Supporting study for an Impact Assessment for the Revision of Directive 2000/59/EC on Port Reception Facilities

Final Report

ECORYS

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Background

Operational discharges of waste from ships form a significant threat to the marine environment. In order to reverse this trend, the EU adopted Directive 2000/59/EC[1] on port reception facilities for ship-generated waste and cargo residues ('the PRF Directive'). The PRF Directive aims '*to reduce the discharges of ship-generated waste and cargo residues into the sea, especially illegal discharges from ships using ports in the EU, by improving the availability and use of port reception facilities*' (Article 1).

The PRF Directive is based on the requirements contained in the International Convention for the Prevention of Pollution from Ships (the *MARPOL Convention*). MARPOL requires the Contracting Parties[2] to provide for port reception facilities for waste from ships that is not allowed to be discharged into the sea. Those facilities must be adequate to meet the needs of ships using the port, without causing undue delay. MARPOL has defined general discharge prohibitions and technical norms in a number of Annexes, covering the different waste streams.

At the time of developing the PRF Directive, the MARPOL waste discharge norms were less stringent than they are today, as the Annexes to the Convention have undergone various changes since the entry into force of the PRF Directive. This development is to be taken into consideration when revising the PRF Directive, making it relevant to today's situation.

Since the adoption of the PRF Directive, volumes of ship-generated waste and cargo residues *delivered to EU ports have increased significantly* (ex-post evaluation of the PRF Directive, Panteia, 2015). However, *waste continues to be discharged at sea*. Various studies (e.g. Eunomia (2016), Van Franeker (2010), UNEP (2009), GESAMP (2007)) indicate that significant parts of marine litter originate from sea-based sources. Other waste streams, such as oily waste and sewage, also continue to be discharged at sea in contravention with existing discharge norms/prohibitions.

This report has defined the problems of the current regime, building on the outcome of the ex-post evaluation of the PRF Directive conducted in 2015[3], and has assessed the options for the revision of the PRF Directive.

Problem analysis

The proposed revision of the PRF Directive should target two main problems:

1. Ship-generated waste and cargo residues discharged at sea

Significant parts of marine litter originate from sea-based sources. Other waste streams, such as oily waste and sewage, also continue to be discharged at sea. The discharges of ship-generated waste and cargo residues at sea have a negative impact on the marine environment.

[1] OJ L 332, 28.12.2000, p.81.
[2] I.e. Contracting Parties to the MARPOL Convention: 152 states, representing 99.2% of the world's tonnage.
[3] This was a REFIT Evaluation.

1. Administrative burden caused by the implementation of the PRF Directive

The PRF Directive causes administrative cost, notably related to advance notification, the development of WRH plans and inspections[4]; part of the administrative cost is unnecessary and due to inefficiencies in the system.

Main problem 1: Waste discharged at sea

The following waste categories have been included in the analysis, as defined MARPOL: Annex I (oily waste), Annex IV (sewage), Annex V (garbage) and Annex VI (waste from Exhaust Gas Cleaning Systems). For each of these waste types, a distinction has been made between three different shipping segments (merchant shipping, fisheries and recreational boating), as waste generation differs per shipping segment. In addition, where possible, analysis has been made on cargo residues falling under MARPOL Annexes I, II and V.

For each of the above-mentioned waste categories, a *waste gap* is assessed. The waste gap is defined as *the difference between waste generated on-board the ship and waste delivered at ports*. The waste gap is a *proxy for the potential amount of waste that is illegally discharged*.

The following formulas are applied to assess the waste gap:

primary waste generated – (on-board treatment + legal discharges) = net waste generated
net waste generated - waste delivered in ports = waste gap = potential illegal discharge

For the quantification of the *waste gap,* the impact assessment relies both on existing reports and literature, as well as the *MARWAS model*. The MARWAS model was developed and applied by the contractor of the impact assessment support study to calculate volumes of waste generation on-board of vessels. The waste gap was assessed by comparing the MARWAS results with waste delivery volumes for 29 large EU ports. It should be noted that MARWAS has been used for Annex I (oily waste) and Annex IV (sewage waste).

Annex I oily waste

MARPOL Annex I waste covers oily waste, which includes oily bilge water, oily residues (sludge) and dirty ballast water and oily cargo residues; mostly being tank washings. This type of waste is mostly generated by merchant shipping, as a result of the consumption of heavy fuel oil. Ship engines running on marine diesel or LNG hardly generate any oily waste. Therefore, the fisheries and recreational sector do not contribute much to the generation of this waste category. In addition, oily cargo residues and tank washings are also included under MARPOL Annex I.

Based on MARWAS the amount of primary waste generated would be in the order of 750,000 m^3 per year for the 29 ports analysed. When aggregating this to the total *EU merchant shipping*[5], about *2 million m^3* of primary oily waste is generated.

The generation of oily waste from *fishing vessels and recreational craft* is limited, as in those segments diesel is the dominant fuel instead of heavy fuel oil. Estimates for oily waste generation indicate less than 600 kg of oil per annum per medium size fishing vessel[6] and about 5 kg oil per average recreational craft per annum[7].

[4] Only the part of inspections related to information obligations falls under administrative burden.
[5] Merchant shipping refers to activities of vessels that transports cargo or carries passengers for hire. This excludes pleasure craft that do not carry passengers for hire; warships are also excluded.
[6] http://www.engines.man.eu/global/en/marine/engines-for-commercial-shipping/overview/Overview.html and http://www.mtu-online.com/fileadmin/fm-dam/mtu-usa/mtuinnorthamerica/white-papers/WhitePaper_PrevMaintenance_Marine.pdf.

Larger sized vessels, with higher primary waste generation, often have *on-board treatment facilities*. Typically, smaller sized ships have no or *lower on-board treatment potential*. The MARWAS model applies assumptions for values of combined on-board treatment and legal discharges for 16 vessel types and 5 size classes. The average figure for combined on-board treatment and legal discharges for the relevant ship categories in MARWAS is estimated at 38%. MARWAS does not provide insight in a breakdown between on-board treatment and legal discharges; hence an assessment of the size of these two individual groups cannot be made. Given the very strict MARPOL discharge norms, it is expected that *hardly any legal discharges* take place and the majority of the combined value consists of on-board treatment. For fisheries and recreational boating, where vessels are typically small and volumes of oily waste generated per vessel are very low, it is assumed, in line with MARWAS, that no on-board treatment is taking place.

Regarding the *delivery of oily waste* at port reception facilities, waste delivery data collected for 29 larger EU ports indicate that volumes of oily waste delivered to port reception facilities have doubled between 2004 and 2008, and have remained stable ever since. Waste delivery data correlated for the amount and size of ships calling at the ports (measured by Gross Tonnage (GT) of all ships called) shows a similar pattern.

A comparison of net oily waste generated (taking account of treatment and legal discharges) with delivery data from ports indicates that the gap between net waste generated and waste delivered at a port reception facilities is about 2.5%, or some 31,000 m3 of oily waste, as presented in Table ES 1.

Table ES 1 Volumes of net oily waste generated and delivered and waste gap (in 1,000 m^3)

Waste to be delivered (after treatment and legal discharge)	Volume delivered waste	Waste gap
1,226	1,195	31 (2.5%)

Source: MARWAS calculations (generation), and port delivery data (collected by Ecorys for 29 ports and aggregated to EU level).

It can be concluded, based on a number of sources that the discharge of oily waste at sea has substantially decreased over time. Sources include the MARWAS analysis, the CE Delft study on ship-generated waste (2016), a review of delivery data of 29 larger ports, the ex-post evaluation (Panteia, 2015) and validation through case studies and interviews. Notwithstanding the apparent progress in delivery, some oily waste (estimated at 2.5% or 31,000 m^3) that should be delivered in EU ports is not, indicating potential discharges at sea, causing harm to the marine environment.

Annex IV sewage

Under MARPOL, sewage is defined as drainage and other wastes from any form of toilets and urinals, medical premises, spaces containing living animals, or other waste waters mixed with the above.

MARPOL Annex IV regulates the discharge of sewage. The regulations in Annex IV prohibit the discharge of sewage at sea, except when the ship has an approved sewage treatment plant in operation or when the ship is discharging comminuted and disinfected sewage using an approved system, at a distance of more than three

[7] http://www.yanmarmarine.com/theme/yanmarportal/UploadedFiles/Marine/productDownloads/Pleasure-operation-manual/JH5/JH5_EN_operation-manual.pdf.

nautical miles from the nearest land. Sewage, which is not comminuted or disinfected, can be discharged at a distance of more than 12 nautical miles from the nearest land. It is observed that the on-board treatment of sewage is significant and can be up to 100% for the larger sized modern cruise ships (those that generate the largest amount of primary sewage). MARWAS calculations show that of all primary sewage generated by merchant ships, typically *80-100% is treated on board and/or legally discharged*. In the calculations a weighted average of 95% is applied, as indicated below.

MARWAS calculates the *net waste generated* (merchant shipping only). The average annual net waste generated for the 29 ports included in the analysis over the period 2011-2015 is *477 thousand m^3*, resulting in an estimated *1.36 million m^3 at EU level*[8]. No data is available on total primary sewage generated, however, if MARWAS assumptions for *combined on-board treatment and legal discharges* are applied (95% weighted average, see above) to the net waste generated volumes calculated by MARWAS, the *primary sewage generated by EU merchant shipping would be approximately 27.2 million m^3 annually.*

The *fisheries and recreational sectors* also generate sewage, and typically those ships do not have on-board treatment facilities. Recreational vessels also typically operate within 12 nautical miles from shore. Furthermore, these segments are operating in port significant proportions of time (about 50% for fishing vessels, and about 55% for recreational vessels), where they cannot discharge and therefore are normally delivered to port reception facilities (or even not generated on board as recreational boaters will use on-shore toilet facilities). Estimates on the basis of the European recreational and fishing fleet indicate a sewage generation of *1-1.5 mln m^3 from the recreational boating sector*, and about *1 mln m^3 from the fisheries sector*, both thus of similar order of magnitude as the merchant shipping sector.

The *port delivery data for sewage* registered a strong increase (75%) in sewage delivered from 2004 to 2005. which coincides with the revision and entry into force of MARPOL Annex IV. Since then, a decrease between 2005 to 2008 was observed, with one possible explanation being that existing ships were required to comply with the provisions of the revised Annex IV five years after the date of entry into force of Annex IV, namely since 27 September 2008. Since 2008, a slight increase has been observed. It should be noted that the increasing cruise liner traffic to Member States ports does not seem to influence this pattern significantly, which might be explained by the improvements of sewage treatment technologies on board. However, it is not certain that all ports have registered their cruise liner sewage delivery as part of their data, as some ports have special arrangements with cruise liners. Waste delivery data correlated for the GT calling the ports show a similar pattern.

The limited delivery observed is confirmed by a study by HELCOM (2014) for the Baltic Sea, which reveals that only 30% of cruise ship calls involve sewage delivery. Reasons provided for this include statements on unreasonably high costs as, well as low capacity for waste delivery in some ports.

When comparing the net sewage waste volumes with volumes delivered to 29 ports, a *sewage waste gap of 10%* or *136,000 m^3* is assessed, as presented in Table ES.2, indicating that this part of sewage is not delivered, so potentially discharged illegally.

[8] Assuming the same factor (35%) as applied in oily waste analysis and presented in the box in Section 5.1.1.

Table ES 2 Volumes of net sewage waste generated and delivered and waste gap (in 1,000 m^3)

Waste to be delivered (after treatment and legal discharge)	Volume delivered waste	Waste gap
1.362	1.226	136 (10%)

Source: MARWAS calculations (generation), and port delivery data (collected by Ecorys for 29 ports and aggregated to EU level).

It can be concluded that the amount of primary sewage generated by EU merchant shipping is substantial (estimated at approximately 27 million m^3.). However, the vast majority (95%) of this generated waste is expected to be treated on board and/or legally discharged (with an expected high share of legal discharges, given the room provided by MARPOL discharge norms). A waste gap is assessed at10%, or 136,000 m^3 of sewage. This waste could potentially be discharged illegally, affecting the marine environment. For the recreational and fisheries sector volumes of net generated sewage are expected to be similar to those of the merchant sector, however, no data on delivery are available, so no waste gap can be assessed. Less legal discharges are expected in the recreational and fisheries sector, as fishing and notably recreational ships often operate in the proximity of ports.

Annex V garbage

MARPOL Annex V covers garbage, including domestic waste, plastics, food waste, cooking oil, animal carcasses, fishing gear, operational waste and incinerator ashes. In addition, Annex V waste also includes cargo residues; mostly tank washings from dry bulk.

As the MARWAS model is unable to assess total garbage waste generation on-board the ship (MARWAS only considers household waste), results of the Eunomia study (2015) are used, as presented in Table ES 3.

Table ES 3 Estimates of Annex V ship-generated waste for 2013 (tonnes)

Sector / waste stream	Shipping	Fishing	Cruises	Passenger	Recreational	Navy	Total	%
Annex V – domestic type waste	74,443	43,531	86,717	123,016	170,928	8,769	507,406	58%
Annex V – solid CR	122,521						122,521	14%
Annex V – fishing gear		218,467					218,467	25%
Annex V – Other operational type waste	27,074	4,305		360		867	32,606	4%
Total	**224,038**	**266,303**	**86,717**	**123,376**	**170,928**	**9,636**	**881,000**	**100%**
%	25%	30%	10%	14%	19%	1%		

Source: Eunomia, 2016.

Table ES.3 indicates that the *fishing and recreational boating sectors are relatively large sea-based sources contributors, with shares of 30% and 19%*.

The MARPOL discharge norms *allow the discharge of organic and other relatively easy degradable waste, but prohibit the discharge of plastics*.

The amount of marine litter found in European seas remains at a rather constant level and time series of marine litter on European shores indicate that the problem has persisted since the implementation of the PRF Directive. Although land-based sources are dominant in generating marine litter, *sea-based sources actively contribute to the problem with an estimated EU average 32% and values up to 50% for some sea basins.*

In order to estimate the *waste gap for garbage*, a comparison has been made between total waste generated and waste delivered, using the delivery estimates from studies by Panteia (2015) and Ramboll (2012). *Generated waste* is estimated at a rather constant level of some *881 thousand tonnes*. *Waste delivered* strongly varies on a year by year basis, *ranging from 580 to 820 thousand tonnes* in the period 2009-2013. As the waste delivery patterns have been rather volatile the gap between generation and delivery has been fluctuating. Consequently, *the waste gap varies from 61 to 301 thousand tonnes or 7-34%,* as illustrated in Table ES 4.

Table ES 4 Volumes of net garbage waste generated and delivered and waste gap (in 1,000 m^3)

Waste to be delivered (after treatment and legal discharge)	Volume delivered waste	Waste gap
881	580-820	61-301 (7-34%)

Source: MARWAS calculations (generation), and port delivery data (collected by Ecorys for 29 ports and aggregated to EU level).

Based on the above information, it can be concluded that although garbage delivered in ports has increased since the adaptation of the PRF Directive, a significant waste gap still remains.

Annex VI (scrubber waste, ozone depleting substances)

Under MARPOL Annex VI strict requirements regarding emission levels apply. Exhaust gas cleaning systems (scrubbers) are one of several possibilities to comply with low emission standards required in Sulphur Emission Control Areas (SECAs). Annex VI prohibits the waste from these scrubbers, mainly so-called scrubber sludge, as well as Ozone depleting Substances (ODS), to be discharged at sea. The analysis concentrates on waste from scrubbers, as ODS are mainly handled through repair yards, which fall outside the scope of the PRF Directive.

This type of waste is and will be mainly generated by *merchant shipping*, as their ship engines run on heavy fuel oil for which abatement measures are required, at least SECAs. *Fisheries and recreational* boating hardly contribute to the generation of Annex VI waste.

The *total volume of scrubber waste* generated for all ships then depends on the share of closed loop scrubbers.[9] If 5% of the current 400 scrubbers would operate in closed loop mode, the total volume of waste generated would be *24,000 m^3 sludge* (1,200 m^3 dry matter) and *360,000 m^3 of bleed-off*.

Scrubber waste volumes are expected to increase in the future as a result of a growing uptake potential of scrubbers, driven by regulatory measures including SECA zones in Europe, and announced global sulphur content limits. Any estimate on future volume is, however, premature, as it is uncertain how the shipping sector will respond

[9] A verification of these figures and assumptions has been asked from EGCSA, but at the time of writing had not yet been received.

to upcoming legislation (i.e. investing in scrubbers and choosing between open-loop or closed-loop systems, or switching to cleaner but more expensive fuels).

Based on the above information, it can be concluded that the current volumes of Annex VI waste generation are limited. Environmental legislation is expected to drive the demand for increased use of scrubbers, potentially causing a growing volume of Annex VI waste generation. As no delivery data is available, no waste gap can be established.

Cargo residues

Cargo residues have been defined under the PRF Directive as '*remnants of any cargo material on board in cargo holds or tanks which remain after unloading procedures and cleaning operations are completed and shall include loading/unloading excesses and spillage.*' As such, they include both cargo residues as defined in MARPOL Annex V, as well as tank drainings, tank washings and other oily mixtures falling under MARPOL Annex I (oily slops)and residues and tank washings containing noxious liquid substances falling under MARPOL Annex II (tank washings containing noxious liquid substances). MARPOL allows for discharges of Annex I and II residues under predefined conditions. Discharges of MARPOL Annex V cargo residues are generally prohibited, with the exception of non-harmful categories of residues.

The amount of cargo residues which is generated depends on several factors, such as the type of cargo, the handling equipment and the efficiency of the stevedores. Results from interviews concluded that the amounts generated per washing, per cargo tank, ranged from 1 to 2 m^3 (CE Delft, 2016).

The inventory of waste delivery to ports has found that data on cargo residues is lacking in many ports, which is attributed to the fact that cargo residues are often delivered to terminal operators rather than PRF operators. As a result, data provided regarding the delivery of cargo residues is quite limited and shows strong fluctuations between years, for both types (oily and solid residues in tank washings).

Environmental vulnerability

The concept of environmental vulnerability is used to assess the environmental impact of waste discharged at sea. To this end relative environmental vulnerability scores have been established (in EU projects - BEAWARE, BRISK)[10], as presented in Table ES 5.

Table ES 5 Relative environmental vulnerability for waste types in regions of European Seas

Sea basin	Oily waste	Sewage	Garbage
Baltic Sea	27	22	35
East Atlantic Ocean	28	19	35
Mediterranean Sea	24	24	35
Black Sea	28	19	35

Source: COWI.

The above environmental vulnerability scores are of a rather similar magnitude, with a factor of almost two between the lowest (sewage in the East Atlantic and the Baltic) and the highest (garbage in all basins) scores.

[10] In the absence of a reliable and straightforward methodology, covering all relevant MSFD descriptors, the proposed methodology, based on two projects in Northeast Atlantic and the Baltic, is used for convenience for the purposes of complementing the analysis of environmental impacts of various policy options amending the PRF Directive.

The environmental vulnerability scores can be combined with the volumes of waste discharges. The waste gaps, as presented in the previous sections, providing a proxy for *illegal discharges* at sea, indicate that the garbage waste gap is relatively large. The corresponding environmental weight and thus negative impact to the marine environment for garbage is also severe. On the other hand there is the issue of *legal discharges*, which are expected to consist mostly of sewage, with relatively little room for legal oily and garbage waste discharges according to MARPOL norms. The corresponding environmental impact of legal discharges of sewage is less severe, as sewage waste has a lower average environmental vulnerability score, compared to the other waste categories.

Main problem 2: Administrative burden caused by the implementation of the PRF Directive

Administrative burdens are those costs borne by businesses, citizens, civil society organizations and public authorities as a result of administrative activities performed to comply with information obligations included in legal rules, according to the Better Regulation Toolbox.

The implementation of the PRF Directive has created administrative burden. The ex-post evaluation (Panteia, 2015) estimated total annual administrative costs to be approximately 97 million Euro. Analysis of the ex-post evaluation has been updated, resulting in annual administrative costs of 127 million Euro. A breakdown of administrative costs is presented in the table below, highlighting the contributions from advance notifications, WRH plans, exemptions and inspections.

Table ES 6 Annual administrative costs caused by the PRF Directive (million €)

#	Administrative costs	Stakeholder	Annual costs
1	Total annual costs for WRH plans	Ports	7.0
2	Costs for Member States to approve WRH plans	Competent authorities	4.1
3	Application for an Exemption	Port users	5.0
4	Assessment and granting exemptions	Competent authorities	12.3
5	Advance waste notification - reporting	Port users	89.9
6	Advance waste notification – assessment	Ports / competent authorities	7.8
7	Inspection – providing documentation and collaboration	Port users	0.5
8	Inspection – reporting results from inspections	Competent Authorities	0.4
	Total		**127**

Source: ex-post evaluation of PRF Directive, EMSA, Ecorys.

Table ES.6 shows that advance notifications are strongly contributing to administrative costs, especially for port users. While advance notification is a clear requirement of the PRF Directive, two-third of port users consider related administrative costs to be too high (Panteia, 2015). The administrative costs can partly be considered as unnecessary. These unnecessary costs are mostly the case for stakeholders for whom *administrative procedures are not part of their core business, notably port users and PRF operators*. For stakeholder groups as inspection bodies, Member States and port authorities, administrative procedures are more mainstreamed in regular work procedures and therefore are less likely to be considered and felt as unnecessary.

For port authorities, administrative burden is caused by the fact that ports use their own system in parallel to the Common Monitoring and Information System, which is being developed at EU level based on SSN and THETIS-EU. Definitions in those

systems are often not aligned. The case studies indicated that data is not systematically exchanged between ports or Member States.

In addition, (unnecessary) administrative burden is caused by inconsistent or insufficient implementation of the PRF Directive; as well as legal inconsistencies between MARPOL and the PRF Directive. These latter causes are elaborated below.

Inconsistent or insufficient implementation of the PRF Directive

The administrative burden is created by the way the provisions in the PRF Directive have been implemented across ports and Member States in Europe. Lack of consistent implementation of the PRF Directive causes (unnecessary) administrative burden, as illustrated in the following areas:

- *Development of WRH Plans (including transparency)*. The ex-post evaluation (Panteia, 2015) concluded that especially for smaller ports the requirement to develop and implement a WRH plan leads to a substantial increase in administrative burden as smaller ports often lack the resources needed (Deloitte, 2016). For larger ports the administrative burden is mainly influenced by the increased complexity of the requirement and the time needed to draft the plan accordingly. The administrative burden was assessed to be € 7.0 million per year. Also Member States face administrative burden as a result of the WRH plans. The competent authorities are required to check and approve all the WRH plans of their ports. In addition, Member States also need to check all requests for exemptions, which further increases their administrative burden. The combined administrative burden for ports on EU level is € 4.4 million per year;
- The variety in *cost recovery systems* in place in EU ports creates an additional administrative burden, notably for port users. It is argued that simpler and more transparent cost recovery systems would lead to lower administrative burden (Eunomia, 2016; IEEP 2013; ESSF PRF sub-group and EMSA);
- The provisions on *exemptions*, in particular the lack of harmonisation of the exemption criteria, constitute another cause for unnecessary burden for stakeholders (EMSA). Member States and ports have adopted their own interpretation of the criteria for granting exemptions, and consequently the exemption regime differs widely between Member States, creating inefficiencies for port authorities, spending a considerable amount of time checking the required parameters;
- An *unclear definition of sufficient storage capacity*. Under Article 7 (2) of the PRF Directive, a ship may proceed to the next port of call without delivering the ship-generated waste it has on board, if sufficient storage capacity is available on board to store the waste that will be generated *en route* to the next port. This has to be assessed on basis of the information being notified in accordance with Article 6 and Annex II of the PRF Directive, but no clear definition of sufficient storage capacity is provided. This has led to inefficiencies for both ports and port users in view of the mandatory delivery requirement.

Legal inconsistencies between MARPOL and the PRF Directive

Administrative burden also results from the differences in definitions used by the PRF Directive and MARPOL, as indicated below:

- The difference between what is defined as *ship-generated waste and cargo residues* under the PRF Directive and MARPOL leads to confusion amongst stakeholders involved (Deloitte, 2016). This view is confirmed by the Open Public Consultation conducted for this impact assessment. In total, 70% of respondents

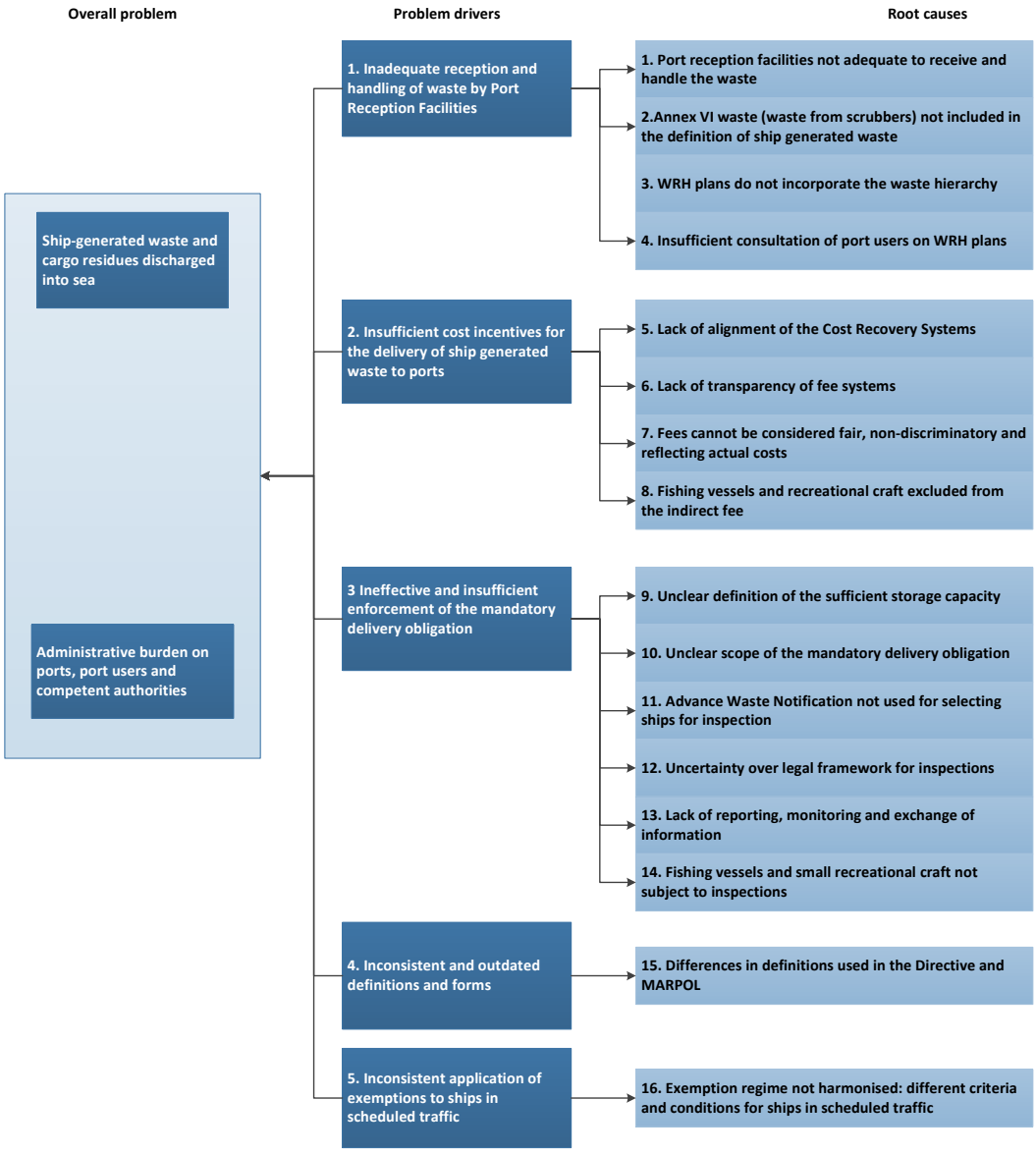
indicated that this is an important contributor to the problem of administrative burden;

- As a result *waste notification forms cannot be fully aligned with the MARPOL forms (IMO Circular 834)* resulting in an unnecessary administrative burden. Furthermore, ship owners have indicated that poor online accessibility of the forms also creates a large administrative burden for crew members (ECSA, 2016). In the Open Public Consultation 65% of the respondents indicated that the outdated reporting forms constitute an important contributor to the problem of administrative burden. This is also linked to the lack of electronic reporting and exchange of information.

Underlying root causes of the two main problems

Underlying these two main problems, a set of 16 root causes has been identified, grouped into five problem drivers. In the problem tree presented hereafter, the main problem drivers and underlying root causes are presented in further detail.

Figure ES 1 Overall problems, problem drivers and root causes



Source: Ecorys.

The relationship between the two main problems and the defined problem drivers is summarised in Table ES 7.

Table ES 7 Relationship between main problems and problem drivers

Problem driver	Relation to waste discharges	Relation to administrative burden
Adequacy	Inadequate port reception facilities are a disincentive to deliver waste (Panteia (2015); OPC, surveys, case studies).	Unclear definition on adequacy may hamper administrative procedures causing administrative burden.
Incentives	Insufficient (cost) incentives discourage delivery of waste (Panteia (2015), and incentivise discharge at sea, Eunomia (2016), OPC, surveys, case studies).	Non-harmonised principles between ports cause administrative burden for port users (Panteia, 2015; ESSF PRF sub-group).
Enforcement	Insufficient enforcement prohibits active prevention / monitoring of discharges into sea (Panteia, 2015; OPC, case studies). In practice, less inspections undertaken than required.	Unclear rules on enforcement (e.g. definition of sufficient storage capacity, mandatory delivery requirements and MARPOL discharge norms) lead to administrative burden.
Definitions and forms	Complicated reporting procedures may trigger waste discharges at sea rather than compliance with the regime.	Inconsistencies between EU waste notification form and the IMO Circular create administrative burden for ports and port users. In addition, there is a lack of electronic exchange of information and/or parallel systems are in place.
Exemptions	Invalid issuing of exemptions and insufficient monitoring resulting in illegal discharges into sea.	Unclear and inconsistent application of exemption criteria causes administrative burden for port users.

Specific problem: limited coverage of fisheries and recreational boating

A specific problem identified is the limited inclusion of the fishing and the recreational boating sector. Currently, these sectors are excluded from the requirements under Articles 6 (notification), Article 8 (indirect fee principle, providing a disincentive to discharge waste at sea) and Article 11 (inspection criteria and procedures) of the PRF Directive. As a result, limited data on waste volumes is available, no economic incentives are created for these vessels, and enforcement of the delivery obligation is insufficient, even though these segments contribute significantly to waste discharges at sea, in particular Annex V waste. For these reasons, specific attention for the fishing and recreational sector is warranted.

Objectives and policy measures

Objectives

The objective of the proposed revision is *to reduce the discharges of ship-generated waste at sea, while at the same time ensuring effective maritime operations and reducing the administrative burden.* In addition, the revision seeks to contribute to the wider *objectives of the circular economy* through an improvement of the waste handling process, as well as reduction of marine litter from sea-based sources.

To achieve this general objective, five specific objectives are defined:
SO-1: To ensure the *availability of adequate facilities*;

SO-2: To provide *effective (cost) incentives* to deliver waste at port reception facilities;
SO-3: To remove barriers to *effective and efficient enforcement*;
SO-4: To *harmonise and update definitions and forms*;
SO-5: To clarify the rules for *exemptions*.

Policy measures

The policy measures are motivated by the factors indicated below, which find their origin in the problem analysis:

- *Updating the PRF Directive* in relation to developments in the last 15 years, including updated international legislation, such as MARPOL, and the need for monitoring and information collection and preparing it for the future. This also includes clarification of key concepts and criteria to improve implementation of the PRF Directive;
- *Further align the PRF Directive with the MARPOL Convention*:
  - Definition of ship-generated waste, to include MARPOL Annex VI waste;
  - Clarify the delivery obligation of the PRF Directive in relation to the MARPOL discharge norms;
  - Provide more uniformity in forms applied, e.g. waste notification and waste receipt.
- *Contribute to other relevant EU policies*, in particular in the context of EU waste legislation (waste hierarchy), as also set out in the *Circular Economy Strategy*.

A set of measures has been defined and grouped according to the above-mentioned specific objectives. The policy measures are linked to underlying root causes, as illustrated in Table ES.8.

Table ES 8 Overview of policy measures

Objective	Policy measure	Description	Related root causes
SO-1 Adequacy	PM-1A	Broaden the scope of the PRF Directive to include MARPOL Annex VI waste (residues from exhaust gas cleaning systems).	2
	PM-1B	Reinforce the waste hierarchy as laid down in the Waste Framework Directive, promoting separate collection in view of re-use and recycling of ship-generated waste.	1, 3
	PM-1C	Strengthen the requirements for systematic consultation of stakeholders in the development and updating of waste reception and handling plans.	3, 4
	PM-1D	Provide a better definition of 'adequacy' in line with international practice.	3
SO-2 Incentives	PM-2A	Introduce the use of a shared methodology to calculate the indirect fee, including the 'right to deliver', and higher levels of transparency on the various elements of costs charged to port users for the use of port reception facilities.	5, 6, 7
	PM-2B	Introduce a 100% indirect fee for garbage (MARPOL Annex V).	5
	PM-2C	Incentivise measures that reduce the amount of waste produced on-board: harmonisation of the Green Ship concept provided in Article 8.	6,7

Objective	Policy measure	Description	Related root causes
	PM-2D	Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime.	8
	PM-2E	Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes.	Direct*
SO-3 Enfor-cement	PM-3A	Clarify the scope of the mandatory waste delivery obligation in Article 7, two variants:	
	PM-3A.1	Align the delivery obligation with the MARPOL discharge norms.	10
	PM-3A.2	Strengthen / emphasize the current mandatory delivery obligation for all ship-generated waste, beyond the MARPOL discharge norms.	10
	PM-3B	Introduce a requirement for issuing a waste receipt upon delivery.	13
	PM-3C.1	Clarify the definition of 'Sufficient Storage Capacity' – taking into account MARPOL discharge norms.	9
	PM-3C.2	Clarify the definition of 'Sufficient Storage Capacity' –PRF regime.	9
	PM-3D	Replace the 25% minimum inspection requirement with a risk-based approach. Two variants for strengthening the inspection regime:	
	PM-3D.1	Incorporate the PRF inspections in the PSC Regime (amending Directive 2009/16/EC).	11,12
	PM-3D.2	Develop a dedicated PRF targeting mechanism.	11,12
	PM-3E	Bring fishing vessels and small recreational craft into the PRF inspection regime, by including them in the inspection criteria and procedures in Article 11. Consider differentiation of vessels on basis of GT.	14
	PM-3F	Extend the electronic Monitoring and Information System (based on THETIS-EU and SSN) to ensure a better reporting and exchange of information.	13
SO-4 Definitions	PM-4A	Align the definition of ship-generated waste with the Annexes of MARPOL, by including MARPOL Annex VI (see also measure 1A), as well as incorporating the definition of cargo residues within the overall scope of ship-generated waste (including Annexes I and II wash waters and Annex V cargo residues).	15
	PM-4B	Align and update the form(s) to reflect the IMO standard (IMO MEPC.1/Circ.834) and its definitions and categories.	15
SO-5 Exemption	PM-5A	Develop common criteria to be applied for the application and approval of exemptions, including the introduction of a standardised exemption certificate; require electronic reporting of exemptions to facilitate monitoring and exchange of information between relevant authorities.	16
	PM-5B	Clarify in the legal text of the Directive that vessels which are operating exclusively within one port (tug vessels, pilot vessels, etc.) can also be exempted on the basis of the same exemption criteria.	16

Direct* refers to a direct relationship between the policy measure and the problem driver.

For some policy measures variants are defined, mostly linked to how the policy measures are shaped under the different policy options (see below). Some of the measures proposed as part of the revision of the PRF Directive can also be implemented through soft law. In general, this results in achieving a lower impact, against potentially lower costs.

Policy options

The policy measures have been grouped together in a number of policy options. The policy options have been constructed in such a way as to provide clearly identifiable packages of policy measures, focusing on the objectives and underlying problems. Policy options 3 and 4, and their variants, can be structured in line with the matrix, as presented in Table ES 9.

Table ES 9 Variants 3 and 4 and their variant options

	MARPOL alignment	EU PRF regime
No additional focus on marine litter	Policy option 3A	Policy option 4A
Focus on marine litter	Policy option 3B	Policy option 4B

PO-1: Baseline scenario

This is the current PRF Directive plus adopted initiatives. The baseline scenario is based on the situation when the existing legislative framework would continue to apply. It serves as a benchmark against which all the other policy options will be compared. Under the baseline scenario it will not be possible to adapt the PRF Directive to accommodate the substantial changes in MARPOL or to fully align the definitions in the PRF Directive with those used in MARPOL, as this would require a revision process.

The baseline scenario takes into consideration initiatives that are already adopted. These include:

- Amendment of Annex II of the PRF Directive (Information to be notified) through comitology, to bring Annex II in line with the recent changes to MARPOL Annex V and IMO Circulars, as well as to include data on quantities and types of waste delivered;
- The PRF Interpretative Guidelines;
- The Technical Recommendations, as prepared by EMSA;
- Development of the Common Information and Monitoring System, based on existing reporting systems (SafeSeaNet and THETIS-EU), as required by Article 12(3) of the PRF Directive[11];
- Guidance for ship inspections;
- The adoption of the Proposal for a Regulation establishing a framework on market access to port services and financial transparency.

PO-2: Minimum legislative revision of the PRF Directive

This is the baseline scenario plus targeted initiatives that have already been prepared and planned plus concise legal adjustments to the PRF Directive, as well as possible soft law measures on aspects not included in the revised PRF Directive. It entails:

[11] The development of the Common Information and Monitoring System will continue; next steps will be part of PO-2, i.e. minimum legislative revision.

- Minimum legal alignment to MARPOL to reflect the latest changes to the MARPOL Convention and its Annexes;
- Update of legal references in the PRF Directive.
- PM-1A: Broaden the scope of the PRF Directive to *include MARPOL Annex VI waste*.

PO-2 leaves ample opportunity for policy measures to be implemented through soft law. The following policy measures could be considered to be included in PO-2 through soft law:

- PM-2A: Introduce the use of a *shared methodology* to calculate the indirect fee and introduce the 'right to deliver';
- PM-2C: Incentivise measures that reduce the amount of *waste produced on board*. For this the current provisions for *Green Ships* should be further improved.

PO-3: MARPOL alignment

In contrast to PO-2 this policy option, as well as PO-4, results in a more elaborate revision of the PRF Directive. This policy option has the following characteristics:

- Define the *scope of the mandatory delivery requirement* in Article 7 in relation to MARPOL: the delivery obligation will reflect the MARPOL discharge prohibition, i.e.: what cannot be discharged under MARPOL shall be delivered to port reception facilities by ships calling in EU ports;
- Align the definition of *ship-generated waste* more closely with the Annexes of MARPOL, by including a reference to MARPOL Annex VI, as well as the cargo residues, which are currently defined as a separate category of waste under the Directive (including MARPOL Annexes I and II wash waters, as well as MARPOL Annex V cargo residues);
- This in turn will allow for the *waste notification form* to be fully aligned to the IMO Circular IMO MEPC.1/Circ. 834, and in case the *waste receipt* will be introduced in the revision this form should also fully reflect the IMO Circular;
- MARPOL alignment will also allow for bringing the *PRF inspections fully under the Port State Control Regime*, which should contribute to simplification. For this Directive 2009/16/EC will have to be amended to incorporate these inspections, and priority criteria shall be incorporated in Annex I to that Directive (overriding factors, and/or unexpected factors);
- This option also includes the *adequacy measures* (defined in accordance with IMO Guidelines), as well as the measures for improving the *incentives for delivery*.

Policy option 4: EU PRF Regime beyond MARPOL

PO-4 results in a more elaborate revision of the PRF Directive, as is the case in PO-3. The clear distinguishing factor with PO-3 is the approach towards mandatory delivery of ship-generated waste and the subsequent consequences, as described below:

- This option seeks to strengthen the mandatory delivery of *all waste* under the PRF Directive, thereby *going beyond the scope of MARPOL* (and its waste discharge norms), and also aiming to address - at least part of - the '*legal discharges*', i.e. mainly sewage and small quantities of oily waste;
- This option would also imply keeping the *distinction between ship-generated waste and cargo residues*, as there is no ground for subjecting the latter to the stricter EU regime, given their specific nature and way of handling in the terminals, which

is different from ship-generated waste. Consequently, the *forms* to be used (*waste notification* and *waste receipt*) cannot be fully aligned with IMO Circular 834[12];

- A *PRF inspection regime* will have to be developed, with a dedicated targeting mechanism: selection of ships for inspection to verify compliance with the provisions of the PRF Directive (going beyond MARPOL), building on the dedicated module in THETIS-EU (available since April 2016);
- This option also includes the *adequacy measures* (defined in accordance with IMO Guidelines and EU waste law), as well as the measures for improving the *incentives* for delivery.

Policy option variants: with or without additional focus on marine litter

Variant options are defined to specifically address the issue of marine litter (MARPOL Annex V waste) from ships and will group all the measures that can effectively make a contribution to combating marine litter.

The policy option variant with *special focus on marine litter* includes the following policy measures (which are excluded from the policy option variant with no special focus on marine litter):

- PM-2B: Introduce a 100% indirect fee for garbage;
- PM-2D: Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime;
- PM-2E: Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes;
- PM-3E: Bring fishing vessels and small recreational craft into the PRF inspection regime, by including them in the inspection criteria and procedure in Article 11.

Both variant options will also include those measures on reinforcing the waste hierarchy on land (in particular separate collection) in line with EU waste legislation, as this is a prerequisite for having this waste effectively delivered on land.

Policy measures and policy options

The policy measures are allocated to the defined policy options, as presented in Table ES 10.

A ticked cell indicates inclusion of the policy measure in the policy option. PO-2 includes some policy measures that are to be applied through soft law; these are indicated by' SL'. In the baseline scenario (PO-1) and PO-2 Interpretive guidelines (IG); technical recommendations (TR); and inspection guidance (GI) are sometimes included. Please note that all options are scored against the baseline scenario (policy option 1). Consequently, this policy option has scores of '0'[13].

[12] It should be noted that one can strive to align the forms as much as possible with MARPOL categories, as has already been undertaken by the waste expert group for implementing Annex II to the Directive.

[13] Where interpretive guidelines (IG); technical recommendations (TR); and inspection guidance (GI) are involved already available in the baseline, this has been clearly indicated in the table. Also reference has been made to future development of the Common Monitoring and Information System (CMIS) and the development of Soft Law (SL) in option 2.

Table ES 10 Policy measures per policy option

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - without additional focus on marine litter	PO-3B: MARPOL alignment - - with special focus on marine litter	PO-4A EU PRF regime – without additional focus on marine litter	*PO-4B: EU PRF regime - - with special focus on marine litter*
PM-1A: Broaden the scope of the PRF Directive to include MARPOL Annex VI waste (residues from exhaust gas cleaning systems and ozone depleting chemicals).	0	✓	✓	✓	✓	✓
PM-1B: Reinforce the waste hierarchy as laid down in the Waste Framework Directive, promoting separate collection in view of re-use and recycling of ship-generated waste.	IG	IG	✓	✓	✓	✓
PM-1C: Strengthen the requirements for systematic consultation of stakeholders in the development and updating of waste reception and handling (WRH) plans.	IG	✓	✓	✓	✓	✓
PM-1E: Provide a better definition of 'adequacy' in line with international guidance.	IG	✓	✓	✓	✓	✓
PM-2A: Introduce the use of a shared methodology to calculate the indirect fee and introduce the 'right to deliver', and require higher levels of transparency on the various elements of costs charged to port users for the use of PRFs through mandatory publication in the WRH Plans.	0	SL	✓	✓	✓	✓
PM-2B: Introduce a 100% indirect fee for garbage.	0			✓		✓
PM-2C: Incentivise measures that reduce the amount of waste produced on board. For this the current provisions for Green Ships should be further improved.	0	SL	✓	✓	✓	✓
PM-2D: Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including them in the indirect fee regime.	0			✓		✓
PM-2E: Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes.	0			✓		✓
PM-3A.1: Clarify the position of the PRF Directive related to delivery of ship-generated waste. Variant 1: Align with MARPOL on discharge norms and applying one single system.	0		✓	✓		
PM-3A.2: Clarify the position of the PRF Directive related to delivery of ship-generated waste. Variant 2: Strengthen / emphasize the current Article 7 provision on delivery of all ship-generated waste, beyond	0				✓	✓

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - without additional focus on marine litter	PO-3B: MARPOL alignment - - with special focus on marine litter	PO-4A EU PRF regime – without additional focus on marine litter	*PO-4B: EU PRF regime - - with special focus on marine litter*
the MARPOL discharge norms.						
PM-3B: Introduce requirement for a waste receipt to be issued upon delivery.	0		✓	✓	✓	✓
PM-3C.1: Clarify the definition of 'sufficient storage capacity'. Variant 1: Taking into account MARPOL discharge norms.	0		✓	✓		
PM-3C.2: Clarify the definition of 'sufficient storage capacity'. Variant 2: Based on PRF regime.	0				✓	✓
PM-3D.1: Replace the 25% minimum inspection requirement with a risk based approach. Variant 1: Incorporate the PRF inspections in the PSC Regime (amending Directive 2009/16/EC).	0		✓	✓		
PM-3D.2: Replace the 25% minimum inspection requirement with a risk based approach. Variant 2 Dedicated PRF targeting mechanism.	IG, GI	IG, GI			✓	✓
PM-3E: Bring fishing vessels and small recreational craft into the PRF inspection regime.	0			✓		✓
PM-3F: Extend the electronic Monitoring and Information System, based on THETIS-EU and SSN, to ensure a better reporting and exchange of information, as well as including the essential information from the WRH Plans.	0		✓	✓	✓	✓
PM-4A: Align with the definitions used in MARPOL for 'cargo residues' and 'ship-generated waste'.	0		✓	✓		
PM-4B: Align and update the forms to reflect the IMO standard (IMO MEPC.1/Circ.834) and its definitions and categories, and reflect these updates in the electronic reporting into the National Single Window.	0		✓	✓		
PM-5A: Develop common criteria to be applied for the application and approval of exemptions, including the introduction of a standardised exemption certificate, while also setting minimal requirements on information exchange between relevant authorities.	IG, TR	IG, TR	✓	✓	✓	✓
PM-5B: Clarify in the legal text of the Directive that vessels which are operating exclusively within one port can also be exempted, provided they comply with the conditions.	IG	IG	✓	✓	✓	✓

Comparison of policy options

The impacts of the policy measures of the defined policy options have been aggregated, considering synergies and conflict between policy measures where relevant. This has resulted in a summarised description of the effectiveness and efficiency of the policy options, as presented in Table ES 11.

Table ES 11 Impacts per policy option

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Effectiveness – waste delivery	0	**Low** The relatively small number of policy measures have a limited combined impact on waste delivery. Through soft law measures additional waste impact can be generated.	**Low-medium** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic positive impact on waste delivery. MARPOL alignment coincides to a large extent with current practice and does not result in additional waste delivery. No policy measures are included that are specifically focused on marine litter.	**Medium** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic impact on waste delivery. MARPOL alignment coincides to a large extent with current practice and does not result in additional waste delivery. Additional policy measures are included that are specifically focused on marine litter (100% indirect fee for garbage; policy measures aimed at fishing and recreational boating sectors).	**Medium** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic impact on waste delivery. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results in some additional waste delivery, notably in sewage and to some extent oily waste and garbage. No policy measures are included that are specifically focused on marine litter.	**Medium-high** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic impact on waste delivery. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results in some additional waste delivery, notably in sewage and to some extent oily waste and garbage. Additional policy measures are included that are specifically focused on marine litter (100% indirect fee for garbage; policy measures aimed at fishing and recreational boating sectors).

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Effectiveness – reduction of administrative burden	0	**Low - reduction** The majority of the policy measures reduce the administrative burden, although the overall impacts are rather limited.	**Medium-high – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. MARPOL alignment provides an additional reduction of administrative burden, as the PRF system and MARPOL will be harmonised.	**Medium-high – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. MARPOL alignment provides an additional reduction of administrative burden, as the PRF system and MARPOL will be harmonised. The additional policy measures to reduce marine litter may create an additional administrative burden on smaller vessels and ports.	**Low – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results will cause an increase in administrative burden (double systems, also reflected in forms, etc.).The net effect is expected to be a small reduction of administrative burden.	**Low – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results will cause an increase in administrative burden (double systems, also reflected in forms, etc.). The additional policy measures to reduce marine litter create an administrative burden to smaller vessels and ports. The net effect is expected to be a small reduction of administrative burden.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Effectiveness – contribution to circular economy	0	**Low** Limited contribution to the circular economy is expected from soft law measures, based on MARPOL PRF Guidelines ('adequacy', waste reception and handling plans, etc.), also guidance on the Green Ship concept may potentially contribute to the circular economy.	**Low-medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. (Inclusion of some of the aspects from the MARPOL Guidelines into EU law.	**Medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. (Inclusion of some of the aspects from the MARPOL Guidelines into EU law). The additional policy measures to reduce marine litter result in an additional contribution to the circular economy.	**Low-medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. Strict interpretation of Article 7 of the PRF Directive has limited additional effect on the circular economy.	**Medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. Strict interpretation of Article 7 of the PRF Directive has limited additional effect on the circular economy. The additional policy measures to reduce marine litter result in an additional contribution to the circular economy.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Efficiency – operational costs	0	**Low** The policy measures come at hardly any operational costs.	**Low-medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest and as MARPOL alignment is rather close to current practice, additional operational costs coming from MARPOL alignment are limited.	**Low-medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest and as MARPOL alignment is rather close to current practice, additional operational costs coming from MARPOL alignment are limited. Some additional operational costs are expected from policy measures to reduce marine litter.	**Medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest. Strict interpretation of Article 7 of the PRF Directive comes at additional operational costs (inspection, double systems, increased costs of waste storage on-board and delivery).	**Medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest. Strict interpretation of Article 7 of the PRF Directive comes at additional operational costs (inspection, double systems, increased costs of waste storage on-board and delivery). Some additional operational costs are expected from policy measures to reduce marine litter.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Efficiency – investment costs	0	**Low** Policy measures require very little investment costs. The exception may be the inclusion of Annex VI waste in the PRF Directive, requiring investments in storage, reception and treatment costs; and the Green Ship policy measure (soft law), which requires investment costs.	**Low-medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). MARPOL alignment does not result in the need for additional investment costs.	**Medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). MARPOL alignment does not result in the need for additional investment costs. The policy measures to reduce marine litter result in some additional investment costs.	**Low-medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). Strict interpretation of Article 7 of the PRF Directive comes at limited investment costs (increased costs of waste storage on-board and delivery).	**Medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). Strict interpretation of Article 7 of the PRF Directive comes at limited investment costs (increased costs of waste storage on-board and delivery).The policy measures to reduce marine litter result in additional investment costs.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Other impacts	0	**Low** Limited other impacts are expected. The Green Ship policy measure may contribute to innovation and competitiveness.	**Low-medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase. The fisheries sector is not impacted). MARPOL alignment does not result in additional impacts.	**Medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase, negative impact for fisheries expected as measures specifically focus on fisheries). MARPOL alignment does not result in additional impacts. The policy measures focused on marine litter result in some additional impacts (business for port reception facilities, employment).	**Low-medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase. The fisheries sector is not impacted). Strict interpretation of Article 7 of the PRF Directive has limited additional impacts.	**Medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase, negative impact for fisheries expected as measures specifically focus on fisheries). Strict interpretation of Article 7 of the PRF Directive has limited additional impacts. The policy measures focused on marine litter result in some additional impacts (business for port reception facilities, employment).

Based on Table ES 11 the policy options are compared, considering the criteria effectiveness, efficiency and coherence, resulting in an assessment per policy option, as presented below.

PO-2: Minimum revision

- The policy option has only limited impact on waste delivery to port reception facilities and consequent reduction in waste discharged at sea. A small reduction of administrative burden and a limited contribution to the circular economy is expected. Through soft law measures additional contribution to the stated objectives (waste delivery; administrative burden; circular economy) can be realised. Overall, this policy measure scores relatively low on *effectiveness*;
- Through this policy option little additional impacts are generated. The policy measure on Green Ships (PM-2C) is expected to have a small positive impact on competitiveness and innovation. The policy measure on including Annex VI waste in the PRF Directive (PM-1A) may affect business for PRF operators;
- The operational and investment costs are relatively low as well. Some operational and investments costs are expected from including Annex VI waste in the PRF Directive (PM-1A). The balance between these relatively small benefits and the minimal operational and investment costs involved is positive, making this an *efficient* policy option;
- The policy option scores rather neutral on *coherence*. Involving the stakeholders in the development of WRH plans is coherent with the EU policy to actively involve users in decision making. However, the link to relevant policies, such as environmental policies (clean seas, circular economy) and administrative burden reduction is not strong.

The overall assessment is that the minimum revision of the PRF Directive is a feasible policy option, given the relatively low score on effectiveness, the positive score on efficiency and the neutral score on coherence. In addressing the stated objectives, this policy option relies on parallel policy measures to be implemented through soft law.

PO-3A: MARPOL alignment – without additional focus on marine litter

- This policy option has low-medium impacts on waste delivery to port reception facilities and consequent reduction in waste discharged at sea. This is mainly through policy measures in the adequacy, definitions and exemptions cluster. This policy option scores relatively low on delivery of garbage waste, notably because fishing vessels and recreational craft are not specifically addressed. The combination of MARPOL alignment and no special focus on marine litter scores very well on administrative burden reduction (high impact). This policy option has a low-medium impact on the circular economy. This policy option benefits from synergetic effects between defined policy measures as a result of MARPOL alignment. Policy measure 3A.1, i.e. mandatory delivery of waste - MARPOL alignment, adds to the effectiveness of other measures, such as bringing PRF inspections within the scope of Port State Control regime (through an amendment of Directive 2009/16/EC (policy measure 3D.1). In addition, the introduction of the requirement for a waste receipt to be issued upon delivery (policy measure 3B) will benefit from MARPOL alignment. Based on the above, this policy option scores well on *effectiveness*;
- This policy option scores relatively well on other impacts, such as business for PRF operators (through the increased waste delivered at port reception facilities). However, these impacts are lower than the variant options that focus on marine litter (policy options 3B and 4B);

- At relatively modest operational and investment costs, both rated as low-medium, and substantial benefits this policy option scores positively on *efficiency*.

This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas and circular economy) and reduction of administrative burden. Bringing the PRF inspections within the scope of Port State Control regime further adds to coherence.

Based on the above, it can be concluded that MARPOL alignment without additional focus on marine litter provides a feasible policy option, with a strong score on effectiveness (low-medium impact on waste delivery; highest impact on administrative burden reduction of all policy options and low-medium impact on circular economy); and good scores on efficiency and coherence.

PO-3B: MARPOL alignment – with special focus on marine litter

- Performance on waste delivery is better than in policy option 3A (rated at medium). On top of the waste delivery performance of policy option 3A this policy option adds a package of policy measures focused on the delivery of garbage waste and thus tackles the problem of marine litter. This policy option also benefits from synergetic effects, as described under policy option 3A. This policy option reduces the administrative burden (medium-high impact), although to a lesser extent than policy option 3A, as the policy measures aimed at reducing marine litter cause some additional administrative burden. The contribution to the circular economy is substantial, rated at a medium impact. Overall this policy option scores very well on *effectiveness*;
- This policy option outscores the performance of policy option 3A on waste delivery, thus creating spin-off impacts, notably on business for PRF operators, impact on SMEs and employment;
- Although investment costs (rated medium) are higher than in policy option 3A as a result of including policy measures focused on reducing marine litter, the increased contribution to the objectives results in a positive score on *efficiency*;
- This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas, with additional focus on marine litter, and circular economy) and reduction of administrative burden. Bringing the PRF inspections within the scope of Port State Control regime further adds to coherence.

Considering all of the above, this policy option provides an excellent overall package, based on a strong combined score on effectiveness, and good scores on efficiency and coherence.

PO-4A: EU PRF regime - without additional focus on marine litter

- Regarding *effectiveness*, strict operation of the EU PRF regime (based on a mandatory delivery obligation – beyond MARPOL), without an additional focus on marine litter, scores better than policy option 3A as this policy option aims to capture the legal discharges at sea (rated medium). In collecting this additional waste, it should be noted that a delivery obligation is not as effective as a discharge prohibition, thus gains in additional waste volumes delivered at port reception facilities may be limited. This policy option also scores relatively well on the circular economy objective (rated low-medium), similar as policy option 3A. However, the lower score on administrative burden (rated low) has a negative

impact on overall effectiveness of this policy option. The administrative burden is negatively affected by having a dual system in place (MARPOL and EU PRF regime). The (potential) gains in waste delivered are offset by the performance on administrative burden, resulting in a lower score on effectiveness than policy option 3;

- Similar as policy option 3A, this policy option scores well on spin-off related to other impacts, such as business for PRF operators (through the increased waste delivered at port reception facilities). However, these impacts are lower than the variant options that focus on marine litter (policy options 3B and 4B);
- The operational costs of policy option 4 are higher (rated medium) than policy option 3, mainly as a result of having a dual system in place. The investment costs of this policy option are similar as policy option 3A. The combination of higher aggregated costs and lower effectiveness leads to a lower score on *efficiency*, compared to policy options 3A and 3B;
- This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas and circular economy) and reduction of administrative burden (similar to policy option 3A).

This policy option is feasible. Although some additional waste may be delivered to port reception facilities, the additional administrative burden places this policy option at a lower effectiveness level than policy option 3. With a similar score on coherence and a lower score on efficiency, this policy option has an overall rating that is lower than policy options 3A and 3B.

PO-4B: EU PRF regime – with special focus on marine litter

- Strict interpretation of the PRF Directive, with special focus on marine litter, scores well on the waste delivery objective (rated medium-high). Compared to policy option 4A, this policy option adds a package of policy measures focused on the delivery of garbage waste and thus tackles the problem of marine litter (similar as policy option 3B). This policy option scores well on the circular economy objective (rated medium). However, the performance on administrative burden scores lower than policy option 4A (rated low), negatively impacting overall *effectiveness* of this policy option. Also in this policy option, the overall additional waste delivered is offset by the score on administrative burden;
- This policy option outscores the performance of policy option 4A on waste delivery, thus creating spin-off impacts, notably on business for PRF operators, impact on SMEs and employment;
- The aggregated operational and investment costs are higher than policy options 3A-B, resulting in a lower *efficiency* as compared to policy options 3A-B;
- This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas, with additional focus on marine litter, and circular economy) and reduction of administrative burden.

This policy option is feasible, but the overall balance is at a lower level than policy measure 3B.

Conclusions

Based on the above comparison, *policy option 3B - MARPOL alignment with special focus on marine litter* provides the best overall score on the defined criteria (effectiveness, efficiency, coherence). This policy option has a positive contribution to the stated objectives. More waste will be delivered to the port reception facilities and

hence less waste will be discharged at sea. This is combined with a reduction on administrative burden and a contribution to the circular economy. The operational and investment costs are modest and at a lower level than the policy options 4A-B. Furthermore, this policy option scores well on coherence, notably by connecting to EU environmental policies and ambitions to reduce administrative burden. Finally, this policy option includes policy measures, notably through MARPOL alignment, which create synergetic effects.

Policy option 3B - MARPOL alignment with special focus on marine litter consist of a well-balanced set of 19 policy measures, covering the areas of provision of adequate port reception facilities; incentives for waste delivery; effective enforcement; improving definitions and forms; and consistent application of exemptions. The combined policy measures, strengthened by synergetic effects between the measures, have a positive impact on reducing the main defined problems, i.e. (i) discharges of ship-generated waste and cargo residues at sea, negatively impacted the marine environment, and administrative burden caused by the implementation of the PRF Directive. Notably the problem of waste discharges at sea is substantial, with waste gaps, defined as the difference between waste generated on board the ship and east delivered at ports, of 2,5% of oily waste; 10% of sewage waste and 7-34%of garbage waste. *The combined policy measures, coming at relatively modest costs, form an effective approach which is proportionate to the identified problems*.

1. Introduction

1.1. Background

Directive 2000/59/EC on port reception facilities for ship-generated waste (SGW) and cargo residues (CR) (hereafter referred to as the PRF Directive) was published on the 27th of November 2000 and since then regulates the delivery of waste by ships in EU ports.

Member States were required to implement the PRF Directive by 28 December 2002 the latest. The PRF Directive was subsequently evaluated in 2015[14], and a number of challenges have been identified with respect to the overall functioning of the PRF Directive. In order to improve the implementation of the PRF Directive, several actions have been initiated, as detailed in Chapter 2, which aim to overcome one or more of the above mentioned challenges. In addition, a revision of the PRF Directive is envisaged. To facilitate the revision an impact assessment is being prepared by the Commission. This report supports the impact assessment by providing input on the problem analysis; policy objectives, measures and options; and impacts of the defined policy measures. The latter forming the basis for selecting a preferred policy option.

1.2. Objective of the study

The objective of the study is to support the Commission in preparing its impact assessment for the revision of the PRF Directive.

1.3. Contents of the Final Report

The report follows the sequence of the key questions, as defined in the Better Regulation Guidelines[15], resulting in a number of parts. The first part (Chapters 1-3) presents the context of the proposed revision (Chapter 2) and the methodological aspects (Chapter 3). The second part (Chapters 4-8) addresses the problem analysis, definition of policy objectives, options and measures. First, the problem analysis is conducted in Chapters 4, 5 and 6. The findings of these chapters are the basis for setting the policy objectives (Chapter 7) and defining the policy measures and options (in Chapter 8). The third part (Chapters 9-14) addresses the assessment of impacts and the comparison of options. In the Chapters 9-13 a detailed analysis of the most important impacts for each policy measure is presented. A comparison of the policy options is then presented in Chapter.14, including the proposed preferred policy option. Finally, Chapter 15 presents information on monitoring and indicators.

Background information and supporting input are presented in a separate Annexes Report. Annexes are referred to at the relevant places in the main text.

[14] Panteia (2015), ex-Post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues.
[15] European Commission (2015), Better Regulation Guidelines. Section 3.2: key questions and principles of impact assessments.

2. Context

This chapter presents the context of the PRF Directive, consisting of a description of the historic perspective of the PRF Directive (Section 2.1), including the link to MARPOL, and an inventory and description of recent and ongoing relevant initiatives (Section 2.2). As these initiatives are already implemented or ongoing, they are incorporated in the baseline scenario of the impact assessment.

2.1. Historic perspective of the PRF Directive

The PRF Directive was adopted in 2000 as one of the means to address the problem of ship-generated waste and cargo residues discharged at sea, by demanding (i) Member State ports to ensure adequate port reception facilities; (ii) ships to deliver their waste; and (iii) authorities to enforce and incentivize this process. With these objectives the PRF Directive aims to transpose the relevant parts of the IMO Convention for the Prevention of Pollution from Ships (MARPOL) into EU law. Ship-generated waste has been defined in the PRF Directive with reference to the relevant Annexes of the MARPOL Convention.

MARPOL Convention

To address the problem of discharges of ship-generated waste and cargo residues at sea at an international level, the International Maritime Organization (IMO) set out general discharge prohibitions and technical norms under which certain types of discharges are allowed. The norms are laid down in the MARPOL Convention, in particular the different Annexes to the Convention. To reduce waste discharges at sea, waste discharge norms are defined in a total of six Annexes to MARPOL, covering different waste streams.

At the time of developing the PRF Directive, the MARPOL waste discharge norms were less stringent than they are today, as the Annexes to the Convention have undergone various changes since the entry into force of the Directive (see Annex 14 for an overview of the current discharge norms). This development is to be taken into consideration when revising the PRF Directive, making it relevant to today's situation.

Performance after adoption of the PRF Directive

Since the adoption of the PRF Directive, volumes of ship-generated waste and cargo residues delivered to EU ports have increased significantly, indicating that the problem of waste discharged at sea has been reduced (Panteia, 2015). However, the problem of waste discharges at sea has not been resolved. Various studies (e.g. Eunomia (2016), Van Franeker (2010), UNEP (2009), GESAMP (2007)) indicate that significant parts of marine litter originate from sea-based sources. Other waste streams, such as oily waste and sewage, also continue to be discharged at sea in contravention with existing discharge norms/prohibitions.

The ex-post evaluation of the PRF Directive (Panteia, 2005) identified several challenges related to the implementation of the PRF Directive, including:

- Lack of knowledge and relevant information regarding availability of reception facilities, handling of ship-generated waste and cargo residues facilities;
- Inadequate delivery by ships of their waste and cargo residues;
- A lack of a level playing field between ports and between port users;
- Unnecessary administrative burden for port users;
- Lack of clear responsibilities regarding ship waste handling.

2.2. Recent and ongoing initiatives

In order to improve the implementation of the PRF Directive, the Commission has started, in close cooperation with relevant stakeholders, several actions which aim to overcome one or more of the above-mentioned challenges. These initiatives, which will amongst others affect the volumes of waste delivered in the near future, are presented below:

- Amendment of Annex II of the PRF Directive through comitology, to bring Annex II in line with the recent changes to MARPOL Annex V and IMO Circulars, as well as to include data on quantities and types of waste delivered;
- The PRF Interpretative Guidelines;
- The Technical Recommendations, as prepared by EMSA;
- Development of the Common Information and Monitoring System, based on existing reporting systems (SafeSeaNet and THETIS-EU), as required by Article 12(3) of the PRF Directive;
- Guidance for ship inspections;
- The adoption of the Proposal for a Regulation establishing a framework on market access to port services and financial transparency.

2.2.1. Amendment of Annex II of the PRF Directive

In 2015, Annex II to the PRF Directive, on information to be notified on entering a port, was revised (Commission Directive (EU) 2015/2087). This amendment resulted in two important changes to Annex II of the PRF Directive:

- The first change includes additional distribution of garbage into specific categories (in line with the revised Annex V of MARPOL, as far as legally possible)[16]. Besides food waste and plastic, categories such as domestic waste, cooking oil, incinerator ashes, operational wastes and animal carcass(es) are now also distinguished. The ship's captain must indicate how much waste per category he intends to deliver, and how much is on board;
- The second change concerns the obligation to report the quantities (measured in m^3) and the types of waste delivered in the previous port. Based on this additional information, it should be easier to assess whether or not the dedicated storage capacity on board the ship is indeed available and sufficient for storing the waste, allowing for more targeted enforcement[17]. In this way, unnecessary inspections can be avoided, facilitating maritime traffic in ports.

2.2.2. PRF Interpretative Guidelines

A clear result of the ex-post evaluation (Panteia, 2015) was that some of the key provisions of the PRF Directive are interpreted differently by Member States. The different interpretations hamper the effectiveness of the PRF Directive, as it results in uncertainties for both ports and port users and increased administrative burden. In order to address this issue, the Commission has issued in April 2016 a set of Interpretative Guidelines, supported by Technical Recommendations from EMSA[18] (see further below), which aim to provide a uniform interpretation of some of the key provisions of the Directive. These guidelines can be qualified as soft law measures, i.e. not legally binding on the Member States.

[16] Recital, Commission Directive (EU) 2015/2087.
[17] Recital, Commission Directive (EU) 2015/2087.
[18] EMSA Technical Recommendations (2016).

The Interpretative Guidelines laid down in Commission Notice (2016/C 115/05) provide clarification on 'adequacy' (Article 4), the waste reception and handling plans (Article 5), waste notification (Article 6), delivery of ship-generated waste (Article 7), enforcement (Article 11) and exemptions for ships in scheduled traffic (Article 9). For each of the topics the main concepts are further clarified and, where needed, the relation with other EU or international legislation, especially MARPOL, is further explained.

2.2.3. EMSA Technical Recommendations

In parallel to the Interpretative guidelines, EMSA adopted Technical Recommendations which focus on the application of the PRF Directive. The main aim of the Technical Recommendations is to provide practical guidance. For example, the Technical Recommendations indicate which aspects need to be covered in a WRH plan. As a result, the Technical Recommendations aim to reduce confusion amongst users of port reception facilities. The focus of the Technical Recommendations is Article 5 (WRH plans), Article 7 (especially defining 'sufficient dedicated storage capacity') and Article 9 (exemptions for scheduled traffic), for which practical guidance is given.

The EMSA Technical Recommendations build on the Commission's Interpretative guidelines and good practices identified within Member States. The Technical Recommendations have four objectives:

- To contribute towards a more uniform and harmonised application of the PRF Directive;
- To ensure more efficient use of resources during the application and enforcement of the PRF Directive;
- To help Member States follow the requirements of the PRF Directive;
- To support Member States to develop new, or enhance any existing, guidance that Member States have developed to implement their national legislation.

In addition, the Technical Recommendations will be subject to revision in the light of their use and possible amendments to the PRF Directive.[19]

2.2.4. Common information and monitoring system

Article 12 (3) of the PRF Directive indicates that the Member States and the Commission shall co-operate to establish a joint information system which needs to (i) improve the identification of ships which have not delivered their ship-generated waste and cargo residues in accordance with this Directive and (ii) ascertain whether the goals set in Article 1 of the Directive - reduce discharges of ship-generated waste and cargo residues at sea – have been met.

In order to create such a system, the Commission, together with EMSA, is developing an electronic reporting and monitoring system based on existing databases, in particular SafeSeaNet (SSN) and THETIS-EU (the Port State Control database). In THETIS-EU, a module supporting the enforcement of the PRF Directive is developed, which is part of the main THETIS-EU Port State Control database. The distinction is made as the PRF Directive is not covered by international Port State Control legislation, so an associated system has been set up to report inspections, done as part of the PRF Directive.

In SSN, established under Directive 2002/59/EC, a Community vessel traffic monitoring and information system is created. Since 1 June 2015, the advance waste notification (Article 6, PRF Directive) has to be reported electronically into the National

[19] See EMSA Technical Recommendations.

Single Window and is subsequently exchanged through SSN. In addition, the information that is included in SSN is shared between national authorities and should be made available to THETIS-EU in the coming years to facilitate monitoring and enforcement.

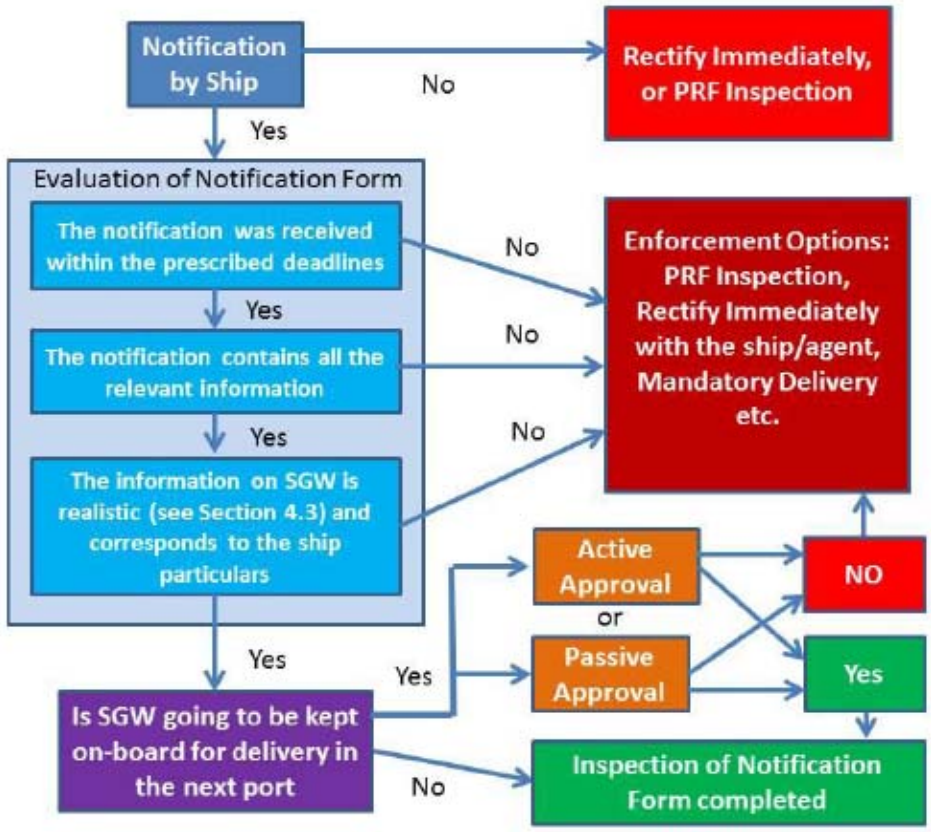
It should be noted that both fishing vessels and small recreational craft are not included in SafeSeaNet, as Directive 2002/59/EC does not apply to such vessels (Article 2.2.b).

2.2.5. Guidance for ship inspections

In November 2016, EMSA published the guidance for inspections under the PRF Directive. The aim of the document is to provide a harmonised approach to the enforcement of the PRF Directive. The guidance provides information on the relevant documentation that should be checked during the inspection, on the criteria to be used to select a ship (see Figure 1), as well as checklists for conducting the inspections. These checklists cover several topics, i.e. the inspection of the advanced waste notification form, inspection of the delivery of ship-generated waste and cargo residues in ports, actions stemming from non-compliance in the previous ports, exempted ships and enforcement actions and penalties. Practical directions are provided for each of these topics, which could assist the inspectors with conducting their inspections in a more harmonised way.

In Appendix III, the guidance methods for calculating the sufficient storage capacity are presented. The inspector is free to choose the most feasible calculation method.

Figure 1 Guidance on selecting a ship for inspection



Source: EMSA (2016).

2.2.6. A framework on market access to port services and financial transparency – Port Service Regulation

Port reception facilities services are part of the services that the port (or a third party contractor) provides to its users. The provision of these port services falls under the Regulation (EU) 2017/352 of the European Parliament and of the Council of 15 February 2017, establishing a framework for the provision of port services and common rules on the financial transparency of ports (the Port Service Regulation).

The Port Service Regulation firstly seeks to create a clear framework for *access to the market of port services*, and second, establish common rules on the *financial transparency and charges* to be applied by managing bodies or providers of port services. It should apply to the TEN-T seaports, but Member States may extend its application to other seaports. New rules are designed to ensure financial transparency of seven port services (including collection of ship-generated waste and cargo residues by port reception facilities) and open market access. However, a port managing body may cite scarcity of land and public service obligations to limit the number of providers of a service and to impose minimum requirements on them.

3. Methodological aspects

This chapter presents the methodological aspects of the impact assessment support study of the PRF Directive. The design of the impact assessment is presented in Section 3.1. This is followed by a description of the methodological building blocks (Section 3.2). The MARWAS model is presented in more detail in Section 3.3, based on the important role of this model to estimate the waste gap. Section 3.4 presents the data availability and limitations.

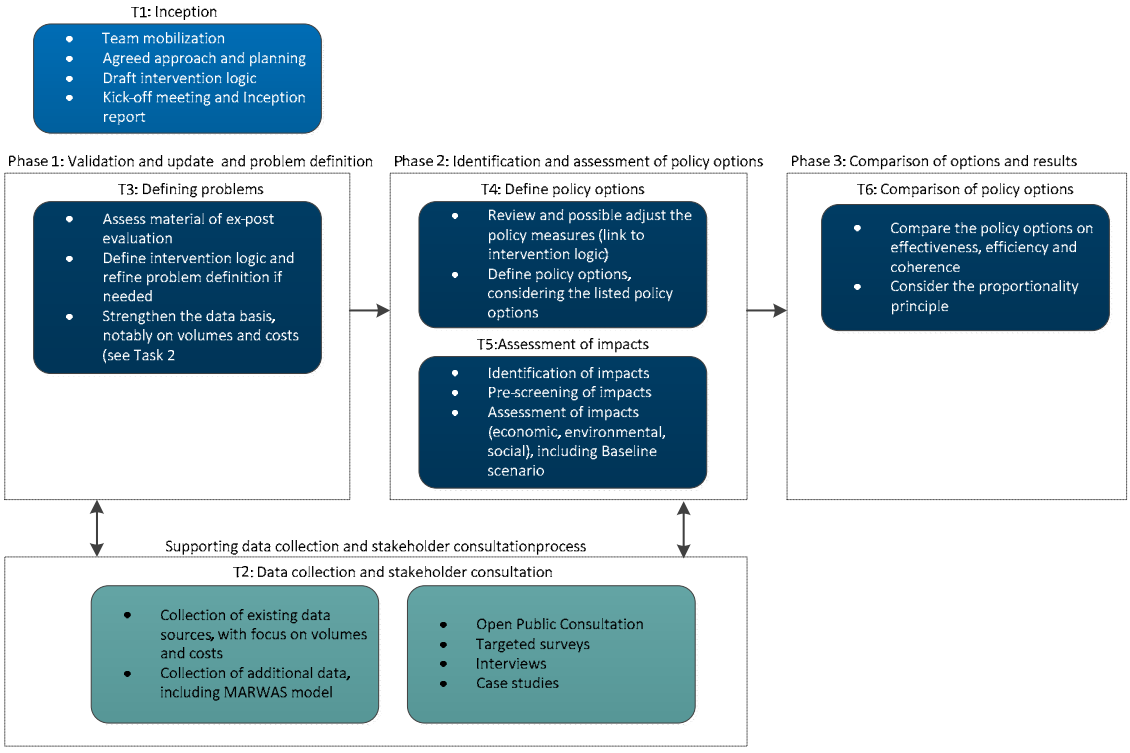
3.1. Design of the impact assessment

As described in Section 1.2, the objective of this study is to support the Commission in the impact assessment exercise for the future revision of the PRF Directive. In order to deliver this objective a four-step approach has been followed:

1. Validation and update of findings of the ex-post evaluation study and problem definition;
2. Identification of options;
3. Assessment of policy options;
4. Comparison of the options and concluding results.

The approach is graphically presented in Figure 2.

Figure 2 Schematic overview of phases and tasks



Source: Ecorys.

3.2. Methodological building blocks

The following elements are the building blocks behind the study and have formed the overall framework of the impact assessment:

- Problem definition and analysis;
- Administrative burden;
- Assessment of environmental vulnerability;
- The baseline against which policy options are compared;

- Justification of the proposed five case studies;
- Defining policy options;
- Assessment of impacts;
- Small and Medium sized Enterprises (SMEs);
- Data collection results.

3.2.1. Problem definition and analysis

The problem definition describes the relationship between the two main problems (waste discharges at sea; administrative burden as a result of implementation of the PRF Directive), the five problem drivers (inadequate reception and handling of waste by port reception facilities; insufficient (cost) incentives to deliver the waste to port reception facilities; insufficient enforcement of the mandatory delivery of ship-generated waste; inconsistent and outdated definitions and forms; inconsistent application of exemptions from ships in scheduled traffic with frequent and regular calls) and the 16 root causes[20]. The problem definition is included in Chapter 1 and illustrated by a problem tree.

The problem analysis concentrates at two levels. First, the two main problems are described in Chapter 1. The waste discharges at sea is presented for different waste types, taking into account the various data limitations, as indicated in Section 5.1. Furthermore, the problem of administrative burden is presented in Section 5.2. Chapter 6 then presents a more elaborate analysis of the root causes, including their contribution to the two main problem drivers.

3.2.2. Regulatory costs and administrative burden

Administrative burdens are those costs borne by businesses, citizens, civil society organizations and public authorities as a result of administrative activities performed to comply with information obligations included in legal rules, according to the Better Regulation Toolbox (European Commission, 2015)[21].

In assessing the impacts of the revision of the PRF Directive a distinction is made for the following regulatory costs[22]:

- *Operational costs*: costs at an operational level that are affected as a result of the revision of the PRF Directive, as described inTable 1;
- *Investment costs*: investments that need to be made as a result of the revision of the PRF Directive, as described in Table 1;
- *Administrative burden*: costs to comply with information obligations, as described above, and illustrated in Table 1.

Administrative burden, as one of the two main identified problems, is addressed in more detail in Section 5.2 and in Chapters 9-13, dealing with the assessment of the impacts.

3.2.3. Assessment of environmental vulnerability

In addition to analysing the problem in terms of waste generated and delivered, a specific analysis has been made of the environmental vulnerability of waste when

[20] See Figure 4.
[21] Tool #51 of the Better Regulation Toolbox.
[22] It should be noted that an alternative breakdown of regulatory costs is: compliance costs + administrative burden + enforcement costs. In the approach applied in this impact assessment support study, the operational costs and investment costs jointly form the compliance costs. The enforcement costs are included in the investment costs. When enforcement costs are addressed in this study, it will be under the heading of investment costs.

entering the marine environment, focusing on the aspect of damage of oily waste, sewage or garbage to the marine ecosystem.

The vulnerability analysis applies methods and results that have been developed and agreed upon among several Member States in earlier EU-funded projects of regional scale (Be AWARE 2015, BRISK 2012)[23]. The approach is compatible with EU-wide methodologies for the assessment of the quality of the marine environment, as developed under the Marine Strategy Framework Directive (MSFD).

The different waste types will have different environmental impacts, which can be weighted accordingly, and which will facilitate focusing on waste types of particular interest and concern.

3.2.4. The baseline against which policy options are compared

In order to deliver estimates of impacts of each policy option, a clear picture of the baseline situation is needed. Therefore, the two main problems are analysed in detail, with results presented in Chapter 1, i.e. for waste generated and delivered and administrative burden. At the same time, the baseline scenario includes a number of initiatives that have already been adopted. These initiatives are described in Section **8.2.1**.

3.2.5. Justification of the five case studies

The following five ports were selected for the case studies to represent ports in the European Sea Basin:

- Copenhagen (Baltic Sea);
- Antwerp (North Sea);
- Constanta (Black Sea);
- Genoa (Mediterranean); and a
- Le Havre (Atlantic).

The five selected ports cover a spectrum of smaller (Genoa, Constanta) to larger (Antwerp, le Havre) ports, plus different port types ranging from mostly passenger dominated (Copenhagen is mostly a ferry and cruise port) to ports with a specific focus on cargo (Antwerp).

Other points that were taken into account when choosing these ports was a good coverage in terms of differences in:

- Waste type and volume actually collected;
- Applied waste notification system;
- Applied cost recovery system;
- Role and responsibilities regarding waste handling in the port;
- Ownership and operation;
- Contractual framework;
- Impact of the PRF Directive.

[23] The methodology proposed in the present vulnerability study has similar principles with MSFD inasmuch as it uses features overlapping with the MSFD descriptors and list of pressures and impacts and tries to accumulate the impacts on all features into an overall impact assessment. In the absence of a reliable and straightforward methodology, covering all relevant MSFD descriptors, the proposed methodology, based on two projects in Northeast Atlantic and the Baltic, is used for convenience for the purposes of complementing the analysis of environmental impacts of various policy options amending the PRF Directive.

The case studies are used to analyse the problems and assess the impacts. Reference to the case studies is made throughout the text, with details presented in Annex 11.

3.2.6. Defining policy options

The policy options have been constructed in such a way as to provide clearly identifiable packages of policy measures, in line with the Better Regulation Toolbox[24]. In creating the policy options three main aspects are considered:

- The *scope of the revision*. A policy option with a minimum legislative revision is defined, focusing mainly on adequacy and incentives measures to be included in the revised PRF Directive. The other policy options focus on a more extensive revision of the PRF Directive, covering all identified specific objectives;
- The vision towards *mandatory delivery of waste in ports* (Article 7). This principle choice defines a major difference between policy options. One policy option aligns the PRF Directive with MARPOL, meaning that it is acknowledged that some waste may be discharges at sea in line with the discharge norms, as specified in the relevant MARPOL annexes. This will also reflect on other policy measures in this policy option, such as those related to inspections and waste receipts. Another policy option aims to have all waste delivered at ports, also the 'legal discharges' (waste discharged in accordance with MARPOL discharge norms). This position will also reflect on other policy measures, i.e. related to inspections and waste receipts; as mentioned above. Furthermore, the above-mentioned policy options will show different impacts, for example on investment and operational costs and administrative burden. The two policy options that are defined based on the above-mentioned vision towards mandatory delivery of waste in ports address an *ambiguity* that has existed since the implementation of the PRF Directive, i.e. whether a ship should deliver all waste on board the ship at port reception facilities before leaving for the next port or whether a ship should deliver all waste generated at port reception facilities before leaving for the next port. The difference between the two being the amount of waste that can be *legally discharged* at sea in accordance with MARPOL discharge norms;
- The position towards *marine litter*. Two variant options are defined; one with and one without focus on marine litter.

3.2.7. Assessment of impacts

In line with the Better Regulation guidelines[25] a stepwise approach is followed in the impact assessment process.

First, *impacts of the selected policy measures and options are identified*. Ten relevant impacts are identified[26], which are presented in Table 1, grouped in the three main impact categories.

[24] EC, Better Regulation Toolbox, 19 May 2015, notably Tool#14 and Tool#15.
[25] See Better Regulation Toolbox, tool #16.
[26] Based on the impacts included in the Terms of Reference and a comparison with the overview of key impacts to be screened, as included in the Better Regulation Toolbox.

Table 1 Table Impact categories and impacts

Impact categories	Impacts
Economic	1. Operational costs, which may include on the one hand an increase of costs e.g. if the scope of waste collection is extended to include MARPOL Annex VI waste, but on the other hand a reduction achieved through more efficient operating practices It applies to different affected groups, i.e. ships, ports, PRF operators.
	2. Investment costs, which may be required to implement a policy measure, e.g. additional storage capacity at port reception facilities or on board the ship if the scope of waste collection is extended to include MARPOL Annex VI waste.
	3. Administrative burden, for example related to advance notification for ports and port users; costs for developing and updating WRH plans, etc.
	4. Business for PRF operators, which is expected to increase if more waste is delivered in ports.
	5. Impact on SMEs, which is related to ports (small ports, fishing ports and marinas), vessels (small: fishing, recreational) and PRF operators.
	6. Impact on competitiveness and innovation, which may be affected as a result of reduced turn-around-time in ports through better reporting and exchange of information between Member States.
	7. Impact on third countries, foreign trade and investment, which may be affected by provision of better port reception facilities in EU ports or more stringent requirements on EU ports.
Environmental	8. Discharges at sea and consequent impacts on the environment[27].
Social	9. Employment impacts, focusing on changes in employment in the port, the PRF and the shipping sector, for example in fishing.
	10. Working conditions at sea, which may be affected as a result of policy measures. As indicated in the pre-screening process, limited impact is expected in this field.

Next, *impacts that are likely to be significant are singled out*. Pre-screening of impacts per policy measure has provided a quick overview of where (main) impacts are expected. The results of the pre-screening of impacts are used to identify the main impacts that will be assessed per policy measure. The identification of main impacts is based on a process of initial pre-screening combined with the results of the questionnaire:

- Results of *initial pre-screening*: pre-screening of impacts was carried out in a number of sessions, with results presented and discussed with the Commission. Results of the initial pre-screening are presented in Annex 13;
- Results of *questionnaire*: in a dedicated survey questionnaire stakeholders were asked to indicate the impact of each policy measure. Results of the questionnaire scores are presented in Annex 8;
- The results of *initial pre-screening and the questionnaire* have been combined. Both sources present a rather consistent pattern on impacts, although some policy measures were scored higher in the questionnaire in terms of impacts than in the initial pre-screening process[28]. Summarised results of pre-screening and the questionnaire are presented below in terms of a vertical and horizontal assessment and more detailed results and scores of impacts are presented in Annex 13.

[27] Environmental impact concentrates on discharges of waste at sea. The consequent impact on the environment will be assessed in a qualitative way.

[28] It should be noted that policy measure 3D-variant 1 is considered to be close to the current situation. As such, limited impacts are expected from this variant, other than a reduction of administrative burden. This deviates from how this policy measure (variant) was cored in the questionnaire survey.

A *vertical assessment*, i.e. with impacts as starting point, indicates that impacts concentrate on (i) volumes of waste discharged at sea; and (ii) cost related impacts, i.e. a combination of investment and operational costs, as well as administrative burden. In addition, business for PRF operators is impacted. The latter is directly linked to the volumes of waste delivered, which also impacts the operational costs of ships. In other words, these three impacts are related;

More specific conclusions that can be drawn from the vertical assessment are:

- The impact on SMEs (see Section 3.2.8) is relatively modest;
- The other economic impacts, i.e. impact on competiveness and innovation; and impact on third countries, foreign trade and investment are relatively small;
- The social impacts are expected to be small. Employment effects could result from increased business at PRFs, although this is not expected to develop at the same rate of changes in waste collected. Working conditions are not expected to be impacted by the identified policy measures.

A first *horizontal assessment*, i.e. with policy measures as starting point, indicates that some policy measures have a broad impact (with many impacts scored at medium or high). This applies for example to policy measures 1A (broaden the scope of the PRF Directive to Annex VI waste) or the policy measure 3A – (clarify the position of the PRF Directive related to delivery of ship-generated waste). In addition, some policy measures are expected to have only a modest impact, for example policy measure 1D (provide a better definition of 'adequacy' in line with the PRF Directive and the IMO Guidelines for Annex V). Policy measure scoring low on impacts are not automatically discarded, as these policy measures may also come at low costs and could still be considered beneficial. This assessment will be done on a case by case basis.

Finally, the *significant impacts are assessed quantitatively where possible, otherwise qualitatively*. This is done in Chapters 9-13 per policy measure cluster and represents a crucial part of the impact assessment report. The results of Chapters 9-13, indicating impacts per policy measure, are the basis for presenting the impacts per policy option and comparing the policy options in Chapter 14.

3.2.8. Small and medium-sized enterprises (SMEs)

Enterprises can be classified in different categories according to their size; for this purpose different criteria may be used (e.g. number of persons employed, employees, balance sheet total, investments), but the one most common in a statistical context is number of persons employed. Small and medium-sized enterprises (SMEs) are enterprises with fewer than 250 persons employed[29]. As indicated above, one of the criteria considered is the impact of the revision of the PRF Directive on SMEs.

The impact on SMEs is directly linked to the way the waste collection and shipping industry is structured. In the *waste collection industry the share of SMEs is limited*. Euroshore, the international trade association of port reception facility providers in Europe and beyond, indicates that there are a few SMEs amongst their members. Most members are belonging to multinational companies (Veolia, Shanks, Van Gansewinkel, Nature Group). Other members are large national companies, for example the Hellenic Environmental Centre (HEC). Euroshore has an almost 100% coverage of the ship-generated waste collection sector in Belgium, the Netherlands, Spain, Greece, Portugal and Bulgaria. This country coverage makes the Euroshore members' non-SME dominance representative for EU-28.

[29] According to Eurostat: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Micro_enterprises.

The enterprise size structure of the EU-28's transportation and storage services sector is dominated by large enterprises[30]. Eurostat indicates relatively high shares of large companies for *sea and coastal water transport water transport*[31]. Within this category *merchant shipping sector* is dominated by large enterprises whereas the fishing sector has a relative high number of SMEs.

The majority of ports are larger enterprises. This is not the case for marina; 80% of marinas European marinas (80%) are qualified as SME[32].

3.2.9. Data collection methods

A variety of data collection methods has been used for collecting the necessary data for the impact assessment, as described below.

Desk research

Relevant literature has been reviewed and used for the impact assessment (see Annex I for a full overview of the literature reviewed). Literature can be grouped in the following categories:

- Literature on PRF performance and related documents;
- Delivery and handling of healthcare waste – for all PRF problems and impacts;
- Delivery and handling of aviation waste- for all PRF problem drivers and impacts;
- Littering behaviour in behaviour economics - for all PRF problem drivers and impacts;
- Literature on Port State Control – for problem drivers and impacts related to PRF enforcement;
- Enforcement at sea via the Directive on ship-source pollution - for problem drivers and impacts related to PRF enforcement;
- Impact of enforcement in academic behavioural studies – for problem drivers and impacts related to PRF enforcement;
- Relevant EU maritime policy areas (third maritime package).

Open Public Consultation (OPC)

The main objective of the OPC was to get a better view of the extent to which the identified problem drivers contribute to the illegal discharge of waste at sea and of whether the proposed policy measures are adequate. As this OPC addresses a technical directive, it was expected that the general public would not be a major participating party in the OPC and this appeared to be the case. In fact, from all the 79 respondents, only 5 respondents (6%) filled in the survey under their personal capacity. In addition, only 6% of the respondents did not belong to one of the identified key stakeholder groups (see Annex 6 for those groups) and only 3 respondents (4%) indicated that they knew very little about the current PRF Directive, indicating a high level of expertise among the respondents (a detailed overview of the OPC is presented in Annex 6).

[30] According to Eurostat, just over half (54.5 %) of the value added in 2013 was generated by some 3 400 large enterprises and these employed 47.6 % of the workforce.
[31] As compared to inland water transport. See Eurostat: Transportation and storage statistics - NACE Rev. 2: http://ec.europa.eu/eurostat/statistics-explained/index.php/Transportation_and_storage_statistics_-_NACE_Rev._2#Size_class_analysis.
[32] As indicated in the Study on challenges for sustainable development of coastal and maritime tourism in Europe (Ecorys, 2016). Assuming that between 4,500 – 5,000 marinas are located in Europe, this means that 3,600 - 4,000 SMEs are involved.

Waste delivery data in ports update requests

The update of waste data mostly aims at supplementing and updating the current data on waste volumes delivered at merchant ports. This exercise has updated the data already collected in previous studies, such as the study on the delivery of ship generated waste and cargo residues (Ramboll, 2012) and the ex-post evaluation of the PRF Directive (Panteia, 2015). These two studies have provided waste delivery data for approximately 40 ports for the period 2004-2013. In order to have an updated picture, these ports were requested for data for the period 2013-2015. A total of 29 ports have provided input.

The waste data provides a solid time series of waste volumes delivered for the period 2004-2015 for 29 ports. The waste delivery data concerns ship-generated waste for the following waste categories:

- Annex I – Oily waste from machinery space;
- Annex IV – Sewage;
- Annex V – Garbage;
- Cargo Residues (Annex I - Oily cargo residues and Annex V -Liquid cargo residues).

A full overview of waste data figures is presented in Annex 4.

Targeted (impact) surveys

The targeted surveys were directed towards all stakeholder categories (including fisheries and marina organisations in a separate survey), focusing on the expected impacts (economic, environmental, social) of the proposed policy measures. Stakeholders were asked to assess the expected impacts of each policy measure. The scope of the surveys was narrower and more in-depth than the OPC. For a complete overview of the survey and its results, see Annex 7 and 8.

MARWAS model

The main purpose for the MARWAS analyses is to have an indication of the waste types and volumes, which should theoretically be delivered to a port and compare it to the actually delivered waste volumes, obtained directly from the largest 29 ports that provided waste delivery data. The difference between the volumes calculated by MARWAS and the actual volumes delivered to the ports form the *waste gap*, i.e. waste which is potentially illegally discharged at sea. A description of MARWAS is presented in Section 3.33.3 and detailed results of MARWAS calculations are presented in Annex 3.

Interviews with key stakeholders

Interviews have been conducted with a series of stakeholders representing the various sectors involved to obtain their views on the possible measures and their expected impacts. The interviews have provided in depth information and filled (data or knowledge) gaps. An overview of all interviews conducted can be found in Annex 2.

Case studies

The five case studies have facilitated a verification of the findings of data and MARWAS runs and a more detailed assessment of impacts of the policy measures. The results of the case studies are presented in Annex 11.

3.3. Application of the MARWAS model

The MARWAS model is based on a data base manager, which normally processes data from Lloyds Maritime Intelligence Services. Using comprehensive data on the parameters influencing waste generation and the number of voyages and ships in a

given period, MARWAS predicts the types and calculates the amounts of waste generated on board the ship during the voyage from the last port of call. MARWAS calculations cover three waste categories (Annex I oily waste, Annex IV sewage and Annex V household garbage).

Formulas and statistics are based on IMO recommendations, literature and on numerous discussions with relevant partners, such as ship masters, engineers, port operators and ship owners.

Before running MARWAS a number of assumptions (waste generation factors) has to be entered into the model. These assumptions influence the estimates. As mentioned in the CE Delft study (2016), waste generation factors can vary for different kind of waste and depending on a number of issues (e.g. maintenance level and ship category). In the MARWAS analysis, different assumptions have been used for 16 ship categories and up to five sizes (see Annex 3 for details on the data processing and data limitations).

The MARWAS model was run for the 29 ports for which port delivery data was obtained, so as to allow an equal comparison between MARWAS estimates and waste delivery data from ports for ship-generated waste, based on:

- The length of the journey (previous, current and next port of call);
- Ship size;
- Engine type;
- Type of traffic engaged in;
- Number of passengers on board (including crew).

To increase the reliability of outcomes and correct for variations over the years, data was aggregated over a 5-year period (2011-2015). Results are presented and compared with ship-generated waste delivery data in Chapter 15.

For this study, the decision was made to use data provided by EMSA instead of Lloyds, in order to allow for an analysis of more ports. However, the use of EMSA data has resulted in some restrictions, as illustrated below:

- Movements' data has been provided by EMSA for most EU ports. However, due to differences in data format for the data provided and what is normally used in MARWAS (Lloyd's data), significant data adjustments had to be done. To solve this, the consultants had to manually determine port positions and port ID numbers, Furthermore, some data was missing from major ports (Bremerhaven, Venice, Tallinn) and a range of inconsistencies occurred in the data provided (e.g. missing previous port data). This information is vital to calculate length of voyage and waste generated. To overcome the missing data and data inconsistencies comprehensive MARWAS software adjustments were carried out. See Annex 3 for details of the data processing steps;
- MARWAS normally runs on data provided by Lloyds (LMIS) and estimates waste generation from previous port to port in question. This means that MARWAS does not take into account situation where the calling ship accumulates waste on board or keeps the waste on board for delivery in the next port. However, seen over five years, these differences are anticipated to level out;
- For garbage waste MARWAS estimates only household waste. Other types of garbage waste categorised are not estimated and included in the MARWAS figures, for example various types of wood and packaging material, as this type of garbage is very specific from ship to ship. The amount of waste delivered at the port reception facility is more than twice as large as the amount of household waste

generated on board as modelled by MARWAS. The shortage of information on garbage waste derived from MARWAS has been compensated by using alternative sources, notably the Eunomia report (2016).

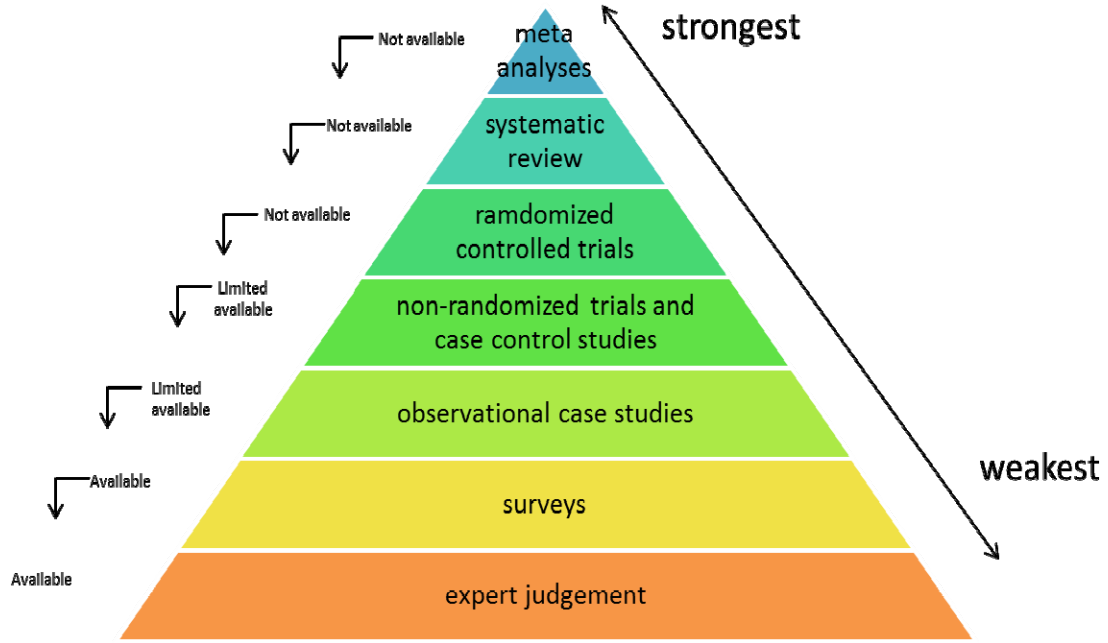
3.4. Data availability and limitations

Previous studies made it clear that waste data is not easily obtained, and that the link between waste generated and delivered is not firm. Typically data on ship-generated waste is based on case examples and estimates, while for waste delivered in ports reporting may be incomplete. This indicates a major drawback in relation to the available literature and data on the topic. This limitation is even stronger when trying to attribute waste delivery impacts to policy measures. Causality is a major weakness in the available literature. This is enforced by the fact that the topic is technical and the problems are very case specific.

This has been addressed by data collection and review of relevant literature from other sectors, such as hospital and aviation waste (see Annex I for the literature reviewed). This has proven to be of relatively limited use due to the specific nature of the issues regarding port reception facilities.

Therefore actually available and used data on the topic do not systematically originate from solid quantitative data sources (see Figure 3) and the impact assessment is heavily dependent on the case studies, surveys and expert judgment of the relevant stakeholders.

Figure 3 Evidence hierarchy and availability of data



Source: Ecorys.

The MARWAS model has facilitated the analysis of the main problem of waste discharged at sea, notably by estimating the amount of waste produced on board the ship, as established in Section 3.3. Also this process came with some data challenges, as outlined in Section 3.3. Nevertheless, MARWAS analysis has provided an additional element in creating better insight in the problem of waste discharged at sea.

4. Problem definition

This chapter presents the problem definition, linking the overall problem of waste discharged at sea, as well as administrative burden related to the implementation of the PRF Directive (see Section 4.1), to problem drivers and root causes (see Section 4.2).

4.1. Main problems

The proposed revision of the PRF Directive should target two main problems:

1. ***Ship-generated waste and cargo residues discharged at sea***

   Significant parts of marine litter originate from sea-based sources. Other waste streams, such as oily waste and sewage, also continue to be discharged at sea. The discharges of ship-generated waste and cargo residues at sea have a negative impact on the marine environment.

2. ***Administrative burden caused by the implementation of the PRF Directive***

   The PRF Directive causes administrative cost, notably related to advance notification, the development of WRH plans and inspections[33]; part of the administrative cost is unnecessary and due to inefficiencies in the system.

4.2. Problem drivers and root causes

Five problem drivers have been identified in the ex-ante evaluation of the PRF Directive (Panteia, 2015):

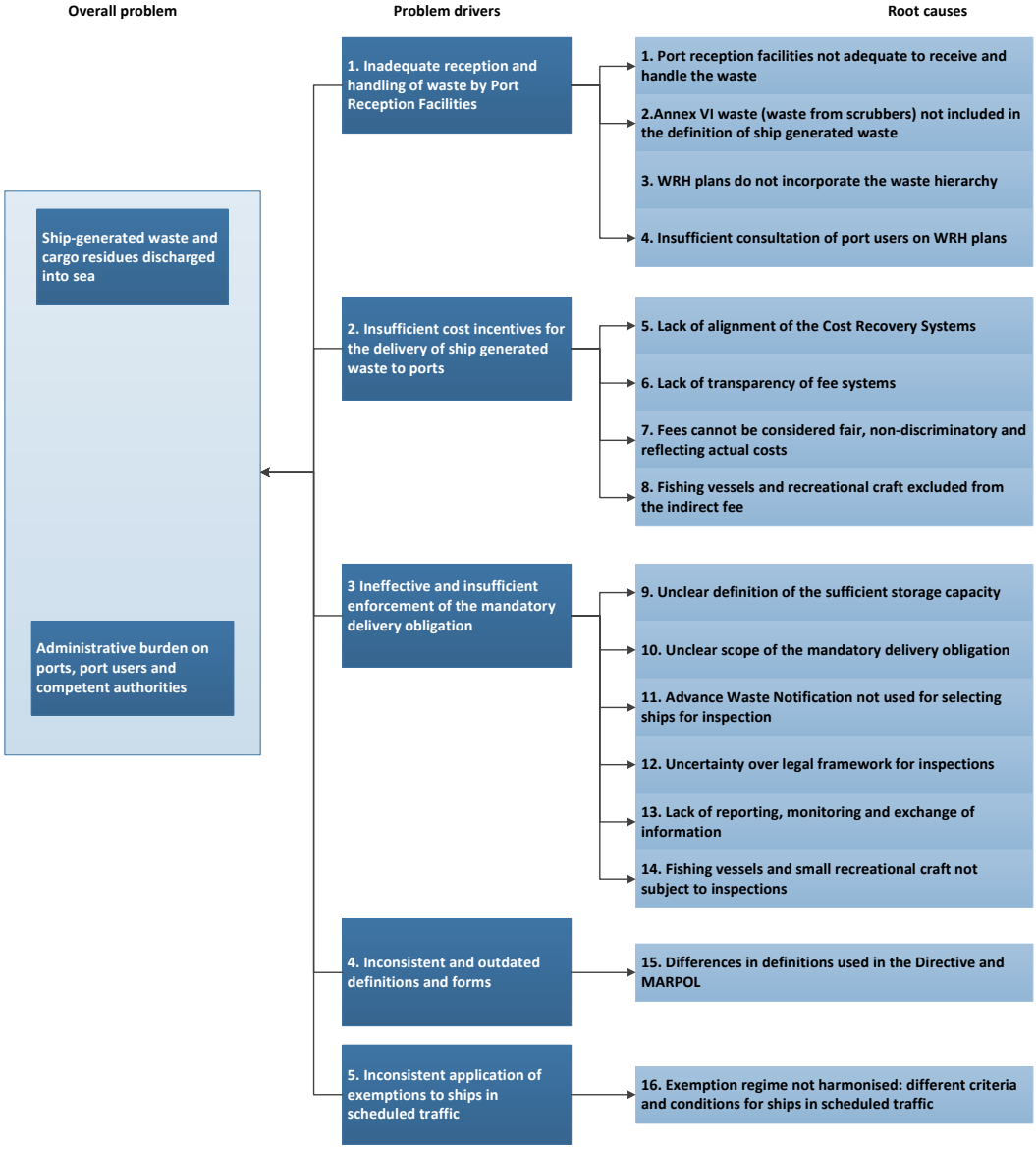
1. Inadequate reception and handling of waste by port reception facilities;
2. Insufficient cost incentives for the delivery of ship generated waste to ports;
3. Ineffective and insufficient enforcement of the mandatory delivery obligation;
4. Inconsistent and outdated definitions and forms;
5. Inconsistent application of exemptions to ships in scheduled traffic.

While the first three mainly relate to the problem of waste discharged at sea (adequacy, delivery and enforcement), the latter two (definitions and exemptions) have a direct relation to administrative burden. It is noted, however, that these two main problems are interrelated, and problems of outdated forms and definitions and exemptions may contribute to waste discharges, while adequacy, delivery or enforcement problems may also impact administrative burden.

Underlying these five problem drivers, a set of 16 root causes has been identified. Figure 4 presents the problem tree, indicating the relationship between main problems, problem drivers and root causes.

[33] Only the part of inspections related to information obligations falls under administrative burden.

Figure 4 Problem tree



Source: Ecorys.

5. Analysis of main problems

This chapter concentrates on the analysis of the main problems. As defined in the previous chapter the main problems are (i) waste discharged at sea, which is described in Section 5.1, and (ii) administrative burden caused by the implementation of the PRF Directive, which is described in Section 5.2.

5.1. Main problem 1: Waste discharged at sea

The following waste categories have been included in the analysis, as defined in the MARPOL Annexes: Annex I (oily waste), Annex IV (sewage), Annex V (garbage) and Annex VI (scrubber waste). For each of these waste categories a distinction has been made between three different shipping segments (merchant shipping, fisheries and recreational boating), as waste generation differs per shipping segment. In addition, where possible, analysis has been made on cargo residues falling under MARPOL Annexes I, II and V.

For each of the above-mentioned waste categories a *waste gap* is assessed. The waste gap is defined as *the difference between waste generated on board the ship and waste delivered at ports*. The waste gap is a *proxy for the potential amount of waste that is illegally discharged*.

The following formulas are applied to assess the waste gap:

primary waste generated – (on-board treatment + legal discharges) = net waste generated

net waste generated - waste delivered in ports = waste gap = potential illegal discharge

The MARWAS model has been applied for Annex I (oily waste) and Annex IV (sewage) and combined with the results of other sources. For Annex V (garbage) and Annex VI (scrubber waste) MARWAS could not be applied, hence the waste gap assessment has been fully based on other sources.

5.1.1. Annex I oily waste

Definition

MARPOL Annex I waste covers oily waste, which includes oily bilge water, oily residues (sludge) and dirty ballast water and oily cargo residues; mostly being tank washings. This type of waste is mostly generated by merchant shipping, as a result of the consumption of heavy fuel oil. Ship engines running on marine diesel or LNG hardly generate any oily waste. Therefore, the fisheries and recreational sector do not contribute much to the generation of this waste category. In addition, oily cargo residues and tank washings are included in MARPOL Annex I.

Primary and net waste generation

The MARWAS model (see description in Section 3.3) has been applied to estimate the following waste volumes:

- *Engine sludge* in relation to distances sailed (kg per nautical mile). Volumes generated range from 0,13 – 1,60 kg/nm depending on ship type and size;
- *Engine bilge* in relation to engine running time (tonnes per day). Volumes generated range from 0.20 – 3.00 ton/day depending on ship type and size.

An analysis by CE Delft (2016), taking into account previous studies, provided the following key indicators:

- An average ship generates 20 m^3 per month of oily bilge water (EMSA, 2008; figure based on an average ship of 30,000 dwt. The report also indicates large variations between ships);
- An average cruise ship generates anywhere between 4 to 19 m^3 per day, depending on the size of the vessel (EPA, 2008);
- Results from interviews conducted by CE Delft concluded that the amounts generated per day varied from 0.01 to 13 m^3. There was a weak correlation with the size of the ship: the amount per GT varied from 0.003 to 0.85 m^3/1000 GT per day (CE Delft, 2016);
- Oily residues (sludge) generation ranges between 0.9% to 2% of the daily fuel consumption when using heavy fuel oil, depending on the vessel type (Afcan, 2006; EPA, 2008; EMSA, 2015 as summarised in CE Delft, 2017, p.26);
- Results from interviews among randomly selected ships conducted by CE Delft concluded that the amounts of oily waste generated per day varied from 0.003 to 11.3 m^3. There was a strong correlation with the amount of fuel consumed: the amount per tonne of fuel varied from 0.001 to 0.03 m^3/tonne of fuel (CE Delft, 2016). It is noted that these figures cannot be used as averages for all ships due to the small and random sample used;
- Regarding cargo residues (i.e. oily tank washings,) results from four interviews concluded that the amounts generated per washing, per cargo tank, ranged from 1 to 2 m^3 (CE Delft, 2016).

MARWAS calculates the *net waste generated*. The average annual net waste generated for the 29 ports included in the analysis over the period 2011-2015 is *418,000 m^3* (see Annex 3). MARWAS also includes estimates of *combined on-board treatment and legal discharges* for different ship categories. This average figure for relevant ship categories producing oily waste is estimated at some *30-40%*[34]. Consequently, the amount of *primary waste generated* would be approximately *750,000 m^3* per year for the 29 ports analysed in the MARWAS model. When aggregating this to the *total EU merchant shipping sector*, applying the assumptions presented in the box below, approximately *2 million m^3* of primary oily waste is generated annually.

> Waste delivery data were obtained from 29 merchant ports, whose total throughput covers 35% of the throughput of all EU merchant ports (in tonnes handled, based on ESPO and Eurostat 2015 data). This ratio is valid for individual cargo categories handled (dry bulk, liquid bulk, general cargo, containers). In order to aggregate this from the 29 ports for which we have data to all EU merchant ports, this 35% ratio is applied to calculate totals for EU merchant shipping.

The generation of *oily waste by fisheries vessels and recreational craft is limited,* as in those segments diesel is the dominant fuel instead of heavy fuel oil. Estimates for oily waste generation indicate less than 600 kg of oily waste per annum per medium size fishing vessel[35] and about 5 kg oily waste per average recreational craft per annum[36]. Taking account of the size of the European fisheries and recreational vessel fleet, total volumes of oily waste for these segments amount to an approximate 55,000 m^3 from fisheries vessels and 9,000 m^3 from recreational boating, adding about 3% to the total

[34] See Chapter 3 for an explanation of the MARWAS mode and Annex 3 for model assumptions. For the calculations here a value of 38% is applied (based on an average of the most relevant ship categories used in MARWAS), which would bring the unrounded figure of primary waste generated at 751,419 m^3.

[35] http://www.engines.man.eu/global/en/marine/engines-for-commercial-shipping/overview/Overview.html andhttp://www.mtu-online.com/fileadmin/fm-dam/mtu-usa/mtuinnorthamerica/white-papers/WhitePaper_PrevMaintenance_Marine.pdf.

36 http://www.yanmarmarine.com/theme/yanmarportal/UploadedFiles/Marine/productDownloads/Pleasure-operation-manual/JH5/JH5_EN_operation-manual.pdf.

volume generated by merchant shipping (see Annex 3 for assumptions underlying these estimates).

On-board treatment and legal discharges - MARPOL discharge regime

Under Annex I, the discharge of oily waste is only allowed under very strict conditions, as presented in Table 2.

Table 2 MARPOL discharge norms divided per waste category specified in Annex I

MARPOL Annex I[37] **Waste category**	**Ships outside special areas**	**Ships within special areas[38]**	**Offshore platforms and all ships within 500 m of such platforms**
Oily bilge water	Applicable to ships > 400 GT Discharge only permitted when: * the ship is proceeding en route; * the oily mixture is processed through an oil filtering equipment meeting the requirements of regulation 14 of this Annex; * the oil content of the effluent without dilution does not exceed 15 parts per million; * the oily mixture does not originate from cargo pump-room bilges on oil tankers; * the oily mixture, in case of oil tankers, is not mixed with oil cargo residues.	Applicable to ships > 400 GT Discharge only permitted when: * the ship is proceeding en route; * the oily mixture is processed through an oil filtering equipment meeting the requirements of regulation 14.7 of this Annex; * the oil content of the effluent without dilution does not exceed 15 parts per million; * the oily mixture does not originate from cargo pump-room bilges on oil tankers; * the oily mixture, in case of oil tankers, is not mixed with oil cargo residues.	Discharge prohibited.
Oily residues (sludge) Oily residues (sludge)			
Other			

Source: MARPOL, Annex I.

Table 2 indicates that the discharge of oily waste at sea *is only allowed when the oily waste is treated and significantly diluted*, so that it cannot cause harm to the marine environment.[39]

Larger sized ships, with higher primary waste generation, *often have on-board treatment facilities*. Typically, *smaller sized ships have no or lower treatment potential*. The MARWAS model applies assumptions for values of combined on-board

[37] http://www.marpoltraining.com/MMSKOREAN/MARPOL/Annex_I/r15.htm and http://www.bsh.de/en/Marine_data/Environmental_protection/MARPOL_Convention/Discharge_regulations_in_Annex_I.pdf.

[38] The following European waters are special zones: Mediterranean Sea, Baltic Sea, Black Sea and North Western European Waters (Annex I).

[39] As an empirical rule, it is known that 15 ppm is the limit for no visual detection of oil on the sea surface.

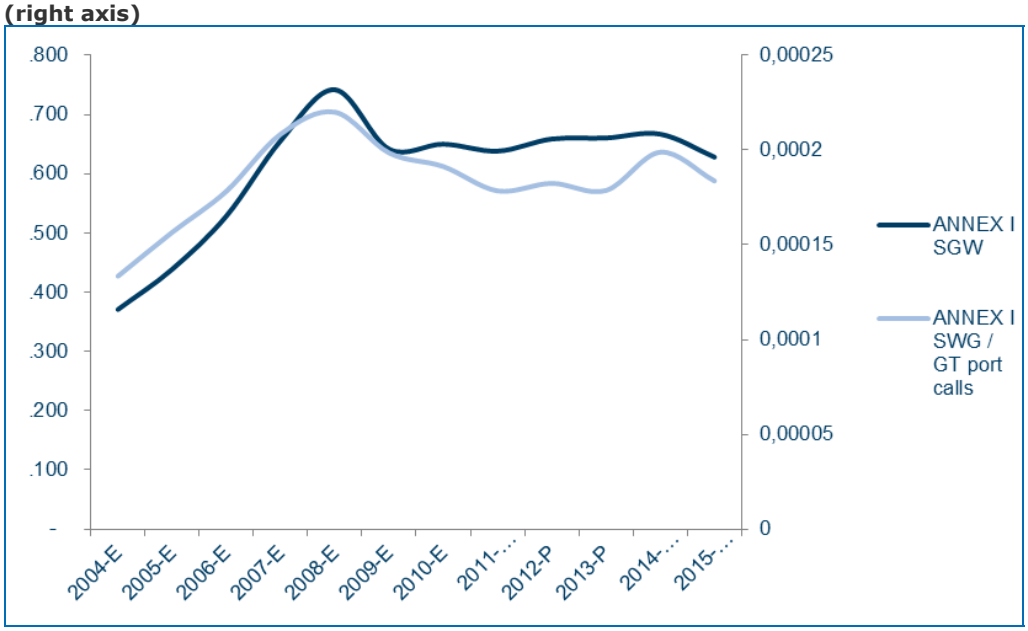
treatment and legal discharges for 16 vessel types and 5 size classes (see Annex 3). As indicated before, the average figure for combined on-board treatment and legal discharges for the relevant ship categories in MARWAS is estimated at 38%. MARWAS does not provide insight in the division between on-board treatment and legal discharges; hence an assessment of the size of these two groups cannot be made. Given the very strict MARPOL discharge norms, as presented in Table 2, it is expected that *hardly any legal discharges take place and the majority of the combined value consists of-board treatment*.

For fisheries and recreational boating, as vessels are typically small and volumes of oily waste generated per vessels are very low, it is assumed, in line with MARWAS, that no on-board treatment is taking place.

Delivery volumes and waste gap

Regarding the *delivery of oily waste* at port reception facilities, waste delivery data collected for 29 larger EU ports indicate that volumes of oily waste delivered to port reception facilities have doubled between 2004 and 2008, and have remained stable since, as shown in Figure 5.

Figure 5 ANNEX I oily waste SGW delivered in 1,000 tonne (left axis) and per unit of GT calls (right axis)



Source: delivery data collected by Ecorys from 29 merchant shipping ports.

The doubling of the waste volumes delivered between 2004 and 2008 may be explained as an impact of the implementation of the PRF Directive and more focus on waste delivery. The decrease of approximately 15 % from 2008 to 2009 is explained by the financial crisis and the resulting drop in maritime transport and activity in EU Member State ports, as also observed in port throughput data. The stable development from 2009 to 2015 is surprising, as economic activities picked up in this period. A reason could be that due to the residual value of oily waste, oily waste has been delivered to operators outside the official PRF system (oily waste has a commercial value, is cleaned and re-sold). Delivery of oily waste outside the official ship waste handling system is often seen in Asia, however, it is not possible to confirm whether this also occurs in Europe (as regulations should prevent this from occurring). If so, it will be on an individual basis and the responsibility would be at the discretion of the respective ship's captain. Currently, however, the oil prices are low and a drop in the delivery of oily waste is observed, which contradicts this hypothesis. The case studies do not point to any irregularities in regard of oily waste delivery trends.

Waste delivery data correlated for the amount and size of ships calling at the ports (measured by Gross Tonnage (GT) of all ships called) shows a similar pattern.

A comparison of estimates made for merchant shipping using MARWAS between net oily waste generated (taking account of treatment and legal discharges) and waste delivery data at ports indicates that the *waste gap is about 2.5% or 31,000 tonnes*, as illustrated in Table 3. This amount represents the potential amount of waste that is illegally discharged at sea. This order of magnitude is confirmed by interviews with representatives from ports and PRF operators.

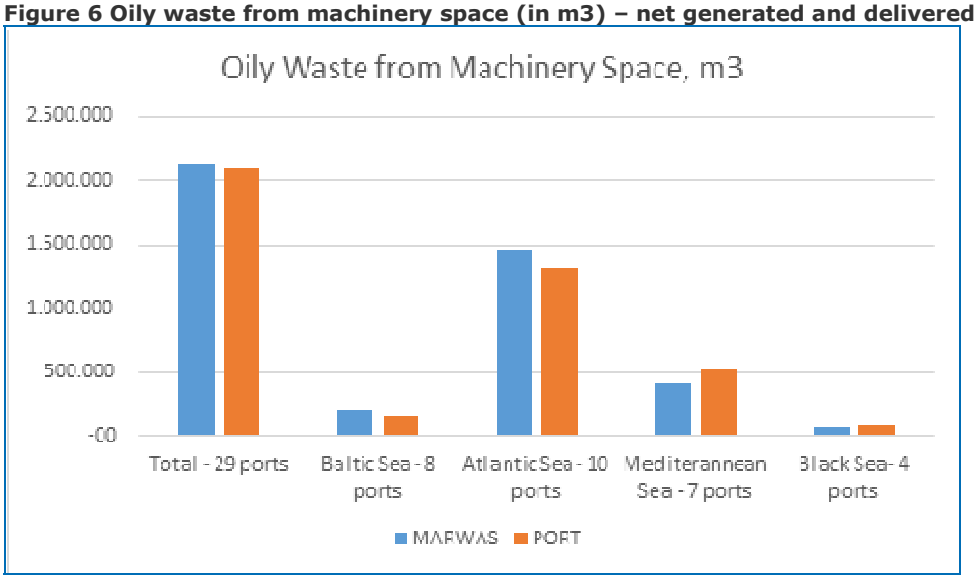
Table 3 Volumes of net oily waste generated and delivered in 29 EU ports, in 1,000 m³ (average annual volumes 2011-2015)

Waste to be delivered (after treatment and legal discharge)	Volume delivered waste	Waste gap
1,226	1,195	31 (2.5%)

Source: MARWAS calculations (generation), and port delivery data (collected by Ecorys).

Delivery levels are largely similar across EU sea basins, as illustrated in Figure 6.

Figure 6 Oily waste from machinery space (in m3) – net generated and delivered



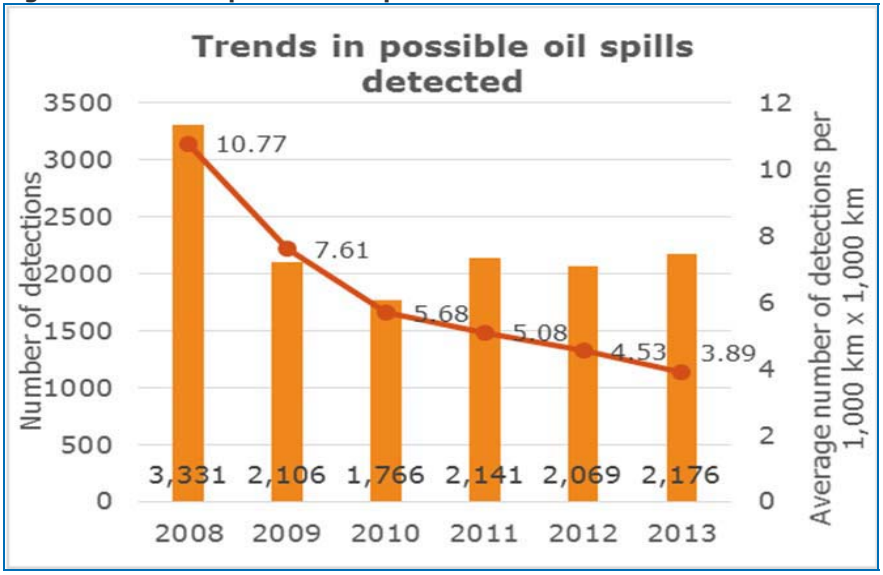
Source: MARWAS calculations and port data collected.

All areas except the Mediterranean Area show a smaller negative gap. The reason behind the positive gap for the Mediterranean Area (more delivered than generated) could be due to the traffic pattern and the assumption that long haul voyages may choose to deliver at their first port of call after passing the Suez Canal. The fact that the oil price has been high until 2014 further underlines that ships do deliver oily waste to ports, as it represents a commercial value and in some ports is even paid for, especially in Asia. Lack of port reception facilities in e.g. Asia before departure to Europe could also indicate accumulation of oily waste, then to be delivered to port reception facilities in Europe. The drop of oil prices by some 50% over the past year is reported to have impacted the volumes of oily waste delivery (Deloitte, 2016).

For the fisheries and recreational sector, no data on oily waste delivery is available.

Aerial surveillance data on oil spills detected in surface water indicate that the amount of oily waste discharged at sea has significantly decreased since the introduction of the PRF Directive (EMSA (2014), Bonn Agreement (2012)), as illustrated in the Figure 7[40].

Figure 7 Trends in possible oil spills detected



Source: EMSA (2014), Pollution Preparedness and Response Activities.

Information from PRF operators (Deloitte, 2016) indicates that oily waste, due to its commercial value, is typically kept on board to be delivered in a port where market conditions are most favourable (relating to oil prices and demand for oily waste). Such conditions may be found within, but possibly also outside, the EU.

Conclusion on Annex I waste

Based on a number of sources, it can be concluded that the illegal discharge of oily waste at sea has substantially decreased over time. Sources include the MARWAS analysis, the CE Delft study on ship-generated waste (2016), a review of delivery data of 29 larger ports, the ex-post evaluation (Panteia, 2015) and validation through case studies and interviews.

Notwithstanding the apparent progress in delivery, some oily waste that should be delivered in EU ports is not, indicating potential discharges into sea, causing harm to the marine environment. The gap between oily waste generated, corrected for on-board treatment and legal discharges (very limited amounts of untreated legal discharges are expected) versus the waste delivered in ports is estimated at *2.5%, equalling some of 31,000 $m^{3\ of}$ oily waste*.

5.1.2. Annex IV sewage

Definition

Under MARPOL, sewage is defined as drainage and other wastes from any form of toilets and urinals, medical premises, spaces containing living animals, or other waste waters mixed with the above.

[40] Note that these concern 'possible' oil spills, as not all dark areas on images collected are necessarily oil.

Primary and net waste generation

MARWAS assumes a sewage generation of 80 litres/person/day. CE Delft (2016) estimates a waste production of 10-60 litres /person/day of sewage, based on interviews and a survey on a handful of selected ships. An older source indicates 38 litres/person/day (Lester & Weeden, 2004). Eunomia (2016) refers to estimates by Butt (2007) of 20-40 litres/person/day. Various sources thus give different values, but all in the same order of magnitude.

An analysis by HELCOM (2014) for cruise ships in the Baltic Sea arrives at an estimated 170 litre/person/day (possibly this includes 'grey water' i.e. from showers, galley etc. but the report does not specify this), but also mentions that for instance the Port of Copenhagen considers volumes above 130 litres/person/day as disproportionally large.

MARWAS calculates the net waste generated (merchant shipping only). The average annual net waste generated for the 29 ports included in the analysis over the period 2011-2015 is *477 thousand m^3* (see Annex 3), resulting in an estimated *1.36 million m^3 at EU level*[41]. No data is available on total primary sewage generated, but if MARWAS assumptions for *combined on-board treatment and legal discharges* are applied (80-100% depending on ship type, taking *95%* as an weighted average) to the net waste generated volumes calculated by MARWAS, the *primary sewage generated by EU merchant shipping would be approximately 27 million m^3 annually.*

The fisheries and recreational sectors also generate sewage and typically those ships do not have on-board treatment facilities. Recreational vessels also typically operate within 12 nautical miles from shore. Furthermore, these segments are operating in port significant proportions of time (about 50% for fisheries vessels, and about 55% for recreational vessels), where they cannot discharge and therefore are normally delivered to port reception facilities (or even not generated on board, as recreational boaters will use shore toilet facilities). Estimates on the basis of the European recreational and fisheries fleet indicate a sewage generation of *1-1.5 million m^3 from the recreational boating sector* and about *1 million m^3 from the fisheries sector*, both thus of similar order of magnitude as the merchant shipping sector[42].

On-board treatment and legal discharges - MARPOL discharge regime

MARPOL Annex IV regulates the discharge of sewage. The regulations in Annex IV prohibit the discharge of sewage at sea, except when the ship has an approved sewage treatment plant in operation or when the ship is discharging comminuted and disinfected sewage using an approved system, at a distance of more than 3 nautical miles from the nearest land. Sewage, which is not comminuted or disinfected, can be discharged en-route and when not sailing at a special area at a distance of more than 12 nautical miles from the nearest land. Specific discharge prohibitions apply to special areas. The MARPOL discharge norms for Annex IV waste are outlined in Table 4.

[41] Assuming the same factor (35%) as applied in oily waste analysis and presented in the box in Section 5.1.1.
[42] See Annex 3 for assumptions underlying these figures.

Table 4 MARPOL discharge norms divided per waste category specified in Annex IV

MARPOL Annex IV[43] Waste category	Ships outside special areas	Ships within special areas[44]	Offshore platforms and all ships within 500 m of such platforms
Sewage	Discharge in principle prohibited unless ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land. Sewage which is not comminuted or disinfected may be discharged en-route and at a distance of more than 12 nautical miles from the nearest land.	Of the EU waters, only Baltic Sea is appointed as special area. Currently regulation is not yet in force. If in force only applicable to passenger ships. The following applies: discharge of sewage from passenger ships within the special area will generally be prohibited under the new regulations, except when the ship has in operation an approved sewage treatment plant which has been certified by the Administration.	See rules 'ships outside special areas'.

Source: MARPOL, Annex IV.

MARPOL thus allows for discharging when the ship operates outside special areas in less than within 12 and more than 3 nautical miles away from shore, provided the sewage is treated or comminuted and disinfected, so that the harm to the marine environment is minimised. As the discharges should take place under certain minimum sailing speeds and maximum discharge rates, the sewage will be diluted, further reducing its potential environmental impact.

It is observed that the *on-board treatment of sewage is significant and can be up to 100% for the larger sized modern cruise ships* (those that generate the largest amount of primary sewage). A calculation using the MARWAS model shows that of all primary sewage generated by merchant ships, typically *80-100% is treated on board and/or legally discharged*. It is not possible to make a breakdown of this percentage in (i) on-board treatment and (ii) legal discharges. Unlike MARPOL Annex I (oily waste) and Annex V (garbage waste), Annex IV discharge norms provide substantial opportunity for legal discharges of sewage for ships outside special areas. Hence, *the amount of legal discharges of sewage is expected to be substantial*.

Besides minimal treatment, more advanced physical, chemical and biological treatment systems are gradually gaining importance. Interviews with representatives of ports and ship owners, as well as discussions in the European Sustainable Shipping Forum (ESSF) PRF sub-group, confirm that on-board treatment and legal discharge are common practice.

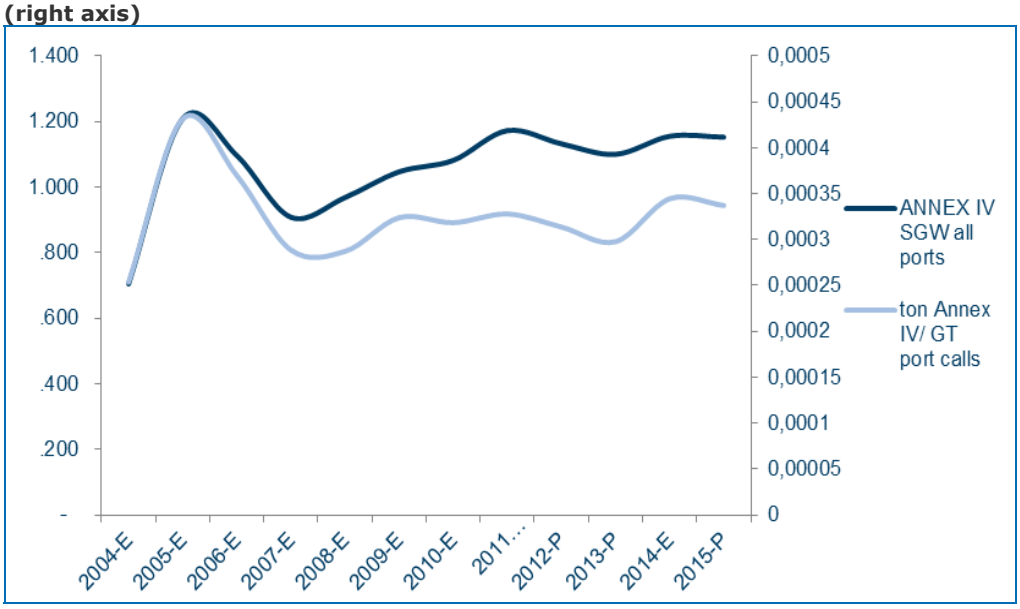
[43] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Sewage/Pages/Default.aspx, especially MEPC.157(55) and MEPC.227(64).
[44] The following European waters are special zones: the Baltic Sea (Annex IV).

It is noted that the *Baltic Sea is designated as a special area* under MARPOL Annex IV (effective as of 2019/2021) for sewage, where no discharges are allowed for passenger ships. As a consequence, *more advanced treatment technologies have been developed*, some of which requiring the mixing of sewage (black water from toilets etc.) with parts of grey water (from showers, galley etc.) so that more water is treated than only sewage, and consequently possibly more sewage sludge remains to be delivered, as this qualifies as 'black water'.

Delivery volumes and waste gap

The *port delivery data for sewage* in Figure 8 show a strong increase (75%) in sewage delivered from 2004 to 2005. which coincides with the revision and entry into force of MARPOL Annex IV (revision date: April 1, 2004 and entered into force on 1 August 2005). Since then, a decrease of between 2005 to 2008 was observed, with one possible explanation being that existing ships were required to comply with the provisions of the revised Annex IV five years after the date of entry into force of Annex IV, namely since 27 September 2008. Since 2008, a slight increase is observed. Note that the increasing cruise liner traffic to Member State ports does not seem to influence this pattern significantly, which might be explained by the improvements of sewage treatment technologies on board. It should be noted, however, that it is not certain that all ports have registered their cruise liner sewage delivery as part of their data, as some ports have special arrangements with cruise liners. Waste delivery data correlated for the GT calling the ports show a similar pattern.

Figure 8 ANNEX IV SGW sewage delivered – in 1000 tonne (left axis) and per unit of GT calls (right axis)



Source: delivery data collected by Ecorys from 29 merchant shipping ports.

Lack of registration of delivered sewage, e.g. from cruise liners (individual arrangements), and insufficient knowledge of on-board treatment facilities and legal discharges reduce the transparency regarding the amount of sewage delivered to port reception facilities, although some areas begin to map the sewage delivery more systematically, notably in the Baltic Sea[45].

When comparing the net sewage waste volumes with volumes delivered to 29 ports, a *sewage waste gap of 10%* or *136,000 m^3* is assessed, as presented in Table 5, indicating that this part of sewage is not delivered, so potentially discharged illegally.

[45] http://www.helcom.fi/action-areas/shipping/sewage-from-ships/overview-report/.

Table 5 Volumes of sewage generated and delivered, in 1000 m^3 (average annual volumes 2011-2015), EU merchant ports

Waste to be delivered (after treatment and legal discharge)	Volume delivered waste	Waste gap
1.362	1.226	136 (10%)

Source: MARWAS calculations (generation), and port delivery data (collected by Ecorys for 29 ports and aggregated to EU level).

The observed waste gap is confirmed in a study by HELCOM (2014) for the Baltic Sea, which reveals that *only 30% of cruise ship calls involve sewage delivery*. Reasons provided for this include statements on unreasonably high costs as, well as low capacity for waste delivery in some ports.

As delivery by the fisheries and recreational boating sector is currently not (required to be) notified, reliable data on volumes delivered by these ship categories is not available.

Conclusion on Annex IV waste

Based on a broad range of sources, including CE Delft (2016), MARWAS calculations, delivery data from 29 ports, HELCOM (2014), case studies and interviews, it is concluded that *primary sewage generated by EU merchant shipping would be approximately 27 million m^3.* However, the vast majority (95%) of this generated waste is expected to be treated on board and/or legally discharged. The division of on-board treatment and legal discharges is unknown, but given the room provided in the MARPOL discharge norms, it is expected that substantial amounts of swage waste are legally discharged. Based on annual sewage waste delivery volumes at ports a waste gap is established at *10%, or 136,000 m^3 of sewage.* This waste could potentially be discharged illegally, affecting the marine environment.

For the *recreational and fisheries sector volumes of net generated sewage are expected to be similar to those of the merchant sector*, however, no data on delivery are available, and as a result no waste gap can be assessed. *Less legal discharges are expected* in the recreational and fisheries sector, as fishing and notably recreational ships often operate near or in the ports.

5.1.3. Annex V garbage

Definition

Annex V covers garbage, including domestic waste, plastics, food waste, cooking oil, animal carcasses, fishing gear, operational waste and incinerator ashes. In addition, Annex V waste also includes cargo residues; mostly tank washings from dry bulk.

Primary waste generation

For household waste, MARWAS assumes a generation of 3 kg/person/day, resulting in approximately 190,000 tonnes for EU merchant shipping. This volume is more or less in line with the volume as established by Eunomia (280,000 tonnes, i.e. the sum of shipping, cruise and passenger as presented in Table 6. However, for other garbage categories the MARWAS model does not provide estimates.

The Eunomia study (2016) provides the most extensive estimates of waste generation for all Annex V waste on an aggregate level and per waste category, as illustrated in Table 6.

Table 6 Estimates of Annex V ship-generated waste for 2013 (tonnes)

Sector / waste stream	Shipping	Fishing	Cruises	Passenger	Recreational	Navy	Total	%
Annex V – domestic type waste	74,443	43,531	86,717	123,016	170,928	8,769	507,406	58%
Annex V – solid CR	122,521						122,521	14%
Annex V – fishing gear		218,467					218,467	25%
Annex V – Other operational type waste	27,074	4,305		360		867	32,606	4%
Total	**224,038**	**266,303**	**86,717**	**123,376**	**170,928**	**9,636**	**881,000**	
%	25%	30%	10%	14%	19%	1%		

Source: Eunomia, 2016.

Table 6 shows that the contribution of the various shipping segments differs between waste categories, where typically passenger ships (cruise, ferries, recreational boating) cover the majority of domestic waste (garbage), while (cargo) ships are the main responsible for MARPOL Annex V cargo residues and other operational waste. It should be noted that cargo residues are not limited to Annex V and that the figures presented in the table only cover cargo residues from dry bulk. In calculating the above figures, Eunomia already corrected for legal discharges of food waste.

On-board treatment and legal discharges - MARPOL discharge regime

Under MARPOL Annex V legal discharge of specific types of garbage is allowed, for example food waste, animal carcasses and cleaning agents can be legally discharged (mostly when the ship is beyond 12 nautical miles from the nearest coast). All other garbage, including plastics, domestic wastes, cooking oil, incinerator ashes, operational wastes, and fishing gear cannot be legally discharged under MARPOL. An overview of the discharge norms is presented in Table 7.

Table 7 MARPOL discharge norms divided per waste category specified in Annex V

MARPOL Annex V[46] Waste category	Ships outside special areas	Ships within special areas[47]	Offshore platforms and all ships within 500 m of such platforms
Food waste comminuted or ground.	Discharge permitted ≥3 nm from the nearest land and en route.	Discharge permitted ≥12 nm from the nearest land and en route.	Discharge permitted ≥12 nm from the nearest land.
Food waste not comminuted or ground.	Discharge permitted ≥12 nm from the nearest land and en route.	Discharge prohibited.	Discharge prohibited.

[46] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Garbage/Documents/2014%20revision/Annex%20V%20discharge%20requirements%2007-2013.pdf.
[47] The following European waters are special zones: Mediterranean Sea, Baltic Sea, Black sea and North Sea (Annex V).

MARPOL Annex V[46] Waste category	**Ships outside special areas**	**Ships within special areas[47]**	**Offshore platforms and all ships within 500 m of such platforms**
Cargo residues[1] not contained in wash water.	Discharge permitted ≥12 nm from the nearest land and en route.	Discharge prohibited.	Discharge prohibited.
Cargo residues[1] contained in wash water.		Discharge only permitted in specific circumstances[2] and ≥12 nm from the nearest land and en route.	Discharge prohibited.
Cleaning agents and additives[1] contained in cargo hold wash water.	Discharge permitted.	Discharge only permitted in specific circumstances[2] and ≥12 nm from the nearest land and en route.	Discharge prohibited.
Cleaning agents and additives[1] contained in deck and external surfaces wash water.		Discharge permitted.	Discharge prohibited.
Carcasses of animals carried on board as cargo and which died during the voyage.	Discharge permitted as far from the nearest land as possible and en route.	Discharge prohibited.	Discharge prohibited.
All other garbage including plastics, domestic wastes, cooking oil, incinerator ashes, operational wastes and fishing gear	Discharge prohibited.	Discharge prohibited.	Discharge prohibited.
Mixed garbage.	When garbage is mixed with or contaminated by other substances prohibited from discharge or having different discharge requirements, the more stringent requirements shall apply.		

Source: MARPOL, Annex V.
1. These substances must not be harmful to the marine environment.
2. According to regulation 6.1.2 of MARPOL Annex V, the discharge shall only be allowed if: (a) both the port of departure and the next port of destination are within the special area and the ship will not transit outside the special area between these ports (regulation 6.1.2.2); and (b) if no adequate reception facilities are available at those ports (regulation 6.1.2.3).

The MARPOL discharge norms *allow the discharge of organic and other relatively easy degradable waste, but prohibit the discharge of plastics*.

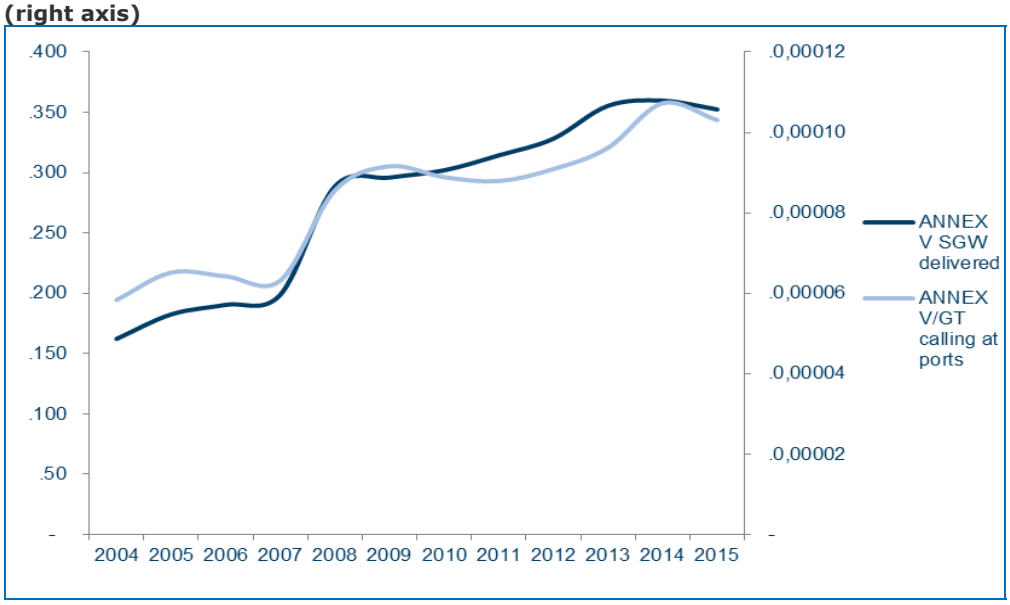
Eunomia assumes that food waste accounts for 17% of total Annex V domestic waste. Furthermore, they assume that fishing vessels, passenger ferries and recreational vessels are unlikely to have incinerators, but that about a quarter of shipping, cruise and navy vessels would have incinerators on board. This is in line with the MARWAS model, which assumes no treatment for small specialised vessels, and 20-30% on-board treatment of garbage for larger sized ships. For cruise ships, treatment (usually

incineration) is assumed to be up to 80%, an estimate confirmed by Butt (2007) who indicates that on cruise ships 75%-85% of residual waste is incinerated.

Delivery volumes and waste gap

Data on Annex V waste delivery to 29 ports show an increase in waste delivery by merchant ships since the implementation of the PRF Directive, as reflected in Figure 9, showing volumes higher than the amounts of waste generated as estimated by Eunomia (see Table 6).

Figure 9 ANNEX V garbage delivered – in 1000 tonne (left axis) and per unit of GT calls (right axis)



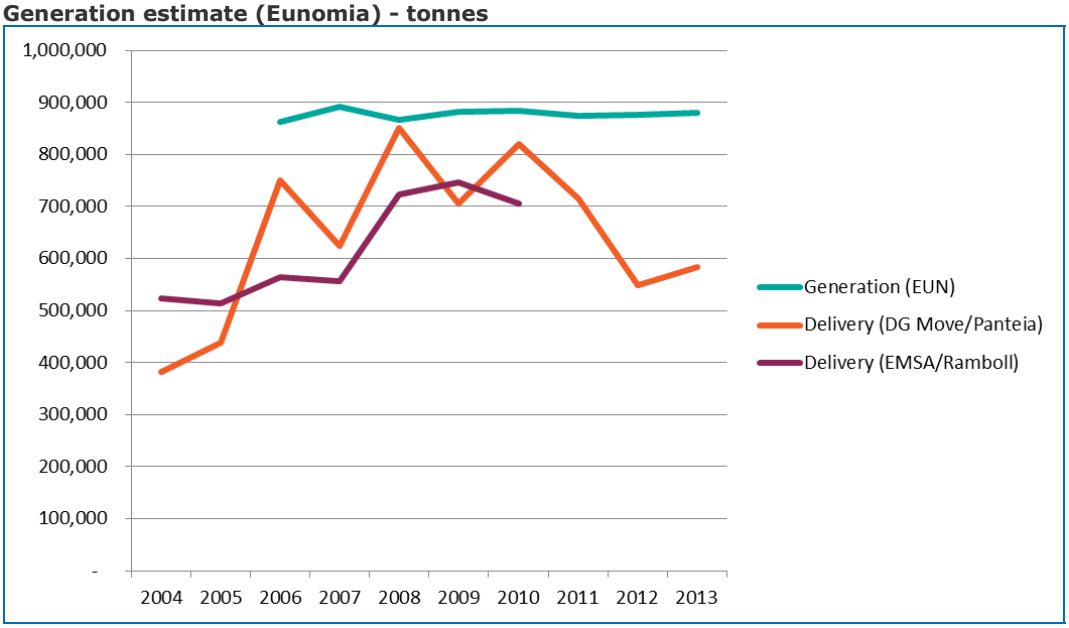
Source: Data from waste deliveries from 29 EU ports.

Figure 9 shows a clear increase in Annex V garbage delivery (all annex V waste types) from 2004 to 2014 (with a minor decrease in 2015), which can be explained by the implementation of the Directive. The individual variations are more difficult to explain. The unchanged garbage volume delivery in 2009-2010 is probably due to the financial crisis. The slight increase in delivery from 2011-2014 could be explained by the increasing cruise liner traffic, leading to an increase in garbage delivered. However, this cannot be verified as ports do not specify from which shipping segments the received waste is derived. Further to this, it is noted that some cruise liners or ferries have entered into special agreements with the ports/garbage operators (possible under Article 9 of the PRF Directive) and therefore do not notify their garbage before arrival in port; likewise, the delivery of waste by these exempted vessels is not registered. This is, for instance, the case for DFDS at the port of Copenhagen, where the liner is exempted from notification and handles the waste itself. Therefore, their waste is not registered in the PRF system of the port and, hence, not included in the statistics. Also in other case study ports (Le Havre, Genova), a significant share of calls is exempted.

In order to estimate the *waste gap for garbage*, Eunomia has made a comparison between total waste generated and waste delivered, using their own delivery estimates based on studies by Panteia (2015) and Ramboll (2012). *Generated waste* is estimated at a rather constant level of some *881 thousand tonnes*. *Waste delivered* strongly varies on a year by year basis in the figures presented by Eunomia, *ranging from 580 to 820 thousand tonnes* in the period 2009-2013, as shown in Figure 10. Figure 10 makes clear that delivery patterns have been rather volatile, so that the gap between generation and delivery has been fluctuating, and the findings should

therefore be considered with care. Based on the above, *the waste gap varies from 61 to 301 thousand tonnes or 7-34%.*

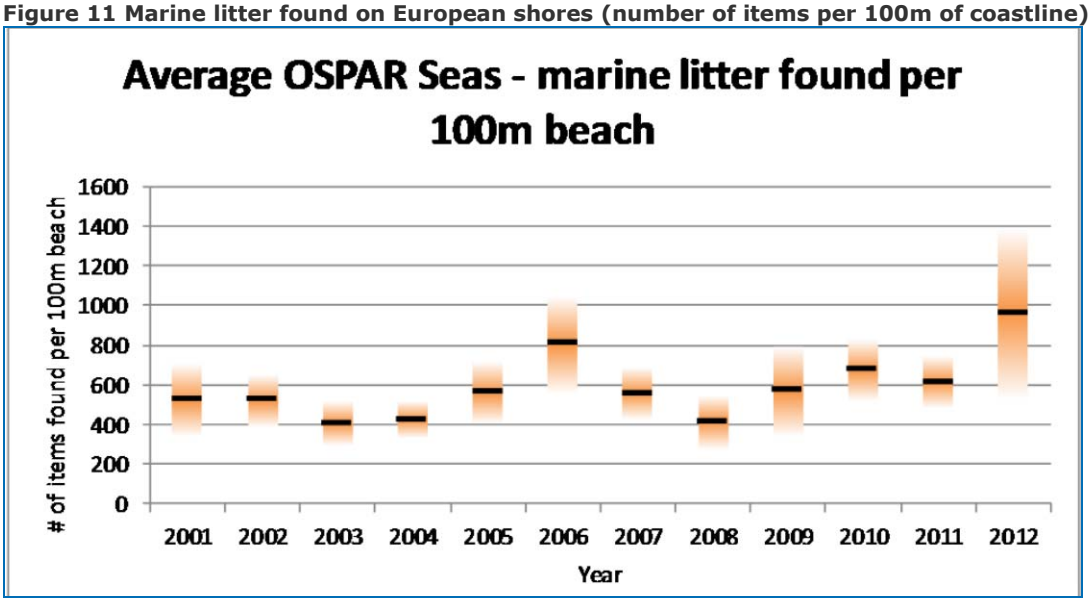
Figure 10 Delivery estimates based on EMSA/Ramboll (2012) and DG Move/Panteia (2015); Generation estimate (Eunomia) - tonnes



Source: Eunomia (2016).

At the same time, time series data from marine litter monitoring programmes (OSPAR, 2012) do not indicate a reduction of the amount of marine litter in European seas, as shown in Figure 11.

Figure 11 Marine litter found on European shores (number of items per 100m of coastline)



Source: OSPAR (in Panteia, 2015).

It should be noted that given the high share of marine litter from land-based sources, the above developments cannot be directly linked. However, a study by Sá *et al* (2015) finds evidence that significant higher concentrations of Annex V waste float near dense shipping routes (operational waste and packaging material), compared to the areas with little shipping traffic, thus indicating a significant contribution of the (merchant) shipping sector to waste at sea.

For the *fisheries sector*, apart from ship-generated waste, more specific estimates exist in relation to fisheries equipment, including so-called abandoned, lost or otherwise discarded fishing gear (*ALDFG*), ranging up to 220,000 tonnes per year for the EU as a whole (calculation based on Eunomia (2016), see Annex 3). Data from fishing for litter programmes initiated over the past decade suggest that the amount of ALDFG is gradually decreasing, but still a lot of 'old' ALDFG is in Europe's seas.

Plastics are the most abundant debris found in the marine environment and comprise more than half of marine litter in European Regional Seas, according to Eunomia (2016). They estimate figures of 54,000 to 145,000 tonnes of plastic per year entering the marine environment from land-based sources. Visual surveys and surface trawls indicate a stock of plastics floating near the surface to be in the order of 268,000 tons, to which European seas are accounting at least 30% (Five Gyres Institute, 2014 as reported in Eunomia, 2016). These figures do not take into account plastics that sink or to micro-plastics that cannot be visually observed, indicating that the overall stock of plastics in the marine environment is significantly larger. Eunomia (2016) provides a more detailed analysis of marine litter and its various forms of presence in the seas, concluding that the concentration of litter items on the sea floor is higher than floating on the surface.

Analyses of the *origin of marine litter* found in the European seas and on its shores indicate that a substantial part originates from ships, but various sources use different estimates, caused by different measurement methods. JRC (2016) outlines methods of identifying the source of litter, but also indicates the complexity and limitations of doing so. See Eunomia (2016) for a discussion on various sources and methods. In any case, Ocean Conservancy (2012) reports 12% of marine litter to be of sea-based sources for the EU as a whole, and 20% for the North-East Atlantic. When Eunomia (2016) corrects this figure for weight factors, the EU figure would increase to 32%. Arcadis (2012) gives an estimate of 34%, and provides a breakdown by sea basin showing higher estimates for the North-East Atlantic (50%) and the Black Sea (48%). Arcadis also gives an indication of the proportion of the sea-based waste coming from the fisheries sector versus other shipping segments, suggesting that the fisheries sector is responsible for some two thirds of sea based garbage.

Table 8 Share of marine litter from sea based sources

Source	Baltic Sea	North East Atlantic	Mediterranean Sea	Black Sea	EU average
Ocean Conservancy (2012) – waste count		20%			12%
Idem, weight corrected (Eunomia, 2016)					32%
Arcadis (2012)	18%	48%	16%	50%	34%
• Of which fishing sector.	9%	42%	9%	24%	22%
• Of which other shipping.	9%	6%	7%	26%	12%

Eunomia (2016) discusses the limitations of data and methods applied by Ocean Conservancy and Arcadis, and, also referring to other sources (Van Franeker et al., 2010 and Ioakeimidis et al., 2014), *assumes a general split of 20-40% of marine litter being derived from sea-based sources.*

As the MARPOL discharge regime prohibits the discharge of plastics and other non-degradable garbage, it is expected that all this sea-based litter has ended into sea through illegal discharges.

Conclusion on Annex V waste

The amount of marine litter found in European seas remains at a rather constant level and time series of marine litter on European shores indicate that the problem has persisted since the implementation of the PRF Directive. Although land-based sources are dominant in generating marine litter, *sea-based sources actively contribute to the problem with an estimated EU average 32% and values up to 50% for some sea basins.* Comparison of waste generation and delivery indicates *a waste gap ranging from 61,000 to 301,000 tonnes or 7-34%* based on the data from EMSA/Ramboll (2012), DG Move/Panteia (2015); and Eunomia (2016).

It is estimated that the *fishing and recreational boating sectors are relatively large sea-based sources contributors, with shares of 30% and 19%* respectively according to Eunomia (2016) - the balance provided by merchant shipping, and 65% for fisheries alone according to Arcadis (2012). Although garbage delivered in ports has increased since the adaptation of the PRF Directive, a significant waste gap still remains.

5.1.4. Annex VI (scrubber waste, ozone depleting substances)

Definition

Under MARPOL Annex VI strict requirements regarding emission levels are adopted. A range of waste types are included in Annex VI, such as Exhaust Gas Cleaning Systems (EGCS) waste, also referred to as scrubber waste, and ozone depleting substances (ODS). This analysis concentrates on scrubber waste; as ODS is mainly handled through repair yards, which are covered by the Waste Framework Directive[48].ODS itself is dealt with by Regulation 1005/2009 on substances that deplete the ozone layer. The main reason for focusing on scrubber waste in this analysis is that the generation of this category of waste is expected to increase as a result of stricter emission regimes currently being implemented, in particular the Sulphur ECA zones in the North Sea and Baltic Sea.

Primary waste generation

The use of scrubbers is one of several possibilities to comply with low emission standards. The use of scrubbers results in the generation of so-called *scrubber sludge*; categorised under MARPOL Annex VI. Currently, Annex VI waste is not regulated by the PRF Directive. This type of waste is, and will continue to be, *mainly generated by merchant shipping*, as their ship engines run on heavy fuel oil for which abatement measures are required, at least in Sulphur Emission Control Areas (SECA). *Fisheries and recreational boating hardly contribute to the generation of scrubber waste*.

Scrubber sludge is currently *generated in limited volumes only*, due to the fact that the number of ships with on-board scrubbers is still small. Volumes of waste generated have not been studied widely, but from a *survey by the ESSF sub-group on Exhaust Gas Cleaning Systems*, some indications can be derived. According to their data, some *400 scrubbers* have been sold up to now. It is indicated that these concern both open loop and closed loop scrubbers. Open loop scrubbers take in sea water, use it for scrubbing, then treat it and discharge it back into sea, whereas closed loop scrubbers use fresh water from a holding tank that, after use and treatment, is used again, while the treatment gives wash water bleed-off and sludge.

[48] Directive 2008/98/EC.

The same survey provides indications that closed loop scrubbers would generate 1kg of dry matter per MWh, or 20 kg/MWh sludge in total (assuming 5% dry matter content). For an average ship with a 15MW engine, operating 4,000 hours per year, this would imply 60 tonnes of dry matter or 1.2 million tonnes of sludge (approximately 1,200 m^3). Open loop scrubbers are reported not to generate any sludge. It is also reported that closed loop scrubbers bleed-off about 0.3 m^3/MWh. If an average RoRo ship is assumed to have installed power of 15 MW, this gives 4.5m^3 of waste per hour. Assuming an average engine running time of 4,000 hours per year, one ship would thus generate 18,000 m^3/year.

The *total volume of scrubber waste* generated for all ships then depends on the share of closed loop scrubbers.[49] If 5% of the current 400 scrubbers would operate in closed loop mode, the total volume of waste generated would be *24,000 m^3 sludge* (1,200 m^3 dry matter) and *360,000 m^3 of bleed-off*.

Scrubber waste volumes are expected to increase in the future as a result of a growing uptake potential of scrubbers, driven by regulatory measures including SECA zones in Europe, and announced global sulphur content limits. Any estimate on future volume is, however, premature, as it is uncertain how the shipping sector will respond to upcoming legislation (i.e. investing in scrubbers and choosing between open-loop or closed-loop systems, or switching to cleaner but more expensive fuels). In addition, estimates of generation of sludge when using open-loop systems do not exist, as was concluded by the PRF subgroup of EGCS (2016). Moreover, the recent study by CE Delft (2016) commissioned by EMSA concluded that it has proven difficult to provide a range of waste generation on-board ships for this type of waste.

As market uptake of EGCS can be monitored, ports and PRF operators can monitor and adjust required capacity accordingly.

On-board treatment and legal discharges - MARPOL discharge regime

Under MARPOL Annex VI, strict requirements regarding emission levels are adopted (see Annex 14). However, an important deviation from Annex VI compared to all other MARPOL Annexes is that the emission norms do not deal with discharges at sea, but instead concentrate on air emissions. As annex VI emissions are generated by the maritime sector, they are under the scope of MARPOL.

Scrubbers are one of several possibilities to comply with low emission standards required in Sulphur Emission Control Areas (SECAs). Currently, Annex VI waste is not regulated by the PRF Directive.

The EGCS survey indicates that currently the majority of scrubbers sold are open loop systems, thus discharging wash waters and not generating any sludge. However, specific figures on the share of open loop scrubbers and the time they are operated in open loop mode are not presented. The survey also indicates that closed loop systems still have some discharge (0.1-0.3 m^3/MWh), although closed loop systems are also stated to be able to operate with zero discharge for limited periods, depending on storage of bleed off water).

Delivery volumes and waste gap

Data on delivery of Annex VI waste is not available, also because this category is currently not separately included in the PRF Directive. Therefore, no gap can be calculated. In absolute terms, the amount of potential waste to be delivered would

[49] A verification of these figures and assumptions has been asked from EGCSA, but at the time of writing had not yet been received.

currently be small as the number of scrubbers currently in use is very low, and a large share of these are open-loop scrubbers, which can legally discharge at sea.

Conclusion on Annex VI waste

While the current volumes of Annex VI waste generation are limited, environmental legislation will drive the demand for increased use of exhaust gas treatment systems, causing a growing volume of Annex VI waste generation. An important factor is the ratio of closed versus open loop scrubbers.

5.1.5. Cargo residues

Cargo residues have been defined under the PRF Directive as 'remnants of any cargo material on board in cargo holds or tanks which remain after unloading procedures and cleaning operations are completed and shall include loading/unloading excesses and spillage'. As such, they include both cargo residues as defined in MARPOL Annex V, and tank washings falling under MARPOL Annexes I (oily tank washings) and II (tank washings containing noxious liquid substances).

The PRF Directive states in Article 10 that cargo residues are to be delivered to a port reception facility in accordance with the provisions of MARPOL. MARPOL allows for discharges of Annex I and II wash water under strict conditions and a general prohibition of discharges of cargo residues under Annex V (see Table 7), with the exception of non-harmful categories of residues and under predefined conditions.

The issue of cargo residues is very different from ship-generated waste and more complex. Cargo residues fall outside the scope of both Article 7 (delivery obligation) and Article 8 (fees) of the Directive, and are regulated under Article 10 (referring to MARPOL) instead. In contrast to ship-generated waste, cargo residues can vary widely. They may also still have a commercial value and therefore usually remain the property of the cargo owner. At the same time, depending on the type of residue, they may require special handling, equipment or treatment. As a result, cargo residues are normally a matter for the terminal operators and shippers to handle, rather than being under the direct competence of the port authorities. The costs are normally covered by the cargo owners (although the ship and/or its agent may also be involved). PRF providers are also used, in case the cargo owners are not interested and/or the terminals cannot take the residues.

Regarding oily tank washings under Annex I CE Delft (2016) concludes that these are only generated on oil tankers, whereas cargo residues are mostly generated by cargo ships (mainly dry bulk carriers). The amount generated depends on several factors such as the type of cargo, the handling equipment and the efficiency of the stevedores. Results from interviews concluded that the amounts generated per washing, per cargo tank, ranged from 1 to 2 m^3 (CE Delft, 2016).

The inventory of waste delivery to ports has found that data on cargo residues is lacking in many ports, which is attributed to the fact that cargo residues are often delivered to terminal operators rather than PRF operators. As a result, data provided regarding the delivery of cargo residues is quite limited and shows strong fluctuations between years, for both types (oily and solid residues in tank washings). Conclusions on any waste gap cannot be given as a result of above-mentioned limitations. However, as cargo residues have a residual value and thus delivery implies revenues instead of costs, it is generally regarded that this is a sufficient incentive to deliver cargo residues and not discharge them at sea. Nonetheless, volatile commodity market prices affect the attractiveness of delivering cargo residues; if the market price is low, there is less of an incentive to deliver cargo residues. This is currently the case for oily residues due to the low oil prices.

5.1.6. Summarised waste gaps

Table 9 summarises the volumes of waste generated and delivered, resulting in a waste gap for all waste streams. It should be noted that no waste delivery data are available for the fishery and recreational boating sectors for oily and sewage waste. As a consequence no waste gap for these sectors could be established. In addition, no waste delivery data are available for scrubber waste, hence no waste gap can be assessed for scrubber waste either.

Table 9 Volumes of waste generated, delivered, and waste gap

Category	Annex I - oily waste		Annex IV - sewage		Annex V - garbage		Annex VI -scrubber waste
Category	Merchant shipping	All, including fishing and recreational craft	Merchant shipping	All, including fishing and recreational craft	Merchant shipping	All, including fishing and recreational craft	All (only applicable for merchant shipping)
Primary waste generation (1)	Appr. 2 mln m^3[50]	Merchant: 2 mln m^3 Fishing vessels: 55,000 m^3 Recreational craft: 9,000 m^3	Appr. 27,2 mln m^3[51]	Merchant: 27 mln m^3 Fishing vessels: 1,0 / 1,5 mln m^3 Recreational craft: 1,0 mln m^3	434,000 tonnes	881,000 tonnes, consisting of 434,000 tonnes (merchant); 266,000 fishing and 171,000 recreational craft)[52]	*Unknown*
Treatment/legal discharge (2)	38%[53] of (1) = 750,000 m^3[54]	Close to zero from fishing and recreational craft, thus limited to merchant shipping, i.e. 700,000 m^3	80-100% of (1) – assuming average 95% = 25.8 mln m^3[55]	High for merchant shipping - average 95% = 25.6 mln m^3, Fishing vessels: 50% = 0.5 / 0.75 mln m^3[56]: Recreational craft: 55% = 0.55 mln m^3	*Unknown*	*Unknown*	*Unknown*

[50] The exact figure calculated is: 1,977,419 m^3.
[51] The exact figure calculated is: 27,240,000 m^3.
[52] The balance of waste generated (10,000 tonnes) is created by navy.
[53] 38% is based on the most relevant ship categories used in MARWAS.
[54] The exact figure calculated is: 751,419 m$^{\#}$.
[55] The exact figure calculated is: 25,878,000 m^3.
[56] The waste deducted from waste produced for fishing and recreational craft is based on time of fishing vessels and recreational craft in ports.

Category	Annex I - oily waste		Annex IV - sewage		Annex V - garbage		Annex VI -scrubber waste
Category	**Merchant shipping**	**All, including fishing and recreational craft**	**Merchant shipping**	**All, including fishing and recreational craft**	**Merchant shipping**	**All, including fishing and recreational craft**	**All (only applicable for merchant shipping)**
Waste to be delivered - after treatment and legal discharge (3) = (1) – (2)	1,226,000 m^3	1,290,000 m^3 Merchant: 1,226,000 m^3 Fishing vessels: 55,000 m^3 Recreational craft: 9,000 m^3	1,362,000 m^3	Merchant: 1.362 mln m^3 Fishing vessels: 0.5 / 0.75 mln m^3 Recreational craft: 0.45 mln m^3	434,000 tonnes[57]	881,000 tonnes	24,000m3 sludge 360,000 m3 bleed-off (generated by scrubbers operating in closed-loop mode, i.e. 5% of 400)
Actually delivered (4)	1,195,000 m^3	*Unknown, as waste delivery data for fishing ports and marinas are unknown*	1,226,000 m^3	*Unknown, as waste delivery data for fishing ports and marinas are unknown*	Range from 286,000 to 404,000 tonnes[58]	Range from 580,000 to 820,000 tonnes	*Unknown*
Delivery gap (3) – (4)	**31,000 m^3 (2.5%)**	*Unknown, but consisting of 31,000 m^3 caused by merchant shipping and a small expected contribution from fishing vessels and recreational craft*	**136,000 m3 (10%)**	*Unknown*	**Between 30,000-148,000 tonnes (7-34%)**	**Between 60,000-300,000 tonnes (7-34%)**	*Unknown*

Source: MARWAS (Annex I-IV waste); Annex V waste estimates are based on Eunomia (2016).

[57] Based on data from Euonmia (2016), including the identified sectors: shipping; cruises; and passenger.
[58] To get insight in the delivery data of the merchant sector, the total delivered waste volumes are applied to the share of waste produced by merchant shipping (thus considering a common garbage delivery pattern per sector).

5.1.7. Evolvement of the problem in absence of EU intervention

The above analysis shows the current magnitude of the problem of discharges of waste into sea under the current PRF Directive. For justifying action, a perspective on the autonomous evolution in the future is relevant. This will depend on *economic, technological, and legal trends*. IN order to come to a future evolvement the following assumptions have been made:

- The *expected growth of shipping*, driven by global economic and trade growth. Growth predictions range from 2.5% to 6% volume growth per year.[59] [60] For the cruise sector, a growth of 4.5% per year is considered, based on historic data of CLIA.[61] For the fisheries fleet, a 6% decline per year is observed over the past year and taken as a proxy for the near future, while for the recreational boating sector, an annual growth of 3% is considered;
- *Ship size developments*, which will create a cushioning effect on waste generation, as larger ships generate lower amounts relative to their volume of cargo carried. Growth of ship size is most visible in the container segment, with an average ship size increase of about 5% [62] [63], and in the cruise segment, with an annual increase of about 4%.[64] [65] For other ship types, sizes do not increase much, and a 0% annual change is taken;
- *Technology developments* vis-à-vis particular waste categories, notably:
  - *Changes in the fuel mix* leading to less oily sludge production. With an increased use of LNG and MGO as opposed to HFO, and an upcoming global cap on sulphur contents in HFO (as of 2020 (MEPC(70)), a significant reduction of oily sludge may be expected;
  - The *uptake of Exhaust Gas Cleaning Systems* (EGCS, often referred as scrubbers), leading to the generation of scrubber sludge. So far, only about 400 scrubbers have been installed[66], and no distinction between data for closed and open loop scrubbers is available. This number appears still small, even since the entry into force of the Sulphur emission control areas in the Baltic and North Sea,[67] which is attributed to the low fuel prices, making the alternative of shifting to low sulphur fuels more attractive than investing in after treatment equipment. This might change in the future. Moreover, an extension of low sulphur regimes (including the aforementioned global sulphur cap) could boost the uptake. In any case the uptake scenarios are highly uncertain. Based on trend analysis a low and high scenario could be assumed:
- *Low market uptake scenario*

  This scenario is based on projections made by DNV-GL[68]. They estimate that the market penetration of scrubbers will be maximum 25% in 2020. This means that between 2015 and 2020 the uptake of scrubbers will cover 5% of the fleet per year. After 2020 DNV-GL assumes that the market for scrubbers will be stable at the level of 25%.

[59] Panteia (2015), 'Study on the Analysis and Evolution of International and EU Shipping'.
[60] OECD (2011), 'Strategic Transport Infrastructure Needs to 2030'.
[61] CLIA (2015), 'Cruise industry outlook 2016).
[62] Based on UNCTAD shipping statistics.
[63] https://www.statista.com.
[64] ISL (2016) 'Shipping statistics and market review 2016, volume 60 - No. 8'.
[65] http://www.cruiseindustrynews.com/cruise-industry-analysis/orderbook-data.html.
[66] Report from ESSF sub-group on Exhaust Gas Cleaning Systems (2016).
[67] The Report from the ESSF sub-group on Exhaust Gas Cleaning Systems (2016) also mentions that the global Low S cap of 0.5% may provide a stronger case for installation of EGCS, but that some EGCS may be marketed as being 0.5% equivalent instead of 0.1%, and in doing so greatly reduce size, cost and wash water requirements.
[68] DNV-GL (2013), 'An outlook for the maritime industry towards 2020 – future development in maritime shipping'.

- *High market uptake scenario*

  This scenario is based on projections made by ENSYS Energy & Navigistics Consulting in combination with IMO. [69] This study assumes that the market uptake of scrubbers in 2020 is 18%. Between 2020 and 2025 the uptake of scrubbers will further grow to a level of 60% by 2025 (an annual increase of 5%). After 2025, a saturation is assumed.

  Both scenarios imply that the share of the fleet not opting for EGCS will thus opt for a shift to cleaner fuels.

  - In addition to this, *ongoing technological advancements* may contribute to lower amounts of ship-generated waste per unit of shipping. The 2016 CE Delft study for EMSA, however, does not provide any further (quantified) information in this regard. Rather, they conclude that technical advancement tends to mirror the development of new legislation rather than to promote efficiency.

These assumptions result in a prediction of the evolution of waste generation by ships, which for *sewage and garbage show an increase along with the growth of shipping*. For *oily waste*, the introduction of a global sulphur limit for HFO can lead to a *significant drop by 2020 after which a gradual increase would take place*, following the future growth of shipping. For annex VI waste, high uncertainties on the uptake result in widely diverging scenarios.

The impact of initiatives already undertaken, in particular the Amendment of Annex II – PRF Directive, the PRF Interpretative Guidelines, the EMSA Technical guidelines, and the Common information and monitoring system, is still premature. While these initiatives are aimed to increase waste delivery (and as a result lower the waste gap or discharges at sea), their exact impact still needs to materialise, and quantitative estimates are not available. Generally, members of the ESSF PRF sub-group interviewed indicate benefits of these actions, although their magnitude varies between ports, depending on current and past practices (already in line with guidelines or not). Open Public Consultation responses suggest that these initiatives will contribute to an increase of waste delivery by some 5%, thus reducing discharges into sea.

To summarise, it is expected that *waste generation will increase for almost all waste categories*, while *delivery is also expected to improve due to recent initiatives*. Which of those two forces will be overriding is uncertain, but is seems likely that the autonomous growth of the shipping industry and waste generation will be in orders of magnitude above and beyond 5%. This would call for a need for further EU intervention to promote good waste practices. In Annex 3, detailed assumptions and scenario results are presented.

5.1.8. Environmental vulnerability

The discharge of ship-generated waste and cargo residues at sea is a problem, as it damages the marine environment and ecosystems. The concept of environmental vulnerability is used to assess the environmental impact of waste discharged at sea.

Link to WFD and MSFD

The Water framework Directive[70] and the Marine Strategy Framework Directive[71] both contain objectives on improving water quality and the marine environment. In particular, the MSFD specifies 11 descriptors for Good Environmental Status, one of which is marine litter (the physical waste in the sea, caused by the disposal of garbage

[69] Ensys Energy & Navigistics consulting (2016), 'Marine Fuels Outlook Under MARPOL ANNEX VI'.
[70] Directive 2008/98/EC (Waste Framework Directive).
[71] Directive 2008/56/EC (Marine Strategy Framework Directive).

either from land or sea sources). Other descriptors have a more indirect relation to waste discharges.

Environmental vulnerability factors

The analysis of environmental vulnerability is based on the assumption that quantitative data on mass flows (volumes of waste discharged into sea) is available for each sea basin. Analyses has been based on a range of sources including sources on ship waste generation (the MARWAS model, literature incl. Eunomia, EMSA 2016 and CE Delft 2017), waste delivery data (data from 29 ports, Panteia 2015), and literature on waste found in sea (Eunomia 2016, UNEP, Panteia 2015, and various others, as listed in Annex 1).

Environmental weighting factors

The environmental vulnerability assessment weights the different waste categories depending on the level of vulnerability of marine ecosystem in the various sea basins. As such, the assessment gives values that relate to species diversity, in relation with biological activity and resilience. These all differ between all the European sea basins, as studied in past projects (BEAWARE, BRISK).

The ***environmental vulnerability is weighted per waste category and per sea basin, addressing four environmental categories (species, habitat, protected area, and socio-economic factors)***, and takes into account the response to waste impact with regards to fate, impact severity, length of interruption, and possible compensation. These factors are explained in Annex 15. The sum for the weights for each four categories is then taken as the overall vulnerability score for the waste category and sea basin. A summary of the resulting scores for the four sea basins and three waste categories describes the relative vulnerability and is presented in Table 10. Sensitivity analyses using different assumptions from a range of scientific experts result in variations to these weights of 10-13%.

Table 10 Summary of relative environmental vulnerability for three ship-generated waste types in four regions of European Seas

Sea basin	Oily waste	Sewage	Garbage
Baltic Sea	27	22	35
East Atlantic Ocean	28	19	35
Mediterranean Sea	24	24	35
Black Sea	28	19	35

Source: COWI.

Combining the environmental vulnerability scores with volumes of waste discharges

The above environmental vulnerability scores are of a rather similar magnitude, with a factor of almost two between the lowest (sewage in the East Atlantic and the Baltic) and the highest (Garbage in all basins) scores.

The environmental vulnerability scores can be combined with the volumes of waste discharges. The waste gaps, as summarised in Table 9, providing a proxy for *illegal discharges* at sea, indicate that the garbage waste gap is relatively large. The corresponding environmental weight and thus negative impact to the marine environment for garbage is also severe.

On the other hand there is the issue of *legal discharges*, as established in the relevant previous sections. Legal discharges are expected to consist mostly of sewage, with relatively little legal oily and garbage waste discharges according to MARPOL norms.

The corresponding environmental impact of legal discharges of sewage is less severe, as sewage waste has a lower average environmental vulnerability score, compared to the other waste categories.

5.2. Main problem 2: Administrative burden

5.2.1. Identification of administrative burden

The implementation of the PRF Directive has created administrative burden to stakeholders involved, notably port users. The approach towards administrative burden is described in Section 3.2.2. The ex-post evaluation (Panteia, 2015), in which the problem of administrative burden has been addressed extensively and the effect of administrative burden on different elements of the PRF Directive has been highlighted, estimated the total annual administrative costs to be approximately 97 million Euros. The main elements creating administrative burden are presented in Table 11[72].

Table 11 Annual administrative costs caused by the PRF Directive (million Euro)

Administrative costs	Stakeholder
Costs for developing and updating WRH plans and related inspections	Ports
Costs for checking and approving the WRH plans, combined with costs related to dealing with exemptions	Member States authorities
Costs due to advance notification	Port users
Costs due to advance notification	Ports
Costs due to inspection	Port users
Costs due to inspection	Inspection authority

Source: ex-post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues.

Table 11 shows that advance notifications are contributing to administrative costs, especially for port users. While advance notification is a clear requirement of the PRF Directive, two-third of port users consider related administrative costs to be too high (Panteia, 2015). The administrative costs can partly be considered as unnecessary. These unnecessary costs are mostly the case for stakeholders for whom *administrative procedures are not part of their core business, notably port users and PRF operators*. For stakeholder groups as Member States and port authorities, administrative procedures are more mainstreamed in regular work procedures and therefore are less likely to be considered and felt as unnecessary.

For port authorities, administrative burden is often caused by the fact that ports use their own system in parallel to the Common Monitoring and Information System which is being developed at EU level, based on SSN and THETIS-EU. The case studies indicated that data is not systematically exchanged between ports or Member States. In addition, (unnecessary) administrative burden is caused by inconsistent or insufficient implementation of the PRF Directive; as well as legal inconsistencies between MARPOL and the PRF Directive. These latter causes are elaborated below.

Inconsistent or insufficient implementation of the PRF Directive

The administrative burden is created by the way the provisions in the PRF Directive have been implemented across ports and Member States in Europe. Lack of consistent implementation of the PRF Directive causes (unnecessary) administrative burden, as illustrated in the following areas:

[72] Note that this table provides an overview of the administrative costs. Not all administrative costs are considered as excessive administrative burden.

- *Development of WRH Plans (including transparency).* The ex-post evaluation (Panteia, 2015) concluded that especially for smaller ports the requirement to develop and implement a WRH plan leads to a substantial increase in administrative burden as smaller ports often lack the resources needed (Deloitte, 2016). For larger ports the administrative burden is mainly influenced by the increased complexity of the requirement and the time needed to draft the plan accordingly. The administrative burden was assessed to be € 7.0 million per year. Also Member States face administrative burden as a result of the WRH plans. The competent authorities are required to check and approve all the WRH plans of their ports. In addition, Member States also need to check all requests for exemptions, which further increases their administrative burden. The combined administrative burden for ports on EU level is € 4.4 million per year;
- The variety in *cost recovery systems* in place in EU ports creates an additional administrative burden, notably for port users. It is argued that simpler and more transparent cost recovery systems would lead to lower administrative burden (Eunomia, 2016; IEEP 2013; ESSF PRF sub-group and EMSA);
- The provisions on *exemptions*, in particular the lack of harmonisation of the exemption criteria, constitute another cause for unnecessary burden for stakeholders (EMSA). Member States and ports have adopted their own interpretation of the criteria for granting exemptions, and consequently the exemption regime differs widely between Member States, creating inefficiencies for port authorities, spending a considerable amount of time checking the required parameters;
- An *unclear definition of sufficient storage capacity*. Under Article 7 (2) of the PRF Directive, a ship may proceed to the next port of call without delivering the ship-generated waste it has on board, if sufficient storage capacity is available on board to store the waste that will be generated *en route* to the next port. This has to be assessed on basis of the information being notified in accordance with Article 6 and Annex II of the PRF Directive, but no clear definition of sufficient storage capacity is provided. This has led to inefficiencies for both ports and port users in view of the mandatory delivery requirement.

Legal inconsistencies between MARPOL and the PRF Directive

Administrative burden also results from the differences in definitions used by the PRF Directive and MARPOL, as indicated below:

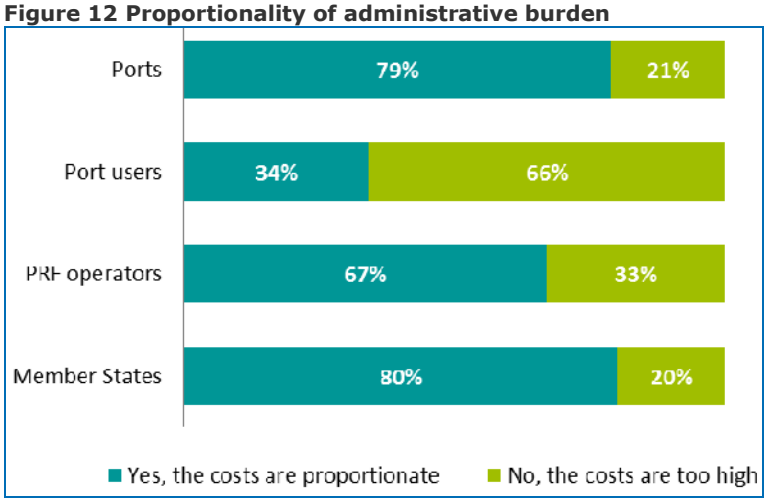
- The difference between what is defined as *ship-generated waste and cargo residues* under the PRF Directive and MARPOL leads to confusion amongst stakeholders involved (Deloitte, 2016). This view is confirmed by the Open Public Consultation conducted for this impact assessment. In total, 70% of respondents indicated that this is an important contributor to the problem of administrative burden;
- As a result *waste notification forms cannot be fully aligned with the MARPOL forms (IMO Circular 834)* resulting in an unnecessary administrative burden. Furthermore, ship owners have indicated that poor online accessibility of the forms also creates a large administrative burden for crew members (ECSA, 2016). In the Open Public Consultation 65% of the respondents indicated that the outdated reporting forms constitute an important contributor to the problem of administrative burden. This is also linked to the lack of electronic reporting and exchange of information.

Proportionality of administrative burden

In the ex-post evaluation by Panteia (2015) an assessment was also made of the proportionality of the administrative burden (i.e. the costs in relation to the benefits of

the PRF Directive) according to stakeholders. As Figure 12 shows, port users in particular consider that the administrative burden is not proportionate in relation to the benefits. In the other stakeholder groups, the majority believes the administrative burden to be proportionate to the benefits resulting from the PRF Directive.

Figure 12 Proportionality of administrative burden



Source: Panteia (2015), based on stakeholder consultation.

5.2.2. Quantification of administrative burden

In this impact assessment the calculations for assessing the administrative burden caused by the PRF Directive have been updated. The calculations provide estimations for the following categories:

- Developing and updating the WRH plans (elements 1 and 2);
- Applying for and granting of exemptions (elements 3 and 4);
- Reporting on the advance waste notification (elements 5 and 6);
- Inspections (elements 7 and 8).

Below the assumptions and calculations made for the different elements are discussed in more detail.

Development and updating of WHR plans

This group can be broken down into two cost components. On the one hand, costs will be made by the ports who are responsible for the development and updating of the WRH plans (element 1). On the other hand, Member State officials need to approve the plans made (element 2).

Administrative burden for ports (element 1)

In order to arrive at annual costs of developing and updating WRH plans, the following assumptions are made (according to ex-post evaluation's methodology) with regard to the development of a WHR Plan:

Table 12 Estimation of costs of developing WRH plans

	Daily wage cost – 8 hours a day[73]	Number of days required for developing[74]	Costs for developing WHR plan
Low effort	175.84	30	5,275
High effort	175.84	220	38,685
Average			**21,980**

In the ex-post evaluation a relatively high share of larger ports provided input and as a result the estimated average costs might be too high. To correct for the underrepresentation of smaller ports, the average costs have been scaled down. On *average 10,000 Euro* is spent on developing WRH plans.

Also an estimation for updating WHR plans has been made. The table below present that assumptions that were made in the ex-post evaluation.

Table 13 Estimation of costs of updating WRH plans

	Daily wage cost – 8 hours a day[75]	Number of days required for developing[76]	Costs for developing WHR plan
Low effort	175.84	16	3,865
High effort	175.84	40	7,034
Average			**5,450**

As here it is believed that the average based on the analysis in the ex-post evaluation is biased as a relatively high share of larger ports provided input. Therefore, the average has been adjusted and it is assumed that on *average 4,000 Euro is spent annually* on updating WRH plans.

In addition to the figures presented above, the following assumptions have been made:

- A new WRH plan has a useful life time of 15 years, after which the WRH plan will be newly developed;
- There are 1,500 ports in the EU.[77]

On the basis of the above-mentioned assumptions, the total annual costs for WRH plans for port users are:

[73] Based on Eurostat – Public administration (2015).
[74] Reference to ex-post evaluation study: "In the consultation, port authorities were asked to indicate how much time they spent to develop WRH plans. Those that answered to this question in the stakeholder consultation indicated that they spent between 30 and 220 days on developing the WRH plan. Time spent on the WRH plans largely depends on the size of the port."
[75] Based on Eurostat – Public administration (2015).
[76] Reference to Panteia study: "In the consultation, port authorities were asked to indicate how much time they spent to update WRH plans. Those that answered to this question in the stakeholder consultation indicated that they spent between 16 and 40 days on updating the WRH plan. Time spent on the WRH plans largely depends on the size of the port."
[77] According to the ex-post evaluation.

Table 14 Total annual costs for WRH plans for ports

Activity of WRH plan	Number of ports	Average annual costs (Euro)	Total annual costs (million Euro)
Development	1500	667[78]	1.0
Update	1500	4000	6.0
Total			**7.0**

Administrative cost for Member States (element 2)

Next to costs made by the ports to develop and update their WRH plans, also Member States need to make costs. Member State officials do have to approve the plans made by the ports. Also for this requirement the administrative burden has been calculated.

The average hourly wage of a person working in public administration was 21.98 (see Eurostat, 2015 figures). It is assessed that on average a person works 1,696 hours per year.[79] Total average annual wage costs for a person working in the public administration are therefore 37,278 Euro.

The total staff needed to approve the WRH plans can be calculated on the basis of officers needed to deal with all administrative tasks resulting from port calls. The ex-post evaluation found that one desk officer, on average, handled the administrative costs that follow from roughly 20,000 ports calls, i.e. 1 officer per 20,000 calls is needed. In 2015, the total number of ports calls was 2,224,608 (see Eurostat, 2015 data). The total number of staff needed, therefore, is 111.

Total estimated costs for approving the WRH plans is *4.1 million Euro*.[80]

Applying for and granting exemptions

The groups also contains two types of costs. On the one hand, costs will be made by the port users who wish to apply for an exemption (element 3). On the other hand, costs need to be made by the competent authorities who are need to assess whether or not an exemption will be granted (element 4).

Applying for an exemption (element 3)

The following parameters are used in calculating the administrative burden resulting from the application for an exemption.

Table 15 Parameters used to calculate costs resulting from the application for an exemption

Hourly wage costs (Eurostat)	Daily wage costs[81], derived from Eurostat (based on 8 hours)	Number of days required for applying[82]	Costs for Applying for an exemption
26.6	212.8	10	2,128 Euro

[78] 10000 euros/15 years = 667 euros.
[79] OECD 2015 figures – Average annual hours actually worked in 2015 within the EU.
[80] 111 staff * 37,278 (individual wage) = 4, 1 million Euro.
[81] Assuming that one officer will be responsible for compiling the application file.
[82] The assumption takes into account the preparation of the application file, communication between ship and shipping company, communication with Port Authorities/PRF operators/administrations, collection of necessary information from all relevant stakeholders etc. Participants in the Correspondence Group on Exemptions established under the ESSF/PRF SG have offered information on the average time which ranges from 15 minutes (but not including time spent from ship Agents) to 1 month. The 10 days assumption is a conservative average within these limits.

Today, there are reports from only seven Member States (two of them have also reported in SafeSeaNet) on the number of exemptions granted. Some of the data is fragmented, possibly obsolete and difficult to extract the final number of exemptions.

However, we may assume that 710 exemptions from seven Member States may correspond to 2,333 exemptions from all 23 maritime EU Member States[83]. Therefore the costs are estimated to be:

2,333 exemptions * 2,128 Euro = *5.0 million Euro* annual costs for port users.

Granting an exemption (element 4)

The same assumptions may be used for calculating the cost incurred by the Competent Authorities for assessing and granting exemptions. Therefore, the following parameters are used in calculating the administrative burden resulting from the assessment and granting of an exemption.

Table 16 Parameters used to calculate costs resulting from the application for an exemption

Hourly wage costs (Eurostat data for public administrations/2015)	Daily wage costs[84], derived from Eurostat (based on 8 hours)	Number of days required for assessment[85]	Costs for assessing and granting an exemption
21.98	175.84	30	5,275 Euro

2,333 exemptions * 5.275 Euro = *12.3 million Euro* annual costs for Competent Authorities.

Advance waste notification

This category leads to two types of administrative burden. For ports users this requirement will lead to an obligation to fill in a notification form, i.e. contains a reporting obligation (element 5). For the authorities this requirement leads to an assessment obligation, i.e. the forms need to be checked (element 6).

Reporting on waste (element 5)

Regarding the information obligations of the PRF Directive, stakeholders indicated[86] that it generally does not take longer to collect the data for the advance notification requirement and file it than 30-60 minutes, but an average sized cruise ship spends roughly 8 man-hours to retrieve and/or estimate the necessary information on the amounts of waste to discharge. Passenger vessels that are not cruise ships face similar difficulties as cruise ships, though not as substantially; we therefore assume 4 hours for this category.

85% of port calls were freight vessels, with an estimated average time of 1 hour work. Passenger vessels (14%) around 4 hours, and cruise ships (1%) around 8 hours. The division as noted above was applied to the 2015 Eurostat statistics of port calls in the EU, against an average wage cost in the Maritime transport sector of €26,6 (also by Eurostat).

[83] Y = 23 * 710/7 = 2333.
[84] Assuming that one officer will be responsible for checking the application file.
[85] The assumption takes into account the initial examination of the application file, communication with the applicants (ship and shipping company), communication with Port Authorities/PRF operators/administrations, collection of necessary information from all relevant stakeholders etc. It is also based on the outcome of the CG for exemptions established under the ESSF/PRF SG. The participants indicated a range of time spent from one week to 45 days or several weeks. 30 days seems to be a sensible average in this regard.
[86] Ex-post evaluation (Panteia, 2015).

The large share of freight transport in the number of annual port calls (85% in 2013) and the relatively small share of cruise ships (1%) and other passenger transport (14%) have been weighed in our calculation, resulting in *total annual costs of 89.9 million Euro*.

Table 17 Estimated administrative burden on port users

Number of hours required for notification	Sector – share in overall port calls EU	Number of port calls/2015 (Eurostat)	Hourly wage costs/2016 (Eurostat)	Estimated total Costs (in million)
1	Freight – 84%	1,868,671	26.6	49.7[87]
4	Passengers – 15%	333,691	26.6	35.5[88]
8	Cruise ships – 1%	22,246	26.6	4.7[89]
Total	**100%**	**2,224,608**		**89.9**

Assessment of waste notification forms (element 6)

Once transmitted to the port authority, the advance notification form needs to be processed by the relevant authorities, creating an administrative burden on the side of the port authority. The port of Piraeus indicated[90] that they have one person full time working on the management of advance notification forms, which comes down to roughly 10 minutes per port call[91]. Calculations are presented in Table 18:

Table 18 Estimated administrative burden on authorities

Number of hours required for process	Number of port calls/2015 (Eurostat)	Hourly wage costs (Eurostat data for public administrations/2015)	Estimated total costs[92] (in million)
0.16	2,224,608	21.98	7.8

Administrative burden resulting from inspection cost

Also the inspection obligation results in administrative burden. On the side of the port users the inspection requirement leads to an obligation to provide documentation and collaborate during an inspection (element 7). On the side of the competent authorities the inspection requirement lead to a reporting obligation (element 8).

Providing documentation and collaborate (element 7)

The ex-post evaluation had assumed[93] that "on average, 2.27% of all port calls are subject to inspection." This assumption gave a number of 51,961 inspections annually. However, this figure is far too higher than the real one (the number of the whole EU PSC inspections in the old PSC regime was around 20,000 inspections annually - for 2016 the figure would have been 19,453)[94].

Therefore, we calculate (around) 19,500 inspections * 1 hour work for the crew member to accompany the inspector (according to the ex-post evaluation[95]) = 19,500 hours * 26.6 Euro[96] = *518,700 Euro* (theoretical cost).

[87] Y = 1 * 26.6* 1,868,671 = 49,706,649.
[88] Y = 4 * 26.6 * 333,691 = 35,504,722.
[89] Y = 8 * 26.6 * 22,246 = 4,733,949.
[90] Ex-post evaluation.
[91] Ex-post evaluation.
[92] Y = 2,224,608 * 0.16 * 21.98 = 7,823,501.
[93] Based on data collected in the stakeholder consultation.
[94] See EMSA's Technical assessment on the list of open questions (Supplement on enforcement)/Annex I.
[95] Based on the information collected in additional interviews and the stakeholder consultation, an inspection lasts generally no more than one hour, and requires a crew member to accompany the inspectors.

Alternatively, we have 1,166 inspections recorded in THETIS-EU for 2016 so:

1166 * 1 hour = 1166 hours * 26.6 Euro = 31,016 Euro (actual cost).

Reporting on results from inspections (element 8)

The enforcement costs for the competent authority were based on the same calculation, but the EU average hourly wage costs for public administration were used.

Therefore, we calculate 19,500 inspections * 1 hour (according to the ex-post evaluation) = 19,500 hours * 21.98 Euro[97] = *428,610 Euro* (theoretical cost).

Alternatively, we have 1166 inspections recorded in THETIS-EU for 2016 so:
1166 * 1 hour = 1166 hours * 21.98 Euro = 25,629 Euro (actual cost)

Total administrative costs

Based on the calculations presented above the total annual administrative burden resulting from the PRF Directive in its current form is assessed to be 127 million Euro, as presented in Table 19.

Table 19 Summary table administrative costs

#	Administrative costs	Stakeholder	Annual costs
1	Total annual costs for WRH plans	Ports	7.0
2	Costs for Member States to approve WRH plans	Competent authorities	4.1
3	Application for an Exemption	Port users	5.0
4	Assessment and granting exemptions	Competent authorities	12.3
5	Advance waste notification - reporting	Port users	89.9
6	Advance waste notification – assessment	Ports / competent authorities	7.8
7	Inspection – providing documentation and collaboration	Port users	0.5
8	Inspection – reporting results from inspections	Competent Authorities	0.4
	Total		**127**

[96] Hourly wage cost in the Maritime transport sector for 2016.
[97] Eurostat for year 2015.

6. Analysis of problem drivers and root causes

In this chapter, each of the problem drivers and their underlying root causes are analysed (Sections 6.1 - **6.5**). For each underlying root cause an indication of the size of the problem is made. The effect of the root causes and problem drivers on the two main problems – discharges at sea and administrative burden – are presented at the end of each section. In conclusion, the chapter provides a summary overview of main problems and the problem drivers (Section **6.6**).

6.1. Inadequate reception and handling of waste at port reception facilities

One of the problem drivers to an optimal functioning of PRF Directive identified in the 2015 ex-post evaluation of the PRF Directive[98] was inadequate reception and handling of waste at port reception facilities. Four underlying root causes to this problem driver were identified:

- Waste segregated on board is not always collected separately on land. This inconsistent application may contribute to (perceived) inadequacy of port reception facilities and could discourage separation of waste types on board of ships;
- The increased use of exhaust gas cleaning systems requires adequate reception of the residues (sludge) generated. However, the mandatory waste discharge requirement of the PRF Directive is currently not applicable to the waste generated by scrubbers;
- Waste Reception and Handling (WRH) plans developed by ports and approved by the relevant competent authorities do not always take the waste hierarchy into account as required by the Waste Framework Directive. This can lead to inefficiencies between ships and ports;
- Port users are not always properly consulted on a continuous basis in the development and implementation of WRH plans.

6.1.1. Waste segregated on board is not always collected separately on land

Description of the problem

Port users generally apply international norms and standards to segregate waste on board. This is reflected in the following regulations and guidelines:

- *MARPOL regulations and IMO guidelines* for on-board waste management, resulting in many port users having procedures to segregate garbage on board. As an illustration, the 2012 MARPOL Guidelines for the Implementation of MARPOL Annex V [99] mention the development of a garbage management plan in which garbage is segregated in the following recommended types: non-recyclable plastics and plastics mixed with non-plastic garbage; rags; recyclable material (e.g. cooking oil; glass; aluminium cans; paper, cardboard, corrugated board; wood; metal, plastics); garbage that might present a hazard to the ship or crew (e.g. oily rags, light bulbs, acids, chemical, batteries, etc.);
- Segregated garbage as a requirement for *ISO certification 21070* (management and handling of shipboard garbage), which contributes to making waste separation a common practice by port users as segregation of solid waste is a precondition for ISO certification[100].

[98] ex-post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues.
[99] RESOLUTION MEPC.219(63), Adopted on 2 March 2012, 2012 Guidelines for the Implementation of MARPOL Annex V.
[100] See: http://www.iso.org/iso/catalogue_detail.htm?csnumber=51003.

However, the 2015 ex-post evaluation of the PRF Directive[101] indicates that many ports do not have specific arrangements for separated garbage collection, and collect all garbage at one location. This finding is in line with the finding of the impact assessment for the Waste Framework Directive,[102] in which it was indicated that on average, only 19 % of generated municipal waste is collected separately in EU-28 capitals: in other words, 80% of the waste still ends up in the residual waste bin. The study also indicates that when the possibility to deliver waste separately is provided, this will result in a positive effect. The study states: 'Strict separate collection (one recyclable in one bin) usually leads to higher recycling rates. The quality of the collected material is better and rejection rate is lower.'

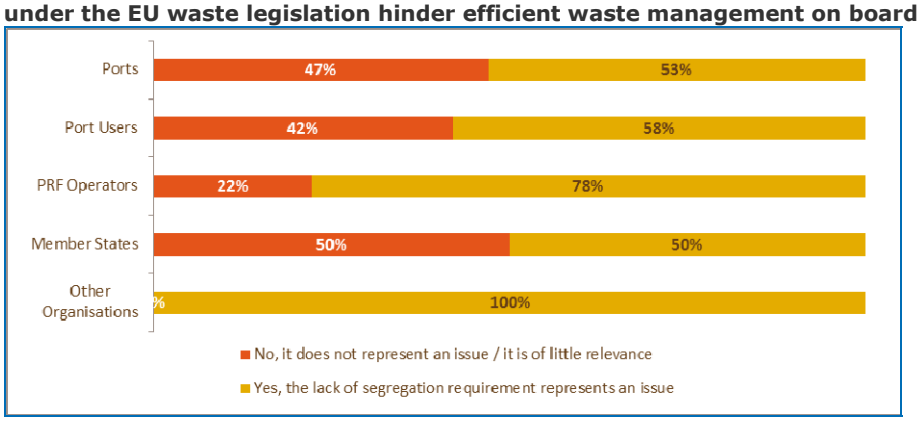
Special consideration for Animal by-products (ABPs)

Animal by-products (ABPs) are animal carcasses, parts of animals, or other materials which come from animals, but are not meant for humans to eat[103]. Regulation 1069/2009 (the ABP Regulation) covers the handling of catering waste which has been into direct or indirect contact with animal products. It states that this type of waste should be disposed directly (with or without prior processing) and cannot be recycled, as animal by-products coming from outside the EU can contain harmful (animal) diseases, such as foot-and-mouth disease. Therefore, all waste (including packaging materials and plastics) that might have come into contact with animal products should be regarded as potentially harmful to society. As a consequence, the ABP Regulation deviates from the application of the EU waste hierarchy, as established in the Waste Framework Directive (WFD).

Size of the problem

According to the survey conducted as part of the ex-post evaluation of the PRF Directive in 2015, the majority of the respondents agree that the lack of separation of waste on shore hinders the waste management on board of ships, as presented in Figure 13[104].

Figure 13 In your opinion, does the lack of segregation requirement for waste landed in ports under the EU waste legislation hinder efficient waste management on board of ships?



Source: ex-post evaluation of the PRF Directive (Panteia, 2015).

[101] ex-post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues.
[102] http://ec.europa.eu/environment/waste/studies/pdf/Separate%20collection_Final%20Report.pdf.
[103] Definition provided at https://www.gov.uk/guidance/animal-by-product-categories-site-approval-hygiene-and-disposal.
[104] A total of 125 stakeholders responded to the question. Overall, most stakeholders agree with the statement above. In particular in case of Other Organisations and PRF Operators the large majority (or totality as in the case of other organisations) of respondents believes that the lack of segregation requirement constitutes an issue.

In that same survey, stakeholders pointed to the demoralising effects of delivering on-board segregated waste into a 'single bin' in the port reception facility[105]. Although it is not explicitly stated and proven in the ex-post evaluation, this demoralisation could lead to an increase of waste discharges at sea.[106]

On the issue of segregated waste on board not being collected separately on land, the Eunomia report (2016) states that 'Even though this may not have direct implications for levels of marine litter, it may impact the willingness and motivation of crews to recycle. '

Port users regularly complain that although they have gone through the effort to segregate their waste, they see it mixed together again at the port.

Based on the above, it can be concluded that port users may see the lack of collecting separated waste on land as an inadequacy of port reception facilities. Note that for smaller ports, it is often not economically/financially viable collecting all waste types separately. This justification, however, is not applicable to larger ports; when waste is not collected separately in those ports, this can be regarded as actual inadequacy. The (perceived) lack of adequacy could result in port users being less motivated to strictly adhere to guidelines and procedures related to garbage segregation on board the ship. As a result, the relevance of this root cause in relation to the problem driver of inadequacy is rated to be Medium.

6.1.2. Mandatory discharge requirement of the Directive is currently not applicable to the waste generated by scrubbers

Description of the problem

While port reception facilities may be adequate for the waste categories defined in the PRF Directive, *MARPOL Annex VI waste* is currently not included in the PRF Directive and therefore there are no requirements for providing Annex VI waste reception facilities.

The most common type of Annex VI waste is residues from exhaust gas cleaning systems, or scrubber residues. Users of such systems may consider port reception facilities inadequate in this respect, as currently PRF operators are not obliged to collect Annex VI waste separately and as a result ship operators cannot deliver their Annex VI waste. It should be noted that the definition and scope of Annex VI is much broader than scrubber residues. Annex VI regulates all air pollutants emitted by ships, including ozone-depleting substances, i.e. NOx[107], SOx[108], VOCs[109] and shipboard incineration. It does not seem to be the case that all aforementioned waste categories included in Annex VI are currently contributing equally to the inadequacy of PRF; scrubber waste seems to be the main problem.

Besides laying down waste requirements, the Annex also regulates topics like, incinerators, fuel oil quality, and the establishment of SECAs.[110] Also rules regarding off-shore platforms and drilling rigs are provided.

[105] Results are integrated in the final report of the Ex-Post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues (European Commission, 2015).
[106] From a behavioural point of view, people have a stronger incentive to litter (or discharge waste) than to deliver. See for example Kolodko, J. Read, D. Taj, U. (2016).
[107] Nitrogen Oxides.
[108] Sulphur Oxides.
[109] Volatile Organic Compounds.
[110] Sulphur Emission control Areas.

As highlighted above, scrubber waste seems to be the main problem. However, the actual waste produced will depend on the type of scrubber used. Closed loop scrubbers, producing ODS and EGCS residues, would contribute to increasing volumes to be delivered in port. Open loop scrubbers do not produce residues separately. They only produce diluted wash water, which can be discharged under MARPOL. Hybrid systems can have both. These three scrubber types and volumes of waste are presented in Table 20.

Table 20 Volumes of scrubber waste per type

Mode	Amount
Closed loop scrubbers	0.000625 kg per kWh (including 36% water that is trapped in the sludge and sent to storage for disposal at port).
	0,4 g/kWh
	1 kg dry matter per MWh Typically the sludge has a dry matter content of 5 %, which thus gives a sludge rate of 20 kg/MWh.
Open Loop scrubbers	None.
Hybrid scrubbers	In hybrid mode, assuming a 50-50% equal share split between the two possible modes of operation (open/closed) 0.0003125 kg per kWh (including 36% water that is trapped in the sludge and sent to storage for disposal at port).
	Alfa Laval open loop scrubbers are currently not fitted with equipment that could generate sludge, as the systems as is complies with the wash water criteria of the EGC Guidelines.

Source: PRF sub-group on scrubbers, 2016.

Currently, very few ports in EU Member States offer facilities dedicated specifically to scrubber waste. According to the ex-post evaluation, the majority of the ports collect waste from closed loop scrubbers under special agreements with hazardous waste collectors. In addition, there are also few examples of ports collecting scrubber waste under Annex I waste; the waste treatment companies are responsible for classifying waste, so it would depend on how they perceive the residues.

The above illustrates an area in which MARPOL and the PRF Directive are not (yet) aligned[111].

Size of the problem

Annex VI waste is particularly relevant for short sea vessels, operating exclusively or primarily in (Sulphur) Emission Control Areas. Thus, the adequacy problem related to delivery of scrubber waste is a geographical one, as scrubbers are primarily applied in (Sulphur) Emission Control Areas. Not all European sea basins are appointed as (S)ECA zones; only the Baltic Sea area and the North Sea area are dedicated (S)ECAs and therefore are covered under Annex VI[112]. For the Member States bordering (S)ECA sea basins, scrubber waste only significantly affects some segments of the shipping industry; notably short sea shipping. These affected segments, at least for the most part, already have agreements in place with waste operators for delivering scrubber waste.

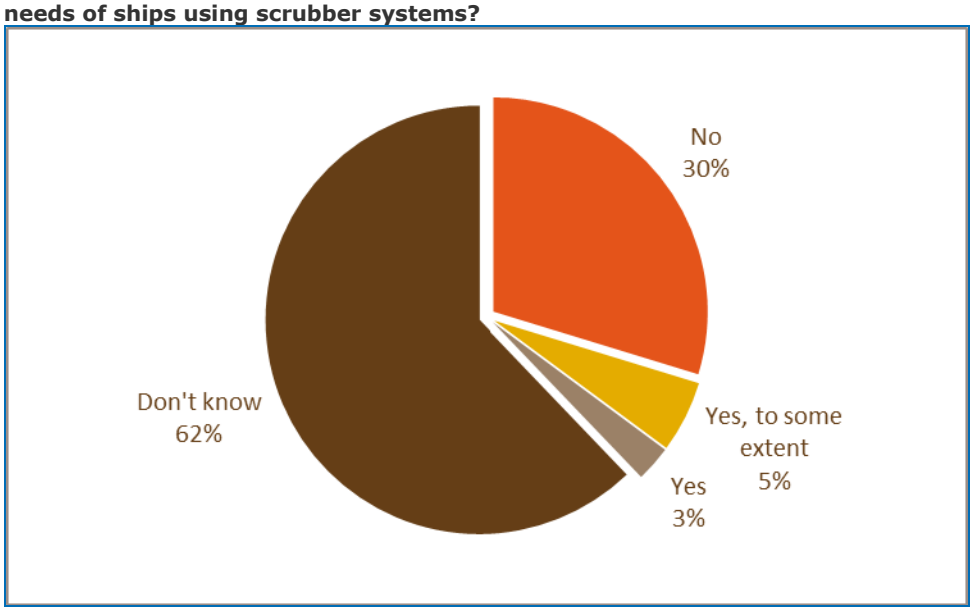
[111] A revision of the PRF Directive provides the opportunity to further align the PRF Directive with MARPOL. In this case (including Annex VI waste) based on market developments that would require such alignment. In general, alignment with MARPOL could result in a reduction of administrative burden, although that would not be the main driver in this specific case.

[112] The ECAs established under MARPOL Annex VI for SOx are: the Baltic Sea area; the North Sea area; the North American area (covering designated coastal areas off the United States and Canada); and the United States Caribbean Sea area (around Puerto Rico and the United States Virgin Islands).

It is expected that in the future more sea basins will become (S)ECA zones and as a result the amount of Annex VI waste will increase. In addition, also globally allowed sulphur limits will be reduced (see IMO regulations) and this will lead to pressure to comply with overall sulphur norms. It is noted in interviews and sector magazines[113], however, that due to the relatively low fuel prices over the past two years, many ship owners have opted for using low sulphur fuel instead of investing in scrubber technologies. As a consequence the volumes of scrubber waste generated have remained small. If fuel prices would increase, this is likely to change. However, it is unclear whether or not this will happen in the near future.

The survey carried out in 2015 as part of the ex-post evaluation of the PRF Directive (see Figure 6.2) indicates that the majority of the respondents (62%) does not know if current port reception facilities are adequate to deal with scrubber waste. Only 8% of the respondents think that port reception facilities are adequate to meet the demands of ships using scrubber systems. The fact that the majority of respondents cannot respond to the question could be explained by the fact that scrubber waste delivery problems only affect a relatively small market segment, restricted by geography (Baltic Sea area and the North Sea area) and type of operation (short-sea shipping). Remaining respondents clearly indicate inadequacy at port reception facilities to meet the needs of ships using scrubber systems.

Figure 14 In your view, is the current availability of port reception facilities adequate to meet the needs of ships using scrubber systems?

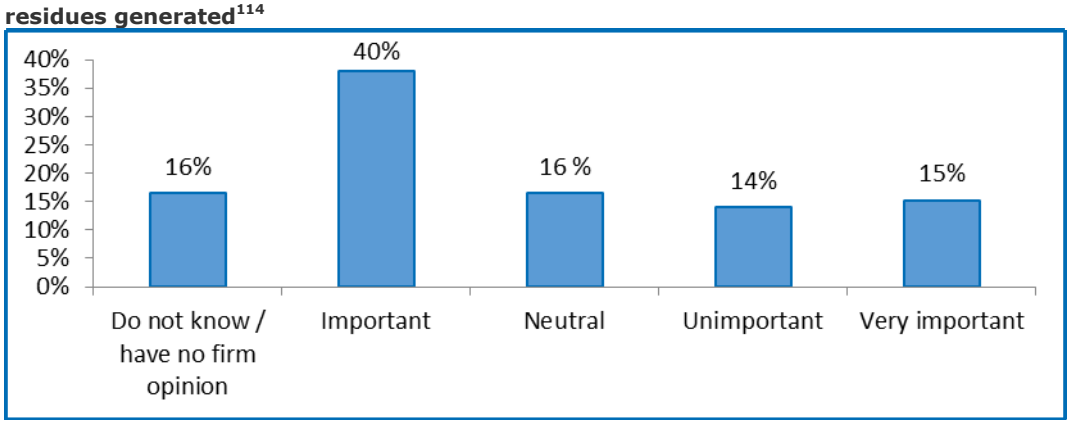


Source: PwC and Panteia, 2015.

The results from the 2016 OPC (see Figure 15) confirm this view and show that the exclusion of the delivery of scrubber waste from the PRF Directive is indeed an important contributor to inadequate or unavailable port reception facilities. As the figure below shows, 55% of the respondents indicated that this root cause is an important or very important contributor to the (in) adequacy of port reception facilities.

[113] See for instance http://www.platts.com/latest-news/shipping/houston/oil-price-collapse-hits-sales-of-exhaust-gas-26016024.

Figure 15 OPC score on exhaust gas cleaning systems requiring adequate reception of the residues generated[114]



Source: OPC, N= 79.

Based on the above, it can be concluded that the exclusion of the delivery of scrubber waste from the PRF Directive has led to the inability to receive scrubber waste. At the same time, it should be noted that this only applies to restricted sea basins (Baltic Sea area, North Sea area, and potentially the broader Mediterranean area in the near future) and type of operation (short-sea shipping). In time, this market segment may grow, but timing of such development is unknown[115]. The causal relation of this root cause in terms of its contribution to inadequacy is therefore rated as Medium to High.

6.1.3. WRH plans do not fully take the waste hierarchy into account

Description of the problem

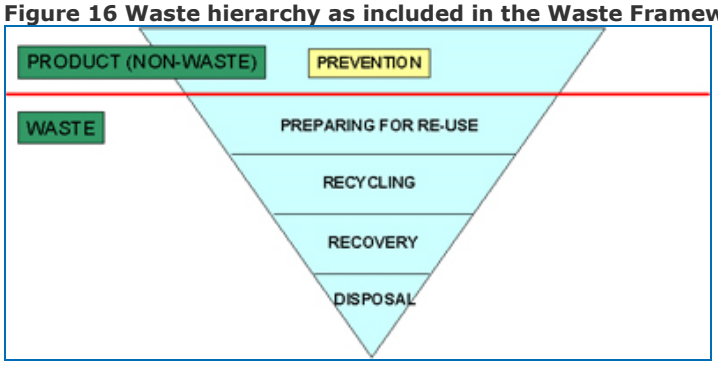
Ports do not always take the waste hierarchy fully into account. This is reflected by the waste reception and handling (WRH) plans that are developed by the ports, in consultation with port users (see Section 6.1.4), and approved by relevant authorities. This aspect links to the inconsistent application of waste segregation on board the ship and in ports, as described in Section 6.1.1. However, the problem addressed here is broader and provides an obstacle in employing the circular economy strategy.

According to the EU action plan for the circular economy[116], the transition to a more circular economy - where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised - is an essential contribution to the EU's efforts to develop a sustainable, low carbon, resource efficient and competitive economy.

A key element in the circular economy is the waste hierarchy, which is set out in the Waste Framework Directive[117]. This hierarchy provides the concepts of waste handling and management. The Waste Framework Directive presents the preferred waste hierarchy going from prevention, preparing for re-use, recycling, recovery and ultimately disposal, as illustrated in Figure 16.

[114] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the aforementioned problem of port reception facilities not being always suitable for purpose or available?: The increased use of exhaust gas cleaning systems requires adequate reception of the residues generated. However, the mandatory discharge requirement of the Directive is currently not applicable to the waste generated by scrubbers.
[115] See paragraph 5.1.4 on annex VI waste assumptions and paragraph 5.1.7 on evolvement of the problem.
[116] COM(2015) 614 final, Brussels, 2015.
[117] Directive 008/98/EC.

Figure 16 Waste hierarchy as included in the Waste Framework Directive



Source: Waste Framework Directive.

Annex I of the PRF Directive describes mandatory and non-mandatory elements for WRH plans. This annex includes a detailed description of the procedures for the reception and collection of ship-generated waste and cargo residues (the mandatory element), as well as a description of how the ship-generated waste and cargo residues are to be disposed of (the non-mandatory element). In 2010, EMSA carried out an assessment of the extent to which these elements were included in the WRH plans. EMSA reported that the first above-mentioned element (description of the procedures for the reception and collection of ship-generated waste and cargo residues) was included in 62% of the inspected cases, while the second above-mentioned element (description of how the ship-generated waste and cargo residues are to be disposed of) was included in only 33% of the inspected cases[118].

The ex-post evaluation of the PRF Directive stated that, when developing and updating their WRH plans, ports have insufficiently addressed procedures for reception, collection, storage, treatment and disposal of ship-generated waste and cargo residues.

The fact that managing waste according to the waste hierarchy is not a mandatory element of the WRH plans and that most inspected ports did not include information on waste disposal in their WRH plans, could be an indication that ports are not fully taking the waste hierarchy into account. One reason for this could be that waste is handled further up in the waste chain. This is, for instance, the case for recycling oily waste and sewage, which is bound to some restrictive legislation[119].

Size of the problem

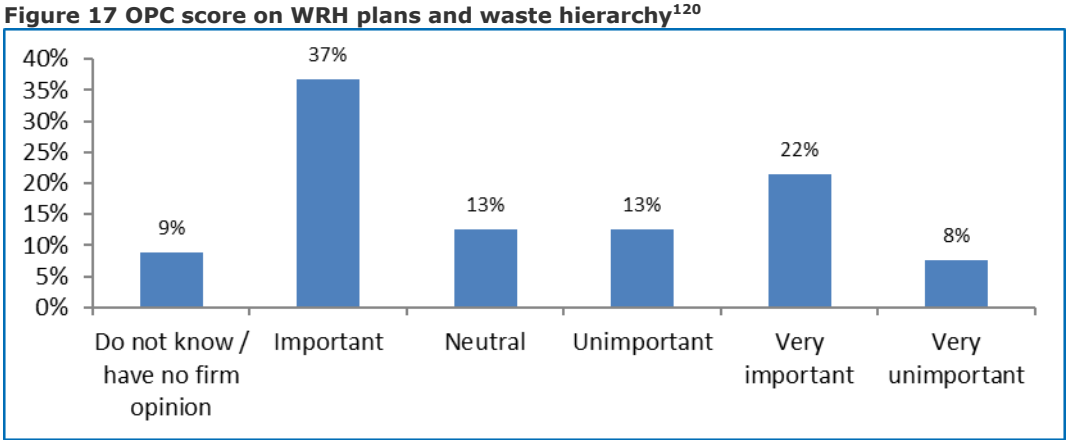
The fact that there is no mandatory element on waste hierarchy in the WRH plans and the fact that a description of how the ship-generated waste and cargo residues are to be disposed is included as a non-mandatory element only, leaves plenty of room for ports to not include the waste hierarchy in the WRH plans. Thus it can be safely assumed that the waste hierarchy is included in only few WRH plans. This is a missed opportunity as the WRH plans, in which both ports and port users are involved, provide a strong base for managing the waste flows at the ship-port interface.

The inconsistency in the application of segregated waste between ships and ports, as reported in Section 6.1.1, also applies to this broader subject of the waste hierarchy. The results from the 2016 OPC show that waste segregated on board, which is not collected separately on land, is indeed an important contributor to inadequate or

[118] EMSA (2006) Technical report assessing the waste reception and handling plans adopted in accordance with Article 5 of Directive 2000/59/EC.
[119] An example is the Urban Waste Water Treatment Directive (Council Regulation 91/271/EEC), indicating how to deal with urban waste. Sewage generated on board a ship will be subject to the Urban Waste Water Treatment Directive once delivered at ports. This may result in conflicts as a result of different rules applying to dealing with waste.

unavailable port reception facilities, with 59% of the respondents indicating that this is an important or very important contributor, as illustrated in Figure 17.

Figure 17 OPC score on WRH plans and waste hierarchy[120]



Source: OPC, N= 79.

Again, port users may perceive this inconsistency related to the waste hierarchy on land as an inadequacy of port reception facilities. Also in this case, port users could be less motivated to follow guidelines related to the application of the waste hierarchy on board the ship. Therefore the contribution of this root cause to the problem of inadequacy of port reception facilities is rated as medium.

6.1.4. Port users not always properly consulted in WRH plans

Description of the problem

Article 5(1) of the PRF Directive lays down the requirement to involve port users or their representatives in the process of developing the WRH plans. Furthermore, port users are to be involved in periodic revisions of the WRH plans. In practice, it seems that port users are not always properly consulted – at least not to the extent they would prefer- in the development and the implementation of the WRH plans. This lack of consultation prevents an optimal inclusion of user needs in the WRH plans and often contributes to perceived inadequacies in port reception facilities.

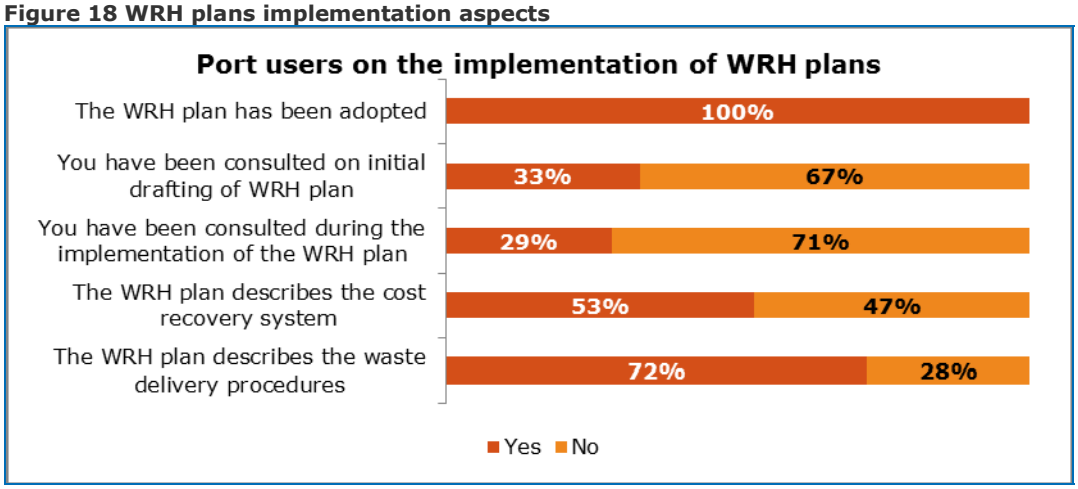
According to the ex-post evaluation of the PRF Directive, the EMSA 2010 Horizontal Assessment and visits to the Member States, the WRH plans were mostly developed in collaboration with port users, often in the form of meetings or sometimes more formal consultation procedures. This implies a discrepancy in the views of the port users and the ports. Still, in one-third of the Member States no documentary evidence could be provided of such stakeholder consultations. However, there is the possibility that such consultations have taken place informally, as part of normal daily contacts without a reporting routine[121]. The survey carried out in the ex-post evaluation indicated that the major commercial ports (89%) reported that they have contacted the primary port users, and in slightly lower numbers (81%) that they continued to consult their port users to update the WRH plan.

[120] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the aforementioned problem of port reception facilities not being always suitable for purpose or available?: Waste Reception and Handling (WRH) plans developed by ports and approved by the relevant competent authorities do not always take the waste hierarchy into account, as required by the Waste Framework Directive. This can lead to inefficiencies at the sea-port interface, such as waste segregated on board which is then not collected separately on land.

[121] EMSA (2010), Horizontal Assessment Report - Port Reception Facilities (Directive 2000/59/EC).

The perspective from the port users on consultation seems to differ. Figure 18 shows that port users indicated that they were not sufficiently consulted on the WRH plans; 67% indicated they were not consulted on the initial drafting, and 71% reported they were not consulted during the implementation phase and/or during possible revisions[122].

Figure 18 WRH plans implementation aspects

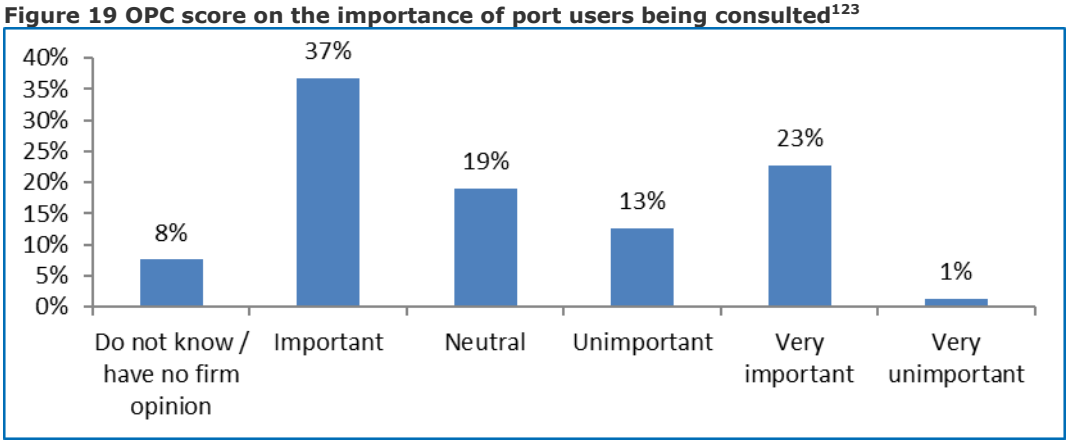


Source: Ex-post evaluation of the PRF Directive (Panteia, 2015).

The ex-post evaluation mentions that a large number of WRH plans were developed before 2006, and consequently it may be too long ago for port users to be aware of the consultation procedures for the initial drafting. However, this does not explain to the high percentage that was not consulted on revisions of the WRH plans.

The views from the ex-post evaluation of the PRF Directive are confirmed by the results from the 2016 OPC, in which 60% of the respondents indicated that improper consultation is an important or very important contributing factor to port reception facilities not always being adequate or available.

Figure 19 OPC score on the importance of port users being consulted[123]



Source: OPC, N=79.

[122] Survey results are based on a response of 39 port users.
[123] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion major contributing factors to the aforementioned problem of PRF not being always suitable for purpose or available? Port users are not always properly consulted on a continuous basis in the development and implementation of WRH plans.

Size of the problem

Based on the above, it can be concluded that port users feel that they are not properly consulted in the development and notably the implementation and revision of the WRH plans. Differences are expected between frequent and less frequent port users (frequent port users being more actively consulted[124]) and type of ports. Especially smaller ports, including fishing and recreational ports, lack the capacity to properly draft WRH plans and include port users in the process.

According to the 2010 EMSA report, some smaller ports (see above), did not have WRH plans in place, while others have been poorly monitored. The findings relating to these ports arose mainly because the designated authorities had either failed to require and/or verify that these ports drafted a WRH plan, or (initially) had exempted smaller ports (mostly fishing and recreational ports) from developing a plan or had not approved the plan.[125]

These findings were confirmed by the ex-post evaluation of the PRF Directive that found specifically that among the WRH plans developed by fishing ports, only 48% included an assessment on the need for port reception facilities. For recreational ports, the descriptions of the types and quantities of waste accepted are only present in 37% of the WRH plans. This can be explained because these ports are mostly concerned with the collection of garbage.[126] As a consequence of the lower levels of stakeholder consultation in WHR plans developed by smaller ports, it may be concluded that their wishes / needs regarding waste handling facilities are not sufficiently incorporated in the plans.

As far as the development since 2010 is concerned, the number of adequate port reception facilities in small marinas and fishing harbours has been reported to increase.[127]

Insufficient consultation of port users is expected to affect the adequacy of the port reception facilities, as the WRH plans are insufficiently based on user needs. Note that this problem is linked to the provisions of the Port Services Regulation Article 15, in which a mandatory 'port users' advisory committee' is proposed. Overall, it can be concluded that the causal contribution of this root cause to inadequacy is assessed as Medium to High.

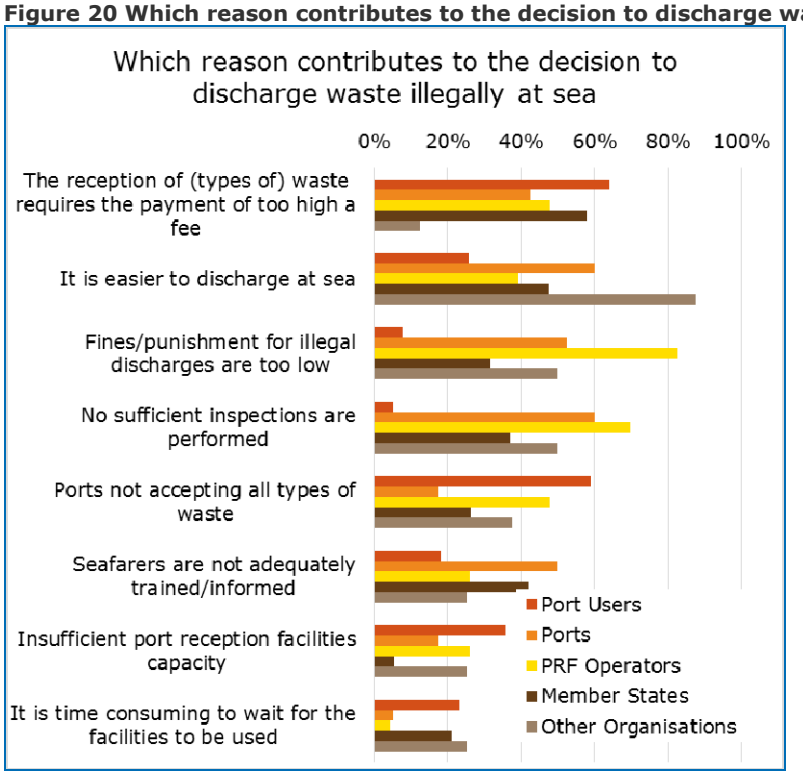
6.1.5. Effect of adequacy of port reception facilities on discharges at sea

Having adequate port reception facilities to prevent discharges of waste at sea is one of the corner stones of the PRF Directive. This concept is considered in the ex-post evaluation of the PRF Directive (2015) by asking stakeholders for reasons that contribute to discharges of waste at sea. Responses are presented in Figure 20.

From the responses two categories can be clearly linked to adequacy of port reception facilities, i.e. (i) the non-acceptance of waste in port reception facilities; and (ii) the inadequate capacity of port reception facilities to deliver waste. It is noted that inadequate capacity of port reception facilities to deliver waste scores relatively low, although particularly port users consider this a rather important reason. Although costs, fines and inspections score high(er), the non-acceptance of waste in port reception facilities is also considered an important factor.

[124] The major commercial ports generally reported in large numbers (89%) that they had contacted the primary port users, as reported in the Ex-Post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, 2015, p. 47.
[125] EMSA, Horizontal Assessment Report - Port Reception Facilities (Directive 2000/59/EC), 2010, p. 10.
[126] Panteia and DG MOVE, Ex-Post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, 2015, p. 46.
[127] Panteia and DG MOVE, Ex-Post evaluation of Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, 2015, p. 83.

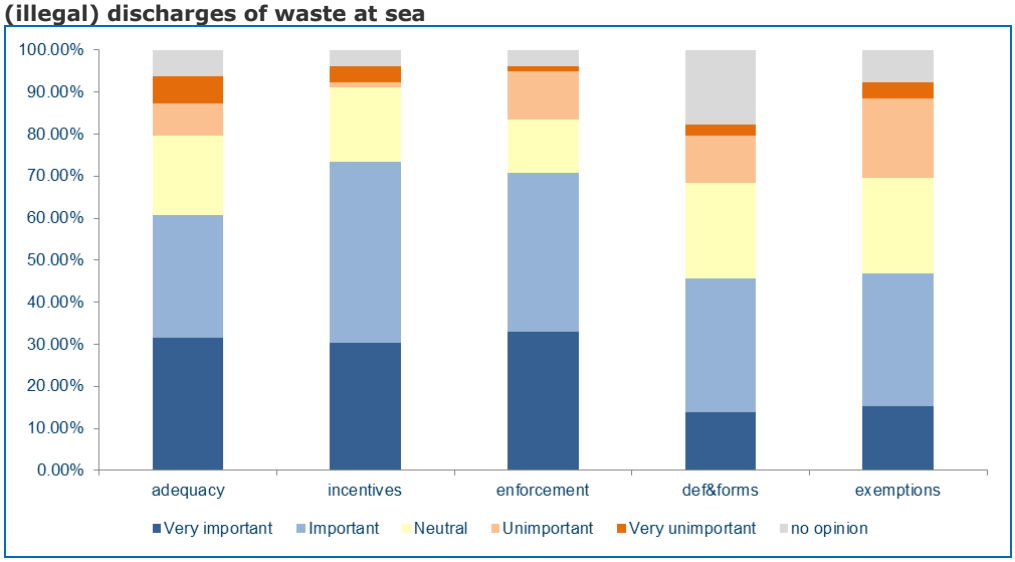
Figure 20 Which reason contributes to the decision to discharge waste illegally at sea?



Source: ex-post evaluation 2015 (Panteia).

When taking the results of the OPC into account, it is indeed confirmed that adequacy is one of the most important contributors to the illegal discharge of waste at sea, see Figure 21. However, overall stakeholders indicate that (cost) incentives and enforcement are considered to be more 'important' or 'very important', compared to adequacy issues.

Figure 21 Overview of the contribution of the major problem drivers to the overall problem of (illegal) discharges of waste at sea



Source: OPC, N=79.

Based on the above mentioned sources (ex-post evaluation and the OPC), the effect of inadequacy of port reception facilities on discharges at sea is considerable (rated Medium), and provides a major disincentive to deliver waste at a port reception facility.

6.1.6. Effect of adequacy of port reception facilities on administrative burden

Inadequate reception and handling of waste at port reception facilities may hamper administrative procedures causing administrative burden. The insufficient consultation of port users during the developing, evaluating and re-drafting WRH plans may create substantial administrative burden as due to the insufficient consultation WHR plans are not developed in the most optimal way. Also they will not contain the user needs. WHR plans that are based on a sufficient stakeholder consultation could match the needs and demands of the different port users, while also respecting the requirements of the local authorities. This in its turn would result in creating more ownership with port users over the process of delivery/reception of waste in ports. The exchange of best practices could help ports to strengthen the involvement of port users in this process.

Another point that may create administrative burden occurs when the waste hierarchy is not sufficiently included in the WHR plans. Not taking the waste hierarchy into account works against the best intentions of port users and other stakeholder of working towards a circular economy. This can lead to annoyance, especially in the case when waste is segregated on board and notified in separate categories on the waste notification form, but collected in a 'single bin' on shore. This practice will have a demotivating impact on ship operators.

In addition, it is often unclear what the exact definition of adequate and available port reception facilities entail, which hampers administrative procedures when delivering might waste, causing administrative burden.

6.2. Inefficient (cost) incentives to deliver waste to port reception facilities

As the ex-post evaluation of the PRF Directive has pointed out, the PRF Directive provides a combination of enforcement measures and incentive measures. On both sides, it was concluded that strengthening would be needed.

On the side of incentives, the ex-post evaluation concludes that there are variations in waste delivery that appear to be related to differences in cost recovery systems put in place. This may also be seen as illustrative for the differences in interpretation of the PRF Directive across Member States, an issue that comes back under other problem drivers as well.

This problem driver of inefficient (cost) incentives is decomposed into the following underlying root causes:

- The lack of alignment in the implementation of cost recovery systems between ports (Article 8 of the PRF Directive);
- The relation between fees charged to ships and the costs of port reception facilities is unclear or non-transparent;
- Fees cannot be considered fair, non-discriminatory and are not reflecting the actual costs;[128]
- Fishing vessels are excluded from a cost recovery mechanism.

Each of these root causes is analysed hereafter and its contribution to the problem driver assessed. In the first sub-section (6.2.1), higher level aspects of incentives (i.e. fee levels and direct versus indirect fees) are also assessed.

[128] This root cause is interrelated with the one mentioned above.

6.2.1. The lack of alignment in the implementation of cost recovery systems between ports (Article 8 of the Directive)

Description of the problem

Currently there are many different cost recovery systems in place, which are often lacking transparency as to how the fee relates to the actual costs of reception and management of the waste (i.e. lack of clarity on the relationship between the fee and the costs).

The cost recovery systems in place in the various Member States and ports can be categorised into three major groups[129]:

- *No special fee systems (NSF)*: under such a system ships are charged a waste handling fee, irrespective of their use of facilities (i.e. this model is also referred to as a 100% indirect fee system);
- *Administrative waste fee/contribution systems (ASF)*: under such a system ships are charged a fee, which is partly based on the actual amount of waste delivered by the ship, plus an additional fixed fee, which is refundable on delivery of waste;
- *Direct fee only systems*: under such a system the ship operator is charged for the actual amount of waste delivered at the port. The system does not charge an additional standard fee.

A key requirement in the PRF Directive is that a significant part of the waste fee shall be indirect (paid regardless of the waste volumes delivered) – where significant is explained as at least 30%[130]. This requirement leaves room for interpretation and has led to a number of different models of cost recovery system in ports, ranging from cost recovery system based on a 100 % indirect fee (some with limitations in volume, others without) to systems where some waste types are covered by the indirect part whereas for other waste types a fee has to be paid according to the service provided (direct). Although, the latter model in a pure form would not meet the significant indirect contribution requirement, it is still reported to exist (ex-post evaluation, 2015).

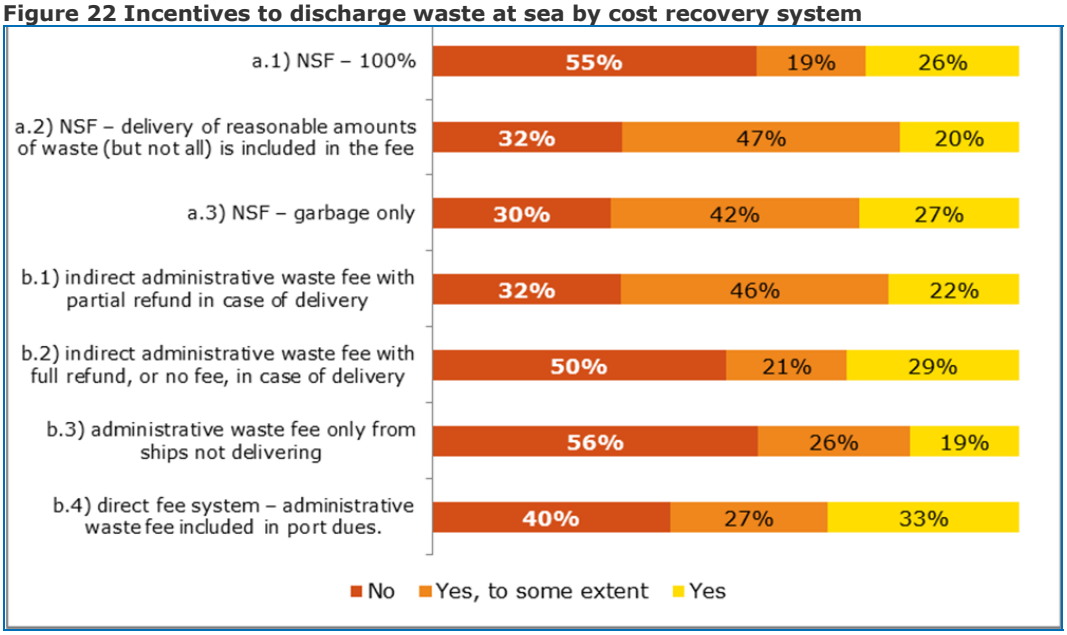
A detailed description of cost recovery systems used in Member State ports was provided by an EMSA study from 2005 (Carl Bro) and updates of this were included in the PRF ex-post evaluation (PwC and Panteia, 2015). Across these ports, fees for garbage are can typically be qualified as indirect, while fees for sewage and oily waste can be qualified as direct fees. For oily waste this also relates to the fact that this type of waste has a commercial value; it can be cleaned and re-sold.

The question under this root cause, however, is whether the fact that different cost recovery system are applied matters from a user perspective. The facts presented in the ex-post evaluation conclude that indirect mechanisms result in higher volumes of waste delivered than direct systems (which does not necessarily mean that waste is discharged at sea. It could also point to strategic delivery behaviour, i.e. delivering in the port where costs are lowest from a user perspective). However, the ex-post evaluation does not provide evidence whether more alignment of cost recovery systems would contribute to higher delivery of waste in ports.

[129] Following the categorization as stated in EMSA (2010), Horizontal Assessment Report - Port Reception Facilities (Directive 2000/59/EC), page 18-19.
[130] Please refer to the Statement of the Commission of 28.12.2000 (L332/90) that states: *'The Commission interprets the word 'significantly' as a figure of the order of at least 30 % of the costs referred to in Article 8(1).'*

It is, therefore, not possible to say whether the lack of harmonisation as such is the main cause for not delivering waste to a port reception facility. The lack of harmonisation can, however, be a source of administrative costs, as the fees charged to port users are not uniformly calculated and therefore more difficult to understand for port users and more difficult to invoice for PRF operators. Also other factors, in particular fee levels and direct versus indirect fees, as well as operational practices of delivery (adequacy) are seen as important. The relevance of each aspect varies per waste category. In other words: the type of cost recovery system in place matters significantly, and the benefit of harmonisation thus would depend on the direction of harmonisation (i.e. towards more incentivising cost recovery system).

Figure 22 Incentives to discharge waste at sea by cost recovery system



Source: Stakeholder consultation as part of ex post evaluation Panteia and PwC (2015).

A working group on cost recovery systems under the ESSF-PRF working group is assessing possible options for harmonisation, suggesting that the indirect fee should cover at least all indirect costs as well as part or all of the direct costs, per waste category, where the indirect percentage would be 30% or an alternative percentage, which could be differentiated per waste category.[131]

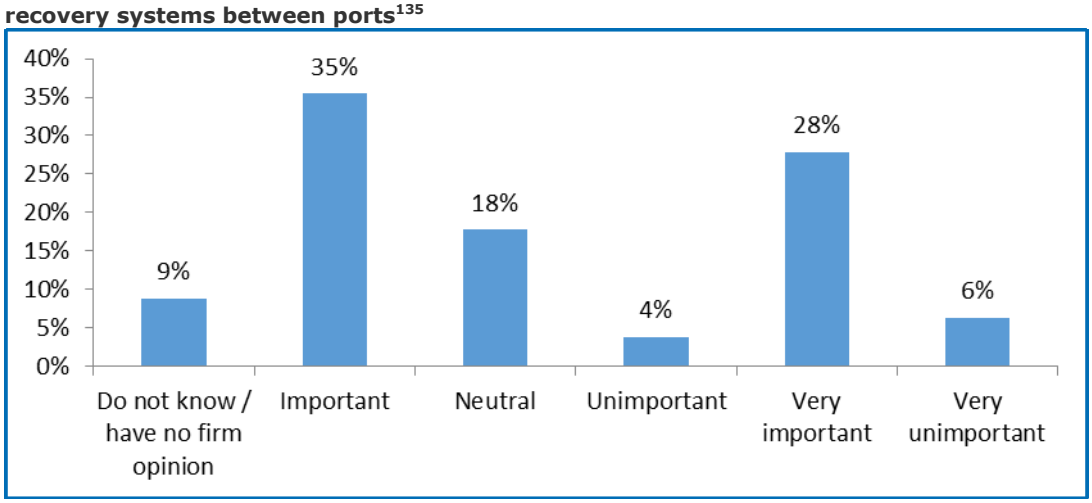
Size of the problem

The question here is what contribution a lack of alignment of cost recovery systems makes to the problem of inefficient cost incentives. If indeed, as the ex-post evaluation points out, indirect systems are more effective (i.e. result in higher volumes of waste delivered) than direct systems[132], an alignment towards more indirect fee structures would indeed result in better incentives at EU level. The impacts at port level would depend on which cost recovery system is currently in place and how much it deviates from the alignment direction. Alignment might contribute as a means of pushing towards improved cost incentives to deliver waste to port reception facilities.[133]

[131] Draft Report Third round CG on cost recovery systems ESSF-PRF 19 May 2016.
[132] Art.8 of the PRF Directive already excludes direct cost recovery systems. The e- post evaluation findings, however, indicate that for individual waste categories, direct fees are still applied in some ports.
[133] Due to the wide variety of cost recovery systems throughout the EU it is not possible to assess the current practices. Cost recovery systems do not only different between countries, but also between ports in the same country. Also within one port different systems can be used, depending on the waste category concerned. For example, a port can opt for applying a NSF regime for Annex V waste, while for Annex I a direct fee system is applied.

The 2016 OPC results also stress the importance of the lack of alignment in cost recovery systems[134] and indicate that it is a major contributor to insufficient (cost) incentives for delivery of waste at port reception facilities. Overall, 63% of the respondents indicate that a lack of alignment in cost recovery system is an 'important' or 'very important' contributing factor.

Figure 23 OPC score on the importance of lack of alignment in the implementation of cost recovery systems between ports[135]



Source: OPC, N= 79.

As the discussing above shows, the lack of alignment in cost recovery systems used by individual ports has a large impact on (in) efficient costs recovery systems. Therefore the relation between this root cause and the problem driver of inefficient cost incentives is asses to be high.

6.2.2. The relation between fees charged to ships and the costs of port reception facilities is unclear or non-transparent

Description of the problem

Most Member State ports do not provide a clear and transparent overview of the costs associated with waste handling in their port. This was one of the main findings of the EMSA 2010 Horizontal Assessment reports, which indicated that for 14 out of 22 Member States visited no clear overview was available. The lack of transparency was confirmed by the 2015 ex-post evaluation.

One of the reasons for this lack of transparency is that most ports have outsourced port reception facilities to external waste operators to provide the services. As a consequence, ports no longer have the detailed overview of the actual costs and cost structures associated with the handling and processing of waste. Some ports have just a negotiated total price from the waste operator based on the services provided, which does not include a breakdown of the specific costs of offering the services. Other ports will leave the payment directly to the operator and the agent. Several other ports will manage all payments to and from ship and waste operators. This differences in how PRFs are organized among seaports within the European Union makes the entire fee

[134] In the OPC respondents were asked to comment to the following statement: 'The lack of alignment in the implementation of cost recovery systems between ports (the obligations/principles laid down in Article 8 of the PRF Directive)'.

[135] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion major contributing factors to the problem of '(cost) incentives not being sufficient for users to deliver waste and cargo residues in port reception facilities' as identified in the evaluation? The lack of alignment in the implementation of cost recovery systems between ports (the obligations/principles laid down in article 8 of the Directive).

system more opaque and in some cases impossible to get a clear overview of the relation between costs and fees.

With regard to the calculation of the waste fee, some ports list the cost breakdown provided by the waste operator directly in the WRH plans, while others try to include other types of cost into the fee, e.g. administrative costs. Several ports simply estimate the waste fee based on 'what it used to be'.[136] It is up to each port and its policy/strategy to decide on the payment flow for waste handling services and to calculate to height of the waste fee. Consequently, the picture is unclear due to the many payment and invoicing systems implemented.

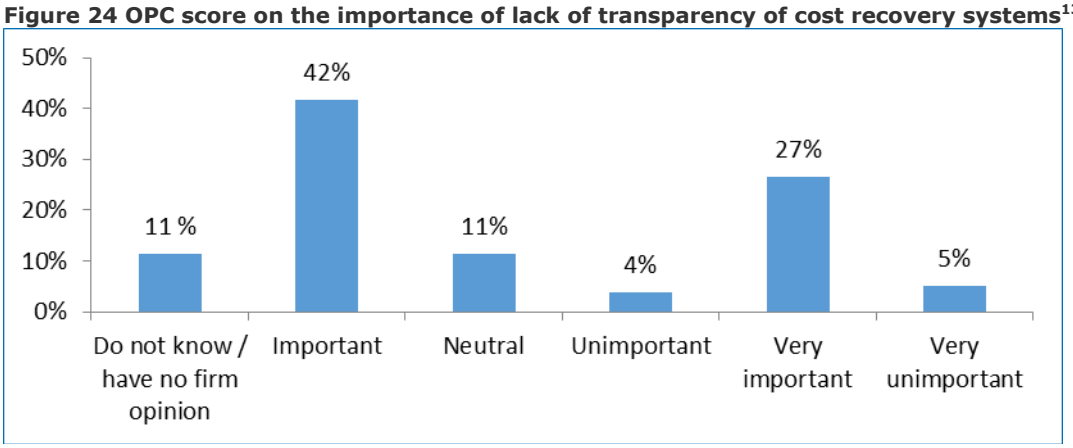
At an overall level, for the shipping sector a level playing field is considered of crucial importance. If costs need to go up or regulations need to be implemented, an equal application across the sector is demanded to ensure fair competition. In this respect, non-transparency contributes to mistrust among port users, and according to the ex-post evaluation, 'this has contributed to the overall idea among port users that port reception facilities are too expensive.' [137]

The CRS correspondence group notes in this regard the difference between indirect costs (e.g. administration, management, and invoicing) and indirect fees (i.e. the significant contribution). Suggestions to address this include the provision of definitions on direct and indirect costs, either in the Directive or in guidelines. In order to raise fairness, the group suggests fees to be the same for ships of similar characteristics as well as proportionate to the waste volume such a ship produces. More specifically, to categorise by type and size of ship.

Size of the problem

According to the ex-post evaluation stakeholder consultation, 65% of the port users considered the cost structures of the port reception facilities to be non-transparent.

Figure 24 OPC score on the importance of lack of transparency of cost recovery systems[138]



Source: OPC, N= 79.

The 2016 OPC results also stress the importance of the relationship between fees and costs and that this is often not clear (lack of transparency) and indicate that it is a major contributor to insufficient (cost) incentives for delivery of waste at port reception facilities. Overall, 69% of the OPC respondents indicate that a lack of

[136] Based on the case studies.
[137] PwC and Panteia (2015), ex-post evaluation of the PRF Directive, page ii.
[138] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the problem of '(cost) incentives not being sufficient for users to deliver waste and cargo residues in port reception facilities' as identified in the evaluation?: Fees cannot be considered fair, non-discriminatory and do not reflect the actual costs of PRF, or the relationship between fees and costs is not clear (lack of transparency).

transparency in cost recovery systems is an 'important' or 'very important' contributing factor.

The relation between this root cause and the problem driver of inefficient cost incentives is asses to be high.

6.2.3. Fees cannot be considered fair, non-discriminatory and are not reflecting the actual costs

Description of the problem

As the size of the waste fees varies between Member State ports and little knowledge regarding the actual pricing of the waste handling services is available, it is difficult to say whether the waste fees are fair and non-discriminating and whether they reflect the actual costs. The ex-post evaluation (Panteia, 2015) indicated that typically PRF operators consider fees to be lower than the costs, while users consider them to be higher than costs. Port authorities think the fees and costs are in balance.

A ship will normally deliver waste where it is the most efficient in terms of handling time and charges, irrespective of whether these charges are 'fair'. If there is a direct fee for waste delivery in a port, the ship will be tempted to find alternative solutions and deliver its waste in another port with an indirect fee, if such port is included in the ship's route. This phenomenon is called 'PRF shopping' and occurs frequently in practice; at least this was stated by the ports in the case studies (for full results regarding the case studies, see Annex 11).

Part of the problem with variations in waste fees relates to the fact that some ports leave the waste handling to external operators that will price the services according to their own calculations. Other ports will determine the waste fees themselves taking, for example, competition matters into consideration. Finally, some ports do not charge a separate waste fee as the service is fully included into their port dues. From a survey among cruise ships in the Baltic Sea (HELCOM, 2014), respondents considered fees unreasonably high for various ports. However, a clear comparison of fee rates was not provided in the aforementioned study.

A large share of stakeholders (see Section 6.2.1) considers indirect fee systems to be more effective. Some ports and shipping lines, however, find this unfair if no or only small amounts of waste are to be delivered due to a short voyage; especially when the full indirect waste fee has to be paid, if they have taken measures against the generation of waste or apply cleaning systems. Efforts to reduce waste generation could, however, be compensated through a rebate.

Under this root cause, the concept of Green Ships is also considered relevant. The PRF Directive leaves room for ports to differentiate waste delivery charges between ships based on their green profile. However, ports apply a range of criteria for a ship being green or not, and these criteria are not always linked to waste volumes, as common criteria for what a Green Ship is, are lacking.

Size of the problem

The key question under this root cause is: does 'fairness' matter? Obviously everyone would like to be treated fair and transparent, but whether unfair prices lead to non-delivery is not an automatic follow-on conclusion one can draw here. The PRF Directive demands fairness in general terms, and stakeholders responding to the ex-post evaluation survey confirm this, but neither the evaluation nor other literature give any indication of whether more transparency and clarity over criteria would result in more 'fair' fees and indirectly delivery.

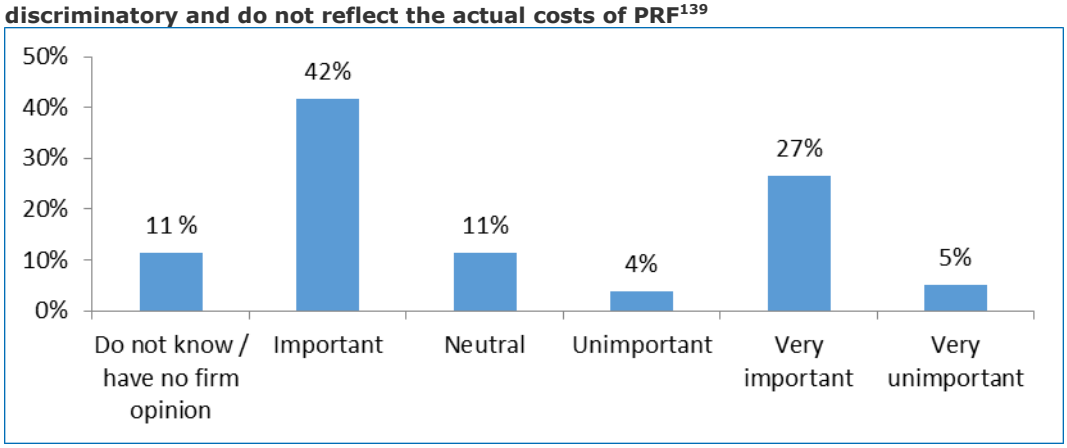
Market signals indicate that price levels matter, even though waste fees are typically small in comparison to overall port dues (a few percent according to interviewees).

A more uniform and transparent method for waste fee calculation would make it easier for the ports to ensure that all their costs are covered. It will also ensure that ship owners and agents understand how the waste fee(s) are calculated. Whether an increased (perception of) fairness would result in increased waste delivery is doubtful, as the role of this factor is much lower than issues of fee levels and direct versus indirect cost recovery systems as such. Nevertheless, a more uniform and transparent method for waste fee calculation still has an impact on cost incentives, i.e. providing efficient cost incentives may potentially lead to more waste delivery.

In addition, a more uniform approach to the calculation would decrease the PRF shopping incentives for shipping agents and liners, which is a highly undesirable side effect of the current cost recovery situation. Although the net impact of PRF shopping on an EU level is probably limited, making the assumption that even though shopping behaviour occurs, the waste is still delivered at port reception facilities instead of being discharged at sea. However, one could argue that disincentivising waste shopping, incentivises waste delivery in ports.

These unintended side effects of the current cost recovery systems are confirmed by the results of the OPC. In the 2016 OPC 69% of the respondents indicated that both fees that are considered unfair, discriminatory and do not reflect the actual costs of PRF and the relationship between fees and costs is not clear (lack of transparency), are important or very important contributors to insufficient cost incentives for the delivery of waste. In addition there is a very strong link to the problem of 'The relation between fees charged to ships and the costs of port reception facilities is unclear or non-transparent' and 'Fees cannot be considered fair, non-discriminatory and are not reflecting the actual costs' (see previous two paragraphs).

Figure 25 OPC score on the importance of fees (which cannot be considered fair, non-discriminatory and do not reflect the actual costs of PRF[139]



Source: OPC, N= 79.

It is concluded, therefore, that the unfair, discriminatory fees that are not linked to the actual costs constitute a clear problem, as it is directly linked to PRF shopping behaviour. However, it is expected that this is only a problem in cases where the fees charged to the PRF users are considered to be (too) high compared to other ports.

[139] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion major contributing factors to the problem of '(cost) incentives not being sufficient for users to deliver waste and cargo residues in port reception facilities' as identified in the evaluation? Fees cannot be considered fair, non-discriminatory and do not reflect the actual costs of PRF, or the relationship between fees and costs is not clear (lack of transparency).

Therefore this root cause is assessed as having a Medium causality to inefficient cost incentives.

6.2.4. Fishing vessels excluded from a cost recovery mechanism to disincentive ships to discharge waste at sea through an indirect fee principle

Description of the problem

As mentioned in Chapter 5, fishing vessels and recreational vessels carrying less than 12 passengers are exempted from the fee structure stipulations provided in Article 8(2) of the PRF Directive. This in effect means that such vessels are exempted from the mandatory 'indirect fee'. Yet, the delivery of waste by such vessels is still mandatory pursuant to Article 7 of the Directive, meaning that fishing vessels are effectively under a direct fee to cover the waste reception and disposal costs. This provides an insufficient incentive for such vessels to deliver waste at port reception facilities, in particular waste that has not been generated by the vessel, but collected in nets during the vessel's operations.

In relation to incentivising the delivery of ship (self-)generated waste in the fisheries sector, a range of projects has been launched concerning the delivery of litter fished while active on the seas. The text box below provides an example of this.

Text box 1 KIMO's 'Fishing for litter'

KIMO's Fishing for Litter is an initiative that aims to improve waste management practices and reduce marine litter by engaging the fishing industry. The initiative includes not only the direct removal of litter from the sea, but also raises awareness of the detrimental impact of marine litter on the environment. The project provides sturdy, hard wearing bags to fishing vessels to collect marine litter that is caught in their nets as part of their normal fishing activities. Full bags are then deposited on the quayside where the bag is moved by harbour staff to a dedicated skip for disposal. The waste costs are covered by the project, while the participating fisherman and harbour staff volunteers their time.

Pilot schemes were run as part of the Save the North Sea Project in Scotland, Sweden, Netherlands and Denmark until 2005. The Scottish project was set up at this time and has remained active ever since. Fishing for Litter South West (England) was set up in 2009. KIMO continues to operate Fishing for Litter projects in the Netherlands, the Isle of Man, the Faroe Islands and the Baltic Sea. Affiliated pilot projects have also taken place in Milford Haven, Wales and Northern Ireland. In Scotland as between 2011-2014, some 375 tonnes of waste had been landed by the participating vessels, 52% of which concerned plastics and polystyrene.

Source: KIMO International and Fishing for litter 2011-2014 Final Report.

Size of the problem

An understanding of what constitutes the underlying causes leading to fishers' decision on garbage disposal is necessary in order to assess the size of the problem and to design effective measures to reduce garbage pollution from fishing vessels. For example, Chen and Liu (2013)[140] investigated different factors that have the potential to influence fishers' garbage disposal practices and, in particular, their intention to bring waste back to shore. The study was based on a number of personal interviews and a survey of 427 fishers in Taiwan. As shown in the table below, a total of nine factors were identified in the study to either promote or hinder fishers' bringing garbage back to port. These factors were indexed and classified in two categories: motive and constraint.

[140] Chen, C.L., Liu, T.K., 2013, Fill the gap: developing management strategies to control garbage pollution from fishing vessels. Marine Policy 40, 34-40.

Table 21 Mean rating of factors to fishers' bringing garbage back to port

Factors	Mean[a]	S.D.[b]
Motive items		
M_1: a well-developed household waste recycling practice	4.04	1.04
M_2: captains requiring crews to bring garbage back to port	4.01	0.97
M_3: positive attitude towards the protection of the marine environment	3.81	1.14
M_4: adequate collection facilities placed at port	3.70	1.08
M_5: providing a reward for the garbage brought back to port	3.46	1.23
M_6: making regulations to prohibit fishing vessels from discharging garbage into sea	3.12	1.30
Constraint items		
C_1: catching fish is far more important than dealing with garbage at sea	4.10	1.25
C_2: indifference to the garbage being dumped at sea	3.91	1.18
C_3: collecting garbage on board causes inconvenience to fishing operations	3.09	1.13

[a] Five-point Likert scale was used for rating the agreement level of each factor, ranging from 1 (strongly disagree) to 5 (strongly agree).
[b] S.D. is standard deviation.

Source: Chen, C.L., Liu, T.K., 2013, Fill the gap: developing management strategies to control garbage pollution from fishing vessels. Marine Policy 40, 38.

The study concluded that major motivational factors for bringing garbage to ports were a well-developed recycling practice, adequate collection facilities placed at port, fishers' positive views towards marine environments and provision of rewards. While developed household recycling practices were a strong factor, the motivation to bring garbage back to port was even stronger if garbage could be sold for recycling purposes. For the constraint items, the most agreed item that posed a barrier to fishers' bringing garbage to port was that catching fish is far more important than dealing with garbage at sea. This was followed by indifference to the garbage being dumped at sea and the perception that collecting garbage on board causes inconvenience to fishing operations.

While the study has not specifically addressed the issue of passively fished out waste[141] nor of the costs that may be associated with the delivery of waste to port reception facilities, an important finding was that rewards can act as an incentive to encourage 'new' waste disposal practices. Moreover, the study found that if the perceived benefit of the reward was less than the perceived cost of the additional effort and time taken to collect, sort and hand over the waste then the reward would be meaningless.

Other sources confirm that costs are one of the major discouraging factors to deliver waste. For example, respectively 44% and 43% of respondents to the fisheries survey indicated that costs discourage the delivery of waste collected in nets and garbage (including household garbage) to port reception facilities. As far as the former 'waste type' is concerned, KIMO confirmed that the fact that the 'no special fee' (see text box below) system encourages vessels to deliver waste ashore.[142]

Finally, a somewhat specific issue in this context is the problem of abandoned, lost or otherwise discarded fishing gear (ALDFG). Some ALDFG may be intentional and some unintentional and, accordingly, methods used for reducing the problem may need to be different.

However, even for ALDFG, available literature confirms that economic incentives play an important role in addressing the problem. For example, the 2016 GHOST Manual[143] found that economic incentives are potentially important in solving the problem, providing that they are used in the framework of an integrated strategy. The 2009 FAO Study on Abandoned, lost or otherwise discarded fishing gear, United Nations

[141] It should be noted that ship generated waste and passively fished out waste are not the same. Ship generated waste refers to waste produced during the operation of the ship. Passively fished out waste can be ship generated waste (but is produced by another ship, but it can be much broader. It also can refer to land based generated waste that got into the sea.
[142] KIMO response to the impact assessment questions for revision of the PRF Directive - fishing vessels, 4 October 2016.
[143] GHOST, Hands-on Manual to prevent and reduce abandoned fishing gears at sea, 2016.

Environment Programme[144] found that a fee-for-service approach (i.e. direct fees) can be a barrier to the use of port reception facilities since vessel operators may not wish to pay for such fees and, instead, may opt to illegally dispose of their garbage at sea at no immediate direct cost. A 'general fee' (i.e. indirect fee), requiring that all vessels using a port pay a standard fee, was found in some instances more effective. In this connection, as example from Baltic was cited, where costs of disposal of nets are already contained as part of port fees, thus providing little economic incentive for fishers to deliberately discard nets at sea to avoid onshore costs of doing so.

Based on the above it can be concluded that excluding fishing vessels for the cost recovery mechanisms leads to disincentives at the side of fishers not to deliver their own waste as well as passively fished waste. The relation between this root cause and the problem driver of inefficient costing system is evaluated to be Medium.

6.2.5. Effect of (cost) incentives on discharges at sea

Ultimately, incentives included in the PRF Directive should be such that they do not provide an incentive to discharge waste at sea. The incentives given should rather be a motivation for waste delivery at port reception facilities. The Inception Impact Assessment of the European Commission refers to the ex-post evaluation (Panteia and PwC, 2015) in which it was found that ports with direct fee systems received significantly lower volumes of waste than ports with (partially) indirect fee systems. Incentives to waste delivery thus relate to fee levels as well as how they are charged.

According to the survey in the ex-post evaluation (Panteia, 2015), 'port users considered financial incentives more important than adequacy of reception facilities in the decision to discharge at sea' (p.22 of the ex-post evaluation), whereas other stakeholders pointed to other problems, in particular enforcement (see Section 6.3).

When taking the results of the OPC into account, it is indeed confirmed that (cost) incentives are the most important contributor to the illegal discharge of waste at sea (see Figure 21). As shown in the graph, 73% of the respondents indicated that efficient cost incentives are an 'important' or 'very important' reason for the (illegal) discharge of waste. Therefore, it is concluded that (cost) incentives play an important role in delivery of waste and whether or not ship-generated waste ends up in sea.

6.2.6. Effect of (cost) incentives on administrative burden

Non-harmonisation or differences in cost recovery systems across the EU are causing implementation differences and are thus negatively affecting port users. The variety in systems (NSF, AFS, direct fees) applied, creates an unnecessary administrative burden, both for port users and port authorities. It is argued that simpler and more transparent cost recovery systems will lead to lower administrative burden (Eunomia, 2016; IEEP 2013; ESSF PRF sub-group and EMSA). In particular, a 100% indirect fee would reduce the administrative burden as the complexity of the system is low.

An assessment of waste delivered vis-à-vis different cost recovery systems in ports, made as part of the ex-post evaluation, shows that the more complicated cost recovery systems are the larger the incentive is to discharge at sea. Complicated systems are perceived to create high administrative burden for port users as it will be time consuming to find out how needs to be paid when waste is delivered. These systems often also contain many exceptions under Article 9, which make the systems even less transparent.

[144] Abandoned, lost or otherwise discarded fishing gear, United Nations Environment Programme (UNEP), Food and Agriculture Organization of the United Nations (FAO), 2009.

In addition, non-uniform cost recovery systems stimulate PRF shopping behaviour and distort the level playing field. PRF shopping is by definition hampering the efficiency of the system for both port users, PRF operators and ports, as shopping does not only take time, it also can lead to lower volumes of waste delivered than expected. In its turn, lower volumes delivered than excepted may disrupt investments and capacity planning in port reception facilities.

6.3. Ineffective enforcement

The third problem driver identified in the ex-poste evaluation of the PRF Directive (Panteia, 2015), relates to enforcement. Under this problem driver, the following six root causes have been identified[145]:

- Unclear definition of 'sufficient storage capacity' which constitutes the main exception to mandatory delivery in port;
- The inconsistency between mandatory discharge requirement (for 'all' ship-generated waste) and the MARPOL discharge norms, in particular when the next port of call is a non-EU port;
- The insufficient use and inspection of waste notification forms by the relevant authorities, which causes that this data is not used for selecting ships for inspection;
- Legal uncertainties regarding the Port State Control framework, leading to less PRF-inspections being conducted than required by the PRF Directive;
- Not all port authorities keep track of the specific amounts of waste delivered to their port over time, as the electronic means for doing this are generally not in place and there is no legal requirement to do so;
- Fishing vessels and small recreational craft are not subject to inspections.

6.3.1. Unclear definition of 'sufficient storage capacity' which constitutes the main exception to mandatory delivery in port

Description of the problem

Based on Article 7(2) of the PRF Directive, a ship may proceed to the next port of call without delivering the ship-generated waste it has on board. This is only allowed when sufficient dedicated storage capacity is available on board the ship to store the waste that will be generated on route to the next port. In order to assess whether or not sufficient storage capacity is available, information given in accordance with Article 6 and Annex II of the PRF Directive is used. Neither Article 7(2) nor any article in the PRF Directive provides a clear definition of sufficient storage capacity, which means that this requirement is a multi-interpretable criterion.

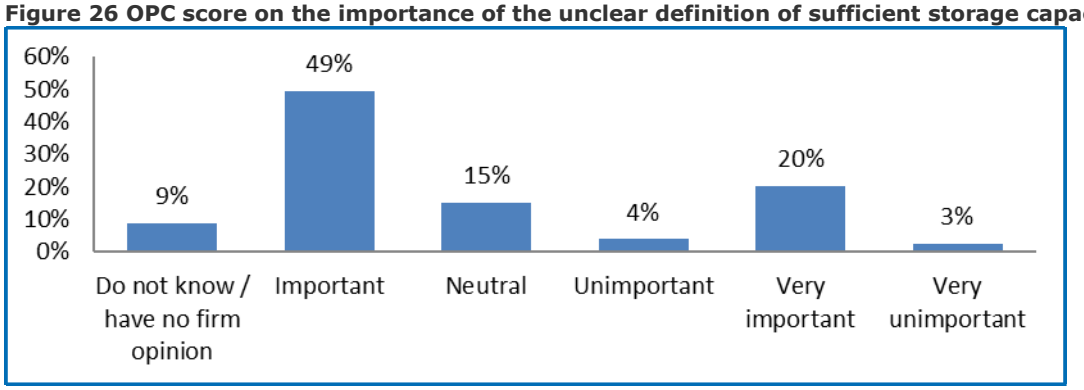
In order to address this issue, the Commission provided additional guidance in its Interpretative Guidelines (2016/C 115/05). The Commission indicated that the exemption should be interpreted narrowly and therefore is not fulfilled easily. Also technical guidance (EMSA) for assessing whether sufficient storage capacity is available has been developed. For each waste type, the ship-owner should report what the maximum storage capacity available is (in m^3), what amount of waste is retained on board (in m^3), and estimate how much waste will be generated between notification and the next port of call (in m^3). The Commission stresses that the assessment should be conducted for each separate waste type. If for one waste type insufficient storage capacity is available, the ship should not be allowed to proceed. This reasoning is in line with the narrow interpretation required.

[145] Refer to the inception impact assessment, pages 4 – 5.

Size of the problem

As a result of clarifications provided in the guidelines relating to sufficient storage capacity and how to assess it, the amounts of waste delivered at port reception facilities should increase. Ships that currently falsely claim to have storage capacity available can be more easily detected. A clear definition of 'sufficient storage capacity' is expected to help strengthen the enforcement as it will become more straightforward to assess whether or not invoking this exemption is justified. Based on the new notification form (described above) it would become easier to compare the maximum storage capacity of a ship with the actually storage capacity used. By comparing the figures, enforcement officers would be able to assess if sufficient storage capacity is available. As a result, ships falsely claiming that sufficient capacity is available, can be better detected and unwanted behaviour can be prevented (i.e. enforcement becomes more effective). This view is shared by the stakeholders responding to the OPC. 70% of the respondents indicated that the insufficient definition of storage capacity indeed is a large contributor ('important' or 'very important') to the problem of ineffective enforcement.[146] This view is held by the main stakeholder groups, e.g. port authorities, ship operators, PRF operators and Member State authorities. Ultimately, more effective enforcement will lead to a decrease in illegal discharges at sea.

Figure 26 OPC score on the importance of the unclear definition of sufficient storage capacity[147]



Source: OPC, N= 79.

As the Interpretative Guidelines have been adopted recently (2016), it is currently not possible to assess the impact of the clarification, and to what extent a problem regarding lack of clarity still remains to exist. Therefore, it is also not possible to indicate the impact this solution has on enforcement.[148] The relevance of this problem in relation to ineffective enforcement, taking account of the measures already taken in the guidelines, is therefore rated as Low / Medium.

6.3.2. The inconsistency between mandatory discharge requirement (for 'all' ship-generated waste) and the MARPOL discharge norms, in particular when the next port of call is a non-EU port

Description of the problem

Under the PRF Directive 'all' ship-generated waste needs to be delivered at a port reception facility. According to Article 2(c) ship-generated waste means *'all waste, including sewage, and residues other than cargo residues, which are generated during the service of a ship and fall under the scope of Annexes I, IV and V to MARPOL 73/78*

[146] OPC question 17A.
[147] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the problem of 'insufficient and ineffective enforcement of the mandatory delivery of ship generated waste' as identified in the evaluation? Unclear definition of 'sufficient storage capacity' which constitutes the main exception to mandatory delivery in port.
[148] It should be noted that it is not possible to indicate whether or not the respondents to the OPC already considered the impact of the interpretative guidelines in their answer.

and cargo-associated waste as defined in the Guidelines for implementation of Annex V to MARPOL 73/78.' Under MARPOL, some waste categories can, under certain conditions, be discharged at sea. Such an example is sewage. As indicated by Article 2(c) of the PRF Directive, sewage needs to be seen as ship-generated waste as well and therefore needs to be delivered at a port reception facility.

This example shows the inconsistency between MARPOL and the PRF Directive, which can lead to confusion amongst the crew members. This could consequently lead to unwanted behaviour by ships using the 'opportunity' such an inconsistency offers.

In its Interpretative Guidelines, the Commission indicated that what is allowed to be discharged under MARPOL is not also automatically excluded from the delivery requirement laid down in the Directive. Whether or not an exception to this rule applies, needs to be established for each waste category based on sufficient storage capacity until next port of delivery.

Size of the problem

As indicated above, for some waste categories[149] a deviation between MARPOL and the PRF Directive exists. Clarifying the inconsistency between MARPOL discharge norms and PRF delivery requirements is likely to help ship owners in reducing confusion. Guidelines will provide a basis for enforcement actions. However, as guidelines do not have a legal status and therefore only serve as guidance, it is possible to put the guidelines aside and not consider them during enforcement. The guidelines in itself cannot be enforced, as they are qualified as soft law.

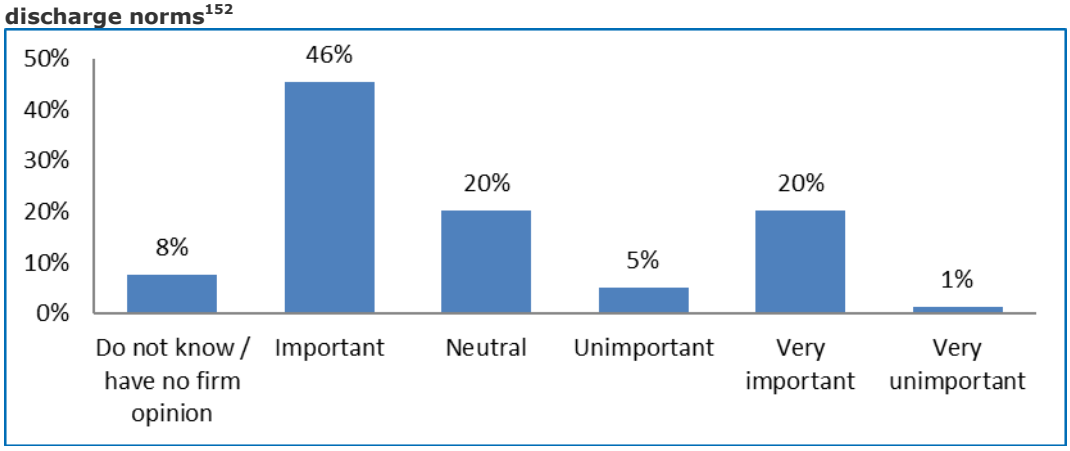
The main problem for enforcement officers is to detect whether or not waste that should have been delivered according to the PRF Directive is actually delivered. As the EMSA report on illegal discharges[150] points out, much of the waste illegally discharged is not discharged in coastal regions (where enforcement is relatively easy), but at open sea, where it is difficult for enforcement bodies to enforce regulations. It is, for instance, difficult to detect who discharged the waste illegally as ships discharging at open sea are often not caught in the act.

Clarifying the inconsistency between MARPOL and the PRF Directive will likely not lead to a more effective enforcement, as especially enforcement officers, will already be aware of what is and what is not allowed to be discharged at sea. Enforcement officers are facing different problems, more specifically, how they could assess whether all ship-generated waste is actually delivered.

This view is not fully shared by the OPC respondents. In total, 65% of the respondents indicated that they think that the inconsistency between mandatory discharge requirements and MARPOL discharge norms is an 'important' or 'very important' contributor to the problem of insufficient enforcement.[151]

[149] Please refer to Annex 3.
[150] EMSA (2012), 'Addressing illegal discharges in the marine environment'.
[151] OPC question 17B.

Figure 27 OPC score on the inconsistency between mandatory discharge requirements and IMO discharge norms[152]



Source: OPC, N= 79.

The view is shared among different stakeholders groups (port authorities, Member State authorities, PRF operators and ship operators). For stakeholders, especially ship operators, the confusion about what needs to be delivered and what could be discharged could be reduced.

Overall, the relevance of this problem in relation to ineffective enforcement rated as Low.

6.3.3. The insufficient use and inspection of waste notification forms by the relevant authorities causes that this data is not used for selecting ships for inspection

Description of the problem

Under the PRF Directive the master of the ship needs to notify the competent authorities, under certain conditions, about its arrival in port and the waste the ship intends to deliver. Each ship (with the exemption of fishing vessels and recreational craft carrying no more than 12 passengers) has to notify the authority at least 24h prior to its arrival (Article 6). The master of the ship is required to truly and accurately fill in the form as presented in Annex II of the Directive. This form is used in the selection of ships for inspection. According to Article 11(2) of the Directive, ships that have not duly notified the authorities, or based on the information provided there is reason to believe that the ship is not complying with the PRF Directive, will be selected for inspection.

However, relevant Member State authorities do not carefully consider the forms received and therefore do not sufficiently use them in their selection of vessel inspections. According to the ex-post evaluation, authorities combining the PRF and PSC inspections do not always use the contents of ships' advance notification in their inspection selection. As a result, ships that might pose a danger for illegal discharging at sea might not be sufficiently detected.

Size of the problem

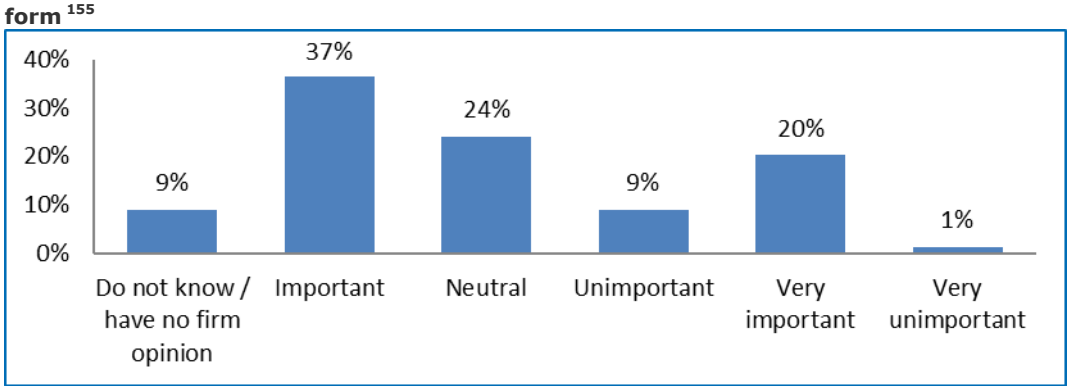
The notification forms with the information on waste to be delivered are already available and need to be submitted to the relevant authorities before a ship enters a port. The problem, though, is that some authorities do not use these forms in

[152] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the problem of 'insufficient and ineffective enforcement of the mandatory delivery of ship generated waste' as identified in the evaluation? The inconsistency between the Directive's mandatory discharge requirement (for 'all' ship generated waste) and the MARPOL discharge norms.

selecting ships to be inspected under the PRF regime.[153] Enforcement would become more effective once all inspectorates start to consider the submitted forms and base their inspection decisions on the information provided by these forms. Solving this root cause (i.e. use the forms in the correct manner) will not lead to additional administrative burden, as the forms are already available to the inspectorates; they only have to be used in the decision making process. This will not lead to an increased effort on the side of the inspectorates.

This view is partially confirmed by the stakeholders. In the OPC 60% of the respondents indicated that the insufficient use and inspection of the waste notification form leads to insufficient enforcement.[154] And therefore can be qualified as an 'important' or 'very important' contributor. Especially the port authorities and PRF-operators confirmed this view.

Figure 28 OPC score on effect of the insufficient use and inspection of the waste notification form [155]



Source: OPC, N= 79.

During the EMSA visits, it became clear that in eight Member States the responsible authorities did not always consider the notification forms as a basis for inspections (EMSA, 2010). It is unclear if these inspectorates have changed the way of selecting ships since the EMSA visits. If these inspectorates have not changed their way of selecting ships, a change in behaviour would improve the effectiveness of the enforcement considerably. However, if most inspectorates have changed their way of selecting and already use the forms in their decisions, the effects of a change in behaviour will probably be limited, and the causal relation is therefore assessed as Low to Medium. Rather, more impact is expected from the amount of PRF inspections selected (see next root cause).

6.3.4. Legal uncertainties regarding the Port State Control framework lead to less PRF-inspections being conducted than required by the PRF Directive

Description of the problem

The number of inspections and grounds for selection differ between the PRF Directive and the Port State Control (PSC) Directive. The PSC Directive inspection system is

[153] The ex-post evaluation of the PRF Directive (2015) concluded that both ports and inspection authorities make insufficient use of the forms. Port authorities that are not directly responsible for waste deliveries seem not review the contents of the waste notification forms and in other ports waste handling companies are not granted access to the forms. Please refer to the ex-post evaluation of the PRF Directive, pages 65-67.
[154] OPC question 17C.
[155] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the problem of 'insufficient and ineffective enforcement of the mandatory delivery of ship generated waste' as identified in the evaluation?: The insufficient use and inspection of waste notification forms by the relevant authorities causes that this data is not used for selecting ships for inspection.

based on a risk-based approach, while the PRF Directive inspection system indicates that a certain % of the fleet (i.e. 25%) needs to be inspected, irrespective whether or not a ship poses a risk. Before the revision of the Port State Control Directive, both directives indicated that at least 25% of the ships in port should be inspected. The PRF Directive still uses this system (please refer to Article 11(2) (b)). Nevertheless, the article states that some risk-based approach should be followed. The inspection criteria focus on (i) ships that did not notify the competent authority about their arrival, and (ii) ships that did notify, but of which the notification seems incorrect. As a result, ships posing a (high) risk will be selected first.

The inspection regime under the PSC Directive is different and is based on a shared inspection burden between Member States and risk-based selection of vessels. The focus of inspection lies on Priority I ships (ships that have clear indications of being substandard) and Priority II ships, which might be substandard. In Articles 5-7 of the PSC Directive an overview of inspection commitments is presented which aims to ensure that the inspection burden is equally shared between Member States.

As indicated under the previous root cause many Member States combine the PSC and the PRF inspections. As presented above, the selection criteria differ and this may lead to insufficient enforcement. For example, the number of ships inspected under the PRF Directive may be lower than required (i.e. less than 25%) or ships posing a risk of discharging at sea may slip the inspection criteria, as under the PSC requirements they are not in the frame of frequent inspection (if they comply with the PSC requirements).

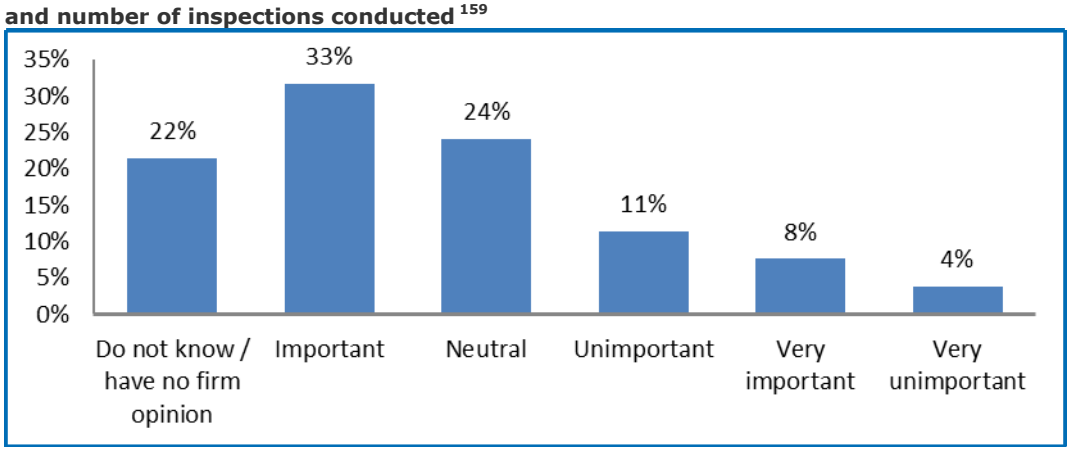
Size of the problem

In order to assess the magnitude of this problem, it is important to establish which Member States combine PRF inspections with PSC controls.[156] Based on this list, it would be possible to assess the number of inspections that should be conducted following the PRF requirements[157] and the number of inspections that are likely to be conducted following the PSC requirements.[158] In assessing the number of PRF inspections it should be kept in mind that not only 25% of all ships calling a port should be inspected, but that in this selection, the requirements laid down in Article 11(2) (a) should be followed (i.e. start with ships not notifying and ships wrongfully notifying) and the PRF inspections should check that ships deliver or have delivered their waste in accordance with the Directive, distinguishing it from a MARPOL inspection. Based on those figures, an estimation could be made as to how many ships should have been inspected (under PRF requirements), but were not, because PSC requirements were used. More clarity on the selection criteria for PRF inspections is expected to assist in achieving more effective enforcement.

It is important to ensure that the PRF inspections are targeted and focus on ships posing the highest risk of illegally discharging their waste at sea. This problem mainly contributes to the illegal discharges at sea, but it also does (to a lesser extent) contribute to the problem of administrative burden.

[156] The latest EMSA visits, conducted for the PSC Directive, showed that 7 Member States hold separate PRF inspections. Nonetheless, it should be noted that 4 out of these 7 Member States also partially combine those inspections with the PSC regime.
[157] Calculate number of ships inspected using PRF rules: total number ships calling in EU * 25%.
[158] Calculate number of ships inspected using PSC rules: Priority I and Priority ships => based on flags.

Figure 29 OPC score on effect of legal uncertainty regarding the Port State Control Framework and number of inspections conducted [159]



Source: OPC, N= 79.

This view was not confirmed by the stakeholders responding to the OPC. The majority, 60%,[160] indicated that they do not think that the legal uncertainty regarding PRF inspections lead to insufficient enforcement,[161] and a large part this group (17 respondents out of the 79) indicated that they were not able to answer this question. Nevertheless, the causal relationship between this root cause and ineffective enforcement is assessed as High.

6.3.5. Not all port authorities keep track of the specific amounts of waste delivered to their port over time, as the electronic means for doing this are generally not in place and there is no legal requirement to do so

Description of the problem

Data is needed to assess whether or not the PRF Directive is reaching its goals, i.e. more waste delivery at port reception facilities. Indirectly, data would also help to assess if illegal discharges at sea are reduced or that more enforcement is required. However, without a legal requirement for ports to keep track of waste deliveries, ports can decide not to monitor the volumes of waste delivered. In addition, there is no uniformity in the way of measuring, which leads to the situation that data provided by ports is not easily comparable. Therefore, it is very difficult to assess the exact quantities of waste delivered in ports, and relies on what ports are able to report (see Chapter 5).

Size of the problem

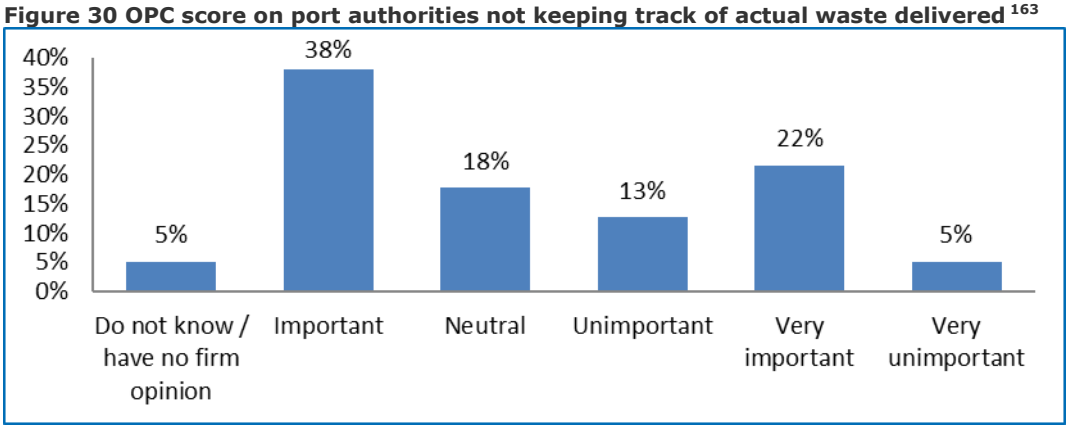
Based on consistently collected and monitored data on waste delivered in port, it would be possible to better assess whether or not the enforcement effort needs to increase or is already sufficient. Additionally, more and better data will also help enforcement officers to target their enforcement efforts. If, for example, only one or two waste types are not sufficiently delivered at ports (while all others are), enforcement bodies can target their efforts and focus on these waste categories.

From the data inventory of waste delivered in port conducted as part of this study it is clear that not all ports are able to provide such data, while it also appears that the data cannot always be compared as the basis of information differs between ports.

[159] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the problem of 'insufficient and ineffective enforcement of the mandatory delivery of ship generated waste' as identified in the evaluation?: Legal uncertainties regarding the inspection framework lead to less PRF-inspections being conducted than required.
[160] Including all answers categories, except 'important' and 'very important'.
[161] OPC question 17D.

Therefore, more consistent data collection and monitoring in all EU ports would contribute to achieving a better picture of waste volumes delivered, and consequently provide supportive information for enforcement. This view is confirmed by 60% of the respondents to the OPC who this is an 'important' or 'very important' contributor.[162]

Figure 30 OPC score on port authorities not keeping track of actual waste delivered [163]



Source: OPC, N= 79.

The causal contribution of this root cause to enforcement is rated as Medium.

6.3.6. Fishing vessels and small recreational craft not subject to inspections

Description of the problem

As discussed in Section 6.2.4 above, there are numerous factors with a potential impact on illegal garbage discharging at sea practices. One of these factors is the lack of an effective enforcement regime to secure compliance with applicable legislation.

Fishing vessels and small recreational craft are, in addition to the notification requirements and Article 8(2) of the PRF Directive, exempted from the specific inspection requirements and control procedures (Article 11(2) of the PRF Directive). While pursuant to Article 11(3) of the PRF Directive Member States are obliged to establish control procedures for fishing vessels and recreational craft carrying no more than 12 passengers to ensure compliance with the PRF Directive. The 2010 EMSA report however concluded that there was an almost complete lack of implementation of the provision regarding such control procedures for fishing vessels and small recreational craft. [164]

Size of the problem

Again, similarly as for the issue of economic incentives to deliver garbage, it is important to distinguish between abandoned, lost or otherwise discarded fishing gear (ALDFG) and other garbage (including household garbage).

As far as ALDFG is concerned, the results of the fisheries survey indicate that lack of enforcement is among the main factors discouraging delivery to port reception facilities (see Annex 10 for all results). 43% of respondents found the lack of enforcement to be a discouraging factor for waste delivery. Similarly, the 2016 FAO

[162] OPC question 17E.
[163] The full question in the OPC is stated as follows: Which of the following drivers are in your opinion contributing factors to the problem of 'insufficient and ineffective enforcement of the mandatory delivery of ship generated waste' as identified in the evaluation?: Insufficient reporting on quantities and types of waste delivered to EU ports, as well as insufficient exchange of information, given that a Common Monitoring and Information System is not yet fully developed.
[164] EMSA, Horizontal Assessment Report - Port Reception Facilities (Directive 2000/59/EC), 2010.

Study[165] found the prohibition of intentional discarding and abandoning fishing gear at sea to be an effective measure, but only if surveillance and enforcement systems elicit strong compliance.

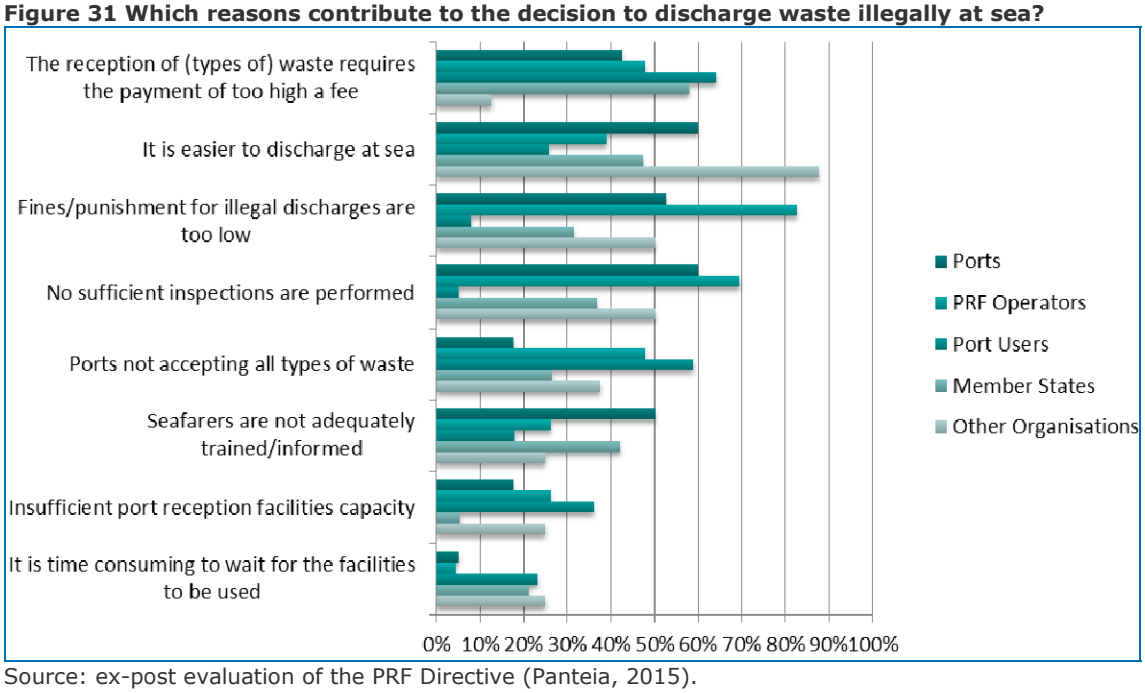
As for other types of Annex V waste (garbage), including household waste, 31% of the respondents to the fisheries survey found the lack of enforcement to be a factor discouraging delivery, i.e. as a significant factor, but comparably less important compared to cost (43%), convenience (44%) and bureaucracy (38%).

Overall, the effect of this root cause on the problem driver enforcement is assessed to be Medium.

6.3.7. Impact of enforcement on discharges at sea

In the ex-post evaluation (PwC and Panteia, 2015), several stakeholders indicated that insufficient inspections could fail to prevent discharging waste at sea. As indicated in Figure 31, around 70% of PRF operators and 60% of all port authorities indicated that insufficient inspections may lead to illegal discharges.

Figure 31 Which reasons contribute to the decision to discharge waste illegally at sea?



Source: ex-post evaluation of the PRF Directive (Panteia, 2015).

When taking the results of the OPC into account, it is indeed confirmed that enforcement is one of the major contributors to the illegal discharge of waste at sea, see Figure 31 and is only just rated below (cost) incentives.

If the effectiveness of enforcement could be improved, it would provide a forceful motivation to deliver waste in port, thus raising the volumes of waste delivered. As a result, it will become less attractive for ship operators to try to circumvent the rules laid down in the PRF Directive and discharge their waste at sea. Effective enforcement increases the chances to be caught and this is something ship operators would aim to avoid. Enforcement is therefore assessed to have a Medium to High impact on waste volumes delivered in port.

[165] FAO, Abandoned, lost or otherwise discarded gillnets and trammel nets, 2016.

6.3.8. Impact of enforcement on administrative burden

Ineffective enforcement, especially unclear rules on enforcement (e.g. definition of sufficient storage capacity, mandatory delivery requirements and MARPOL discharge norms) lead to administrative burden. Although administrative burden is felt by different types of stakeholders, a group often affected by ineffective enforcement are the ship operators. For example, the different forms that have to be used to notify waste, lead to an unnecessary burden on the side of ship operators. Once equal forms are used, it will become easier to fill in the required information. As a result, the administrative burden may decrease slightly for ship operators.

Also the inconsistency between mandatory discharge requirement (for 'all' ship-generated waste) and the MARPOL discharge norms creates unnecessary administrative burden. For stakeholders, especially ship operators, the confusion about what needs to be delivered and what could be discharged contributes to administrative burden. For ships only sailing within EU waters, the administrative burden will probably be low as the regime used is always the same. However, ships not so often visiting EU ports are faced with different regimes, as outside EU waters the MARPOL definitions will apply, while in the EU the PRF definitions apply. Each time this latter group needs to assess which set of norms applies and this can take quite some of their time.

6.4. Inconsistent and outdated definitions and forms

6.4.1. Differences in definitions used in the Directive and those contained in the MARPOL Convention. In particular what is included in the definition of 'ship-generated waste' in the Directive, which only covers certain categories of waste covered by MARPOL, as well as the definition of cargo residues

Description of the problem

Definitions

The definitions given to 'ship-generated waste' and 'cargo residues' are not the same in the PRF Directive and in MARPOL. The PRF Directive definition of ship-generated waste refers to MARPOL Annexes I, IV and V. MARPOL includes Annex VI in its definition of ship-generated waste as well, but the PRF Directive currently does not cover this Annex. Therefore, the definition used in the PRF Directive is narrower than the one used in MARPOL.

There are also differences between the PRF Directive and MARPOL regarding the definition of cargo residues. MARPOL only refers to Annex V, while the PRF Directive includes, besides Annex V, the remnants of cargo material after cleaning (thus covers tank washings falling under Annex I and II). Therefore, the MARPOL definition is narrower than the PRF one in this respect.

As a result of the discrepancies between these two definitions, much confusion exists amongst different stakeholders. For both users and operators, it is not always clear what waste is actually covered and therefore what waste needs to be delivered/received. Mismatches can lead to additional discharges at sea, and complying with both MARPOL and the PRF Directive will also be difficult.

Reporting forms

The notification form as part of Annex II of the PRF Directive has been revised in 2015 for better alignment with the IMO advance notification form. However, this could not be done to the full extent, as definitions differ between the Directive and MARPOL, in

particular as regards 'cargo residues' and 'ship-generated waste'. Additionally, the format is not fully standardised from port to port[166], affecting the administrative burden for the crew. As a result of lacking one uniform waste notification system, where the agents will only have to address the waste handling issue at one place, agents in some ports will have to liaise with different waste operators for collection of different kinds of waste as well as payment for these services. The deadline for Member States to adopt the revised Annex II notification form is set at December 9, 2016, so currently Member States are still allowed to apply different formats. The issue therefore is mainly a slow implementation of revisions.

Closely related to the problem of the reporting form itself, is the way the forms have to be submitted, namely electronically. The electronic reporting procedure is taking place via the National Single Window as of June 2015. However, ship owners are frequently experiencing connectivity issues on board when trying to fill in the notification form.

Size of the problem

The discrepancies between MARPOL and the PRF might lead to an additional burden in practice for the captain and crew as every time they would like to discharge at sea they need to check whether or not the waste can be legally discharged or should be delivered (especially before entering EU waters). For ships only sailing in EU waters, the administrative burden will probably be low as the same regime will always apply. However, those ships which do not visit EU ports very often are faced with different regulations, as outside EU waters, only the MARPOL definitions apply to their activities. Each time they should check which legislations are applicable and whether or not they can legally discharge a certain type of waste. A more detailed analysis of the size of this problem could include a rough indication of the number of ships solely operating in EU waters (and therefore are less affected) and ships that also operate in non-EU waters (as for these ships the discrepancies could lead to additional administrative burden of the crew).

Efficient advance waste notification shall ensure that the administrative burden for the ship captain and ship agent is kept to a minimum and as such does not form an obstacle to deliver waste. However, as explained above, one uniform reporting form does not yet exist. First of all, the PRF form and the IMO form still differ on minor points and secondly, the forms used in EU ports also slightly differ often in their own parallel systems. These different reporting forms lead to an increase in the additional burden as crew members need, for each port, to ensure that the form is filled in correctly. Although the current PRF Directive should prevent different formats, in practice the forms are different and thus it will take longer to fill in the form (i.e. completion of the form is not yet standardised).

The differences in definitions and inconsistencies in forms might cause some confusion amongst crew members, it is estimated that this root cause substantially contributes to the problem driver (Low to Medium).

6.4.2. Impact of outdated definitions on discharges at sea

Although outdated definitions can lead to additional hassle for crew members, especially to an increase in their administrative burden, outdated definitions do not necessarily lead to large amounts of additional illegal discharges. Many crew members will try their best to still fill in the forms as best as they can and will not, at least not wilfully, discharge at sea. Nevertheless, some of the crew members still might opt for discharging at sea instead of complying with the PRF-regime.

[166] As concluded by the REFIT Evaluation (2015).

When taking the results of the OPC into account, it is indeed confirmed that the outdated definitions is one of the least important contributors to the illegal discharge of waste at sea, as illustrated in Figure 31.

6.4.3. Impact of outdated definitions on administrative burden

The above described root cause contributes to an increase in administrative burden for the crew members, but also other stakeholders, e.g. ports. Stakeholders indicated in the OPC that they think that the differences in definitions are an important contributor to the administrative burden. In total, 70% of all respondents indicate that this root cause is an 'important' or 'very important' contributor to the problem of administrative burden.[167] Also the outdated reporting forms are seen as an 'important' or 'very important' contributor to the problem of administrative burden, as indicated by 65% of the respondents.[168] For both questions the different stakeholder groups were well-balanced containing ship operators, PRF operators, port authorities and Member State authorities.

In addition, stakeholders indicated that a lack of electronic exchange of information and / or the existence of parallel systems, creates administrative burden, as information exchange is more complicated and not well streamlined. Taking away those barriers would reduce administrative burden for different stakeholder groups, e.g. ship operators, ports and PRF operators.

6.5. Inconsistent application of exemptions

6.5.1. The parameters and conditions for granting exemptions are not well defined and are interpreted differently across Member States

Description of the problem

Different procedures and conditions are currently employed to grant or (re)evaluate exemption requests from port users across the EU. Information is hardly shared between relevant authorities (such as port authorities or other competent authorities). This results in a disproportionate administrative burden and financial burden for both port users and Member State authorities. It may also lead to exemptions granted where they should not have. Reasons for this could be:

1. The requirements laid out in the Directive text for exempting vessels in scheduled traffic - from notification, payment and delivery of their waste - are insufficiently clear. Vessels in scheduled traffic with frequent and regular port calls may qualify for an exemption via Article 9, but it is not clear when the criteria 'scheduled', 'frequent' and 'regular' have been fulfilled. This problem especially arises in the short sea shipping market, where vessels, in principle, can be categorised as scheduled traffic. However, in practice it seems difficult for such vessels to receive exemption as substitution, delays and cancelations of voyages happen frequently in the short sea shipping market. This makes it difficult to prove that they are actually in scheduled traffic and thus qualify for exemption. Even if they can demonstrate that they do comply with the other conditions, such as having made arrangements with the waste operator(s) in their home port, the exemption is not always granted;
2. An additional problem lies with exempted vessels for which third party arrangements have been made which lay outside the port's control; so strictly speaking, not delivering any waste or paying an actual fee in a port alongside the ship's route as required in Article 9. This provision could result in a situation where the ship has waste agreements with several PRF operators along its route and

[167] OPC question 18A.
[168] OPC question 18B.

therefore is practically exempted in all ports, without actually landing its waste in one of the PRFs as no proof of delivery is required for granting an exemption.

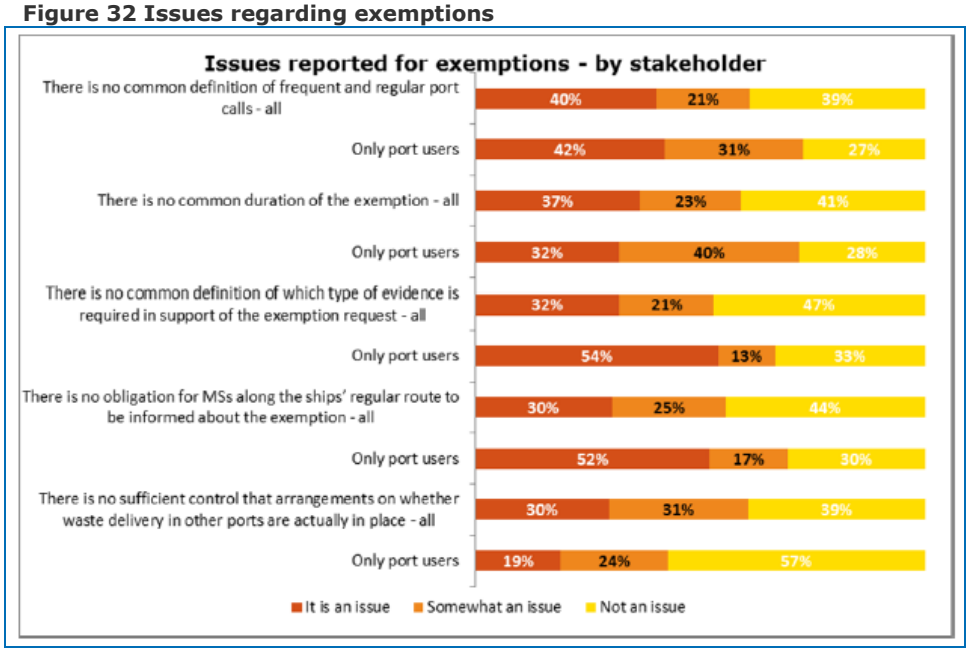
To address the issues described above, the Commission provided guidance in its Interpretative Guidelines (2016/C 115/05) on the exemptions possible, and paid special attention to the criteria 'scheduled', 'frequent' and 'regular'. Guidance relating to sufficient proof of evidence that a ship is engaged in scheduled traffic is also provided. As the Interpretative Guidelines are a recommendation by the Commission, Member States are not obliged to implement and follow them. As the Interpretative Guidelines have been adopted quite recently (early 2016), full impact is probably not yet reached, although limited evidence exists. Even so, the case study ports included in this study did not show any clear signs that their exemption procedures have changed significantly since the publication of the Guidelines.

Additionally, there are issues regarding non-harmonised processes of renewal of exemptions, the duration of validity, and the required procedures and documents in the exemption application and approval process.

Size of the problem

According to the ex-post evaluation, the differences in exemption procedures applied limit the ability of Member States to efficiently and effectively enforce the requirements of the PRF Directive. The current issues regarding the exemption procedures do seem to contribute significantly and even disproportionately to the administrative burden faced by port users. Many of the issues addressed above contribute to this, see Figure 32. Therefore the impact of unclear rules regarding exemptions, contribute highly to the problem driver.

Figure 32 Issues regarding exemptions



Source: Stakeholder survey in the ex-post evaluation of the PRF Directive (Panteia, 2015).

6.5.2. Impact of the inconsistent application of exemptions on discharges

The procedures for applying and granting exemptions vary greatly across the EU, which causes a lot of frustration and administrative burden and sometimes delay for port users. Although this problem driver causes much administrative burden and leads to frustration, it is less likely that it has a high contribution to illegal discharge at sea. Nevertheless, it cannot be ruled out completely, especially in areas with dense ferry traffic. It may be possible that in these areas exemptions have been granted where

they should not have. As a result, there might be an incentive for a ship operator to illegally discharge in sea. In areas with a high share of frequent 'port callers' in scheduled traffic, invalid issuing of exemptions may open the door for illegal discharges into sea.

When taking the results of the OPC into account, it is indeed confirmed that the inconsistent application is one of the less important contributors to the illegal discharge of waste at sea, see Figure 32.

The influence of this problem on illegal discharges at sea is considered to be low-medium as it is mainly concentrated in the areas with high shares of scheduled traffic.

6.5.3. Impact of inconsistent application of exemptions on administrative burden

As described above, this problem driver has a high impact on administrative burden, and as a result on maritime operations in the shipping sectors affected (in particular, short sea shipping). Especially the unclear and inconsistent application of exemption criteria causes administrative burden for port users as each time the port user needs to re-apply for an exemption, which takes time. By having a clear set of rules regarding exemptions in place, the administrative burden will decrease significantly.

6.6. Summary of problem drivers and main problems

The relationship between the two main problems and the defined problem drivers is summarised in Table 22.

Table 22 Relationship between main problems and problem drivers

Problem driver	Relation to waste discharges	Relation to administrative burden
Adequacy	Inadequate port reception facilities are a disincentive to deliver waste (Panteia (2015); OPC, surveys, case studies).	Unclear definition on adequacy may hamper administrative procedures causing administrative burden.
Incentives	Insufficient (cost) incentives discourage delivery of waste (Panteia (2015), and incentivise discharge at sea, Eunomia (2016), OPC, surveys, case studies).	Non-harmonised principles between ports cause administrative burden for port users (Panteia, 2015; ESSF PRF sub-group).
Enforcement	Insufficient enforcement prohibits active prevention / monitoring of discharges into sea (Panteia, 2015; OPC, case studies). In practice, less inspections undertaken than required.	Unclear rules on enforcement (e.g. definition of sufficient storage capacity, mandatory delivery requirements and MARPOL discharge norms) lead to administrative burden.
Definitions and forms	Complicated reporting procedures may trigger waste discharges at sea rather than compliance with the regime.	Inconsistencies between EU waste notification form and the IMO Circular create administrative burden for ports and port users. In addition, there is a lack of electronic exchange of information and/or parallel systems are in place.
Exemptions	Invalid issuing of exemptions and insufficient monitoring resulting in illegal discharges into sea	Unclear and inconsistent application of exemption criteria causes administrative burden for port users.

7. Policy objectives

This section defines objectives for a potential revision of the PRF Directive, in line with the defined problems, and serves as a basis for defining policy measures and subsequent policy options. This section presents the general objective (Section 7.1) and specific objectives (Section 7.2).

7.1. General objective

The objective of the proposed revision is to reduce the discharges of ship-generated waste at sea, while at the same time ensuring effective maritime operations and reducing the administrative burden. In addition, the revision seeks to contribute to the wider objectives of the circular economy through an improvement of the waste handling process, as well as reduction of marine litter from sea-based sources.

7.2. Specific objectives

To achieve this general objective, five specific objectives are defined:

SO-1: To ensure the *availability of adequate facilities*;

SO-2: To provide *effective (cost) incentives* to deliver waste at port reception facilities;

SO-3: To remove barriers to *effective and efficient enforcement*;

SO-4: To *harmonise and update definitions and forms*;

SO-5: To clarify the rules for *exemptions*.

The specific objectives described are defined below.

SO-1: To ensure the availability of adequate facilities

As described in the previous section, inadequate and unavailable can dis-incentivise delivery of ship-generated waste and cargo residues in ports. Providing adequate port reception facilities is one of the key policy objectives to contribute to the above-mentioned general objectives, i.e. reduce the discharges of ship-generated wastes and cargo residues at sea, while achieving smooth operations in maritime traffic and minimising the administrative burden for the maritime sector.

SO-2: To provide (cost) incentives to deliver the waste at port reception facilities

The problem analysis indicates as insufficient delivery of waste into port reception facilities by port users. Therefore, creating incentives to delivering waste in ports is one of the defined specific objectives. Providing incentives ultimately aims at increased delivery and therefore indirectly at reducing discharge at sea.

SO-3: To remove barriers to effective and efficient enforcement

The objective of removing barriers of enforcement will target the issue of insufficient delivery of waste into port reception facilities by port users. In contrast to incentives, removing enforcement barriers will be less of a guiding approach, but will ultimately also incentivise the implementation of the PRF Directive for all parties; leading to less discharge at sea.

SO-4: To harmonise and update definition and forms

As the ex-post evaluation of the PRF Directive indicated, some parts of the PRF Directive cause unnecessary large administrative burdens for stakeholders involved. Differences in definitions and forms between the EU and the rest of the world cause confusing and additional administrative tasks, all leading to less of an incentive to deliver waste. The aim of better harmonisation is to decrease administrative burden and promote the use of port reception facilities, ultimately leading to less discharge at sea.

SO-5: To clarify the rules for exemptions

The process of receiving exemption from the mandatory delivery requirements is very burdensome and there is little alignment between ports. This leads to an administrative and financial burden to port users, making (illegal) discharge at sea more attractive. Decreasing the burden of the exemption process by clarifying the rules will thus help to combat discharge at sea.

8. Policy measures and options

This chapter presents policy measures and policy options. Section 8.1 presents the policy measures. Section 8.2 focuses on policy options. Section 8.3 provides an overview of the relation between the defined policy options and policy measures.

8.1. Policy measures

Policy measures are motivated by the factors presented below, which find their origin in the problem analysis:

- *Updating the PRF Directive* in relation to developments in the last 15 years, including updated international legislation, such as MARPOL, and the need for monitoring and information collection and preparing it for the future. This also includes clarification of key concepts and criteria to improve implementation of the PRF Directive;
- *Further align the PRF Directive with the MARPOL Convention*:
  - Definition of ship-generated waste, to include MARPOL Annex VI waste;
  - Clarify the delivery obligation of the PRF Directive in relation to the MARPOL discharge norms;
  - Provide more uniformity in forms applied, e.g. waste notification and waste receipt.
- *Contribute to other relevant EU policies*, in particular in the context of EU waste legislation (waste hierarchy), as also set out in the *Circular Economy Strategy*.

8.1.1. Overview of policy measures

This section presents policy measures in relation to the specific objectives, as defined in Section 7.2 and the factors mentioned above.

SO-1: To ensure the availability of adequate facilities

1.A Broaden the scope of the PRF Directive to *include MARPOL Annex VI waste* (residues from exhaust gas cleaning systems);
1.B Reinforce the *waste hierarchy* as laid down in the *Waste Framework Directive*, promoting separate collection in view of re-use and recycling of ship-generated waste;
1.C Strengthen the requirements for *systematic consultation of stakeholders* in the development and updating of waste reception and handling plans;
1.D Provide a better definition of *'adequacy'* in line with international guidance.

SO-2: To provide (cost) incentives to deliver the waste at port reception facilities

2.A Introduce the use of a *shared methodology* to calculate the indirect fee, including the *'right to deliver'*, and require higher levels of transparency on the various elements of costs charged to port users for the use of port reception facilities;
2.B Introduce a *100% indirect fee for garbage*;
2.C Incentivise measures that reduce the amount of *waste produced on board*. For this the current provisions for *Green Ships* should be further improved;

2.D Incentivise the *delivery of all waste from fishing vessels and small recreational craft* to port reception facilities by including these vessels in the indirect fee regime;

2.E Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through *fishing for litter programmes*.

SO-3: To remove barriers to effective and efficient enforcement

3A Clarify the scope of the *mandatory waste delivery obligation* in Article 7, two variants:

- 3A.1 *Align the PRF Directive with MARPOL* on discharge norms and applying one single system;
- 3A.2 *Emphasize the current Article 7* provision on delivery of all ship-generated waste, beyond the MARPOL discharge norms.

3B Introduce the requirement for a *waste receipt to be issued upon delivery*;

3C Clarify the definition of *'Sufficient Storage Capacity'* (especially when the next port of call is located outside the EU);

3D Replace the *25% minimum inspection requirement with a risk-based approach*. Two variants for strengthening the inspection regime:

- 3D.1 Incorporate the PRF inspections in the *PSC Regime* (amending Directive 2009/16/EC);
- 3D.2 Develop a *dedicated PRF targeting mechanism.*

3E Bring *fishing vessels and small recreational craft into the PRF inspection regime* by including them in the *inspection criteria and procedure* in Article 11;

3F Extend the *Electronic Monitoring and Information System*, based on THETIS-EU and SSN, to ensure a better reporting and exchange of information, as well as including the essential information from the WRH Plans.

SO-4: To harmonise and update definition and forms

4.A *Align the definition of ship-generated waste* with the Annexes of MARPOL, by including MARPOL Annex VI (see also measure 1A), as well as incorporating the definition of cargo residues within the overall scope of ship-generated waste (including Annexes I and II wash waters and Annex V cargo residues);

4.B *Align and update the form(s)* to reflect the IMO standard (IMO MEPC.1/Circ.834) and its definitions and categories.

SO-5: To clarify the rules for exemptions

5.A Develop *common criteria* to be applied for the *application and approval of exemptions*, including the introduction of a standardised exemption certificate, while also setting minimal requirements on information exchange between relevant authorities;

5.B Clarify in the legal text of the Directive that vessels which are operating *exclusively within one port* (tug vessels, pilot vessels, etc.) can also be *exempted*.

8.1.2. Description of policy measures

This section provides a description of the identified policy measures, summarising information in Table 23, with more detailed information presented in the policy measures book (Annex 12).

Table 23 Description of policy measures

Policy measure	Description	Underlying problem	Objective
PM-1A	Broaden the scope of the PRF Directive to include MARPOL Annex VI waste (residues from exhaust gas cleaning systems).	Annex VI waste currently not covered by the PRF Directive resulting in unavailability of adequate PRF.	To ensure the availability of adequate facilities for the reception of MARPOL Annex VI waste.
PM-1B	Reinforce the waste hierarchy as laid down in the Waste Framework Directive, promoting separate collection in view of re-use and recycling of ship-generated waste.	Although waste is segregated on board ships (as in accordance with international norms and standards) the waste is not always collected separately at land. This inconsistent application discourages compliance with the applicable norms for the segregation of waste on board of ships. WRH plans developed by ports and approved by the relevant competent authorities do not always sufficiently take into account the waste hierarchy as required by the Waste Framework Directive, as it is not properly reflected in the PRF Directive. This also leads to inefficiencies between ships and ports. The great differences in the size of ports in the EU may further contribute to this inconsistent application.	To remove this inconsistency by requiring port reception facilities to collect and handle waste segregated/separately in view of recycling, especially when the waste has already been segregated on board. This should contribute to improved adequacy (environmentally sound operation of the facilities in accordance with the WFD), as well as partly addressing the problem of marine litter (by encouraging green waste practices on board).
PM-1C	Strengthen the requirements for systematic consultation of stakeholders in the development and updating of WRH plans.	Port users are not always properly consulted and/or on a continuous basis in the development, implementation and assessment of the WRH plans. Although the Directive expressly requires consultation of the relevant parties at the stage of development of a new plan (Article 5(1) and Annex I), it is less clear on consultations at the stage of evaluation and re-approval. The lack of consultation often contributes to (perceived) inadequacies in port reception facilities. At the same time, there could be a higher level of involvement by port authorities in waste management and associated process, which could be more clearly mandated by the legislation.	To enhance the (contributing) role of all port users by better involving them in the development of the WRH plans. Promote a constructive dialogue between all relevant stakeholders (including representatives of PRF operators). This is expected to contribute to more adequate port reception facilities which are more adequate for receiving and handling the waste from ships normally visiting the port, and create more ownership amongst port users, resulting in landing more waste in ports, more efficiency in operations and a more

Policy measure	Description	Underlying problem	Objective
			environmentally sound management of the waste in line with EU waste principles.
PM-1D	Provide a better definition of 'adequacy' in line with international guidance.	Article 4 of the PRF Directive requires that the port reception facilities are adequate to meet the needs of the ships normally using the port. However, the PRF Directive does not specify when a PRF fulfils this requirement and is indeed adequate. In the Interpretative Guidelines the Commission includes guidance on when a facility can be considered as adequate. As the explanation is laid down in guidelines it is part of soft law.	To provide port users with information on the availability of adequate port reception facilities.
PM-2A	Introduce the use of a shared methodology to calculate the indirect fee, including the 'right to deliver', and require higher levels of transparency on the various elements of costs charged to port users for the use of port reception facilities.	Currently there are many different CRS in place in the different Member State ports, which are often lacking transparency as to how the fee relates to the actual costs of reception and management of the waste (lack of clarity on relationship between the fee and the costs). The problem is related to port strategy (port owned/operated or private owned/operated).Some systems currently in place do not give a right of delivery, following the payment of the fee. Direct fees still need to be paid before the waste can be discharged and it must be assured that there is no subsidy for waste disposal (CG CRS)	To provide a shared methodology or harmonised principles for the transparent calculation of all costs related to ship waste management in ports and thereby ensure similarities to the extent possible in determining the expected waste fee, in order to incentivise delivery. It would also address the need for a definition of 'significant contribution' in relation to the costs. Three elements for shared methodology are included: • Cost structures; relationship between fee and the costs. Also, a list of what constitutes 'direct costs' and 'indirect costs'. Consider including this list in an Annex to the Directive; • Method for calculation of the fee and determining the significant contribution, including a right to deliver and the calculation method for determining this based on the 30% threshold; • A common definition of transparent and fair

Policy measure	Description	Underlying problem	Objective
			and non-discriminatory fees that are reflecting the costs (see CG CRS report).
PM-2B	Introduce a 100% indirect fee for garbage (Annex V waste).	Insufficient (cost) incentives to deliver the garbage waste to port reception facilities, resulting in insufficient delivery of garbage to port reception facilities, which could affect discharging of garbage in the sea.	To provide effective cost incentives to deliver (Annex V) waste at port reception facilities.
PM-2C	Incentivise measures that reduce the amount of waste produced on-board: harmonisation of the Green Ship concept (provided in Article 8).	On board production of waste. No harmonised understanding of the Green Ship concept. This hampers the development/uptake of 'greener' practices on board, in terms of waste handling/production, treatment, etc.	To provide incentives towards reducing the amounts of ship-generated waste on board.
PM-2D	Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime.	The relative large amount of garbage waste generated by the fishery and recreational craft sector (see Eunomia study).	The objective of this measure is two-fold: • Avoid discharge of waste at sea generated during fishing operations; • Avoid discharge of waste at sea from small recreational craft.
PM-2E	Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes.	The amount of passively fished waste, i.e. waste which has been collected in nets and which is not delivered to port reception facilities.	The objective of this measure is to avoid discharge of waste at sea which is collected during the fishing operation; and instead have this passively fished waste delivered at port reception facilities.
PM-3A PM-3A.1 PM-3A.2	Clarify the scope of the mandatory waste delivery obligation in Article 7. Two variants: • MARPOL alignment: align the delivery obligation with the MARPOL discharge norms; • EU PRF regime: emphasize the mandatory delivery obligation	Since the implementation of the PRF Directive there has been a debate on the interpretation of Article 7, which states that 'the master of a ship calling at a Community port shall, before leaving the port, deliver all ship-generated waste to a port reception facility'. The ambiguity concentrates on the question what is included in all ship-generated waste to be delivered to a port reception facility. On the one hand this can be interpreted as all ship-generated waste produced. Another	To apply one single system and by doing so remove ambiguity, either by aligning with the MARPOL discharge norms in the PRF Directive; or by emphasizing the current Article 7 provision on delivery of all ship-generated waste (and going beyond the MARPOL discharge norms).

Policy measure	Description	Underlying problem	Objective
	for all ship-generated waste, beyond the MARPOL discharge norms.	interpretation is that it includes all ship-generated waste produced minus the ship-generated waste that is legally discharged at sea in accordance with MARPOL discharge norms.	
PM-3B	Introduce a requirement for issuing a waste receipt upon delivery.	Deficiencies in the way waste operators keep track on the quantities and types of waste delivered. Lack of information on waste streams in ports, unavailability of accurate information on actual waste deliveries, which impacts on assessment of storage capacity on board, and thus hampers monitoring and enforcement of the PRF Directive's delivery requirements. It is to be noted that issuing a waste receipt is also an (optional) requirement under MARPOL (MEPC.1/Circ.645).	The objective of this policy measure is three-fold: • To enable accurate information reporting and thereby facilitate monitoring and enforcement of the mandatory discharge requirement, as more data will become available on waste flows in ports; • Alignment with MARPOL forms (IMO Circular for the waste receipt).
PM-3C PM-3C.1 PM-3C.2	Clarify the definition of 'Sufficient Storage Capacity' (MARPOL alignment/beyond MARPOL; limit the application of the SSC exception in situations in which the next port of call is located inside the EU). Two variants: • Taking into account MARPOL discharge norms; • Based on PRF regime.	In the absence of a clear definition on sufficient storage capacity the application of the PRF Directive is hampered, notably on defining exceptions.	To provide a clear definition of sufficient storage capacity in order to be able to define exceptions and avoid unintended use of this provision.
PM-3D PM-3D.1 PM-3D.2	Replace the 25% minimum inspection requirement with a risk-based approach. Two variants: • Incorporate the PRF inspections in the PSC Regime (amending Directive	PRF inspections are often (i.e. not always) conducted within the framework of the Port State Control Directive. However, the inspections are not similar and the inspection selection requirements differ. The risk based inspection measure would update the inspection approach for PRF, and bring the PRF inspections in line with risk-based approach contained in the	To apply a risk based inspection regime similar to the approach laid down in the Port State Control Directive, but based on the information from the advance waste notification (art. 6), in order to reduce legal uncertainty and enforce the PRF directive better.

Policy measure	Description	Underlying problem	Objective
	2009/16/EC); • Develop a dedicated PRF targeting mechanism.	PSC inspection framework.	
PM-3E	Bring fishing vessels and small recreational craft into the PRF inspection regime, by including them in the inspection criteria and procedure in Article 11. Consider differentiation of vessels on the basis of GT.	This policy measure addresses ineffective enforcement of the mandatory delivery of waste, specifically related to the exempted position of the fishing vessels and small recreational craft. This contributes to the problem of discharge at sea (in which the role of fishing vessels and small recreational craft is substantial, notably on Annex V waste (see Eunomia report).	To improve the enforcement of waste discharges and consequently reduce the volume of waste discharged at sea.
PM-3F	Extend the electronic Monitoring and Information System, based on THETIS-EU and SSN, to ensure a better reporting and exchange of information, as well as including the essential information from the WRH Plans.	Insufficient exchange of information between Member States to support, the PRF inspection regime, as well as to provide information on waste streams in ports (to help monitoring the PRF Directive).	To facilitate the electronic reporting and exchange of data between Member States CA in support of monitoring and enforcement.

Policy measure	Description	Underlying problem	Objective
PM-4A	Align the definition of ship-generated waste with the Annexes of MARPOL, by including MARPOL Annex VI (see also measure 1A), as well as incorporating the definition of cargo residues within the overall scope of ship-generated waste (including Annexes I and II wash waters and Annex V cargo residues).	The definitions given to ' ship-generated waste' and 'cargo residues' in the PRF Directive are not the same as waste definitions used in MARPOL. The PRF Directive definition of 'ship-generated waste' refers to MARPOL Annexes I, IV and V. MARPOL also includes an Annex VI (waste from EGCS and ODS), but the PRF Directive does not cover Annex VI waste. Also discrepancies between PRF and MARPOL regarding the definition of 'cargo residues' exist. MARPOL only refers to Annex V, while the PRF Directive includes, besides Annex V, also the remnants of cargo material after cleaning (thus tank washings falling under Annex I and II). As a result of the discrepancies between these two definitions, confusion exists amongst stakeholders. For both users and operators it is not always clear what waste is actually covered and what waste needs to be delivered.	To align the definitions used in the PRF Directive with the definitions used in MARPOL. This to support a better understanding of waste categories for uses and to reduce administrative burden. Better aligned definitions will also contribute to alignment of the reporting forms (see policy measure 4B).
PM-4B	Align and update the form(s) to reflect the IMO standard (IMO MEPC.1/Circ.834) and its definitions and categories.	Inconsistent and outdated definitions applied in forms causing unnecessary administrative burden and costs for authorities, ports and port users. Align and update the notification form to reflect the IMO standards (IMO MEPC.1/Circ.834) and its definitions and categories, and reflect these updates in the electronic reporting into SafeSeaNet through the National Single Reporting Window. This concerns both the waste notification form and the waste receipt (see policy measure 3B).	To harmonise and update forms, reducing administrative burden. Further alignment of definitions of PRF Annex II with IMO MEPC.1/Circ.834 appendix 2 and update the formats in SafeSeaNet via the National Single Reporting Window. Addition of electronic signature as replacement of written signature on notification form in SSN, making hard copy notifications obsolete. To be specified in the legal text of the Directive.

Policy measure	Description	Underlying problem	Objective
PM-5A	Develop common criteria to be applied for the application and approval of exemptions, including the introduction of a standardised exemption certificate, while also setting minimal requirements on information exchange between relevant authorities.	Inconsistent application of exemptions for ships in scheduled traffic with frequent and regular port calls.	To further enhance and harmonise the procedures for applying for and granting of exemptions. To avoid ships from being exempted from delivery and/or payment in all the ports along its route.
PM-5B	Clarify in the legal text of the Directive that vessels which are operating exclusively within one port (tug vessels, pilot vessels, etc.) can also be exempted.	Inconsistent application of exemptions for ships in scheduled traffic with frequent and regular port calls.	To ensure more consistent application of exemptions for ships those are operating in one port.

8.1.3. Discarded policy measures

This section includes policy measures that have been considered, but were discarded based on arguments that are presented below per policy measure.

1. Policy measure: Seek further consistency between the PRF Directive and Directive 2005/35/EC

To seek further consistency between the PRF Directive and Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements, by aligning in terms of scope and measures (i.e. penalties). The measures proposed in both directives are complementary and work together towards the overall objective of better protection of the marine environment. The PRF Directive provides the framework for giving ships incentives to deliver their ship-generated waste and cargo residues at the port, while the Ship-source pollution Directive introduces (criminal) penalties for illegal discharges of MARPOL Annex I and II waste. Moreover, for ship-generated waste the PRF Directive provides additional complementarity by introducing the principle of mandatory delivery in the port and introducing cost recovery systems that do not provide incentives to discharge at sea. Together, these two directives establish a legal framework of positive incentives complemented by punishment for illegal discharges of Annex I and II waste, which together works towards the overall objective of better protection of the marine environment. The main difference is that the PRF Directive aims to reduce all discharges at sea of ship-generated waste and cargo residues, whereas the Ship-source pollution Directive specifically targets illegal discharges of substances defined in MARPOL Annex I and II. Further consistency could come from aligning the scope in terms of waste covered, making the penalties also applicable for Annex IV and V (and Possibly VI) waste.

Argument for discarding the policy measure

Although the principle of seeking consistency between the two directives is justified and the ambition to complement both legal framework in terms of incentives and penalties is applauded, it is concluded that most alignment would need to come from the Ship-Source Pollution Directive[169]. A revision of the PRF Directive would not be able to create consistency.

2. Policy measure: Exceptional circumstances when port reception facilities are not or temporarily unavailable

In some ports port reception facilities are not or temporarily unavailable for the delivery of waste. This may occur in situations where cruise liners want to deliver huge volumes of sewage or in the case of hazardous waste for which specialised treatment facilities need to be available. Also, situations may occur where port reception facilities are unavailable due to natural disasters or serious problems with the infrastructure. It is not always possible for ships to wait in the port until the situation has been resolved, due to itinerary planning, etc. Furthermore, ships incur high costs due to delays in turnaround times. Currently, the PRF Directive does not prescribe what ships should do in these circumstances. The aim of this policy measure is to ensure at all times the availability of adequate facilities for reception of ship-generated waste and cargo residues from ships normally visiting the ports.

Argument for discarding the policy measure

As already noted, ships must deliver all generated waste before departure, otherwise they will be subject to an inspection in the next port of call in accordance with Article 11. Within the context ESSF PRF Sub-Group discussions have been held to address the issue, with particular emphasis to those cases where the master of a ship has done everything is required to do, including contacting the port, but still cannot deliver all

[169] This would need to be identified in an evaluation of the Ship-Source Pollution Directive and a subsequent impact assessment in case of a revision.

ship-generated waste. This could be due to inadequacy, but it could also be due to other reasons, such as force majeure, bad weather, strikes, or bad management of port reception facilities. Members of the ESSF PRF Sub-Group indicated a strong preference for not introducing the principle of 'exceptional circumstances' in the revision of the PRF Directive. This is because if it is explicitly stated in the PRF Directive, albeit above-mentioned caveats, it introduces the opportunity for ships to leave the port without delivering the waste that it has notified, thus creating a loophole in the legislation. It should be noted that problems related to port reception facilities being (temporality) unavailable could at least partly be addressed by better communication, for example through improved WRH plans, notification and exchange of information.

3. Policy measure: discharge prohibition

The PRF Directive is based on the principle that a ship calling at a port shall, before leaving the port, delivers all ship-generated waste to a port reception facility. In accordance with the definitions of the PRF Directive, ship-generated waste shall mean all waste, including sewage. In this respect, all sewage on board a ship should be delivered to a port reception facility prior to its departure from the port. A number of ship operators and competent authorities have imposed the claim that a discrepancy occurs between MARPOL Annex IV and EU law (the PRF Directive) in relation to sewage. However, it should be noted that in practice the discrepancy is often not felt by the sector. Ships *en route* are allowed, under MARPOL Annex IV, to discharge sewage without violating the PRF Directive, which regulates the delivery of ship-generated waste when ships are in port. This implies not only for sewage, but for all waste categories. A discharge prohibition would go beyond MARPOL and would make discharge of any waste at sea illegal.

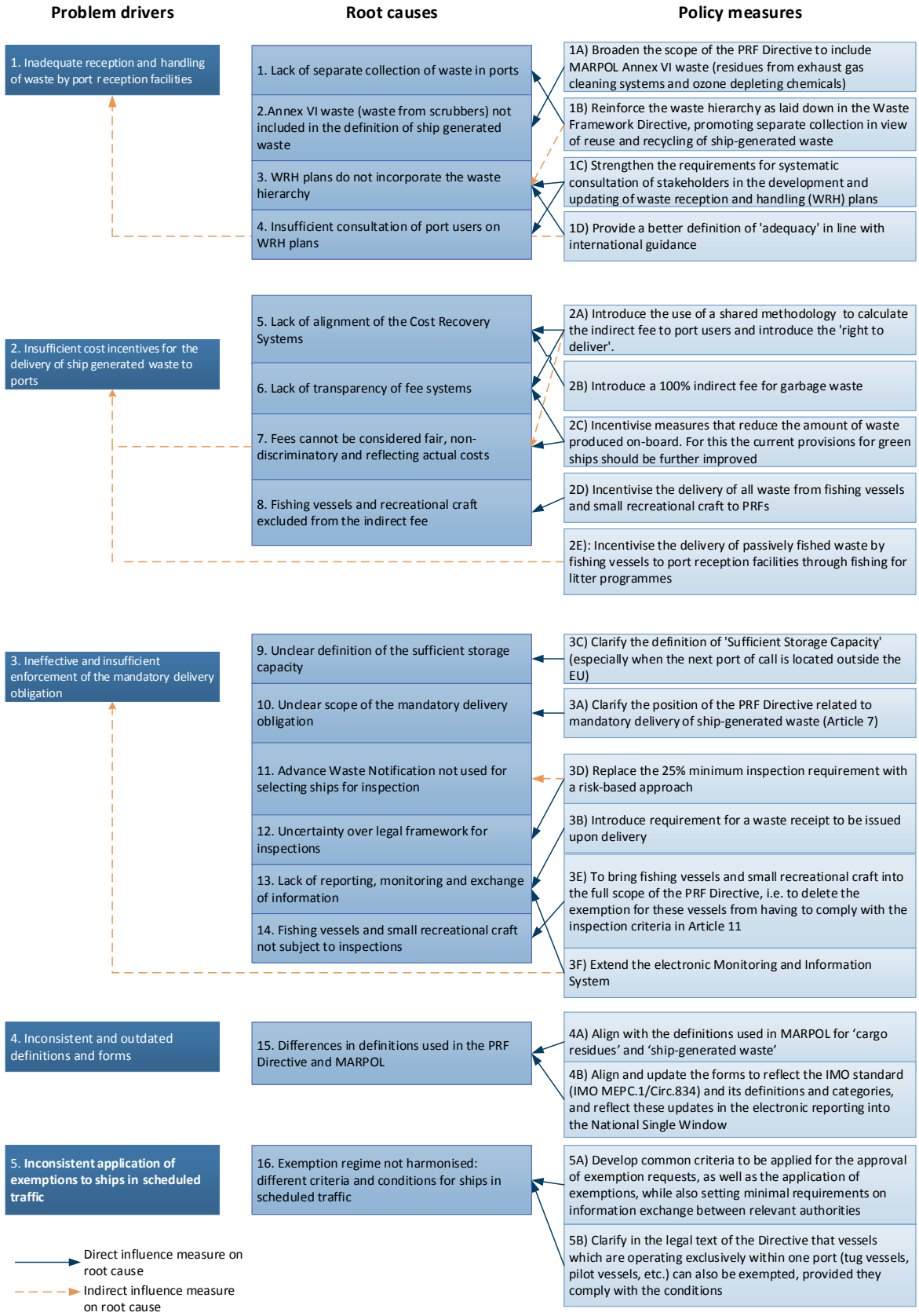
Argument for discarding the policy measure

The policy measure to bring the waste discharge prohibitions under the PRF Directive is discarded, as the PRF Directive regulates the delivery of waste to port reception facilities in ports, not the waste discharge regime at sea. The latter is regulated under MARPOL. If any amendments are desired, it should be addressed in MARPOL. Moreover, as the PRF Directive only regulates (delivery to) EU ports, a measure aiming to prohibit discharges would be easily circumvented through discharges outside EU waters, and further would be hard to enforce due to the wide geographic area concerned.

8.1.4. Intervention logic: linking problems to measures

As stated in the introduction of this chapter, the policy measures are defined based on the defined problems and policy objectives. The relationship between the problems, further detailed in drivers and root causes, and the policy measures is presented in Figure 33.

Figure 33 Problems linked to policy measures



Source: Ecorys.

8.2. Policy options

In creating the policy options three main aspects are considered, as introduced in Section 3.2:

- The *scope of the revision*. Policy option 2 concentrates on a minimum legislative revision, focusing mainly on adequacy and incentives measures, while other areas are to be covered through parallel soft law measures. Policy options 3-4 focus on a more extensive revision of the PRF Directive, covering all identified specific objectives;
- The vision towards *mandatory delivery of waste in ports* (Article 7). This principle choice defines the difference between policy options 3 and 4. Policy option 3 aligns the PRF Directive with MARPOL. Policy option 4 aims to have all waste delivered at ports, also the 'legal discharges' (waste discharged in accordance with MARPOL discharge norms);
- The position towards *marine litter*. Policy options 3 and 4 both have two variant options; one with and one without focus on marine litter.

The more extensive revisions and their variant options, based on these two principle choices, are presented in Table 24.

Table 24 Variants 3 and 4 and their variant options

	MARPOL alignment	EU PRF regime
No focus on marine litter	Policy option 3A	Policy option 4A
Focus on marine litter	Policy option 3B	Policy option 4B

8.2.1. Overview of policy options

The following policy options are foreseen:

1. *Baseline scenario*: this is the current PRF Directive plus adopted initiatives;
2. *Minimum legislative revision of the PRF Directive*: this is the baseline scenario (PO-1) plus concise legal adjustments to the PRF Directive, as well as possible soft law to provide further guidance;
3. *MARPOL alignment*: this is a more elaborate revision that includes policy measures defined under each of the five specific objectives (adequacy; incentives, enforcement, definitions and exceptions). This policy option concentrates on alignment with MARPOL, which is reflected in mandatory delivery, aligning definitions, harmonising forms, and bringing inspections fully under the Port State Control regime;
4. *EU PRF Regime beyond MARPOL*: this is also a more elaborate revision that includes policy measures defined under each of the five specific objectives (adequacy; incentives, enforcement, definitions and exceptions). This policy option seeks to strengthen the mandatory delivery of all ship-generated waste under the PRF Directive. By doing so, this policy option goes beyond MARPOL, which allows legal discharges through the defined waste discharge norms. Based on this fundamental principle, this policy measures also has specific (variant) measures regarding enforcement, forms and definitions.

It should be noted that for PO-3 and PO-4 two variants are defined:

1. No additional focus on marine litter;
2. Special focus on marine litter.

These policy options, including the two variant options, are described in more detail below.

PO-1: Baseline scenario

This is the current PRF Directive plus adopted initiatives. The baseline scenario is based on the situation when the existing legislative framework would continue to apply. It serves as a benchmark against which all the other policy options will be compared. Under the baseline scenario it will not be possible to adapt the PRF Directive to accommodate the substantial changes in MARPOL or to fully align the definitions in the PRF Directive with those used in MARPOL, as this would require a revision process.

The baseline scenario takes into consideration initiatives that are already adopted. These include:

- Amendment of Annex II of the PRF Directive (Information to be notified) through comitology, to bring Annex II in line with the recent changes to MARPOL Annex V and IMO Circulars, as well as to include data on quantities and types of waste delivered;
- The PRF Interpretative Guidelines;
- The Technical Recommendations, as prepared by EMSA;
- Development of the Common Information and Monitoring System, based on existing reporting systems (SafeSeaNet and THETIS-EU), as required by Article 12(3) of the PRF Directive[170];
- Guidance for ship inspections;
- The adoption of the Proposal for a Regulation establishing a framework on market access to port services and financial transparency.

PO-2: Minimum legislative revision of the PRF Directive

This is the baseline scenario plus targeted initiatives that have already been prepared and planned plus concise legal adjustments to the PRF Directive, as well as possible soft law measures on aspects not included in the revised PRF Directive. It entails:

- Minimum legal alignment to MARPOL to reflect the latest changes to the MARPOL Convention and its Annexes;
- Update of legal references in the PRF Directive.
- PM-1A: Broaden the scope of the PRF Directive to *include MARPOL Annex VI waste*.

PO-2 leaves ample opportunity for policy measures to be implemented through soft law. The following policy measures could be considered to be included in PO-2 through soft law:

- PM-2A: Introduce the use of a *shared methodology* to calculate the indirect fee and introduce the 'right to deliver';
- PM-2C: Incentivise measures that reduce the amount of *waste produced on board*. For this the current provisions for *Green Ships* should be further improved.

PO-3: MARPOL alignment

In contrast to PO-2 this policy option, as well as PO-4, results in a more elaborate revision of the PRF Directive. This policy option has the following characteristics:

[170] The development of the Common Information and Monitoring System will continue; next steps will be part of PO-2, i.e. minimum legislative revision.

- Define the *scope of the mandatory delivery requirement* in Article 7 in relation to MARPOL: the delivery obligation will reflect the MARPOL discharge prohibition, i.e.: what cannot be discharged under MARPOL shall be delivered to port reception facilities by ships calling in EU ports;
- Align the definition of *ship-generated waste* more closely with the Annexes of MARPOL, by including a reference to MARPOL Annex VI, as well as the cargo residues, which are currently defined as a separate category of waste under the Directive (including MARPOL Annexes I and II wash waters, as well as MARPOL Annex V cargo residues);
- This in turn will allow for the *waste notification form* to be fully aligned to the IMO Circular IMO MEPC.1/Circ. 834, and in case the *waste receipt* will be introduced in the revision this form should also fully reflect the IMO Circular;
- MARPOL alignment will also allow for bringing the *PRF inspections fully under the Port State Control Regime*, which should contribute to simplification. For this Directive 2009/16/EC will have to be amended to incorporate these inspections, and priority criteria shall be incorporated in Annex I to that Directive (overriding factors, and/or unexpected factors);
- This option also includes the *adequacy measures* (defined in accordance with IMO Guidelines), as well as the measures for improving the *incentives for delivery*.

Policy option 4: EU PRF Regime beyond MARPOL

PO-4 results in a more elaborate revision of the PRF Directive, as is the case in PO-3. The clear distinguishing factor with PO-3 is the approach towards mandatory delivery of ship-generated waste and the subsequent consequences, as described below:

- This option seeks to strengthen the mandatory delivery of *all waste* under the PRF Directive, thereby *going beyond the scope of MARPOL* (and its waste discharge norms), and also aiming to address - at least part of - the '*legal discharges*', i.e. mainly sewage and small quantities of oily waste;
- This option would also imply keeping the *distinction between ship-generated waste and cargo residues*, as there is no ground for subjecting the latter to the stricter EU regime, given their specific nature and way of handling in the terminals, which is different from ship-generated waste. Consequently, the *forms* to be used (*waste notification* and *waste receipt*) cannot be fully aligned with IMO Circular 834[171];
- A *PRF inspection regime* will have to be developed, with a dedicated targeting mechanism: selection of ships for inspection to verify compliance with the provisions of the PRF Directive (going beyond MARPOL), building on the dedicated module in THETIS-EU (available since April 2016);
- This option also includes the *adequacy measures* (defined in accordance with IMO Guidelines and EU waste law), as well as the measures for improving the *incentives* for delivery.

Policy option variants: with or without additional focus on marine litter

Variant options are defined to specifically address the issue of marine litter (MARPOL Annex V waste) from ships and will group all the measures that can effectively make a contribution to combating marine litter.

The policy option variant with *special focus on marine litter* includes the following policy measures (which are excluded from the policy option variant with no special focus on marine litter):

[171] It should be noted that one can strive to align the forms as much as possible with MARPOL categories, as has already been undertaken by the waste expert group for implementing Annex II to the Directive.

- PM-2B: Introduce a 100% indirect fee for garbage;
- PM-2D: Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime;
- PM-2E: Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes;
- PM-3E: Bring fishing vessels and small recreational craft into the PRF inspection regime, by including them in the inspection criteria and procedure in Article 11.

Both variant options will also include those measures on reinforcing the waste hierarchy on land (in particular separate collection) in line with EU waste legislation, as this is a prerequisite for having this waste effectively delivered on land.

8.2.2. Discarded policy options

This section included policy options that have been considered, but were discarded based on arguments that are presented below.

Policy option: Revision of the PRF Directive with additional focus on adequacy

Description

This policy option concentrates on a revision of the PRF Directive in which measures are included that improve the adequacy of the port reception facilities, as presented in Section 6.2.1 (policy measures 1A-1E). This would come on top of the policy measures that are foreseen in the minimum legislative revision (PO-2). On a case by case basis, it is to be determined whether these policy measures are to be included in the revision of the PRF Directive (hard law) or are better dealt with through soft law.

Argument for discarding the policy option

The policy option that would only address measures to improve the adequacy of the port reception facilities is not regarded to be a realistic alternative option, as it misses the opportunity to address identified problems related to incentives and enforcement.

8.3. Policy options and policy measures

In this section the policy measures, as defined in Section 8.1, are linked to the above-mentioned policy options. A ticked cell indicates inclusion of the policy measure in the policy option. PO-2 includes some policy measures that are to be applied through soft law; these are indicated by' SL'. In the baseline scenario (PO-1) and PO-2 Interpretive guidelines (IG); technical recommendations (TR); and inspection guidance (GI) are sometimes included and consequently marked in Table 25. Please note that all options are scored against the baseline scenario (policy option 1). Consequently, this policy option has scores of '0'[172].

[172] Except when interpretive guidelines (IG); technical recommendations (TR); and inspection guidance (GI) are involved.

Table 25 Policy measures per policy option

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - without additional focus on marine litter	PO-3B: MARPOL alignment - - with special focus on marine litter	PO-4A EU PRF regime – without additional focus on marine litter	*PO-4B: EU PRF regime - - with special focus on marine litter*
PM-1A: Broaden the scope of the PRF Directive to include MARPOL Annex VI waste (residues from exhaust gas cleaning systems and ozone depleting chemicals).	0	✓	✓	✓	✓	✓
PM-1B: Reinforce the waste hierarchy as laid down in the Waste Framework Directive, promoting separate collection in view of re-use and recycling of ship-generated waste.	IG	IG	✓	✓	✓	✓
PM-1C: Strengthen the requirements for systematic consultation of stakeholders in the development and updating of waste reception and handling (WRH) plans.	IG	✓	✓	✓	✓	✓
PM-1E: Provide a better definition of 'adequacy' in line with international guidance.	IG	✓	✓	✓	✓	✓
PM-2A: Introduce the use of a shared methodology to calculate the indirect fee and introduce the 'right to deliver', and require higher levels of transparency on the various elements of costs charged to port users for the use of PRFs through mandatory publication in the WRH Plans.	0	SL	✓	✓	✓	✓
PM-2B: Introduce a 100% indirect fee for garbage.	0			✓		✓
PM-2C: Incentivise measures that reduce the amount of waste produced on board. For this the current provisions for Green Ships should be further improved.	0	SL	✓	✓	✓	✓
PM-2D: Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including them in the indirect fee regime.	0			✓		✓
PM-2E: Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes	0			✓		✓
PM-3A.1: Clarify the position of the PRF Directive related to delivery of ship-generated waste. Variant 1: Align with MARPOL on discharge norms and applying one single system.	0		✓	✓		
PM-3A.2: Clarify the position of the PRF Directive related to delivery of ship-generated waste. Variant 2: Strengthen / emphasize the current Article 7 provision on delivery of all ship-generated waste, beyond the MARPOL discharge norms.	0				✓	✓

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - without additional focus on marine litter	PO-3B: MARPOL alignment - - with special focus on marine litter	PO-4A EU PRF regime – without additional focus on marine litter	*PO-4B: EU PRF regime - - with special focus on marine litter*
PM-3B: Introduce requirement for a waste receipt to be issued upon delivery.	0		✓	✓	✓	✓
PM-3C.1: Clarify the definition of 'sufficient storage capacity'. Variant 1: Taking into account MARPOL discharge norms.	0		✓	✓		
PM-3C.2: Clarify the definition of 'sufficient storage capacity'. Variant 2: Based on PRF regime.	0				✓	✓
PM-3D.1: Replace the 25% minimum inspection requirement with a risk based approach. Variant 1: Incorporate the PRF inspections in the PSC Regime (amending Directive 2009/16/EC).	0		✓	✓		
PM-3D.2: Replace the 25% minimum inspection requirement with a risk based approach. Variant 2 Dedicated PRF targeting mechanism.	IG, GI	IG, GI			✓	✓
PM-3E: Bring fishing vessels and small recreational craft into the PRF inspection regime.	0			✓		✓
PM-3F: Extend the electronic Monitoring and Information System, based on THETIS-EU and SSN, to ensure a better reporting and exchange of information, as well as including the essential information from the WRH Plans.	0		✓	✓	✓	✓
PM-4A: Align with the definitions used in MARPOL for 'cargo residues' and 'ship-generated waste'.	0		✓	✓		
PM-4B: Align and update the forms to reflect the IMO standard (IMO MEPC.1/Circ.834) and its definitions and categories, and reflect these updates in the electronic reporting into the National Single Window.	0		✓	✓		
PM-5A: Develop common criteria to be applied for the application and approval of exemptions, including the introduction of a standardised exemption certificate, while also setting minimal requirements on information exchange between relevant authorities.	IG, TR	IG, TR	✓	✓	✓	✓
PM-5B: Clarify in the legal text of the Directive that vessels which are operating exclusively within one port can also be exempted, provided they comply with the conditions.	IG	IG	✓	✓	✓	✓

9. Impacts of adequacy measures

This chapter presents the assessment of the impacts of the individual policy measures in the cluster of adequacy. For each of the defined policy measures a brief description and the assessment of the impacts and other considerations are described, together with a summary of the main impacts. The main impacts are determined on the basis of a pre-screening process and the results of a questionnaire on impacts, as described in Section 3.2.7.

9.1. PM 1A: Broaden the scope of the Directive to include MARPOL Annex VI waste

9.1.1. Description of the measure

This measure describes broadening the scope of the PRF Directive to include MARPOL Annex VI waste, in particular the residues from exhaust gas cleaning systems (EGCSs). By doing so, ports would be required to ensure adequate reception facilities for this type of waste, while ships would be required to deliver Annex VI waste to ports reception facilities (and notify ports accordingly) and pay a fee to ports or port reception facilities.

9.1.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

No waste delivery data is available for scrubber waste. A complicating factor in obtaining data on scrubber waste is that this type of waste is labelled differently in ports. Several interviewees suggest that ships already deliver scrubber waste to ports, which is categorised under different headings in different ports, for example in Antwerp, as hazardous substance.

As established in Section 5.1.4, the current number of scrubbers in use is limited (400 scrubbers sold up to now) and most ports included in the case study report that so far they have seen no or marginal demand for scrubber waste delivery. The same section provides an estimate of current *annual scrubber waste generation of 24,000 m^3 of sludge and 360,000 m^3 of bleed-off*.

This measure will not substantially impact the volumes delivered in ports. It should be noted that under MARPOL ship operators are not allowed to discharge their Annex VI waste and hence are already obliged to deliver this type of waste in port. Based on stakeholder input it seems that the waste currently produced is often already delivered in port (although sometimes it is qualified under a different heading). Explicitly incorporating Annex VI waste in the scope of the PRF Directive will provide clarity for ship operators, however, it is expected that the actual volumes delivered will not change much (as delivery of waste is already mandatory under MARPOL).[173]

The fact that including Annex VI explicitly in the scope of the PRF Directive, will lead to more clarity is confirmed by responses to the targeted survey. Respondents expect a decrease (41%) or even a strong decrease (15%) of discharges of scrubber waste at sea. At the same time, respondents also expect an increase (56%) or even a strong increase (17%) of scrubber waste delivery in port.

[173] Irrespective whether Annex VI waste is included in the PRF Directive or not, it may be possible that the volumes will increase, in case the number of scrubbers in use increases. Whether or not more scrubbers will be used, depends on multiple factors (e.g. oil prices, technology development and the establishment of ECA's). However, this measure will not influence the number of scrubbers used.

Although it is not possible to indicate the exact impact of this measure in terms of waste delivered in ports, based on the above information the impact is expected to be *low*.

Administrative burden

This policy measure will reduce the administrative burden slightly (impact rated low). Ships that generate scrubber waste benefit from simplified reporting mechanisms, as scrubber waste will be included in notification and waste receipt forms (hence there is no need to include Annex VI under other categories as before). Including scrubber waste in the scope of the PRF Directive contributes to overall alignment with MARPOL and also allows for forms to be harmonised.

Contribution to circular economy

Annex VI waste is not reusable or recyclable and therefore will not contribute to the circular economy.

Operational costs

For *ports*, once waste reception equipment is in place, the operational costs of receiving Annex VI waste are not considered to be very different from those of other waste categories. The main cost component concerns the treatment process, of which the costs will depend on what facilities are already in place. In larger ports, such treatment facilities will already be available, while in smaller ports, this may not be the case, potentially resulting in higher operational costs per unit of waste received. As experiences with receiving and processing scrubber waste are still limited, only estimates of operational costs can be given, indicating disposal costs to be around € 400 per tonne.[174] Depending on the number of scrubbers in operation in the future (see uncertainties, as described in Section 5.1.4), the total costs can become significant, especially if by 2020 many more ship owners will choose EGCS to adhere to the (then global) sulphur emission limits.

The *operational costs for ships* delivering scrubber waste are considered low, as the process of delivering is very similar to that of other liquid waste.

An important factor in determining operational costs is the way the ship operator is charged by the port for delivering its scrubber waste. If ports will charge a direct fee for collecting scrubber waste, the costs will be relatively high for ships equipped with scrubbers. However, if the costs for reception, treatment and disposal of scrubber waste would be shared by all ships (i.e. scrubber waste falls within an indirect fee), the impact on indirect delivery fees would be marginal. However, many stakeholders consider this to be unfair towards those that did invest in alternative means to meet ECA requirements (i.e. using more expensive low sulphur fuel or installing LNG engines).

For *port authorities*, once reporting and monitoring systems are adapted, the inclusion of Annex VI waste does not have to result in extra operational costs.

Overall, the impact of this measure on the operational costs is assessed to be *medium*.

This is (partly) confirmed by respondents to the targeted survey expect an increase (54%) or even a strong increase (21%) in their operational costs as a result of this measure.[175]

[174] Based on the ESSF sub-group on EGCS, where indications range from € 50-150 /tonne for liquid waste, € 325-350 for solid waste, and € 400-490 in total.
[175] A total of 35 respondents answered this question.

Investment costs

Meeting sulphur emission requirements potentially leads to investments in scrubbers by the *shipping sector*. However, the PRF Directive itself does not require investment in scrubbers, so investment costs in scrubbers are not attributed to the PRF Directive. The mandatory delivery of scrubber waste would require ship operators to store their scrubber waste separately on board. As this is already common practice, no additional investments on board ships are required.

PRF operators may need to invest in additional reception capacity. The size of these costs depends on the availability of equipment in ports and expected volumes of scrubber waste delivery. The expected volumes are highly uncertain as the future demand depends on a range of variables. The case studies provide some more insight in this subject:

- *Larger sized ports* typically have more extensive PRF facilities, including waste reception barges, especially if their traffic is more diverse. Furthermore, if waste operators are also serving industrial companies in the port, they will have facilities to receive chemical, acidic or toxic waste categories. Still, investments might be needed to upgrade reception tanks. Estimates obtained from interviews suggest recoating of tank holds to be able to accept acidic substances may only cost a few thousand Euros. If, however, volumes of delivery are still limited in the first years after the revision of the PRF Directive, an investment in large scale reception may not be feasible, and PRF operators may opt for smaller scale facilities to ensure adequacy (see under smaller ports);
- *Smaller ports* typically have less extensive and specialised facilities[176], using tank trucks with limited capacity, sometimes not permanently operating in the port but called upon when demand is there. When their traffic is less diverse (for instance, not receiving chemical cargoes to the port), they may lack advanced chemical reception and treatment facilities. In those cases, having to adapt to receive scrubber waste may incur much larger investments. In practice, often such ports are served by tank trucks rather than barges, which could thus be purchased. Costs for PRF operators might range up to € 100,000. Alternatively, instead of purchasing PRF, operators may opt to hire service upon demand (thus incurring operational costs rather than investment costs).

At EU level the investments would in particular be required in ports in the North Sea and Baltic Sea (the sulphur ECA zones). Greater ports with larger scale PRF operators would then only face limited investment needs, while smaller ports might be required to make larger investments. If ports coordinate amongst themselves in relation to the provision of scrubber waste reception capacity[177], investment costs could be optimised in relation to the expected demand (as mostly larger ships will use scrubbers and smaller will not, a concentration of delivery to larger ports could be expected). A quantification of the total costs, however, would only be speculative.

Furthermore, as the global sulphur emission limit is set by IMO to be maximum 0.5% from 2020 onwards[178], ship owners would potentially adhere to this by using scrubbers (the alternative being the use of more expensive low sulphur fuels). This could then imply a strong boost of the uptake of EGCS, and as a result the volume of waste

[176] To handle this toxic waste specialized equipment is required that enables the PRF operator to treat the scrubber waste delivered. Such specialized equipment is often not available in smaller ports.
[177] MARPOL Annex VI offers ports in the same region to seek a regional solution for the collection of Annex VI waste. Not all ports in the same region do have to ensure that they are able to collect the Annex VI. They can appoint one or several ports (depending on the regional situation) that are able to collect the waste on behalf of all ports in the region. In return all ports part of the agreement need to ensure that the costs for having the waste collection in place are sufficiently cover, so ports need to ensure that ship owners using the facility pay.
[178] MEPC(70).

generated (although the ESSF sub-group on EGCS reports that scrubbers designed for 0.5% sulphur instead of 0.1% sulphur might generate much lower amounts of waste). By that time, not only ports in ECA zones, but all across Europe would need to be adequately prepared for receiving scrubber waste. Investment costs could then rise significantly.

For *port authorities*, investment costs relate to extending their notification and monitoring facilities (software) to include Annex VI information. The costs of this will depend on what system they currently have in place and how easy this can be modified. From the case studies it appears that in those five ports it would only require a very simple adjustment, at low investment costs. In addition, *Member State authorities* may also need to make such investments as to update their national single window software.

All in all, it can be concluded that the impact of this measure on the investment costs for the different stakeholders is substantial. Therefore it is assessed that the impact is *medium*.

This is confirmed by the targeted survey in which respondents indicate an increase (47%) or even a strong increase (5%) of the investment costs as a result of this measure.[179]

Business PRF operators

PRF operators may expect increased business as a result of increased scrubber waste delivery. Survey respondents expect a high impact (75% expect a strong or very strong increase). The real impact heavily depends on the uptake of scrubbers on board ships.

Case study interviewees indicate that so far, they have seen little or no demand for scrubber waste delivery, and state that it is highly uncertain if this will increase in the near future. Frequent reference to low oil prices is made. Respondents to the targeted survey indicate that 83% (out of a total of 20 responses) expect an increase of business for PRF operators as a result of this policy measure. Based on the different stakeholder opinions it may be concluded that it is difficult to indicate how large the impact of this measure will be on the business of PRF operators. Nevertheless, it is assessed that the impact of this measure on the business for PRF operators is *medium*.

Impact on SMEs

Based on overviews of EUROSHORE members, a small part of the PRF operators can be qualified as SME companies (see Section 3.2). However, also a range of large companies is active, which typically are operators dealing with other waste flows (industrial waste, household waste) and for which ship-generated waste is a minor share of their business. Both larger and smaller companies, those not yet able to receive scrubber waste, would be required to invest and would benefit from additional business. The response to this question in the targeted survey was too low to derive statements on this impact.

As highlighted above, smaller ports might not have the required facilities available as they do not receive much diverse traffic. Those ports may be required to invest in new facilities to deal with Annex VI waste in case ships visiting the port wish to deliver such waste. However, it is uncertain whether those ships will wish to deliver Annex VI waste, as it might very well be that they have opted for other ways of reducing their sulphur emissions (e.g. change to different fuel type, opt for other abatement

[179] This question was answered by 25 respondents.

technology, etc.). Marinas and fishing ports will likely not have to deal with Annex VI waste, as fishing vessels and recreational craft will likely opt for other different solutions than scrubbers (vessels are too small to install a scrubber).

Overall, it is assessed that the impact of this measure is *medium*.

9.1.3. Other considerations

Stakeholders interviewed mention that the feasibility of investments in scrubber waste facilities by PRF operators strongly depends on the expected delivery volumes. To date, the demand for these services has not encouraged investments. A mandatory requirement for scrubber waste reception facilities would force ports visited by ships using scrubbers to invest on the basis of a highly uncertain delivery expectation, as indicated in the section above on investment costs. Hence, a detailed market consultation on estimated delivery volumes might be needed as part of the implementation process.

The five case studies generally confirm the impacts as described above and underline two key aspects: (i) uncertainty about the delivery of future scrubber waste volumes; and (ii) required investments and operational costs will strongly depend on current facilities and systems in place.

9.1.4. Summary

Results of the impacts of this policy measure are presented in Table 26.

Table 26 Impacts policy measure 1A

Key impacts	Results
Volume of waste discharged at sea / delivered	Low - The mandatory nature of delivering scrubber waste (Annex VI) in port reception facilities may result in an increase of scrubber waste delivered. However, it is assumed that most waste produced is already delivered in port (but is not always properly labelled).
Annex I	No increase.
Annex IV	No increase.
Annex V	No increase.
Annex VI	Considerable increase expected.
Administrative burden	Low - The administrative burden for ship operators will slightly decrease because scrubber waste will be easier placed in reporting forms (which can be harmonised with MARPOL).
Contribution to circular economy	Neutral - This measure does not contribute to the circular economy as scrubber waste is neither reusable nor recyclable.
Operational costs	Medium - Potentially substantial increase for PRF operators as a result of higher treatment costs, Also a slight increase is expected for shipping companies with total operation costs also depending on the cost recovery system applied.
Investment costs	Medium - Investment costs are expected to increase, but the actual increase will depend on the current facilities in place. It is expected that larger ports already have facilities in place that can deal rather easily with the treatment of Annex VI waste. However, smaller ports will probably not have such facilities in place, and therefore relatively large investment

Key impacts	Results
	need to be done in case ships producing scrubber waste frequently visit those ports The investment costs for ship operators and port authorities are expected to be limited.
Business PRF operators	Medium - Increased delivery volumes will directly generate increased business for PRF operators.
Impact on SMEs	Low-medium - As some PRF operators are SMEs, they will be impacted positively (more business) but SMEs will also have to invest in reception facilities.
Overall assessment, including other considerations	This policy measure will result in increased scrubber waste delivery, at modest costs, and benefits for PRF operators as a side effect. There is a need for careful design of the systems given the uncertainty of delivery demand and given existing facilities in place.

9.2. PM 1B: Reinforce the waste hierarchy as laid down in the Waste Framework Directive

9.2.1. Description of the measure

The aim of the policy measure is to oblige ports to collect and handle waste segregated in view of recycling, especially when the waste has already been segregated on board. This should contribute to improved adequacy of port reception facilities; more specifically, to environmentally sound management of waste by the port reception facilities in accordance with the Waste Framework Directive. Furthermore, this policy measure (partly) addresses the problem of marine litter by encouraging green waste practices on board. However, to achieve this, the conflict with the animal by product legislation, as well as with the EU Waste Framework Directive, allowing for deviation from the waste hierarchy, will have to be addressed.

9.2.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

As this policy measure provides an obligation for ports to provide for separate collection of the waste that has been segregated on board, it may serve as an incentive for ships to land waste at ports. However, this view is however not fully confirmed by the stakeholders responding to the target survey. 50% of the respondents (out of 26 responses in total) indicated that they are of the opinion that this measure will not affect the volumes discharged at sea. Approximately 40% of the respondents indicated that they think volumes discharged at sea will (slightly) decrease. This last group mainly consists of PRF operators and Member State inspectorates.

With regards to the specific waste categories (Annex I, Annex IV and Annex VI) the majority of stakeholders does not expect that this measure will lead to an increase in waste delivery. Most of the stakeholders indicate that the volumes delivered will remain the same. Only for Annex V, 35% of the stakeholders, mainly PRF operators, expect that the volumes delivered will increase.

The five case studies underline the potential of reinforcing the waste hierarchy, although not much impact on waste delivery is expected.

Overall, it is assessed that the impact of this measure on volumes delivered is *low*.

Administrative burden

For PRF operators the administrative burden also may be temporarily higher. Currently, the waste categories of MARPOL do not align with those in the EU Waste Framework Directive. Some PRF operators currently do not follow the waste hierarchy and therefore need to adapt to the new structure. This will lead to more administration to ensure that waste is treated in the required manner. Therefore, the administrative burden will increase, at least temporarily until the hierarchy is properly incorporated in their activities.

It is noted that the respondents to the targeted survey (31 in total) expect an increase (45%) or strong increase (21%) of administrative burden (mainly port authorities and ship operators), while only 9% expects a decrease (a shipping line, a PRF operator and one unknown).

Overall, it is assessed that the overall impact of this measure on administrative burden is *low*.

Contribution to circular economy

This policy measure will highly contribute to the circular economy as this measure requires port reception facilities to collect waste separately and also treat it differently. For example, PRF operators are required to separate reusable waste from waste that needs to be incinerated. As a result, recycling and re-use of waste will increase, while the amount of waste directly incinerated (or being landfilled) will decrease, which positively contributes to the realisation of the circular economy. The overall impact is assessed as *high*.

Operational cost

Compared to the current situation operational costs are expected to increase as different handling techniques have to be used. Currently, according to stakeholders, most of the waste collected is incinerated, which is generally the least costly method. Waste handling techniques for recycling or re-use will have higher operation costs, therefore the overall operational costs are expected to increase for PRF operators. On the other hand, PRF operators may be able to generate additional income from selling waste that can be re-used or recycled.

About half of the respondents of the targeted survey, mainly port authorities and PRF-operators, expect an increase (35%) or strong increase (15%) of their operational costs due to this measure, while 40% expects a decrease and 10% has no opinion-also mainly port authorities and PRF-operators.[180] The overall impact of this measure on the operational costs is assessed to be *medium*.

Investment cost

The need for investments depends on the local situation in ports and whether existing facilities are already sufficiently equipped to meet the Waste Framework Directive requirements in terms of waste processing/recycling capabilities[181]. If not, substantial investments may be needed to restructure current waste handling operations.

After the introduction of the proposed measure, *inspection costs* may increase as inspections need to ensure that waste is indeed collected separately. It is expected that after an introduction period, inspections can be conducted less frequently and costs are reduced to normal levels.

[180] Overall, 32 respondents answered this question.
[181] It should be noted that this falls mostly under land based waste handling and municipal waste streams and therefore outside the scope of the PRF Directive.

The respondents to the targeted survey (24 in total)[182] expected an increase (56%) or strong increase (12%) of their investment costs, while 24% expected no change. Two respondents did not know the answer, and none of the respondents expected a decrease.

The state of existing facilities, and hence the need for investments, is largely unknown. Considering also the feedback from stakeholders, the impact of this measure is assessed to be *medium*.

Business for PRF operators

The total waste volume is expected to increase only slightly, specifically for garbage waste, thus the volume effect is limited. However, the way waste is delivered will be different. As some of the segregated waste may represent an economic value (re-use, recycling) there may be a positive price effect, resulting in a positive impact on PRF business. This is confirmed by the targeted survey in which more than 60% of the respondents (19 in total) expect an increase (47%) or strong increase (16%) of business for PRF operators. Based on the above, the impact of this measure on PRF operators is assessed to be *medium*.

Impact on SMEs

As indicated in Section 3.2, a small part of PRF operators are SMEs. PRF operators will be affected positively as a result of the expected increase of business for PRF operators outlined above. Smaller ports, as well as fishing ports and marinas, will need to ensure that they are able to separately collect the waste. However, the waste streams they receive are less complicated than the waste streams of larger ports (many waste types may be missing, e.g. chemicals). It is likely that the smaller ports already collect the waste separately and therefore are only mildly affected by this measure. Given the relatively low share of SMEs in the waste collection sector, and the simpler waste streams in smaller ports, the impact of this policy measure is assessed at *low-medium*.

9.2.3. Other considerations

Ships currently segregate their waste on board, however, lack of provision of separate collection on land has become a disincentive to segregate waste on board of the ship. If waste reception facilities collect the waste separately, the incentive for ships to actually segregate the waste on board already will improve.[183] In addition, the waste collected can be more easily re-used or recycled in line with the waste hierarchy. One of the comments made in the targeted survey is that separated waste collection could be costly in ports that receive low volumes of waste, i.e. small ports.

9.2.4. Summary

Results of the impacts of this policy measure are presented in Table 27.

Table 27 Impacts policy measure 1B

Key impacts	Results
Volume of waste discharged at sea:	Low - Overall, not much change expected.
Annex I: oily waste	None.
Annex IV: sewage	None.
Annex V: garbage	Slightly positive.
Annex VI: scrubber waste	None.

[182] Most respondents to this question are either port authorities or PRF-operators. They do not provide a conclusive answer as the majority of them expects an increase, while some expect a decrease.
[183] Please refer to OSPAR Guidelines on management of shipboard garbage and the Dutch Ministry of Infrastructure and Environment on the Green Deal.

Key impacts	Results
Administrative burden	Low – The administrative burden will initially increase (temporarily), for both inspections and PRF operators, and then return to normal levels.
Circular economy	High - The impact of this measure on the circular economy is high, as separate delivery allows for efficient re-use and/or recycling.
Operational costs	Medium –Costs will increase as different techniques (with higher operational costs) will have to be used. However, PRF operators may also generate additional income from the subsequent recycling or re-used waste.
Investment costs	Medium – Costs will increase because investments are needed to collect waste in different ways.
Business PRF operators	Medium – Additional business for current PRF operators or entry of new PRF operators, notably caused by a price effect.
Impact on SMEs	Low-medium – Business of PRF operators will increase, however, given the relatively small share of SMEs in the waste collection sector, the impact on SMEs will be relatively limited.
Overall assessment, including other considerations	The waste volumes delivered will not increase substantially; the only category where a slight increase is considered is garbage. This measure will lead to increased investment and operational cost for the PRF operators. Administrative burden will, at least temporarily, increase for PRF operators and the inspection authority. The big impact of this policy measure is the contribution to the circular economy.

9.3. PM 1C: Strengthen the requirements for systematic consultation of stakeholders in the development and updating of WRH plans

9.3.1. Description of the measure

This policy measure aims to strengthen the requirements for systematic consultation of stakeholders in the development and updating of WRH plans, supplemented by an exchange of good practices of port user involvement.

Through effective and periodic consultation, the WRH Plan can better respond to and take account of the needs and demands of the different port users, while respecting the requirements of local authorities. The consultation will also result in creating more ownership with port users in relation to the process of waste delivery in ports. The exchange of best practices can help ports to strengthen the involvement of port users in this process.

All five case study ports indicate they already involve their relevant stakeholders in the development and updating of the WHR Plans. Although the ports themselves are positive about this process, some PRF operators in the case study ports indicated that they are not involved sufficiently. As a consequence, they are often not aware of ongoing discussions with regard to these plans in development.

9.3.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

Port reception facilities are perceived to be more adequate to meet the needs of the ships visiting the ports, if the port users are actively involved in the process of developing, evaluating and re-approving the WRH plans. The needs of the port users can be better taken into account through consultation. Furthermore, the port users have a better understanding of the operation and availability of the port reception facilities and the need for delivering ship-generated waste and cargo residues to ports (rather than discharging at sea). Being actively involved in the consultation process will result in more commitment from the port users, resulting in more waste delivered to port reception facilities. This finding is (partly) confirmed by the targeted survey responses: 36% of the respondents expected a decrease of waste discharges at sea, although 50% of the respondents did not expect any significant impact on waste delivery at ports.

In addition, it is expected that more frequent and more in-depth consultation of port users will lead to more clarity of operational aspects of delivery, reducing misunderstanding or error related to waste delivery. This will improve delivery practices by being more aware of accidental littering behaviour.

Overall, the impact of this measure on the waste volumes delivered is assessed to be *medium*.

Administrative burden

More systematic consultation of stakeholders in the development and updating of WRH plans results in reporting requirements, increasing the administrative burden. This point is underlined by two of the case study ports, who indicate that they already consult their relevant stakeholders and that fear that more extensive consultation will only increase the port's administrative burden, without any effects on the volumes delivered in port. However, as stakeholder involvement is already a requirement under the current Directive, the proposed measure only intends to clarify the legal situation, so the net impact is limited.

Additionally, as the consultations will take place more frequently, efficiency gains may be developed, reducing the increase in administrative burden. As a net effect, the impact of this measure on the administrative burden is assessed to be *low*.

Contribution to the circular economy

This policy measure leads to better involvement of all stakeholders, which increases the commitment of good waste practices, which could contribute to the development of a circular economy. However, although the impact is positive, the overall impact is expected to be rather limited, and the overall impact is assessed to be *low*.

Operational cost

The operational costs are expected to be low for most stakeholder groups involved, such as port users, PRF operators and the majority of the larger ports and its authorities. Ports and relevant authorities, which are currently not consulting stakeholders for (re)approval of the WRH plans operational costs are expected to be moderate, although this is already a requirement under the current Directive. Thus those costs *should* already be made by these specific ports. The overall *low impact* is confirmed by the respondents to the targeted survey (32 in total), of which 47% expects no impact, and 13% a decrease. Despite the above, around 28% still expect a (strong) increase.

Investment costs

No investments are required for this policy measure.

Impact on SMEs

It should be noted that the costs of more systematic consultation are disproportionally high for small ports as a result of (dis)economies of scale. This impact on smaller ports results in a negative impact on SMEs. It should be noted that this is not the case for other SME groups, such as small and medium sized port users and therefore the overall impact on SMEs is assessed as *medium*.

9.3.3. Other considerations

From the individual comments given in the targeted survey and from the case studies, it appears that the impacts can strongly vary between ports. Some ports already apply this policy measure, whereas for other ports, respondents indicate that this measure is strongly needed and would benefit from very specific guidance on how it is to be implemented (frequency of consultation, whom to engage, etc.). In all five case studies some form of stakeholder engagement in updating the WRH plans is already applied, so that impacts of this measure are expected to be limited.

9.3.4. Summary

Results of the impacts of this policy measure are presented in Table 28.

Table 28 Impacts policy measure 1C

Key impacts	Results
Volume of waste discharged at sea:	Medium - it will be easier for ports and PRF operators to understand user needs and for port users it will lead to more clarity of and better insight in operational aspects of waste delivery, reducing misunderstanding or error, and raising delivery practices.
Annex I: oily waste	Slight increase expected.
Annex IV: sewage	Slight increase expected.
Annex V: garbage	Slight increase expected.
Annex VI: scrubber waste	Slight increase expected.
Administrative burden	Low - Initially the consultation process may increase the administrative burden, but over time efficient gains are expected to reducing the administrative burden.
Contribution to circular economy	Low - A small improvement through active involvement of port users, resulting in commitment to good waste practices.
Operational costs	Low - Minimal costs to organise the consultation process and to update the WRH plans accordingly (for SMEs this might be different, as indicated below).
Investment costs	None - No investment required.
Impact on SMEs	Medium - for smaller ports for which costs are disproportionally high.
Overall assessment, including other considerations	The measure contributes to the overall objectives (reduction of waste delivery; slight increase of administrative burden; contribution to the circular economy) against fairly limited costs. Current practices show substantial variations; the revision could benefit from accompanied guidance on how to implement the consultation process.

9.4. PM 1D: Provide a better definition of 'adequacy' in line with international guidance

9.4.1. Description of the measure

The objective of this policy measure is to provide a better definition of 'adequacy' in line with the IMO Guidelines for Annex V of MARPOL. This would imply including the main elements from the Commission's interpretative guidelines on adequacy into Article 4 of the PRF Directive. The article should highlight what is meant by the operational needs of ships visiting the port. For instance, the article should indicate which factors make a facility adequate (i.e. location, procedures, ability to collect all waste types as well as reasonably priced and opening hours). In addition, the environmental performance criteria for the facility should be included in the definition of adequacy, thus allowing for the disposal of waste in an environmentally friendly way.

9.4.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

If port reception facilities become more adequate[184], especially if they are able to cater for all waste types, it will become easier for ship operators to deliver their waste at the facility. The extent to which this will result in more waste delivered in ports (and less waste discharges at sea) also depends on the type of traffic visiting the port, as well as the port size and the port's geographic location.

Almost 40% of the respondents (out of a total of 23) to the targeted survey are of the opinion that the volumes discharged at sea will decrease. This view is mainly hold by the PRF operators. Another 50%, mainly port authorities, ship operators and shipping agents, indicate that volumes discharged at sea will not be influenced by this measure and are likely to be the same.

21% of the respondents indicated that the volumes of garbage delivered to the PRF operator will increase as a result of this measure. Overall, most stakeholders indicated for all waste categories that the volumes delivered at the facilities will not change or they do not know whether or not the volumes will increase or decrease.

The case study ports highlighted that although it is a welcomed initiative to clarify what adequacy is and how it should be measured, all five also underline that in their ports facilities are already adequate and therefore are able to receive the waste delivered. They also indicate that this measure will not increase the volumes delivered at ports.

Considering the above, the impact of this measure on volumes delivered is assessed to be *low*.

Administrative burden

Adequacy will be better defined by incorporating the main elements from the interpretative guidelines on adequacy into Article 4 of the PRF Directive. Assuming that this will result in a more harmonised approach and more clarity for the stakeholders involved, a reduction of the administrative burden can be expected. In this way, this policy measure would address the problem of inconsistent and insufficient implementation of the PRF Directive, as presented in Section 5.2. Overall, the impact on the administrative burden is expected to be *low-medium*.

[184] The changed definitions will make clear when a port reception facility is adequate. This is expected to lead to a situation in which the services provided to ship operators are more harmonized and the same level of service is offered in each port.

Contribution to circular economy

This policy measure is expected to have a positive impact on the circular economy. The more adequate port reception facilities become, the better these facilities are able to treat waste in an efficient way. Moreover, the adequacy of port reception facilities is linked to environmentally sound management of waste. Overall, the impact of this policy measure on the circular economy is assessed at *low-medium*.

Operational costs

The impact depends on the number of facilities that is currently not able to process all different waste types required.[185] In case many facilities are not able to deal with all waste types, these facilities will have to expand their operations in order to ensure that ships can deliver all waste types. This will increase the operational costs of the ports quite substantially. In case most facilities are already offering services to deliver all waste types, the impact will be more limited. For smaller ports the impact might be higher, as it is unknown whether these ports are able to deal with all the different waste types, as required. Based on feedback from stakeholders, the impact of this measure on the operational costs is expected to be *low*.

Investment costs

The impact depends on the exact locations of the individual port reception facilities. One of the requirements is that the facility is conveniently located, a term that can now be interpreted in various ways. If the facilities are located at spots which would be qualified as not sufficiently convenient, it might be possible that the facilities have to be relocated. This will lead to substantial relocation costs. Other requirements, such as the ability to handle all waste types, may lead to substantial investments and not all facilities might able to deal with all waste types. However, based on indications from stakeholders (case studies and interviews), it seems that additional investments are not required and therefore the impact is assessed to be *low*.

9.4.3. Other considerations

During the case studies, stakeholders indicated that this measure is useful. Stakeholders do not expect this measure to have a strong impact on waste deliveries; however a positive aspect is that it has very limited costs.

9.4.4. Summary

Results of the impacts of this policy measure are presented in Table 29.

Table 29 Impacts policy measure 1D

Key impacts	Results
Volume of waste discharged at sea:	Low - It will become easier to deliver waste at the ports It is expected that the volumes discharged at sea as a result of this measure will slightly decrease.
Annex 1: oily waste	No change expected.
Annex IV: sewage	No change expected.
Annex V: garbage	Slight increase in delivery expected.
Annex VI: scrubber waste	No increase expected.

[185] Based on the information currently available it is not possible to indicate how many port reception facilities are not able to process all different waste types required.

Key impacts	Results
Administrative burden	Low–medium - Clearer definitions will result in a more harmonised application of the concept of adequacy, contributing to a more consistent implementation of the PRF Directive. This is expected to contribute to a reduction of administrative burden.
Circular economy	Low-medium - Positive impact expected, assuming that the adequacy of PRF is linked to environmentally sound management of waste.
Operational costs	Low - Impact is expected to be limited.
Investment costs	Low - Impact is expected to be limited.
Overall assessment, including other considerations	Overall, it is expected that this measure will contribute to a decrease of waste discharged at sea, especially for garbage. For the other waste categories – Annex I, IV and VI, no changes are expected. It should be noted that this measure may have a larger impact on smaller ports (especially fishing ports and marinas) as their operational and investment costs are expected to increase as a result of this measure.

9.5. Summarised impacts of policy measures in the adequacy cluster

The impacts of the policy measures in this cluster are summarised in Table 30.

Table 30 Impact of recommended policy measures

Policy measure	Effectiveness Waste delivery	Administrative burden reduction *	Efficiency Contribution to circular economy	Operational costs	Other impacts Investment Costs	
1A (Annex VI waste)	L (already delivery obligation in place under MARPOL)	L+ (reduction through MARPOL alignment)	Neutral (no contribution is expected)	M (reception and treatment costs increase compared to current delivery practices)	M (investment in reception facilities required, possibly also in treatment)	Impact on business for PRF: M Impact on SMEs: L-M
1B (waste hierarchy)	L (improvement of on-shore waste processing)	L -(initial temporary increase, then return to normal)	H (separate delivery allows efficient recycling)	M (higher costs for more advanced operations, but also possible revenues from recycling)	M (depends on current waste treatment/recycling facilities in place on shore)	Impact on business for PRF: M Impact on SMEs: M
1C (WRH consultation)	M (more clarity over operational aspects of delivery will reduce misunderstanding or error, and raise delivery practices)	L -(initially the consultation process may increase the administrative burden, but over time efficient gains are expected to reducing the administrative burden)	L (a small improvement through active involvement of port users, resulting in commitment to good waste practices)	L (minimal costs to organise the consultation process and to update the WRH plans accordingly).	Neutral (no investments required)	Neutral (no additional impacts foreseen)
1D (adequacy definition)	L (it will become easier to deliver waste at the ports Volumes discharged at sea may slightly decrease)	L-M+ (clearer definitions will result in a more harmonised application of the concept of adequacy, and a more consistent implementation of the PRF Directive. This is expected to result in a reduction of administrative burden)	Low-medium (positive impact expected, assuming that the adequacy of PRF is linked to environmentally sound management of waste)	L (potentially higher for individual smaller ports)	L (potentially larger for smaller ports if they face a more significant increase of waste delivery)	Neutral (no additional impacts foreseen)

10. Impacts of incentives measures

This chapter presents the assessment of the impacts of the individual policy measures in the cluster of incentives. For each of the defined policy measures a brief description and the assessment of the impacts and other considerations are described, together with a summary of the main impacts. The main impacts are determined on the basis of a pre-screening process and the results of a questionnaire on impacts, as described in Section 3.2.7.

10.1. PM 2A: Shared methodology to calculate the indirect fee and transparency on costs charged to port users through mandatory publication in the WRH plans

10.1.1. Description of the measure

The policy measure introduces the use of a shared methodology to calculate the (part of the) costs to be covered by the indirect fee to port users; introduces a 'right to deliver'[186]; and requires higher levels of transparency on the various elements of costs charged to port users for the use of port reception facilities through mandatory publication in the WRH Plans. The overall objective is to provide the right economic incentives for delivery of waste to ports.

Four elements for shared methodology are included as proposed in the report by the ESSF PRF sub-group's correspondence group on cost recovery systems:

1. *Cost structures; relationship between fee and the costs*. In addition, a list of what constitutes 'direct costs' and 'indirect costs'. As part of this measure, it is considered including this list in an Annex to the Directive;
2. *Method for calculation of the fee* and determining the *significant contribution*, including a *right to deliver* and the calculation method for determining this based on the *30% threshold*;
3. A common definition of '*transparent and fair and non-discriminatory fees reflecting the costs*';
4. Required higher levels of *transparency* on the various elements of costs charged to port users for the use of port reception facilities through *mandatory publication in the WRH Plans*.

The third element is the most difficult to apply for ports with multiple PRF operators in (fully or partly) open markets. For applying the transparency requirements and calculating the 30% threshold for significant contribution, information regarding the costs of providing a PRF is often lacking, as this is provided by private companies and thus commercially sensitive (PRF working group, October 2016).

10.1.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

The introduction of a shared methodology to calculate the indirect fees may lead to fewer variations between ports, as ports are incentivising delivery of waste in a similar way. At an aggregated EU level no significant changes in volumes are foreseen. This is confirmed by respondents to the targeted survey, of whom 65% expect no impact.

[186] Note: development at regional level can be considered by including a reference in Article 8 or 5, but it is not envisaged to propose a harmonised methodology per sea basin.

Regarding the introduction of the right to deliver, The ESSF PRF Correspondence Group on Harmonising the principles of Cost Recovery Systems in Article 8 of the PRF Directive (2017) concludes on this matter that: 'It is expected that ports which have not implemented this 'right' before, will receive more wastes in future (as a result of including this policy measure)'. The right to deliver may be an incentive for ship operators to deliver their waste to ports, as nothing is gained in discharging waste at sea. The impact of the right to deliver depends on the fee the user has to pay, as this measure does not imply that the right to deliver comes free of charge. However, if the right to deliver is combined with a 100% indirect fee system (see Section 0) the fee paid is irrespective of the amount of waste delivered.

The policy measure creates better incentives for waste delivery, which is expected to result in additional waste delivery. At EU level, this effect at is expected to be modest. However, significant impact may occur at individual port level due to redistribution of waste delivery. The overall impact of this measure of waste delivery is assessed at *low-medium*.

Administrative burden

The need to restructure the current cost recovery system and to include right to deliver, and report on this in the WRH plans, is expected to result in a modest increase of administrative burden for ports. For ports that already apply these principles, no additional administrative burden is expected. After an initial increase of administrative burden caused by the necessity to report adjustments in the WRH plans, the administrative burden will eventually decrease once the basic principles are defined and communicated to the port users and defined in the WRH Plan. Based on the above the impact on administrative burden is assessed to be *low*.

Contribution to the circular economy

No contribution to the circular economy is expected.

Operational costs

This policy measure is not expected to result in additional operational costs. As the total waste volumes are expected to only slightly increase and no other significant changes are foreseen, the total operational costs will hardly be impacted. It should also be noted that it was thought that structuring of the fee system does not affect the actual costs of waste handling, and should not lead to increase in operational costs. These findings are confirmed by the analysis conducted by the ESSF PRF Correspondence Group Harmonising the principles of Cost Recovery Systems in Article 8 of the PRF Directive (2016) Consequently, the impact is assessed to be *low*.

Investment costs

Adjustments in the administration systems and communication costs related to the changes made and the consequences for the port users may result in some initial investments for the port authorities. These investments are modest and will take place once only. Consequently, the impact is assessed to be *low*.

10.1.3. Other considerations

It is considered a good idea to provide a methodology and guidelines to the ports for calculation of costs related to ship waste management. Some ports today do not calculate their costs properly and impose a waste fee, which is not directly linked to the costs. It can be very difficult to calculate the costs when external waste operators are involved in some of the waste operations, and the port itself in others. The difficulty related to external operators is confirmed by Antwerp, one of the case study ports. Therefore, guidelines will be appreciated by most ports. Respondents to the

targeted survey expect this policy measure to be neutral for investment (50% of respondents state this), operational (38%) and administrative costs (33%).

This measure will also contribute to the competitiveness in ports. By providing a common methodology to calculate the costs, and thus increasing the transparency between PRF operators in a port, the level playing field between PRF operators becomes more level, which in its turn may lead to fairer competition between operators in the port and between ports. However, this view is not shared by the case study ports. They indicate that as a port authority it will be difficult to implement such a measure, especially when all PRF operators are already competing with each other on an open market. They also believe that PRF operators will all have their own cost structure on which they base their fees. By introducing a shared methodology they might not be able to charge a fee that will cover their costs.

10.1.4. Summary

Results of the impacts of this policy measure are presented in Table 31.

Table 31 Impacts policy measure 2A

Key impacts	Results
Volume of waste discharged at sea:	Low-medium - Create better incentives for delivery, resulting in an overall modest overall increase of waste delivered at EU level, but with potential substantial effect at individual port level due to redistribution of waste delivery.
Annex I: oily waste	Slight increase expected.
Annex IV: sewage	Slight increase expected.
Annex V: garbage	Slight increase expected.
Annex VI: scrubber waste	No impact expected.
Administrative burden	Low - Initially a temporary increase, but once methodologies are adjusted, administrative burden may reduce.
Contribution to circular economy	Neutral - No contribution is expected.
Operational costs	Low - The total waste volumes are expected to only slightly increase and no other significant changes are foreseen, the total operational costs will hardly be impacted.
Investment costs	Low – Relatively modest investments needed in the administration systems and communication costs.
Other impacts	Neutral - No net effects, but a redistribution of business and employment across ports may occur.
Overall assessment, including other considerations	This policy measure results in some additional waste delivered at ports and subsequent reduction of discharges in sea. The impacts on administrative burden and the circular economy are expected to be low or nihil respectively. Investments and operational costs are also expected to be low.

10.2. PM 2B: Apply a 100% indirect fee system for garbage

10.2.1. Description of the measure

Three principal types of cost recovery systems can be distinguished[187]:

1. The *100% indirect fee system*, also referred to as the *No Special Fee (NSF)* system, is based on charging ships a waste handling fee, irrespective of their use of the port reception facilities. In this system, no additional fee is charged, besides the waste handling fee, which the port authority charges to all ships.[188] This waste handling fee usually does not depend on the volume of the delivered waste in ports (although ports sometimes apply a volume limit above which additional direct fees need to be paid) and is also charged if a vessel does not use the port reception facilities at all. The waste handling fee is normally based on ship size and sometimes also on ship type and the waste handling fee can be included in the port dues or charged separately[189];
2. The *administrative fee system for waste*, also referred to as *AFS*, which generally consist of an administrative fee (to be paid to the port authority) and a refund that can be claimed from the port authority when evidence is provided of the actual waste delivery at the PRF operator;
3. The *100% direct fee system*, which is based on a payment per volume of waste discharged and paid directly to the PRF operator.

The ex-post evaluation of the PRF Directive (Panteia, 2015) indicates that the cost recovery systems for garbage waste (Annex V) in EU ports are often based on *100% indirect fee system for waste* (69%). A *direct fee system for waste* is applied on a relatively small scale (7%), mostly in Mediterranean ports. The *administrative fee system for waste* is applied on a broader scale (24%), notably in North Sea ports.[190]

Through this policy measure *all ports covered by the PRF Directive will apply a cost recovery system for garbage waste (Annex V) that is based on charging ships a waste handling fee, irrespective of their use of the port reception facilities*. This principle applies to the above-mentioned 100% indirect fee system and it may also apply to the administrative fee system (if this system is based on charging a fee which is not related to the volume discharged).[191]

1. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

This policy measure only affects Annex V waste (garbage).

[187] The mentioned three cost recovery systems constitute the main systems applied in EU ports. It should be noted that variants based on the three mentioned systems are applied throughout Europe.
[188] In some ports, this is presented as a separate fee, while in other ports it is included in the port dues.
[189] A variant exists in which ports accept waste up to a reasonable amount, meaning that a specified amount of waste is covered by the common waste handling fee charged to all ships. All quantities of waste that are considered 'excessive' are charged separately, and may be charged by either the port authority or by waste operating companies. In the context of the impact assessment we focus on the 100% indirect fee without the reasonable amount.
[190] The percentages are based on results of the ex-post evaluation of the PRF Directive, which looked into 62 ports. For the ex-post evaluation the data from various EMSA studies was pooled and updated where necessary. As such, the ports included follow EMSA initial selection criteria, which seek to include the largest port, a medium-sized port and smaller port per Member State. More details are presented in Annex 12.
[191] The policy measure focuses on garbage because the waste collection figures in the ex-ante evaluation (Panteia. 2015) seem to indicate a positive relationship between the 100% indirect fee system and garbage waste delivered. Furthermore, in dialogue with DG MARE this policy measure was strongly suggested based on its potential towards stimulating garbage waste delivery.

The EUONMIA study (2016) compares the 100% indirect (NSF) and the administrative fee system:

- The driver of having *no incentive for ships to discharge waste at sea* can be achieved through a *100% indirect fee system*. However, the cost of delivering garbage may in many cases be relatively small for shipping operators and so this may not be a dominant factor in the decision of some vessels to dump garbage into the sea;
- The driver to *encourage the delivery of ship-generated waste to ports* can be achieved through an *administrative fee system*, in which a deposit is only refunded upon delivery of waste or a penalty applied to vessels that choose not to deliver waste. Such a system can be effective at increasing the number of vessels using the port reception facilities and the amount of waste delivered.

The authors of the above-mentioned report conclude that the potential impact on reduction of waste discharged at sea of the administrative fee system is higher than for the 100% indirect fee system[192]. This is different for the direct fee system, as this system includes a (price) incentive to discharge waste at sea. A change from a direct fee system to a 100% indirect fee system is expected to result in more delivery of waste in ports. However, as established above, only a relatively small share of ports (7%) has a direct fee system for garbage, lowering the impact on waste delivered to ports.

The case study ports do not agree with the view held in Eunomia. They indicate that they either already have a full indirect system (100% indirect fee) or partial system (e.g. 50% indirect fee). They do not expect much change in the volumes delivered in port when each port will have a 100% indirect system in place.

The fishing ports and marinas are not reflected in the above-mentioned percentages and deserve special attention. The fishing and recreational boating sectors contribute considerably to garbage waste discharges at sea, i.e. 30% and 19% respectively (see Section 5.1.3). Including fishing and marinas is expected to contribute to the impact on waste discharges at sea. This is subject of policy measure 2D (see Section 10.4).

Based on the above, this policy measure is expected to provide a *low to medium positive impact* on waste delivered at ports. Respondents to the targeted survey confirm the potential of this policy measure by indicating that it is relatively effective in delivery of waste in ports; 58% of respondents indicated an increase or strong increase, whereas 13% indicated a (strong) decrease of garbage delivered in ports as a result of this policy measure.

Administrative burden

Creating a harmonised and simplified fee system for garbage waste is expected to reduce the administrative burden to some extent. This is mainly due to port users having to deal with one cost recovery system only. Hence the impact is assessed to be *low* (reducing administrative burden).

Contribution to circular economy

The contribution to the circular economy is expected to be *low to medium*. As established above, more garbage waste is expected to be collected. Furthermore, this policy measure provides an incentive to deliver the garbage waste separately.

[192] As established above, both these systems can be implemented as part of this policy measures.

Operational costs

Operational costs of port authorities and PRF operators are expected to be affected to some extent and to a limited extent for the ship operators (represented through agents). The change in operational costs mainly relates to handling of financial flows. It is assumed that in the 100% indirect fee system, the waste handling fee is paid in the form of an indirect fee that is integrated in the general port dues, which are collected by port authorities[193].

In the current situation, the fees for garbage delivery are paid to the port authority (in case of 100% indirect or administrative fee system) or to a PRF operator directly (in the case of direct fee system). If this policy measure is applied, all waste handling fees will be paid to the port authority (in most cases integrated in the general port dues). For those ports for which the waste handling fee is paid to the port authority, which is the vast majority as indicated above, existing procedures and systems may need to be adjusted (which is an investment cost, see below). Once that is executed, changes in operational costs are expected to be limited.

Operational costs are not (or hardly) affected for the majority of ports (69% no change in case of 100% indirect fee system; 24% some change in case of administrative fee system. The change from a direct fee system to a 100% indirect fee system may be more substantial, however, as assumed above, there are only a limited number of ports (7%) with a direct fee system for garbage. Based on the above, it can be concluded that the impact on operational costs is *low-medium*.

Investment costs

Initial investment is needed to adjust to the new cost recovery system, i.e. the 100% indirect fee system for garbage. These investments can be grouped into (i) adjusting the systems and procedures related to the financial flows between port authorities, PRF operators and port users; and (ii) communication costs related to the new cost recovery system. Again, it should be noted that these adjustment only apply to ports that currently have different cost recovery systems, as illustrated below:

- Current system is *100% indirect fee system*: no change;
- Current system is *administrative fee system*: medium change. Existing systems (establishing financial transfers between port authorities and PRF operators) are in place, but may need to be adjusted for the new situation. This will require investment costs at both the port authority and the PRF operators. In addition, port authorities will need to inform port users, resulting in communication costs, which includes placing information related to changes in cost recovery system on the port website and producing an email notification to main clients (ship operators and agents).Furthermore, the WRH plans will also need to be updated;
- Current system is *direct fee system*: medium-high change. In the existing situation, no system related to financial flows for garbage is in place at the port authority. This system needs to be established, resulting in substantial investment costs. In addition, communication costs will need to be made, as described above (for administrative fee system).

Based on the above, it can be concluded that the overall impact on investment costs can be rated at *medium*, with 24% of the ports having a medium impact on investment costs and 7% of ports having a medium-high impact, and the remaining ports not being affected.

[193] It is noted that the waste handling fee follows a slightly different route in some ports, however, the main route follows the pattern as described above.

Business PRF operators

The business of PRF operators is directly linked to the impact on garbage waste collected (see volume of waste discharged at sea – delivered in ports above). As a low to medium impact is estimated on Annex V waste delivered at ports, a similar impact (*low-medium*) can be foreseen for additional business for PRF operators.

Employment

Impact on employment at port reception facilities is linked to the volumes delivered at ports and the impact on PRF business. As these impacts are assessed at low-medium, this will also impact employment at port reception facilities. Given the fact that port reception facilities are more capital than labour intensive, the size of the employment impact is expected to be modest. A small temporary increase in workload can be expected at port authorities as a result of investments in adjusting systems and communicating changes to users. However, this is not expected to result in employment effects at port authorities. No employment impact is expected at the ships or agents. Based on the above, the overall employment impact is assessed to be *low*.

10.2.2. Other considerations

A complicating factor in the implementation of this policy measure is that ports have historically set up their cost recovery systems. Up to now, ports are free to choose their cost recovery system, as long as it meets the requirements as set out in the PRF Directive. Therefore, ports may be reluctant to adjust their cost recovery system.

By introducing a 100% indirect fee system for Annex V waste in all ports, the playing field will become more level, i.e. the same system applies in all ports. It may increase the competition between ports, as applying the same system everywhere will increase the transparency. Transparency in its turn will lead to more competition.

10.2.3. Summary

Results of the impacts of this policy measure are presented in Table 32.

Table 32 Impacts policy measure 2B

Key impacts	Results
Volume of waste discharged at sea:	Low-medium - This policy measure only affects Annex V waste (garbage). The fact that the principle of a 100% indirect fee for garbage waste is applied in most EU ports reduces the potential impact.
Annex 1: oily waste	None.
Annex IV: sewage	None.
Annex V: garbage	Low-medium.
Annex VI: scrubber waste	None.
Administrative burden	Low – A reduction of administrative burden due to harmonisation and simplification of cost recovery systems.
Contribution to the circular economy	Low-medium - More separately delivered garbage.
Operational costs	Low-medium - Operational costs are not or hardly affected for the majority of ports (69% no change in case of 100% indirect fee system; 24% some change in case of administrative fee system. The change from a direct fee system to a 100% indirect fee system may be more substantial, however, there are only a limited number of ports (7%) with a direct fee system for garbage.

Key impacts	Results
Investment costs	Medium - With 24% of the ports (those currently having an AFS system) having an expected medium impact on investment costs and 7% of ports (currently having a 100% direct system) having an expected medium-high impact.
Business PRF operators	Low-medium - Linked to development of Annex V waste volumes delivered at ports.
Employment	Low - Modest impact at port reception facilities; no employment effects at port authorities or ships (or agents).
Overall assessment, including other considerations	The policy measure has a low-medium impact on waste delivered at ports and contributes to the circular economy as well. Due to harmonisation and simplification of the cost recovery systems a (concise) reduction of administrative burden is expected. Investment costs are needed to adjust systems and procedures, as well as in communicating changes to port users. Once that has been done, operational costs are expected to be modest (low-medium impact).An additional point of consideration is that ports have established their cost recovery systems over time and may be reluctant to changing their systems.

10.3. PM 2C: Incentivise measures that reduce the amount of waste produced on board, including the Green Ship concept

10.3.1. Description of the measure

The PRF Directive in Article 8(2)(c) states that fees (to be paid by ship operators) may be reduced if the ship's environmental management, design, equipment and operation are such that the master of the ship can demonstrate that it produces reduced quantities of ship-generated waste. The underlying thought is that waste generation can be reduced due to developments in technology and a process towards sustainable shipping. However, the Green Ship concept, which is advocated in the PRF Directive, leaves room for interpretations and has not materialised very well in the implementation process of the PRF Directive.

Therefore this policy measure aims to provide incentives, notably in reduced waste fees to ships that produce reduced amounts of ship-generated waste on-board. To this end the current provision needs to be further improved by including the following aspects:

- Green Ship criteria need to be defined in order to create a harmonisation approach between ports;
- Identify criteria (and related evidence) that ports can use to reward ships.

10.3.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

Incentivised measures for reduced on-board waste generation have the potential to reduce the waste discharged at sea. The effectiveness of this policy measure depends on a number of factors, including:

- The *level* of the financial incentive;
- The *waste type*, which is elaborated below;

- The *ship size*, where typically larger ships are more often (and more easily) equipped with on-board treatment than smaller ships;
- The *ship segment*, distinguishing between merchant, fishing and recreational ships. The potential for on-board treatment is higher for merchant ships than for fishing ships and recreational craft as a result of economies of scale.

The level of financial incentive is particularly crucial for the success and therefore impact of the measure. It is uncertain if the investments required in green on-board waste technologies are offset by the reduction in (in)direct waste fees, as is noted by the cost benefit analysis presented during the 2016 environmental ports conference in Venice by Cogea: "So why should ship owners go greener for next to nothing?" As the overall port charges (including PRF) only make up of less than 5% of the total costs for the ship owner and "green discounts" are –when substantial- often only financially feasible for vessels with multiple calls that can cumulate rebates to some substantial level (Cogea, 2016).

Oily waste

Only a small oily waste delivery gap can be recorded, estimated at 2.5% (see Section 5.1.1). This may be the result of the fact that reducing oily waste discharges at sea has received a lot of attention over the years. Furthermore, oily waste has a residual value and despite the current low oil prices, this may have also contributed to delivery of waste at port reception facilities. Based on the above information, this policy measure will not focus on oily waste and the expected impact of this measure on oily waste is expected to be low.

Sewage

Larger merchant ships and especially the cruise liners have on-board treatment facilities for sewage. Reducing the production of sewage is difficult since sewage is a function of the number of persons on board the ship. Green Ship Technologies (GST) may help to filter and treat sewage so that less sewage waste will be discharged at sea or delivered at ports. It is assumed that on-board treatment is mainly applicable for larger vessels (which often already have on-board treatment facilities); hence the effect of this measure on fishing vessels and recreational craft is minimal.

Garbage

Reduction of on-board generated garbage is achieved by implementing on board waste (garbage) management plans[194]. In general, a garbage minimisation policy for the shipping industry has a potential *substantial* impact and should focus on the following industrial waste management options[22]:

- Garbage avoidance and re-use;
- Recycling;
- Reduction by treatment.

Scrubber waste

Scrubber waste is a relatively new type of waste and technical measures are not applied on a routine basis. Incentives to introduce technologies that can treat scrubber water on-board may therefore have a positive effect. This measure should be seen in addition to the mandatory delivery of scrubber waste, as presented in policy measure 1A (see Section 9.1).

[194] http://www.marineinsight.com/environment/how-can-ships-crew-contribute-towards-reducing-garbage-production-onboard-ship/.

Based on the above, the impact of this policy measure on waste discharged at sea is assessed as *low-medium*.

Administrative burden

Port authorities will need to manage funds and compensate PRF operators for reduced fees for ships equipped with green technologies. This is expected to generate additional administrative costs at the side of port authorities, who may need to certify applications for reductions (for instance on certificates of approved treatment equipment installed). However, this is mostly part of the regular work of the port authorities, so this is not expected to result in an increased administrative burden. Ship operators are expected to spend time on administering the measures taken to comply with the Green Ship criteria and to be subject to auditing procedures on-board, increasing administrative burden. Respondents to the targeted survey expect a neutral impact (40%) or a slight increase (36%). The impact, therefore, is rated as *low-medium*.

Contribution to the circular economy

This policy measure will promote the uptake of more environmental friendly technologies and incentivise producing less waste and raising awareness of waste and littering behaviour. All these factors have a positive impact on the circular economy by producing less waste and better waste segregation and delivery. Consequently, the impact on the circular economy is assessed as *medium*.

Operational costs

Ship operators are expected to face increased operational costs as a result of operating and maintaining the green technologies (see investment costs below). This may be (partly) offset by reduced port fees as a result of the implemented green technologies. The net effect on operational costs of this measure for port operators is expected to be limited.

Impacts on operational costs of ports and PRF operators will depend on the incentives and the method of cost calculation (in particular the indirect fees). Some additional operational costs are expected for running those incentive schemes for ports.

The overall impact on operational costs is considered to increase moderately (rated *low* impact). This is confirmed by the targeted survey in which 30% of the respondent expects some increase in operational costs as a result of this measure.

Investment costs

Ports and PRF operators need to do some investment to implement environmentally differentiated fees, mostly related to *adjusting IT systems and procedures*. However, no major investments in the port reception facilities are expected. For port users, investments in green technologies are expected to comply with this policy measure. Based on the above information, the impact of this measure on investment costs is assessed as *medium-high*.

Business PRF operators

Less waste volumes will be delivered, as less will be generated (see below), resulting in reduced business for PRF operators. Further, the reduced waste volumes may be of higher density, since the wastes are compressed and concentrated. This may lead to relatively high operational costs at the port reception facilities. The overall impact on business for PRF operators is expected to be *low*.

Impact on SMEs

As some of the PRF operators can be qualified as SMEs, SMEs will be limitedly affected (see above).

The impact of developing and maintaining new technologies for reduced waste generation on board ships is assessed to be minor for SMEs, as the industry is dominated by larger companies. The overall impact on SMEs is assessed to be *low*. The number of responses to this question in the targeted survey is too low to derive an answer.

Competitiveness and innovation

This policy measure promotes the uptake of efficient technologies and can, therefore, be an incubator for developing more of such technologies. This could result in a reduction of primary waste production (for instance, develop engines that generate less sludge, or toilets that can operate with smaller flush water volumes) or on-board waste treatment equipment, such as sewage treatment or scrubbers. As the European manufacturing industry is leading in these areas of (green) equipment, European competitiveness can benefit from further promotion[195] resulting in a *medium* impact. Respondents to the targeted survey confirm this expectation, with 55% expecting an increase on this point.

10.3.3. Other considerations

No other considerations are recorded for this policy measure.

10.3.4. Summary

Results of the impacts of this policy measure are presented in Table 33.

Table 33 Impacts policy measure 2C

Key impacts	Results
Waste discharged at sea / delivered in ports: Annex I Annex IV Annex V Annex VI	Low-medium - Reduction of waste generation will also lead to fewer discharges. However, the uptake of waste generation reduction is uncertain as this depends on the levels of incentive given. This measure is also not expected to be effective for fishing ships and small recreational craft and restricted to some waste streams (see below): Low. Low-medium. Medium-high. Low-medium.
Administrative burden	Low-medium – Ship operators are expected to spend time on administering the measures taken to comply with the Green Ship criteria and to be subject to auditing procedures on-board, increasing administrative burden.
Contribution to the circular economy	Medium - Less waste produced and potential other waste hierarchy measures.
Operational costs	Low - Little impact expected.
Investment costs	Medium-high - Significant for ship owners, focused on investments in green technologies. Ports and PRF operators investing in adjusting IT systems and procedures.
Business PRF operators	Low - little impact expected.

[195] Ecorys (2012), Green growth opportunities for shipbuilding. Study for EC DG ENTR.

Key impacts	Results
Impact on SMEs	Low - little impact expected.
Competitiveness and innovation	Medium – improvement expected as the measure drives demand for technology development.
Overall assessment, including other considerations	The policy measure has the potential to reduce waste discharges at sea, notably for garbage and to a lesser extent sewage and scrubber waste. The contribution to the circular economy is also substantial, while a slight increase in administrative burden is expected. Investment costs may be substantial, especially for ship operators; operational costs are expected to be modest and (partly) offset by reduced port fees. The costs to promote this measure in terms of subsidies/funds/tax reduction etc. is not included here, as the diversity in funding schemes from port to port will be too large to assess an average estimate.

10.4. PM 2D: Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities

10.4.1. Description of the measure

The aim of this policy measure is to incentivise the delivery of ship-generated waste from fishing vessels and recreational craft to port reception facilities by including them in the indirect fee regime.

This policy measure considers incentives through several systems, for example, by including deposit systems and waste subscriptions on a seasonal or annual basis. Besides fishing vessels and small recreational craft, this policy measure also focuses on fishery ports and marinas by including additional requirements, provisions, and simplified procedures for small ports.

10.4.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

Oily Waste

Unlike in merchant shipping, the use of heavy fuel oil by the fisheries and recreational boating sector is very low or close to zero. This means that virtually no increase in oily waste delivery can be achieved from fisheries and recreational boating, hence the impact on oily waste is assessed to be *low*.

Sewage

The potential for delivery of more sewage to the port reception facilities can be described as follows:

- Potential additional delivery of 0-50% for fishery vessels;
- Potential additional delivery of 0-20% for recreational craft.

The range depends on whether exemptions for small vessels remain. If so, no additional delivery of waste is expected. If the exemption for small vessels is completely removed an increase can be expected of 50% for the fishery vessels and 20% for recreational craft. This is assuming that the requirements for waste delivery at port reception facilities are fully implemented, including adequate inspection and

penalty systems. Respondents to the targeted survey only expect a limited effect (12% indicating an increase of sewage waste delivery, 27% neutral and 15% expecting a decrease). The overall impact on sewage waste is expected to be *low-medium*.

Garbage

The targeted survey indicates that this policy measure could result in additional delivery of approximately 5% garbage waste. This percentage is applied to garbage waste volumes generated by the fishing and boating sector.

The *fisheries sector* is expected to generate some 266 thousand tonnes of garbage waste, which represents 30% of all garbage waste produced (see Table 6), presenting the breakdown of ship-generated garbage waste per sector). This amount includes some 44 thousand tonnes of household waste, 218 thousand tonnes of fishing gear and 4 thousand other operational waste. Accordingly, the delivery potential by the fisheries sector as a result of this measure is estimated at some *13.000 tonnes per year*.

The *recreational sector* is expected to generate 170 thousand tonnes of garbage waste, which represents 19% of all garbage waste produced (see Table 6)). Applying the above-mentioned 5% results in an estimated delivery potential of some *8,500 tonnes per year*.

Based on the above, the impact of this policy measure on garbage waste is *high*.

Administrative burden

The administrative burden depends on how the fee system is organised. If marinas and fishing ports implement a (annual) subscription based indirect fee system, the administrative burden could be minimal. However, if a different indirect fee scheme is implemented, an increase can be expected. As the type of fee system (annual subscription, invoicing after each port call) impacts the outcome significantly, generalised estimations based on known figures cannot be made. Respondents to the targeted survey expect an increase of the administrative burden (48%). Therefore this measure is expected to lead to a *low to medium* increase in administrative burden.

Contribution to the circular economy

It is expected that this measure will promote both the segregation of waste on board as separate delivery on shore at port reception facilities. Segregation of waste streams and types enables integration of the waste hierarchy and thus re-using it as a resource for new products; moving from a linear to a circular economy. Therefore the impact of this measure in terms of contribution to the circular economy can be regarded as *medium*.

Operational costs

If *fishing vessels and recreational craft* will have to pay indirect fees, this could imply an increase of their port dues and thus their operational costs. Case study information reveals amounts of annual fees of some 800 Euro for fishing vessels. For recreational vessels, the operational costs will be applied most likely on a user basis, as for other services (such as electricity, water, sanitation), where the cost for using the waste reception facility is included in the port fee. Alternatively, many marinas already apply annual port fee systems in which the costs of waste reception are included, so the cost impact would therefore be limited. For ships visiting a marina, often daily port dues are charged, including waste delivery rights.

For the *port side*, port authorities will need to manage funds and compensate the PRF operators for providing facilities (if waste reception is handled by a private third party as is the case in large commercial ports; in small marinas it is often taken up by local authorities). This could generate some additional operational costs. In addition, as it is expected that waste delivery would increase as a result of this measure, some increase of operational costs of running port reception facilities is expected. The above description results in an expected *medium* impact of this policy measure.

Investment costs

If *fishing vessels and recreational craft* are incentivised to deliver all their waste, they also need to be technically able to store the waste produced until they arrive in port. It is expected that additional storage capacity might be required, although storage capacity is already a requirement under MARPOL. *Medium* investment costs are expected to adapt a vessel to ensure that sufficient storage capacity is available.

Currently it is doubtful if all the *marinas and fishing ports* will have the capacity to collect all generated waste. As for oily waste and garbage, most marinas and fishing ports (larger than 200 berths) have adequate operational facilities. These marinas and fishing ports operate on commercial conditions and are therefore in a positon to provide reception facilities which are included in the port fees. Increased waste delivery of sewage by emptying of sewage holding tanks may require investments in additional sewage reception facilities in marinas and small fishing ports, as currently many ports cannot provide this service in an operational, practical and cost efficient way.

The investment cost for such a facility for a marina, including pump and connection to the public sewage system, is assessed to be in the range of 30,000-40,000 Euro. Based on the number of marinas in Europe (in the range of 4,500 – 5,000)[196] the approximate investment costs for sewage reception facilities in all marinas are estimated at some 150 – 200 million Euro. However, it is expected that a considerable number of marinas already have such facilities, so that only a fraction of the marinas will need to invest. Fishery ports are expected to be already equipped with sewage reception facilities. Although due to an expected increase in delivery, it is not unlikely that many port reception facilities need to expand their capacity. Based on the above information, the investment costs are expected to be *medium*. Respondents to the targeted survey confirm this direction (43% expect an increase).

Business PRF operators

The waste delivery volumes are expected to increase as a result of this policy measure, as established above. PRF operators are expected to benefit from the additional waste delivery; the impact is assessed at *medium*. This result is confirmed by the targeted survey, where 43% of respondents expect an increase in the business of PRF operators.

Impact on SMEs

As some of the PRF operators can be qualified as an SME, the increase in volumes delivered will benefit the smaller PRF operators and hence is beneficial for SMEs.

In addition, the impact on SMEs will be large as many European marinas (80%) are qualified as SME. Assuming a range of 4,500 – 5,000 marinas located in Europe, this means that 3,600 - 4,000 SMEs are involved. The fisheries sector also has a large share of SMEs, with many relatively small fishing companies. Based on this, it can be concluded that a large number of SMEs are affected by this policy measure. The impact per SME is relatively limited, resulting in an overall impact of *low-medium*.

[196] Ecorys (2016).

10.4.3. Other considerations

No other considerations are recorded for this policy measure.

10.4.4. Summary

Results of the impacts of this policy measure are presented in Table 34.

Table 34 Impacts policy measure 2D

Key impacts	Results
Waste discharged at sea / delivered in ports: Annex I oily waste Annex IV sewage Annex V garbage Annex VI scrubber waste	Medium – the impact differs per waste stream. Hardly any additional oily waste delivery is expected. Additional sewage is expected, but results depend on whether small vessels are exempted. High impact (5%) is expected for garbage waste, i.e. delivery potential by the fisheries and recreational sector of tsome13.000 and 8,500 tonnes per year respectively. Low. Low-medium. High. None.
Administrative burden	Low-medium - Increase of administrative burden, relating to inclusion in indirect fee mechanism; possibly minimised through periodic (season, annual) payment scheme.
Contribution to the circular economy	Medium - Separate delivery of garbage waste for recycling.
Operational costs	Medium – additional operational costs for ship operators and ports as a result of increased delivery of waste to ports.
Investment costs	Medium - investments in delivery reception capacity needed and storage on board.
Business PRF operators	Medium - Increase based on additional volumes of waste delivered to ports.
Impact on SMEs	Low-medium - Substantial number of SMEs (ports, fishing companies and PRF operators) is affected, however the impact generally low.
Overall assessment, including other considerations	This policy measure results in increased waste delivery and contributes to the circular economy, but also causes some possible increase of administrative burden. The policy measure comes at medium investment and operational costs.

10.5. PM 2E: Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes

10.5.1. Description of the measure

The objective of this measure is to have the passively fished waste delivered at port reception facilities. Currently there is a number of *fishing for litter programmes* whereby fishermen are provided with bags to bring ashore litter that they find in their nets during their normal fishing operations. These programmes are made to dispose of the litter collected and to monitor the amount and nature of collected litter[197].

[197] These 'passive' schemes should not be confused with 'active' schemes where boats go out deliberately to pick up litter. Such schemes have been limited to a very small number of pilot projects and are not the issue here.

Article 40.1(a) of the *European Maritime Fisheries Fund* allows contributions to the costs of the operations of such fishing for litter programmes. The operational programmes include 108 projects in 14 Member States for fishing for litter projects. The Fund can also contributes to improvements of the waste handling infrastructure at ports[198].

Many of the fishing for litter projects are coordinated by KIMO[199], an association of coastal local authorities whose goal is to eliminate pollution from the Northern Seas and who provide useful information on the costs as well as the amount and nature of litter fished up. The European Maritime and Fisheries Fund supports some, but not all, of these projects. The regional sea conventions have also been active in compiling information.

Through this policy measure, individual vessels would not be charged according to the amount of waste delivered at the port, whether it be generated on board or fished up in their nets. Instead, fees would depend on the type of vessel and nature of trip or other factors independent of the amount of litter. In this respect, this policy measure complements policy measure 2D, which includes fishing vessels in the indirect fee regime. The specific focus of this policy measure is on making passively fished litter part of this scheme.

It is proposed that this policy measure would be limited to vessels above a certain threshold. If the small scale fleet is excluded, there are about *16,000 fishing vessels* in the EU[200] to which this policy measure would apply, representing less than 30% of the European fishing vessels fleet.

10.5.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

Whilst there is still no agreed quantification of the sources of marine litter, there is mounting evidence to suggest that the contribution of the fisheries sector is significant:

- The fisheries sector is expected to generate some 266 thousand tonnes of garbage waste, which represents 30% of all garbage waste produced (see Table 6));
  - Ungar and Harrison[201] analysed litter found on 1,023 beaches in England and Scotland and concluded that the fishing industry *is largely responsible for marine debris*;
  - Material fished up in KIMO's 2011-2014 fishing for litter campaigns[202] includes significant quantities of nets, fish boxes or lobster pots that can only come from fishing;
  - UNEP estimates[203] that 640,000 tonnes of ghost nets are scattered overall in the world oceans, representing *10 percent of all marine debris*;
  - A scientific study[204] including video footage and trawls of the ocean floor round Europe found that 34% of litter came from derelict fishing gear;

[198] It is not possible to identify how much has been set aside for this because projects cannot be distinguished from other projects at ports.
[199] Local Authorities International Environmental Organisation.
[200] According to DG MARE.
[201] Marine Pollution Bulletin Volume 107, Issue 1, 15 June 2016, pages 52–58.
[202] http://www.fishingforlitter.org.uk/assets/file/Report%20FFL%202011%20-%2014.pdf.
[203] UNEP (2009), Marine Litter A Global Challenge, Nairobi: UNEP. Page 232.
[204] Pham et al. Marine Litter Distribution and Density in European Seas, from the Shelves to Deep Basins PLOS ONE, 1 April 2014, Volume 9, Issue 4.

- OSPAR indicates that fishing may account for 30%.of all material, including land-based sources.

The above information indicates that the problem related to the so-called ALDFG (see Section 5.1.3) and related problems are substantial.

The performance of fishing for litter programmes initiatives organised through OSPAR has been monitored. Results, as presented in Table 35, indicate the potential if applied on a large scale EU basis.

Table 35 Performance of fishing for litter programmes (OSPAR)

	Harbours	Vessels	Tonnes	Tonnes per vessel
Germany	3	60	1.2	0.02
Netherlands	12	91	285.2	3.13
Sweden	2	33	491	14.88
UK	25	474	142.7	0.30
Total	**42**	**658**	**920.1**	**1.40**

Source: OSPAR.

Based on the above, a *medium* impact can be expected as a result of this policy measure.

Administrative burden

In this policy measure, a vessel is not charged according to the amount of litter discharged at the port (100% indirect fee system) and no distinction is made between the source of the waste (produced or passively fished). As a consequence little to no administrative burden is created for the stakeholders involved. This is especially true for the measure applies to the larger fishing vessels only, i.e. the earlier-mentioned 16,000 vessels. Consequently, the administrative burden of this policy measure is expected to be *low*.

Contribution to the circular economy

The fishing for litter programme is likely to have a positive impact on the circular economy (rated: *low-medium*). The passively fish waste, for example fishing nets, can be recycled, at least to some extent.

Operational costs

The passively fished waste is placed in bags and delivered in ports, instead of being thrown back in sea. In ports, the waste needs to be stored and handled. Overall, the impact on operational costs is expected to be *medium*.

Investment costs

For the assessment of investment costs results costs of fishing for litter projects organised by KIMO have been used, as presented in Table 36.

Table 36 Costs of fishing for litter projects organised by KIMO

	Scotland	Netherlands	Average
period	2011-2014	2015	
vessels	210	80	
cost	€303,292[205]	€102.301	
cost per annum	€101,097	€102.301	
proportion spent on waste disposal[206]	32%	39%	
cost per vessel per annum	€49	€495	€172

Source; KIMO.

The average annual costs per vessel of 172 Euro has been combined with the relevant fishing fleet size (16,000 vessels), resulting in total annual costs at EU level of *2.75 million Euro*. This figure is considered to be a maximum. First, economies of scale are expected to reduce port costs. Secondly, it may very well be that not all vessels would participate[207] and thirdly, the amount of litter would reduce over time. Based on the above, the investment costs are expected to be *low-medium*.

Business PRF operators

Additional waste is delivered in ports, which is likely to contribute to business of PRF operators. As total volumes generated by the 16,000 fishing vessels are expected to be modest, compared to total volumes produced by all vessels, the overall impact is expected to be *low*.

Impact on SMEs

Low impact on SMEs is expected because the largest fishing vessels are included in the scope of this policy measure, leaving out the small fishing vessels (in which SMEs are relatively well represented). Furthermore, the additional impact on port reception facilities is limited, as indicated above.

10.5.3. Other considerations

Through the fishing for litter programmes substantial savings can be made in in fishing operations. Litter causes damage to fisheries through fouling of propellers, blocked intake pipes and valves, snagging of nets, silting of cod ends and contamination of catch. Additionally less waste in the sea (especially plastics) has a positive impact on the resilience of the fish stock. Efforts to estimate the cost of this to fishermen range from 1%[208] to 5%[209] of revenue. For the entire EU fleet, this amounts to between €60 million and €300 million per year.

10.5.4. Summary

Results of the impacts of this policy measure are presented in Table 37.

[205] £263,732.
[206] The rest is spent on organisation and monitoring.
[207] Most litter is on the sea floor. Pelagic vessels cannot contribute as they pick up very little waste.
[208] JRC Technical Report: Harm caused by Marine Litter, 2016.
[209] Marine Anthropogenic Litter, Editors: Bergmann, Melanie, Gutow, Lars, Klages, Michael (Eds.), 2015 Springer, ISBN 978-3-319-16510-3.

Table 37 Impacts policy measure 2E

Key impacts	Results
Volume of waste discharged at sea Annex I oily waste Annex IV sewage Annex V garbage Annex VI scrubber waste	Medium – Fishing for litter projects address a substantial waste problem and the impact on garbage waste is substantial (1.4 tonne/vessel, applied at EU scale). None. None. Substantial. None.
Administrative burden	Low - Little to no administrative burden is expected because the passively fished litter is 'covered' by the 100% indirect fee and no distinction is made in source (produced or passively fished waste).
Contribution to the circular economy	Low-medium - The fishing for litter programme is likely to have a positive impact on the circular economy. The passively fished waste, for example fishing nets, can be recycled, at least to some extent.
Operational costs	Medium - Additional costs are made in collecting and storing passively fished waste on board ships and at ports.
Investment costs	Low-medium – 2.75 million Euro at annual basis (related to the 16,000 larger fishing vessels).
Business PRF operators	Low - Additional waste is delivered in ports, but volumes generated by the 16,000 fishing vessels are expected to be modest, compared to total volumes produced by all vessels.
Impact on SMEs	Low - Limited impact on SMEs is expected because only the larger fishing vessels are included in the scope of this policy measure.
Overall assessment, including other considerations	Through this policy measure the problem of ALDFG is addressed, which is considerable in size (10 percent of all marine debris). The policy measure comes at relatively low costs and has the additional benefit that substantial harm to the fishing sector caused by fouling of propellers, blocked into pipes, etc. is prevented.

10.6. Summarised impacts of policy measures in the incentives cluster

The impacts of the policy measures in this cluster are summarised in Table 38.

Table 38 Impact of recommended policy measures

Policy measure	Effectiveness Waste delivery	Administrative burden reduction *	Contribution to circular economy	Efficiency Operational costs	Investment Costs	Other impacts
2A (shared methodology, including the right to deliver, and improved transparency)	L-M (create better incentives for delivery, resulting in an modest overall increase of waste delivered at EU level, but with potential substantial effect at individual port level)	L+ (initially a temporary increase, but once methodologies are adjusted, admin burden can reduce)	Neutral (no contribution is expected)	L (the total waste volumes are expected to only slightly increase and no other significant changes are foreseen, the total operational costs will hardly be impacted)	L (relatively modest investments needed in the administration systems and communication costs)	Neutral (no net effects, but a redistribution of business and employment across ports may occur.
2B 100% NSF for garbage (with variants like AFS allowed)	L-M (only Annex V waste. The 100% indirect fee for garbage waste is applied in most EU ports, reducing potential impact.)	L+ (reduction due to harmonisation and simplified cost recovery systems)	L-M (separate delivery of garbage waste contributing to a better waste hierarchy)	L-M (only for ports not yet applying 100% indirect fee for garbage)	M (only for ports not yet applying 100% indirect fee for garbage)	L-M (business for PRF operators) L (employment)
2C (Green Ship, reduce ship-generated waste on board)	L-M (depending on waste category; the uptake of waste generation reduction is uncertain as this depends on the levels of incentive given)	L-M - (Ship operators are expected to spend time on administering the measures taken to comply with the Green Ship criteria and to be subject to auditing procedures on-board, increasing administrative	M (less waste produced and potential other waste hierarchy measures)	L (operational costs associated with running of incentive schemes)	M-H (significant for ship owners, focused on investments in green technologies. Ports and PRF operators investing in adjusting IT systems and procedures)	L (business for PRF operators) L (SME impact) M (improvement of innovation and competitiveness)

Policy measure	Effectiveness Waste delivery	Administrative burden reduction *	Contribution to circular economy	Efficiency Operational costs	Investment Costs	Other impacts
		burden.)				
2D (fishing vessels and recreational craft in indirect fee regime)	M (hardly any additional oily waste delivery is expected. Additional sewage is expected, but results depend on whether small vessels are exempted. High impact is expected for garbage waste, i.e. delivery potential by the fisheries and recreational sector of some13.000 and 8,500 tonnes per year respectively)	L-M- (increase of administrative burden, relating to inclusion in indirect fee mechanism; possibly minimised through periodic (season, annual) payment scheme)	M (separate delivery of garbage waste for recycling)	M (costs/income of port reception facilities will increase to accommodate growing delivery) Running the indirect fee system for these vessels.	M (investments in reception capacity needed) Separation on board.	M (business for PRF operators) L-M (SME impact)
2E (fishing for litter)	M (fishing for litter projects address a substantial waste problem and the impact on garbage waste is substantial (1.4 tonne/vessel, applied at EU scale)	L- (Little to no administrative burden is expected because the passively fished litter is 'covered' by the 100% indirect fee and no distinction is made in source)	L-M (potential for recycling of passively fish waste)	M (additional costs are made in collecting and storing passively fished waste on board ships and at ports)	L-M (2,75 million Euro at annual basis)	L (business for PRF operators) L (SME impact)

11. Impacts of enforcement measures

This chapter presents the assessment of the impacts of the individual policy measures in the cluster of enforcement. For each of the defined policy measures a brief description and the assessment of the impacts and other considerations are described, together with a summary of the main impacts. The main impacts are determined on the basis of a pre-screening process and the results of a questionnaire on impacts, as described in Section 3.2.7.

11.1. PM 3A: Clarify the position of the PRF Directive related to delivery of ship-generated waste

11.1.1. Description of the measure

Since the implementation of the PRF Directive there has been a debate on the interpretation of Article 7, which states that 'the master of a ship calling at a Community port shall, before leaving the port, deliver all ship-generated waste to a port reception facility'. The ambiguity concentrates on the question about what is included in *all ship-generated waste* to be delivered to a port reception facility:

- On the one hand this can be interpreted as *all ship-generated waste produced*;
- Another interpretation is that it includes *all ship-generated waste produced minus the ship-generated waste that is legally discharged* at sea in accordance with MARPOL discharge norms (see Section 5.1 on MARPOL and Annex 14 on MARPOL waste discharge norms).

This policy measure aims to remove the ambiguity by creating two variants that reflect the two above-mentioned positions. The variants are:

- Variant 1 - MARPOL alignment. In this variant Article 7 will be adjusted; instead of requiring the delivery of all ship-generated waste before departure, the *delivery obligation will reflect the MARPOL waste discharge norms*, i.e.: what cannot be discharged under MARPOL shall be delivered to port reception facilities by ships calling at EU ports;
- Variant 2 – EU PRF regime. In this variant the mandatory delivery of *all ship-generated waste* is strengthened, thereby going beyond the scope of MARPOL and its waste discharge norms. This variant would aim to address - at least part of - the 'legal discharges', i.e. mainly sewage and small quantities of oily and garbage waste. It should be understood that without a waste discharge prohibition, which measure has been discarded (see Section 8.1.3), not all 'legal discharges' can be captured.

The choice for one of these variants is a principle one which reflects on additional policy measures related to waste notification forms and waste receipts (measure 3B) and inspections (measure 3D). As such, the variants coincide with the policy option 3 (MARPOL alignment) and policy option 4 (EU PRF regime)[210].

Variant 1 is close to *current practice*, which allows for certain discharges of waste at sea in accordance with the MARPOL discharge norms. This is in particular the case for discharges of sewage and limited amounts of oily and garbage waste. The ability to legally discharge waste in accordance with MARPOL discharge norms was reinforced by inclusion of an additional footnote introduced in 2007 in Annex II (on the advance waste notification) to the PRF Directive, which provided for an exception for sewage that can be legally discharged at sea in accordance with MARPOL. As variant 1 is close

[210] Given the importance of these two variants, separate sections are created for each of the variants, as shown below. As such, the structure of this paragraph is different from the description of other policy measures with variant options (for example policy measure 3B and 3D).

to the baseline scenario, the impact of variant 1 is relatively limited and mainly concentrates on a reduction of administrative burden, as indicated below.

For variant 2, *going beyond MARPOL*, some additional waste is expected to be delivered in ports, related to what can be legally discharged, as illustrated above. This variant will have more substantial impact, both positive and negative, as illustrated below.

11.2. Variant 1: MARPOL alignment

11.2.1. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

As this variant represents the current situation in which ship-generated waste is legally discharged in accordance with MARPOL discharge norms, the impact on waste discharges at sea is assessed to be *low*.

Administrative burden

Administrative burden will be reduced as a result of removed ambiguities between the MARPOL discharge norms and the delivery obligation in the PRF Directive. The consequent legal clarity will reduce administrative burden, which focuses on the reporting requirements on waste delivery, as included in the waste notification forms and the waste receipts. For the reduction of administrative burden resulting from more aligned waste notification forms, please refer to measure 4B. For the reduction of administrative burden resulting from aligned waste receipts, please refer to measure 3B.

Based on this, the total reduction of administrative burden is assessed to be *medium-high*.

Contribution to the circular economy

No contribution to the circular economy is expected as variant 1 represents the current situation.

Costs and other impacts

The fact that variant 1 represents the current situation leads to the conclusion that investment and operational costs, as well as other impacts, are not affected.

11.2.2. Other considerations

The sector seems to have a preference for MARPOL alignment. This was reinforced at the ESSF PRF Working Group meeting[211], during which the policy measures were discussed and the majority of participants indicated to prefer MARPOL alignment.

11.2.3. Summary

Results of the impacts of this policy measure are presented in Table 39.

[211] This meeting took place on 4 October 2016.

Table 39 Impacts policy measure 3A.1

Key impacts	Results
Volume of waste discharged at sea: Annex I oily waste Annex IV sewage Annex V garbage Annex VI scrubber waste	Low - Limited effect on waste discharged at sea or waste delivered at ports, as this variant is close to the current practice. Low. Low. Low. Low.
Administrative burden	Medium-high – A substantial reduction of administrative burden due to legal clarity and alignment (only one system).
Circular economy	Neutral - No effect on the circular economy is expected.
Operational costs	Neutral - No effect on the operational costs is expected.
Investment costs	Neutral - No effect on the investment costs is expected.
Overall assessment, including other considerations	Although this variant affects few impact categories, it does reduce administrative burden because legal clarity is created and two systems (MARPOL and PRF Directive) are aligned. This reflects also on other policy measures (notification, inspection). The overall balance is positive. This is reinforced by the sector embracing this variant.

11.3. Variant 2: EU PRF regime

11.3.1. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

Volumes of waste delivered in ports are expected to be affected. Additional volumes of waste may be delivered to ports. These volumes are linked to the MARPOL discharge norms, which are summarised in Table 40 (see Annex 14 for a description of the MARPOL discharge norms).

Table 40 Summarised MARPOL discharge norms

Waste category	Description and expected volume	Consideration and expected environmental impact
Annex I (oily waste)	Discharge norms for oil and oily waste under very strict conditions only, resulting in only small quantities of Annex I waste that can be legally discharged.	Discharging of oily waste at sea is only allowed when the oily waste is filtered and significantly diluted, so that it cannot cause harm to the marine environment.
Annex IV (sewage waste)	Discharge norms for sewage leaving open the ability to discharge under strict condition, resulting in potentially substantial quantities of Annex IV waste that can be legally discharged. It should be noted that with the Baltic special area coming into force in 2019-2021, sewage will also have to be delivered under MARPOL in that particular sea area, resulting in less sewage discharges. The concept of special areas and ban on sewage discharge may be expanded to other	MARPOL thus allows for discharging when the ship operates 12 nautical miles away from shore, provided the sewage is treated or comminuted and disinfected, so that the harm to the marine environment is minimised. As the discharges should take place under certain minimum sailing speeds and maximum discharge rates, the sewage will be diluted, further reducing its

Waste category	Description and expected volume	Consideration and expected environmental impact
	European sea basins.	potential environmental impact.
Annex V (garbage waste)	Discharge norms for garbage have become stricter with the revised Annex V coming into force on 1 January 2013, allowing hardly any garbage to be discharged. The only garbage that can be discharged is food waste, non-harmful cargo residues, some cleaning agents and additives and carcases of animals. For ships operating in special areas or offshore platforms even stricter restrictions apply. No other than above-mentioned garbage can be discharged, so no plastics, domestic waste, cooking oil, incinerator ashes, operational waste and fishing gear.	The MARPOL discharge regime thus allows the discharge of organic and other relatively easy degradable waste, but prohibits the discharge of plastics.

Source: MARPOL.

Based on Table 40, it can be concluded that the main waste type affected by this variant is sewage. MARWAS provides some indication on the size of the legal discharges of sewage by correcting the amount of ship-generated waste for on-board treatment of waste and legal discharges of waste.[212] This percentage varies substantially per ship type. As an illustration, average percentages of combined on-board treatment of waste and legal discharges range from 40-50% for chemical and oil tankers and can go up to 90% for ferries and passenger ships. The large sewage producing ships (ferries, cruise ships) have on-board treatment plants, reducing the amount of sewage to be discharged. Based on the existing information it is not possible to indicate the share of legal discharges. However, it is fair to assume the amount of sewage that is legally discharged is substantial.

In the absence of a waste discharge prohibition (see discarded policy measure in Section 8.1.3), this variant may capture some of the legal discharges, but certainly not all of it. Given the fact that (i) legal discharges for oily waste and garbage are limited and for sewage are substantial; and (ii) in the absence of a waste discharge prohibition, the overall impact on discharge at sea is assessed at *low-medium*.

Administrative burden

Administrative burden will be negatively affected by the fact that two systems will co-exist (PRF Directive and MARPOL), both needing specific reporting requirements. Consequently, the overall impact on administrative burden is *medium-high*.

Contribution to the circular economy

The ambition of delivery of all waste in ports and no discharges at sea would have a positive impact on the circular economy at large. However, given the relatively limited impact of volumes delivered at ports, as described above, the overall impact on the circular economy is *low*.

Operational costs

The impact of this measure on the operational costs is not equal for all shipping sectors. Some sectors will be affected more than others, especially when Annex IV is considered. If more waste is delivered at ports, operational costs for ships will be

[212] This is a combined value (on-board treatment plus legal discharges). As such, it is not possible to provide separate values for on-board treatment and legal discharges from MARWAS.

affected. Ships will need to spend more time on delivering waste in ports. This may especially affect the cruise sector, which is producing large amounts of sewage. For most shipping sectors the costs might be low, while for the cruise sector the costs will be high. Although impacts have not been quantified, costs are on average expected to be *medium-high*.

Investment costs

As a result of the waste delivery obligation investments will be required in the following areas:

- Ports need to invest in *additional capacity of port reception facilities*. The level of investment is expected to be modest as the additional waste volumes are expected to be low-medium and concentrate on sewage waste;
- Ships need to invest in *additional storage capacity*, notably for sewage waste. Ships may also have to invest in *on-board treatment facilities*. The related investments are expected to be substantial.

As this variant clearly goes beyond what is required by MARPOL's discharge norms, a crucial element in properly implementing this variant is *strong enforcement*, aiming to assure ship operators deliver their waste in ports, resulting in costs for the sector.

Based on the above investment costs are expected to be *high*.

Business PRF operators

The business of PRF operators is directly linked to the additional Annex IV waste collected. Although some of the reduced legal discharges at sea may be absorbed by on-board treatment facilities that will be installed or expanded as a result of this variant, the net effect on (sewage) waste delivered at ports is still expected to be positive, with a positive impact on business for PRF operators. In addition, limited impact could be foreseen from additional delivery of Annex I and V waste. Overall, a *medium* impact is foreseen.

Impact on SMEs

Affected parties are mainly PRF operators and the shipping sector, notably the cruise operators. SMEs represent a relatively small part of the PRF operators (see Section 3.2.8). SMEs are also not well represented in the cruise sector. As a consequence, impact on SMEs is *low*.

Competitiveness and innovation

The competitive position of EU ports may be negatively affected by having more strict delivery norms applied to EU ports, notably related to sewage delivery. This would apply to the cruise sector, not for cargo ships.

Third countries

Ports outside the EU may benefit from having less strict provisions/discharge norms. Trade and investment in EU may be affected negatively.

Employment

Employment is likely to improve as a result of the medium impact on PRF business. Indicatively, the impact on employment is expected to be *low-medium* (given the fact that the PRF sector is capital intensive).

11.3.2. Other considerations

A complicating factor in the implementation of this variant is the fact that the sector is reluctant to go beyond what is defined in MARPOL.

11.3.3. Summary

Results of the impacts of this policy measure are presented in Table 41

Table 41 Impacts policy measure 3A.2

Key impacts	Results
Volume of waste discharged at sea: Annex 1: oily waste. Annex IV: sewage Annex V: garbage Annex VI: scrubber waste	Low-medium – The delivery obligation may result in additional delivery of waste to ports which can be legally discharged in accordance with MARPOL. Legal discharges of oily waste and garbage are limited and for sewage are potentially substantial, hence the focus on sewage waste. The absence of a waste discharge prohibition will reduce the impact. Very limited. Substantial. Very limited. None.
Administrative burden	Medium-high - Administrative burden will be created by having a dual system (PRF Directive, MARPOL).
Contribution to the circular economy	Low – The ambition to have additional waste delivered to ports would have a positive contribution to the circular economy, however, the expected additional waste volumes are limited (low-medium).
Operational costs	Medium-high - Ships will need to spend more time on delivering waste in ports. This may especially affect the cruise sector, which is producing large amounts of sewage.
Investment costs	High - Investments are needed in storage capacity at ships and at PRF operators. Possibly also investments in on-board treatment facilities may be needed. Furthermore, a strong effort is needed in enforcement.
Business PRF operators	Medium - Increased sewage flows are delivered in ports, resulting in business opportunities for PRF operators.
Impact on SMEs	Low - As SMEs are not well represented in the affected target groups (PRF operators, cruise sector).
Competitiveness and innovation	Low - Negative impact on competitiveness and innovation.
Third countries	Low - Negative impact on third countries.
Employment	Low-medium - Based on improved PRF business.
Overall assessment, including other considerations	Some additional waste is expected to be delivered to ports (notably sewage waste and some garbage and oily waste). The absence of a waste discharge prohibition reduces the impact on waste delivery in ports. The waste discharge reduction will come at a cost. High administrative burden is created, notably through the need for strong enforcement and by having a dual system in place. In addition, operational and investment costs are expected to increase, while competitiveness and trade with third countries are negatively affected. The reluctance of the sector to accept this variant may be a complicating factor.

11.4. PM 3B: Introduce requirement for a waste receipt to be issued upon delivery

11.4.1. Description of the measure

This policy measure aims to introduce requirements for waste receipts to be issued upon delivery, issued by the PRF operator or by the Member State's competent authority. The waste receipt should provide information on actual waste deliveries, which can be used for assessment of storage capacity on board, and thus for monitoring and enforcement of the PRF Directive's delivery requirements.

The objective of this policy measure is two-fold:

1. To make sure that the port reception facilities are properly used and that no waste has to be discharged illegally at sea due to (temporary) unavailability;
2. To enable accurate information reporting and thereby facilitate monitoring and enforcement of the mandatory delivery requirement, as more data will become available on waste flows in ports.

It should be noted that issuing a waste receipt is also an (optional) requirement under MARPOL (MEPC.1/Circ.645). Waste receipts are already provided for larger ports (e.g. in all five case study ports), as they are used for invoicing. In most cases such waste receipts are in line with the format of MEPC.1/Circ. 645. Some ports might have developed their own formats for waste receipts, in line with their own waste notification forms. This is often not the case however for smaller ports, including marinas and fishery ports. Such ports do often not issue waste receipts yet.

11.4.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

A mandatory waste receipt will improve the information needed for effective inspections. For the inspecting authority, the waste receipt can be used to check if:

- Delivery of the pre-notified ship-generated waste and cargo residues occurred;
- Delivery was complete.

More effective inspections provide an incentive to deliver waste at port reception facilities and therefore a small but positive effect on waste delivery is expected (EMSA, 2016). Consequently, the impact is expected to be *low*.

Administrative burden

In case it is required that the waste receipt is in line with MARPOL (MEPC.1/Circ.645) the administrative burden will *slightly decrease* as there will be more harmonisation with MARPOL. Waste receipts issued will be the same everywhere.

In case a different format other than MARPOL will be chosen this will lead to a *small increase* of administrative burden as the waste receipt will need to be in a (slightly) different format to make sure all waste is delivered (see EMSA horizontal assessment, 2016). As many larger ports are currently issuing receipts, which are in line with the MARPOL requirements, they need to change their receipts to ensure that they are in line with a strict PRF regime. In addition, some smaller ports and PRF operators might face a small increase, in case they are not yet issuing a waste receipt.

Of the respondents to the targeted survey[213], 44% expect an (strong) increase and another 44% expect no impact on administrative burden.

[213] In total, 25 respondents answered this question.

The overall impact is assessed to be *low*.

Contribution to circular economy

A small contribution (impact rated *low*) to the circular economy is expected, caused by increased waste delivery, more data on and better monitoring of waste streams at ports. Due to better data, ports will have an incentive to segregate the waste streams and implement the waste hierarchy.

Operational cost

Most (larger) ports already have implemented this measure, as it is recommended under MARPOL and confirmed by the case studies (see Annex 11). However, for smaller ports that do not have such a system in place, the measure will increase the work load significantly, especially as additional documentation handling will be needed. Furthermore, for ports with unmanned facilities, some strong concerns are raised for the technical and economic feasibility of a mandatory waste receipt. The expected impact on operational costs is *low,* depending on the receipt format chosen.

Most respondents to the targeted survey (54% out of the 23 responses received) expect a neutral effect for operational cost, while still a significant part (37%) expects an increase.

Investment costs

The investment costs are absent or small for the majority of ports (impact rated *low*). However, for smaller ports, especially those with unmanned facilities, disproportionate investments are required in order to comply with this measure. EMSA (2017) studied a number of possible solutions, but concluded that 'all solutions are either impracticable, costly (although no costs were quantified), ineffective or do not provide legal certainty.' A possibility would be to exempt small unmanned facilities, while introducing additional inspections of those facilities. It should be noted that this could also lead to additional costs related to inspections, as those facilities still need to be inspected.

11.4.3. Other considerations

The policy measure can indirectly contribute to better monitoring and enforcement, as more data on actual waste deliveries become available (if the waste receipt will also have to be reported into SSN/THETIS EU).

11.4.4. Summary

Results of the impacts of this policy measure are presented in Table 42.

Table 42 Impacts policy measure 3B

Key impacts	Result
Volumes delivered at PRF/ discharged at sea: Annex I: oily waste Annex IV: sewage Annex V: garbage Annex VI: scrubber waste	Low - Increase due to more effective monitoring and enforcement. Slight increase. Slight increase. Slight increase. Slight increase.
Administrative burden	Low – Moderate decrease to moderate increase, depending on the format of the waste receipt.
Contribution to circular economy	Low - Increase, better monitoring of waste delivered, more data on waste streams in ports.
Operational costs	Low - Limited impact on operational costs of authorities,

Key impacts	Result
	most are already working with waste receipts.
Investment costs	Low - Possible investments for smaller/unmanned ports.
Other impacts	Neutral - No other significant impacts.
Overall assessment, including other considerations	The measure is low cost, low impacts on administrative burden, and can indirectly benefit a reduction of waste discharges, through more effective enforcement.

11.5. PM 3C: Clarify the definition of 'sufficient storage capacity' and limit the application to next port of call in the EU

11.5.1. Description of the measure

This policy measure aims to provide a clear definition of *sufficient storage capacity* in order to be able to define exceptions and avoid unintended use of this provision.

For the approach towards clarifying the concept of sufficient storage capacity two variants are proposed:

- *Variant 1:* taking into account MARPOL discharge norms;
- *Variant 2:* based on PRF regime.

Variant 1 will allow for legal discharges at sea. Therefore, less storage capacity will be needed as some of the waste produced could discharges (as long as in line with the MARPOL discharge norms). Nevertheless, calculating when the storage capacity is sufficient is complex, as the guidance developed on calculating sufficient storage capacity does not consider legal discharges in accordance with MARPOL discharge norms. This would need to be factored into the calculations, adding to the complexity of establishing sufficient storage capacity and granting exceptions based on this.

Variant 2 will introduce a regime that is stricter than the MARPOL discharge. As a result, ships will be required to have sufficient storage capacity available as they as not allowed to discharge (also when it would be allowed under the MARPOL discharge norms). Calculating whether storage capacity will be sufficient is easier as guidance is already developed on how to calculate sufficient storage capacity. In EMSA's *Technical Recommendations* (see Section 2.2.3) assistance to ports is provided and the recommendations are based on a situation in which the PRF Directive principles apply (mandatory delivery of waste in ports).

11.5.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

If a ship operator wants to keep its waste on board and deliver the waste in the next port of call, it is allowed to do so if the ship has *sufficient storage capacity* to proceed to the next port of call. The definition of sufficient storage capacity is currently not clear and ports are not using the same criteria. In its *Technical Recommendations*[214], EMSA provides several calculation methods to help ports in assessing whether or not a ship has sufficient storage capacity available. Three different methods are proposed:

- *Method 1* – to be used on all ship generated waste when the destination port is known;

[214] EMSA final consultation 15 April 2016, pages 15 and 16.

- *Method 2* – to be used on all ship generated waste in the unlikely situation where the destination port, and therefore the estimated amount of waste to be generated is unknown;
- *Method 3* – for sewage.

The stakeholder consultation showed that currently a number of ports are using 50 % free capacity as a criterion for sufficient storage capacity. Whether this is indeed sufficient depends on the location of the next port of call and to what extent legal discharges are allowed. With uniform definitions of sufficient storage capacity, better communication and inspections of ships not delivering waste, ports will have a better opportunity to allow only ships that have sufficient storage capacity to proceed to the next port of call and deliver waste there. This point is confirmed by the five case study ports, in which it is indicated that having a uniform definition in place would help them to better assess whether or not a ship has sufficient storage capacity available. Some ports, however, stress that such an assessment is difficult as waste production is very ship specific (e.g. the engine which is used and sailing behaviour).

Nonetheless, most ships do deliver waste in ports unless the next port is nearby or outside the EU. Although it makes sense to introduce uniform definitions for sufficient storage capacity, *no significant increase of the volume of waste is expected* if such definitions are applied. From the case studies it is observed that port authorities monitoring waste notifications do not encounter many cases of storage capacity limits (75%) reached. Based on the analysis above the impact of this measure is expected to be *low,* both for *variant 1 and 2*.

Administrative burden

Initially, some administration burden is expected as the ports need to revise their WRH plans to include uniform definitions – i.e. each port needs to apply the same calculation method(s) to establish whether or not sufficient storage capacity is available. In addition, the incoming waste notification forms shall be evaluated and analysed in a slightly different way, as due to this measure the interpretation of what sufficient storage capacity is, might slightly change.

Although it is expected that the net effect of this policy measure will be a reduction of administrative burden - 25% of respondents to the targeted survey expect a (strong) increase of administrative burden.[215] Overall, the impact of this measure on the administrative burden for both *variant 1 and 2* is assessed to be *low*.

Contribution to the circular economy

It is expected that this measure will not contribute to the circular economy; therefore there is *no impact* expected from this measure on the circular economy. Also here, this applies for both *variant 1 and 2*.

Operational cost

By its character, this policy measure would *hardly require any operational costs*. Once the system has been established (see below, investment costs), no substantial operational costs are needed. It is noted that 41% (out of a total of 23) of respondents to the targeted survey expect a (strong) increase of operational costs. Notwithstanding the targeted survey results, the impact of this measure on the operational costs is assessed to be *low*.

[215] This question was answered by a total of 24 respondents.

Investment costs

For *variant 2* no substantial investment costs are foreseen. Guidance has been developed and reported in the Technical Recommendations. This needs to be integrated in the port systems, requiring some investments in the procedures at the port authorities. For *variant 1* the investment costs are expected to be more substantial. The calculations towards establishing sufficient storage capacity need to be reviewed, discussed with the sector and reported. This will result in an additional effort and results will only become available later in time, delaying potential benefits.

In order to implement this measure, existing *inspection* procedures need to be updated in order to take into account sufficient capacity on board, which may result in an initial increase in costs. At the same time, a better understanding of the sufficient storage definition, if communicated properly between inspection authorities, can contribute to more effective *enforcement* and less misunderstanding, resulting in reduced costs.

Considering the above-mentioned aspects, the impact of this measure is assessed to be *low-medium* for *variant 1* and *low* for *variant 2.*

11.5.3. Other considerations

Even with fixed definitions for sufficient storage capacity, for example 50 %, some ships might argue that they easily can proceed to the next port of call and avoid paying the waste fee. Some ships do not know their next port of call and others change routes underway. It is therefore very difficult to have 100 % fair assessment on whether a ship can proceed without delivering waste in a port, even with fixed definitions. However, fixed definitions and/or detailed guidelines to ports on how to respond to ships not delivering waste seem to be welcomed by ports, as also indicated during the case studies. Besides the proposed formulas to calculate whether or not sufficient storage capacity is available, EMSA also provided guidance on the expected amounts of ship-generated waste produced per waste type and per day. Within certain waste types a differentiation between ships and/or techniques used is made. For example for the category 'oily waste' distinction is made for ships using heavy fuel oil and ships using marine diesel oil. In addition, also other parameters are presented, which can help the port to assess if the storage capacity is sufficient.[216]

11.5.4. Summary

Results of the impacts of this policy measure are presented in Table 43.

Table 43 Impacts policy measure 3C

Key impacts	Variant 1	Variant 2
Volume of waste discharged at sea: Annex I: oily waste Annex IV: sewage Annex V: garbage Annex VI: scrubber waste	Low - Limited increase is expected in volumes delivered. Slight increase inspected. Slight increase inspected. Slight increase inspected. Slight increase inspected.	Low - Limited increase is expected in volumes delivered. Slight increase inspected. Slight increase inspected. Slight increase inspected. Slight increase inspected.
Administrative burden	Low - Administrative burden may be reduced due to better understanding of the sufficient storage definition.	Low - Administrative burden may be reduced due to better understanding of the sufficient storage definition.
Circular economy	Neutral – No impact expected.	Neutral – No impact expected.
Operational costs	Low – Only marginal changes in operational costs.	Low – Only marginal changes in operational costs.

[216] EMSA final consultation 15 April 2016, pages 16 and 17.

Key impacts	Variant 1	Variant 2
Investment costs	Low-medium – Calculations towards establishing sufficient storage capacity need to be reviewed, discussed with the sector and reported, resulting in investment costs. Initial increase in enforcement costs, but once systems are adjusted enforcement costs may be reduced.	Medium – Calculations and guidance are established, resulting in limited investments (mainly on implementing the system). Initial increase in enforcement costs, but once systems are adjusted enforcement costs may be reduced.
Overall assessment, including other considerations	A uniform definition of sufficient storage capacity is welcomed by ports, although it will be difficult to have a one-size-fits-all solution. The contribution of this measure to the overall objectives is limited, but also the costs involved are limited.	

11.6. PM 3D: Replace the 25% minimum inspection requirement with a risk-based approach

11.6.1. Description of the measure

This measure aims to replace the 25% minimum inspection requirement as laid down in Article 11 (2)(b). Instead of using the 25% norm, the new measure would establish a risk based approach (i.e. selection of vessels for inspection is based on the information from the waste notification form). In the current PRF Directive a first start for a risk based assessment is already incorporated. Article 11 does not only state that, in line with the requirement laid down in Directive 95/21/EC, 25% of all individual ships a port should be inspected, but also the requirements laid down in Article 11(2) (a) should be followed (i.e. focus on ships not notifying and ships wrongfully notifying).

As indicated in Section 6.3.4 it is important to ensure that the PRF inspections are targeted and focus on ships posing the highest risk of illegally discharging their waste at sea. Introducing a risk based approach contributes to this objective and ensures that ships posing the highest risk are sufficiently targeted.

The system introducing more targeted (risk based) inspections can be designed in different ways. In this analysis two variants are proposed:

- *Variant 1:* Incorporate the PRF inspection within the PSC regime;
- *Variant 2:* Inspection through a PRF dedicated targeting mechanism, using a risk based approach.

In *variant 1* the PRF inspections will be fully incorporated in the PSC inspection regime. As a result, in selecting a ship for a PSC inspection, also the relevant criteria for a PRF inspection will be considered. As was highlighted in the ex-post evaluation (Panteia, 2015), in many Member States the PRF inspections are already conducted within the framework of the Port State Control Directive. Therefore, this variant will not deeply change the inspection regime in most Member States. For the remaining Member States, seven (7) in total, the inspection regime will have to slightly change.[217]

[217] As already presented in section 6.3.4 the latest EMSA visits, conducted for the PSC Directive, showed that 7 Member States hold separate PRF inspections. Nonetheless, it should be noted that 4 out of these 7 Member States also partially combine those inspections with the PSC regime.

It is important to note that, when opting for variant 1, only *merchant ships* can fall under the scope of the PSC regime, as the PSC Directive only applies to merchant ships (EMSA PRF IA - open issues). In this variant the *domestic ships* are not included under the PSC inspection, as the PSC Directive does not apply to such vessels. In order to ensure that such vessels will be inspected, as they also contribute to the waste production and need to deliver their waste, a separate PRF regime will be introduced for domestic vessels. Fishing vessels and recreational craft do not fall under the scope of this variant.[218]

In *variant 2* the PRF inspections will be conducted under a separate regime. All Member States will be obliged to establish a *dedicated PRF regime* and therefore will no longer be able to combine PRF and PSC inspections. In case a ship qualifies for both inspections (based on the respective inspection criteria), this variant results in two separate inspections; one conducted by a PSC officer (PSCO) for the PSC Directive and one by a PRF inspector for the PRF Directive.

The scope of the dedicated PRF inspections can be extended to domestic vessels as well and therefore the same inspection regime applies to both shipping sectors. As a result, the impacts of this regime are assessed jointly (no distinction is made). Fishing vessels and recreational craft do not fall under the scope of this variant.[219]

11.6.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

More targeted inspections would contribute to less waste discharged as the ships posing the highest risks are specifically targeted. As both proposed regimes aim to contribute to this objective using similar selection criteria, the impact of targeted inspections is expected to be similar for both *variant 1* and *variant 2*. Therefore the results presented below apply to both variants.

The new inspection regimes, if supported by electronic reporting and the exchange of inspection results, are expected to have a deterrent effect, as ships know they will be monitored more closely and inspected more efficiently.

In total, 47% of the respondents[220] in the targeted survey (mainly PRF operators and port authorities) are of the opinion that this measure will positively contribute to the level of discharges at sea, i.e. the volumes discharged at sea will (strongly) decrease. The remaining respondents are of the opinion that the volumes discharged at sea will remain the same or they do not know whether or not the volumes discharged at sea will change.

With regard of the delivery of different waste types in ports, all PRF operators expected that the delivery of Annex, I, Annex IV, Annex V and Annex VI waste will increase as a result of this measures. Most other stakeholder categories are neutral or are not able to answer the question. For Annex I waste the majority (70%) of the respondents answered they are neutral or do not know whether or not more Annex I waste will be delivered. Similar answers were given for the other waste types; Annex IV waste (67%), Annex V waste (69%) and Annex VI waste (79%).

The impact of both variants on volumes delivered is assessed to be *medium*.

[218] For the inclusion of fishing vessels and recreational craft, please refer to measure 3E.
[219] For the inclusion of fishing vessels and recreational craft, please refer to measure 3E.
[220] This question was answered by 19 respondents.

Administrative burden

Some administrative burden will be created as a result of provision of information for inspections by port users. For *variant 1* this is limited as the information is mostly already provided in the base case. For merchant ships the additional effort of providing the sufficient information is estimated at 15 minutes additional time. The costs resulting from this new inspection regime will be *101,000 Euro.*[221] In addition, domestic vessels will be included in the inspection regime as well. Being available for such an inspection will create an administrative burden for the crew members of domestic ships. It is assessed that the administrative burden for domestic ships is *32,000 Euro.*[222]

Total administrative burden of *variant 1* is estimated to be *133,000 Euro* (i.e. 101,000 Euro for merchant ships plus 32,000 Euro for domestic ships). The impact is assessed to be *low*.

In *variant 2* all ships will be inspected under a dedicated PRF inspection regime. Crew members need to ensure that they are available during the inspection (in case of questions etc.). This will create an additional administrative burden. The administrative burden resulting of variant 2 is assessed to be *916,100 Euro*.[223] Consequently, the impact for *variant 2* is assessed to be *medium*.

Contribution to circular economy

Both *variant 1* and *variant 2 do not contribute to the circular economy* as this measure does not influence the way waste is processed by the PRF operator. Both variants can only lead to an increase in volumes delivered, but the measure does not influence whether waste is incinerated, recycled or re-used. That decision lies outside the scope of this measure.

Operational costs

The impact of *variant 1* on the operational costs will be limited. As indicated many Member States already combine the PRF and PSC inspections. By combining the two inspections instead of conducting two separate ones, inspections become more effective and less time consuming. However, besides the inspections of merchants also domestic ships need to be inspected. Those ships do not fall under the scope of the PSC Directive and therefore need to be inspected separately which will require an additional inspection effort (i.e. domestic ships are currently not sufficiently inspected). As highlighted above, the costs will be relatively small.

Overall, the operational costs might decrease. As many Member States have already combined the inspections, time gains for those Member States will be limited. For Member States conducting two separate inspections, time gains may be possible. The impact is assessed to be *low*.

The impact of *variant 2* on the operational costs is medium. In this variant, all PRF inspections will have to be conducted as stand-alone inspections, which implies that either two inspectors are needed to conduct the inspections (one for PSC and one for PRF) or that one inspector has to visit the ship twice or for a considerable longer time. Irrespective the option chosen, this variant will increase the overall time spend on ship inspections considerably.

[221] 15,186 inspections x 0.25 hours (equals 15 minutes) x 26.6 Euro = 100,987 Euro. The average hourly wage of 26.6 Euro is based on Eurostat figures for 'hourly wage cost in the Maritime transport sector 2016'.
[222] 600 inspections x 2 hours (average time for a fully dedicated PRF inspection) x 26.6 Euro = 31,920 Euro.
[223] 17,220 inspections x 2 hours x 26.6 Euro = 916,104 Euro.

EMSA recommends that PRF inspectors will follow a dedicated training. Assuming that two training sessions per year will suffice and that each session will cost 35,000 Euro, the total costs for organising those sessions will amount to *70,000 Euro*. These costs will be borne by EMSA.

As a result, the overall operational costs will slightly increase for variant 2. Therefore, the impact is assessed to be *medium*.

Investment costs

To implement this measure some investment costs have to be made related to adjusting systems and inspections, as illustrated below.

Investment in systems

For *variant 1* it might be that the PRF inspections should be fully integrated into the PSC regime; however, as many Member States already have a system of combined PSC and PRF inspections the efforts to realise this incorporation will be limited. As highlighted in the supporting document of EMSA the outcome of a PSC inspection needs to be included in THETIS. By including the outcomes in the system it becomes easier for other inspectors to see whether or not a ship has been granted an exemption. Some minor changes to THETIS are needed for this. EMSA assessed that the costs for further developing the programme will be *70,000 Euro* (lump-sum).

For *variant 2* the investment costs will be higher. As indicated above, the PRF related inspections can no longer be combined with the PSC inspections. As a result, many inspectorates need to disentangle their PRF inspection from their PSC inspection, which will require some investment. The procedures for conducting PRF inspections have to be adjusted. Although it is not possible to estimate the total cost involved, it is expected that the costs for adjusting such procedures might be substantial.

Inspection results need to be included in THETIS-EU. To ensure that this is possible, some minor adaptations are required. EMSA assessed that the costs for those adaptations are between *30,000 – 50,000 Euro*. This is a lump-sum investment.

For *variant 1* the impact is assessed to be *low* and for *variant 2* the impact is assessed to be *medium*.

Inspection costs

The analysis of this impact distinguishes between *merchant ships* and *domestic ships*. As was explained in the introduction of this section, if *variant 1* is chosen, only merchant ships will be covered, as the PSC Directive only applies to those ships. Domestic vessels do not fall under the scope of the PSC Directive and therefore a separate regime needs to be created. In this variant the two ships types are described separately. In *variant 2*, *both merchant ships and domestic ships* are covered under the same regime and therefore no distinction is made.

Inspection costs for variant 1

When incorporating the PRF inspection in the PSC inspection, the scope of the latter inspection will be extended somewhat. As indicated by EMSA[224] the initial PSC inspection will have to cater for the verification of the delivery of ship generated waste and cargo residues according to the PRF Directive. This can be done by checking:

- The certificates and documents of the ship (e.g. Oil Record Book, Garbage Record Book, Ship's logs and other relevant documents);

[224] EMSA's assistance with Directive 2000/59/EC on Port Reception Facilities – 12 May 2017 (version 5).

- The submitted Advanced Waste Notification Form (i.e. whether it is in line with Article 6 of the PRF Directive);
- Previous waste delivery receipts, if available.

In order to select a ship for inspection, a two-step approach will be followed:

1. The PSCO shall assess the ship's operation in relation to Articles 7 and 10 of the PRF Directive. If the ship is non-compliant with one or both articles there is a clear ground justifying a more detailed inspection. The PSCO will follow the standard PSC procedures;
2. The PSCO will decide whether ship generated waste has to be delivered in the port of inspection. The PSCO can also grant an exception and allow the ship to proceed to the next port of call. A notification will be included in the information system.

To ensure that ships can be inspected under the PSC regime, the PSC Directive needs to be adapted as well. A proposal has been made by EMSA in its document on technical assistance (version 4, page 5).

If the above system is followed, it is expected that on a yearly basis 15,200 ships will undergo a PRF inspection as part of the PSC inspection. EMSA calculated that for 2016[225], a total of 15,186 ships qualified for a PRF inspection. On average such a PRF inspection, as an addition to the PSC inspection, will have a duration of 15 minutes.[226] The hourly wage of a PSC inspector is 21.98 Euro.[227] Total inspection costs on a yearly basis amount to *83,500 Euro*.[228]

As indicated in the introduction, domestic ships do not fall under the scope of the PSC Directive. To ensure that those vessels are also inspected a dedicated, separate regime is required. EMSA has assessed that 2,959 ships can be qualified as domestic ships above 100GT[229]. If this inspection regime requires that 20% of all domestic ships needs to be inspected, this results in an inspection obligation of 600 inspections per year. It is assumed that a dedicated inspection will last two hours. Overall inspection costs for domestic ships above 100GT will be *26,400 Euro per year*.[230]

Total inspections costs will be approximately *110,000 Euro per year* (i.e. 83,500 for merchant ships plus 26,400 for domestic ships).

Based on the analysis presented above, the impact of inspections of variant 1 is assessed to be *low*.

Inspection costs for variant 2

In this variant, the inspections are not combined with the PSC inspections, but are conducted separately. As indicated by EMSA the dedicated PRF inspection regime would:

- Need to secure stricter control of all ship generated waste and cargo residues;
- Require better information sharing between Member States;
- Need a dedicated PRF targeted mechanism for selection of ships for inspection;

[225] Estimation made by EMSA (page 5).
[226] Estimation made by EMSA.
[227] Eurostat – average wage in the maritime sector.
[228] 15,186 inspections * 15 minutes * € 21.98 per hour = € 83,523.
[229] Estimation made by EMSA (page 7).
[230] 600 inspection * 2 hours * € 21.98 per hour = 26, 1376 Euro.

- Entail a tailor made PRF inspection procedure to secure a delivery of all ship generated waste and cargo residues beyond the requirements of MARPOL.

The PRF Directive needs to be adapted to allow for this new inspection regime. EMSA made a proposal for this adaptation (technical assistance version 4, pages 9-11).

If the above system is followed, it is expected that on a yearly basis 17,220 ships will undergo a PRF inspection. This equals 20% of all unique ships coming to one of the Member State ports.[231] On average such a dedicated PRF inspection will have a duration of two hours.[232] The hourly wage of a PSC inspector is 21.98 Euro.[233]

Total inspection costs on a yearly basis amount to *757,000 Euro*.[234]

Based on the analysis presented above, the impact of inspections of variant 1 is assessed to be *medium*.

Overall, impact on investment costs is assessed to be *low* for *variant 1* and *medium* for *variant 2*.

11.6.3. Other considerations

Also within smaller ports, inspections currently need to be carried out; however, it is unknown whether or not the inspections are actually conducted. The inspection obligation for smaller ports could be better enforced. Changing the rules would also affect the smaller ports as they need to comply with the new inspection criteria.

The case studies confirm the above views, indicating in particular that inspections are often done by national inspection authorities in combination with PSC inspections.

11.6.4. Summary

Results of the impacts of this policy measure are presented in Table 44.

Table 44 Impacts policy measure 3D

Key impacts	Variant 1	Variant 2
Volume of waste discharged at sea: Annex I: oily waste Annex IV: sewage Annex V: garbage Annex VI: scrubber waste	Medium - Overall, the volumes discharged at sea will decrease. Slight increase expected. Slight increase expected. Slight increase expected. Slight increase expected.	Medium - Overall, the volumes discharged at sea will decrease. Slight increase expected. Slight increase expected. Slight increase expected. Slight increase expected.
Administrative burden	Low – Provision of information for inspections can lead to a slight increase in administrative burden.	Medium – As the domestic shipping sector will be included, an additional effort from these stakeholders are required in providing information for inspections, resulting in higher administrative burden.
Circular economy	Neutral – No impact expected.	Neutral – No impact expected.
Operational costs	Low- Possibly reduction due to alignment with PSC inspections (for	Medium- Increase of operational costs for inspections. Also two training,

[231] Estimation made by EMSA (pages 21-22).
[232] Estimation made by EMSA.
[233] Eurostat – average wage in the maritime sector.
[234] 17,220 inspections * 2 hours * € 21.98 per hour = € 756,991.

Key impacts	Variant 1	Variant 2
	Member States that conduct separate inspections).	sessions per year will have to be organised, which lead to additional cost.
Investment costs	Low - Possibly initial costs to adjust THETIS. The inspection regime might be optimised which can lead to a slight decrease in administrative burden.	Medium - Possibly initial costs to adjust THETIS-EU and costs for adjusting inspection regime. It is expected that inspection cost will increase as a result of this measure as inspection time per ship will increase.
Overall assessment, including other considerations	The proposed measure is likely to increase the inspection costs considerably – mainly for the inspectorates when conducting dedicated PRF inspections. They will experience an increase in the number of inspections that they have to conduct and each inspection will take longer. For domestic ships the inspection regime will become a regime with mandatory targets, which will result in an increase in the inspection effort as well. This increases the administrative burden slightly; however it will probably lead to a slight increase in waste delivered in ports.	

11.7. PM 3E: Bring fishing vessels and small recreational craft into the PRF inspection regime, by including them in the inspection criteria and procedure in Article 11

11.7.1. Description of the measure

Fishing vessels and recreational craft are already obliged to deliver their waste in port reception facilities. Nevertheless, those groups are currently excluded from Article 6 and Article 11. This measure seeks essentially to improve the enforcement of the mandatory delivery and, as such, to reduce the volume of waste discharged at sea by these vessels by including fishing vessels and small recreational craft in provisions for inspection criteria and conditions (Article 11). This measure will only apply to fishing vessels and recreational of 100 GT or more. All vessels and craft below 100 GT will remain exempted from Article 11.

11.7.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

This policy measure addresses ineffective enforcement of the mandatory delivery of waste, specifically related to the exempted position of the fishing vessels and small recreational craft. The introduction of enforcement measures for the two types of vessels is thus likely to have a *very significant impact on reducing the waste gap*. While it is not realistic to expect a 100% reduction (due to, among other things, risk of error), it is estimated that inspections have the potential of reducing approximately 80-95% of the gaps. This estimate assumes more or less 100% compliance with PRF requirements.

According to the questionnaire for the fishing sector, fishing vessels are already subject to numerous inspections and any move to increase the number of inspections may be counter-productive. According to some stakeholders it even may lead to additional discharge of waste at sea instead of more delivery in port.[235] This statement supports our hypothesis that the impact of the measure in terms of increase of

[235] NL and UK in KIMO response to the IA questions for revision of the PRF Directive.

delivery is likely to be somewhat lower than its total potential and address approximately 50-60% of the waste gap (with an equal percentage for each three waste types):

- *Oily waste*: delivery of 50-60% of 550 tonnes (fishing vessels) and 160 tonnes (recreational craft) = 302.5 and 88 tonnes respectively;
- *Sewage*: delivery of 50-60% of 500,000 tonnes (fishing vessels) and 272.000 tonnes (recreational craft) = 275,000 and 149,600 tonnes respectively;
- *Garbage*: delivery of 50-60% of 10,000 tonnes (fishing vessels) and 8,500 tonnes (recreational craft) = 5,500 and 4,675 tonnes respectively.

Stakeholders indicate that the largest impact to be expected of this measure is the increase in delivery of garbage. This is also influenced by the fact that fishing boats and small recreational craft do not produce much Annex I and Annex VI waste. They do produce some Annex IV waste; however, the quantities are rather small. The largest waste category produced is Annex V – garbage.

As a result of the above presented analysis, the impact of this measure on the volumes delivered is assessed to be *medium*.

Administrative burden

The need to provide information for inspections will create some administrative burden for operators of fishing vessels and small operational craft. Given the fact that a relatively small group of fishing vessels and small recreational craft is subject to inspections (see below on investment costs), the overall administrative burden is *low*. As is assed under investment costs, the total number of inspections that will be conducted is 770 (i.e. 600 for fishing vessels and 170 for recreational craft). For each inspection one crew member needs to be available (for 2 hours). The average hourly wage of a crew member is estimated to be 26.6 Euro.[236] Total administrative burden resulting from this measure is estimated to be *41,000 Euro.*[237]

Contribution to circular economy

The contribution of this measure to the circular economy is expected to be limited (*rated low*). As indicated above, the main waste category to which both fishing vessels and recreational craft contribute is Annex V waste. As both fishing vessels and recreational craft only produce small quantities of garbage the impact on the circular economy will be limited. Although garbage can be recycled or re-used, the quantities remain small compared to the quantities produced by merchant ships, especially cruise ships. Contribution to other waste categories is limited.

Operational costs

As far as fishing vessels are concerned, fishermen participating in the questionnaire for the fishing sector indicated that the introduction of a measure providing for the inclusion of fishing vessels in the specific inspection requirements of the PRF Directive would lead to an increase of their operational costs by approximately 4.5% and 2.5% respectively.

A PRF inspection will essentially consist of the scrutiny of relevant documentation, including receipts, to ascertain delivery of the waste. As such, the average inspection will in most cases not exceed 2 hours. Within this period the ship may be disturbed in its operations. However, when divided nominally, each fishing vessel will be up for inspection every 5 years (only 20% of the fleet is inspected per year).

[236] Eurostat.
[237] 770 inspections x 2 hours x 26.6 Euro = 40,964 Euro.

Accordingly, it is estimated that the total increase in operational costs for fishing vessels would be *low*.

Also for recreational craft not much impact on their operational costs is expected. The costs of this measure have been qualified as administrative burden. As the operational costs are not influenced, the impact is assessed to be *low*.

Investment costs

As mentioned above, recreational craft and fishing boats are currently excluded from Article 11 (*inspection*). To assess the impact of the measure, it needs to be assessed how many recreational craft and fishing vessels would fall under the scope of this measure.

EMSA recommends applying the inspections obligations for the fisheries sector only for ships larger than 100 GT. This criterion is also in line with MARPOL legislation that requires that all fishing vessels above 100 GT do have a Garbage Record Book on-board. EMSA assessed that the total number of ships above 100 GT equals 3,000 ships.[238]

A similar line of reasoning is followed for recreational craft. Also recreational craft above 100 GT are required to have a Garbage Record Book on board and therefore fall under the scope of MARPOL. EMSA estimated that 850 craft would fulfil this requirement.[239]

This measure will impact the inspection authorities. Currently, both fishing vessels and recreational craft are not impacted in an inspection regime. This measure proposes to include in a system. Those ships cannot be included in the PSC regime (as the PSC Directive does not apply to those vessels). Therefore a dedicated inspection regime is required. This dedicated regime is identical to the one proposed under measure 3D - variant 2. This implies that the same criteria for ship selection will be used and for each category (fishing vessels and recreational craft) an inspection requirement of 20% of the entire fleet exists. Also the inspection duration is assumed to be similar, i.e. two hours per inspection.

For fishing vessels this measure will lead to a total number of 600 inspections per year (20% of 3000). If each inspection takes two hours and the average wage of an inspector is 21.98 Euro, total inspection costs will be *26,400 Euro*.[240]

For recreational craft this measure will lead to a total of 170 inspections per year (20% of 850). If each inspection takes two hours and the average wage of an inspector is 21.98 Euro, total inspection costs will amount to *7,500 Euro*.[241]

Total inspection costs on a yearly basis amount to *33,800 Euro* (i.e. 26,400 Euro for fishing vessels plus 7,500 Euro for recreational craft).

Overall the impact of this measure on the investment costs is assessed to be *low*.

Business for PRF operators

This measure may influence the business of PRF operators. As the larger fishing vessels and recreational craft will be obliged to deliver their waste, the amounts of

[238] EMSA's assistance with Directive 2000/59/EC on Port Reception Facilities – 12 May 2017 (version 5) page 12.
[239] EMSA's assistance with Directive 2000/59/EC on Port Reception Facilities – 12 May 2017 (version 5) page 15.
[240] 600 inspections * 2 hours * 21.98 Euro per hour = 26,376 Euro.
[241] 170 inspections * 2 hours * 21.98 Euro per hour = 7,473 Euro.

waste to be collected by PRF operators might slightly increase. This will generate more business for PRF operators. The impact is assessed to be *medium*.

Impact on SMEs

As indicated before, a relatively small part of the PRF operators can be qualified as SMEs. In case more waste is delivered, more business for PRF operators is generated and this will benefit the SMEs.

Most of the fishing vessels and recreational craft can be qualified as SMEs. By bringing those vessels under the full scope of Article 11 of the PRF Directive many SMEs will be impacted.

Overall, the impact is assessed to be *medium*.

11.7.3. Other considerations

Despite a gap reduction potential of the measure the administrative burden associated with the implementation of the measure is estimated to be quite high compared to the total gap reduction in tonnes. The majority of stakeholders responding to the fisheries questionnaire considered the introduction of the measure aimed at the requirement to provide an advance notification to be negative and expressed worries about further increases in bureaucracy (e.g. for fishing vessels making shorter trips and thus carrying out small amounts of waste at a time), which do not seem to be warranted by an adequate benefit. [242]

Inspections will incur additional costs for national inspection authorities. Estimates of the costs can be made on the basis of the expected number of administrative and physical inspections and their required time.

Although the case studies did not concern fishing ports, the stakeholders interviewed do express their doubts about the feasibility of this measure.

11.7.4. Summary

Results of the impacts of this policy measure are presented in Table 45.

Table 45 Impacts policy measure 3E

Key impacts	Results
Volume of waste discharged at sea:	Medium –Oily waste: delivery of 50-60% of 550 tonnes (fishing vessels) and 160 tonnes (recreational craft) = 302.5 and 88 tonnes respectively. Sewage: delivery of 50-60% of 500,000 tonnes (fishing vessels) and 272.000 tonnes (recreational craft) = 275,000 and 149,600 tonnes respectively. Garbage: delivery of 50-60% of 10,000 tonnes (fishing vessels) and 8,500 tonnes (recreational craft) = 5,500 and 4,675 tonnes respectively.
Annex I: oily waste	Medium.
Annex IV: sewage	Medium.
Annex V: garbage	Medium.
Annex VI: scrubber waste	None.

[242] It should be noted that at the time of the fisheries questionnaires it was not yet the decide that this measure will only apply to vessels of 100 GT or more. By introducing this requirement only a small number of vessels will fall under the scope of the Directive and as a result the increase in administrative burden on the side of the fisheries is expected to be limited.

Key impacts	Results
Administrative burden	Low - The need to provide information for inspections will create some administrative burden for operators of fishing vessels and small operational craft, but only a small group of vessels are included.
Contribution to circular economy	Low – As only small quantities of garbage are produced, especially compared to cruise vessels. As both fishing vessels and recreational craft hardly produce other waste types, the contribution to the circular economy remains limited.
Operational costs	Low- Some additional costs for inspections and reporting might arise, however the impact will be limited.
Investment costs	Low – Increase compared to current low levels of enforcement, including additional reporting and additional inspections to be undertaken. With regard to inspections: • Fishing vessels: total inspection costs are 15,900 Euro per year; • Recreational craft: total inspection costs are 4,500 Euro per year.
Business for PRF operators	Medium – Due to more enforcement, more waste may be delivered which increases the business of PRF operators.
Impact on SMEs	Medium – Some PRF operators are SMEs, they will be impacted positively (more business). Most fishing vessels and recreational craft are SMEs and will be thus impacted by the measure.
Overall assessment, including other considerations	The administrative burden associated with the implementation of the measure is estimated to be quite high compared to the total gap reduction in tonnes. Nevertheless, by only including fishing vessels and craft of 100 GT or more this measure aims to mitigate for the increase in administrative burden.

11.8. PM 3F: Extend the Electronic Monitoring and Information System

11.8.1. Description of the measure

The aim of this policy measure is to extend the Electronic Monitoring and Information System by:

- Clearly laying down in the PRF Directive the envisaged functioning of this system in terms of monitoring and enforcement:
  - Explaining the role of SafeSeaNet and THETIS-EU and how the two should be linked (see EU vision paper);
  - Including facilities for exchanging between all the relevant information on the application of the mandatory delivery of ship-generated waste and cargo residues Member States;
  - Contributing to better enforcement and understanding of waste flows in ports.

11.8.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

This policy measure will have a *low but positive impact* on waste volumes delivered, mainly through better alignment and streamlining of enforcement across Member

States. Some ships may be motivated to deliver waste in order to avoid issues regarding inspections, as it is expected that inspections will improve due to better exchange of data between inspection bodies and Member States.

Administrative burden

The measure will improve the cross border exchange of information via the Electronic Monitoring and Information Systems, due to uniform data formats in a single programme, thus *significantly decreasing the administrative burden for port and inspection authorities*.

For port users, it is expected that this measure will reduce the administrative burden, as the WRH plans could be included in the Electronic Monitoring and Information Systems. Currently WRH plans of individual ports are often only published on ports' websites, making consultation of WRH plans time consuming and dispersed for port users.

The overall impact of this measure strongly depends on the uptake of the Electronic Monitoring and Information Systems by its users, instead of using a port-specific parallel system. Therefore the overall impact is expected to be *medium*.

Contribution to the circular economy

No significant contribution to the circular economy is expected from this measure.

Operational costs

National authorities responsible for inspections will need to establish procedures for a more detailed review and input of data to/from SafeSeaNet and THETIS-EU, as well as for inspection of ships to ensure sufficient storage capacity in case of non-delivery. However, after the initial changes, it is expected that the operational costs at a national level will decrease again due to harmonization and internal market effects. At EU level, some continuous costs related to maintenance are expected. The overall impact on operational costs is *low*.

Investment costs

Further development of SafeSeaNet and THETIS-EU for incorporating the PRF relevant pages will require *some investment at an EU, Member State and port level*. It is not possible to estimate investment cost at this stage as IT specifications are not known. It is expected that *costs could be significant*, and involve costs at the side of public stakeholders.

11.8.3. Other considerations

Today, SafeSeaNet is implemented by Member State authorities and ports. However, a number of ports do not utilise the waste notification facility as they regard it as inadequate and not useful for their specific purpose (no possibility to communicate with SafeSeaNet, no sender, no pop-ups in case of change of arrival time). Instead they have built a parallel waste notification system, which is more an 'order for service' system.

In the current situation, many ports do not have formalised procedures to inspect ships regarding their waste delivery and to estimate whether a ship has sufficient storage capacity to proceed to next port. The coupling between SafeSeaNet and THETIS-EU ensures waste delivery in case of insufficient storage capacity on board, making this a relevant tool for inspection authorities. However, increased operational and IT costs are to be seen in relation to increase waste delivery.

11.8.4. Summary

Results of the impacts of this policy measure are presented in Table 46.

Table 46 Impacts policy measure 3F

Key impacts	Results
Volume of waste discharged at sea: Annex I: oily waste Annex IV: sewage Annex V: garbage Annex VI: scrubber waste	Low - Limited impact expected, mainly indirect through alignment of monitoring and enforcement across Member States Slight increase expected. Slight increase expected. Slight increase expected. Slight increase expected.
Administrative burden	Medium – Reduction of administrative burden for authorities due to better information exchange, but dependent on use of parallel systems.
Contribution to circular economy	Neutral - No impact expected.
Operational costs	Low - After initial adjustments, decrease of operational costs for authorities.
Investment costs	Medium - Adjustment of IT systems at central, Member State and port level.
Overall assessment, including other considerations	Extending the Electronic Monitoring and Information System contributes to better monitoring and enforcement across Member States, resulting in a low, but positive impact on waste volumes delivered. Furthermore, a reduction of administration burden can be realised. No impact is expected on the circular economy. The measure comes at medium investment costs and low operational costs.

11.9. Summarised impacts of policy measures in the enforcement cluster

The impacts of the policy measures in this cluster are summarised in Table 47.

Table 47 Impact of recommended policy measures

	Effectiveness			Efficiency		Other impacts
Policy measure	**Waste delivery**	**Administrative burden reduction ***	**Contribution to circular economy**	**Operational costs**	**Investment Costs**	
3A.1 (MARPOL alignment)	L (limited effect as this variant is close to current practice)	M-H+ (reduction due to legal clarity & alignment)	Neutral (no impact is expected)	Neutral (no impact on operational costs as this variant is close to current practice)	Neutral (no investment costs are expected)	Neutral (no other significant impacts)
3A.2 (beyond MARPOL)	L-M (substantial for sewage, limited for other waste categories)	M-H- (large administrative burden by having a dual system)	Low (limited impact expected)	M-H (increased costs of waste delivery)	H (expansion of reception capacity needed, plus additional enforcement)	M (more business for PRF operators) L (SME operators affected) L (Competitiveness and innovation) L (third countries) L-M (employment)
3B (Waste receipt)	L (modest increase due to more effective monitoring and enforcement)	L- (slight increase for PRF operators not yet issuing a waste receipt)	L (better monitoring of waste delivered, more data on waste streams in ports)	L (limited impact on operational costs of authorities)	L (possible investments for smaller/unmanned ports)	Neutral (no other significant impacts)
3C.1 (Clarify the definition of 'Sufficient Storage Capacity – considering MARPOL discharge norms')	L (limited impact, as storage limits only occur infrequently)	L+ (initially some WRH plans may need to be revised, after which admin burden reduces)	Neutral (no impact is expected)	L (initially operational costs may be affected, but longer term impact is negligible. More harmonised inspections)	L-M (calculations towards establishing sufficient storage capacity need to be reviewed, discussed with the sector and reported, resulting in investment costs. Initial increase in enforcement costs, but once systems are	Neutral (no other significant impacts)

Policy measure	Effectiveness Waste delivery	Administrative burden reduction *	Contribution to circular economy	Efficiency Operational costs	Investment Costs	Other impacts
					adjusted enforcement costs may be reduced)	
3C.2 (Clarify the definition of 'Sufficient Storage Capacity' – based on PRF regime)	L (limited impact, as storage limits only occur infrequently)	L+ (initially some WRH plans may need to be revised, after which admin burden reduces)	Neutral (no impact is expected)	L (initially operational costs may be affected, but longer term impact is negligible. More harmonised inspections)	L (Calculations and guidance are established, resulting in limited investments (mainly on implementing the system). Initial increase in enforcement costs, but once systems are adjusted enforcement costs may be reduced)	Neutral (no other significant impacts)
3D.1 (Incorporating PRF inspections within the PSC regime)	M (slight increase due to more targeted inspections)	L- (provision of information for inspections can lead to a slight increase)	Neutral (no impact is expected)	L (possibly reduction due to alignment with PSC inspections)	L (Initial costs to adjust THETIS. Optimised inspection regime which can lead to a slight decrease in inspection costs)	L (no other significant impacts)
3D.2. (Inspection through a PRF dedicated targeting mechanism)	M (slight increase due to more targeted inspections. Better and more efficient enforcement	M- (domestic shipping sector included, resulting in need to provide information for inspections and	Neutral (no impact is expected)	M (increase of operational costs for inspections)	M (initial costs to adjust THETIS-EU. It is expected that inspection cost will increase as a result of	L (no other significant impacts)

Policy measure	Effectiveness Waste delivery	Administrative burden reduction *	Contribution to circular economy	Efficiency Operational costs	Investment Costs	Other impacts
	should also lead to less illegal discharges)	higher administrative burden)			this measure as inspection time per ship will increase.)	
3E (fishing vessels and recreational craft in the PRF enforcement regime: criteria and procedures	M (especially. for garbage/annex V)	L- (the need to provide information for inspections will create some administrative burden, but only a small group of vessels are included)	L (separate delivery of garbage waste for recycling)	L (additional costs for inspections and reporting)	L (with regard to inspections: Fishing vessels: total inspection costs are 15,900 Euro per year Recreational craft: total inspection costs are 4,500 Euro per year)	M (more business for PRF operators) M (SME operators affected)
3F (electronic Common Monitoring and Information System)	L (limited impact expected, mainly indirect through alignment of monitoring and enforcement across Member States)	M+ (improvement for authorities due to better information exchange, but dependent on use of parallel systems)	Neutral (no impact expected)	L (after initial adjustments, decrease of operational costs for authorities)	M (adjustment of IT systems at central, Member State and port level)	Neutral (no other significant impacts)

12. Impacts of definitions measures

This chapter presents the assessment of the impacts of the individual policy measures in the cluster of harmonisation and updating of definitions and forms. For each of the defined policy measures a brief description and the assessment of the impacts and other considerations are described, together with a summary of the main impacts. The main impacts are determined on the basis of a pre-screening process and the results of a questionnaire on impacts, as described in Section 3.2.7.

12.1. PM 4A: Align with the definitions for cargo residues and ship-generated waste used in MARPOL

12.1.1. Description of the measure

This policy measure aims to align the definitions used in the PRF Directive with the definitions used in MARPOL. Special focus lies on the definitions used for *cargo residues* and *ship-generated waste*. Consequently, this will also be reflected in the notification forms to be used (as subsequently the forms need to correspond with the definitions used). The definitions given to ship-generated waste and cargo residues in the PRF Directive are not the same as the definitions used in MARPOL (as was explained in Section 6.4.1). The PRF Directive definition of ship-generated waste refers to MARPOL Annexes I, IV and V. MARPOL as such does not contain a definition of ship-generated waste, but in general Annex I, IV and V are referred to. In addition, also Annex VI waste is included.

Also discrepancies between the PRF Directive and MARPOL regarding the definition of cargo residues exist; MARPOL only refers to Annex V cargo residues, while the PRF Directive includes, besides Annex V, also the remnants of cargo material after cleaning (thus tank washings falling under Annex I and II). As a result of the discrepancies between these two definitions, confusion exists amongst stakeholders. For both users and operators it is not always clear what waste is actually covered when referring to ship-generated waste and cargo residues. Subsequently, it is not always clear what waste needs to be delivered or reported on.

As this measure seeks alignment between the definitions used in the PRF Directive and MARPOL, a revised PRF Directive could contain an extended scope of the ship-generated waste as it will also include Annex VI. It will also lead to an adapted definition of cargo residues which is fully in line with the definition used under MARPOL. Better aligned definitions would also support full alignment with the MARPOL reporting forms (please refer to policy measure 4B for more details).

12.1.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

This policy measure will not influence the volumes discharged at sea or the volumes delivered at a port reception facility. This view is confirmed by stakeholders answering the targeted survey, in which the majority of the stakeholders scoring the impact of this measure as *neutral* (with also a substantial group scoring 'no opinion').

Also the case study ports are in favour of alignment between the PRF Directive and MARPOL. Nevertheless, they do not expect an increase in volumes delivered in port.

Administrative burden

The current discrepancies in the definitions used in MARPOL and the PRF Directive might lead to an additional burden for ship operators as the forms that need to be used for waste notification may differ between EU-ports and non-EU ports. In the EU, the PRF distinction will be used, while in non-EU ports the forms will be based on the distinction made by MARPOL.

For ships only sailing within EU waters, the administrative burden will probably be low as the same definitions that need to be used are always the same. However, ships not so often visiting EU ports are faced with different definitions. Each time a check needs to take place which definition needs to be used, which will take additional time. Therefore, it seems likely that non-EU flagged ships[243] will benefit highly of more alignment, as it is assumed that these operators are less familiar with the PRF delivery norms.

Efficient advance waste notification shall ensure that the administrative burden for the ship operator and ship agent is kept to a minimum and as such does not form an obstacle to deliver waste. When harmonised definitions are used, the risk of errors will be reduced as well, as the same definitions will be used in both EU and non-EU ports.

From the case studies, the reduction of administrative burden due to this measure is confirmed. Four out of the five[244] ports indicated that any alignment between EU legislation and MARPOL is welcomed, as it will result in a reduction of the administrative burden in general and for ships coming from outside the EU in particular, as was explicitly highlighted by the Port Genoa.

The overall impact of this measure on the administrative burden is assessed to be *medium*.

Contribution to circular economy

No contribution of this measure to the circular economy is expected.

Operational costs

This policy measure is not expected to impact the operational process of ship operators, PRF facilities or port authorities. Only a small change in the WHR plans might be required, which would lead to a small temporary increase in the operational costs of ports. Overall, the impact is assessed to be low. This view is confirmed by the majority of stakeholders that responded to the targeted survey (22 respondents in total). One stakeholder (i.e. port authority) indicated an expected strong increase in operational costs, while two stakeholders indicated to expect an increase (one ship operator and one PRF operator).[245] Overall, it is concluded that the impact of this measure on the operation costs is *low*.

Investment costs

To implement this measure *no investments* are required and therefore the impact on investment costs is assessed to be *nihil*. This view is confirmed by the majority of stakeholders that responded to the target survey (16 respondents in total).

[243] Assuming that non-EU flagged ships visit EU ports less frequently than EU flagged ones.
[244] Only the Port of Le Havre was not able to provide an indication whether or not the impact of this measure is either high, low, medium or nihil.
[245] These three stakeholders are either based outside the EU (i.e. USA) or at the borders (i.e. Greece and Ireland). Their geographical location may have influenced their answer, but no explicit motivations were given.

12.1.3. Other considerations

Annex VI waste should already be delivered to port reception facilities, as it cannot be discharged at sea under MARPOL. Furthermore, cargo residues could still be kept out of the mandatory delivery, especially when the delivery requirement of Article 7 is fully aligned with MARPOL discharge norms. This is important, because in case of full alignment, the PRF Directive in itself would not be able to clearly distinct (or to a lesser account) between cargo residues and ship-generated waste. Consequently, most waste would all fall under the same articles of the PRF Directive and hence the ship-generated waste articles (Articles 7 and 8) would apply to cargo residues as well. As a result of the latter article, i.e. having to pay fees for cargo residues in accordance with Article 8, is not considered a feasible option for stakeholders. Hence, harmonising definitions is desired, but this should not result in bringing cargo residues under Article 8 (ESSF-PRF Working Group).

12.1.4. Summary

Results of the impacts of this policy measure are presented in Table 48.

Table 48 Impacts policy measure 4A

Key impacts	Results
Volumes of waste discharged at sea: Annex I: oily waste Annex IV: sewage Annex V: garbage Annex VI: scrubber waste	No impact expected on the volumes discharged at sea. None. None. None. None.
Administrative burden	Medium - This measure will lead to a significant reduction of the administrative burden, as it will become clearer for the captain and the crew under which conditions waste could be discharged at sea. The system would be in line with the international regime.
Circular economy	Neutral - No impact expected.
Operational costs	Low - No impact expected, apart from initial revision of WRH plans.
Investment costs	Neutral - No impact expected.
Overall assessment, including other considerations	This measure will positively contribute to lower administrative burden for the sector. Most other impacts are neutral or low.

12.2. PM 4B: Align and update the waste notification and waste receipt forms

12.2.1. Description of the measure

This policy measure aims to align and update the PRF notification form to reflect the IMO standards (IMO MEPC.1/Circ.834) and its definitions and categories. In addition, this measure aims to include these adjustments in the electronic reporting of SafeSeaNet (SSN) through the National Single Reporting Window. This concerns both the waste notification form and the waste receipt (see policy measure 3B).

More specifically, the measure will address:

- Further alignment of definitions of Annex II of the PRF Directive with IMO MEPC.1/Circ.834 appendix 2 (inclusion of 'oil tank washings' in 'waste oils', 'fishing

gear' in 'garbage' and addition of Annex VI) and update the formats in SafeSeaNet via the National Single Reporting Window[246];

- Replacing the written signature on notification forms by an electronic signature in SafeSeaNet, making hard copy notifications obsolete.

12.2.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

A *low* impact on volumes discharged is expected. Nevertheless, through better monitoring of waste flows (through better and more uniform waste data), a reduction of waste discharged at sea can be expected as enforcement can be more targeted. In addition, the risk of miscommunications or errors in the waste notification form is smaller as a result of more harmonised forms. However, the impact of this measure should not be overestimated; 50% of respondents[247] to the targeted survey indicated that they do not expect any impact from this measure on volumes delivered.

Administrative burden

An updated form, based on harmonised definitions will reduce administrative burden. Nonetheless, for some ports the administrative burden might increase as those ports might opt to use the notification in SafeSeaNet in addition to their own notification system.

The ex-post evaluation of the PRF Directive (Panteia, 2015) presents annual administrative costs related to advance notification at 74.5 million Euro for port users and 8.6 million Euro for port administrations (see Section 5.2), bringing the combined annual administrative costs related to advance notification at 86% of the total calculated administrative costs. Hence, the administrative costs related to waste notification is assessed as the key administrative cost. Thus the legal clarity and consequent simplification through this policy measure will have a substantial potential effect in reducing administrative burden.

In the updated calculation made for this study, the costs resulting from the reporting obligation (the advance waste notification) for port users was estimated to be 12.3 million Euro (see Section 5.2.2 element 5). Once the reporting obligations are brought in line with the MARPOL reporting obligations a time saving for port users seems likely. A possible alignment and updating of the PRF Directive's waste notification form, with MARPOL (IMO Circular 834) will provide some benefits mostly with regard to cargo residues, Annex II and Annex VI waste which are currently different or not included in the 'EU' form.

It is assumed that for freight carriers around 5% time savings will occur (mostly because of the alignment on cargo residues). For cruise and passenger vessels it is assumed that only 1% savings will occur because cargo residues are not applicable. As a result, the following savings can be achieved:

- Freight carriers: 1 hour x 5% = 0.05 hours savings;
- Passenger ships: 4 hours x 1% = 0.04 hours savings;
- Cruise ships: 8 hours x 1% = 0.08 hours savings.

Table 49 presents the estimated administrative burden on port users.

[246] It should be noted that including 'oil tank washings' under waste oils, does not affect the way fees are charged in this measure, or that cargo residues are now included in the cost recovery system.
[247] In total, 16 respondents gave their opinion how this measure will influence the volumes discharged at sea.

Table 49 Estimated administrative burden on port users (reporting)

Number of hours required for notification	Sector – share in overall port calls EU	Number of port calls/2015 (Eurostat)	Hourly wage costs/2016 (Eurostat)	Estimated total Costs (in million)
0.95[248]	Freight carriers – 84%	1,868,671	26.6	47.0[249]
3.96[250]	Passengers ships– 15%	333,691	26.6	35.1[251]
7.92[252]	Cruise ships – 1%	22,246	26.6	4.7[253]
Total	**100%**	**2,224,608**		**87.0**

Estimated cost savings from aligning the PRF Directive with MARPOL definitions of Ship Generated Waste and Cargo Residues = 89.9 million Euro – 87.0 million Euro = 2.9 million Euro.

Respondents to the targeted survey expect that the impact of this measure is neutral (46% or 11 out of the 24 respondents). While some respondents expect an increase in the administrative burden (18% - predominantly port authorities), others expect a decrease (21% - predominantly ship-owners and operators).

The case studies confirm the contribution of this measure to reducing administrative burden, as port authorities often have implemented parallel forms at this moment, especially for Annex VI waste. Nevertheless, the impact on the total time spent on administrative procedures is expected to be limited (see Annex 11 for the full report).

Overall, the impact of this policy measure on administrative burden is assessed to be *low-medium*.

Contribution to the circular economy

No contribution to the circular economy is expected for this measure.

Operational costs

No impacts are expected regarding changes in operational costs.

Investment costs

Some investments will be needed to update and adjust the formats in SafeSeaNet via the National Single Reporting Window. The costs related to the National Single Reporting Window will be mostly carried by the Member States, while costs related to SafeSeaNet will be carried by EMSA.

12.2.3. Other considerations

Some of the actions under policy measure 4B are closely related to policy measure 4A; notably related to the alignment of cargo residues definitions between MARPOL and the PRF Directive. A main concern with this alignment would be the cost recovery systems of delivery of cargo residues. However, this concern does not necessarily apply to aligning and updating the waste notification forms.

[248] Without MARPOL alignment it will take the crew 1 hour to prepare the waste notification form. Due to the alignment a 5% reduction in time is needed. 95% of the original time needed will be spend on filling in the form.
[249] Y = 0.95 * 26.6 * 1,868,671 = 47,221,316.
[250] Without MARPOL alignment it will take the crew 4 hours to prepare the waste notification form. Due to the alignment a 1% reduction in time is needed. Actual time saving will result in 0.04 hours saved.
[251] Y = 3.96 * 26.6 * 333,691 = 35,149,675.
[252] Without MARPOL alignment it will take the crew 8 hours to prepare the waste notification form. Due to the alignment a 1% reduction in time is needed. Actual time saving will result in 0.08 hours saved.
[253] Y = 7.92 * 26.6 * 22,246 = 4,686,609.

12.2.4. Summary

Results of the impacts of this policy measure are presented in Table 50.

Table 50 Impacts policy measure 4B

Key impacts	Results
Volume of waste discharged at sea	Low – small increase expected, mainly indirect through better monitoring across countries and through better understanding among stakeholders.
Annex I: oily waste	Possible slight decrease.
Annex IV: sewage	Possible slight decrease.
Annex V: garbage	Possible slight decrease.
Annex VI: scrubber waste	Possible slight decrease.
Administrative burden	Low-medium – small improvement, due to harmonisation and clarity and reduced time for a waste notification form by applying an electronic signature.
Contribution to the circular economy	Neutral - No impact expected.
Operational costs	Neutral - No impact expected.
Investment costs	Low - small increase expected due to adjustment of IT systems.
Other impacts	Neutral - No other significant impacts.
Overall assessment, including other considerations	This measure has low costs (both operational and investment) and leads to a reduction in administrative burden and a possible slight decrease in waste discharged at sea.

12.3. Summarised impacts of policy measures in the definitions cluster

The impacts of the policy measures in this cluster are summarised in Table 51.

Table 51 Impact of recommended policy measures

	Effectiveness			Efficiency		Other impacts
Policy measure	**Waste delivery**	**Administrative burden reduction ***	**Contribution to circular economy**	**Operational costs**	**Investment Costs**	
4A (definitions)	Neutral (no impact is expected)	M+ (significant reduction due to consistency and less errors)	Neutral (no impact is expected)	L (no operational cost impact, apart from initial revision of WRH plans)	Neutral (no impact on investment costs)	Neutral (no other significant impacts)
4B (forms)	L (limited impact expected, mainly indirect through better ability to monitor cargo flows, resulting in more effective enforcement)	L-M+ (improvement due to harmonisation and clarity and reduced time for a waste notification form by applying an electronic signature)	Neutral (no impact is expected)	Neutral (no impact on operational costs)	L (adjustment of IT systems)	Neutral (no other significant impacts)

13. Impacts of exemptions measures

This chapter presents the assessment of the impacts of the individual policy measures in the cluster of exemptions. For each of the defined policy measures a brief description and the assessment of the impacts and other considerations are described, together with a summary of the main impacts. The main impacts are determined on the basis of a pre-screening process and the results of a questionnaire on impacts, as described in Section 3.2.7.

13.1. PM 5A: Develop common criteria exemptions

13.1.1. Description of the measure

This policy measure has the objective to develop common criteria that could be applied for the approval of exemption requests:

1. By introducing basic requirements/criteria which a ship should comply with;
2. By introducing an application form;
3. By reporting the granting of an exemption to the information system (SafeSeaNet).

Based on the above, this measure aims to incorporate the relevant of the Interpretative Guidelines (2016/C 115/05) into the PRF Directive, contributing to harmonisation across ports. More specifically, the policy measure ensures that exemptions, which can be given for notifications, deliveries and payments, are only applied jointly, i.e. for all three components together. In addition, the introduction of (common criteria) for a standard exemption certificate can be considered.

13.1.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

This policy measure is expected to lead to exemptions being granted on a stricter and more consistent basis, and most likely to less exemptions than today. EMSA estimates that there are *approximately* 1,000 exemptions in place, based on data and SSN and the 7 Member States that have reported on this. It needs to be taken into account that the data is fragmented, possibly obsolete and difficult to extract the final number of exemptions. It is very likely that this is an underestimation, as only 7 of the 22 coastal Member States did provide information.

The latter is also based on the case studies that indicate that several ports provide large numbers of exemptions and that exemption criteria are applied differently between ports. A reduced number of exemptions could result in a more controlled environment related to waste delivery. This could potentially result in increased waste delivery at ports, thus potentially contributing to less waste discharges at sea.

Most respondents (56%, equalling 10 respondents) to the targeted survey expect a neutral effect on waste discharges, as well as to waste deliveries in port (53-60% of responses, depending on waste category).

Based on the above the impact on waste delivered in ports is assessed as *low-medium*.

Administrative burden

Different procedures and conditions are currently employed to evaluate and grant exemption requests across the EU and information is hardly shared between port and other competent authorities. This results in a disproportionate administrative burden on both port users applying for and Member State authorities evaluating the exemption requests. This policy measure will address this problem by including a set of common criteria in Article 9 of the PRF Directive for the requirements of approval of

exemptions (e.g. definitions of scheduled, frequent and regular, and whose owners/managers can provide sufficient evidence).

This measure will thus contribute to lowering administrative burden for ship owners and port authorities, as the measure will lead to:

- Harmonisation of exemption approval procedures across ports, lowering administrative costs for ship operators (or agents);
- Easier verification for port authorities of ships that are exempted.

The case studies indicated that the number of exemptions given in ports can be significant, not only because of high numbers of scheduled traffic calls (e.g. ferries), but also because the current interpretation leads to many frequent but unscheduled calls being exempted from either of the three aspects (notification, delivery, payment). An example is Le Havre where these exempted frequent unscheduled ships notify, but can be exempted from delivery or payment if they have delivered in a previous port (based on waste delivery receipt and provided they have sufficient storage capacity until the next port of call). In the case of Le Havre more than half of the 6,000 calls is exempted on this basis (see Annex 11 for the case study reports).

Even though this can be considered as an implementation issue, if the requirements for granting exemptions are unclear, incorrect implementation cannot always be qualified as deliberate non-compliance. Removing this wide interpretation would lead to fewer exemptions, as well as a reduction in related approval and monitoring activities.

In addition, the reporting of exemptions into SafeSeaNet will make the process of checking whether a calling ship is actually exempted much easier and faster. The online application in SSN will very likely speed up the exemption application procedure, as this is what did occur in Belgium. Belgium national's legislation allows for a full application duration of 45 days. However they noted that: *"In practice, it does not take us 45 days to decide, especially since our web application is into force, which allows direct and swift communication/interactions with the competent (port) authorities. Communication via regular mail did take longer."* Note that 45 days from a complete exemption request to an exemption being excepted in on the longer end of the spectrum, other ports indicate that this process takes normally a couple of days to a couple of weeks on average (PRF Correspondence Group on Exemptions, 2017).

The PRF Correspondence Group on Exemptions also shared input on expected time and cost savings, including the recent introduction of an online application tool in one of the EU Member States for the evaluation and granting of exemptions in all their seaports. The new system in place has resulted in a reduction from (up to) 45 days needed for the exemption process to 20 days, which corresponds to 25 days of time saving, or a 56% reduction of the time needed for assessing and granting an exemption. Therefore, taking a conservative approach[254], it is assumed that based on the average time of 30 days for assessing and granting an exemption, the proposed measures may reduce the time needed for competent authorities to complete the process with 10 days. This corresponds to a reduction of the cost for assessing and granting an exemption of 3,517 Euro.

[254] As some competent authorities already have IT applications in place, a more conservative approach in terms of time savings is warranted.

As a result, granting exemptions under a revised PRF Directive will lead to a cost of 2,333 exemptions[255] * 3,517 Euro = 8.2 million Euro updated annual costs for Competent Authorities.

Potential cost savings annually may be in the order of:
12.3 million Euro[256] - 8.2 million Euro = *4.1 million Euro*

Interviewees from the case study ports have indicated that the *Interpretive Guidelines* have already helped them in better understanding the exemption criteria, and in adjusting their procedures. Consequently, the impact of this policy measure (incorporating the common criteria into the PRF Directive) would be more limited.

Responses to the targeted survey[257] are not conclusive; 28% of the respondents expects no impact on administrative burden, 36% expects an increase, while 20% expects a decrease.

Overall, the impact on administrative burden is assessed as *high*.

Contribution to the circular economy

No significant direct impacts are expected for this measure in terms of contributing to the circular economy, although there might be some minor positive impacts expected due to increased waste delivery.

Operational costs

As this policy measure is expected to lead to a reduction of the number of exemptions granted (see above), competent authorities will need to monitor fewer exemptions, resulting in lower operational costs. Over time the number of exemption requests will probably decrease as well, as port users know that fewer exemptions will be granted, resulting in lower operational costs for the competent authorities.

However, as it is expected that waste delivery will increase due to more non-exempted ships, the operational costs of handling waste is expected to increase. Overall, a *low* increase in operational costs is expected.

Investment costs

Minor investments are required for implementing this measure. This includes adjusting the WRH plans by updating the new exemption conditions and procedures; and updating the electronic monitoring and information systems by adding features for reporting and exchange of information regarding exceptions is required. The overall impact is assessed to be *low*.

13.1.3. Other considerations

Monitoring and enforcement in ports that have granted exemptions would require information to be shared between the ports involved. This process could be facilitated by SafeSeaNet.

13.1.4. Summary

Results of the impacts of this policy measure are presented in Table 52.

[255] Based on the number of exemptions reported through SSN and to the Commission in 2015 (please refer to section 5.2.2, element 4).
[256] See the Calculation of administrative burden caused by the PRF Directive – chapter 6.
[257] In total, 25 respondents answered this question.

Table 52 Impacts policy measure 5A

Key impacts	Results
Volume of waste discharged at sea/delivered at PRFs Annex I: oily waste Annex IV: sewage Annex V: garbage Annex VI: scrubber waste	Low-medium - Increase of waste delivery is to be expected, due to stricter criteria for granting exemptions. Low-medium increase. Low-medium increase. Low-medium increase. Increase, depending on whether the scope for the PRF Directive will be broadened towards scrubber waste.
Administrative burden[258]	High - Reduced administrative burden of both port users and port authorities related to request for and approval of exemptions. Potential cost savings annually may be in the order of 4.1 million Euro.
Contribution to the circular economy	Neutral - No significant contribution is expected.
Operational costs	Low – An overall small increase is expected. Fewer exemptions leads to less approval and monitoring costs for authorities, but possibly more costs of handling non-exempted ships.
Investment costs	Low - Limited investments are required, except for adjustment of WRH plans. Electronic reporting and exchange of information needs to be incorporated as well.
Other impacts	Neutral - No other significant impacts.
Overall assessment, including other considerations	The measure reduces the administrative burden, contributes to a more harmonised approach across ports and is expected to contribute to increased waste delivery to port. For effective and efficient monitoring, it would need to be combined with information exchange between ports.

13.2. PM 5B: Clarify position of vessels which are operating exclusively within one port

13.2.1. Description of the measure

This measure aims to clarify the position of vessels that are operating exclusively within one port (tug vessels, pilot vessels, dredgers etc.). It should be noted that this measure only applies to dredging and other vessels operating within the port area and not to vessels, whose home port is their only port of call but remain at sea for a longer period, such as fishing vessels, recreational craft, dredging vessels that operate outside of the port area.

In addition, exempting the vessels operating exclusively within one port from notification, delivery and payment does not mean that they are exempted from having proof of waste agreements with a PRF operator (within that port), nor from delivery and payment of the waste fees as part of this agreement.

[258] Note that this is the isolated impact of the measure. When combined with systematic exchange of information and a standard exemption certificate, the administrative burden could be further reduced, which is the main aim of the proposed measure.

13.2.2. Assessment of impacts

Volume of waste discharged at sea - delivered in ports

The number of vessels covered under this measure is relatively small and the vessels are relatively small in size. Also these ships sail short distances, thus generating limited amounts of ship-generated waste. As a small group of vessels will be exempted, a modest reduction in waste delivered can be expected.

Additionally, as these vessels operate near shore, no legal discharges under MARPOL norms are allowed and all waste needs to be delivered to a port reception facility. Hence, the impact on waste delivery volumes is expected to be limited.

The impact of this measure on delivery at port reception facilities and discharges at sea is thus *low*.

Administrative burden

The process of applying for and approving and monitoring of exemptions for vessels that operate exclusively in one port is being simplified and harmonised across ports. The Interpretive Guidelines, as included in the baseline (see Section 5.1.7), provide the basis for the conceptual basis, which is integrated into the PRF Directive by this policy measure. Applicants (i.e. ship operators), port authorities and enforcement authorities are expected to benefit from this measure.

It is noted that the impact of this measure is substantial for those vessels operating in one port only, which are typically smaller sized ships (tug & pilot vessels, dredgers) that, due to their operational nature, make a large number of calls (a tug boat could visit the port several times per day). The administrative burden reduction can, therefore, be significant for these types of ships. The exact time involvement or time saving is, however, difficult to estimate. If in most ports, these ships are in practice already exempted, no extra impact from the legislative revision can be expected. For individual ports not doing so, the benefits may be significant. The five case studies indicate a limited impact, as in those ports, this type of vessels is already exempted.

As the total volume of ships in this category is limited, the total impact is *low*, but positive.

Contribution to the circular economy

It is not expected that this measure will significantly contribute to the circular economy.

Operational costs

It is expected that the costs for the port authorities and other competent authorities will slightly decrease, as less cost will be made for the approval and the monitoring of exemptions for vessels operating in one port due to clarified principles. However, due to the small share of these types of vessels in the total fleet calling at EU ports, the overall impact is *low*.

Investment costs

No investments required for implementing this measure, except for an initial adjustment of WRH plans, describing the conditions for exemptions for these type of vessels. The overall impact of this measure on investment costs is *low*.

Other impacts

No other impacts are expected for this measure.

13.2.3. Other considerations

An issue which needs to be clarified is whether this policy measure applies to vessels that operate exclusively in a port on a temporary basis, after which the exemption for that port then expires (and a new exemption could be applied for in another port where the ship would then operate).

13.2.4. Summary

Results of the impacts of this policy measure are presented in Table 53.

Table 53 Impacts policy measure 5B

Key impacts	Results
Volume of waste discharged at sea/ delivered at PRFs	Low – A reduction of waste delivered to port reception facilities can be expected with a relatively small group of vessels being exempted. It should be noted that these vessels are still to deliver their waste and given their place of operation are restricted in legally discharging waste under MARPOL.
Annex I: oily waste	Slight to no increase, due to limited generation of oily waste.
Annex IV: sewage	No increase (discharges are strictly prohibited in the port area).
Annex V: garbage	Slight increase.
Annex VI: scrubber waste	No impact.
Administrative burden	Low - More clarity for the vessels involved and authorities concerned, reducing their administrative burden.
Contribution to the circular economy	Neutral - No contribution to the circular economy expected.
Operational costs	Low - Reduced costs for approval and monitoring due to clarified principles.
Investment costs	Low - No investments required, except for adjustment of WRH plans.
Other impacts	Neutral - No other significant impacts.
Overall assessment, including other considerations	The measure reduces the administrative burden and is expected to slightly increase the waste delivered in ports. Costs are relatively limited.

13.3. Summarised impacts of policy measures in the exemptions cluster

The impacts of the policy measures in this cluster are summarised in Table 54.

Table 54 Impact of recommended policy measures

	Effectiveness			Efficiency		Other impacts
Policy measure	**Waste delivery**	**Administrative burden reduction ***	**Contribution to circular economy**	**Operational costs**	**Investment Costs**	
5A (exemptions criteria)	M (significant due to much stricter criteria for granting exemptions)	H+ (lower burden to apply for and approve exemptions)	Neutral (no impact is expected)	L (less exemptions leads to less approval & monitoring costs for authorities, but possibly more costs of handling more non-exempted ships)	L (no investments required, except for adjustment of WRH plans. Electronic reporting and exchange of information)	Neutral (no other significant impacts)
5B (vessels exclusively in one port)	L (negative for a small group of ships to be exempted/low waste potential. Less waste will be delivered when these ships get an exemption)	L+ (more clarity for the relevant vessels and authorities concerned, reducing their administrative burden)	Neutral (no impact is expected)	L (less cost for approval and monitoring due to clarified principles)	L (no investments required, except for adjustment of WRH plans)	Neutral (no other significant impacts)

14. Assessment and comparison of policy options

This chapter presents the assessment and the comparison of policy options and the selection of the preferred policy option. First the impacts per policy option are assessed (Section 14.1). Based on the assessment of impacts per policy option, the policy options are compared (Section 14.2). This results in conclusions, including the selection of preferred policy option (Section 14.3), for which the proportionality is assessed.

14.1. Assessment of policy options

In order to assess the impact for each of the defined policy options, the composition of the policy options in terms of policy measures, as described in Chapter 1 is combined with the impacts per policy measure, as described in the Chapters 9-13. The impacts of the policy measures that are included in the defined policy options are aggregated, considering synergies and conflict between policy measures where relevant, resulting in overall impacts per policy options, as elaborated below.

14.1.1. Economic impacts

Economic impacts, as introduced in Section 3.2.7, are described below per policy option.

Operational costs

Policy option 2 (minimum revision) consists of targeted initiatives that have already been prepared and planned plus concise legal adjustments to the PRF Directive, (notably on including MARPOL Annex VI waste in the PRF Directive; systematic consultation of stakeholders in the development of WRH plans; and better definition of 'adequacy'), as well as possible soft law measures on aspects not included in the revised PRF Directive. Together, these policy measures have a limited impact (rated low) on the operational costs of stakeholders involved.

The operational costs of *policy option 3 (MARPOL alignment)* are higher than policy option 2 and are rated *low-medium* for both variant options. As MARPOL alignment is rather close to the current practice, additional operational costs as a result of MARPOL alignment are relatively modest (rated medium-low). The policy measures involved in policy option 3 have scores that range from low to medium on operational costs. Increases in operational costs are reflected in the following policy measures (the other policy measures rated at zero or low):

- *Adequacy measures:*
  - PM-1A (Broaden the scope of the PRF Directive to include MARPOL Annex VI waste - residues from exhaust gas cleaning systems): reception and treatment costs increased as a result of handling Annex VI waste;
  - PM-1B (Reinforce the waste hierarchy as laid down in the Waste Framework Directive, promoting separate collection in view of re-use and recycling of ship-generated waste): higher costs as a result of more advanced handling in case of reinforcing the waste hierarchy.

With the *special focus on marine litter (policy option 3B)* additional operational costs are created:

- *Incentives measures:*
  - PM-2B (Introduce a 100% indirect fee for garbage only): operational costs are generated for ports not yet applying the 100% indirect fee system for garbage waste;
  - PM-2D (Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime) and PM-2E (Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes): operational costs at ports will increase because of the additional delivery waste in ports as a result of fishing vessels and recreational craft included in the indirect fee regime, as well as the fishing for litter programme. At ships operational costs are expected to increase as a result of additional handling and storage of waste, including passively fished waste.

The operational costs for *policy option 4 (EU PRF regime)* are higher than policy option 3 and are rated *medium* for both variant options. The policy measures that distinguish policy option 4 from policy option 3 can be found mostly in the enforcement cluster, and score relatively high on operational costs:

- PM-3A.2 (Emphasize the current Article 7 provision on delivery of all ship-generated waste, beyond the MARPOL discharge norms): increased costs of (mandatory) waste delivery, for example sewage waste for cruise ships;
- PM-3D.2 (Develop a dedicated PRF targeting inspection mechanism): increased costs for inspections.

For the operational costs of *policy option 4B (EU PRF regime with focus on marine litter)*, the same additional operational costs are included as listed under policy option 3B.

Investment costs

Investment costs show a rather similar pattern as operational costs. *Policy option 2* requires little investment costs and the overall impact on investment costs is rated *low*. The exception may be the inclusion of Annex VI waste in the PRF Directive, requiring investments in storage, reception and treatment costs; and the Green Ship policy measure (soft law), which requires investment costs, notably in on-board waste treatment techniques. Although the investment costs for *policy option 3A (MARPOL alignment)* are higher than policy option 2. Also here the fact that MARPOL alignment is rather to the current practice, results in limited additional operational costs as a result of MARPOL alignment (rated *medium-low*). Policy measures that result in increased investment costs are:

- *Adequacy measures:*
  - PM-1A (Broaden the scope of the PRF Directive to include MARPOL Annex VI waste - residues from exhaust gas cleaning systems) investment in storage, reception and treatment costs;
  - PM-1B (Reinforce the waste hierarchy as laid down in the Waste Framework Directive, promoting separate collection in view of re-use and recycling of ship-generated waste): investment will be required in waste treatment and recycling facilities.
- *Incentives measures:*
  - PM-2C (Incentivise measures that reduce the amount of waste produced on board). The Green Ship concept requires investment costs for on-board treatment and segregation of waste on board the ship.

- *Enforcement measures:*
  - PM-3F (Extend the Electronic Monitoring and Information System, based on THETIS-EU and SSN); the system requires investment in IT systems at central, Member State and port level.

Also here the *special focus on marine litter (policy option 3B*) requires additional investments, resulting in a rating of *medium* impact. This applies in case of the following policy measures:

- PM-2B (Introduce a 100% indirect fee for garbage): ports not yet applying the 100% indirect fee system will have to invest in new or adjusted systems;
- PM-2D (Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime): investment in additional waste reception capacity needed;
- PM-2E (Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes): investments are needed in special bags and storage capacity for passively fished litter.

The investment costs for *policy option 4 (EU PRF regime)* are comparable to those of policy option 3. Also here the difference between the two policy options concentrate on enforcement of policy measures, however, investment costs in these policy measures are relatively limited. For the investment costs of *policy option 4B (focus on marine litter)*, the same additional investment costs are included, as listed under policy option 3B. Investment costs of policy option 4A are rated *low-medium*, while investments costs of policy option 4B are rated *medium*.

Administrative burden

Policy option 2 (minimum revision) reduces the administration burden, however, given the limited number of policy measures, the overall reduction is limited (rated *low*). A concrete contribution comes from PM-1D (Provide a better definition of 'adequacy' in line with international guidance): clearer adequacy definitions is expected to reduce errors and administrative burden.

Policy option 3A (MARPOL alignment) scores *high* on reducing administrative burden because the PRF system and MARPOL will be harmonised. This general assessment is reinforced by considering the individual policy measures. Most policy measures in the *adequacy cluster* indicate a limited impact on administrative burden, with an overall reduction.

A similar pattern can be seen for *incentives measures*:

- PM-2A (Shared methodology to calculate the indirect fee): results in reduced administrative burden (after an initial increase in administrative burden);
- PM-2C (Incentivise measures that reduce the amount of waste produced on board; Green Ship concept): an upward effect on administrative burden is expected as a result of increased auditing processes on board and adjustments needed of tariff structures and systems.

On aggregate, *enforcement measures* reduce the administrative burden, notably through PM-3A.1 (mandatory delivery – MARPOL alignment); PM-3C.1 (clarify sufficient storage capacity-taking into account MARPOL discharge norms); and PM-3F: better exchange and through the electronic Monitoring and Information System). PM-3E, which includes fishing vessels and small recreational craft in the PRF Directive,

increases the administrative burden to some extent (only limited number of vessels included). The net effect, however, is a reduction of administrative burden.

Both the *information and the exemptions measures* reduce the administrative burden. Notably PM-5A (develop common criteria to be applied for the application and approval of exemptions, including the introduction of a standardised exemption certificate) has a high impact on administrative burden reduction (assessed at 4.1 million Euro annually). The overall reduction of administrative burden of policy option 3A is rated *medium-high*.

For *policy option 3B (MARPOL – special focus on marine litter)* the additional policy measures to reduce marine litter may create an additional administrative burden on smaller vessels and ports:

- PM-2D (Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime): increased administrative burden is expected related to the inclusion in the indirect fee mechanism;
- PM-3E (Bring fishing vessels and small recreational craft into the PRF inspection regime by including them in the reporting obligation and the inspection criteria and procedure): an increase in administrative burden is expected, especially as a result of the additional inspection (ships, inspection authorities).

Policy option 3B increases the administrative burden (as compared to policy option 3A). However, the net effect of this policy option is a relatively small reduction in administrative burden, resulting in a similar rating as policy option 3A (rated *medium-high*).

Policy option 4 (EU PRF regime) score lower on administrative burden reduction than policy option 3 (MARPOL alignment). Overall, this policy option results in only a slight reduction of the administrative burden. The main difference in administrative burden compared to policy option 3 is caused by enforcement measures. PM-3A.2 creates an increase in administrative burden, mainly as a result of having a dual system and the consequent differences in waste receipts (PM-3B) and inspections (PM-3D). The overall impact of policy option 4A on administrative burden is rated *low* (decreasing).

Adding the specific policy measures that *focus on marine litter (policy option 4B)* further increases the administrative burden. The overall impact of policy option 4B on administrative burden is rated *low* (decreasing).

Business for PRF operators

The business for PRF operators is strongly linked to the amount of waste delivered in ports; PRF operators are expected to benefit from increased waste delivery. Consequently, this impact follows the pattern of volumes of waste delivered in ports, as described in Section 14.1.2, which can be summarised in the following way:

- *Policy option 2* (minimum revision) low impact on PRF business;
- *Policy option 3* (MARPOL alignment): substantial impact on increased business for PRF operators. This impact is highest for policy option 3B (MARPOL alignment with special focus on marine litter);
- *Policy option 4* (EU PRF regime) has the biggest impact on business for PRF operators, as this policy option aims to have all ship-generated waste delivered at ports. Also here, policy option 4B (EU PRF regime with special focus on marine litter) is expected to provide an additional increase in business of PRF operators.

Impact on SMEs

The impact on SMEs is mainly linked to two factors: (i) the impact on waste delivered at ports, creating additional business for port reception facilities and (ii) the position of the fishing and recreational boating sector, affected through a number of policy measures that are specifically targeted at the fishing and recreational boating sector. The PRF operators have a relatively small share of SMEs, as indicated in Section 3.2.8. The inclusion of the fishing industry and recreational boating, with a relatively high number of SMEs, will have an impact on SMEs.

Policy option 2 (minimal revision) has limited impact on SMEs, as none of the above-mentioned sectors are affected. *Policy option 3 (MARPOL alignment)* has impact on SMEs through the additional business for PRF operators. This impact is somewhat higher for *policy option 4 (EU PRF regime)* given the potential for additional waste delivered at ports. The highest impact is expected for *policy option 3B (MARPOL alignment – special focus on marine litter)* and *policy option 4B (EU PREF regime – special focus on marine litter),* given the focus of these variants on the fishing sector.

Impact on competitiveness and innovation

As indicated in the pre-screening process (see Annex 13) impact on competitiveness and innovation is limited to a small number of policy measures, notably PM-2C (Incentivise measures that reduce the amount of waste produced on board; Green ships) and PM-3A.2 (mandatory delivery of ship-generated waste – EU PRF regime). As PM-2C is included in *policy options 2-4*[259], all these policy options benefit from the positive impact on competitiveness and innovation generated by this policy measure. Policy measure PM-3A.2, going beyond MARPOL, may negatively impact the competitiveness of the port sector in the EU, as ships may prefer to call at ports outside the EU, thus negatively impacting *policy option 4 (EU PRF regime)*.

Impact on third countries, foreign trade and investment

Also here the pre-screening process (see Annex 13) indicates a very restricted impact on third countries, foreign trade and investment. In this case the impact is limited to *PM-3A.2 (mandatory delivery of ship-generated waste – EU PRF regime)*. Policy measure PM-3A.2, going beyond MARPOL, may negatively impact investment in the port sector, as the rules applied in EU ports are stricter than elsewhere in the world, thus negatively impacting *policy option 4 (EU PRF regime)*.

14.1.2. Environmental impacts

Environmental impacts, as introduced in Section 3.2.7, are described below per policy option. The impact on the circular economy, which is introduced as an additional objective, has been added in the assessment.

Volume of waste discharged at sea - delivered in ports

The relatively small number of policy measures in *policy option 2 (minimum revision)* has a *low* combined impact on waste delivery. Through soft law measures additional waste impact can be generated.

Policy option 3A (MARPOL alignment-no focus on marine litter) provides a basic impact (rated *low-medium*) on waste delivery. This can be attributed mostly to policy measures in the following categories:

- *Adequacy measures:*
  - PM-1C (Strengthen the requirements for systematic consultation of stakeholders in the development and updating of waste reception and handling plans): better

[259] Through soft law in policy option 2.

jointly agreed procedures and principles, as recorded in the WRH plans, are expected to result in more waste delivered in ports.

- *Enforcement measures:*
  - PM-3D.1 (Replace the 25% minimum inspection requirement with a risk-based approach – incorporating PRF inspections within the PSC regime); more waste is expected to be delivered as a result of improved inspections.
- *Exemptions measures:*
  - PM-5A (Develop common criteria to be applied for the application and approval of exemptions, including the introduction of a standardised exemption certificate, while also setting minimal requirements on information exchange between relevant authorities); more waste is expected as a result of stricter criteria for granting exemptions.

In *policy option 3B (MARPOL alignment- special focus on marine litter)* additional measures are included that have a positive impact on waste delivery in ports, resulting in a *medium* impact:

- PM-2B (100% indirect fee for garbage waste): is expected to contribute to the delivery of waste in ports as the threshold for delivering garbage waste is lowered;
- A range of projects is expected to bring in more waste from the fishing and recreational boating sector PM-2D (Incentivise the delivery of all waste from fishing vessels and small recreational craft to port reception facilities by including these vessels in the indirect fee regime) and PM-3E (Bring fishing vessels and small recreational craft into the PRF inspection regime by including them in the reporting obligation and the inspection criteria and procedure);
- An additional increase in waste delivered in ports comes from fishing for litter programmes in PM-2E (Incentivise the delivery of passively fished waste by fishing vessels to port reception facilities through fishing for litter programmes).

Policy option 4A (EU PRF regime, no focus on marine litter) is expected to result in more waste delivered to port reception facilities than through MARPOL alignment as this policy option is trying to capture the legally discharged waste at sea. Nevertheless, it should be noted that a *delivery obligation* is not as effective as a *discharge prohibition*, thus gains in additional waste volumes delivered at port reception facilities may be limited. Additional waste volumes are expected for *sewage* and a slight impact may be expected on *oily waste and garbage,* as little amounts of these waste streams are discharged legally. The impact of this variant is rated at *medium*.

In *policy option 4B (EU PRF regime, with special focus on marine litter),* additional garbage waste is expected to be delivered in ports, in line with the description in policy option 3B. The impact of this variant is rated at *medium-high*.

Circular economy

Policy option 2 (minimum revision) will lead to a small positive impact on the circular economy, mainly through PM-1C (improved stakeholder consultation, including on waste hierarchy, reflected in WRH plans). Furthermore, PM-2C (Incentivise measures that reduce the amount of waste produced on board; Green Ship) is likely to contribute to the circular economy, for example by segregating waste on board the ship.

Policy options 3 (MARPOL alignment) and 4 (EU PRF regime) also benefit from PM-1B (Reinforce the waste hierarchy as laid down in the Waste Framework Directive, promoting separate collection in view of re-use and recycling of ship-generated waste), which is specifically focused on waste hierarchy. In addition, PM-3B (waste receipt) is expected to contribute to the circular economy by providing better insight in waste streams delivered in ports.

The policy measures dedicated to marine litter (see description above) are all expected to contribute to the circular economy by bringing additional garbage waste to the port reception facilities, which may either be re-used or recycled. Consequently, *policy options 3B and 4B* provide good scores on impact on the circular economy (rated medium).

14.1.3. Social impacts

Social impacts, as introduced in Section 3.2.7, are described below per policy option.

Employment impacts

The employment impacts are also limited to a number of policy measures, notably to those that create additional volumes, i.e. the policy measures with special focus on marine litter (see description above). As a consequence, *policy options 3B (MARPOL alignment, special focus on marine litter)* and *4B (EU PRF regime, special focus on marine litter)* score well on employment impact.

Working conditions at sea

The pre-screening process (see Annex 13) indicates that none of the policy measure has a noticeable impact on working conditions at sea. Although some measures will affect the activities that are carried out on board the ship, for example in the case of PM-2C (Green Ship, including segregation of waste on board the ship) or PM-2E (fishing for litter), actual working conditions are not expected to be affected. As such, no impacts are foreseen on working conditions at sea for the policy options.

14.2. Comparison of policy options

Table 55 presents summarised impacts per policy option. Note that the policy options are scored in comparison to the base line scenario (policy option 1). As such, policy option 1 scores neutral (zero) on all impacts.

Table 55 Comparison of policy options

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Effectiveness – waste delivery	0	**Low** The relatively small number of policy measures have a limited combined impact on waste delivery. Through soft law measures additional waste impact can be generated.	**Low-medium** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic positive impact on waste delivery. MARPOL alignment coincides to a large extent with current practice and does not result in additional waste delivery. No policy measures are included that are specifically focused on marine litter.	**Medium** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic impact on waste delivery. MARPOL alignment coincides to a large extent with current practice and does not result in additional waste delivery. Additional policy measures are included that are specifically focused on marine litter (100% indirect fee for garbage; policy measures aimed at fishing and recreational boating sectors).	**Medium** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic impact on waste delivery. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results in some additional waste delivery, notably in sewage and to some extent oily waste and garbage. No policy measures are included that are specifically focused on marine litter.	**Medium-high** All policy measures in the clusters adequacy, definitions and exemptions are included, providing a basic impact on waste delivery. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results in some additional waste delivery, notably in sewage and to some extent oily waste and garbage. Additional policy measures are included that are specifically focused on marine litter (100% indirect fee for garbage; policy measures aimed at fishing and recreational boating sectors).

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Effectiveness – reduction of administrative burden	0	**Low - reduction** The majority of the policy measures reduce the administrative burden, although the overall impacts are rather limited.	**Medium-high – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. MARPOL alignment provides an additional reduction of administrative burden, as the PRF system and MARPOL will be harmonised.	**Medium-high – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. MARPOL alignment provides an additional reduction of administrative burden, as the PRF system and MARPOL will be harmonised. The additional policy measures to reduce marine litter may create an additional administrative burden on smaller vessels and ports.	**Low – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results will cause an increase in administrative burden (double systems, also reflected in forms, etc.).The net effect is expected to be a small reduction of administrative burden.	**Low – reduction** The combined policy measures in the clusters adequacy, definitions and exemptions provide an aggregated reduction of administrative burden. A strict interpretation of Article 7 of the PRF Directive related to delivery of all ship-generated waste results will cause an increase in administrative burden (double systems, also reflected in forms, etc.). The additional policy measures to reduce marine litter create an administrative burden to smaller vessels and ports. The net effect is expected to be a small reduction of administrative burden.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Effectiveness – contribution to circular economy	0	**Low** Limited contribution to the circular economy is expected from soft law measures, based on MARPOL PRF Guidelines ('adequacy', waste reception and handling plans, etc.), also guidance on the Green Ship concept may potentially contribute to the circular economy.	**Low-medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. (Inclusion of some of the aspects from the MARPOL Guidelines into EU law.	**Medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. (Inclusion of some of the aspects from the MARPOL Guidelines into EU law). The additional policy measures to reduce marine litter result in an additional contribution to the circular economy.	**Low-medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. Strict interpretation of Article 7 of the PRF Directive has limited additional effect on the circular economy.	**Medium** The combined policy measures in the clusters adequacy, definitions and exemptions provide a substantial contribution to the circular economy. Strict interpretation of Article 7 of the PRF Directive has limited additional effect on the circular economy. The additional policy measures to reduce marine litter result in an additional contribution to the circular economy.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Efficiency – operational costs	0	**Low** The policy measures come at hardly any operational costs.	**Low-medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest and as MARPOL alignment is rather close to current practice, additional operational costs coming from MARPOL alignment are limited.	**Low-medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest and as MARPOL alignment is rather close to current practice, additional operational costs coming from MARPOL alignment are limited. Some additional operational costs are expected from policy measures to reduce marine litter.	**Medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest. Strict interpretation of Article 7 of the PRF Directive comes at additional operational costs (inspection, double systems, increased costs of waste storage on-board and delivery).	**Medium** Combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest. Strict interpretation of Article 7 of the PRF Directive comes at additional operational costs (inspection, double systems, increased costs of waste storage on-board and delivery). Some additional operational costs are expected from policy measures to reduce marine litter.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Efficiency – investment costs	0	**Low** Policy measures require very little investment costs. The exception may be the inclusion of Annex VI waste in the PRF Directive, requiring investments in storage, reception and treatment costs; and the Green Ship policy measure (soft law), which requires investment costs.	**Low-medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). MARPOL alignment does not result in the need for additional investment costs.	**Medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). MARPOL alignment does not result in the need for additional investment costs. The policy measures to reduce marine litter result in some additional investment costs.	**Low-medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). Strict interpretation of Article 7 of the PRF Directive comes at limited investment costs (increased costs of waste storage on-board and delivery).	**Medium** In line with the operational costs the combined operational costs related to policy measures in the clusters adequacy, definitions and exemptions are modest (Green Ship, electronic Common Monitoring and Information System, waste hierarchy, scrubber waste storage). Strict interpretation of Article 7 of the PRF Directive comes at limited investment costs (increased costs of waste storage on-board and delivery).The policy measures to reduce marine litter result in additional investment costs.

	PO-1: Baseline scenario	PO-2: Minimum Revision	PO-3A: MARPOL alignment - no special focus on marine litter	PO-3B: MARPOL alignment - - special focus on marine litter	PO-4A EU PRF regime (beyond MARPOL) - no special focus on marine litter	PO-4B: EU PRF regime (beyond MARPOL) - special focus on marine litter
Other impacts	0	**Low** Limited other impacts are expected. The Green Ship policy measure may contribute to innovation and competitiveness.	**Low-medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase. The fisheries sector is not impacted). MARPOL alignment does not result in additional impacts.	**Medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase, negative impact for fisheries expected as measures specifically focus on fisheries). MARPOL alignment does not result in additional impacts. The policy measures focused on marine litter result in some additional impacts (business for port reception facilities, employment).	**Low-medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase. The fisheries sector is not impacted). Strict interpretation of Article 7 of the PRF Directive has limited additional impacts.	**Medium** Other impacts related to policy measures in the clusters adequacy, definitions and exemptions are relatively small (impact on business for port reception facilities as business might slightly increase, negative impact for fisheries expected as measures specifically focus on fisheries). Strict interpretation of Article 7 of the PRF Directive has limited additional impacts. The policy measures focused on marine litter result in some additional impacts (business for port reception facilities, employment).

14.2.1. PO-2: Minimum revision

Based on Table 55 the criteria on which this policy option is assessed are presented below:

- The policy option has only limited impact on waste delivery to port reception facilities and consequent reduction in waste discharged at sea. A small reduction of administrative burden and a limited contribution to the circular economy is expected. Through soft law measures additional contribution to the stated objectives (waste delivery; administrative burden; circular economy) can be realised. Overall, this policy measure scores relatively low on *effectiveness*;
- Through this policy option little additional impacts are generated. The policy measure on Green Ships (PM-2C) is expected to have a small positive impact on competitiveness and innovation. The policy measure on including Annex VI waste in the PRF Directive (PM-1A) may affect business for PRF operators;
- The operational and investment costs are relatively low as well. Some operational and investments costs are expected from including Annex VI waste in the PRF Directive (PM-1A). The balance between these relatively small benefits and the minimal operational and investment costs involved is positive, making this an *efficient* policy option;
- The policy option scores rather neutral on *coherence*. Involving the stakeholders in the development of WRH plans is coherent with the EU policy to actively involve users in decision making. However, the link to relevant policies, such as environmental policies (clean seas, circular economy) and administrative burden reduction is not strong.

The overall assessment is that the minimum revision of the PRF Directive is a feasible policy option, given the relatively low score on effectiveness, the positive score on efficiency and the neutral score on coherence. In addressing the stated objectives, this policy option relies on parallel policy measures to be implemented through soft law.

14.2.2. PO-3A: MARPOL alignment – without additional focus on marine litter

Based on Table 55 the criteria on which this policy option is assessed are presented below:

- This policy option has low-medium impacts on waste delivery to port reception facilities and consequent reduction in waste discharged at sea. This is mainly through policy measures in the adequacy, definitions and exemptions cluster. This policy option scores relatively low on delivery of garbage waste, notably because fishing vessels and recreational craft are not specifically addressed. The combination of MARPOL alignment and no special focus on marine litter scores very well on administrative burden reduction (high impact). This policy option has a low-medium impact on the circular economy. This policy option benefits from synergetic effects between defined policy measures as a result of MARPOL alignment. Policy measure 3A.1, i.e. mandatory delivery of waste - MARPOL alignment, adds to the effectiveness of other measures, such as bringing PRF inspections within the scope of Port State Control regime (through an amendment of Directive 2009/16/EC (policy measure 3D.1). In addition, the introduction of the requirement for a waste receipt to be issued upon delivery (policy measure 3B) will benefit from MARPOL alignment. Based on the above, this policy option scores well on *effectiveness*;
- This policy option scores relatively well on other impacts, such as business for PRF operators (through the increased waste delivered at port reception facilities). However, these impacts are lower than the variant options that focus on marine litter (policy options 3B and 4B);
- At relatively modest operational and investment costs, both rated as low-medium, and substantial benefits this policy option scores positively on *efficiency*;

- This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas and circular economy) and reduction of administrative burden. Bringing the PRF inspections within the scope of Port State Control regime further adds to coherence.

Based on the above, it can be concluded that MARPOL alignment without additional focus on marine litter provides a feasible policy option, with a strong score on effectiveness (low-medium impact on waste delivery; highest impact on administrative burden reduction of all policy options and low-medium impact on circular economy); and good scores on efficiency and coherence.

14.2.3. PO-3B: MARPOL alignment – with special focus on marine litter

Based on Table 55 the criteria on which this policy option is assessed are presented below:

- Performance on waste delivery is better than in policy option 3A (rated at medium). On top of the waste delivery performance of policy option 3A this policy option adds a package of policy measures focused on the delivery of garbage waste and thus tackles the problem of marine litter. This policy option also benefits from synergetic effects, as described under policy option 3A. This policy option reduces the administrative burden (medium-high impact), although to a lesser extent than policy option 3A, as the policy measures aimed at reducing marine litter cause some additional administrative burden. The contribution to the circular economy is substantial, rated at a medium impact. Overall this policy option scores very well on *effectiveness*;
- This policy option outscores the performance of policy option 3A on waste delivery, thus creating spin-off impacts, notably on business for PRF operators, impact on SMEs and employment;
- Although investment costs (rated medium) are higher than in policy option 3A as a result of including policy measures focused on reducing marine litter, the increased contribution to the objectives results in a positive score on *efficiency*;
- This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas, with additional focus on marine litter, and circular economy) and reduction of administrative burden. Bringing the PRF inspections within the scope of Port State Control regime further adds to coherence;

Considering all of the above, this policy option provides an excellent overall package, based on a strong combined score on effectiveness, and good scores on efficiency and coherence.

14.2.4. PO-4A: EU PRF regime - without additional focus on marine litter

Based on Table 55 the criteria on which this policy option is assessed are presented below:

- Regarding *effectiveness*, strict operation of the EU PRF regime (based on a mandatory delivery obligation – beyond MARPOL), without an additional focus on marine litter, scores better than policy option 3A as this policy option aims to capture the legal discharges at sea (rated medium). In collecting this additional waste, it should be noted that a delivery obligation is not as effective as a discharge prohibition, thus gains in additional waste volumes delivered at port reception facilities may be limited. This policy option also scores relatively well on the circular economy objective (rated low-medium), similar as policy option 3A. However, the lower score on administrative burden (rated low) has a negative impact on overall effectiveness of this policy option. The administrative burden is negatively affected by having a dual system in place (MARPOL and EU PRF

regime). The (potential) gains in waste delivered are offset by the performance on administrative burden, resulting in a lower score on effectiveness than policy option 3;

- Similar as policy option 3A, this policy option scores well on spin-off related to other impacts, such as business for PRF operators (through the increased waste delivered at port reception facilities). However, these impacts are lower than the variant options that focus on marine litter (policy options 3B and 4B);
- The operational costs of policy option 4 are higher (rated medium) than policy option 3, mainly as a result of having a dual system in place. The investment costs of this policy option are similar as policy option 3A. The combination of higher aggregated costs and lower effectiveness leads to a lower score on *efficiency*, compared to policy options 3A and 3B;
- This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas and circular economy) and reduction of administrative burden (similar to policy option 3A);

This policy option is feasible. Although some additional waste may be delivered to port reception facilities, the additional administrative burden places this policy option at a lower effectiveness level than policy option 3. With a similar score on coherence and a lower score on efficiency, this policy option has an overall rating that is lower than policy options 3A and 3B.

14.2.5. PO-4B: EU PRF regime – with special focus on marine litter

Based on Table 55 the criteria on which this policy option is assessed are presented below:

- Strict interpretation of the PRF Directive, with special focus on marine litter, scores well on the waste delivery objective (rated medium-high). Compared to policy option 4A, this policy option adds a package of policy measures focused on the delivery of garbage waste and thus tackles the problem of marine litter (similar as policy option 3B). This policy option scores well on the circular economy objective (rated medium). However, the performance on administrative burden scores lower than policy option 4A (rated low), negatively impacting overall *effectiveness* of this policy option. Also in this policy option, the overall additional waste delivered is offset by the score on administrative burden;
- This policy option outscores the performance of policy option 4A on waste delivery, thus creating spin-off impacts, notably on business for PRF operators, impact on SMEs and employment;
- The aggregated operational and investment costs are higher than policy options 3A-B, resulting in a lower *efficiency* as compared to policy options 3A-B;
- This policy option scores well on *coherence*, as there is a clear link to EU environmental policy (clean seas, with additional focus on marine litter, and circular economy) and reduction of administrative burden.

This policy option is feasible, but the overall balance is at a lower level than policy measure 3B.

14.3. Conclusion

Selection of the preferred option

Based on the above comparison, *policy option 3B - MARPOL alignment with special focus on marine litter* provides the best overall score on the defined criteria (effectiveness, efficiency, coherence). This policy option has a positive contribution to

the stated objectives. More waste will be delivered to the port reception facilities and hence less waste will be discharged at sea. This is combined with a reduction on administrative burden and a contribution to the circular economy. The operational and investment costs are modest and at a lower level than the policy options 4A-B. Furthermore, this policy option scores well on coherence, notably by connecting to EU environmental policies and ambitions to reduce administrative burden. Finally, this policy option includes policy measures, notably through MARPOL alignment, which create synergetic effects.

Proportionality of the preferred option

Policy option 3B - MARPOL alignment with special focus on marine litter consist of a well-balanced set of 19 policy measures, covering the areas of provision of adequate port reception facilities; incentives for waste delivery; effective enforcement; improving definitions and forms; and consistent application of exemptions. The combined policy measures, strengthened by synergetic effects between the measures, have a positive impact on reducing the main defined problems, i.e. (i) discharges of ship-generated waste and cargo residues at sea, negatively impacted the marine environment, and administrative burden caused by the implementation of the PRF Directive. Notably the problem of waste discharges at sea is substantial, with waste gaps, defined as the difference between waste generated on board the ship and east delivered at ports, of 2,5% of oily waste; 10% of sewage waste and 7-34%of garbage waste. *The combined policy measures, coming at relatively modest costs, form an effective approach which is proportionate to the identified problems*.

15. Monitoring and indicators

The Commission services will monitor the implementation and effectiveness of this initiative through a set of core progress indicators listed in Table 56 that will measure the progress in achieving the specific objectives. Some of the indicators are of qualitative nature and show if the desired deliverables are achieved and implemented, while others are based on data to be collected that will need to be analysed further.

It is foreseen that five years after the end of the implementation date of the proposed legislation, the Commission services will carry out an evaluation to verify whether the objectives of the initiative have been reached. It is intended to verify whether the new measures in place have resulted in an improvement of the situation, in terms of increased waste deliveries in port, as well as simplification and administrative burden reduction. This evaluation shall be carried out based on the below mentioned core progress indicators in line with Commission requirements on evaluation.

Table 56 Core progress indicators for monitoring purposes

Specific objectives	Core progress indicators	Source of data
Availability of adequate facilities	• Comprehensive WRH Plans; • Basic information on port reception facilities publicly available; • Increased in separate collection systems in port.	• Website of the ports; • DG ENV (results from monitoring the new Waste Framework Directive).
Effective (cost) incentives to deliver waste at port reception facilities	• Increased in waste deliveries in port.	• EMSA: SafeSeaNet (waste receipt/advance waste notification); • Member States reports.
Effective and efficient enforcement	• Increase in the number of PRF inspections undertaken; • Information on waste deliveries electronically reported.	• EMSA: THETIS(EU); • EMSA: SafeSeaNet.
Harmonised and updated definitions and forms	• Level of alignment with MARPOL forms.	• CAs; • EMSA: SafeSeaNet (waste business rules).
Common rules for exemptions	• Electronic reporting and exchange of exemptions.	• EMSA: SafeSeaNet.
Reduction of marine litter from sea-based sources	• Fishing gear lost at sea; marine litter found at beaches.	• Surveys from the Regional Seas Conventions.

Source: European Commission.