

MRV Regulation Assessment of Impacts of Delegated and Implementing Acts

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1. Introduction

1.1. Regulatory background

The EU Regulation on the monitoring, reporting and verification of emissions of carbon dioxide (CO₂), from maritime transport (2015/757).

- Delegated powers to Commission (see Table)

Article	Type of act	Purpose of the act
5.2	Delegated Act (optional)	to amend the methods set out in Annex I and the rules set out in Annex II, in order to take into account relevant international rules as well as international and European standards.
5.2	Delegated Act (optional)	to amend Annexes I and II in order to refine the elements of the monitoring methods set out therein, in the light of technological and scientific developments.
6.5	Implementing Act	standardised monitoring plans based on templates and technical rules for their uniform application
12.2	Implementing Act	technical rules establishing the data exchange formats, including the electronic templates.
15.5	Delegated Act	to further specify the rules for the verification activities
16.3	Delegated Act	to further specify the methods of accreditation of verifiers
17.5	Implementing Act	technical rules for the data exchange formats, including the electronic templates
Annex II, Article 2	Implementing Act	technical rules specifying the cargo carried applicable to each of the other categories of ships

1.2. Relevant impacts

The Commission's proposal for the regulation was accompanied by an impact assessment (European Commission, 2013: SWD(2013) 236 final and SWD(2013) 237 final). That impact assessment only concerns the impacts of the Delegated and Implementing Acts. Design choices for MRV regulation may have different cost impacts than the costs presented in the earlier impact assessment. Focus of this paper is on the administrative burden from the different design options to measure cargo, exchange data and verify information, compared to the current practice. Wider economic impacts, environmental impacts and social impacts of the regulation are hardly affected and are only assessed when there is a clear ground that different design choices have different impacts.

1.3. Outline of this paper

This paper assesses the impacts of different design options for MRV regulation for ships over 5,000 GT. Chapter 2 summarizes the options and results for the choice of different cargo parameters for four ship types. Chapter 3 describes the design and impacts of data exchange formats and the option of a web based tool for the emissions report and Document of Compliance (DoC). Chapter 4 describes the options for site visits, the additional administrative costs and possible other impacts.

Disclaimer

The information and views set out in this paper are those of the author(s) and do not necessarily reflect the official opinion of the Commission.

2. Cargo Parameters

2.1. Introduction

In this chapter we evaluate the different cargo parameters and the corresponding administrative costs for four ship types.

2.1.1. Selection of ship types

The selection of ship types included in this analysis is based on the number of ships and CO₂ emissions per ship type over 5,000 GT (see European Commission, 2013). The four ship types selected cover around 60% of the number of ships for the EU scope, and 34% of the CO₂ emissions. Container ships are excluded, because they already have a cargo load reporting system specified in Annex II to the MRV regulation. Also passenger ships (like ferries) are beyond the scope of the analysis for the same reason.

Table 1 Number of ships and CO₂ emissions in 2010 for EU scope per ship type (>5,000 GT)

Ship type	Number of vessels	CO ₂ tonne	Rank number	Rank CO ₂	Included
Bulker	2,732	21,940,872	1	2	x
Container	1,964	54,565,733	2	1	
Chemical tanker	1,577	13,971,459	3	5	x
General cargo	1,349	7,583,619	4	6	x
Oil tanker	1,208	15,404,869	5	4	x
Ferry	488	16,888,627	6	3	
Vehicle	438	5,591,435	7	9	
Other dry	394	4,277,142	8	11	
RoRo	356	6,137,373	9	8	

Source: European Commission, 2013, p. 159

2.1.2. Overview of design choices

Table 2 presents a list of options for parameters for the amount of cargo carried for the selected ship types.

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

Ship Type	Parameters for the amount of cargo carried
Bulk carriers	1. Mass of the cargo on board 2. Volume of the cargo on board 3. Volume + mass 4. Mass + a correction factor 5. Deadweight carried
Oil tankers	1. Mass of the cargo on board 2. Volume of the cargo on board
Chemical tankers	1. Mass of the cargo on board 2. Volume of the cargo on board 3. Mass of the cargo on board + voluntary memo field
General cargo	1. Mass of the cargo on board 2. Volume of the cargo on board 3. Volume + mass 4. Mass + deadweight carried 5. Deadweight carried

2.1.3. Overview of administrative costs

European Commission (2013) estimates administrative costs and administrative burden for monitoring, reporting and verification based on fuel consumed for all ships above 5,000GT using the Standard cost model (SCM) for estimating administrative costs. The administrative burden only includes costs that are additional compared to a situation without an MRV system. **Fout! Ongeldige bladwijzerverwijzing.** shows the main burden is for the ship owners / operators. Costs are based on man-days per activity, an hourly wage, and equipment costs. For the calculation of these additional costs it is assumed that existing data can be used and no new data have to be produced. Highest costs are costs for verification of the annual reports. Each additional man day for ship owners / operators would increase the yearly administrative costs by EUR 3.8 million, if all ship owners / operators are affected.

There is no administrative burden for public authorities as they are not involved in the reporting exercise.

Table 3 **Yearly administrative burden**

	Number of entities	Per entity (EUR)	Total (mio EUR)
Ship owner / operator	11,400 (ships)	6,700	76.4

Source: European Commission (2013), based on AEA Technology et al. (2012)

The estimates do not distinguish between ship types. The European Commission (2013, p. 159) gives an overview of the number of vessels per ship type (> 5,000 GT). Table 4 shows an estimation of the administrative costs for ship owners / operators per ship type, assuming that the costs do not differ per type of ship.

Table 4 **Yearly administrative burden ship owner / operator per ship type**

Ship type	Share of entities	Total (mio EUR)
Bulk carrier	24%	18.9
Oil carrier	11%	8.3
Chemical Carrier	14%	10.9
General cargo	12%	9.3

Source: own calculations, based on European Commission, 2013

The European Commission (2013, p. 76) states that the administrative burden for monitoring fuel use is *very low*. It is only a small share of the total operational costs. Electronic reporting can reduce time spend by the crew and can have a downward effect on administrative costs. Economies of scale can lead to lower costs for bigger shipping companies.

The following sections build on the Impact Assessment (European Commission 2013), making the following assumptions:

- The administrative burden for monitoring, reporting and verification of data that are available in a shipping company's information system does not depend on the type of data.
- If two sets of data need to be monitored, reported and verified and additional calculations need to be performed, this raises the costs for the applicable cost items by 10%.
- If data needs to be monitored that is not available in current information systems, the applicable cost items increase by 50%.
- If data needs to be monitored, reported and verified that is not available in current information systems and difficult to measure, the applicable cost items increase by 100%.

2.2. Bulk carriers

2.2.1. Options for the determination of cargo carried

There are five options for the determination of cargo carried that can be measured for bulk carriers: all based on the mass and volume of the solid bulk cargo.

- **Mass.** Measuring mass is already common practice for bulk carriers. Appendix 5 of the BLU code (Code of Practice for the Safe Loading and Unloading of Bulk Carriers) requires terminal operators to inform a ship's master in advance of loading cargo about the weight of the load. In addition, information on the cargo mass is included in commercial documents, documents required under SOLAS for carriage of dangerous cargoes, and, if the cargo is imported or exported into or from the EU, in the summary declarations required under the EU customs code.
- **Volume.** Volume of cargo does not appear to be routinely measured, but SOLAS documents include a stowage factor (density) which allows for calculating volume when mass is known.
- **Mass and volume.** A combination of both parameters can be used to better reflect the different types of solid bulk cargo.
- **Deadweight carried.** Deadweight carried (contents) is defined as displacement (ship + contents) minus ship lightweight (ship). This would recognize the fact that on laden voyages, low density cargoes require the ship to carry ballast water in order to keep the center of gravity at a safe point. When only mass of the cargo is measured, energy efficiency can be underestimated. Displacement can be calculated from a ship's draught, which is routinely monitored and logged. When mass is known, deadweight can be calculated.
- **Mass in combination with a correction factor.** A corrected mass may yield more robust information on energy efficiency. If actual density is less than *nominal* cargo density, mass can be corrected by multiplying with a correction factor (>1).

2.2.2. Assessment of the administrative costs

For parameters based on data that can be retrieved from existing systems, the administrative costs estimated by the European Commission (2013) give a proxy of the additional administrative costs. We assume that MRV systems for measuring fuel consumption are comparable to MRV systems for measuring cargo. The size of the costs depends on the information already available and monitored. Bulk carriers are already informed about the **mass** of the cargo, so data can be retrieved from existing systems. Mass can be measured using different weighing systems, that should be regularly inspected. Order of magnitude for the administrative costs for MRV per ship would be EUR 6,700. Total yearly costs for all bulk carriers will be approximately EUR 18.3 million.

If **volume** is used, information about mass and a stowage factor are required. The accuracy of this method depends on the type of commodity transported. The stowage factors for some commodities are given as a range. For example, the stowage factor of coal varies between 0.79 and 1.53 (IMO, 2007). In that case, laboratory analysis of samples will be necessary to give an accurate indication of the volume. The stowage factor can also vary between different parts of the bulk or change during a voyage, e.g. when shells and grain kernels collapse. This implies that using a stowage factor for measuring volume when mass is known, can lead to significant additional administrative costs. This is especially the case for commodities without a single, accurate stowage factor. Because both mass and stowage factor would need to be monitored, we expect the following cost items to be higher:

- Preparation of a monitoring plan
- Retrieving relevant information from existing data
- Adjusting existing data
- Filling in forms and tables, including record keeping
- Verification.

Because the stowage factor is not in the current information system, these costs are 50% higher. Because an additional calculation needs to be done, the costs are 10% higher, so in total the costs are EUR 10,400 instead of 6,700 per ship.

Using **mass and volume** would lead to another additional calculation, compared to using volume. No additional item should be monitored, because both mass and volume are needed to monitor volume. This would lead to an increase of the following costs items:

- Preparation of a monitoring plan
- Adjusting existing data
- Filling in forms and tables, including record keeping
- Verification.

Because this option involves an additional calculation, these costs are estimated to be 10% higher compared to monitoring volume only, additional administrative costs will increase from EUR 6,700 to 11,300 per vessel.

Also calculation with a **correction factor** requires extra effort. Information about maximum cargo capacity (in tonnes), actual density (inverse of stowage factor), and actual volume are necessary. We expect effort to be comparable to monitoring mass and volume, so additional administrative costs will increase to EUR 11,300 per vessel.

For calculating **deadweight carried** no additional information sources are necessary, but it also requires additional calculation effort. Information is required about draught and mass. Both are regularly monitored and logged. We expect the following cost items to be higher:

- Preparation of a monitoring plan
- Retrieving relevant information from existing data
- Adjusting existing data
- Filling in forms and tables, including record keeping
- Verification.

Because all the data can be retrieved from current systems but new calculations need to be made, the cost items are 10% higher compared to monitoring mass only, additional administrative costs will increase from EUR 6,700 to 7,300 per vessel.

Table 5 summarizes estimated the yearly additional costs for the five different determination options for bulk carriers.

Table 5 Overview yearly additional administrative costs bulk carriers

Determination option	Costs per ship (EUR)	Total additional costs (mio EUR)
Mass	6,700	18.3
Volume	10,400	28.4
Mass + volume	11,300	30.9
Mass + correction factor	11,300	30.9
Deadweight carried	7,300	19.9

2.2.3. Assessment of other impacts

Because impact on operational costs is low (see IA), no other impacts are relevant.

2.3. Oil Tankers

2.3.1. Options for the determination of cargo carried

There are two qualities of cargo that can be measured for oil tankers: mass and volume of the liquid cargo.

- **Mass.** For tankers, mass is usually calculated by multiplying volume with density. Mass is also recorded in commercial documents and logs.

- **Volume.** Oil tankers already measure the volume of oil carried. Tankers that carry oil or oil products are required to have an Oil Record Book II under Marpol Annex I. In this Record book, the crew is required to log the volume of all loading and unloading of oil cargo in m³, bbl or gallons. These entries can be used for monitoring the volume of the cargo transported.

2.3.2. Assessment of the administrative costs

The accuracy of the parameters depends on the accuracy of the current methods. Volume and density both depend on temperature, so they can vary between time or place. Current practice is to report density and volume at 15° C. Alternatively you should monitor during a trip, which can increase costs. Temperature does not affect mass. A bill of lading can provide information on mass and volume. If a shipmaster signs a bill of lading, he agrees with the mass of the cargo. Some companies require certificates of quantity issued by an independent inspector at the loading terminal.

It is the industry's practice to monitor cargo **mass**, but also **volume** can be monitored by using existing data from the Oil Record Book II. For both options administrative costs are in the order of magnitude of the European Commission (2013). The yearly administrative burden is estimated to be around EUR 8.1 million or EUR 6,700 per vessel.

Table 6 summarizes the estimated yearly additional costs for the two different determination options for oil tankers.

Table 6 Overview yearly additional administrative costs oil tankers

Determination option	Costs per ship (EUR)	Total additional costs (mio EUR)
Mass	6,700	8.1
Volume	6,700	8.1

2.3.3. Assessment of other impacts

Because of the relatively low administrative costs, no other impacts are expected.

2.4. Chemical tankers

2.4.1. Options for the determination of cargo carried

There are three qualities of cargo that can be measured for chemical tankers: mass and volume of the liquid cargo, and mass plus a voluntary memo field.

- **Mass.** For chemical tankers, mass is usually calculated by multiplying volume with density. Mass is also recorded in commercial documents and logs.
- **Volume.** Chemical tankers are not obliged to keep records of the volume of the cargo transported as oil and product tankers do.
- **Mass + voluntary memo field.** The density of cargoes of chemical tankers can vary widely per type of product transported. This will impact the results of efficiency parameters based on actual mass carried, because transporting less dense chemicals will result in lower energy efficiency. Therefore, a voluntary memo field can be included in the reporting template. This field can be used to convey information that can be used to interpret the efficiency parameters, for example the average share of available tank volume used in a reporting year or the average density of the cargoes transported in a reporting year. The memo item would require verification as all other reported information.

2.4.2. Assessment of the administrative costs

Monitoring of **mass** is the common industry practice. Mass is normally calculated by multiplying volume with density, so **volume** is also known at loading and discharge, but not recorded. Total yearly administrative

burden for measuring mass for all chemical tankers would be approximately EUR 10.6 million or EUR 6,700 per vessel.

For measuring volume, adding an additional element needs to be added in the information systems and an additional calculation needs to be made. We expect the following cost items to be higher, because it's not common industry practice;

- Preparation of a monitoring plan
- Retrieving relevant information from existing data
- Adjusting existing data
- Filling in forms and tables, including record keeping
- Verification.

These costs are 65% higher compared to monitoring mass, hence additional administrative costs will increase from EUR 6,700 to 10,400 per vessel. Accuracy also depends on the accuracy of current methods. Measuring cargo can be a time-consuming activity for chemical tankers, because of the different (hazardous) characteristics of the different types of chemicals.

Density depends on the type of chemical products transported. Chemical tankers have a number of tanks, and can carry different types of chemicals. Using mass as a determinant would underestimate energy efficiency for lower density chemicals. In a **voluntary memo field** ship owners / operators can add information on density or share of tank volume used. Because it is a voluntary field, it does not constitute an additional administrative burden compared to using mass. When a company *chooses* to use the field, the following cost items will be higher:

- Preparation of a monitoring plan
- Retrieving relevant information from existing data
- Adjusting existing data
- Filling in forms and tables, including record keeping
- Verification.

Table 7 summarizes the estimated yearly additional costs for the three different determination options for chemical tankers.

Table 7 Overview yearly additional administrative costs chemical tankers

Determination option	Costs per ship (EUR)	Total additional costs (mio EUR)
Mass	6,700	10.6
Volume	10,400	16.4
Mass + voluntary memo field	6,700	10.6

2.4.3. Assessment of other impacts

Because of the low administrative costs, no other impacts are expected.

2.5. General cargo ships

2.5.1. Options for the determination of cargo carried

There are five qualities of cargo that can be measured for general cargo ships:

- **Mass.** Solas Chapter VI, regulation 2, requires the shipper to inform the master about 'the gross mass of the cargo or of the cargo units', and 'prior to loading cargo units on board ships (...) ensure that the gross mass of such units is in accordance with the gross mass declared on the shipping documents'. In addition, information on the cargo mass is included in commercial documents, documents required

under SOLAS for carriage of dangerous cargoes, and, if the cargo is imported or exported into or from the EU, in the summary declarations required under the EU customs code.

- **Volume.** Volume of cargo does not appear to be routinely measured for general cargo ships.
- **Deadweight carried.** This would recognize the fact that low density cargoes require the ship to carry ballast water in order to keep the center of gravity at a safe point, displacement can be calculated from a ship's draught, which is routinely monitored and logged. Ballast is strictly spoken not cargo. Ships that carry light or voluminous cargoes will appear to be less efficient when mass is used. Using deadweight does not have this advantage.
- **A combination of mass and deadweight carried or mass and volume.** A combination better reflects the different types of cargo. Using only mass would disadvantage ships that carry light or voluminous cargoes in a reporting period, as their efficiency appears to be worse than similar ships that carry heavy cargoes.

It is important to note that for general cargo ships, the type (and density) of cargo and the payload utilization varies enormously over time, e.g. a period of one year.

2.5.2. Assessment of the administrative costs

Mass and deadweight carried are in line with common practice. The calculation of the European Commission (2013) can be used. For general cargo ships yearly costs will be approximately EUR 9.0 million of EUR 6,700 per vessel. A combination of **mass** and **deadweight carried** requires some additional calculations, that can lead to higher costs. An increase of 10% for the following cost items is expected because of the required additional calculations:

- Preparation of a monitoring plan
- Adjusting existing data
- Filling in forms and tables, including record keeping
- Verification.

This will increase costs per vessel to EUR 7,300

Volume of cargo is not routinely measured. It will be very difficult and time consuming to measure volume. Because of the variety of freight transported, using a general stowage factor is not possible. Some general cargo ships (Statcode A31 or A32) also have a RoRo-facility or are equipped to carry liquids, containers or passengers. Measuring the volume of cargo would require substantial additional administrative costs, because new data should be produced for every voyage. Different methods have to be used to measure the different types of cargo (liquids, containers, packaged items). The following cost items are expected to change:

- Preparation of a monitoring plan
- Retrieving relevant information from existing data
- Adjusting existing data
- Filling in forms and tables, including record keeping
- Verification

And the item 'Producing new data' should be added. If all existing cost items increase by 100% and 'Producing new data' will cost as much time as retrieving relevant information and adjusting existing data, costs per vessel will increase from EUR 6,700 to at least EUR 15,100. Costs can be very significant between the different types of general cargo ships and will be higher if a ship transports more non-standard freights.

A combination of **mass and volume** would lead to even higher additional administrative costs, because of additional calculations. This would lead to an increase of the following cost items:

- Preparation of a monitoring plan
- Adjusting existing data

- Filling in forms and tables, including record keeping
- Verification.

If all these costs are 10% higher compared to monitoring volume only, additional administrative costs will increase from EUR 6,700 to at least 15,600 per vessel.

Table 8 summarizes the estimated yearly additional costs for the five different determination options for general cargo ships.

Table 8 Overview yearly additional administrative costs general cargo ships

Determination option	Costs per ship (EUR)	Total additional costs (mio EUR)
Mass	6,700	9.0
Deadweight carried	6,700	9.0
Mass + deadweight carried	7,300	9.8
Volume	≥ 15,100	≥ 20.4
Volume + deadweight carried	≥ 15,600	≥ 21.0

2.5.3. Assessment of other impacts

Because monitoring **volume** can lead to a significant increase of the administrative burden, the competitive position of general cargo ships can deteriorate, e.g. in favour of container shipping for smaller bulk goods.

3. Data exchange formats

3.1. Introduction

This chapter describes the design and impacts of data exchange formats and the option of a web based tool for the emissions report and Document of Compliance (DoC). Note that the IT tool can also be used for monitoring, but this is a voluntary option that is beyond the scope of this impact assessment.

3.2. Emissions Report

3.2.1. Options for the emissions report data exchange

No tool

Without a tool, shipping companies and verifiers send their reports to the Commission via email or fax. Communication takes place via several means, like email and phone. The emissions report should include all information as mentioned in the (verified) monitoring plan. Standard exchange formats (e.g. Excel) are available for reporting data.

MRV IT Tool

Article 12 of the EU regulation on MRV (2015/757) describes that ‘the emissions report shall be submitted using automate systems and data exchange formats, including electronic templates’. EMSA describes the design of automated systems, data exchange formats including electronic templates, and voluntary modules under the MRV IT tool in its working papers.

The first working paper describes the systems users and workflow under the MRV IT tool for the reporting and notification obligations. In this case the tool is only used after verification of the emissions report. The second working paper presents additional functionalities for the MRV IT tool, so it can also be used during the monitoring and verification phases, when the emissions report is prepared and submit for assessment.

Standard (mandatory) MRV IT Tool

The MRV IT Tool is used by shipping companies, verifiers, the Commission and Member States (in their capacity as Flag States). The tool is an extension of existing tools operated by EMSA. Shipping companies first produce emission reports per ship without use of the tool. These reports use predefined templates. For data input they can upload a CSV format file or equivalent, possibly developed by EMSA. Shipping companies are obliged to monitor all parameters indicated under the MRV regulation and send the results in a draft emissions report to the verifier. They may also send additional documents (e.g. fuel invoices; oil record book and copies of weather routing systems) to the verifier. Verifiers will verify the content of emissions report as soon as the report meets the predefined standards. In order to submit the verified emissions report to the Commission and concerned Flag States the MRV tool shall be used. Shipping companies upload the emissions report. Verifiers will issue a Document of Compliance (DoC) using the MRV tool. The DoC will be carried on board of the ship. The Commission and Member States (Flag States) will be automatically notified of uploaded documents.

Table 9 Functionalities of the MRV IT tool per stakeholder

Stakeholder	Compulsory use of the MRV IT tool	Outside the tool
Shipping companies	Submit a verified emissions report	Monitoring activities Produce draft emissions report and send additional documents Communicate with verifiers
Verifiers	Submit a DoC	Communicate with shipping companies Assess and verify emissions report
Commission	Access to the verified emissions report and DoCs	-
Member States (Flag States)	Access to the verified emissions report and DoCs	-

Using the tool, compared to no tool, is advantageous for the Commission and Member States (Flag States). They automatically have access to the emissions report and the DoC in a predefined format. The received information is centralized in one system. They have to spend less time collecting and organizing the received information. Moreover, with a reliable tool the risk of not receiving information (e.g. because of problems with an email system) or losing information is reduced. Also shipping companies (and verifiers) profit from the ‘one stop shop’ for all the processes. They cannot for example send the reports to the wrong email address and can check whether their report is received.

Additional voluntary IT modules (during verification phase)

The second working paper describes the option of giving access to integrated IT modules to shipping companies and verifiers. The use of these additional IT modules is voluntary. The modules facilitate communications between shipping companies and verifiers. This implies the tool is also used during the verification phase, when shipping companies produce an emissions report and verifiers assess the report and will issue a verification report.

The additional modules can be used by interested parties. The module facilitates bilateral communication between shipping companies and verifiers. The IT modules can be used as monitoring takes place on an annual basis as well as on a per-voyage basis, directly in the system or by uploading a file. The system can automatically generate annual aggregated figures for the emissions report. Monitoring and reporting, and communication with the verifier will be easier with the module. Because the system is voluntary, companies that only want to use the system to share validated data can also make a limited use of the system.

Table 10 summarizes the functionalities of the tool per stakeholder. Voluntary modules are in italics.

Table 10 **Functionalities of the tool, including voluntary modules, per stakeholder**

Stakeholder	Use of the MRV IT tool	Outside the tool
Shipping companies	<i>Produce / generate draft Emissions Report</i> <i>Communicate with verifiers</i> Submit verified emissions report (automatically)	Send additional documents
Verifiers	<i>Communicate with shipping companies</i> <i>Assess and verify emissions reports</i> Generate DoCs (automatically)	
Commission	Access to the verified emissions report and DoC	
Member States (Flag States)	Access to the verified emissions report and DoC	

Additional standard files (before verification)

Alternatively, no integrated IT modules, but a decentralized approach using self-standing standard (Excel) files was suggested. Because of advantages with respect to harmonization and process control, the centralized IT solution was preferred.

3.2.2. Assessment of the administrative costs

In this paragraph we focus on potential cost savings for shipping companies in case of the mandatory IT tool and voluntary additional modules compared to no IT tool. Without a tool, shipping companies use mandatory templates and send their emissions report via email or fax. The European Commission (2013) estimates administrative costs for an MRV system(see 2.1.3). They estimate yearly costs for shipping companies of EUR 6,700 per ship, including EUR 3,750 for verification costs. Total yearly additional administrative costs for all

ships are EUR 76,4 million. Public competent authorities also face administrative costs because of verification activities, but costs for shipping companies constitute the main part (97%) of the total administrative burden, so we only focus on shipping companies.

European Commission (2013, p. 47) describes: “If the EU monitoring scheme requires electronic reporting, the uptake of electronic data collection tools on board of ships may increase which could reduce the time spend by the crew on data collection and reporting and save money for the ship operator (according to some stakeholders, such as Norden, this would outweigh the initial investment). As a consequence, the administrative burden calculated for the impact assessment is probably a high estimate.”

Cost savings standard (mandatory) MRV IT Tool

When the (mandatory) MRV IT Tool is used for submitting the emissions report three cost parameters are expected to change compared to the different cost parameters estimated by the European Commission (2013). We assume the following changes of these cost parameters:

- Familiarizing with the information obligation +10%
- Verification (including outsourcing costs) -10%
- Submitting the information -50%

Shipping companies will be able to use the IT Tool free of charge. The tool will be an extension of the THETIS system, hosted and managed at EMSA. This tool provides ship inspection related information and reporting support to all European Port State Control officers, but is currently not widely used by shipping companies. Due to the regulatory change shipping companies have to spend time and resources to get used to the new way of submitting information. This implies they need time for familiarizing with the information obligation. Outsourcing costs for verification will be lower, because verifiers have to spend less time on submitting information. Total yearly additional administration costs will decrease from EUR 6,700 to EUR 6,200 per ship.

Cost savings additional voluntary IT modules (during verification)

With an MRV IT Tool including additional IT modules the following cost parameters are expected to change:

- Familiarizing with the information obligation +20%
- Adjusting existing data -10%
- Filling in forms and tables, including recordkeeping -10%
- Verification (including outsourcing costs) -20%
- Submitting the information -100%

Shipping companies will have more initial costs for familiarizing with the information obligation, but will save time because of easier monitoring and verification procedures. Submitting costs will remove completely, because the report will be submitted automatically after verification. Yearly additional administration costs per ship will decrease from EUR 6,700 to EUR 5,500. For the total fleet, the tool will lead to yearly costs savings of EUR 13.4 million.

Table 11 Overview yearly additional administrative costs data exchange emissions report

Method	Costs per ship (EUR)	Total additional costs (mio EUR)
No tool	6,700	76.4
Mandatory MRV IT Tool	6,200	70.3
Mandatory MRV IT Tool + additional modules	5,500	63.0

Developing the tool will lead to development costs for EMSA. Because the technical specifications of the tool are not decided yet EMSA cannot give an indication of this costs. Furthermore, the tool will lead to cost savings for public competent authorities.

3.2.3. Assessment of other impacts

- Because impact on operational costs is low (see IA), no other impacts are relevant.

3.3. Document of compliance

3.3.1. Options for the DoC data exchange

A Document of Compliance (DoC) confirms that the emissions report of a ship fulfils the requirements of the concerned EU Regulations. The DoC is issued by a verifier and carried on board of the ship and is valid for 18 months until 30 June of the year following the DoC's reporting period. Verifiers shall inform the Member State (Flag State) and commission of the issuance of a DoC. We introduce three options for DoC data exchange.

No tool

Without a tool the verifier sends a DoC to the company and informs the Commission and Member State (Flag State) via email or fax. The information included in the DoC is predefined in EU regulations.

MRV IT tool

Standard (mandatory) MRV IT Tool

With the IT Tool, the DoC is generated in the system according to a template defined by EMSA (see concept paper 1). After a notification of the verifier, the DoC is automatically issued by the system and the shipping company, the Commission, Member States (Flag States) have access to the DoC and can download it.

Additional voluntary IT modules (during verification)

The extended tool automatically generates a DoC. The verifier verifies the emissions report in the system. When the report is verified a DoC is automatically issued and stakeholders are notified and can access it.

3.3.2. Assessment of the administrative costs

Without a tool, the verifier has to send the DoC to the shipping company and the Commission and has to inform the Member State (Flag State). In case of a mandatory tool, the verifier only has to make a notification. With the extended tool, the DoC is issued automatically. Time spent on the data exchange for the DoC is limited compared to time spent on producing and verifying the emissions report. The total additional administrative costs for shipping companies are estimated EUR 6,700. EUR 3,750 is spent on verification outsourcing costs. If verifiers spend 1% of their budget on DoC data exchange and with the MRV IT Tool this time is reduced by 50%, administrative costs for the total fleet reduce by EUR 0.2 million to EUR 76.2 million (EUR 6,660 per ship). If they do not have to spend time on DoC data exchange, in case of the extended tool, administrative costs reduce by EUR 0.4 million to EUR 76 million (EUR 6,620 per ship).

Table 12 Overview yearly additional administrative costs data exchange DoC

Method	Costs per ship (EUR)	Total additional costs (mio EUR)
No tool	6,700	76.4
Mandatory MRV IT Tool	6,660	76.2
Mandatory MRV IT Tool + additional modules	6,620	76.0

Moreover, shipping companies and Member States (Flag States) have easier access to the DoCs.

3.3.3. Assessment of other impacts

- Because impact on operational costs is low (see IA), no other impacts are relevant.

4. Verification

4.1. Site visit by the verifier

This chapter describes the options for site visits, the additional administrative costs and possible other impacts.

4.1.1. Options for the site visit

Throughout the verification process for the EU MRV Regulation, verifiers need to gain an understanding of the shipping company, the control environment (how is monitoring and reporting for the EU MRV Regulation managed from an organizational perspective) and the implementation of the systems, processes and control activities. While certain types of verification activities are suitable to be performed remotely, other types of activities might need a visit to the shipping company's premises for the effective execution. There are five options with respect to (mandatory) site visits:

- **No site visit.** For verification purposes, shipping companies might have to provide several documents to verifiers, e.g. bunkering documents, oil record books and log books. Some of these (original) documents are stored on board. Without a site visit, copies of these documents should be sent to the verifier. Without a site visit, the verifier has to execute his verification activities remotely.
- **Visit ship.** When ships are visited, verifiers can check original documents and can get an impression of the normal activities and procedures on board. Verifiers can meet relevant staff in personal.
- **Visit headquarters.** It might be less time consuming not to visit each separate ship, but to visit the headquarters of the shipping companies or a different location where data is kept. Some original documents are stored on board, but copies can be kept at the headquarters. Verifiers can perform their activities for all ships of the concerned shipping company. Verifiers can meet relevant staff in personal.
- **Conditional visit of ship or headquarters.** A risk assessment is carried out on a ship level by the verifier. This risk assessment shall identify potential risks on the ship specific monitoring and reporting system. The outcome of the risk assessment forms the basis of the verification plan, including verification. The risk assessment will lead to effective and efficient, and less time consuming, verification plans. In case of conditional visiting of ships or headquarters only ships with a negative outcome of a risk assessment are visited.

Shipping companies and verifiers can also decide to voluntarily carry out site visits. These site visits can lead to cost savings due to efficiency gains and will not lead to additional administrative costs. Focus of this paragraph is on mandatory site visits.

4.1.2. Assessment of the administrative costs

- The European Commission (2013) does not assume site visits for the estimation of administrative costs. This implies that **no site visit** is the default option, so administrative costs are approximately EUR 6,700 of which EUR 3,750 are outsourced verification costs. Total costs for all ships >5,000GT are EUR 76,4 million.
- **Visiting the ships** will lead to 11,400 visits each year. Many ships are sailing throughout the year and are not regularly visiting EU ports for a long period. Requiring verifiers to visit all ships on annual basis would be a logistical challenge, time consuming and costly. Visits do not have to take place necessarily in Europe, but can also take place overseas. We assume a visit can take place from an office close by. We assume additional costs only refer to travel costs for verifiers (outsourced verification costs), because costs for for example checking documents also exist without a site visit. We assume conservatively that time spent on verification does not depend on the place where verification takes place. The amount of additional travel time and expenses may differ from ship to ship. If we assume average travel expenses (car or short haul flight including an hotel stay) are EUR 800 per ship and travel time is on average a half man day of EUR 400 total yearly additional administrative costs increase by EUR 1,200 to EUR 7,900 per ship. Total administrative costs increase to EUR 90.1 million.

- Alternatively, visiting **headquarters** instead of ships can lower administrative costs, because the number of headquarters is lower than the number of ships. This will save travel time and costs. Moreover, visiting headquarters can lead to efficiency gains. To estimate the costs, we first have to estimate the number of headquarters of shipping companies. The number of shipping companies is hard to determine because of the many different contractual relations that are possible in shipping. These range from simple cases where one company owns, operates and manages a ship, to a situation where a ship has an owner, several layers of charterers, a technical manager, a commercial operator, et cetera. European Commission (2013) estimates that EU shipping companies operate on average 4 to 5 ships above 400 GT. SMEs operate on average 3 to 4 ships above 400 GT. We used Clarkson data to estimate the average number of ships above 5,000 per shipping company. In order to arrive at an estimate of the number of shipping companies and average number of ships per company, we know:
 - o As of February 2016, the world fleet had 28,992 ships of 5,000 GT and more of types that are likely to fall under the MRV regulation (Clarksons World Fleet Register)
 - o Clarksons World Fleet Register distinguishes three types of shipping companies: owners, owner groups and managers. The database has an entry on the owner for all ships. In total, there are 4,552 owners, so the average number of ships per owner is 6.4. The database also has entries on the manager of each ship. In total, there are 4,422 managers, so the average number of ships per manager is 6.5. There are entries on operators for almost 12,000 ships (45%). In total, 1,196 operators are listed which operate on average 10.8 ships.
 - o On the basis of this overview, we consider the number of ships per shipping company to be on average between 6 and 10. For a conservative estimate of the administrative costs, we use the assumption that the number of ships per company is 6. This implies verifiers have to visit 1,900 headquarters.

Visiting headquarters will lead to additional travel time and travel expenses. An headquarters' visit will be most effective when it takes 2 or 3 days and data of all ships are verified on site. This will lead to additional expenses for meals, local transport and hotel stays on top of the EUR 1,200. We assume these additional costs are EUR 500 per company visit. In return, verification at the headquarters can save time compared to remote verification. This can save 1 or 2 man days per company. On average this saves 2 hours per ship or EUR 200. This implies that average additional administrative costs per ship increase from EUR 6,700 to $\text{EUR } 6,700 + (1,200+500)/6 - 200 = \text{EUR } 6,783$ compared to a situation without site visits. Total yearly administrative costs increase to EUR 77.3 million.

- In case of **conditional visiting** of **ships** or **headquarters** only ships with a negative outcome of a risk assessment are visited. To know the additional costs we have to know the chance that the outcome of the risk assessment leads to a site visit of the ship or the headquarter. The risk assessment is obligatory and only costs for the site visit are additional. We assume that only in extreme cases the risk assessments leads to a site visit of the **ship**. A verifier with experience in EU ETS verification activities estimated that only 1% of the ships is at risk. If only 1% of the ships has to be visited, average additional administrative costs will increase to $\text{EUR } 6,700 + (1\% \cdot 1,200) = \text{EUR } 6,712$. In case of visiting **headquarters** the amount of additional administration costs depend on how 'risky ships' are distributed over the fleet. If they are distributed equally over all shipping companies 1% of the headquarters has to be visited. This percentage will be lower if more 'risky ships' are belong to the same shipping companies. When headquarters are visited, verification can be done more efficiently. This can lead to time savings. In the end, costs will not differ significantly from a situation without a site visit.

Table 13 summarizes the estimated yearly additional costs for the five different determination options for site visits for all ship types. Estimations for visiting headquarters might be lower if the number of ships per shipping company is higher.

Table 13 Overview yearly additional administrative costs site visits

Method	Costs per ship (EUR)	Total additional costs (mio EUR)
No visit	6,700	76.4

Visiting all ships	7,900	90.1
Visiting all headquarters	(average) 6,783	77.3
Conditional visiting ships (1%)	6,712	76.5
Conditional visiting headquarters ($\leq 1\%$)	6,700	76.4

We assume that in case of a conditional visit only 1% of the ships will be visited. If this number is too low, additional administrative costs are underestimated. As a sensitivity analysis, we also assumed that 10% of the ships will be visited. In that case costs per ship increase to EUR 6,820 and total additional costs increase to EUR 77.7 million.

4.1.3. Assessment of other impacts

- Because impact on operational costs is low (see IA), no other impacts are relevant.

5. *References*

Clarksons World Fleet Register

EMSA, 2016, Concept Paper on Automated Systems, Data Exchange Formats including Electronic Templates under the EU MRV Regulation

EMSA, 2016, Concept Paper on voluntary modules under the MRV IT tool on monitoring and verification pursuant the EU MRV Regulation

European Commission, 2013, Impact Assessment Proposal for a Regulation of the European Parliament and the Council on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport and Amending Regulation (EU) n° 525/2013

International Marine Organization, 2007, Draft text of the mandatory International Maritime Solid Bulk Cargoes (IMSBC) Code, DSC 12/19/Add.1, retrieved from <http://www.uscg.mil/imo/dsc/docs/dsc12-report-add-1.pdf>