
Study on potential impacts of design choices for monitoring, reporting and verification of CO₂ emissions from maritime transport

08 June 2016

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Executive summary

On 29 April 2015, the European Parliament and the Council adopted Regulation 2015/757¹ setting the frame for an EU -wide MRV for the maritime sector (hereafter identified the MRV Regulation) which came into force on 1 July 2015.

Starting 1 January 2018, all ships weighing above 5,000 gross tonne are required to start monitoring their CO₂ emissions and other energy efficiency related information for all voyages from, to and within the EU and report about the aggregated numbers on annual basis. Besides this monitoring aspect, the MRV regulation requires verification of the annual emissions and other energy related information ultimately 30 April of the consecutive year. Verifiers are required to provide an opinion with reasonable assurance on whether the emissions report (including transport work) is free from material misstatements. Based on a positive outcome of the verification, verifiers are required to issue a document of compliance (DOC) to the party responsible for MRV compliance of a ship ultimately 30 June of the consecutive year. From 1 July 2019 compliance with the obligation to carry the document of compliance can be checked by Port State Authorities when ships are at an EU port.

In preparation of the next step of implementation by the maritime industry (also referred to as shipping companies), the regulation mandated the European Commission to develop and adopt implementing legislation for the purpose of:

- Amending or refining certain technical aspects of methods of monitoring based on international relevant standards, technological and scientific developments;
- Specifying parameters for cargo carried for a number of ship categories;
- Further specifying the rules for verification activities; and
- Further specifying methods for accreditation of verifiers.

The European Commission hired PwC for the support with developing these delegated acts under the project reference 340201/CLIMA/2014/690237/ETU/B3. PwC subcontracted Marena and CE Delft to perform certain tasks in the project.

In order to achieve the project objectives four working papers have been written – with the aim to facilitate the discussions of the Shipping MRV subgroup of experts on shipping MRV monitoring established under the European Sustainable Shipping Forum (ESSF). This concerns a Working Paper Monitoring methods; a Working Paper Cargo parameters; a Working Paper Verification & Accreditation; and a Working Paper Monitoring plan. The highlights of these working papers are summarized below.

Monitoring of CO₂ emissions and other relevant information on maritime transport (possible amendments to Annex 1 and 2)

Article 4 of the EU MRV contains the principles and Article 5 together with Annex I contain the methods for monitoring and reporting emissions of CO₂ emissions and other relevant information on maritime transport.

Annex I contains a list of methods which can be applied to measure fuel consumption and CO₂ emissions:

- (a) Bunker Fuel Delivery Note (BDN) and periodic stock-takes of fuel tanks;
- (b) Bunker fuel tank monitoring on board;
- (c) Flow meters for applicable combustion processes;
- (d) Direct emissions measurements.

For the calculation of CO₂ emissions, the fuel consumption must be multiplied with the emission factor of the fuel used (Methods A, B, C) or CO₂ emissions can be measured directly in the exhaust gas (Method D). Furthermore, Annex II contains rules on the monitoring of other relevant information including distance travelled, time spent at sea and cargo carried (for passenger, ro-ro and container ships).

These provisions could be amended (by means of delegated acts) in order to take into account relevant international rules as well as international and European standards. The Working Paper on monitoring (possible amendments to Annex I and II) has been prepared to analyze the related existing rules and standards, as well as the scientific and technological developments, which might have an impact on the current MRV regulation.

¹ Regulation (EU) 2015/757 of the European Parliament and of the Council of 29 April 2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC

It has been concluded that the room for amendments to Annex I and II is very limited by the MRV Regulation. Based on the discussions at the ESSF sub-group MRV meetings and written comments on the working papers, a number of issues and areas of concern have been identified, which did not trigger amendments to Annex I, but are relevant for possible best practice and guidance documents. Only the associated measurement of density and the emission factor initiated amendments. Regarding the density measurement, it is recommended that the option to measure fuel density in an accredited fuel test laboratory should also be included into Methods A, C and D, as currently the lab measurement is only included in method B. Furthermore, it was concluded to exclusively use the latest IMO emission factors, instead of the IPCC emission factors.

Also, the Regulation specifies when monitoring on a per voyage basis, the following parameters amongst others shall be monitored for each ship and for each voyage to or from an EU port:

Table 1: Key elements with regard to monitoring other relevant information

Key elements	Impact on the regulation
Distance travelled	During the first meeting of the ESSF subgroup on MRV, as well as in many written stakeholder comments, it became apparent that there is a need to further refine or determine the way to calculate port of departure and port of arrival information as these are the moments where voyage begins and ends. The 'berth-to-berth' concept could be specified in Annex II, section A, point 1. (a). This will influence the calculations of fuel consumption and related emissions, time at sea, and distance travelled. Also, several situations have been identified for which there is need for further guidance.
Time spent at sea	Time spent at sea should be calculated on the same basis as distance travelled. A need for guidance has been identified for many of the same situations as mentioned for distance travelled.
Amount of cargo carried - Passenger ships	The MRV regulation does not clearly define 'passenger ships'. During the first meeting of the ESSF subgroup on MRV, as well as in many written stakeholder comments, it became apparent that there is a need for a clear definition of a passenger ship to distinguish it from a Ro-Ro ship, which need to monitor different cargo parameters. Triggered by the SOLAS definition, 'passenger ships' could be defined as 'ships that carry more than twelve passengers but not cargo'. The other ships carrying passengers and cargo could be covered by the category 'Ro-Ro passenger ships' which is considered for the Implementing Act on cargo parameters.
Amount of cargo carried – ro-ro ships	Triggered by the EEOI guidelines and the CEN standard EN 16258 (2012), cargo – ro-ro ships should have the option to monitor and report the actual cargo mass, in addition to 'the number of cargo units (trucks, cars, etc.) or lane-metres multiplied by default values for their weight'.
Amount of cargo carried – container ships	The current text in Annex II reads 'for container ships, cargo carried shall be defined as the 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. 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'. In view of the above, a specific reference to MSC.1/Circ.1475 could be inserted.

Monitoring of cargo carried

Annex II of the Regulation specifies how the amount of cargo carried shall be monitored for passenger ships, ro-ro ships and container vessels. For all other ship types, the Commission shall adopt, by means of implementing acts, technical rules specifying the applicable parameters. For each ship type, one – or if justified more than one – parameter(s) to express cargo carried need(s) to be determined. This has been done in 2 subsequent steps:

- Determination of the ship types for which the amount of cargo carried has to be defined.
- Description of the requirements for a definition of the amount of cargo and description of the possible options for monitoring the amount of cargo carried for all the ship types identified in step 1.

Table 2 Overview of recommended parameters for the determination of cargo carried for different ship types

Ship type	Parameters for cargo parameters
Oil tankers	For tankers, cargo carried should be defined as the mass of the cargo on board.
Chemical tankers	For chemical tankers, cargo carried should be defined as the mass of the cargo on board. A memo field should be included in the reporting template to convey additional information on a voluntary basis.
LNG carriers	For LNG carriers, cargo carried should be defined as the volume of the cargo on discharge, or, if cargo is discharged at several locations, the sum of the cargo discharged and the cargo discharged at all subsequent locations up to the location where new cargo is loaded.

Ship type	Parameters for cargo parameters
Gas carriers	For gas carriers, cargo carried should be defined as the mass of the cargo on board.
Bulk carriers	For bulk carriers, cargo carried should be defined as the mass of the cargo on board. A memo field should be included in the reporting template to convey additional information on a voluntary basis. The memo field will need to be verified and its content will be published to help understand the efficiency metrics for the ship in question.
General cargo ships	For general cargo ships, the report of the ad-hoc task force will recommend cargo parameters.
Refrigerated cargo carriers	For refrigerated cargo carriers, cargo carried should be defined as the mass of the cargo on board.
Vehicle carriers	For vehicle carriers, the report of the ad-hoc task force will recommend cargo parameters.
Combination carriers	For combination carriers, cargo carried should be defined as the mass of the cargo on board. A memo field should be included in the reporting template to convey additional information on a voluntary basis. The memo field will need to be verified and its content will be published to help understand the efficiency metrics for the ship in question.
Ro-ro passenger ships	Ro-Ro passenger ships will report two cargo parameters: The number of passengers on board and the mass of cargo on board. The second cargo parameter can either be actual mass or be calculated as units or occupied lane meters multiplied by default mass per unit or per lane meter. The fuel consumption should be split into fuel used to transport passengers and fuel used to transport cargo using CEN 16258. Further guidance on the use of this standard may be developed.
Container/ro-ro ships	For container/ro-ro ships, cargo carried should be defined as the volume of the cargo.
Other ship types	Ships that do not fall under any of the definitions listed in Chapter Error! Reference source not found., Error! Reference source not found. , should determine their amount of cargo carried either by Mass of the cargo; or by Deadweight carried.

Monitoring plan

A working paper on monitoring plan has been prepared. It comprises a draft of the future structure of monitoring plans, its contents and the motivation for data and level of detail requested. A monitoring plan is a description of the design how the company monitors and report emissions. The result of monitoring and reporting, the aggregated data will be input in the emissions report. In accordance with the EU MRV Regulation, a standardized and structured monitoring plan shall be used by ships, based on templates developed by the Commission.

Article 6 of the EU MRV Regulation establishes the minimum content and set requirements for the submission of monitoring plans. Based on the experience of the project team there is need for additional content, such as the description of (Management) responsibilities & data flow activities, control activities (Performance of a risk assessment, Quality assurance of information technology, Internal reviews and validation of data) and corrections and corrective actions (outsourced activities and documentation).

Below an overview of topics for which a need for further guidance has been identified.

Table 3: Monitoring plan elements for which further guidance is needed

Topic	Why further guidance?
Distance travelled	In order to determine the real distance travelled based on the voyage logbook, its it not specified whether this distance should be based on distance over ground or through water. Further guidance is needed to clarify how companies should determine the real distance travelled.
Amount of cargo carried & number of passengers	Payload carried by cargo ships can be retrieved in different ways (refer to Working Paper on Cargo Parameters) and should all be described in the monitoring plan. Further guidance on this aspect is needed.
Uncertainty assessment of carbon emissions from fuel types	Based on the discussions and conclusions of the subgroup for monitoring, a need for guidance is identified to develop default uncertainty values.
Data gaps: Description of the method to be used to estimate fuel consumption	Best practise/ Standard data gap calculation(s)/formula(e)/guidance documents are needed, companies may use (in the case of data gaps regarding fuel consumption of individual ships in a specific period of time).

Verification procedures and accreditation of verifiers

Article 15.5 and Article 16.3 of the EU MRV Regulation empowers the Commission to adopt delegated acts in order to further specify the rules for the verification activities and methods of accreditation. Elements that shall

be considered are provided in Annex III Part A for verification activities and in Part B for methods of accreditation.

Workflow for verification:

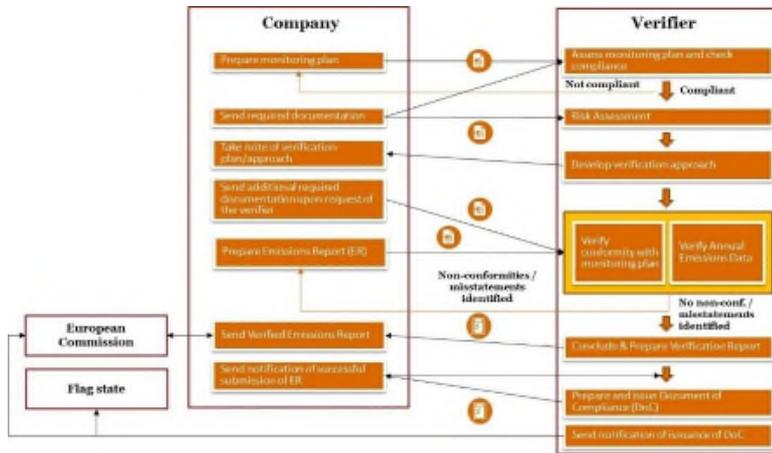


Table 4: Outcome stakeholder meeting discussions on verification procedures

Element	Conclusions reached during the stakeholder meetings
Competencies of verifiers	Based on feedback from stakeholders there will be one single list of competencies covering the assessment of monitoring plan and the verification of emissions reports. The list should include a number of relevant competence criteria for verifiers, including maritime specific competence criteria.
Assessment of the conformity of the monitoring plan	Based on feedback from stakeholders, the following is preferred: <ul style="list-style-type: none"> Additional rules that will address the assertions that have to be fulfilled by the verifier in assessing the monitoring plan were agreed. These assertions could be: completeness, relevance and conformity with the EU MRV Regulation. No further rules with regard to time allocation will be specified. The time allocation is subject to the best estimation of the verifier and the verifier will determine if and how this will be addressed in the verification contract.
Documents to be provided by companies to verifiers	Based on the feedback received from stakeholders, a retention period of a minimum of three years is preferred for all information used for the preparation of the emissions report. This is recommended to be included in the Delegated act. Also, it has been proposed that the delegated act will require shipping companies to have at least a copy (electronic or on paper) of the documents listed above in the office for verification purposes. Furthermore, the delegated act should specify a minimum list of documents that shipping companies shall provide to verifiers (provided that these documents are applicable to the specific ship and to the monitoring method chosen).
Risk assessment to be carried out by verifier	The requirements for the risk assessment should be based on a basic framework, on the principles of inherent risk, control risk and detection risk. Furthermore the delegated act should specify certain requirements on elements the verifier must consider in the risk assessment.
Verification of the emission report	Based on the outcome of the discussions it is suggested to use the minimum requirements of ISO 14065 as a basis, add certain maritime specific elements and to use the structure of the AVR article 13 to 21 to the extent relevant for specifying further rules in the delegated act.
Site visits	Verifiers should carry out a site visit for each verification and it is deemed most appropriate to the onshore location of the company where a critical mass of data is kept. On-board verification is in principle not deemed necessary. Under certain conditions based on the outcome of the risk assessment, the verifier may waive a site visit or decide that an on-board verification is inevitable, provided that the rationale for this decision is appropriate and documented.
Uncertainty	Based on the discussions, verifiers shall: <ul style="list-style-type: none"> verify whether the uncertainty thresholds described in the monitoring plan are compliant with the EU MRV Regulation (as they either use default values provided by guidance documents or establish specific values); verify that shipping companies adequately disclose the applied uncertainty levels in the emissions report.
Materiality	Based on the discussions with and feedback received from stakeholders, consensus has been reached that option “The level of materiality is prescribed by the delegated act” is preferable. The following thresholds are suggested: <ul style="list-style-type: none"> CO₂ emissions: 5% Transport work: 5% Other relevant information: 5%
Misstatements and	Based on feedback obtained from stakeholders, consensus has been reached on: The content of

Element	Conclusions reached during the stakeholder meetings
non-conformities	Article 22 of the AVR on addressing misstatements and non-conformities will be used, with the exception that non-material misstatements do not need to be corrected (except when aggregated non-material misstatements amount to a material misstatement). This should be under the condition that the verifier concludes that uncorrected misstatements and undetected misstatements in aggregate remain below materiality level.
Reasonable assurance	The EU MRV Regulation requires that verification assessment concludes with reasonable assurance from the verifier that the emissions report is free from material misstatements. The following definition, in line with the AVR, could be provided by the Delegated Act: "reasonable assurance' means a high but not absolute level of assurance, expressed positively in the verification opinion, as to whether the company's report subject to verification is free from material misstatement".
Content of the verification report	Based on the feedback obtained, the delegated act will prescribe a list of minimum requirements about the content of the verification report. This should be based on the minimum requirements of ISO14065.
Recommendations for improvements	Rules should be developed with regard to which recommendations for improvements could be made by the verifier. These rules will focus on limiting the recommendations to be made (e.g. no recommendations for improvements allowed for changing the monitoring method, only recommendations on the "What" and not on the "How").

Below an overview of verification topics for which a need for further guidance has been identified.

Table 5: Verification procedures elements for which further guidance is needed

Topic	Why further guidance?
<p>Risk assessment to be carried out by verifiers</p> <p>Topic: How verifiers should use ship's tracking data from an external source and how the verifier should interpret the information for the purpose of the verification of the emissions report.</p>	<ul style="list-style-type: none"> • It should be clear which source for ship's tracking data the verifier shall use and how the verifier can obtain this information • It should be clear how meaningful the information is for the verifier to assess the risk of misstatements in the emissions report (based on the first draft prepared by the ship) • It should be clear for verifiers how to interpret differences between the ships data and tracking data from an independent source in order to avoid meaningless verification procedures.
<p>Site visits</p> <p>Topic: How verifiers should consider the need for a visit to the company and ship.</p>	<ul style="list-style-type: none"> • It should be clear for verifiers which information and level of understanding of the ships monitoring and reporting is required to evaluate how verification of the emissions report can be done effectively and cost efficient. • It should be clear for verifiers in which cases a site visit may be waived and in which cases an on-board visit would be inevitable. In developing this guidance, cost efficiency should be considered
<p>Recommendations for improvements</p> <p>Topic: The extent to which verifiers can make recommendations.</p>	<ul style="list-style-type: none"> • To provide examples of what would be allowed and not, which serves as a preventive means in the MRV system to safeguard impartiality of verifiers, in the form of the risk of self-review. In basis verifiers would be allowed to recommend on the "what", but not on the "how" and verifiers cannot have any role in the implementation of the monitoring plan.
<p>Materiality & verification of the emissions report</p> <p>Topic: How sampling is relevant for EU MRV verification purposes, determining samples for data auditing and how verifiers apply the materiality principle.</p>	<ul style="list-style-type: none"> • To provide guidance for verifiers how sampling, based on proven concepts and best practices, can be performed effectively in the context of maritime MRV. This allows for better harmonization of the interpretation of the meaning of sampling for the emissions report verification. It also provides verifiers having less experience in data auditing insight in the relation of sampling with other verification activities and materiality.
<p>Verification of the emissions report</p> <p>Topic:</p> <ol style="list-style-type: none"> 1) How backward verification should be dealt with when the ship sails to an EU port of call in the reporting period which the company did not foresee and therefore did not submit a monitoring plan to the verifier timely. 2) To provide examples of how verification activities can be carried out by the verifier. 	<ol style="list-style-type: none"> 1) To provide practical guidance on how to deal with backward verification in different scenarios (late submission of MP due to change of owner/manager, change in schedule. This both relates to content and timing and requires adequate and clear guidance. 2) To provide guidance to verifiers based on proven concepts best practices on how verification activities should be carried out in line with the interpretation of the legislation. For example on how verifier should verify completeness of voyages, cargo carried on a per-voyage basis, how to verify results of tank soundings.

Workflow accreditation of verifiers

The picture below provides an overview of the accreditation process for the initial assessment.

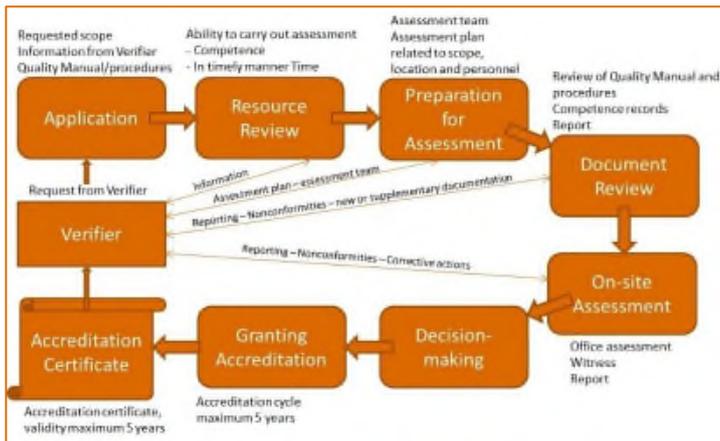


Table 6: Selected items of the stakeholder meeting discussions on accreditation of verifiers

Element	Conclusions reached during the stakeholder meetings
Scope of accreditation	Based on the discussions: <ul style="list-style-type: none"> One single accreditation activity for both assessing the monitoring plan and carrying out the verification of the emissions report. One single accreditation for all monitoring methods and all types of vessels
Accreditation request	Non-EU Verifiers are allowed to choose freely an EU NAB.
Assessment of verifiers by NABs in order to issue an accreditation certificate	Accreditation certificates could be given a validity period with a maximum of five years.
How NABs will perform the surveillance to confirm the continuation of the accreditation	Based on the feedback received from stakeholders, it is suggested to follow the current practices for surveillance (annually is preferred) witness of NABs (both in the office and in the field).
Communication between NAB and Commission	Based on the feedback received from stakeholders, there is a need for transparency on which verification body is accredited. The status of accreditation of verifiers will be communicated by the individual NABs to the Commission by use of a standardized format.
Suspension or withdrawal of accreditation	In case of suspension or withdrawal of accreditation, it is suggested that the previously issued formal documents by the verifier remain valid for the company. During suspension or withdrawal the verifier cannot issue any formal documents for the EU MRV Regulation under subject of the suspension or withdrawal. NABs shall inform verifiers about conditions under which the accreditation can be re-instated by the NAB.

Below an overview of the accreditation activities after the initial assessment has been completed.



Table 7: Accreditation activity elements for which further guidance is needed

Topic	Why further guidance?
Assessment of verifiers by NABs in order to issue an accreditation certificate: <ol style="list-style-type: none"> How accreditation can be received in time during the initial phase (chicken and egg issue) Granting of Accreditation 	<ol style="list-style-type: none"> Reduce the risk that companies and verifiers find out close to the deadlines of the first reporting period that the verifier will not get accredited in time. To provide practical guidance on the best way to setup the accreditation process between verifiers and accreditation bodies, given the inherent chicken and egg issue, is needed. Accreditation need to be granted before confirming assessment of the monitoring plan and before issuing a verification report. The accreditation may need to be granted in two steps. Further guidance is needed.

