



EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR MOBILITY AND TRANSPORT
Directorate D - Logistics, maritime & land transport and passenger rights
D.1 - Maritime transport & logistics

Document reference
[to be filled in by the
Commission]

Final draft version as approved at subgroup meeting on 17 May

**European Sustainable Shipping Forum
Plenary**

Final Report Submission from the ESSF sub-groups

Final report on the work of the MRV sub-group on Shipping MRV Monitoring

This document reflects the outcomes of deliberations of the Shipping MRV Monitoring sub-group of the European Sustainable Shipping Forum of which the European Commission is part. It is not an official document adopted by the European Commission.

Contents

| | | |
|-----|---|---|
| 1 | INTRODUCTION..... | 3 |
| 1.1 | Background..... | 3 |
| 1.2 | Objectives..... | 4 |
| 1.3 | Composition..... | 4 |
| 1.4 | Activities..... | 5 |
| 2 | DELIVERABLES..... | 6 |
| 2.1 | Guidance/ best practices compendium..... | 6 |
| 2.2 | Relevant input to the discussions at the IMO..... | 6 |
| 3 | REQUESTS TO PLENARY..... | 7 |

Annex 1: Summary of work package reports

Annex 2: Guidance on application of parameters for cargo carried

Annex 3: Consideration of voyages and ports of call for the monitoring of fuel consumption, CO₂ emissions, distance travelled, time spent at sea and cargo carried

1 INTRODUCTION

1.1 Background

Maritime transport emits around 1000 million tonnes of CO₂ annually and is responsible for about 2.5% of global greenhouse gas emissions (3rd IMO GHG study).

Shipping emissions are predicted to increase between 50% and 250% by 2050 – depending on future economic and energy developments. This is not compatible with the internationally agreed goal of keeping global temperature increase to well below 2°C compared to pre-industrial levels, which requires worldwide emissions to be at least halved from 1990 levels by 2050.

As a first step to reduce GHG emissions from shipping, Regulation 2015/757 on monitoring, reporting and verification of carbon dioxide emissions from maritime transport and amending Directive 2009/16/EC¹ creates an EU-wide legal framework for the monitoring, reporting and verification of CO₂ emissions from maritime transport. It requires large ships (over 5 000 gross tons) calling at EU ports from 1st January 2018 to collect and later report verified annual data on CO₂ emissions and other relevant information.

In order to complete the MRV shipping legal framework, the Commission amended Regulation 2015/757 so as to update the monitoring methods and rules in Annexes I and II to this Regulation (Commission Delegated Regulation (EU) 2016/2071 amending Regulation (EU) 2015/757 as regards the methods for monitoring carbon dioxide emissions and the rules for monitoring other relevant information²), and further specified its rules on verification and accreditation of MRV shipping verifiers (Commission Delegated Regulation (EU) 2016/2072 on the verification activities and accreditation of verifiers³). These two delegated Regulations aim at helping companies to fulfil their monitoring and reporting obligations in a harmonised way, and set additional rules for verification and accreditation of MRV shipping verifiers.

Also two Implementing Regulations have been adopted by the Commission and entered into force in November 2016.

- Implementing Regulation (EU) 2016/1928 on determination of cargo carried for categories of ship others than passengers ro-ro and container ships pursuant to Regulation (EU) 2015/757⁴
- Implementing Regulation (EU) 2016/1927 setting templates for monitoring plans, emissions reports and documents of compliance pursuant to Regulation (EU) 2015/757⁵

¹ OJ L 123, 19.5.2015, p. 55–76
<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0757&from=EN>

² OJ L 320, 26.11.2016, p. 1–4
<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R2071&from=EN>

³ OJ L 320, 26.11.2016, p. 5–24
<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R2072&from=EN>

⁴ OJ L 299, 5.11.2016, p. 22–25
<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1928&from=EN>

In order to pave the way for the implementation of the MRV Regulation, the Commission services have decided to establish a specific sub-group under the European Sustainable Shipping Forum on various monitoring issues.

1.2 Objectives

According to the Terms of References of the sub-group as approved by the ESSF Plenary in June 2015, the main objectives for the subgroup are to discuss and provide feedback to the Commission on the following aspects:

1. Identifying and reviewing technical rules for calculating the parameter of cargo carried for categories of ships other than passengers, ro-ro and container ships, falling under the Regulation as mentioned in Annex II, part A, point 2.
2. Identifying and reviewing international rules and international and European standards triggering possible amendments to the monitoring methods and rules set under Annexes I and II.
3. Identifying and reviewing scientific and technical developments triggering possible amendments to elements of the monitoring methods and rules set under Annexes I and II.
4. Reviewing draft templates and related technical rules for monitoring plans and emission reports.
5. Identifying best practices for monitoring fuel consumption, CO₂ emissions, cargo carried for all relevant ships types and other MRV relevant parameters.
6. Identifying relevant input to the discussions at the IMO on a global data collection system, including the method for calculating the parameters of cargo carried for all relevant ship types, in the context of further technical and operational measures for enhancing the energy efficiency of international shipping.

Respective tasks 1 – 6 are defined reflecting the corresponding objectives.

The first four tasks have been completed by the subgroup by June 2016, as described in the first report to the ESSF Plenary dated 28 June 2016. The views expressed by the Subgroup on these issues have been taken into account by the Commission as part of the preparation of the implementing and delegated acts related to monitoring and reporting.

Since the approval of the June 2016 report, the subgroup focussed on objective 5 and the corresponding task 5, the identification of best practise and guidance.

1.3 Composition

In accordance with the ToRs, the Subgroup included members drawn from:

- The European Commission (DG CLIMA and DG MOVE),
- The European Maritime Safety Agency (EMSA),
- Member States (MS),
- European and International Associations representing Ship Owners/Operators,
- Classification Societies and verifiers,

⁵ OJ L 299, 5.11.2016, p. 1–21
<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1927&from=EN>

- Environmental Non-Governmental Organisations,
- Representatives of voluntary schemes with the relevant expertise,
- Academia.

1.4 Activities

The report of the subgroup to the ESSF Plenary of 28 June 2016 describes the activities of the first phase including five meetings and four Work Packages.

During the second phase of activities, four additional meetings of the MRV Monitoring Subgroup were held on 6 December 2016, 14 February 2017, 24 April 2017 and on 17 May 2017 where the subgroup agreed on the recommendations to be addressed to the ESSF Plenary.

To support the activities of the subgroup, Task Forces have been established for following additional Work Packages:

| WP | Title | Coordinator |
|----------------|---|-------------------------------------|
| Work Package 5 | Guidance on the monitoring of fuel consumption | Torsten Mundt (DNV GL) |
| Work Package 6 | Guidance on the determination of distance travelled and time spent at sea | Wolfram Guntermann (Hapag-Lloyd AG) |
| Work Package 7 | Guidance on the preparation of monitoring plans | Helena Athoussaki (PwC) |
| Work Package 8 | Guidance on monitoring methods for ships using the exemption from per-voyage monitoring | Carlos Pereira (EMSA) |

Summaries of the results of the work packages are provided in Annex 1.

Based on the reports produced by Work Packages 2, 3 and 4, the Commission prepared a draft guidance paper on the determination of cargo carried which has been agreed by the subgroup at its meeting on 6 December 2016. The key section on application of parameters for cargo carried is documented in annex 2.

Based on discussions at subgroup meetings and input provided by Work Packages, the Commission and EMSA prepared a paper on the consideration of voyages and ports of call for the monitoring of fuel consumption, CO₂ emissions, distance travelled, time spent at sea and cargo carried (see annex 3).

Overall, the subgroup considers its tasks fulfilled and notes that according to points 2.3 of the ToRs on timetable and on duration, the MRV Monitoring Subgroup is to disband as soon as its core mandate is fulfilled.

2 DELIVERABLES

2.1 Guidance/ best practices compendium

The subgroup, based on the material produced by the Work Packages, developed best practise and guidance on a number of issues relevant for the implementation of MRV.

Starting point has been the list of issues documented in Annex 5 to the subgroup's first report to Plenary (dated 28 June 2016).

Following issues have been addressed:

- Fuel consumption monitoring using methods A (BDN & periodic stocktake), B (bunker fuel tank monitoring) and C (flow meters);
- Fuel consumption for LNG carriers using boil-off gas as fuel;
- Determination of fuel density;
- Determination of emission factors for fuels which are not included in MEPC.1/Circ.866;
- Default values for uncertainty of monitoring methods which could be applied in the monitoring plans;
- Determination of distance travelled (e.g. measurement through the water or over ground, consideration of drifting, movements for tank cleaning);
- Determination of time spent at sea;
- Adapted monitoring methods for the use of the exemption from per-voyage monitoring (Article 9 (2));
- Preparation of monitoring plans including the use of templates.

As deliverables several working papers have been produced by the Work Packages and agreed by the subgroup:

- Guidance on fuel monitoring (Work Package 5)
- Guidance on LNG – Boil off Gas (BoG) monitoring (Work Package 5)
- Guidance on EIV determination (Work Package 5)
- Guidance on the determination of distance travelled and time spent at sea (Work Package 6)
- Guidance for the preparation of monitoring plans (Work Package 7)
- Guidance on monitoring methods for ships using the exemption from per-voyage monitoring (Work Package 8)

2.2 Relevant input to the discussions at the IMO

During the preparation of the deliverables of the subgroup, no particularly relevant input for IMO discussions has been identified.

3 REQUESTS TO PLENARY

The Shipping MRV Monitoring Subgroup requests the ESSF Plenary to note and endorse this report including the recommendations for best practice/guidance listed in Annex 1.

Furthermore, the Plenary is requested to note that the subgroup's mandate is fulfilled and that the MRV Monitoring Subgroup is to disband.

Annex 1: Summary of Work Package reports

Work package 5: Guidance on the monitoring of fuel consumption – Summary of reports

Introduction

At its meeting of the ESSF Shipping MRV Monitoring sub-group on 6 December 2016, it was agreed to establish a Work Package to develop guidance/best practices on monitoring of fuel consumption. The coordination of this Work Package has been ensured by Mr Torsten Mundt (DNV GL).

Terms of reference

The group was assigned with the following tasks:

1. Within the legal framework for MRV (Shipping MRV Regulation 757/2015 and its Implementing and Delegated Regulations), provide recommendations on guidance and identify, where relevant, best practise on the monitoring of fuel consumption.
2. Address at least following issues which have been identified by the subgroup:
 - a. Method B (fuel tank readings): In cases of equipment failure, where electronic equipment is used, fuel tank readings can be carried out with manual tank reading methods;
 - b. Fuel consumption for LNG carriers using boil-off gas as fuel: For those ships the existing Custody Transfer Management System (CTMS) can serve as a very advanced method to determine the fuel consumed on its voyages. LNG consumed at berth can be derived by the flow meters installed on the piping supplying gas to the consumers (engines, boilers, etc.) or by level gauges and calibration tables;
 - c. Fuel density: A number of issues should be addressed including the non-linear relationship between fuel oil density, temperature and pressure (to be taken into account when converting measured volumes into mass at varying temperatures), varying densities due to different measurement methods and the mixture of fuels made on board;
 - d. Uncertainty: Guidance on expected levels of uncertainty for the different monitoring methods including default values which could be applied in the monitoring plans.
3. Take into account the earlier work done by the subgroup including the final report of the 'Study on potential impacts of design choices for monitoring, reporting and verification of CO₂ emissions from maritime transport' (PWC study).
4. Organise, if appropriate, a face-to-face meeting to advance the discussions.
5. Submit by 31 January 2017 a report on the findings of the work package in view of agreeing on recommendations on guidance on the monitoring of fuel consumption at the ESSF MRV monitoring subgroup meeting in February 2017.

Furthermore, the ESSF Shipping MRV Monitoring sub-group invited this Work Package to develop guidance/best practice for the determination of the EIV.

Recommendations

The Work Package's main recommendations on the monitoring of fuel consumption can be summarized as follows:

1. For fuel monitoring by method A, the frequency of fuel tanks' stock takings through soundings/ ullages should occur:
 - a) Upon bunkering and de-bunkering
 - b) Upon arrival to the first berth of a port⁶ and before leaving the last berth of the port where commercial cargo operations or embarkation/disembarkation of passengers took place⁷ prior to engaging on a voyage for a port outside the scope of the Regulation.
 - c) For ships in short and regular trades and for ships using shore power while at berth the measurements may take place either upon arrival at the first berth or before leaving the last berth.
 - d) Allocation of all fuel consumption (for each fuel type) not under the scope of the regulation is needed as the sum (of the fuel consumed not under the scope) is to be subtracted from the amount provided in the Bunker Delivery Note (BDN)
2. For fuel monitoring by method B, the frequency of fuel tanks' stock takings through soundings/ ullages should occur:
 - a) Upon bunkering and de-bunkering
 - b) Fuel tank readings for all bunker tanks on board should occur daily when the ship is at sea⁸. These could be on a daily basis at 12:00 noon time, the start/end of a canal crossing, a voyage interruption, etc.
 - c) While at sea passage prior entry and exit of a Sulphur Emission Control Area (SECA) if there is a fuel switch.
3. The ship specific sounding / calibration tables produced by shipyard for each individual bunker tank should be used to determine the volume of bunker in each tank taking into account the trim and list of the vessel.
4. For temperature and atmospheric pressure corrections of density and mass calculations, ASTM D 1250-80 Standard Guide for Petroleum Measurement, table 54B, or equivalent tables or a substantiated software should be used.
5. Density values to be used could be one of the following:
 - a) on-board measurement systems;
 - b) the density measured by the fuel supplier at fuel bunkering and recorded on BDN;
 - c) the density measured in a test analysis conducted in an accredited fuel test laboratory, where available.

⁶ If part of a voyage under the scope of the Regulation

⁷ This may be applicable for fuel monitoring method B as well.

⁸ Fuel tank readings from tanks that have no transfer nor consumption can be omitted.

6. Alternatively, and to cater for temperature correction, standard conversion factors may be used: 0.96 for RME180, RMG 180/380/500/700 or RMK 380/500/700; 0.88 for MGO/MDO.
7. In general, there are several methods of gauging fuel tanks, e.g., manual soundings, gauges with audible noise when an oil interface is reached, pressure transducers, radar and so forth; each ship will adapt this part for description according to the equipment they use.
As back-up for fixed installed tank sounding / gauging equipment, the method of determination of a tank's sounding or ullage is suggested to be manual soundings. The tape or measuring device is to be graduated in feet, inches and fractions of an inch; or meters, centimetres, and millimetres.
8. Vessel's equipment used for gauging should always be substantiated for accuracies. This should be done by:
 - Checking the condition and calibration (if applicable) of the instrumentation used for gauging the quantity of bunkers on board
 - Recording the calibration certification (if applicable).
 - Visual inspection of ullage tape to ensure there has been no damage to the tape and/or whether any repairs have been made that may alter readings.
9. Repeated measurements are taken for each tank to obtain at least two consistent readings. If two measurements are not similar then an average reading based on at least three measurements is recommended to do.
10. For continuous fuel oil monitoring, the data from all flow meters linked to fuel consumers minus the data from all flow meters at the return lines (if applicable) from the same consumers should be combined to determine fuel consumption over a period. Regardless if the fuel measurements are automatically recorded and transmitted, it is a good practice for ships engaged in long voyages when at sea, to record daily measurements in the Engine Logbook.
11. Concerning emission factors for 'non-standard' fuels, for simplicity and consistency reasons, it is suggested that such new fuels (so-called "hybrid-fuels") should use the standard CO₂ - conversion factors applied for light fuel oil (i.e. 3.151 when its viscosity is within RMA to RMD grades) and for distillates (i.e. 3,206 when similar to DMA or DMZ grades).
12. The quantity determination is inherently subject to uncertainty. To deal comprehensively with the overall uncertainty figure with fuel monitoring on board a ship, it is to be noted that the measurement accuracy (uncertainty) of single equipment (e.g. flowmeters for receiving bunkers, density determination, storage in bunker tank,...) provide not the full picture of uncertainty levels for all processes of fuel oil handling on board. To serve as best practice, it is proposed (for the time being) to state an overall uncertainty level as follows:

| Monitoring Method acc. to Reg. EU 2015/757 | overall max. uncertainty level |
|--|--------------------------------|
| method A | ± 10% |
| method B | ± 10% |
| method C | ± 10% |

The Work Package's main recommendations on the monitoring of LNG/ boil off gas (BoG) consumption can be summarized as follows:

13. For calculating the BoG quantity by CTMS (custody transfer measurement system), cargo consumed on the passage is calculated by using the “CTMS closing” (final volume on board at the loading terminal upon completion of loading) and “CTMS opening” (total volume upon arrival at the discharge terminal just before commencement of discharging) figures. In case of cargo discharge at several locations in a port of call, the discharged volumes have to be aggregated. In case of further discharges in other ports of call, the volumes discharged in these ports have to be added to the discharged volume, until new cargo is loaded.
14. On the ballast passage LNG carriers may maintain a comparatively small amount of LNG called "the heel" which can be used as fuel and/ or for maintaining the cargo tanks in cold state ready to be loaded at the next loading port, using the same methodology as for the laden passage consumption.
15. If it is chosen to measure the BoG with flow meters instead of measuring through the CTMS, the BoG is measured either in volume and then converted to mass using appropriate density, pressure and temperature corrections or measured directly in mass (Coriolis type flow meters).
16. In cases where the BoG is measured via onboard volume flow meters, the method to convert volume to weight (e.g. using the composition of the cargo at load port for deriving its density and converting volume to mass) will be decided by the company and described in the company's management procedures. A general formula for determining BoG density is provided (SIGTTO publication 'Liquefied Gas Handling Principles on Ships and in Terminals' (LGHP4) 4th Edition, Section 8.5.2).

The Work Package's main recommendations on the determination of the EIV can be summarized as follows:

17. Companies are encouraged to report voluntary EEDI values, if available, instead of the EIV.
18. The EIV should be calculated using the formulae provided by MEPC.231 (65), MEPC.233 (65) and MEPC.1/Circ. 866.
19. Data should be taken from available documents. If available, the reference speed can be obtained from the power-speed curves produced following sea trials at the time of delivery. Alternatively, data can potentially be obtained for vessels equipped with hull & fuel performance monitoring systems. If no other values are available, the IHSF database should be used.

Work package 6: Guidance on the determination of distance travelled and time spent at sea – Summary of report

Introduction

At its meeting of the ESSF Shipping MRV Monitoring sub-group on 6 December 2016, it was agreed to establish a Work Package to develop guidance/best practice on the determination of distance travelled and time spent at sea. The coordination of this Work Package has been ensured by Mr Wolfram Guntermann (Hapag-Lloyd AG).

Terms of reference

1. Within the legal framework for MRV (Shipping MRV Regulation 757/2015 and its Implementing and Delegated Regulations), provide recommendations on guidance and identify, where relevant, best practice on the determination of distance travelled and time spent at sea.
2. Address at least measurement through the water or over ground, the possible consideration of drifting, movements for tank cleaning and interpretation of the term 'berth'.
3. Take into account the earlier work done by the subgroup including the final report of the 'Study on potential impacts of design choices for monitoring, reporting and verification of CO₂ emissions from maritime transport' (PWC study).
4. Organize, if appropriate, a face-to-face meeting to advance the discussions.
5. Submit by 31 January 2017 a report on the findings of the work package in view of agreeing on guidance on the monitoring of fuel consumption at the ESSF MRV monitoring subgroup meeting in February 2017.

Recommendations

The Work Package's main recommendations can be summarized as follows:

1. Distance travelled should be determined as distance over ground to follow the approach decided at IMO's MEPC 70.
2. Should the vessel be adrift (i.e. while waiting for a berth) the distance should be included as the vessel is underway. Even if the main propulsion is temporarily not required, there will be still auxiliary generators and boilers in operation.
3. Distances made for the purposes of tank cleaning operations should be included as the vessel is underway.
4. Ship to Ship Transfer within defined limits of a port is considered as a port call.
5. Unforeseen voyage deviations such as SAR (Search and Rescue), disembarkation of a sick crewmember, etc. should not result in an additional administrative burden for the carrier and verifier. Therefore it should be reported on a voluntary basis only.
6. Since the EU Regulation stipulates that "time spent at sea" shall be calculated based on port departure and arrival information, it is recommended to use the arrival at the first berth and the departure of the last berth in a port where cargo operations have been conducted.
7. Standard voyage distances and the use of scheduled time between scheduled port of departure and scheduled port of arrival for the monitoring of time spent at sea should be only considered for short fixed voyages such as for ro-ro/ ro-pax vessels. However, the usage of standard short voyages cannot be based exclusively on VTS distance, since distances and time spent at sea could be also subject to many factors such as avoiding shallow waters or an ECA transit.
8. Given a high number of deviation scenarios, applying a "most direct route" (standard distance and time spent at sea) should be strongly discouraged, but could be used in order to fill data gaps subject to final approval by the verifier.

9. It should be borne in mind that any correction factors have to be defensible and must be justifiable towards the verifier. There is a risk of wrongly estimating distances, (either as under or over estimation). It can create uncertainty in comparison to truly measured distances over ground and may result in an uneven, distorted playing field.

Work package 7: Guidance on the preparation of monitoring plans – Summary of report

Introduction

At its meeting of the ESSF Shipping MRV Monitoring sub-group on 6 December 2016, it was agreed to establish a Work Package to develop guidance/ best practise on the preparation of monitoring plans. The coordination of this Work Package has been ensured by Ms Helena Athoussaki (PwC).

Terms of reference

1. Within the legal framework for MRV (Shipping MRV regulation 2015/757 and its Implementing and Delegated Regulations), provide recommendations on guidance and identify, where relevant, best practice for the preparation of Monitoring Plans.
2. Take into account the earlier work done by the subgroup including the final report of the ‘study on potential impacts of design choices for monitoring reporting and verification of CO2 emissions from maritime transport’ (PwC study).
3. Organise, if appropriate, a face-to-face meeting to advance the discussions.
4. Submit by 31 March 2017 a report on the findings of the work package in view of agreeing on recommendations on guidance on the monitoring subgroup meeting in April/May 2017.

Recommendations

The Work Package's main recommendations can be summarized as follows:

1. Companies may use any template as long as it is according to the content of Annex 1 of Regulation 2016/1927.
2. Companies may split the Monitoring Plan into a company specific and vessel specific according to article 2 of Annex 1 of Regulation 2016/1927 and indicate at the beginning of the template which tables are company specific.
3. When describing a procedure in the Monitoring Plan, companies should consider the level of detail required to provide a sufficient level of understanding to the verifiers.
4. For monitoring and reporting carbon emissions it is important for companies to ensure that data is retrieved, collected, transported and stored in a controlled way.
5. A clear description of the data flow is necessary to obtain a clear picture of how data about fuel consumption, transport work and other relevant information is collected from various sources and is subsequently aggregated for the emission

report. Preparing simple process flow charts provide an efficient mean to obtain a good overview of data exchange between departments/locations.

6. The company should mention in the Monitoring Plan the name or the position of the person responsible for the procedure. This enables companies to record responsibilities and to identify whom to contact in case queries are raised about the procedure.
7. The location of where records are kept should be specified in the Monitoring Plan in order to ensure availability of information also in cases where the contact person for the purpose of the Monitoring Plan changes. Also, this will be included in the verifier's risk assessment and the decision on the necessity – and destination – of a site visit.

Work package 8: Guidance on monitoring methods for ships using the exemption from per-voyage monitoring – Summary of report

Introduction

At its meeting of the ESSF Shipping MRV Monitoring sub-group on 14 February 2017, it was agreed to establish an ad-hoc Work Package to develop guidance/ best practice on monitoring methods for ships using the exemption from per-voyage monitoring. Relevant recommendations from other Work Packages have been compiled and additional recommendations developed. The coordination of this Work Package has been ensured by Mr Carlos Pereira (EMSA).

Recommendations

The Work Package's main recommendations can be summarized as follows:

*a) Determination of **distance travelled** and **time spent at sea***

1. Use of standard distance considering routing elements such as avoiding shallow waters or an ECA transit
2. Annual distance travelled: multiplying the distance travelled with the number of annual voyages (calculation per standard route and subsequent aggregation)
3. Time spent at sea: use of scheduled time between scheduled port departure and scheduled port arrival
4. Annual time spent at sea: multiplying the scheduled travel time with the number of annual voyages (calculation per standard route and subsequent aggregation)

*b) Determination of **cargo carried** and **transport work***

5. Deviation from per-voyage monitoring possible in case of single standard routes (cargo and distance to be multiplied to calculate transport work), provided that all the performed voyages are of the exact same length
6. Use of commercial documents with aggregated cargo figures (either total annual or per standard route)

*c) Determination of **fuel consumption** and **CO₂ emissions***

7. Fuel monitoring and recording should be carried out at the beginning of the monitoring period and at the end of the monitoring period for each fuel type and/or each storage tank and upon bunkering and de-bunkering.

8. Companies may follow more frequent intervals according to their internal procedures.
9. Fuel consumption (and subsequently CO₂ emissions) in ports may be calculated by multiplying the estimated hourly consumption while the ship is at berth with the average time spent at berth and the number of annual voyages.

Annex 2: Guidance on application of parameters for cargo carried

This section provides further guidance for some ship types to which more complex rules apply.

1. Determination of cargo carried for ro-ro ships

For ro-ro (cargo) ships, the company must specify in the monitoring plan (Table C.5.) which of the following options will be used for determining cargo carried:

1. Actual cargo weight
2. Actual loaded lanemeters multiplied with the default weight per lanemeter
3. Number and types of units multiplied by default weight per unit

Where options 2 or 3 are applied, the company must list in the monitoring plan (Table C.5.) the relevant default values to be used. These default values have to be representative for the trade in which the vessel is intended to trade and the so applied default value(s) have to be substantiated by the company to the satisfaction of the verifier. Such substantiation can be:

- past performance,
- on the performance of a vessel serving the same trade,
- based on the company's estimated use for the coming period,
- based on another method that satisfies the verifier.

The so declared default weights have to remain unchanged for the reporting period unless the monitoring plan is revised in accordance with Article 7 of the Shipping MRV Regulation to reflect a fundamental change to the average weights per lanemeter or per unit during a reporting period.

2. Determination of cargo carried for ro-ro passenger (ro-pax) ships

For ro-pax ships, the company must specify in the monitoring plan (Table C.5.) which of the following options will be used for determining cargo carried:

1. Actual cargo weight
2. Actual loaded lanemeters multiplied with the default weight per lanemeter
3. Number and types of units multiplied by default weight per unit

Where options 2 or 3 are applied, the company must list in the monitoring plan (Table C.5.) the relevant default values to be used. These default values have to be representative for the trade in which the vessel is intended to trade and the so applied default value(s) have to be substantiated by the company to the satisfaction of the verifier. Such substantiation can be:

- past performance,
- on the performance of a vessel serving the same trade,
- based on the company's estimated use for the coming period,
- based on another method that satisfies the verifier.

The so declared default weights have to remain unchanged for the reporting period unless the monitoring plan is revised in accordance with Article 7 of the Shipping MRV

Regulation to reflect a fundamental change to the average weights per lanemeter or per unit during a reporting period.

The passenger vehicle units loaded in the area allocated to passenger vehicles (which is included in the area allocated to the passenger area), must not be included in the calculation of cargo mass.

3. Determination of cargo carried for vehicle carriers

For vehicle carriers, the company must specify in the monitoring plan (Table C.5.) which of the following options will be used for determining cargo carried:

1. Actual cargo weight
2. Actual loaded lanemeters multiplied with the default weight per lanemeter
3. Number and types of units multiplied by default weight per unit

Where options 2 or 3 are applied, the company must list in the monitoring plan (Table C.5.) the relevant default values to be used. These default values have to be representative for the trade in which the vessel is intended to trade and the so applied default value(s) have to be substantiated by the company to the satisfaction of the verifier. Such substantiation can be:

- past performance,
- on the performance of a vessel serving the same trade,
- based on the company's estimated use for the coming period,
- based on another method that satisfies the verifier.

The so declared default weights have to remain unchanged for the reporting period unless the monitoring plan is revised in accordance with Article 7 of the Shipping MRV Regulation to reflect a fundamental change to the average weights per lanemeter or per unit during a reporting period.

In addition, on a voluntary basis, for vehicle carriers, cargo carried may also be determined as deadweight carried for laden voyages (and zero for ballast voyages).

4. Determination of cargo carried for general cargo ships

Commission Implementing Regulation (EU) 2016/1928 specifies the parameter for cargo carried to be applied for general cargo ships as "*deadweight carried for laden voyages and zero for ballast voyages*".

For laden voyages, deadweight carried is calculated as follows:

DWT carried = volume displacement x water density – ship's lightweight – fuel weight

- DWT carried: expressed in metric tonnes
- Volume displacement: measured volume displacement of a ship at a load draught condition, determined as the volume of the moulded displacement of the ship, excluding appendages, in a ship with a metal shell, and means the volume of displacement to the outer surface of the hull in a ship with a shell of any other material, expressed in cubic metres
- Water density: relative water density at departure of the laden voyage concerned, expressed in metric tonnes per cubic metre

- Ship's lightweight: the actual weight of the ship with no fuel, passengers, cargo, water and other consumables on board, expressed in metric tonnes
- Fuel weight: weight of the fuel on board determined at the departure of the laden voyage concerned, expressed in metric tonnes

For the determination of the above parameters, following methods and sources should be used:

- Visual readings of the draught can be used to calculate the volume displacement with the help of a certified draft measurement scale. Digital readings could be used to validate the visual readings. For the ship's crew it will not be that burdensome, as the crew at almost all times already do visual reading. Draught measurements should be done just before departure/beginning of the voyage.
- The ship's lightweight should be taken from the stability booklet approved by the Administration or an organization recognized by it.
- To calculate the amount of fuel (by weight) the same three proposed monitoring methods (A, B and C) as for the fuel consumption should be used.

The methods applied to determine the volume displacement, the water density and the fuel weight have to be consistently applied during the entire reporting period and have to be specified in the monitoring plan (Table C.5.).

In addition, on a voluntary basis, for general cargo ships, cargo carried may also be determined as mass of the cargo on board.

5. Determination of cargo carried for container ships

The Shipping MRV Regulation foresees two options to determine the amount for cargo carried which is expressed as mass of the cargo on board:

1. Actual cargo weight
2. Number of 20-foot equivalent units (TEU) multiplied by default values for their weight

The selected option has to be specified in the monitoring plan (Table C.5.) and applied consistently for the entire reporting period.

For option 1, the actual cargo weight should be determined using the verified gross mass information used under the new SOLAS regulations applicable to packed containers (reference is made to MSC.1/Circ.1475).

Where option 2 is applied, the company must list in the monitoring plan (Table C.5.) the relevant default values to be used. The use of a single default value of 12 tonnes per TEU is recommended as well as the use of a single default value of 2 tonnes per empty TEU.

It should be noted that the container industry uses a variety of standard container sizes, but standard default weights (consistent with the 12 tonne default figure per TEU and 2 tonnes per empty TEU) are easily calculated. The use of following standard conversion factors and default weights as noted in Table 2 is recommended:

Table 2: TEU Conversion factors and default weights

| Container Size | TEU Conversion factor (TEU equivalents) | Default weight empty containers (in tonnes) | Default container weights (in tonnes) |
|---|---|---|---------------------------------------|
| 20' ST TEU 8'6" plus 20' High Cube (HC) | 1.0 | 2 | 12 |
| 40' ST FFE 8' 6" (forty-foot equivalent unit) | 2.0 | 4 | 24 |
| 40' High Cube (FFE 9'6") plus 45' and 48' | 2.25 | 4.5 | 27 |

ST - Standard, TEU - twenty-foot equivalent unit, FFE – forty-foot equivalent, HC – high cube

6. Determination of cargo carried for LNG carriers

Cargo carried for LNG carriers is determined as volume. LNG carriers often use boil off gas as a fuel. This means that the amount of LNG on board at the start of a voyage is larger than the amount of LNG discharged as cargo at the end of a voyage. Moreover, they often keep a small amount of LNG in the tank to maintain a low temperature. Therefore, for the determination of cargo carried, the amount of cargo is monitored at the discharge terminal.

The discharged volume of LNG is equal to the amount of cargo carried in case of discharge of the total amount at one single location. In case of discharge at several locations in a port of call, the discharged volumes have to be aggregated. In case of further discharges in other ports of call (in other words: during the subsequent voyages), the volumes discharges in these ports have to be added to the discharged volume, until new cargo is loaded.

For example, if an LNG carrier loads LNG at port A, then sails to port B where it discharges $X \text{ m}^3$ and onwards to port C where it discharges $Y \text{ m}^3$, and finally returns to port A where it does not discharge any LNG, the amount of cargo on the voyage from A to B amounts to $X+Y \text{ m}^3$, the amount of cargo on the voyage from B to C amounts to $Y \text{ m}^3$, and the amount of cargo on the voyage from C to A is zero". This example also shows how to calculate the amount of cargo on voyages where no cargo is discharged.

To obtain information about discharged volumes of cargo, the Custody Transfer Management System (CTMS) should be used.

7. Determination of cargo carried for chemical tankers, bulk carriers and combination carriers

In addition to the monitoring and reporting of the amount of cargo carried, on a voluntary basis, the average density of the cargoes transported in the reporting period could be monitored and reported for chemical tankers, bulk carriers and combination carriers.

For that purpose, information about the methodology and procedures applied should be specified in the monitoring plan (Table C.5.) and applied consistently for the entire reporting period.

8. Determination of cargo carried for other ship types

For all other ships not covered by the definitions of one of the 14 categories, the company selects one of the two parameters:

- Mass of the cargo on board
- Deadweight carried for laden voyages and zero for ballast voyages

This choice is to be specified in the monitoring plan (Table C.5.) and applied consistently for the entire reporting period.

Annex 3: Consideration of voyages and ports of call for the monitoring of fuel consumption, CO₂ emissions, distance travelled, time spent at sea and cargo carried

A voyage is considered from the last berth or ship-to-ship transfer within a port of call⁹ to the first berth or ship-to-ship transfer in the following port of call.

For the parameters to be monitored¹⁰, following scope applies:

| Parameter | During voyage | In EEA ports | Total |
|---------------------------|----------------------|---|-------------------------------|
| Fuel consumption | Yes | Yes* | During voyages |
| CO ₂ emissions | Yes | Yes (CO ₂ emitted from arrival at 1 st berth until departure from last berth) | During voyages + in EEA ports |
| Distance travelled | Yes | No | During voyages |
| Time spent at sea | Yes | No | During voyages |
| Cargo carried | Yes | No | During voyages |

* *The monitoring of fuel consumption in EEA ports is required to determine the CO₂ emissions unless direct emissions monitoring is applied.*

For the purpose of shipping MRV, specific situations and activities are considered as follows:

Ship-to-ship transfer of cargo or passengers:

- Part of voyage if carried out outside a port of call¹¹ (cargo carried needs to consider the amount of cargo before and after ship-to-ship transfer by calculating the weighted average for the entire voyage)
- If carried out within a port of call, ship-to-ship transfers are treated as cargo operations at berth: A ship-to-ship transfer within a port (prior to arrival at the first berth, if applicable) would be considered as the endpoint of the incoming voyage (and ship-to-ship transfer within a port after the last berth considered as start point of next voyage).

Anchoring:

- Considered as part of voyage if happening prior to arrival at port of call (arrival at 1st berth or 1st ship-to-ship transfer) or after departure from port of call (departure from last berth or last ship-to-ship transfer)
- Excluded for determination of time spent at sea

⁹ To recall that the EUMRV Regulation defines 'port of call' as the port where a ship stops to load or unload cargo or to embark or disembark passengers.

¹⁰ by measurement, calculation or estimation in accordance with the relevant provisions of the EU MRV Regulation

¹¹ Port limits are defined by the competent authority or body designated by Member States e.g. port authority in each port

Drifting

- Considered as part of voyage if happening prior to arrival at port of call or after departure from port of call

Tank cleaning:

- Considered as part of voyage if happening prior to arrival at port of call or after departure from port of call
 - CO₂ emissions from movements to tank cleaning between the arrival at port of call and the departure from port of call (in the EEA) are considered as part of 'CO₂ emissions within EEA ports'
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