

ANAVE – Circular de Régimen Interior

Madrid, 23 de mayo de 2017
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Asunto: Reglamento MRV: Guías provisionales de la Comisión Europea para cumplimentar los planes de seguimiento.

Muy Sres. nuestros:

La Administración nos ha enviado el informe del Subgrupo sobre "MRV seguimiento y notificación de las Emisiones de CO₂ del transporte marítimo" del Foro Europeo sobre el Transporte Marítimo Sostenible (European Sustainable Shipping Forum, ESSF), junto con los documentos finales de trabajo que van a formar parte de la "Guía para ayudar a las empresas a preparar los planes de seguimiento del MRV" que la Comisión Europea tiene previsto publicar y que les adjuntamos en un Anexo.

Dado que la reunión del plenario del EESF se ha pospuesto hasta después del verano, dichos documentos se van a adoptar con carácter provisional, mediante un procedimiento por correspondencia. No obstante, se pueden dar por definitivos éstos que les adjuntamos.

Como comprobarán, hemos integrado en un solo documento PDF las 8 directrices y recomendaciones que relacionamos a continuación. Tengan en cuenta que no todas ellas son relevantes para todas las empresas:

1. Análisis de los viajes y puertos de escala para efectuar el seguimiento del consumo de combustible, emisiones de CO₂, distancia recorrida, tiempo transcurrido en la mar y carga transportada.
2. Establecimiento de la carga transportada revisada.
3. Buenas prácticas sobre cómo obtener la eficiencia técnica del buque si el EEDI no es aplicable.
4. Orientaciones para llevar a cabo el seguimiento del Gas de Evaporación (Boil Off Gas, BoG) a bordo y el registro de datos sobre el consumo de combustible.
5. Orientaciones sobre el seguimiento del consumo de combustible.
6. Orientación sobre el establecimiento de la distancia recorrida y tiempo transcurrido en la mar.
7. Recomendaciones para preparar los planes de seguimiento.
8. Directrices sobre los métodos de seguimiento para los buques que usan la exención del seguimiento por viaje.

A pesar de su extensión, les sugerimos que examinen estos documentos lo antes posible, de modo que, si les surgiese alguna duda o consulta sobre estos documentos, se pueda aprovechar la reunión de presentación del Informe Técnico de ANAVE del próximo día 30 de mayo, a la que asistirán representantes de la Administración, para intentar solucionarla.

Muy atentamente,

Manuel Carlier
Director General

Shipping MRV – 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 call¹ to the first berth or ship-to-ship transfer in the following port of call.

For the parameters to be monitored², 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 call³ (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

Drifting

¹ To recall that the Shipping MRV Regulation defines 'port of call' as the port where a ship stops to load or unload cargo or to embark or disembark passengers.

² by measurement, calculation or estimation in accordance with the relevant provisions of the Shipping MRV Regulation

³ Port limits are defined by the competent authority or body designated by Member States e.g. port authority in each port

- 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'

**European Sustainable Shipping Forum
Sub-group on Shipping MRV Monitoring**

Draft Guidance Document

The Shipping MRV Regulation – Determination of cargo carried

revised version of 19 May 2017

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.

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1 INTRODUCTION

From 1st January 2018 companies are required to collect and later report verified annual data on CO₂ emissions and other relevant information for ships over 5 000 gross tons on voyages from and to EU ports. Furthermore, by 30 August 2017, for the ships concerned, companies have to submit to an accredited MRV shipping verifier a monitoring plan, consisting of complete and transparent documentation of the monitoring method and procedures to be applied for each of the ships under its responsibilities.

The legal framework is set by Regulation 2015/757 on monitoring, reporting and verification of carbon dioxide emissions from maritime transport and amending Directive 2009/16/EC ("the shipping MRV Regulation")¹.

Further technical legislation has been adopted by the European Commission to implement the MRV requirements. This includes:

- Commission Delegated Regulation (EU) 2016/2071 of 22 September 2016 on amending Regulation 2015/757 as regards the methods for monitoring CO₂ emissions and the rules for monitoring other relevant information²
- Commission Implementing Regulation (EU) 2016/1928 of 4 November 2016 on determination of cargo carried for categories of ship others than passengers ro-ro and container ships pursuant to Regulation (EU) 2015/757³
- Commission Implementing Regulation (EU) 2016/1927 of 4 November 2016 setting templates for monitoring plans, emissions reports and documents of compliance pursuant to Regulation (EU) 2015/757⁴

The present guidance document aims at explaining the legal requirements as regards the monitoring and reporting of cargo carried and at providing additional information to companies and verifiers regarding the application of the rules.

2 PARAMETERS FOR CARGO CARRIED

Parameters for 'cargo carried' are specified for 14 ship types and a category 'others' (in Annex II to the Shipping MRV Regulation, as amended, and in Commission Implementing Regulation (EU) 2016/1928). Furthermore, the emissions report template as specified by Commission Implementing Regulation (EU) 2016/1927 allows for the reporting of additional parameters on a voluntary basis.

The following table provides an overview of the ship categories, their definitions and the applicable cargo parameters:

¹ http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2015.123.01.0055.01.ENG

² http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.320.01.0001.01.ENG

³ http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.299.01.0022.01.ENG

⁴ http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.299.01.0001.01.ENG

Table 1: Overview on ship types and their definitions

Ship type	Definition in the context of the Shipping MRV Regulation	Cargo parameter	Remarks
Passenger ship	-	Number of passengers	To be understood as ship with a passenger capacity above 12 persons but not carrying cargo.
Ro-ro ship	A ship designed for the carriage of roll-on-roll-off cargo transportation units or with roll-on-roll-off cargo spaces.	Mass of the cargo on board, determined as <ul style="list-style-type: none"> • the actual mass <i>or</i> • as the number of cargo units (trucks, cars, etc.) multiplied by default values for their weight⁵ <i>or</i> • occupied lane meters multiplied by default values for their weight 	To be understood as ro-ro cargo ships.
Container ship	A ship designed exclusively for the carriage of containers in holds and on deck.	<ul style="list-style-type: none"> • Total weight in metric tonnes of the cargo or, failing that, • the amount of 20-foot equivalent units (TEU) multiplied by default values for their weight. <p>Where cargo carried by a container ship is defined in accordance with applicable IMO Guidelines or instruments pursuant to the Convention for the Safety of Life at Sea (SOLAS Convention), that definition shall be deemed to comply with this Regulation.</p>	
Oil Tanker	A ship constructed or adapted primarily to carry crude oil or petroleum products in bulk in its cargo spaces, other than combination carriers, noxious liquid substances (NLS) tankers or gas tankers.	Mass of the cargo on board	

⁵ 'Weight' and 'mass' are to be considered as synonyms in the context of the Shipping MRV Regulation and in this document.

Ship type	Definition in the context of the Shipping MRV Regulation	Cargo parameter	Remarks
Chemical tanker	A ship constructed or adapted for the carriage in bulk of any liquid product listed in Chapter 17 of the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk or a ship constructed or adapted to carry a cargo of NLS in bulk.	Mass of the cargo on board	In addition to the monitoring and Additional voluntary reporting of annual average density of the cargoes transported
LNG carrier	A tanker for the bulk carriage of liquefied natural gas (LNG) (primarily methane) in independent insulated tanks.	Volume of the cargo on discharge, or if cargo is discharged at several occasions during a voyage, the sum of the cargo discharged during a voyage and the cargo discharged at all subsequent ports of call until new cargo is loaded.	
Gas carrier	A tanker for the bulk carriage of liquefied gases other than LNG.	Mass of the cargo on board	
Bulk carrier	A ship which is intended primarily to carry dry cargo in bulk, including types such as ore carriers as defined in Regulation 1 of Chapter XII of the 1998 International Convention for the Safety of Life at Sea (the SOLAS Convention), but excluding combination carriers.	Mass of the cargo on board	Additional voluntary reporting of annual average density of the cargoes transported
General cargo ship	A ship with a multi-deck or single-deck hull designed primarily for the carriage of general cargo excluding specialised dry cargo ships, which are not included in the calculation of reference lines for general cargo ships, namely livestock carrier, barge carrier, heavy load carrier, yacht carrier, nuclear fuel carrier.	Deadweight carried for laden voyages and zero for ballast voyages	Mass of the cargo on board as additional voluntary parameter
Refrigerated cargo ship	A ship designed exclusively for the carriage of refrigerated cargoes in holds.	Mass of the cargo on board	

Ship type	Definition in the context of the Shipping MRV Regulation	Cargo parameter	Remarks
Vehicle carrier	A multi-deck roll-on-roll-off cargo ship designed for the carriage of empty cars and trucks.	Mass of the cargo on board, determined as <ul style="list-style-type: none"> the actual mass <i>or</i> as the number of cargo units multiplied by default values for their weight <i>or</i> occupied lane meters multiplied by default values for their weight 	Deadweight carried as additional voluntary parameter
Combination carrier	A ship designed to load 100 % deadweight with both liquid and dry cargo in bulk.	Mass of the cargo on board	Additional voluntary reporting of annual average density of the cargoes transported
Ro-pax ship	A ship, which carries more than 12 passengers and which has roll-on/roll-off cargo space on board.	<ul style="list-style-type: none"> Number of passengers on board <i>and</i> Mass of cargo on board, determined as <ul style="list-style-type: none"> the actual mass or the number of cargo units (trucks, cars, etc.) multiplied by default values for their weight <i>or</i> occupied lane meters multiplied by default values for their weight 	
Container/ Ro-Ro cargo ship	A hybrid of a container ship and a ro-ro cargo ship in independent sections.	Volume of the cargo on board, determined as the <i>sum</i> <ul style="list-style-type: none"> of the number of cargo units (cars, trailers, trucks and other standard units) multiplied by a default area and by the height of the deck (the distance between the floor and the structural beam) <i>and</i> of the number of occupied lane-metres multiplied by the height of the deck (for other ro-ro cargo) <i>and</i> of the number of TEUs multiplied by 38,3 m³ 	
Other ship types	-	<ul style="list-style-type: none"> Mass of the cargo on board <i>or</i> Deadweight carried for laden voyages and zero for ballast voyages 	Other ship types not falling under any of the above categories

3 GUIDANCE ON APPLICATION OF PARAMETERS FOR CARGO CARRIED

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

3.1 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.

3.2 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.

3.3 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).

3.4 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:

$DWT\ carried = volume\ displacement \times water\ density - ship's\ lightweight - fuel\ weight$

- 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.

3.5 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

3.6 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.

3.7 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.

3.8 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.

GUIDANCE ON EIV – ARRANGEMENTS

1 PURPOSE

This guidance paper provides to companies and verifiers best practices on how to derive the technical efficiency of the ship if the EEDI is not applicable.

The legal obligation is stipulated by Article 11 (3) and 21 (2) of Shipping MRV Regulation (EU) 2015/757.

2 BACKGROUND & SCOPE

The attained EEDI is to be reported where required by and in accordance with MARPOL Annex VI, Regulations 19 and 20.

Only for ships not covered by the EEDI, the Estimated Index Value (EIV) has to be reported for ship types as listed in:

- a) MEPC.231(65), paragraph 3: bulk carrier, gas carrier, tanker, containership, general cargo ship, refrigerated cargo carrier, combination carrier, ro-ro cargo ship, ro-ro cargo ship (vehicle), ro-ro passenger ship and LNG carrier.
- b) MEPC.233(65), paragraph 5: cruise passenger ships having non-conventional propulsion, including diesel-electric propulsion, turbine propulsion, and hybrid propulsion systems.

For the ship type which is not covered by the above guidelines, it is not required to report EIV, as "Not applicable".

Companies are encouraged to report voluntary EEDI values¹, if available, instead of the EIV.

It is to be noted that EIV figures for determining ship type dependent reference lines within the EEDI framework have been calculated for a certain build period and have been fixed for this purpose.

This guidance provides the calculation methodology and on how it could / may be applied to accommodate the legal reporting requirements on MRV.

3 CALCULATION OF EIV

To specify the calculation method for the EIV in the context of Shipping MRV, Commission Implementing Regulation (EU) 2016/1927 refers to IMO Resolution MEPC.215(63). This Resolution has been replaced by MEPC.231(65) – Guidelines for calculation of reference lines for use with the Energy Efficiency Design Index (EEDI) and more recently supplemented by MEPC.233(65). The calculation of the EIV is described in paragraphs 13 - 19 and 8 - 9, respectively:

¹ certified independently by e.g. classification societies

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The formula for calculating the EIV value for each ship (excluding containerships and ro-ro cargo ships (vehicle carrier), ro-ro cargo ships, ro-ro passenger ships and LNG carriers) is as follows:

$$\text{Estimated Index Value} = 3.1144 \cdot \frac{190 \cdot \sum_{i=1}^{NME} P_{MEi} + 215 \cdot P_{AE}}{\text{Capacity} \cdot V_{ref}}$$

Figure 1: equation for calculating the EIV for each ship
(excluding some ship types as mentioned above)

Specific formulae (and input parameters - $P_{ME(i)}$ and P_{AE}) for containerships and vehicle carriers², ro-ro cargo ships, ro-ro passenger ships and LNG carriers are provided in MEPC.231(65).

For cruise passenger ships having non-conventional propulsion same information is provided in MEPC.233(65), remaining input parameters other than Capacity and V_{ref} are provided in MEPC.1/Circ. 866.

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. These curves were submitted by the yard to the shipping company and they constitute an important document for the ship. 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 for EIV input parameters. The importance of consistency of data sets for the three parameters P_{ME} , Capacity and V_{ref} has to be underlined.

4 VERIFICATION

Verification of the reported technical efficiency should focus on the correct use of attained EEDI values or on the correct calculation of EIV values including plausibility checks of input values.

In case of no changes in EIV values compared to previous emissions report for a ship, results of verification of previous emissions reports should be considered by the verifiers to avoid repetition of verification activities.

² vehicle carrier is a sub-type of ro-ro cargo ships

GUIDANCE ON EIV – ARRANGEMENTS

Appendix

Abbreviations

EIV	Estimated Index Value
EEDI	Energy Efficiency Design Index
ESSF	European Sustainable Shipping Forum
IMO	International Maritime Organisation
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MEPC	Maritime Environmental Protection Committee
MRV	Monitoring Reporting Verification
ro-ro ship	roll on – roll off ship, ships getting “rolling cargo” on/from board

GUIDANCE ON LNG – BoG MONITORING

1 PURPOSE

This paper provides guidance to the verifier and the company for the on-onboard monitoring of boil off gas (BoG) and recording of data for the purpose of monitoring of fuel consumption required by Regulation (EU) 2015/757.

2 BACKGROUND

As required by the Regulation (EU) 2015/757, Annex-1 (Methods for monitoring CO₂ emissions), the company shall define in the monitoring plan which monitoring method is to be used to calculate fuel consumption for each ship under its responsibility and ensure that once the method has been chosen, it is consistently applied. However, the `Method A` states that `This method shall not be used when BDN are not available on board ships, especially when cargo is used as a fuel, for example, liquefied natural gas (LNG) boil-off`¹.

Since BDN cannot be used for the BoG therefore, it is important for the verifier and the company to ensure that BoG measurement, calculation and documentation is in accordance with in fact use and is accurate, relevant and consistent.

LNG tankers are designed to carry natural gas in liquid form at a temperature of about - 163°C, close to the vaporization temperature. Despite that tank insulation is designed to limit the admission of external heat, even a small amount of it will cause slight evaporation of the cargo. This natural evaporation, known as “natural boil-off” (NBoG) is unavoidable² and has to be removed from the tanks in order to control / limit the cargo tank pressure. Typical values are about 0.15%/day and below, recent projected LNG carriers are offered with a NBoR close to or even beneath 0.1%³.

Where insufficient NBOG volumes are available for propulsion, forced vaporization of LNG can be effected or otherwise liquid fuel (HFO /MDO/MGO) can supplement the additional energy demand. The force vaporized LNG is called Forced Boil Of Gas (FBOG). The NBOG and the FBOG will be collectively called BOG in this paper.

Boil-off gas (BoG) handling systems (known as Gas Management Systems) are typically used onboard LNG carriers as a means of pressure and temperature control. BoG is sent to the engine room via gas heaters by low capacity compressors and is burned by the main boilers or nowadays by dual fuel diesel engines as fuel.

On steam turbine powered vessels, the main boilers are capable of operating under different fuel combustion modes such as exclusively BoG mode (NBoG or NBoG + FBOG), combined BoG and fuel oil mode, and exclusively fuel oil mode. Although steam turbine systems have been the main form of propulsion used onboard LNG carriers and still comprise a large percentage of the operating LNG fleet, diesel engines capable of using BoG as fuel have become a preferred solution due to their higher operating efficiencies.

LNG carriers with diesel engines are required⁴ to have a “Gas Combustion Unit” onboard. This GCU acts as a secondary means of controlling the tank pressure, in particular to cater for certain conditions like bad weather causing excessive NBoG generation, the temporary

¹ Use of cargo as fuel may apply to other low flash point hydrocarbons like Ethane, LPG, etc.

² with the exception of vessels with re-liquefaction capability

³ it may be noted that first boil-off phases contain almost exclusively nitrogen which has no calorific value for combustion

⁴ to fulfil the “historical 2 times 100% BoG capacity rule”

GUIDANCE ON LNG – BoG MONITORING

inability of the engines to burn gas or at engines' low load operation lower than what is required to consume the available NBOG for propulsion and other services or when the vessel is idle. The flow to the GCU is to be included in the amount "consumed". In general, GCU's are equipped with flowmeters. However, there might be other uses for the GCU which may cause conflicts, e.g. when preparing for dry-dock, contaminated BoG / inert gas mixture is disposed off in this unit.

On the Steam LNG Carriers if the required energy for propulsion and other services drops below the energy available by the BOG, the main boilers continue to consume the available BOG and the excess steam generated is dumped directly into the condenser.

The natural Boil-off rate (BoR) is the amount of liquid that is evaporating from a cargo and expressed in % of total liquid volume per unit time.

It shall be noted that the MRV regulation requires the reporting for LNG carries has to be done as follows:

- LNG cargo carried onboard to be reported in VOLUME units
- LNG consumed onboard as fuel to be reported in MASS units

It should be noted that a number of LNG carriers are equipped with re-liquefaction systems which depending on the capacity can partially or fully re-liquefy the NBOG and send it back to the cargo tanks.

3 RESPONSIBILITIES

Usually the Master has overall responsibility for the monitoring of ship's bunker consumption and BoG use / consumption. This will be described in detail in company's management procedures.

4 A GENERIC BoG HANDLING SYSTEM ONBOARD LNG VESSELS

The following diagram shows a generic ships BoG fuel oil system.

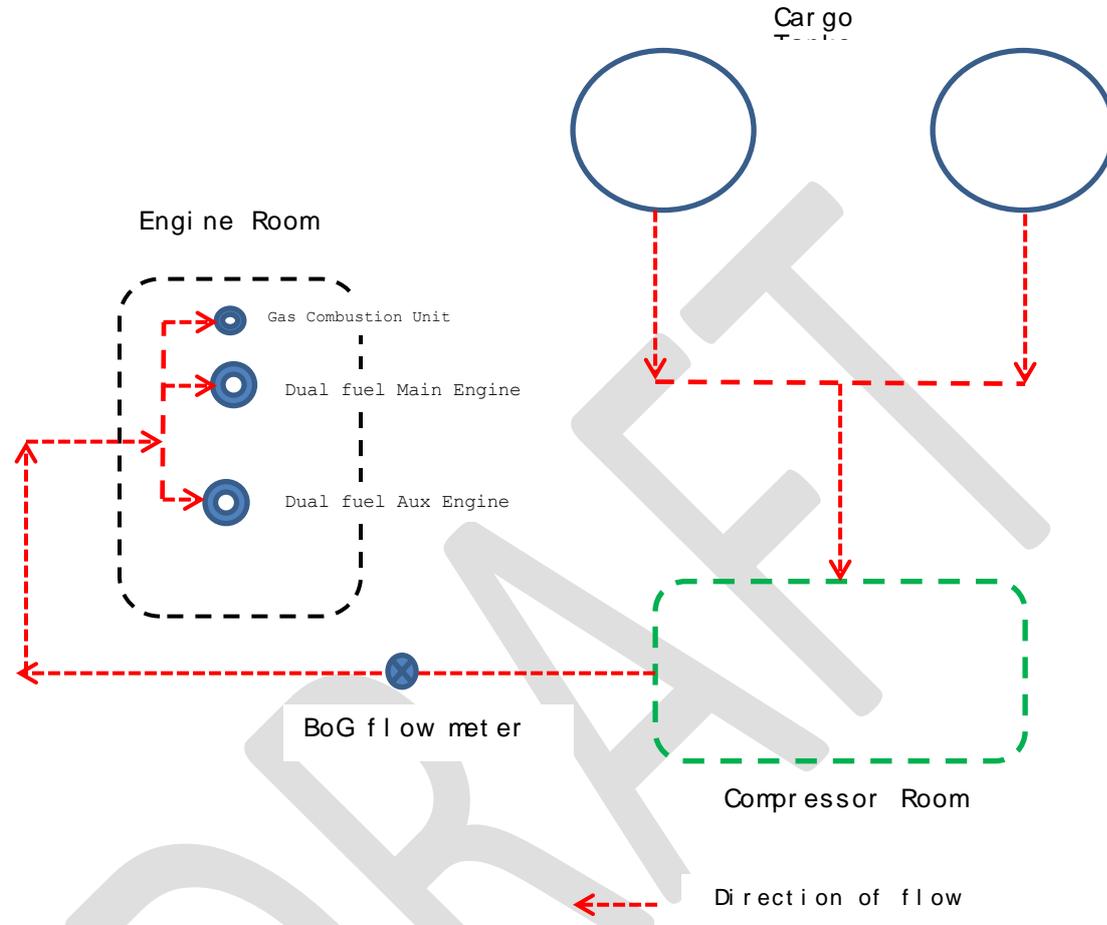


Figure 1: a generic ships BoG fuel oil system

5 BoG MEASUREMENT AND MONITORING

The BoG can be measured by calculating the total LNG consumed for a voyage by custody transfer measurement system (CTMS) or by flow meters (onboard).

CTMS systems are the predominant systems available for all LNG carriers. They are used for determining the amount of cargo loaded or discharged and they have universally accepted with commercial relevance and are typically third-party verified.

a) Calculating BoG quantity by CTMS

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.

GUIDANCE ON LNG – BoG MONITORING

CTMS measures the volume of cargo in the tanks and further calculations convert the volume to weight / mass at the reference temperature. Therefore, the BoG is calculated as the difference between “CTMS closing” figure at the loading port and the “CTMS opening” figure at the discharging port.

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 (in other words: during the subsequent voyages), the volumes discharged in these ports have to be added to the discharged volume, until new cargo is loaded.

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.

b) Calculating BoG quantity by flow meters

If it is chosen to measure the BoG with flow meters (pls. refer to Figure 1) 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).

Flow meters are typically installed on the BoG supply lines to the main boilers, diesel engines and the GCU as the case may be. The sum of all such flow meters determines the total BoG consumed

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. Bases on this method, the BoG used to fuel the ship during the voyage will be determined.

Shipping companies may determine the LNG vapour density for onboard flow meters using standard temperature of 15°C and at vapour space conditions ρ_{vt} by the following calculation based upon ideal gas laws⁵:

$$\rho_{vt} = \frac{T_s}{T_v} \cdot \frac{T_v}{T_s} \cdot \frac{M_m}{I} \quad \left[\frac{kg}{m^3} \right]$$

Where:

T_s is the standard temperature of 288 K (15°C)

T_v is the average temperature of vapour in degrees in Kelvin

P_v is the absolute pressure of vapour space in bar

P_s is the standard pressure of 1.013 bar

M_m is the molecular mass of vapour mixture in [kg/k mol]
(provided from industry tables or from shore)

I is the ideal gaseous molar volume at standard temperature (288 K) and standard pressure (1.013 bar) = 23.645 [m³/k mol]

Note: An accurate knowledge of the vapour composition in deriving M_m is not necessary and the deviation of saturated liquid gas vapours from the ideal gas laws is usually ignored

⁵ the formula is derived from SIGTTO publication:

‘Liquefied Gas Handling Principles on Ships and in Terminals’ (LGHP4) 4th Edition, Section 8.5.2S

GUIDANCE ON LNG – BoG MONITORING

The amount of BoG consumed at berth may be derived by the flow meters installed on the piping supplying gas to the consumers (engines, boilers, etc.).

However, for the consumption in ports, the CTMS (opening and closing) might not in all cases reveal the full picture. Therefore, flow meters are the favourable alternative for port consumption. In particular, the shore meters of the Vapour Return line are useful to mention in this context as they are a commercial method which is applied, accurate and typically verified by a specialized 3rd party. Usually, the commercial calculation process does explicitly calculate the amount (the balance) consumed by the ship during the cargo operations.

6 ACCURACY AND CALIBRATION OF MEASURING EQUIPMENT

All measuring equipment used for the monitoring should be maintained in good order and calibrated or certified for “fitness of purpose” in accordance with the maker’s guidance. Further information on maintenance procedures or in correlation with the PMS should be provided from the shipping company.

A copy of maintenance records and / or the calibration certificate should be kept on board.

7 Other relevant considerations

Existing EU legislation, namely the DIRECTIVE (EU) 2016/802 relating to a reduction in the sulphur content of certain liquid fuels and more specifically the Commission Decision 2010/769/EU allow LNG carriers to use a specified BoG mixture as an equivalent abatement method to the low sulphur content oil-based fuels i.e. for sulphur compliance reasons. For this purpose, it is required by *Article 4* of Commission Decision 2010/769/EU that these ships are equipped with continuous monitoring and metering of the boil-off gas and marine fuel (i.e. pilot fuel) consumption.

More recently, the European Commission and EU Member States (through the Committee on Safe Seas and the Prevention of Pollution from Ships (COSS)) agreed, under certain circumstances (ship-specific design, operational profile & predefined BoG mixtures) on an extension to this equivalence also for propulsion purposes while sailing in the SECA.

Thus, it should be assumed that all the LNG Carriers that would trade in the EU and planning to use BoG and marine fuel mixture as an abatement method, are already equipped with such continuous measuring/metering devices plus related recording logs.

Appendix

Abbreviations

BDN	Bunker Delivery Note
BoG	Boil off Gas which can be Natural NBoG or Forced FBoG
NBoG	Natural Boil off Gas
FBoG	Forced Boil off Gas
BoR	Boil-off rate
CTMS	Custody Transfer Measurement System
COSS	Committee on Safe Seas and the Prevention of Pollution from

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	Ships
ESSF	European Sustainable Shipping Forum
GMS	Gas Management Systems
HFO	Heavy Fuel Oil
IMO	International Maritime Organisation
LFO	Light Fuel Oil
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEPC	Maritime Environmental Protection Committee
MGO	Marine Gas Oil
NG	Natural Gas
PMS	Plant Management System Planned Maintenance System
RO	Recognised Organisation
ROB	Remaining fuel on Board (Liquid fuel or LNG)
SECA	Sulphur Emission Control Area
SEEMP	Ship Energy Efficiency Management Plan
SMS	Safety Management System

GUIDANCE ON FUEL MONITORING

1 PURPOSE

This paper provides guidance on onboard monitoring of fuel oil and recording of data for the purpose of monitoring of fuel consumption required by Regulation (EU) 2015/757.

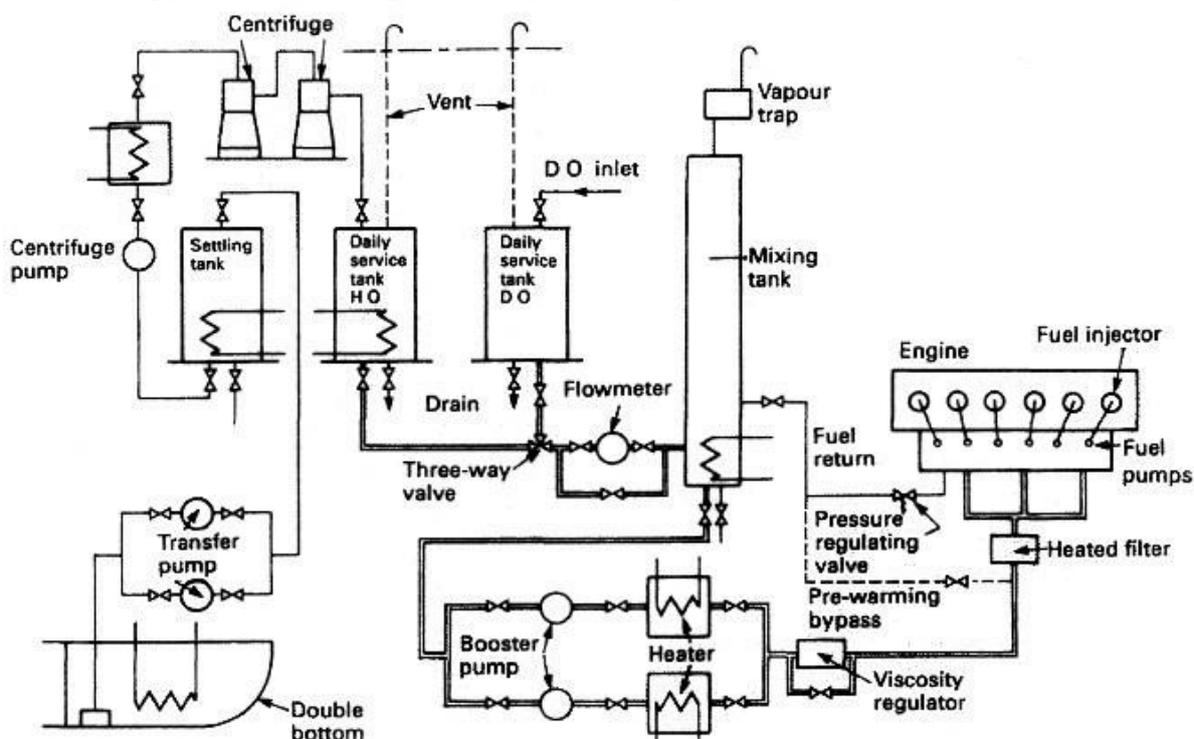
2 RESPONSIBILITIES

The Master has ultimate responsibility for the monitoring of ship's bunker consumption and for reporting the data to the office as set by the company's procedures.

The Chief Engineer is responsible for the overall bunker operations, including the verification of bunker received, the sounding of the bunker tanks and calculation of the exact quantity of bunkers onboard.

3 A GENERIC FUEL OIL SYSTEM ONBOARD

The following picture shows a generic ships fuel oil system.



www.machineryspaces.com

The diagram indicates that fuel oil onboard undergoes several process steps before being used. Own process steps are e.g.: bunkering, storage, heating, settling, cleaning (centrifuging) and in-between several transfers take place.

GUIDANCE ON FUEL MONITORING

4 TANKS SOUNDING FUEL OIL MEASUREMENT AND MONITORING

This is a generic guidance for fuel oil measurement through manual sounding / ullage measurements. Depending on the situation onboard, it should be taken into account that not all ships may need to follow each step and the frequency of measurements provided below.

4.1 Fuel consumption “in port” and “at sea”

For clarification, the fuel consumption “in port” is the total amount of fuel from the time the ship arrives at first berth of a port and up to the time the ship leaves the last berth of the port where commercial cargo operations or embarkation/disembarkation of passenger took place.

For example: a chemical tanker’s “in port” fuel consumption should include the total of the fuel consumed after the ship is securely moored at the first berth of a port including: fuel used for cargo operations to that berth and any other berth of the same port, fuel consumption used by the ship to move from one berth to another berth and fuel consumption used by the ship for moving out to sea for cargo tank cleaning and return to a berth of the same port.

The total fuel consumed “in port” can be:

- the difference between the fuel measured on board when the ship arrives at the first berth of a port and the fuel measured on board when the ship leaves the last berth of the port (eventual fuel bunkered during the stay in the port is not accounted for in this measurement) ; and
- when applicable, the fuel consumed while the ship was waiting at anchor or is carrying out ship-to-ship transfers within the port area

All other fuel consumption except the above, should be considered as “at sea”.

4.2 Frequency

The frequency of fuel tanks’ stock takings through soundings/ ullages should occur:

(1) For fuel monitoring method A)¹:

- a) Upon bunkering and de-bunkering
- b) Upon arrival to the first berth of a port² and before leaving the last berth of the port where commercial cargo operations or embarkation/ disembarkation of passengers took place³ 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.²
- d) Allocation of all fuel consumption (for each fuel type) not under the scope of the regulation is needed as the sum is to be subtracted from the amount provided in the Bunker Delivery Note (BDN)

(2) For fuel monitoring method B)⁴:

- a) Upon bunkering and de-bunkering

¹ Annex I, Although Method A is based on fuel data from BDN, ships need to measure fuel in tanks to make the balance at the end of the voyage or the end of the monitoring period...

² under the scope of the Regulation

³ this may be applicable for fuel monitoring method B) as well

⁴ Annex I, B Methods for DETERMINING CO₂ EMISSIONS, (b) Bunker fuel tank monitoring on board;

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- b) Fuel tank readings for all bunker tanks onboard should occur daily when the ship is at sea⁵. 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 an Sulphur Emission Control Area (SECA), if there is a fuel switch.

4.3 Calculating the volume of bunker in each tank

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.

ASTM D 1250-80 Standard Guide for Petroleum Measurement, table 54B, or equivalent tables or a substantiated software for temperature and atmospheric pressure corrections of density and mass calculations should be used.

The software could additionally be supported by dedicated ship specific software for trim, list and temperature corrections is available on board.

4.4 Density

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.

The source of density values should be stated at all times. However, the fuel oil volumes recorded onboard after each monitoring may always be related to the standard temperature of 15°C⁶.

To cater for most practical handling onboard with the density issue -as an alternative to above- volume to mass conversion - may be done using standard conversion factors. The company may use bespoke conversion factors for the entire reporting period subject to criteria for establishing these have met the agreement of the verifier. The company may also use the following standard conversion factors:

- 0.96 when using RME180, RMG 180/380/500/700 or RMK 380/500/700
- 0.88 when using MGO/MDO

These standard conversion factors derive from ISO 8217 Fuel Standard figures after having been corrected with ASTM D1250 density temperature variation tables (using 60°C - 80°C for IFO/HFO and 40°C for MDO/MGO) and apply regardless of whether the volume measurements are made in the bunker tanks or at a volume flowmeter placed between the service tank and the engine inlet.

4.5 Density for Commingled bunkers

⁵ fuel tank readings from tanks that have no transfer nor consumption can be omitted

⁶ reference is made to: ISO 8217; Specifications of Marine Fuels

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When there are 2 types of fuels (or more) are mixed and stored in one fuel tank then the density volume to mass conversion factor of the fuel tank of the mixed oil should be calculated as per the below mentioned formula:

$$\frac{\text{'A' fuel volume} \times \text{Density (A)} + \text{'B' fuel volume} \times \text{Density (B)}}{\text{'A' fuel volume} + \text{'B' fuel volume}} = \text{mixed fuel Density}$$

4.6 Density for blended fuels

In the rare event that fuel types with different densities are blended in a tank, the weighted average density should be determined, unless a density analysis of the mixed fuel sample is available.

$$\rho_w = \rho_{add} \times \frac{m_{add}}{m_{total}} + \rho_{exist} \times \frac{m_{exist}}{m_{total}}$$

Where:

- ρ_w : is the weighted average density of fuel in the tank after additions [t/m^3]
- ρ_{add} : is the density of the fuel added to the tank [t/m^3]
- m_{add} : is the amount of fuel added to the tank [t]
- m_{total} : is the total amount of fuel in the tank after addition [t]
- ρ_{exist} : is the density of the existing fuel in the tank before addition [t/m^3]
- m_{exist} : is the existing amount of fuel in the tank before addition [t]

4.7 Gauging Equipment

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.

Tapes which have been kinked or spliced or which contain illegible markings should not be used.

4.8 Gauging criteria

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.

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.

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5 CONTINUOUS FUEL OIL MONITORING

This procedure is for ships using flowmeters on consumers (e.g. main engines, auxiliary diesels, inert gas generators, boilers, etc.).

The data from all flow meters linked to fuel consumers minus the data from all flow meters at the return lines from the same consumers (if applicable) should be combined to determine fuel consumption over a period⁷.

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. Depending on type of ship operation the master, chief engineer or the operator may follow other practice as per company SMS.

The validity of fuel flowmeters should be compared on a periodic basis through comparison with the fuel figures that derive from flowmeters and tank soundings. The ship operator's PMS should provide guidance on comparison frequency.

To ensure proper readings, fuel flowmeters onboard should be calibrated as per makers recommendations or based on the ship's operational experience if flow meter is maintaining operational accuracy within manufactures suggested tolerances. Any records of manufacturer calibration should be maintained onboard and captured within the PMS onboard.

In the event that a fuel measurement cannot be made due to failure of a flow metering device the daily fuel consumption should be determined by utilising the tank soundings method⁸.

5.1 Volume flowmeter.

The amount of fuel consumed is determined in units of volume, expressed in litres, and it is converted to mass by using the density values corrected for the applicable temperature by the use of the formula below:

$$M = \rho \times V$$

Where:

M: mass of fuel (kg)

V: volume of fuel (l)

ρ : density at applicable temperature (kg/l).

Density values to be used should originate from BDN or provided through a fuel test analysis conducted in an accredited fuel test laboratory. Source of density values should be stated at all times.

ASTM D 1250-80 table 54B or equivalent tables or a substantiated software for temperature corrections of density should be used.

Temperature to be used for density corrections should be the fuel temperature at the flowmeters.

⁷ The need for a fuel meter in the return line may not be necessary depending on the arrangements, e.g. on where in the system the supply meter is fitted

⁸ means inherently that this is a fall-back solutions for filling (avoiding) data gaps for Methods A), B) and/or C)

GUIDANCE ON FUEL MONITORING

5.2 Mass flowmeters

The mass flow meters measures directly the mass flow rate of the fuel and eliminates the need for further mathematical calculations to derive the mass of fuel consumed.

6 FUEL OIL MONITORING AND RECORDING

This section describes the different sequences of fuel oil handling onboard. This includes that fuel oil measurements on board ships are (or can be) done for different situations and purposes. The sequence and procedures in this chapter are generic and not each of them may apply to all the different ship types and ship trades we are faced with.

Ships may develop (or have) assessment procedures for dealing with possible mistakes or omissions that could occur and lay down control measures that are to be taken by the company to minimize this risk for data gaps.

Data flow charts for every fuel oil measurement method in use would be helpful to indicate the sequence of actions step by step along with the control activities.

6.1 BUNKERING

Bunkering should be covered by routine operational procedures. Therefore, in this guidance paper a description of bunkering is not included as an own part / chapter. However, to just provide an info on what could / might be included in such descriptions, an own annex is attached for informational reasons.

6.2 "NOON REPORT"

As a matter of routine but on a voluntary basis only, ships engaged on long voyages do report the total amount of fuel on board on a daily basis⁹. The report is done at noon local time where the ship is located. This measurement provides also a daily monitor of the fuel consumption. The Officer in charge makes relevant entries in the Engine Log Book. However, ships engaged in shorter voyages may not do this reporting.

6.3 WEEKLY MEASUREMENT

As a matter of best practice for good housekeeping but also to check and confirm proper function of Mass Flow Meters, Volumetric Flow Meters, ships may measure by manual tank sounding and make the balance of the fuel oil onboard on a weekly basis.

The procedure to follow was presented under section 3.

The Chief Engineer makes entries into the Engine Room log of the fuel oil remaining on board (ROB) and, comparing with the previous measurement results, could make the balance of the total fuel consumed during that week.

⁹ If you opt for monitoring Method B) it is required, for Method A) and C) it is a suggestion.

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6.4 END OF VOYAGE MEASUREMENT

As a matter of best practice for easy monitoring and recording of the fuel consumption for each voyage, ships do measure the fuel oil ROBs at the end of each voyage or as determined by company SMS.

The procedure is similar to the one done as presented in section 4.

6.5 FUEL OIL MONITORING IN PORTS

A separated fuel oil monitoring / consumption analysis is required for ships in ports. Although ships may have various ways to monitor fuel consumption while in port, some ships may separately assess / calculate it using a method that with a reasonable accuracy establishes the mass of the individual fuel types consumed during the port stay(s).

6.6 EMISSION FACTORS FOR “NON-STANDARD”-FUELS

Since 1 January 2015, ships have been supplied with an increased number of Ultra Low Sulphur Fuel Oils (ULSFO) which are new products not yet categorised under the ISO 8217. In regard of the CO₂-conversion factor of these fuels, it is that test results from accredited laboratories indicate that the large majority of these new products are within the RMA-RMD grades (i.e. residuals - light fuel oils) and only one or two are categorised as DMB grades (i.e. distillates).

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) as per this regulation.

Type of fuel	Reference	Emission factor (t-CO ₂ /t-fuel)
Distillates (MGO/MDO)	ISO 8217 Grades DMA through DMZ	3,206
Light fuel oil (LFO)	ISO 8217 Grades RMA through RMD	3,151

The above assignment should not be seen as an exhaustive list as new products might be provided in the future.

6.7 UNCERTAINTY ASSOCIATED WITH FUEL MONITORING

The quantity determination is inherently subject to uncertainty. The Regulation requires to specify the uncertainty level within the Monitoring Plan (Art. 6.3.(f).(iv)) as well as in the Emission Report (Art. 11.3.(c)). Supplementary, uncertainty is further dealt with in COMMISSION IMPLEMENTING REGULATION (EU) 2016/1927 and COMMISSION DELEGATED REGULATION (EU) 2016/2072.

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.

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By way of illustration, all process steps as mentioned in chapter 3 contributes to the overall “uncertainty level” to be stated according to the regulation. To serve as best practice within this guidance document it is proposed (for the time being) to state an overall uncertainty level as follows:

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

In case the uncertainty will be determined in more detail, the combined uncertainty is calculated to the following formula:

$$u_c(V) = \sqrt{u(V, bunkering)^2 + u(V, density)^2 + u(\dots)^2 + \dots}$$

Appendix I

Abbreviations

BDN	Bunker Delivery Note
ESSF	European Sustainable Shipping Forum
HFO	Heavy Fuel Oil (RME, RMG and RMK grades as per ISO 8217)
IMO	International Maritime Organisation
LFO	Light Fuel Oil (RMA, RMB, RMD grades as per ISO 8217)
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil (DMA, DMB, DMZ grades as per ISO 8217)
MEPC	Maritime Environmental Protection Committee
MGO	Marine Gas Oil (DMX, DMA grades as per ISO 8217)
PMS	Plant Management System Planned Maintenance System
RO	Recognised Organisation
ROB	Fuel Oil Remaining
SECA	Sulphur Emission Control Area
SEEMP	Ship Energy Efficiency Management Plan
SMS	Safety Management System

Appendix II

An example for a general description of bunkering procedures

Chief Engineer or other appointed crew members ¹⁰ check ALL bunker tanks and complete the respective part of the “Bunkers Calculation” Form.

All quantities of bunkers (e.g. HFO, ULSHFO, MGO or other types of LSFOs) are recorded separately.

Common practice is to plan to receive new bunker in EMPTY bunker tanks. If not possible, comingling of different fuel batches may happen. In general, comingling is not favourable.

The appointed Engineer Officer has to implement the bunkering plan, supervise bunkering process and ensure that bunkering procedure is followed throughout the bunkering operations.

Relevant actions to secure correct assessment of the bunker received:

- carry out a pre-bunkering survey of the bunker barge, as per shipping company / bunker suppliers agreement, in order to determine exact quantity onboard together with the appointed Deck Officer of the watch.
- check ALL bunker tanks.
- witness the completion of the ullage report
(for this purpose, the co-operation of bunker barge personnel should be secured)
- sign and obtain a copy of the completed ullage report;
the copy should be attached to the Bunker Receipt Form.
- inform Master and request approval to start receiving bunkers when both quantity i.e. own vessel and bunker barge have been completed.
- upon completion of the bunkering, the Master and the Chief Engineer should arrange for a post bunkering survey (own vessel and bunker barge) similarly as with the “pre-bunkering survey procedures’ above.
- the Chief Engineer reviews the BDN and declaration of compliance with MARPOL Annex VI, presented by the bunker barge.
- during the review, Chief Engineer compares received quality and quantity against the Company’s bunkering information i.e. ordered regarding quality and quantity.
- both the Chief Engineer and the Master should sign for acceptance the Bunker Delivery Note issued by the bunker barge only if they agree with the figures received.

¹⁰ or otherwise stated by company procedures

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Note : The ship (i.e. the chief engineer on behalf of owner) issues a Letter of Protest in the following situations, but not limited to:

- shortage of bunker delivered,
- quality issues (e.g. failure of fulfilling ISO specifications)
- slow pumping rate,
- ship's fuel samples not signed by the supplier
- lack of co-operation from bunker barge personnel to conduct mutual ullage inspections.

Upon completion of each bunkering, the following documentation are to be submitted to ships' operational Head Office:

1. Bunkering Report Form.
2. Bunkers Quantity Calculation Form
3. Bunkering samples registration and consumption log Form
4. Bunkering pre-loading plan Form
5. Letter of Protest, if applicable
6. Ship-Barge Safety Checklist Form or Ship-Shore Safety Checklist Form, if bunkering by barge or terminal respectively.

The Chief Engineer should also maintain copies onboard. All relevant forms and checklists are kept on board for minimum 3 years.

Officer in charge makes relevant entries in the Engine Log Book and in the Oil Record Book.

Report Task Force Work Package 6 on Guidance on the determination of distance travelled and time spent at sea

Meetings held:

- Kick-off at ECSA Brussels, Nov. 29th 2016.
- Presentation of first results at ESSF Shipping MRV Monitoring subgroup on Dec. 6th 2016 in Brussels.
- Follow-up at DNVGL Hamburg on Jan. 31st 2017.
Participants not being present were joining by skype or phone conference.

Terms of Reference for Work Package 6 – Guidance on the determination of distance travelled and time spent at sea

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.

Excerpts of working papers:

PWC Presentation Requirement by Article 6 (3) e) and h) i)/iii) MRV Regulation

“Determination and documentation of the distance per voyage

- a.) Real distance travelled (voyage distance from the logbook)
- b.) Most direct route between port of departure and port of arrival with use of conservative correction factor

and the time spent at sea between the port of departure and the port of arrival over the reporting period “

MEPC 70/WP.1 Draft Report of the Marine Environment Protection Committee on its Seventieth Session dated 28 October 2016

The Committee decided that distance travelled will be determined as distance over ground. Earlier drafts (Bahamas) had proposed to measure distance travelled as distance through the water. Furthermore, “hours underway” will be reported instead of previously proposed “berth to berth” terminology.

Final Report of the Marine Environment Protection Committee on its Seventieth Session dated Nov 11 2016

- **Draft amendments to MARPOL Annex VI**
- 3.33 The Committee considered the final text of the draft amendments to MARPOL Annex VI related to the data collection system for fuel oil consumption of ships, prepared by the drafting group (MEPC 70/WP.6, annex 3) and took the following decisions:
 - .1 having considered the date range reference in square brackets in regulation 22 of the draft amendments, it agreed to delete the brackets and retain the text;
 - .2 having considered an intervention by the Chair of the Working Group on Air pollution and energy efficiency informing it that the group had agreed to convert the terms "distance travelled from berth to berth" to "distance travelled" and "hours not at berth" to "hours underway" when finalizing the text of the 2016 SEEMP Guidelines (see paragraph 6.10), it agreed to apply the same changes to appendix IX of the draft amendments to Annex VI for harmonization purposes; and

Guidance on determination of “distance travelled” and “time spent at sea” – Legal basis: Annex II (enclosure)

Discussion:

A consensus was expressed by all members to follow the approach decided at IMO’s MEPC 70 where the Committee decided that distance travelled will be determined as distance over ground.

One member provided further reasoning as to why distance through the water should not be considered further. Speed Logs are subject to many factors of uncertainty. Discrepancies of 0.5 knots or more are not uncommon, recalibration would have to be conducted in much more frequent intervals. However, service engineers could be unavailable on a world-wide basis. The lack of precision will result in a blurred vision instead of better data quality.

Data verification of “distance over ground” can be accomplished with greater precision using AIS and similar means.

Since the legal terminology “Hours underway” is matching the language of the Collision Regulations, the participants agreed with Annex II (a) to exclude anchoring. A vessel is “underway” if not berthed or at anchor.

The group discussed various scenarios and concluded:

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.

Distances made for the purposes of tank cleaning operations should be included as the vessel is underway.

A question arose concerning how ship to ship transfers should be handled while both vessels are adrift. DG CLIMA clarified this case as being covered by the regulations and not considered as a port of call.

Ship to Ship Transfer within defined limits of a Port is considered as a port call.

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. Hence, it is strongly recommended to make such reporting voluntary. Calling a safe port of refuge to enable disembarkation should not be considered as a port of call to be reported under the MRV regime.

Since the EU Regulation stipulates that “time spent at sea” shall be calculated based on port departure and arrival information, the group discussed in what ways to deal with movements within a given port complex. It is recommended to use the arrival at the first berth and the departure of the last berth in a port where cargo operations had been conducted.

Anchorage is excluded from time spent at sea.

Discussions also addressed the proposal to consider the most direct route between port of departure and port of arrival with use of a “conservative correction factor.”

One member asked for guidance on how to facilitate reporting for ships that trade on fixed routes (i.e., ferries) and whether multiplying the distance travelled with the number of annual voyages may be used to reduce unnecessary monitoring. It should also be clarified how vessels that are subject to the per-voyage exemption should calculate their time spent at sea and in port should be considered.

Another member agreed with the preceding statement about fixed routes, but noted ship voyages which are under the scope of the regulation and have more than 300 voyages a year are exempted from per voyage monitoring. In addition, two other monitoring parameters (time and distance) are required to be monitored and summed-up in the annual report.

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, but distances and time spent at sea could be also subject to many factors as avoiding shallow waters or an ECA transit.

During a trans-ocean transit, a deviation to avoid heavy weather of up to some hundred nautical miles compared to a standard great circle distance is not unlikely.

Another deviation scenario could occur if a vessel is diverted for commercial reasons to another port of destination. It is self-explanatory that the distance already steamed to the initial destination has to be accounted for in addition. An application of a standard distance is not suitable for these scenarios.

Hence, applying a “most direct route” standard distance should be strongly discouraged.

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

An application of standard voyages (or historic voyage data) should be used as an exemption only in order to fill data gaps subject to final approval by the verifier.

The ESSF Shipping MRV Monitoring sub-group has noted that a large variety of unique circumstances can be expected to arise and that it is impractical to comprehensively address the full range of possible scenarios in a guidance document.

Wolfram Guntermann

(as Task Force Co-ordinators WP 6)

Recommendations on guidance for the preparation of monitoring plans

April 2017

ESSF Shipping

MRV Monitoring Subgroup

Helena Athoussaki

WP7 coordinator





Terms of reference of WP7

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.

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1. Preparation of the Monitoring Plan

1.1 Monitoring Plan

The Monitoring Plan is a document in which the company describes the design of the management system the ship has in place in order to monitor and report several data parameters related to the CO₂ and Energy Efficiency of the vessel.

The Monitoring Plan should consist of a complete and transparent documentation of the monitoring method for the ship concerned along with the description of the relevant procedures, systems and responsibilities used to monitor the completeness and accuracy of the data provided in the Emissions Report in conformity with the Regulation (EU) 2015/757 .

The submission date along with the content of the Monitoring Plan is laid down in Article 6 of Regulation (EU) 2015/757.

1.2 When shall a company modify the Monitoring Plan

Companies shall modify the Monitoring Plan as laid down in Article 7 of regulation (EU) 2015/757.

1.3 Using the appropriate template

Companies may use any template as long as the content is according to Annex 1 2016/1927.

Companies may split the Monitoring Plan into a Company specific and Vessel specific according to article 2 of Annex 1 2016/1927.

Example

Companies may indicate at the beginning of the template which tables are company specific.

1.4 Using the Appropriate Language

Companies should communicate to the verifiers the content of the monitoring plan in an easy and clear way.

Example

Title	Guidance	Example
Reference to existing procedure	Enter the name of the manual, the chapter and paragraph.	Office Operations Manual, Chapter 7.2.1
Version of existing procedures	Use version or date of the doc	Version 2
Description of EU MRV procedures if not already existing outside the MP	Describe the procedures or leave empty if a reference is made above	See procedure on Guidance on fuel oil monitoring
Name of person or position responsible for this procedure	Based on the official organogram	Operational manager, HSQE manager, Master, etc
Location where records are kept	Ref to the company address and department or onboard (master's office)	Company's Office/Technical Department Files
Name of IT system used	Use name, version and module of the system used within procedure, as per IT system provider manual. For internal system specify characteristics for identification.	Software X, Module: vessel management
Data source	Enter the source from where the data is collected	Noon Report, Oil Record Book, BDN, GPS etc.

If the mandatory fields are not applicable then the company should indicate "N/A" in the relevant fields of MP.

1.5 Describing a procedure

When describing a procedure in the Monitoring Plan, companies must consider the level of detail required to obtain a sufficient level of understanding from the verifiers.

Example can be found in the [Guidance on fuel monitoring](#).

Reference to existing procedures

When providing information on elements and procedures as part of the Monitoring Plan, companies should be able to also refer to procedures or systems effectively implemented as part of their existing management systems, such as;

- the International Safety Management Code (ISM Code);
- the Ship Energy Efficiency Management Plan (the SEEMP);

- Systems and controls covered by harmonised quality, environmental or energy management standards, such as EN ISO 9001:2015, EN ISO 14001:2015 or EN ISO 50001:2011;
- Any other internal procedures.

1.6 Creating data flow activities

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.

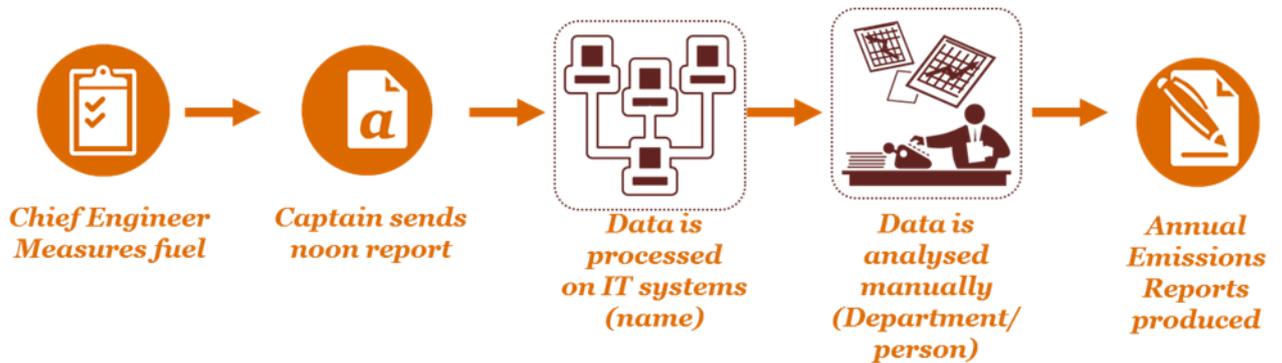
To obtain a clear picture of how data about fuel consumption, transport work and other relevant information is collected from various sources and aggregated for the emission report in accordance with the requirement of the EU MRV regulation a clear description of the data flow is necessary.

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

Example of data flow activities concerning activity data

An example with the information about the procedure along with a diagram.

The Captain receives information from the Chief Engineer after taking the soundings of the fuel tanks using sounding tape, then he inserted into the daily noon report.



1.7 Process flow diagram

To better explain vessel's monitoring system, company may wish to utilize process flow diagrams which could include information such as the fuels used, monitoring methods, measuring equipment, emission sources or other data sources etc.

For example, a diagram of a fuel oil system can be used to better explain the fuel monitoring process. Such a diagram can be found in the [Guidance on fuel monitoring](#).

1.8 Responsibilities and records

Name of Person or position responsible for this procedure

The company should mention in the Monitoring Plan the name or the position of the person responsible for the procedure.

This enables company to record responsibilities and identify whom to contact in case queries are raised about the procedure.

Location where records are kept

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.

2. Guidance on the Monitoring Plan Template

Part A Revision record sheet

Reference to Chapters where revisions or modifications have been made, including a brief explanation of changes.

Example

Table B.2. Change of address, Table C.2.1. Change of method to determine fuel consumption, Table B.5. person responsible for this position.

Part B Basic Data

Table B.1. Identification of the ship

IMO Number

Refers to unique seven digit IMO number as assigned by IHS Maritime and shown on the ship's hull, in accordance with SOLAS regulation XI/3.

IMO unique company and registered owner identification number

Refers to the IMO number of the MRV company (responsible for MRV compliance) and the ship owner company as assigned by IHS Maritime in accordance with SOLAS regulation XI-1/3-1

Name of the ship owner

The legal entity that owns the vessel

Voluntary open description field:

This may concern certain information related to the characteristics of the business activities of the ship based on its type (cruise line etc.).

This information may help to gain a better understanding of the potential fluctuation of CO₂ efficiency between certain voyages or reporting periods (e.g. dry docking, Breakdown etc.).

Also companies may insert additional technical characteristics that may affect the energy efficiency of the vessel (e.g. Mewis Duct, Propeller boss cap fin, Anti-fouling, Hull surface coating).

Table B.2. Company information

Name and address of the company as described in article 3 of regulation (EU) 2015/757.

Name, position and contact details of responsible natural person(s) within the company. In case where companies prefer to appoint several contact persons, responsibilities need to be clearly allocated, with one person carrying the overall correspondence between the company and the verifier.

Table B.3. Emissions sources and fuel types used**Example**

Emission source reference no.	Emission source (name, type)	Technical description of emission source (performance/power, specific fuel oil consumption (SFOC), year of installation, identification number in case of multiple identical emission sources, etc.)	(Potential) Fuel types used
1	Main Engine Hitachi Zosen Type MAN B & W 6S60MC Mk6	Serial No: 3896 Year of Installation: 2001 Rated Power (MCR): 10750 kW @ 99 RPM SFOC (MCR): 172 g/ kWh	HFO LFO MGO
2	Auxiliary Engine HYUNDAI-HIMSEN 6H21/32	Serial No: BA5832-1 Year of Installation: 2016 Rated Power (MCR): 1200kW @ 900RPM SFOC: 195g/kWh	HFO LFO MDO MGO
3	Inert Gas Generator WARTSILA MOSS AS	Serial No: n/a Year of Installation: 2016 Performance: 4500 Nm ³ /hr SFOC: 333 kg/hr	MDO MGO

Table B.4. Emission factors

In case of use of fuel without an emission factor within publicly known source (IMO, EU or other), then company should provide the emission factor along with the methodology for sampling, methods of analysis and a description of the laboratories used, if any.

Guidance on fuel monitoring provides information on how to deal with so-called “hybrid fuels” which not match with ISO 8117 Marine Fuels specifications.

Table B.5. Procedures, systems and responsibilities used to update the completeness of emission sources

Companies should provide details about the systems, procedures and responsibilities used to track the completeness of the list of emission sources over the reporting period.

Example

Procedure: In case any change in the emission sources occur for the vessels under the Company’s management, the Technical Manager is responsible to fully inform the assigned Superintendent Engineer for the changes and provide them with all the necessary information.

The responsible assigned Superintendent Engineer must review and update the list of the emission sources in the related Monitoring Plan(s) and in any other report and document that the Company maintains with the latest information of the emission sources on board, when applicable, in order to ensure completeness and accuracy....

Name of person or position: Assigned Superintendent Engineer / Technical Department

Location where records are kept: The list is saved at the vessel's Monitoring Plan which is located at the Company's Office/Technical Department Files.

Part C Activity Data

Table C.1. Conditions of exemption related to Article 9(2)

If all of a ship's voyages during the reporting period either start from or end at a port under the jurisdiction of a Member State and if the ship, according to its schedule, is planned to perform more than 300 voyages during the reporting period, the company may be exempted from the obligation to monitor the amount of fuel consumed on a per-voyage basis (Art. 9 (2) of MRV Regulation). It is up to the decision of the company to make use of the exemption while providing evidence of the above exemption assumptions.

Companies will be asked to lay down in their monitoring plans whether they opt for the exemption, respectively.

Further guidance on how to prepare the MP for companies making use of the exemption will be provided by the Guidance on monitoring methods for ships using the exemption from per-voyage monitoring.

Table C.2. Monitoring of fuel consumption

Table C.2.1. Methods used to determine fuel consumption of each emission source

Companies can insert as an emission source one of the following categories: 'All sources', 'Main engines', 'Auxiliary engines', 'Gas turbines', 'Boilers' or 'Inert gas generators'. Companies can select one (or more if it enhances the overall accuracy of the measurement) of the following categories: 'Method A: BDN and periodic stock takes of fuel tanks', 'Method B: Bunker fuel tank monitoring on-board', 'Method C: Flow meters for applicable combustion processes' or 'Method D: Direct CO₂ emissions measurement'.

Emission source	Chosen methods for fuel consumption
All sources	Method B

Table C.2.2. Procedures for determining fuel bunkered and fuel in tanks

The procedure must describe (or make a reference to an existing one) how bunkering is performed to ensure that tanks are fueled with the agreed quantity. Another procedure must describe (or make a reference to existing one) how fuel consumption is monitored in a consistent and accurate manner. In addition a procedure can be in place in case where an external, independent BQS Surveyor comes on board so as to provide extra support in the procedure of fuel bunkering. Companies can create a list of forms involved during the bunkering procedure (Bunker Plan Record, Bunkering Checklist, Oil Transfer Procedures Table etc.). Companies may also develop dataflow activities as described in section 1.6.

Example

Procedure: detailed procedure can be found in the Guidance on fuel monitoring

Responsible Person: Chief Engineer, Operations Manager

Location where records are kept: Log book (On board), Noon report (On board/ Operations Department)

Name of IT system used: the system where documents are stored (e.g. ERP system)

Table C2.3. Regular cross-checks between bunkering quantity as provided by BDN and bunkering quantity indicated by on-board measurement

The procedure must describe (or make a reference to existing one) how the company cross-checks the bunkering quantity between on board measurements vs. the quantity provided by the supplier as displayed on the BDNs.

Example

Procedure: The Chief Engineer performs cross-checks between the sounding readings and the Bunker Delivery Note(s), every time upon completion of the bunkering operations. The quantity and receipt number of the Bunker Delivery Note(s) are recorded into the Sounding Form located on board...

Table C2.4. Description of the measurement instruments involved

Companies must insert the name of the measurement instrument (i.e. tank sounding, flowmeter) involved (relevant to method A, B, C, D), the sources used (tanks, boilers, etc.) along with the technical characteristics (year of installation or purchased, maintenance period, accuracy etc.) in order to signify that the measurement equipment is under good condition.

Example

Measurement Equipment	Elements applied to (Emission sources, tanks)	Technical Description (age, specification, maintenance intervals)
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Name of manufacture, Type (sounding tape, flowmeter, CO2 sensor), Model	Main engine	Date of Installation, Reference to manufacture specifications, Calibration and interval standards used.
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Table C.2.5.Procedures for recording, retrieving, transmitting and storing information regarding measurements

Companies should describe (or make a reference) the whole process of how data information related to fuel is recorded, retrieved, transmitted and stored before is reported into the annual emission report. Data flow diagrams and task lists can be proved helpful tools to understand the procedure.

Example

Procedure: Recording and retrieving: The Chief Engineer responsible for recording fuel measurements performing manually daily tank soundings. Chief Engineer then informs the Master who is responsible for retrieving these values and entering them into the X system in order to be transmitted to shore.

Transmitting and Storing: The exchange of information or “transmitting” regarding fuel measurements for all CO2 emissions sources installed on board, is governed by internal procedure (reference) sets clearly the steps which need to be followed: four types of reports (arrival, departure, noon and port) are sent from the Master through the system X to the Technical and Operations departments on shore each with specific values on the fuel consumed per CO2 emission source at specific time intervals...

Table C.2.6.Method for determination of density

In the case where the amount of fuel bunkered or the amount of fuel remaining in the tanks is determined in units of volume or is measured through a volume flow meter, the company should convert that amount from volume to mass by using actual density values by using one of the following options:

- (a) on-board measurement systems;
- (b) the density measured by the fuel supplier at fuel bunkering and recorded on the fuel invoice or BDN;
- (c) the density measured in a test analysis conducted in an accredited fuel test laboratory, where available.

Example

Detailed procedure along with the usage of standard default values temperature correction can be provided in the Guidance on fuel monitoring

Table C.2.7. Level of uncertainty associated with fuel monitoring

Fuel quantity determination is inherently subject to uncertainty. Article 6.3. (f). (iv) specifies that companies should develop a procedure to ensure the total uncertainty of fuel measurements is consistent with the requirements of EU regulation 2015/757. To make monitoring easier, it is appropriate to allow the use of default values for the level of uncertainty associated with fuel monitoring. Companies may use these values to include in their procedure in the monitoring plan.

The use of default values is not mandatory. Ships may also use calculated uncertainty (ship specific estimate) related to fuel monitoring and/or CO₂ emissions, provided that these calculations are appropriate and available for assessment by the verifier..

Default uncertainty values will be provided within the Guidance on fuel monitoring.

Table C.2.8. Procedures for ensuring quality assurance of measuring equipment

Companies should describe in the Monitoring Plan the procedures with regards the effective functioning of relevant measuring equipment (calibration; malfunctions, repairs; accuracy, determining reference figures and comparative measurements). Measuring equipment manuals, technical datasheets, certificates can be used as a reference. Often companies include this procedure within the Planned Maintenance System. Forms include but not limited to: Calibration status report or instrument calibration record.

Moreover, training and familiarization of personnel with the measuring equipment can also be used as a procedure.

Example (in case of manual sounding)

Before performing a sounding, the Chief Engineer or the crew member assigned by the Chief Engineer to perform the sounding, should make sure that: The sounding tape to be used is of sufficient length for the height of the tank to be gauged. The sounding tape is graduated in feet, inches, and fractions of an inch; feet and hundredths of a foot; or meters, centimeters, and millimeters. Markings are visible. The sounding tape is not kinked or spliced. In case any of the above does not hold, then the sounding tape should be discarded and a sounding tape fulfilling the criteria above should be used.

Example (in case of flow meters)

The quality of measuring equipment is supported by the fact that company performs maintenance and calibration of flow meters according to the manufacturer's specifications and if not feasible by the operating experience. This is outlined in the company's Planned Maintenance System (PMS) which describes clearly the procedure and the roles of doing so. Additionally the technical department checks periodically the output of the flowmeter to ensure that works properly.

If a flow meter malfunctions, then the chief engineer informs the technical department and all the necessary steps are followed to immediate replace it...

Table C.3. List of voyages

Companies should provide details about the systems, procedures and responsibilities used to ensure the completeness of the list of voyages over the reporting period. The description of the procedure in place to keep an updated detailed list of voyages during the reporting period which are carried out under EU MRV scope. The procedures in place should ensure completeness and non-duplication of data.

Data flow procedures of recording, monitoring and reporting voyages along with the IT system diagram (if any) may be used.

Example

Procedure: The recording of all voyages is done through the noon, arrival, departure and port reports which are reviewed by the Operations Department. These information is processed through system X, which maintains information for all in scope voyages. The filtering of EU MRV voyages is done through the X system as per EU voyage definition...

Table C.4. Distance travelled

As per Guidance on the determination of distance travelled and time spent at sea, distance travelled is determined as distance over ground. Should the vessel be adrift (i.e. while waiting for a berth) the distance should be included as the vessel is underway.

Example

The distance travelled may be calculated by the two (2) Electronic Chart Display and Information System (ECDIS) which are installed on board per vessel and connected with the two (2) GPS apparatus. The Master reports distance travelled through the daily messages (departure/ noon/arrival) and records distance travel on the Log Book...

Table C.5. Amount of cargo carried & Number of passengers

Companies will be requested to provide information on how the amount of cargo carried will be compiled and calculated. Cargo carried can be recorded and retrieved in different ways and should all be described in the monitoring plan. Companies will be asked to provide details about the procedures, responsibilities and data sources for determining and recording the cargo carried.

The monitoring plan should also use the units for determining 'cargo carried' as specified in Commission Implementing Regulation (EU) 2016/1928.

Example (Tanker)

Procedure: Before loading, the Chief Officer performs ullage measurements using portable instruments (which are certified and annually inspected). A second ullage measurement is performed again upon completion of loading.

Ullage measurements on all cargo tanks are converted from volume to mass of cargo through utilisation of density. Cargo calculation reports are then cross checked by the Captain with the Bill of Lading (B/L).

Loading takes place always at the presence of a Cargo Surveyor (who can be from the supplier's side when loading or buyer's side when unloading).

As a control, a second measurement can be obtained from electronic cargo tank soundings which are conducted by the Chief Officer before and after loading. Further cross-check is performed between cargo tank electronic readings and ullage measurements...

Table C.6. Time spent at sea

Determining and recording the time spent at sea from the arrival at the first berth and the departure of the last berth in a port, as per Guidance on the determination of distance travelled and time spent at sea.

Anchorage is excluded from time spent at sea.

Example

The Master reports the time as per the GPS indications (or the Master Clock(s) / local time zone or GMT) in the Deck Log Book and in the Daily Noon Reports, Arrival and Departure. Time spent at sea is calculated at the end of each voyage and recorded in the voyage documents...

Part D Data gaps

The risk of the occurrence of data gaps should be minimized by developing an appropriate monitoring plan. However, it is not possible to completely exclude events that require the closure of a data gap.

There are several reasons for data gaps or estimations in order to deliver data to be used in the emissions report. It can be distinguished between events that require the closure of a data gap and those that require the correction of existing data. Corrective measures can be made by using secondary data. In contrast to this, estimations have to be used for real data gaps, i.e. when no information by the applied monitoring approach is available.

Companies will be asked to provide a brief description of the method to treat data gaps regarding the parameters other than fuel consumption (i.e. list of voyages, distance, total time spent at sea, cargo carried, number of passengers) as well as control activities to prevent missing data.

This may be the case if information is missing, lost or found corrupt. It should include a back-up solution for each parameter and a formula/description of the calculation.

For example, assume that a flow meter did not output values for 1 day. The Chief Engineer is responsible for noticing this data gap and applying the back-up monitoring method e.g. tank sounding. The Chief Engineer should report the failure promptly to the managing office. If for any other reason, the Chief Engineer cannot close or detect this data gap, then the shore side is responsible for closing it, by applying formulae, historic data etc.

Table D.1. Methods to be used to estimate fuel consumption

Companies can select one of the four methods (A, B, C, D) or can describe a method to estimate fuel consumption.

Example using Method A

In the event of a data gap due to unexpected conditions, the performance manager (shore) communicates its existence to the Chief Engineer who fills the gap once arrival established using the average of the ROB difference between arrival and departure ROBs. He then records the value as an error to the engine log book and communicates this to the Performance Manager (shore)...

Example using Method B

When the related data is missing, the Chief Engineer requests to perform as soon as possible tank sounding in order to close the gap. In the case where the missing data is not immediately identified then the responsible Superintendent shall close the gap manually by using the average fuel consumption of the previous and the next day.

Table D.2. Methods to be used to treat data gaps regarding distance travelled

Example

In the event of a data gap related to distance traveled, while using an automated/electronic chart navigation system, the master can fill the gap by means of back-up methods such as terrestrial or celestial navigation being documented in the Deck Log Book...

Table D.3. Methods to be used to treat data gaps regarding cargo carried

Example (bulk carrier)

In the event of a cargo related document been lost and therefore the occurrence of a data gap, then the Master can report values from other cargo related documents such as Bill of Lading, Mate Receipt or Statement of Facts.

If the total transported cargo cannot be ascertained otherwise, the draft readings may be used to estimate it. From the drafts, the total displacement of the ship is calculated (basis the hydrostatic properties included in the stability booklet or loading computer). By subtracting the Light Weight of the ship, the content in all tanks, as well as consumables, provisions, spares and Crew, the Cargo can be derived...

Table D.4. Methods to be used to treat data gaps regarding time spend at sea

Example

In the event of a data gap related to time spent at sea, the responsible Operator must immediately communicate with the Master and raise the existence of it and close it using the data from the Statement of Facts documents.

The data gap can be filled by using the average of the time difference in hours between Arrival and Departure...

Part E Management

Table E.1. Regular check of the adequacy of the Monitoring Plan

Companies shall check regularly, and at least annually, whether MP is adequate and can be improved further (Article 7 Regulation (EU) 2015/757).

Example

The HSQE manager includes the Monitoring Plan in the official company procedures being subject to review and/or updates through the Management of Change procedure (see Section X). This should be done at list annually and on a when needed basis for example when new flow meters are installed, new procedures are in place or roles and responsibilities are amended, and in general changes which can affect the Monitoring Plan of a vessel...

Table E.2. Control activities: Quality assurance and reliability of information technology

In case of an internal IT system used, the company must describe the back-up procedure in place (i.e. how often are backups taken? Are they tested? Where are they stored? Who has access to those backups? etc.), the user access management procedure (i.e. who is responsible for granting privileges, are the super privileges reviewed? Password policy etc.), the change management procedure (i.e. how requests / issues are reviewed, tracked, are there any user acceptance tests performed?) as well as the logging & monitoring procedure admin action.

Example

Backup Servers will occur every day after regular business hours. Full Backup includes all the source files. Only one full backup will be done once a week. Incremental Backups includes only files that have changed since the last full backup. The next time an incremental backup is done, this file is skipped (unless it is modified again)...

Table E.3. Control activities: Internal reviews and validation of EU MRV relevant data

Companies should have a procedure which ensures quality of information before submitting the respective reports to verifiers. The written procedure should lay down checks to be performed. Minimum review check may include: data completeness check; trend analysis (relative 3 comparison of data over several years) etc.

Example

For Example, this procedure will formalise all actions conducted by the Operations Department with regards to the checks and the reviews applied to measurements related to fuel, time, distance and cargo...

Cargo: The reported cargo values are observed so as to make sure that the number is not bigger than the DWT nominal value. If discrepancies are found, communication with the vessel is established...

Distance: Distances are validated by the Operations Department with the geographical shape and previous similar voyages. Noon reports and reported distances are checked on a monthly basis and verified. In rare cases a big deviation is found, communication is established with the vessel directly...

Time: The Operations Department performs cross-checks between the sum of steaming hours + non steaming hours + off hire hours versus the difference (in hours) between dates from berth to berth. If a difference higher than 10 hours is identified, communication is established with the vessel directly and it is included as an error in the Logbook...

Table E.4. Control activities: Corrections and corrective actions

To establish a systematic and controlled way of reporting and reviewing any non-conformity identified within the Company or on board the vessels, and of deciding and following-up on corrections and corrective actions.

Non-conformity is an observed situation where the objective evidence indicates the non fulfilment of a specific requirement. Such requirements are MRV related procedures, control and MRV management system performance.

The procedure to be described should include: (1) how an MRV non-conformity is reported, (2) Review of a non-conformity, (3) how to implement the corrective action and (4) how corrective actions are followed-up.

Companies can make a reference to existing procedures on ISM with an extended scope to include MRV.

Table E.5. Control activities: Outsourced activities (if applicable)

A procedure for deciding how to outsource to a third party a service related to the Company's MRV management system, and for ensuring quality of outputs.

The procedure should describe how the decision to outsource an activity related to MRV is taken, and (2) how quality in delivering is ensured. The Company might develop a Supplier Performance Rating system and a series of criteria (e.g. level of confidence, response and time availability etc.) based upon which the quality of the services received by the third party is assessed at periodic intervals depending on the length of the outsourced service.

Table E.6. Control activities: Documentation

All companies which are ISM certified do have in place such a procedure. Companies may consider to extend the scope in order to include MRV relevant documents as well as the new legal documents imposed by the EU MRV Shipping Regulation (Monitoring Plan, Emissions Report and Document of Compliance) including the retention period (e.g. DOC 18 months)

Example

All records should be kept in specific files both on board and in the office and be legible, readily identifiable and retrievable. Records should be stored and retained in such a manner as to avoid deterioration or damage.

The Company's filing system is divided in the filing system of each department (i.e. Operations Department, Technical Department and HSQE Department). Each Department is responsible to maintain all hard copies in the floor it is located for at least 3 years after the date of issue. Document of compliance should be kept for at list 18 months.

The filing system on board each ship is divided in the systems of the Master, Chief Engineer, Chief Officer and bridge. All records are retained for at least 3 years after the date of issue...

Part F Further Information

Table F.1.List of definitions and abbreviations

Companies should list any (individual) abbreviations, acronyms or definitions that they have used in completing this monitoring plan (e.g. PMS: Plant Management System, SMS: ship Management system etc.)

Table F.2.Additional information

In this chapter companies may enter any additional information on the MRV matter that they consider relevant for their ship and relevant management procedures (e.g. Data flow diagrams, tasks lists, organizational diagram etc.)

Thank you!

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WP 8 - Guidance on monitoring methods for ships using the exemption from per-voyage monitoring

Recommendation

1. Introduction - Legal background

Application of *Article 9(2)* of the EU MRV Regulation.

This exemption would be given without prejudice to Article 10 i.e. monitoring on an annual basis “in accordance with **Part A of Annex I** and with **Part B of Annex II**.”

2. From previous discussions within other WPs (mainly 5 & 6)

a) Determination of distance travelled and time spent at sea

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

- Deviation from per-voyage monitoring possible in case of single standard routes (cargo and distance to be multiplied to calculate transport work)
- Use of commercial documents with aggregated cargo figures (either total annual or per standard route)

c) Determination of fuel consumption and CO₂ emissions

- 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.
- Companies may follow more frequent intervals according to their internal procedures.
- 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.

3. Technical Question to be answered

How will exempted ships report annually Article 10 figures? Are there any differences to the per-voyage monitoring in need of being identified?

4. Findings and Recommendation

Having in mind the outcome of the discussions held during the past meetings and comments recently received, one could conclude that the difficulty will remain for the calculation of the annual/total transport-work and consequently the two average energy efficiency indicators on which the total transport-work is included. The correct and meaningful calculation of these annual values would only be possible if the aggregation continues to be based on the sum of all the parcels i.e. voyage-specific transport-work values.

Therefore, *unless all the performed voyages are of the exact same length, the need of having a parcel calculation (per-voyage monitoring derived) to obtain the annual reporting value will still remain.*