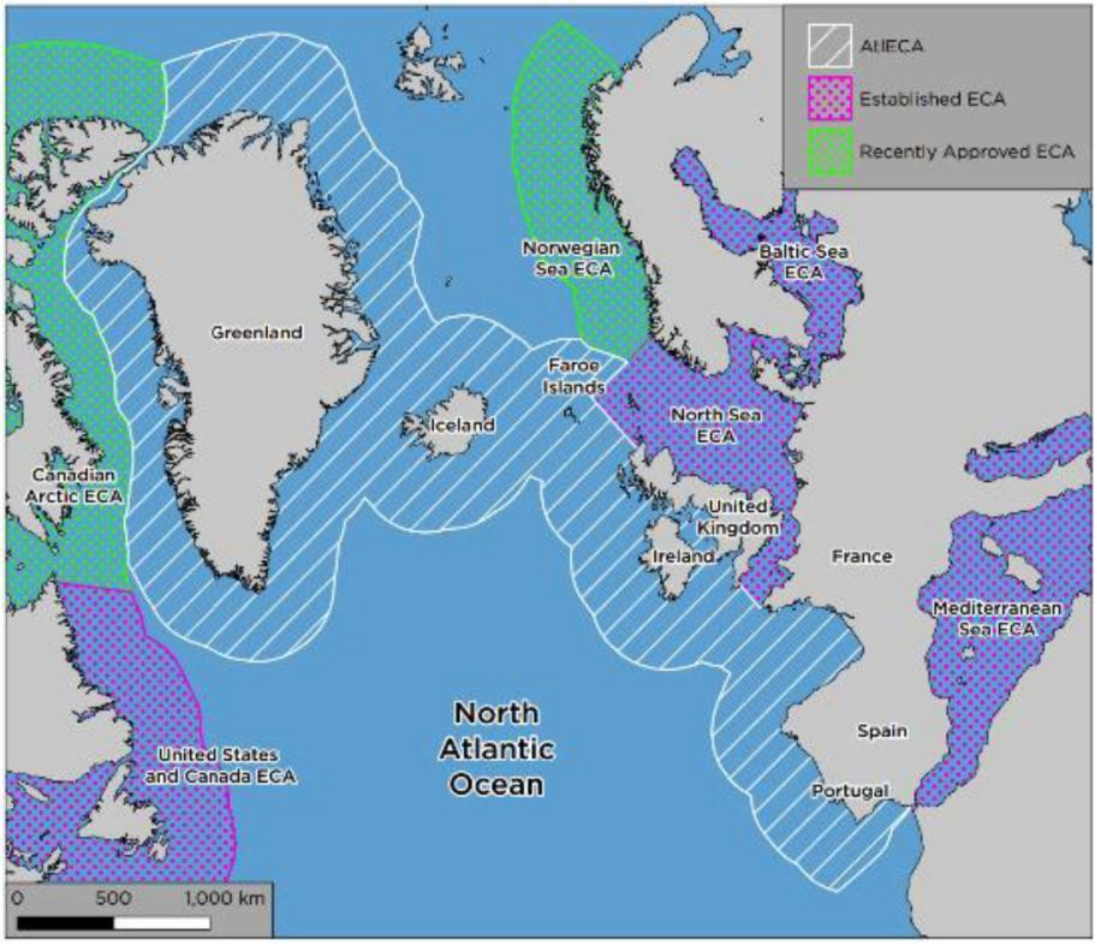


Illustration of North-East Atlantic ECA