DIRECTORATE-GENERAL FOR MOBILITY & TRANSPORT

Directorate D – Waterborne
Unit D1 - Maritime transport and logistics

GUIDELINES FOR REPORTING AND VERIFICATION OF ACTUAL METHANE SLIP TANK-TO-WAKE EMISSION FACTORS FROM MARINE DIESEL ENGINES UNDER THE SCOPE OF FUELEU MARITIME REGULATION

Version, 08 October 2025

Disclaimer

This document is part of a series of documents provided by the Commission services for supporting the implementation of FuelEU Maritime Regulation. The guidance represents the views of the Commission services at the time of publication. It is not legally binding.

Considering that there are no International standards in the maritime scope to certify actual emission factors of methane (CH_4) and/or nitrous oxide (N_2O), these Guidelines were developed to provide procedures for the reporting and verification of actual methane slip (C_{slip}) tank-to-wake emission factors from marine diesel engines, as well as documentation and verification of C_{slip} values, under the scope of FuelEU Maritime Regulation (FEUM).

This guidance document was endorsed in its first version by Member States of the ESSF Subgroup on the Implementation of the Fuel EU Maritime Regulation in its meeting on 8th October 2025.

Version History

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1 Introduction

1.1 The purpose of these Guidelines is to detail procedures for the reporting and verification of actual methane slip (C_{slip}) tank-to-wake emission factors from marine diesel engines[1], as well as documentation and verification of C_{slip} values, under the scope of FuelEU Maritime Regulation (FEUM). These Guidelines do not include measurement procedures for nitrous oxide emissions nor methane emissions from non-methane fuels due to very limited data on these emissions.

1.2 Article 10.5 of FEUM allows companies to diverge from default values for the tank-to-wake emission factors set out in Annex II, provided that actual values are certified by means of laboratory testing[2] or direct emissions measurements. Additionally, article 10.6 foresees that the Commission shall adopt implementing acts to specify which international standards can be used to certify actual emission factors.

1.3 Considering that there were no International standards in the maritime scope to certify actual emission factors of methane (CH_4) and/or nitrous oxide (N_2O), the Commission established a working group under the umbrella of the European Sustainability Shipping Forum (ESSF) to provide inputs on the development of such procedures. The group was established in 2023 and ended its work in 2024 by producing a report outlining 3 possible procedures: Test cycle, Engine Load Monitoring, and Continuous Emissions Monitoring Systems. The key elements of the group's report were included in a submission to IMO (MEPC 81/INF.8), that provided the starting point for a Correspondence group on non-CO_2 emissions (IMO CG). The IMO CG delivered it first report (MEPC 83/6/1) to MEPC 83 with a draft protocol to measure methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines. At its 83rd session, the Committee adopted Resolution MEPC.402(83), *"Guidelines for Test-bed and Onboard Measurements of Methane (CH_4) and/or Nitrous Oxide (N_2O) Emissions from Marine Diesel Engines."* However, due to time limitations it was not possible for the IMO CG to propose how such measurements could be used in estimating actual emissions in service. The Correspondence Group was re-established to further develop procedures for Engine Load Monitoring (ELM) and Continuous Emissions Monitoring Systems (CEMS), with a report expected at MEPC 84 (April 2026).

1.4 FEUM entered into force on 1st January of 2025. It accounts for methane and/or nitrous oxide emissions, and for this reason an interim solution is required until international standards and certification references are developed for demonstration of actual tank-to-wake emission factors and accepted in the EU legislative framework. These Interim Guidelines aim at addressing the following missing elements under discussion at the IMO: onboard verification, monitoring the performance of methane abatement aftertreatment devices, and the validity of test cycles for methane emissions.

1.4.1 To avoid overlapping requirements and additional administrative burden, the measurements, calculations and reporting for methane emission values should be carried out in accordance with MEPC.402(83). In case methane was not measured directly, measurements of total hydrocarbons (THC) performed according to MEPC.402(83) or the NTC, may be used as a proxy for methane The measurements of THC can only be considered if it includes a 10% mode point or the lowest mode point at which gas fuel would be used. For four-stroke engines that are not equipped with closed crankcase ventilation systems, crankcase emissions should be included in the emission value. The crankcase emissions should be based on measurements from the same or similar engines. If this data is not available, a default emission value based on technical justification should be used.

[1] MARPOL Annex VI / Nox Technical Code (NTC) definitions generally apply to the terminology used in this Guidelines.

[2] Laboratory testing is only envisaged for actual CO_2 tank-to-wake emission factors for non-fossil fuels, not for the determination of methane emission factors or methane slip values.

1.5 To address the missing elements mentioned in paragraph 1.4, the following measures should be implemented:

- Engine Load Monitoring to take into consideration the actual load profile of engines (see Annex I),
- A parameter check procedure in the scope of methane slip emissions to ensure that engines are not modified in a way that could increase methane slip emissions, or alternatively a yearly measurement following the procedures established by MEPC.402(83), applying the specific provisions for onboard measurements given therein (see Annex II).

Additionally for engines with methane abatement aftertreatment devices fitted:

- Companies should have a maintenance record book for the methane abatement aftertreatment device, which should be kept updated as long as the methane abatement device is in use. The record book should also contain a schedule of anticipated maintenance activities.

1.6 Continuous Emissions Monitoring measurements procedures are being developed currently under the IMO framework, and this document should be revised to take into consideration those procedures and further developments by the IMO in this scope.

1.7 Additional information on the methodological approach used to develop these Guidelines can be found in Annex III.

2 Documentation of the slip emission values

2.1 The company intending to use actual tank-to-wake methane slip emission factors should prepare the following documentation:

- a Methane File as required by MEPC 402(83) and complemented with the additional information detailed in section 2.2;
- a record book of changes to components, settings and operational values that may increase methane slip emissions;
- for engines with methane abatement aftertreatment, a record book for the methane abatement aftertreatment device;
- Additional methane slip related information for the FEUM report.

Methane File

2.2 The Methane File[3] as required by MEPC 402(83) taking in consideration the additional requirements provided in 1.4 and 1.5, and containing the following additional information:

2.2.1 For four-stroke engines that are not equipped with closed crankcase ventilation systems, crankcase emissions should be included in the emission value. The crankcase emissions should be based on measurements from the same or similar engines. If this data is not available, a default emission value based on technical justification.

2.2.2 allowable ranges for settings and operational values that may increase methane slip emission[4];

2.2.3 an assessment of the influence of ambient conditions on actual methane slip emissions[4]:

[3] A copy should be retained with the engine to which it refers.

[4] The effect of components/settings and operational values which affect methane slip emissions are still under research. Companies should liaise with the engine manufacturers to provide this information based on “best available knowledge and “good engineering judgement”.

2.2.4 A list of the engines in the same Engine Group, for which the company intends to use the actual tank-to-wake emission factors and a justification that the Parent Engine as tested represents the Member Engine of that Engine Group in terms of gaseous fuel slip emissions.

2.2.5 A justification should be provided that the Parent Engine[5] as tested represents the particular Member Engines of that Engine Group in terms of gaseous fuel slip emissions.

2.2.6 procedures to collect data using automated data collection systems (or without automated systems as per paragraph 3.3 of Annex I) and do the necessary calculations for Engine Load Monitoring and fuel consumption as described in Annex I. These procedures should include deviations and calibration validity periods of instruments.

2.2.7 procedures to implement a record book of engine parameters (Methane Slip) for recording of all the changes made relative to an engine's components and settings which may increase methane slip emissions;

2.2.8 A verification procedure, which can be based on one of the following methods:

.1 Parameter check method to be used to verify changes in components and settings/operation values which may increase methane emissions as detailed in Annex II paragraph 8, or;

.2 Measurement following the procedures established by MEPC.402(83), as close as practical to the verification process of the actual emission factors. Regarding engine performance measurements, 6.4.3 (excepting 6.4.3.5.2) of NTC 2008 may be applied). The procedure should consider the impact that ambient conditions may have on the measured emission factors.

2.2.9 For engines with methane abatement aftertreatment, procedures to implement a maintenance record book for the methane abatement aftertreatment device to demonstrate its periods of operations, which should be kept updated if the methane abatement device is in use. The record book should also contain a schedule of anticipated maintenance activities.

Record Book of changes that may increase methane slip emissions

2.3 To ensure the validity of the measurements, the change of engine components, settings or operational values that may increase methane emissions during the reporting period should be documented in a record book[6] (see Annex II). Any change of components, settings or operational values that increase methane emissions during the reporting period would invalidate the results.

Record Book for the methane abatement aftertreatment device

2.4 For engines with methane abatement aftertreatment, a Record Book for the methane abatement aftertreatment device to demonstrate its periods of operations and that an appropriate maintenance should be kept updated. The record book should also contain a schedule of anticipated maintenance activities.

Additional information for the FEUM Report

2.5 The following information should be prepared and reported by the company to the FEUM verifier on an annual basis together with the FEUM Report:

2.5.1 Data and calculations related to engine load monitoring for the reporting period, as described in Annex I.

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[5] For onboard measurements, measurements made following protocol set out in MEPC.402(83), 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. The same principle will be accepted for measurements of THC following NTC procedures made before adoption of MEPC.402(83).

[6] Only changes not already recorded in the record book of engine parameters under the NOx regulations should be recorded

2.5.2 Calibration certificates of instruments used to monitor engine load following NTC requirements as guidance. Where the NTC requirements cannot be followed, a justification should be provided subject to verifiers and administering state approval.

2.5.2.1 If the parameter check method is applied, records of changes to engine parameters and settings that may increase methane emissions within the reporting period - as required by Annex II - should be reported.

3 Verification of the *methane* emission values

Initial verification

3.1 In order to confirm that the emission values have been established according to these guidelines, a Methane File as required by MEPC 402(83) and containing the additional information according to paragraph 2.2 should be submitted. The Methane File should be approved by the flag administration or a organisation recognised by it, in accordance with MEPC.402(83).

3.2 FuelEU Monitoring Plan should be modified to include in Table B9[7], *Procedures for monitoring and reporting the well-to-tank and tank-to-wake emission factors of energy to be used on-board,* a brief description of the procedure and a reference to the approved Methane File.

3.3 On receipt of the modified Monitoring Plan, the FEUM verifier should confirmed that the ship has an approved Methane File according to section 2.2. The FEUM verifier should verify, at least:

- That the Methane File contains all information foreseen in section 2.2, and that it demonstrates with a reasonable assurance that the methane slip emissions were established in accordance with these guidelines.
- Determine the date of application of actual considering that:
    - the measurements of emissions should have been done prior to the end of the reporting for which the company intends to use actual slip emission factors;
    - the engine's components, settings or operating values which may increase methane slip emissions engine have remained unchanged throughout the reporting period, as described in the third bullet;
    - the monitoring procedures for engine load were in place from the beginning of the reporting period;
    - If one of the previous conditions is not fulfilled, the actual emission factor can only be considered from the date that all the previous conditions are in place.

Yearly verification reporting

3.4 The following should be reported annually by companies in the FEUM report and verified on an annual basis by FEUM verifier:

3.4.1 Yearly load monitoring data and corresponding emission factor calculations according to Annex I;

3.4.2 Results of the verification procedure, as specified in 2.2.8.

3.4.3 For engines with methane abatement system for the reporting period, an updated maintenance record book, as close as practical to the end of the reporting period.

3.5 If a Parameter check is required, the FEUM verifier should do a verification as detailed in Annex II.

3.6 If a yearly measurement following the procedures established by MEPC.402(83) is done, the FEUM verifier should confirm that the emission factor calculations according to Annex I are being done taking in considerations these values;

[7] See Commission Implementing Regulation (EU) 2024/2031 of 26 July 2024 on the template for monitoring plans pursuant to Regulation (EU) 2023/1805.

3.7 Administering States should include in the list of possible items to assess during the additional checks[8] the documentation referred to in paragraph 2 and the verification foreseen in paragraph 3.3 to 3.6.

3.8 All reported data and the verification report of the FEUM verifier should be made available on request of the competent authority of the administering state.

[8] As foreseen in Article 17 of FuelEU Maritime Regulation.

ANNEX I

INTERIM PROCEDURE FOR ENGINE LOAD MONITORING (ELM) TO ESTABLISH WEIGHTING FACTORS THAT REFLECTS THE ACTUAL OPERATION OF A MARINE DIESEL ENGINE AND CALCULATION OF EMISSION VALUES

1 Introduction

1.1 The purpose of this procedure is to specify the method for yearly engine load monitoring (ELM) to establish weighting factors that reflects the actual operation of a marine diesel engine, and for the calculation of emission values.

1.2 The ELM can be used to monitor actual engine load during operation instead of the pre-defined weighting factors as described in section 3.2 of the NTC, and to be used in combination with verified slip methane emission measurements in accordance with MEPC.402(83) to derive more representative emission values.

2 Emission values at different engine loads

2.1 The emission values for different engine loads are developed based on the verified methane emission values based on the Guidelines for test-bed and onboard measurements of methane emissions from marine diesel MEPC.402(83) and taking into consideration the 10% mode point or the lowest mode point, at which gas fuel would be used. Between the measured points, the emission value is calculated by linear interpolation of the closest data points above and below the load point. For engine loads below the lowest measured load point[1], or above the highest measured load points the emission value is calculated by linear extrapolation of the closest data points below or above the load point, at least to 1 decimal place.

3 Load monitoring

3.1 Load of each engine onboard is to be monitored. Permissible deviations and calibration validity periods of instruments should be subject to FEUM verifiers assessment and follow NTC requirements as guidance. Calibration certificate of the instruments used should be specified in the data collection procedure as described in paragraph 2.2.6 of these Guidelines, and the calibration and maintenance records should be included as an attachment to the Methane File.

3.2 Load could be based on one or a combination of the following signals:

- direct load measurement signal;
- torque flange and engine speed;
- shaft strain gauge and engine speed;
- calculated from generator output;
- estimated load based on cylinder pressure, injection duration as in 6.4.3.4 of the NTC 2008.

3.3 Engine load is to be continuously monitored and recorded onto a data recording and processing device at a rate which should not be less than 0.0033 Hz. Engine load is averaged in 30-minute intervals average if the range does not exceed 10% of the rated

power or rated speed of the engine – if above that range the 30-minute period should be reduced to the point where that criterion is met, or to the data recording and processing device period, whichever is higher. Shorter time periods can be agreed with FEUM verifier/Administering State. Liquid fuel only operation should be excluded from the averaging. In case of data gaps, companies should present a methodology to cover those periods subject to FEUM verifiers assessment. Acceptance of load monitoring without automated data collection is subject to the acceptance of the FEUM verifiers/Administering State.

3.4 When the engine has a gas fuel flow measurement installed, calibration certificate of the flow meters and the data required to convert the measurements to a mass basis should be specified in the data collection procedure as described in paragraph 2.2.6, and the calibration and maintenance records should be included as an attachment to the Methane File.

4 Calculations

4.1 Emission values for corresponding engine loads are calculated from verified measurements in unit g/g fuel, C_{slip} % (as % of the mass of the fuel used by the engine), or g/kWh. Calculation of C_{slip} % is done by following the procedure, according to one of the following options:

Option A: based on gas fuel flow measurement (example in Table A2):

A.1 total fuel mass (kg) is calculated during the 30 min period (or shorter time periods agreed with FEUM verifier) based on the fuel flow meter (and corrected for leakages and return flows as appropriate);

A.2 C_{slip} (%) emission factor at that specific load is obtained from the measurement data as described in section 2;

A.3 emission mass in kg during the period is calculated by multiplying the fuel mass by the C_{slip} (%) divided by 100; and

A.4 total weighted slip-% (C_{slip}) for the whole monitoring period is achieved by dividing the total emission (kg) of the reporting period by fuel mass (kg) and multiplied by 100.

Option B: without gas fuel flow measurement: (Example in Table A3):

B.1 Specific emission factor in g/kWh for the 30 min period (or shorter time periods agreed with FEUM verifier) is obtained from the measurement data as described in chapter 2;

B.2 Engine load is converted to power (kW);

B.3 Emission mass in kg during the 30 min period is calculated by multiplying the engine power output (kW) with time (h) and emission factor in g/kWh, divided by 1000; and

B.4 Total weighted slip-% (C_{slip}) for the whole monitoring period is calculated by dividing the sum of the emission (kg) by fuel mass (kg) and multiplied with 100.

5 Approval and Verification

Monitoring method and data collection procedure needs to be verified by the FEUM verifier. Load monitoring data made over the reporting period and corresponding emission calculations should be reported by companies in the FEUM report and verified by FEUM verifiers. In case of a measurement failure over some period, it should remain acceptable at the FEUM verifier's appreciation, with necessary prorate interpolation over the missing period.

Table A1: Data collected for calculation based on gas fuel flow measurement

Measurement points	Load (%)	Engine power (kW)	Gas Fuel flow (kg/h)	Gas fuel (g/kWh)	CH_4 (g/kWh)	CH_4 slip-%
5	92	4 031	608	151	3.54	2.3
4	77	3 410	512	150	3.08	2.0
3	50	2 239	350	156	3.91	2.5
2	26	1 152	204	177	7.30	4.1
1	11	500	108	216	13.10	6.1

Table A2: Example of calculation based on gas fuel flow measurement

Interval	Load (avg)	Fuel (kg)	C_{slip} (%)	C_{slip} (kg)	
00:00-00:30	5%	34.8	6.8%	2.4	
00:30-01:00	15%	66.8	5.5%	3.7	
01:00-01:30	55%	190	2.4%	4.6	
01:30-02:00	55%	190	2.4%	4.6	
02:00-02:30	73%	244	2.1%	5.1	
02:30-03:00	95%	313.5	2.4%	7.5	
03:00-03:30	32%	120.25	3.7%	4.4	
Total		1 159		32	
Weighted C_{slip} (%)					**2.8%**

Table A3: Example of calculation without gas fuel flow measurement

Engine rated power 4 400 kW

Total fuel used during the period 1159 kg

Interval	Load (avg)	Engine power (kW)	C_{slip} (g/kWh)	C_{slip} (kg)
00:00-00:30	5%	220	15.4	1.7
00:30-01:00	15%	660	11.6	3.8

01:00-01:30	55%	2 420	3.8	4.6
01:30-02:00	55%	2 420	3.8	4.6
02:00-02:30	73%	3 212	3.2	5.1
02:30-03:00	95%	4 180	3.6	7.5
03:00-03:30	32%	1 408	6.5	4.6
Total				32
Weighted C_{slip}(%)				**2.8%**

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ANNEX II

YEARLY VERIFICATION PROCEDURES

1. Companies should implement a verification procedure to be done yearly or whenever there is a change of components and/or adjustable features of the engine that increase methane emissions. The companies may choose between an engine parameter check or a measurement following the procedures established by MEPC.402(83), as close as practical to the verification process of the actual emission factors.

ENGINE PARAMETER CHECK METHOD TO VERIFY CHANGES IN COMPONENTS AND SETTINGS / OPERATING VALUES WHICH MAY INCREASE METHANE EMISSIONS

2. Engines installed in ships are designed taking into account the feasibility of check of components, adjustable features and engine parameters that may increase NOx emissions. These parameters are expected to be a significant part of the parameters for methane slip emissions, and whenever possible the parameter check under NOx emissions can be used for this scope. The verification should be limited to additional parameters specific of methane slip emissions.

3. Engine component checks, including checks of settings and an engine's operating values, are intended to provide an easy means of deducing the emissions performance of the engine for the purpose of verification that an engine with no, or minor, adjustments or modifications does not require an update of the verified actual emission factors (C_{slip}).

4. The purpose of such checks is to provide a ready means of determining that an engine is correctly adjusted in accordance with the manufacturer's specification and remains in a condition of adjustment consistent with the measurements made in accordance with MEPC.402(83).

5. If an electronic engine management system is employed, this should be evaluated against the original settings (as provided given in the Methane File) to ensure that appropriate parameters are operating within "as-built" limits.

6. For engines equipped with methane abatement systems, it will be necessary to check the operation of the abatement systems as part of the parameter check.

7. **Procedures for an engine parameter check method.**

7.1 The FEUM verifier should do an initial review of the engine documentation to confirm that the engine has not undergone any modifications or adjustments outside the options and ranges in the methane file that could cause the engines methane emissions to increase compared to the initially verified emission factors. The documentation to be evaluated should include, at a minimum, the following:

- Engine Technical File;
- Record Book of changes that may increase methane slip emissions;
- Record Book for the methane abatement aftertreatment device;
- Record book of engine parameters;
- IAPP surveys carried out by the flag administration, or any organisation recognised by it, regarding a parameter check in the scope of NOx.

7.2 The verifier should determine if the documentation review allows for a reasonable assurance that the engine has not undergone any modifications or adjustments outside the options and ranges in the methane file that could cause the engines methane emissions to increase compared to the initially verified emission factors. If this is not the case, an onboard

verification is required, or the company may present a report from an Administration, or an organisation recognised by it, done in parallel to IAPP survey attesting that the components that may increase methane emissions as declared in the Methane File have remained unchanged.

Onboard measurements following the procedures established by MEPC.402(83)

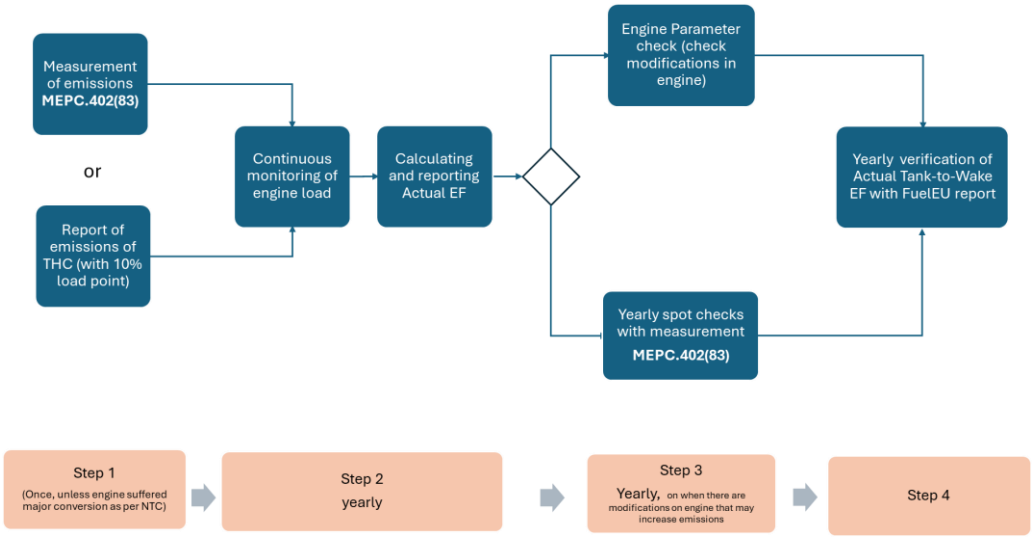
8 As an alternative approach to engine parameter check method, the yearly verification can be ensured through a measurement following the procedures established by MEPC.402(83), as close as practical to the verification process of the actual emission factors. Regarding engine performance measurements, 6.4.3 (excepting 6.4.3.5.2) of NTC 2008 may be applied). The procedure should consider the impact that ambient conditions may have on the measured emission factors.

ANNEX III

Frequently asked question on demonstration of actual C_{slip} emission factors

1. **What are the main steps to demonstrate actual non-CO2 emission factors?**

These are the main steps envisaged in the Interim Guidelines:



2. **Article 10.5 mentions Laboratory analysis as a possibility to certify actual tank-to-wake emission factors. Does this apply to non-CO2 emissions?**

No. As explained in section 5.4 of the 2024 Guidelines on Life Cycle GHG Intensity of Marine Fuels (2024 LCA Guidelines) IMO RES. MEPC.391(81), CO_2 emission factors are based on the molar ratio of carbon to oxygen of the fuel, and these can be determined by laboratory analysis. CH_4 and N_2O emission factors are dependent on the combustion and/or conversion factor and for this reason laboratory analysis are not applicable.

"For CO_2, the emission factors are based on the molar ratio of carbon to oxygen multiplied with the carbon mass of the fuel, assuming that all the carbon in the fuel is oxidized (stoichiometric combustion). The CH_4 and N_2O emissions factors are dependent on the combustion and/or conversion process in the energy converter."

3. **Do the measurements of methane emissions have to be done in all engines, or measurements on a Parent engine or family engine allowed?**

As clarified in Resolution MEPC.402(83) "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." The same principle will be accepted for measurements of THC before adoption of Resolution MEPC.402(83). Parent engine selection is to be well documented by the applicant, keeping in mind note 1 in MEPC402(83).

4. **Will measurements without the specific emission at the 10% mode point or the lowest load point at which gas fuelled will be used, be allowed?**

No. Only measurements that includes a specific emission at the 10% mode point or the lowest load point at which gas fuelled will be used are allowed.

5. **The composition of LNG includes varying percentages of methane, typically ranging from 90% to 98%. In specific instances, such as LNG tankers burning boil-off gas, the percentage can fall below 90%. Will this variation impact the C_{slip} emission factor?**

C_{slip} is the amount of fuel slipped as a percentage of the mass of the fuel consumed by fuel consumer unit. The content of methane on a specific fuel is accounted in a different parameter, the Csf_{CH4}, which is the methane emission factor by slipped fuel. Doing a deduction on C_{slip} based on the content of methane in the fuel is not consistent with FuelEU methodology, neither with the IMO LCA Guidelines methodology. Nevertheless, ships consuming boil off gas may subtract the nitrogen mass content for each laden voyage from LNG consumption in line with the procedures described in IMO 2022 Guidelines (Res. MEPC.346(78)) and IACS REC 175 Section 9.1, may IMO 2022 Guidelines (Res. MEPC.346(78)) and IACS REC 175 Section 9.1[1]. Also important to note, that if a ship is consuming a mix of methane and ethane, nothing prevents the ship from reporting separately each fuel, as it is foreseen under FuelEU that each fuel type should be reported separately. To ensure a methodological consistency, and because fuel composition will affect also CO_2 emissions, possible corrections regarding fuel composition should be done on the monitoring procedure of fuel consumption, and not specifically on the determination of specific emission factors. If a deduction would be applied during the measurements when a 90% methane fuels is used, this would mean that this value would underestimate emissions if the vessel uses an LNG with a higher percentage of methane. Additionally, C_{slip} regarding methane emissions, will only apply to methane fuels, and not to other fuels, like for example the pilot fuel being used on the engine, that should be reported separately.

6. **Does C_{slip} emission factor includes crankcase emissions and fugitive emissions?**

Under the IMO LCA Guidelines RESOLUTION MEPC.391(81), C_{slip} is defined as:
"Factor accounting for fuel (expressed in % of total fuel mass consumed in the energy converter) which escapes from the energy converter without being oxidized (including fuel that escapes from combustion chamber/oxidation process and from crankcase, as appropriate)"
This means that under the IMO LCA Guidelines, C_{slip} emission factor accounts for crankcase emissions however it excludes fugitive emissions.
This is not the case under FuelEU Maritime that defines C_{slip} as "Non-combusted fuel coefficient as a percentage of the mass of the fuel i consumed by fuel consumer unit j [%]. C_{slip} includes fugitive and slipped emissions." Currently there are no standard procedures to estimate onboard fugitive emissions, and as an interim procedure these will not be considered in these guidelines till further developments are made. Crankcase emissions should be included, however this emissions are only relevant for four stroke engines with open crankcase ventilation systems.

7. **Can measurements of Total Hydrocarbon (THC) done prior to the adoption of Resolution MEPC.402(83), with a minimum 25% mode point (E2/E3), be used?**

Extensive discussions have taken place on how to estimate a 10% mode point or the lowest mode point for gas fuel. Two proposals were initially suggested: linear extrapolation and polynomial extrapolation. However, recent discussions have introduced additional, more complex, suggestions as previous methods were considered inadequate. No consensus was reached on how these estimations should be done, consequently, measurements without a 10% mode point, or the lowest mode point at which gas fuel is used, are not allowed.

8. **Who should do the measurements foreseen in Resolution MEPC.402(83) for the scope of FuelEU Maritime?**

Measurements done in accordance with **MEPC.402(83)** and approved by an administration, or and organisation recognised by it, should be accepted in the scope of the Interim Guidelines

to demonstrate methane slip actual values and complemented with the information described in these Guidelines.

9. **Does the engine load monitoring procedures required automated data instruments with tamper proof protection?**

Tamper proof protection for automated data instruments is not currently envisaged. Nevertheless, the verifier should in the extent possible verify that the data reported is coherent with the operation of the vessel and in line with the values expected. The inclusion of this requirement requires further technical discussions and a period for its implementation.