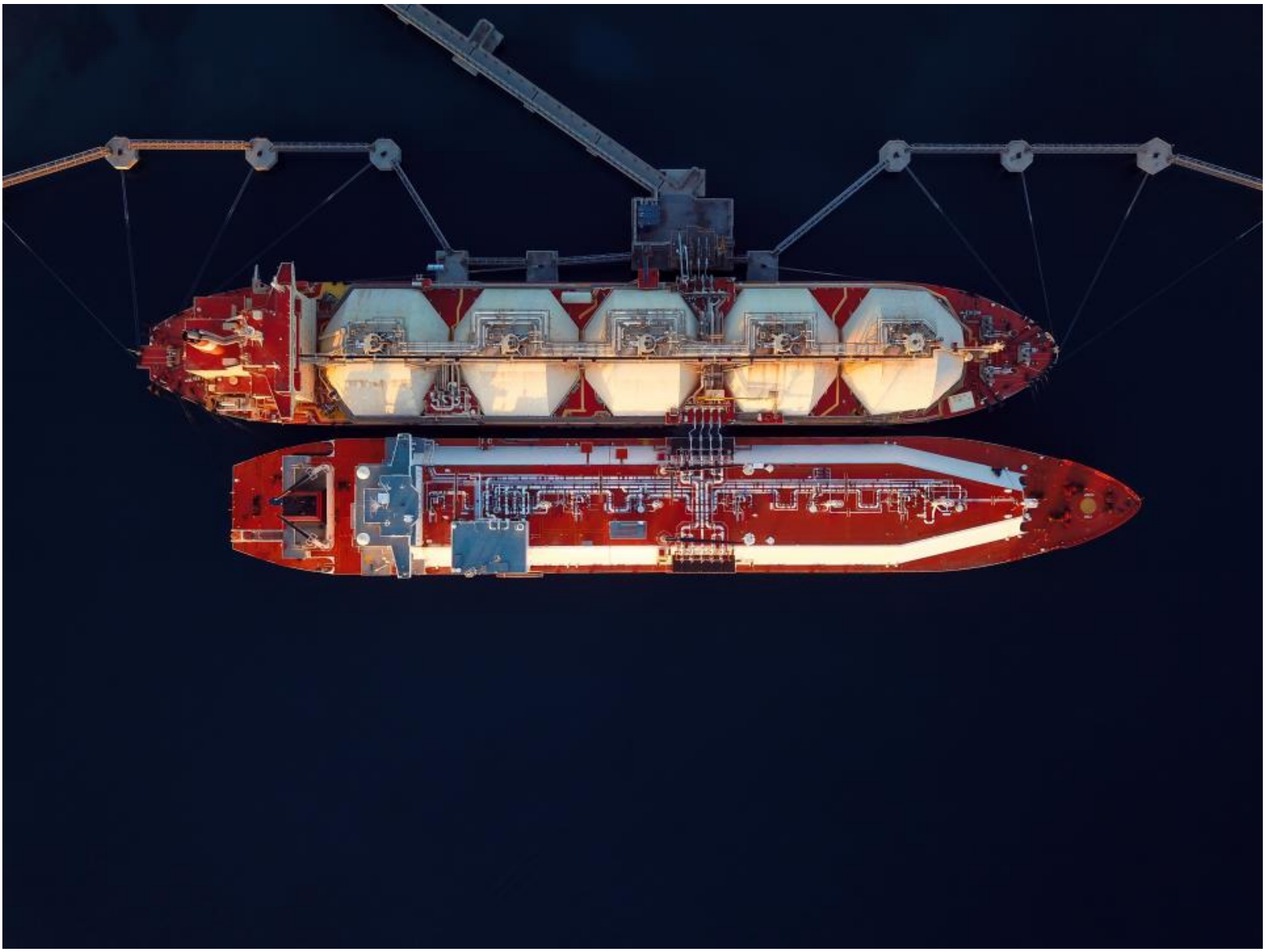

The Waste Management Value Chain Related to Marine and Port Operations – Case Study of Three Finnish Ports

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Contents

1 Introduction

There are about 2,000 cargo ships sailing at the Baltic Sea every day, with an estimation of 25,000 workers on board. Different kinds of waste are generated on board, from solid waste (garbage), wastewaters and sludges to cargo-specific washing waters. Maritime regulations set limits for discharges of waste types that are either harmful (HME) or non-harmful to marine environment (NHME). According to the regulations, cargo ships can discharge legally, under certain conditions, treated sewage, grey waters and ground food waste into sea. This applies also at the Baltic Sea, even though it is considerably fragile due to its shallow waters and low salt content, and one of the most polluted seas in the world. The discharge, containing bacteria, nutrients and microplastics, generates eutrophication, oxygen depletion and increases the amount of marine litter.

Responsible shipping operators, including ferries operating between Finland, Sweden and Estonia and cargo ships operating in scheduled traffic already leave their waste at ports, and there is so called "No Special Fee" - recommendation by HELCOM at the Baltic ports. The system includes that a waste fee is charged regardless of whether the ship leaves its waste at the port or not. (BSAG, 2021). Problem is that many cargo ships sailing at the Baltic Sea are not aware of the special conditions of this sea or the No Special Fee -system.

Baltic Sea Action Group (BSAG), which is an independent, non-profit organization, has launched a project to examine the waste flows and related information flows at the ports, and Port of Oulu, Port of Rauma and Port of Kokkola have been acting as pilot ports in the project. The Port of Oulu was selected to be the first pilot case in the spring 2021 followed by the Port of Rauma and the Port of Kokkola during spring 2022. All the selected ports have their differences but something in common as well. Ports of Oulu, Rauma and Kokkola are all large and busy general port with strong focus on developing. They have partly different focus on handled cargo types and different stakeholders in their waste management value chains.

In this project, the whole value chain was covered in all three ports by numerous stakeholders: ships, shipowners, shipbrokers, port operators, waste management companies and transport companies. The project aims at recognizing each operator's role in the value chain and identifying possible bottlenecks in the chain: what are the difficulties that lead to discharging waste into the sea and prevent from bringing and discharging it ashore? To tackle the challenges, the project aims at recognizing what could be done to ease the process of waste discharge at the port, and waste recovery.

The project is linked to the BSAG's project on responsible shipping, funded by the European Maritime and Fisheries Fund's Finnish Operational Program 2014–2020, aiming at reducing the environmental burden of shipping. The project concentrates in the following questions:

- How could the discharges into the Baltic Sea be reduced?
- How could the ships be encouraged to leave their waste to ports?
- How could the ship generated waste be managed more efficiently at ports?
- How could the waste recovery and utilization be increased?
- How could the communications and information exchange between the stakeholders be improved?

The project was performed by interviewing representatives from different parties of the waste management value chain related to each port. After the interviews, separate

workshops for each port were arranged to further discuss and process the challenges identified in the interviews, and to generate ideas for improvement. As a final step in the project, a nation-wide stakeholder workshop was arranged to identify possible next actions and parties that could execute the actions in practice. In the workshop, representatives from the pilot ports as well as other ports participated, together with shipowners, waste management companies, association representatives and authorities.

This report summarizes the findings from the three pilot ports and the stakeholder workshop. BSAG and AFRY wish to thank everyone who has given their valuable time and expertise for the project during its different stages.

The pilot project is linked to the BSAG's project "Harmaiden vesien ja ruokajätteen vastuullinen käsittely Itämerellä" ("Responsible treatment of grey water and food waste in the Baltic Sea") conducted by the foundation and funded by the European Maritime and Fisheries Fund (EMFF) Operational Programme for Finland 2014-2020.

2 Legislation and policy overview

2.1 International Convention for the Prevention of Pollution from Ships (MARPOL)

The International Convention for the Prevention of Pollution from Ships (MARPOL) is an international convention adopted at IMO. It is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The regulations of the convention are defined in six technical annexes. (IMO 2019a).

- Annex I Regulations for the Prevention of Pollution by Oil (entered into force 2 October 1983)
- Annex II Regulations for the Prevention of Pollution by Noxious Liquid Substances in Bulk (entered into force 2 October 1983)
- Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force 1 July 1992)
- Annex IV Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003)
- Annex V Prevention of Pollution by Garbage from Ships (entered into force 31 December 1988)
- Annex VI Prevention of Air Pollution from Ships (entered into force 19 May 2005)

2.2 PRF Directive and the Act on Environmental Protection in Maritime Transport

The renewed PRF Directive 2019/883/EU (directive on port reception facilities for the delivery of waste from ships) had to be adopted in the national legislation of member states before 28.6.2021. In Finland, the directive was implemented by the Act Amending the Act on Environmental Protection in Maritime Transport (Laki merenkulun

ympäristönsuojelulain muuttamisesta, 669/2021). The new act implements the PRF directive by amending the original act number 1672/2009. In addition, the Act brings into national legislation the amendments of MARPOL from the last 20 years (Rantanen & Hokkanen 2022). The following chapters describe the main changes in the amended act compared to earlier situation, relevant to this project's work. It is to be noted that the text of the Act is not referred directly in the following chapters, but the most relevant points are collected. Text in the Act can contain details that are not written below.

2.2.1 New Requirements for Vessels

In the amended act, it has been stated that Finnish Transport and Communications Agency (Traficom) or accepted classification society are the parties to **accept vessel's sewage treatment systems**. Limits for vessels that need to have a **waste management plan** have been tightened to 100 gross tonnage or 15 passengers.

An advance waste notification has to be done prior the arrival to a port. The notification shall be done:

a) at least 24 hours prior to arrival, if the port of call is known;
b) as soon as the port of call is known, if this information is available less than 24 hours prior to arrival; or
c) at the latest upon departure from the previous port, if the duration of the voyage is less than 24 hours

Mandatory waste delivery obligation applies to all vessels, unless:

a) there is sufficient dedicated storage capacity for all waste that has been accumulated and will be accumulated during the intended voyage of the ship until the next port of call or
b) the ship only calls at anchorage for less than 24 hours or
c) under adverse weather conditions.

2.2.2 New Requirements to Ports' Reception Facilities and Actions at the Port When Receiving Waste

According to the directive, all ports must have **adequate reception facilities** to meet the needs of the ships normally using the port without causing undue delay. Here, the adequacy relates to the operational conditions of the facility in view of the user needs, ports size and location, types of the vessels visiting and possible exempted ships. Port must ensure that the reception facilities work correctly, and repair inoperative facilities without delay. It is to be noted that if there are claimed deficiencies at a port, Traficom is responsible for informing IMO about the deficiencies. Remarks related to deficiencies are added to GISIS (Global Integrated Shipping Information System).

There must be separate **reception facilities for following waste types**:

- oily waste
- waste containing harmful liquid substances
- sewage
- used batteries
- waste electrical and electronic equipment
- biowaste
- fiber packaging
- plastic packaging
- glass packaging

— metal packaging and other small metal
— other solid waste
— exhaust gas cleaning residues

The Port reception facility operator should provide without undue delay, **a waste delivery receipt** to the master of the ship.

2.2.3 Waste Management Fees

Indirect fee, also called "**No Special Fee**", is defined in the PRF Directive 2019/883/EU as a "fee paid for the provision of port reception facility services, irrespective of the actual delivery of waste from ships". It allows ships to discharge waste under MARPOL Annexes I, IV and V to port reception facilities (PRF), with no extra costs. This indirect fee is charged even if no waste is left to a port and is based on ship's characteristics and waste type. The fee was already to some extent in force during the earlier PRF Directive 2000/59/EC. No Special Fee -system is recommended to all Baltic Sea ports by HELCOM. (Directive 2019/883/EU; HELCOM Recommendation 28E/10).

The Act Amending the Act on Environmental Protection in Maritime Transport (669/2021) defines the **waste types or amounts which are not covered** by the indirect fee. The Act also states the principles for defining the size of waste fee, those being the size, type or class of the vessel, service times outside normal opening hours and hazardous properties of the waste.

In addition, the Act states that ports must grant a **discount** to ships that operate in short sea shipping or that use equipment, methods or good-quality fuel, due to which their amount of waste is smaller than normal, or the waste can be utilized. For all vessels it is not mandatory to leave their waste in port's reception facilities. **Principles for ships which have been granted an exemption from mandatory delivery of ship-generated waste and from notification of such waste** are also defined.

2.2.4 New Requirements Related to Ports' Waste Reception and Handling Plans

All the ports have differences based on geographic location, size, administrative set-up and ownership, and by the type of ships that normally visit. Thus, their waste management systems are different, and reflect the differences at municipal level and downstream waste management infrastructure. However, the main waste management principles are specified in the Directive and the amended Act, and requirements are set for the **waste management plans of the ports**. The waste management plans should at least describe the needs for the reception facilities, the existing reception facilities, and the following information:

a) location of port reception facilities applicable to each berth, and, where relevant, their opening hours;
b) list of waste from ships normally managed by the port;
c) list of contact points, the port reception facility operators and the services offered;
d) description of the procedures for delivery of the waste;
e) description of the cost recovery system, including waste management schemes and funds.

The plan needs to be presented for approval every fifth year to a competent authority. (Earlier the period was three years.) Also, the Directive and Act allow several ports in the same geographical region to develop jointly their waste reception and handling plans. Commercial ports should include the information regarding their key waste management issues into the Union Maritime Information and Exchange system SafeSeaNET. (European Commission, 2019). The key information also needs to be available in electronic form for all relevant users of port's facilities.

2.3 Waste Act and Degree

After waste is received at the port, the Act Amending the Waste Act (714/2021, original Act is 646/2011) and the Degrees given under it govern, the Governments Degree on Waste (978/2021) being among the most significant ones. The renewed waste legislation has set more requirements for separate collection of waste compared to earlier. However, most of the emphasis in the text is put on municipal waste and foremost to waste generated in households. Some requirements for separate collection of municipal waste from estates that are located in service-, travel- or workplace areas with urban status are given in 21§ of the Degree. There are limits for weekly generated amounts of the mentioned waste types, for separate collection limit to apply. Waste types to be collected separately are:

- biowaste
- plastic packaging waste
- paper and cardboard packaging waste
- glass packaging waste
- metal packaging waste and other small metal items
- other wastes of mentioned materials, garden waste and textile waste as well as bigger articles, according to possibilities

Ports as such are not mentioned in the Waste Act or the Degree related to their role as waste recipients from ships. The ports are generally related to any other industrial operator which generates waste in its operations, and relevant orders of the waste regulation therefore apply also to ports.

2.4 International Catering Waste (Animal by-products)

EU regulations on animal by-products (EC 1069/2009 and EU 142/2011) have a significant effect on the handling of biowaste in ports. Food waste that is generated in international transportation, meaning transportation into EU from non-EU countries, need to be treated as Category 1 material according to the by-products legislation. Basically, that refers to all food waste generated during cooking and service of meals to passengers or crew, if a ship arrives to a port in EU country from a non-EU country such as UK or Russia. (Norway has implemented the EU legislation for by-products and is considered like EU countries). (Finnish Food Authority 2020; EU not dated).

International food waste needs to be either incinerated or buried in landfill. Collection bins need to be marked with "Category 1", and "International food waste" signs. It is possible to collect the food waste together with mixed waste or energy waste, if the waste management company handling the waste is aware of the waste containing international food waste, and the waste is transported directly to treatment and not intermediately stored at a reloading station. It is not possible to treat international food waste in a biogas or a composting plant. (Finnish Food Authority 2020)

Parties, who are responsible for collection points of international food waste, need to register themselves at the Finnish Food Authority as actors in accordance with by-products regulation. (Finnish Food Authority 2020)

3 The Waste Management Value Chain Related to Shipping and Port Operations

The waste management value chain related to shipping and port operations can be divided into three distinct phases, shown in Figure 1.

1. Operations performed before, during and after cargo handling
2. Operations performed on board
3. Operations performed at ports and later in the waste management facilities

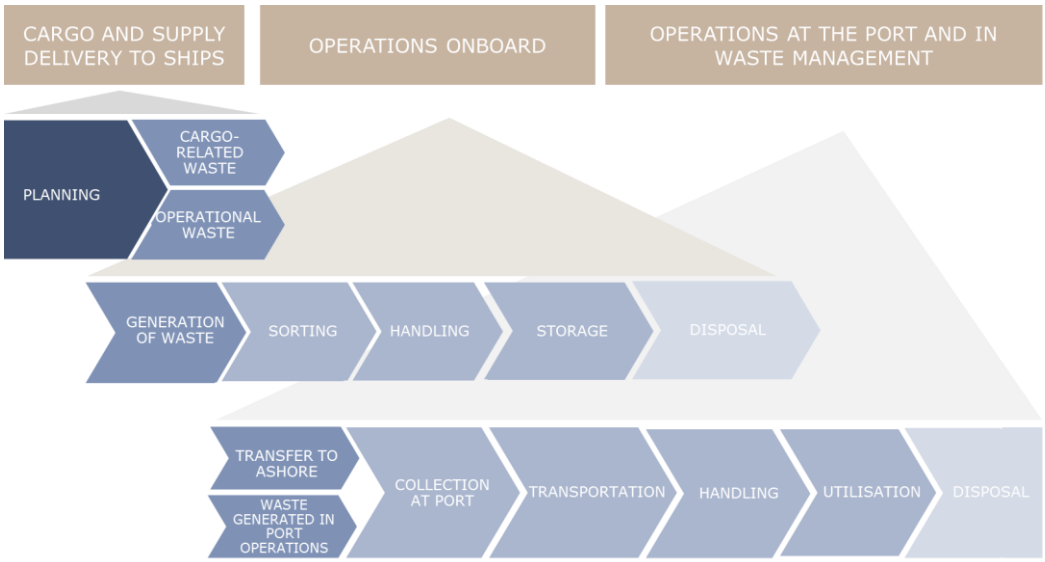

Figure 1. The waste management value chain related to shipping and port operations.

Operations performed before and during the loading of ships include careful planning and a forecast of the types and amounts of the waste that is generated in the ships. Waste can be cargo-related or it is generated during the ships´ operational stage. The ships´ personnel and management need to be informed about the waste management services at ports.

Operations performed on board, after waste is generated, include sorting, handling, and stocking the waste. The ports need to know about the amounts and types of waste that will be transported to them in advance, and therefore a waste notification must be supplied.

Operations performed at ports and regarding waste management include transferring of waste from ships to the port, collection of waste at the port, transportation of waste, utilization, and final disposal. The amount of waste and its handling must be reported and an appropriate report consistent with the environmental permit of the final disposal must be provided.

3.1 The waste management value chain in the pilot ports

All the pilot ports in this project, Oulu, Rauma and Kokkola, have numerous stakeholders in their waste management value chains. On following pages, all three pilot ports are presented shortly, followed by port-specific value chain figures with stakeholders included. Note that not all the stakeholders are included but only those that were contacted during this project.

3.1.1 Port of Oulu

Port of Oulu (Figure 2) is an active port at the Gulf of Bothnia, and the largest general port in the area. The Port has three harbours: Oritkari, Nuottasaari and Vihreäsaari. The Port of Oulu is visited by approximately 550 ships every year with forest industry products, liquid fuels and forest industry raw materials being the most important categories. Port of Oulu aims at becoming the pioneer of responsible port operations and encourages all kinds of improvements and development activities. (Port of Oulu, 2021)

Figure 2. Port of Oulu (https://ouluport.com/en/whats-new/for-the-media/).

Figure 3 presents the waste management value chain with stakeholders related to Port of Oulu.

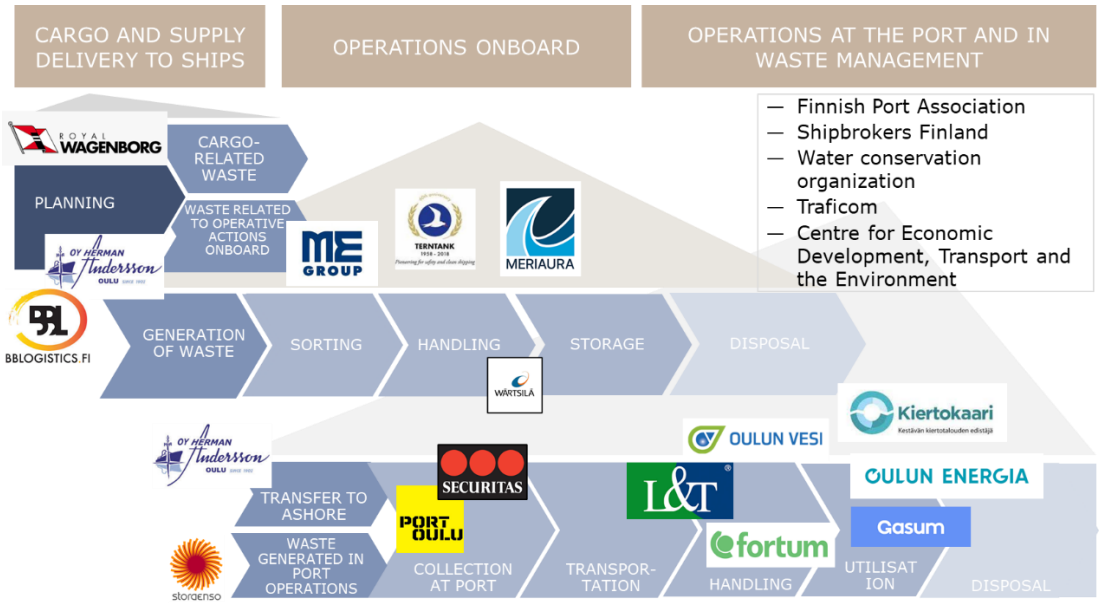

Figure 3. The waste management value chain related to Port of Oulu.

3.1.2 Port of Rauma

Port of Rauma (Figure 4) is the 4th largest general port and the 3rd largest container port in Finland located in the city of Rauma on the southern part of Gulf of Bothnia. The total amount of port calls is around 1000 per year with 5 million tons of annual import and export in total. The cargo in port includes, for example, pulp and paper products, fuels and other liquids, machines, and large industrial components. Port of Rauma aims to improve its operations and to reduce its environmental impact. Port of Rauma has, for example, been developing Port Activity applications to improve communication and making plans on utilizing waste waters from ships. (Port of Rauma, 2022)

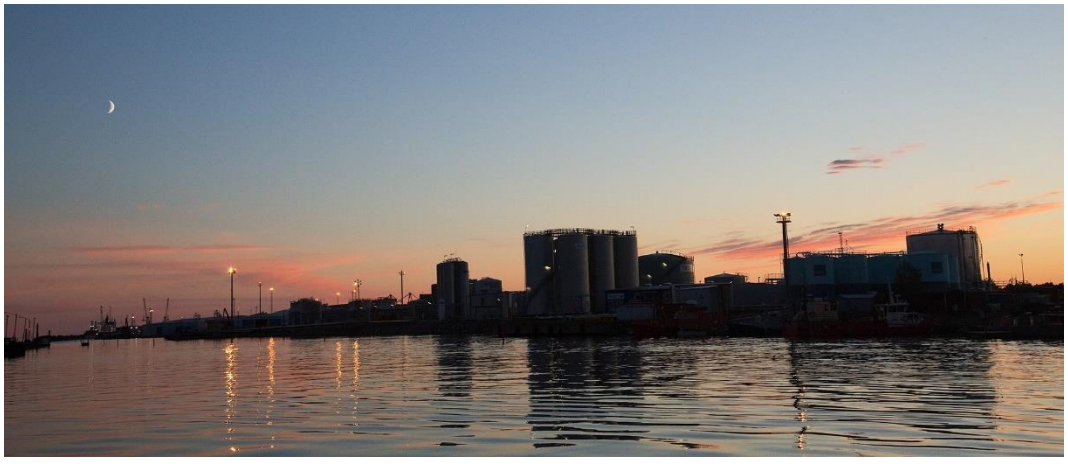

Figure 4. Port of Rauma, chemical harbour (https://portofrauma.com/wp-content/uploads/2021/09/raumansatama_0147.jpg).

Figure 5 presents the waste management value chain with stakeholders related to Port of Rauma.

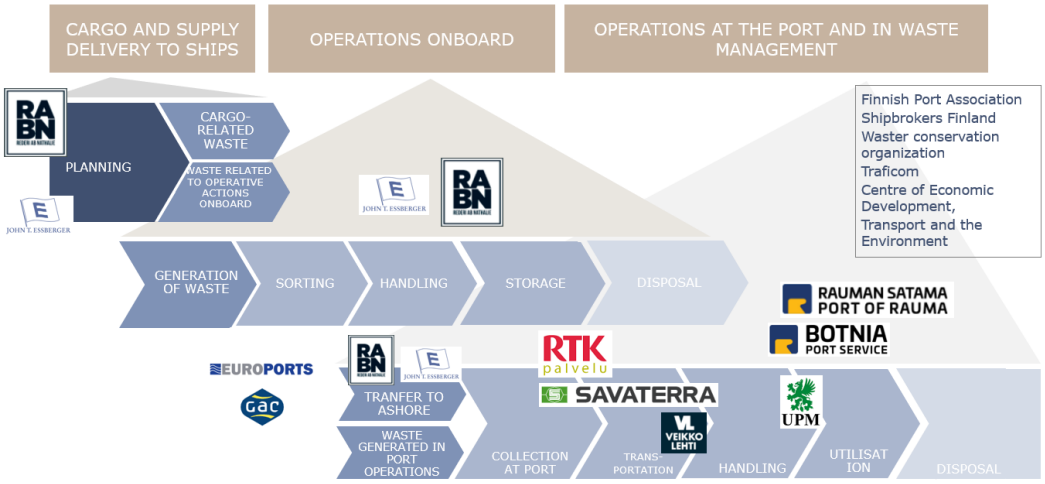

Figure 5. The waste management value chain related to Port of Rauma.

3.1.3 Port of Kokkola

Port of Kokkola (Figure 6) is located on the west coast of Finland on the shore of the Gulf of Bothnia in the city of Kokkola. It is the 3rd largest general port in Finland with 8 million tons of annual import and export in total. Port of Kokkola consists of three port areas that are the deep port, general port and Silverstone port serving different kinds of cargo types. Port of Kokkola is mainly focused on different fields of industry, of which mining industry is the most significant. Kokkola industrial park is located right next to the port area. Port of Kokkola is developing responsible port actions as a member of Greenport organization.

Figure 6. Port of Kokkola (https://portofkokkola.fi/).

Figure 7 presents the waste management value chain with stakeholders related to Port of Kokkola.

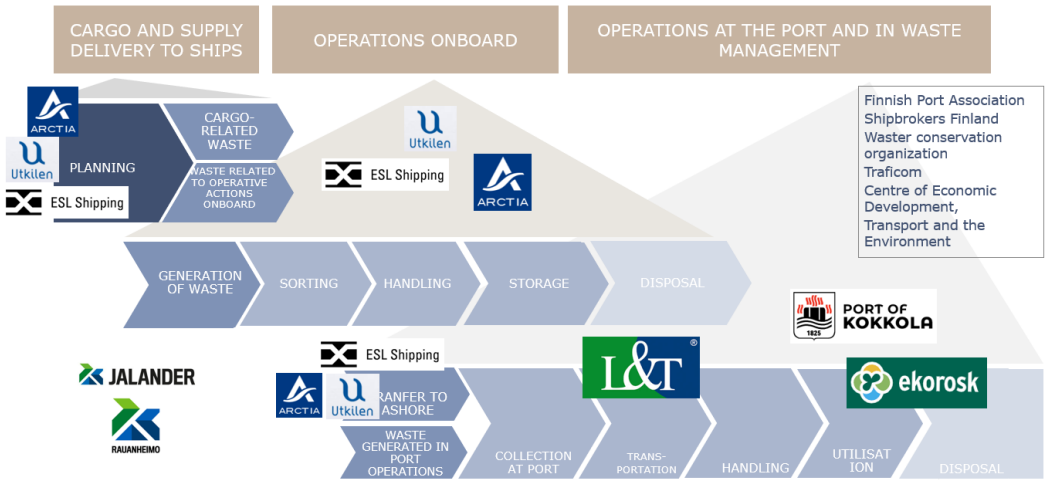

Figure 2. The waste management value chain related to Port of Kokkola.

3.2 Working methods

3.2.1 Interviews

The work included contacting and interviewing a broad range of actors to find out the different waste streams, their management and utilization possibilities as well as the information flow along the value chain. The aim of the interviews was to get a truthful overall picture of all the issues and challenges related to waste management at shipping and port operations as well as the goals and the willingness of the stakeholders to improve the current situation.

During the project, altogether around 70 representatives of stakeholders including the Port of Oulu, Port of Rauma and Port of Kokkola, ship owners, ship brokers, port operators, waste management companies etc. were interviewed. The interviewed stakeholders are listed in Appendix 1.

3.2.2 Workshop

After interviewing a wide range of actors along the waste management value chain, workshops for each port were organized to tackle the bottlenecks found out during the interviews. Workshops were arranged for each port separately. All the interviewed actors and some other representatives from the value chain were invited into the workshops. Altogether 45 participants attended in the workshops arranged in Ports of Oulu, Rauma and Kokkola.

During the workshops, new ideas and best practices for better waste management and better communication were discussed and improvement opportunities were generated. The workshop of Port of Oulu was divided into three working groups with the topics of:

1) wastewaters and food waste
2) solid waste and hold washing waters
3) communication and flow of information

The workshops of Port of Rauma and Port of Kokkola were divided into two topics of:

1) communication and flow of information
2) waste management in practice

For each topic there was a MIRO -platform (whiteboard) with questions related to the waste management value chain. During the workshop, the MIRO platforms were filled with participants' ideas and thoughts about the subject.

3.2.3 Stakeholder event

After all workshops a stakeholder event was arranged in Espoo. Altogether there were 28 participants at the event. The goal of the stakeholder event was to find out how identified solutions could be taken into practice and by whom. The main findings from the earlier interviews and workshops were presented in the event, and after that there was a workshop with two topics:

1) Harmonization of waste management activities
2) Promoting the circular economy and waste recovery

The workshop section of the event was divided into three phases:

1) Gathering the necessary actions
2) Collection of entities adopting actions
3) Discussion

4 Results and Discussion

4.1 Wastewater Management

4.1.1 Current situation and challenges of wastewater management

The current situation of wastewater management was discussed mainly during the interviews. The management on board and the discharge of wastewaters as well as the challenges related to these issues are presented below.

"Wastewater" is used in this report as a general term of different kinds of waters that are generated on ships, and that contain as impurities dissolved or insoluble substances. Typical wastewater types generated on ships are:

- sewage, i.e. black water, is wastewater that is generated from toilets
- grey water is wastewater without fecal contamination, generated from other sources than toilet, such as from sinks, showers, washing machines and dishwashers
- hold washing waters, generated when a ship's hold is washed after the cargo has been unloaded and that can contain cargo residues as impurities

Management on board

Most of the ships have sewage treatment plants (STP) on board. However, their functionality is not systematically monitored by authorities and only occasional tests take place. Thus, some of them are working, and some are either not working or not used. The processes have also different techniques for removing pollutants, some of them might only disinfect the water, some remove the suspended solids, and the newest ones also remove part of the nutrients. The identified challenges are presented in Table 1.

Table 1. Identified challenges in the current situation of wastewater management on board.

Identified challenges
Most of the ships have a combined tank for both grey and black waters, and under the regulations, the mixture is considered to be sewage (for mixtures, the most stringent regulation to apply).
Checking the functionality of the STP-process on board is difficult.
Biological processes are sensitive and vulnerable to malfunctions. For example, the Membrane Bioreactor (MBR) process would require the sludge removal regularly. However, this is often not done, and the sludge can block up the whole process, and cause all the wastewater to be discharged at sea as an overflow.
Storage of untreated sewage is challenging due to formation of hydrogen sulfide and to storage capacity.
If only the sewage sludges are stored on board, they also form hydrogen sulfide and the sludge might harden at the bottom of the tank, which makes it difficult to remove.
The content of the hold washing waters is often unknown, and the washing waters can be a combination of washing several different cargo types. This makes analysing water content slow and expensive to treat.
The level of knowledge among ship personnel about sewage treatment methodologies and the mechanism of eutrophication varies significantly. A common misbelief is that all STP-processes would remove nutrients from the sewage, even if some of the processes only disinfect the sewage leaving all nutrients in the discharge. Another inconsecutive practice is that sewage might be purified from nutrients, but the sludge where nutrients are condensed during STP-process, is finally discharged into the sea separately.

Discharging the wastewaters

Most of the cargo ships discharge their treated sewage and sewage sludges into the Baltic Sea increasing its nutrient load and eutrophication. The identified challenges are presented in Table 2.

Table 2. Identified challenges in the current situation of wastewater discharges.

Identified challenges
The treated sewage can be legally discharged at sea wherever at the sea (even at the archipelago), and the untreated sewage can be discharged legally at sea at 12 miles distance from ashore.
Transferring wastewaters from ships to ports is currently not easy in ports with no fixed reception facilities, and every time a separate tank truck must be ordered.
At some ports, wastewater discharge and unloading/loading of cargo cannot be done simultaneously.
There is not enough knowledge among the ship personnel about the environmental issues, especially about the eutrophication of the Baltic Sea due to excess nutrient load.

Opportunity to discharge waste waters without extra cost under No-special-fee system is not always known by ship personnel.
Varying waste fees, restrictions and rules related to waste receiving in different ports.

4.1.2 Improvement opportunities for wastewater management

The improvement opportunities for wastewater management and their discharge and utilization were discussed and brainstormed in the workshops. Topics for the workshops were chosen based on the challenges identified during the interviews. Following improvement opportunities were identified for wastewater management.

Management on board

- The type certification for STP on board is not enough, but monitoring, maintenance and verifications of the functionality are needed.
- The technical remote support from the supplier could help with the monitoring and maintenance of the STP processes.
- Automatization of the STP processes could help to prevent human errors and create smarter treatment processes.
- Aeration and mixing of the storage tanks could prevent the formation of hydrogen sulfide and hardening of the sludge. Also, online measurement of the hydrogen sulfide would prevent accidents.
- In larger vessels, the sewage sludges are dried and incinerated. The incineration ashes are then left at port.
- Water usage optimization for washing the hold would decrease the water volumes needing treatment (the bigger the volumes, the higher costs).
- Online measurements of wastewater quality could help to design correct treatment option e.g. for hold washing waters.

Discharging the wastewaters

The following improvement opportunities were suggested:

- Concentrating to the advance notifications, adding at least the existing information, where the wastewater is from, what kind of cargo has been washed (in case of hold washing waters), etc. The earlier the information reaches the waste management company, the better the waste can be handled, and the costs might as well decrease.
- Increasing awareness among ship personnel of the wastewater reception possibilities at ports.
- Separate reception facilities on each berth, i.e. adequate tanks or sewage disposal systems straight to drainage would make easier to leave wastewaters at ports.
- The port could give extra bonus (Baltic Sea Bonus) for ships that leave their wastewaters at port.
- Increasing environmental awareness and training of the ship personnel for them to better understand the consequences of wastewater discharges at sea.

Handling and utilization of the wastewaters according to circular economy principles

The following improvement opportunities were suggested:

- The grey and black waters could be led directly to the municipal wastewater treatment plants.
- The sewage sludges are good raw material for biogas production, where both energy and nutrients can be recovered and utilized
    - The biogas can be utilized e.g. as fuel for ships or other transportation
- Hold washing waters that contain fertilizers are important to get into treatment on land, as their nutrient load can be significant.
    - Selection of correct treatment method is crucial from circular economy as well as cost perspective, as fertilizers are very difficult in thermal and wastewater treatment, but easy to treat together with biodegradable waste in biogas plants (as long as they don't contain harmful substances for the biological process as contaminants).

4.1.3 Implementation of identified solutions

As stated before, discharging treated and even untreated sewage to sea is legally possible in current situation. Additionally, improving reception facilities is relatively expensive for ports which makes finding solutions more challenging than, for example, in case of improving reception facilities of solid waste. However, solutions were identified and listed during the workshops in this project. Possible solutions and parties that could be involved in their implementation are listed in Table 3.

Table 3. Possible solutions and parties to involve, to meet the identified challenges related to wastewater management

Implementation of identified solutions	Parties to involve in implementation
Extending sewer network to berths or utilize possible unloading place to existing sewer network instead of transporting wastewater all the way to water treatment plant	Ports, waste companies
Regular inspections of sewage treatment systems	Ship owners
Using small-scale water treatment plants in ports to avoid transportation of water by tank truck	Ports, waste companies
Common discount system for parties that have certified environmental management system with unambiguous rules and certifications listed	Finnish Port Association; Centres for Economic Development, Transport and the Environment (ELY); Traficom
Standardization of green shipping criteria and possible discounts in fairway dues or tax reliefs for parties fulfilling criteria	International authorities
Reduce the amount of wastewater at the begin of value chain by avoiding "unnecessary" washing of cargo hold due to contractual reasons without need from cargo point-of view	Charters, Bimco (contracts)

Mobile container for cargo hold waste water treatment to be able to treat water in port and discharge treated water in sewer network	Service provider of cargo hold washing; Centres for Economic Development, Transport and the Environment (ELY) for fixed term permit

4.2 Solid waste management

4.2.1 Current situation and challenges of solid waste management

The current situation of the solid waste management was discussed mainly during the interviews. The management on board and transferring the waste to port reception facilities as well as the challenges related to these issues are presented below.

In this report, general term "solid waste" is used to mean all waste types that are not waste waters. The term is almost a synonym to the term "garbage", which is used in Marpol Annex V and defined to include "*all kinds of food, domestic and operational waste, all plastics, cargo residues, incinerator ashes, cooking oil, fishing gear, and animal carcasses generated during the normal operation of the ship and liable to be disposed of continuously or periodically*" (IMO 2019b.) However, the term solid waste is not exactly defined in regulations and the selection of the term for this report has been done to emphasise the nature of the waste types from waste management and treatment perspective rather than regulative perspective.

Sorting of waste on board

It was noted that the solid waste fractions are collected separately and sorted quite well on board currently.

Regulations and classification of solid non-hazardous waste is regulated in MARPOL Annex V, Prevention of Pollution by Garbage from Ships. The recommended garbage types that should be separated, according to MARPOL Annex V are (THE MARINE ENVIRONMENT PROTECTION COMMITTEE 2017):

1. non-recyclable plastics and plastics mixed with non-plastic garbage
2. rags
3. recyclable material:
    a. cooking oil
    b. glass
    c. aluminium cans
    d. paper, cardboard, corrugated board
    e. wood
    f. metal
    g. plastics; (including styrofoam or other similar plastic material)
4. E-waste generated on board (e.g. electronic cards, gadgets, instruments, equipment, computers, printer cartridges, etc.)
5. garbage that might present a hazard to the ship or crew (e.g. oily rags, light bulbs, acids, chemicals, batteries, etc.).

In practice, the garbage types that are separated at the ship are dependent on several factors such as space, possibilities to arrange storage on board of different garbage fractions and the amount of separate types that are generated on board. According to interviews during the work, typical fractions to be collected are:

- food waste
- metal
- plastic (at some shipping companies)
- glass
- general / domestic waste.
- paper, cardboard, corrugated board, sometimes in different fractions
- oily rags
- e-waste

For example, food waste is often collected separately and discharged to the port reception facilities. For a ship arriving from a non-EU port, food waste is considered as international catering waste that must be collected separately from other food waste. Since international catering waste is not covered by the No Special Fee -system, related costs must be paid separately. However, as described earlier, international food waste can also be collected among mixed waste and in this case separate payment is not received. According to current legislation, international food waste cannot be used for biogas production.

The identified challenges related to sorting waste on board are presented in Table 4.

Table 4. Identified challenges related to sorting of waste on board.

Identified challenges
The MARPOL regulation uses different titles for waste fractions than what are used in the waste management ashore. Also, the guidelines for sorting and management of the waste might differ between MARPOL regulation and ashore.
The information according to MARPOL should be shared to the waste management companies handling the waste from ports in order the waste fractions to be better recycled and utilized.
All the ports are different, and their waste management differ from each other, thus the ship personnel might get confused of the different practices.
During longer voyages, biowaste will start to decompose. On-board treatment such as composting is difficult as the vessel is vibrating and densifying material. Many ships are therefore freezing the food waste before discharging it at ports.
Importance of the attitude of ship's officers towards sorting and proper waste management was emphasized.
After the waste fractions are sorted on board, someone from the ship's personnel will take the garbage out from the ship, normally in garbage bags. If the bags are not clearly marked with tags or by specific colour, it is impossible for the responsible person to recognise different waste types and to take them into right bins at the harbour.
Sometimes utilities that are brought to ships are overpacked or packed in unnecessarily big cardboard boxes, which generates waste in vain.

Waste fractions received at the port

The port waste management plan i.e. the port waste reception and handling plan has a central role in defining the management operations and final handling of the waste.

In Finland in general, Waste management plan regulated by the PRF directive and MYSL Act define the waste fractions that are collected in the harbours. Fractions are named according to Waste Directive, Finnish Waste Act and the Waste list (jätedirektiivi, jätelaki, jäteluettelo).

Garbage Record book is required from all ships of 400 gross tonnage and above as well as some other vessel types. (IMO 2019b)

The identified challenges related to the waste reception facilities at port are presented in Table 5.

Table 5. Identified challenges related to waste fractions received at the ports. Note that not all challenges are mentioned specifically in relation to the pilot ports but are general observations of ship personnel that are regularly visiting several ports.

Identified challenges
If waste has been sorted properly on board, but on the harbour wharf there is only a mixed waste container, it might frustrate the ship personnel and decrease their motivation in sorting.
If the waste reception area is in disorder and messy, it makes leaving the waste difficult or even impossible, and decreases motivation.
A route /passageway from berth to the waste reception facilities might be long, without signs and dark. Taking the waste from the ship by walking, especially by one person only, can be heavy job and include even safety risks. Also, if the distance to waste reception facility is long, leaving the waste to port is time-consuming and reserves one member of the crew for a long time.
Differences between sorting instructions on board and ashore can cause confusion.
In some ports, supervising right sorting is seen to be challenging

4.2.2 Improvement opportunities for solid waste management

Improvement opportunities for solid waste management, waste transportation and utilization were discussed and brainstormed in the workshops. Topics for the workshops were chosen based on the challenges identified during the interviews. Following improvement opportunities were identified for solid waste management.

Sorting of waste on board

Based on the interviews and workshop results, following improvement opportunities/activities were suggested:

- Sorting needs to be made easy and it has to be clearly instructed. It was proposed that different colour codes for different waste fractions would be used to signal different waste fractions both on board and ashore. Uniform Nordic pictograms (recycling symbols) are already widely in use in Denmark, Sweden, and Norway, and under way in Finland. Taking the pictograms into

use both on ships and in harbours would help to deliver waste bags into right containers.
- Collaboration between ships and shipowners as well as between different departments at ships should be improved.
- Waste generated on board comes from packaging, consumables, food etc. that are brought to the ship. All suppliers should be notified about the waste minimization target, so they could e.g. optimize the packaging materials. It is possible to consider taking waste minimization aspect into account when tendering the consumables contracts.
- General knowledge of waste management among ship personnel should be increased.

Waste fractions received at the port

Based on the interviews and workshop results, the following improvement opportunities/activities were suggested:

- It was recognized that it is very important to pay attention in keeping up the motivation of ships' personnel to sort and handle waste properly. Leaving waste at the ports should be made as easy as possible, keeping in mind that the smallest practical arrangements can have effect on the motivation of the personnel.
- Location to waste containers shall be clearly instructed, e.g. with maps at the berths, where the location of the waste reception area is shown.
- The route to the waste reception facilities should be clear, and clearly signed
- The waste reception area should be tidy and easily accessible, and bins easy to use. For example, in Oulu waste bins are located inside containers which are ventilated and lighted, and this was welcomed as good solution.
- Making sure that there is enough storage capacity in the containers and bins, requires follow-up and updates if necessary.
- The signals on the containers should be provided by several languages and clearly with universal symbols. Preferably same terminology as in MARPOL annexes should be used at least parallel to terminology ashore. Taking the Nordic pictograms into use both on the ships and in the harbours would help to deliver waste bags into right containers.
- Waste reception areas shall be as near the berth as possible. Recommendation would be to have mobile containers that could be moved near the ship during harbour stay (used in some harbours already). Additionally, port operating companies could be responsible of moving waste container to berth on ship arrival.
- Monitoring the waste volumes and ensuring that there is enough space in the containers.
- It was proposed that there would be a waste coordinator or a waste management officer at the port supervising and instructing on waste management and ensuring that facilities are working correctly.
- Orders of special waste management services would go through one person, who would have experience, information, and right contacts available.
- Harbour's waste management plan has central role in arranging the waste management in practice. Waste management plan defines what fractions are

collected and where. Continuous improving principle is to be followed to meet the practical requirements of the ships and to keep the waste management plan up to date.
- Improved communication and encourage to give feedback for other parties in waste management value chain would help to solve challenges related to every-day waste management.
- Giving credit and positive feedback on good work for a ship's personnel.

4.2.3 Implementation of identified solutions

As described earlier, challenges related to solid waste management seem to be related to differences in sorting on-board and ashore but also differences in procedures in different ports and ships. Some waste fractions are also more challenging than others, such as international food waste. Possible solutions to identified challenges and parties that could be involved in their implementation are listed in Table 6.

Table 6. Possible solutions and parties to involve to meet the identified challenges related to solid waste management

Implementation of identified solutions	Parties to involve in implementation
Reduce the amount of waste at the begin of value chain by reducing the amount of packing material	Ship owners, ship operators, Finnish Shipowners' Association, suppliers
Colour coding waste bags and containers both on board and ashore	Helcom, International Maritime Organization, ship owners, ports, waste companies
Ensure that waste containers in ports follow renewed legislation and requirements for waste management plan	Centres for Economic Development, Transport and the Environment (ELY) ; ports
Interim storage facility in port for biowaste to intensify transportation	Ports, waste companies
Harmonizing the waste collection practices between ports to correspond more in detail to practices on ships (which sort according to MARPOL rules)	Finnish Port Association, ports
Mobile waste container to improve service, supervise sorting and amount of waste	Ports, waste companies
Waste coordinator in each port to improve sharing information and supervise well-working waste management	Ports, waste companies
Common discount system for parties that have certified environmental management system with unambiguous rules and certifications listed	Finnish Port Association; Centres for Economic Development, Transport and the Environment (ELY); Traficom
Standardization of green shipping criteria and possible discounts in	International authorities

fairway dues or tax reliefs for parties fulfilling criteria	

4.3 Communication and Flow of Information

4.3.1 Current situation and challenges of communication and information flow

The interviews and workshops were used to acquire information on what the challenges and bottlenecks regarding the waste management information flow on ships and portside operations are. The main issue for the key players was identified as lack of common information systems. Different services and practices offered in different ports mean that crew on board needs to find relevant information from fragmented sources. Problems deriving from this take many forms, which are briefly described below.

Each operator (ship, port, waste management company) collects data on waste and waste management according to their own guidelines (e.g. MARPOL at sea, port waste management plan and national legislation on land), resulting in mismatched waste labelling.

To sort waste exactly according to every port's requirements, crew would need advance information on which waste fractions are accepted in different ports and what are instructions on their sorting. Sorting instructions might differ by every port even in one country, as they reflect the requirements of local waste management systems and -processes.

A related issue transpired from the workshop conversations: Shipping companies often have explicit guidelines for waste management, and procedures and sustainability in waste handling has been considered. Implementation of the guidelines might however vary on ships, for reasons that remained unclear. Possible identified reasons could be lack of education on the environmental issues, or lost motivation for example because of non-systematic sorting instructions and labelling.

Ships arriving to ports need to give advance waste notification to port according to time limits stated by MARPOL. Waste notification includes information about waste that is intended to be left during the port visit. Standard waste streams that are handled with clear routines are normally part of everyday work for the ports and would not require pre-information from the arriving ships in order to receive the waste. For non-standard, occasionally arising waste streams like holds' washing waters, on the other hand, the port operators receive information on the contents of waste usually too late. If the information of waste amount and its properties would reach the port early enough, the waste management operators would have enough time to arrange an optimal treatment method for the waste and ensure cost-effective service.

No special fee -arrangement can be an effective system in ensuring that there is financial incentive for the ships to leave their waste at the ports and not discharging them into sea, as the ships have to pay the fee in any case, did they leave waste at the port or not. However, the system has some drawbacks from the perspective of efficient waste management. As the ports need to decide in advance the waste fees without knowing the amount of ships visiting the port in the coming year or the amount of waste they leave, they need to make compromises on the level of offered

services to avoid excessive cost burden, which could affect their competitiveness. Under No Special Fee -system, ports receive waste fees regardless of the amount of received waste. This way the system may not encourage ports from financial point of view to develop their waste management as the waste fee is received from all visiting ships.

Additionally, the system can unintentionally make the port act as a gatekeeper of the information, as the ships and waste management companies do not naturally discuss about the waste, as the ships are in contact with the port, which in turn is in contact and contractual relation with the waste management company. Information that could be relevant from the technical perspective, isn't necessarily transferred effectively as it can change, dilute, or be delayed during the information transport chain. Understanding about the circumstances on the ship doesn't reach the waste management company and on the other hand the ships and shipping companies do not receive exact information about the treatment methods and plants ashore.

One of the most commonly identified challenge coming along with the renewed legislation is related to waste delivery receipt. In current situation there might be no possibility in ports to verify the amount of different types of waste. Thus, waste delivery receipt is often given based on the information that port received with advance waste notification.

The identified challenges related to communication and flow of information are presented in Table 7.

Table 7. Identified challenges related to communication and flow of information.

Identified challenges
Often, the waste volumes reported in the advance waste notification are estimated by visual approximation, and the port as well as the waste management companies would need more accurate information for the reporting and planning purposes. For managing standard waste streams, inaccuracy normally isn't a problem, but in case the port needs to order a separate truck to receive the waste, it is more important to get exact information on the waste amount.
Waste notification is often sent via email. Usually steps are: ship → agent → port → waste company. It is noticed that there are too many manual steps and there are cases when waste company gets information too late or not at all.
Data that is required to be gathered about the waste is regulated according to MARPOL regulations and is relevant from the marine environment protection perspective. However, it is not often sufficient or relevant from the perspective of planning cost-effective treatment for the varying waste streams.
The information regarding waste management possibilities and services at ports are separated and the information is often difficult to find.
The knowledge and awareness of the requirements and guidelines is often inadequate among the ship personnel.
There is often a misunderstanding among the ship personnel, that treated wastewaters would be harmless for the marine environment, which is not the case, as they contain a lot of nutrients and other pollutants.

Shipowners often have well established environmental guidelines and sustainability/responsibility strategies. However, the information does not always reach the ship personnel or is not fully implemented in waste management practices. For ship owners it is easier to instruct on control their own ships than time-chartered vessels.
Currently there might be no possibility to verify ship-specific waste amounts in ports for providing waste delivery receipt.
Centres for Economic Development, Transport and the Environment (ELY) are working independently on their territories and coordination of supervision conduction in different ports has not been observed. When it comes to environmental permit, it is observed that Centres for Economic Development, Transport and the Environment might conduct supervision according to land-side legislation leaving maritime-related legislation with less attention.

4.3.2 Improvement opportunities for communication and information flow

Improvement opportunities for communication and information flow were discussed and brainstormed in the workshops. Topics for the workshops were chosen based on the challenges identified during the interviews. Following improvement opportunities were identified for communication and information flow.

To alleviate the problems deriving from information availability, Baltic Sea Action Group (BSAG), together with the Finnish maritime cluster, has created an information package on waste collection in different ports. The information package is online, and it contains facts about pricing and waste fractions collected in each port (Available: https://www.bsag.fi/wp-content/uploads/2021/03/BalticSeaWasteFee-info_Port-of-Rauma_202103.pdf). The package aims at improving the information flow, and waste management onboard the ships and ashore. Correct separation of waste could further be made effortless by implementing the Nordic pictogram- and colour coding of waste both in ports and on board the vessels. Environmental education of the crew is also crucial, as attitudes were identified as an important factor in waste recycling.

The waste management facilities benefit from advance knowledge on waste properties. Composition of solid waste is commonly well described or known, but liquid wastes, e.g. hold wash waters' chemical data is often insufficient in relation to the needs of the waste treatment operator, as the requirements for information are regulated from marine environment protection perspective. When waste is labelled as unknown, the inherent liabilities increase costs. As different individuals are responsible for operation and handling of costs, the parties do not have an interest in making a difference to avoid suboptimal solutions. This issue could be mitigated by creating ready specs from the waste handling unit to the ships. The crew could then choose from different wash water types. The different types could be integrated in agreements on waste handling costs.

A new information system, Nemo, is currently being developed and planned to be released in 2025. Nemo could be answering to many information flow- and communication-related issues presented in this report. Different stakeholders should be (and already are) brought together to discuss about functions that should be added in Nemo system. As there are still some years before Nemo is released, some issues,

such as waste delivery receipt, might need temporary solutions as legal obligation is already in place.

Improvement opportunities:

- The advance notification of the waste (fractions, quality and volumes) should be done as soon as the information is available.
- Increasing awareness and knowledge on environmental issues among ship personnel, e.g. already during the nautical school.
- Increasing awareness and knowledge about the requirements and guidelines, especially about the No Special Fee -system.
- Determining responsibilities for updating the information, as databases are only as good as the quality of information filled in, which in turn requires work from the parties.
- Harmonizing the practices at different ports.
- Establishing and maintaining good communication and information flow between different stakeholders. The ports to take a strong role in delivering information between different parties. Alternatively finding practices through which the waste management companies can discuss the waste composition directly with the ship from the technical perspective, to ensure most cost-effective treatment method and ensuring that the contractual conditions make this possible.
- The shipowners could use the sustainability and responsibility as a branding tool for marketing responsible transportation. As stated earlier, it is easier for shipowners to control their own ships than time-chartered vessels. Shipowners should find ways to expand their sustainability-related best practices to time-chartered vessels as well.
- The existing or new systems (Portnet, Port Activity, NEMO) could have extra services about waste management issues to boost efficient information exchange between different parties in the waste chain.

4.3.3 Implementation of identified solutions

As identified during interviews and workshops, information flow through value chain could work better for stakeholders to receive relevant information as soon as possible. Recently renewed legislation set new requirements for ports and based on information gained during this project, new or updated information technology systems could respond to some of these challenges. Waste delivery receipt is a good example of a challenge that information technology together with standardised processes is seen to offer solutions. Reception facilities, for example previously mentioned mobile waste container, could possibly be equipped with system measuring the amount of waste by type and logging them automatically in the system.

It is identified that there is a need for unified procedures for ports to share information about their services and practices. Raising awareness related to environmental aspects among maritime industry has been seen to support change in ways of acting. Possible solutions to identified challenges and parties that could be involved in their implementation are listed in Table 8.

Table 8. Possible solutions and parties to involve to meet the identified challenges related to communication and flow of information

Implementation of identified solutions	Parties to involve in implementation
Increase environmental awareness among ship personnel and maritime students	Ports, agents, ship owners, maritime educational institutions, Baltic Sea Action Group
Increase awareness of wastewater and solid waste utilization	Ports, agents, ship owners, maritime educational institutions
Further increase awareness among ship personnel about no-special-fee system	Ports and agents
Develop standardised process for verifying the amount waste ship-specifically and system to save the information automatically. Include user-specific interfaces for all relevant actors (for example waste carrier) in waste management value chain to add information in the system.	Ports; waste companies; Finntraffic, NEMO project
Order for waste company based on waste notification and implement function to create waste delivery receipt in NEMO system	Finntraffic, NEMO project
Improved cooperation in regulatory control, sharing focus areas among authorities in supervising and instructing ports	Centres for Economic Development, Transport and the Environment (ELY); Traficom
Instructions for ports for interpretation of the law and regulations	Relevant authorities and unions
Standardized form to share information related to port waste management such as waste fees, reception facilities and other relevant information	Ports, Finnish Port Association, waste companies
Benchmarking of good waste management practices from ports in other countries	For example Ecoports (European Sea Port Association), IAPH (International Association of Ports and Harbors)

5 Conclusions and recommendations

As a result of the project, an overall picture of the issues and challenges related to the waste management at shipping and port operations as well as the goals and the willingness of the stakeholders to improve the current situation, was assessed. New ideas and best practices for improved waste management and utilization and better communication were generated, and improvement opportunities suggested based on circular economy principles.

Active communication and collaboration are vital for understanding the environmental boundaries and possibilities within the value chain. This project has already brought the stakeholders together, and concrete collaborative results have already been

gained, e.g. in the field of utilizing the hold washing waters to recover valuable compounds such as nutrients. Workshops that were arranged during the project showed that there is space for more information and experiences exchange between stakeholders onshore and offshore - issues that are clear at a waste management company are not known at the ships, and on the contrary, there can be circumstances on the ships that affect the waste management chain significantly but are not familiar to waste management companies that work mainly on land.

No special fee is an effective system from the perspective of protecting marine environment but can involve inefficiencies in the information flow from ships to ashore and can decrease flexibility in terms of waste management solutions. The project showed that there is space and willingness to increase the discussion and therefore understanding of the circumstances at the sea and ashore for different parties. Ships, ship owners and marine authorities can learn more about the waste management ecosystem on land. The port is part of the ecosystem, and surrounded by different types of waste treatment plants, which serve large number of different customers. Operators on land on the other hand meet customers who can change their location, i.e the ships visit several ports with varying waste management systems and instructions, not to mention the other ships of the shipping company, or even the time-chartered vessels. This sets the ships waste management challenges that are unique compared to waste management on land. Information exchange system Nemo is currently under development and its potential should be utilised also to boost efficient information exchange between different parties in the waste chain.

According to the results of this project, it would be recommended to increase awareness and knowledge of environmental protection among seafarers and to provide more environmental education for ship personnel, already during the nautical school. This would hopefully increase the willingness for voluntary actions regarding the waste and wastewater management and their disposal at port instead of at sea. In addition to raising environmental awareness among stakeholders, it would be equally important to communicate actively about waste utilization – my waste can actually do something good, if I only deliver it to port. Also, keeping up the motivation of the crews by making sure that small practical issues work in every part of the waste chain, and continuously finding ways to improve existing practices.

Legislation that has been renewed in 2021 requires improved waste management in ports but also on-board. Some parts in fulfilling the requirements of the renewed legislation have been seen rather challenging. In general, finding common solutions and unifying procedures and working ways among different ports and other stakeholders have been seen as a good way of facing challenges. Notable is that, even though ports are different from each other, significant share of identified challenges seem to occur in more than one port. This shows the importance of finding and sharing best practices through cooperation and benchmarking. Best solutions seem to be the ones that can be used commonly but can also take port-specific needs into account. Standardized form to share information related to port waste management is good example of this – common and clear for everyone but still applicable according to port-specific needs. In addition to stakeholders that are directly included in waste management value chain, also authorities could take more active role in improving cooperation and unification of guidance and supervision.

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Appendices

Appendix 1: The interviewed stakeholders.

	Role	Company
CASE: Port of Oulu	Port	Port of Oulu
	Port operators	Herman Andersson Oy
		BB Logistics
	Shipowners	Royal Wagenborg
		Terntank
		Meriaura Group
	Ships	Mirva VG (Meriaura Group)
		Ternsund (Terntank)
		Thamesborg (Wagenborg)
	Ship services and gate operations	Securitas Oy
	Ship chandler	Ab ME Group Oy Ltd
	Waste Management	Lassila & Tikanoja Oy
		Fortum Waste Solutions Oy
		Kiertokaari Oy
		Gasum Oy
		Oulun Energia Oy
	Nearby industry	Stora Enso Oyj
	Union for the ports	Finnish Port Association
	Water conservation association	Vesiensuojeluyhdistys
CASE: Port of Rauma	Port	Port of Rauma
	Port operators	Euroports
	Ship agency	Gac
	Shipowners	RABN
		Essberger
	Waste management	RTK-palvelu
	Authority	Centre for Economic Development, Transport and the Environment
CASE: Port of Kokkola	Port	Port of Kokkola
	Port operator	Rauanheimo
	Ship agency	Jalander
	Shipowners	Arctia
		ESL Shipping
		Utkilen
	Waste management	L&T
Others	Shipowners	Finnlines
		Langh Ship / Hans Langh

Appendix 2: BSAG stakeholder event 4.5.2022 workshop results

Jätteiden käsittelyyn liittyvän toiminnan yhtenäistäminen			
Jätekuitti			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1		Kiinteän jätteen kuitti	Tekniikan kehittäminen
Ryhmä1	Satama, jätehuoltoyhtiö, IT	kuitin saaminen virka-ajan ulkopuolella	Vaatii henkilön paikalle
Ryhmä2	Fintraffic Nemo-hanke	Toteutetaan yhdenmukainen jätetositteen tuottaminen Nemoon	
Ryhmä2		Aluksille ja varustamoille tietoa	Määrän todentaminen
Ryhmä3	Vastuulliset tahot tietoon, automatisointi tiedonsiirtoon	Jäteilmoituksen ja -kuitin prosessi ja vastuut sen eri osissa tarvitsevat täsmennyksen	Tiedon saanti automaattisesti
Ryhmä3	IT-palveluntarjoaja, esim. Unique Port Activity sovelluksen kautta	Tilavuus- ja painomittojen konversio suuntaan tai toiseen	
Ryhmä3		Satamiin purettujen jätemäärien tilastointi	
Ryhmä3		Yhtenäinen jätekuitti --> Nemo? (Portnet korvaaja)	
Ryhmä3		Jätemäärä sen jätteen osalta, mikä vain jätetään astiaan	
Ryhmä3		Tietojen toimittaminen yhden rajapinnan kautta	
Ryhmä3		Tilaus-toimitus-kuittaus sludgen osalta	
Jätehuoltosuunnitelman tarkentuneet sisältövaatimukset			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä2	Ely-keskukset	Vaadittavat keräyspisteet	Ei ole operatiivisia tarkastajia, viranomaiskoordinaatio
Ryhmä2	Helcom; IMO:n kautta kaikkiin aluksiin; Jätehuoltoyhtiöt	Jätesäkit värikoodien mukaan satamassa ja laivalla	Tiedon jakaminen aluksille
Ryhmä2		ELY-keskukset ja Traficom yhteistyö parannettava viranomaisvalvonnan osalta	
Ryhmä3		Uusien jätejakeiden nimeäminen yhdenmukaisesti (termit, kuvat, värit)	Onko aikaa? Millä perustellaan?
Ryhmä3	SYKE	Satamissa samanlaiset jäteasemat ja samanlaiset toiminnot ja jätehuoltosuunnitelmat	Satamilla eri määrä rahaa. Myös fyysiset erot.
Ryhmä3		Keskustelun lisääminen eri liittoihin/yhdistyksiin. VVL? Muita?	
Viranomaisten tulkinnan yhtenäistäminen satamien välillä			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1	Viranomaiset ja toimialaliitot	Ohjeet viranomaisilta satamille lain tulkintaan (esim. ruumien pesuvedet)	
Ryhmä1	Viranomaiset ja toimialaliitot	Voiko viranomainen antaa suosituksia?	
Ryhmä2	Satama ja viranomaiset	Jätemaksualennukset	Tahto
Ryhmä2	Komissio	EU-lainsäädännön tulkinnan erot: kielierot, ristiriitaisuudet	
Ryhmä2	Satama	Sanktiot, jos ei lajittelua	Ei lakiperusteita
Ryhmä3	Ympäristöministeriö --> ELY-keskukset	Miten kv-ruokajäte voitaisiin ohjata hyötykäyttöön	Poistetaan kv-ruokajätteen erityissääntö - kestää kauan / kuka vie asian eteenpäin?
Ryhmä3	Sovittava hallinnon sisällä / hallitusohjelma	Valvonnan ja ohjeistuksien keskittäminen yhteen ELY:n yhden teeman osalta	
Ryhmä3	Lisää tiedotusta: EU/Helcom/jäsenvaltiot; Lisää valvontaa asiassa - ELY	No-special-fee suosituksia ei noudateta Itämeren alueella	Varustamot ja laivat eivät tiedä mahdollisuuksiaan
Satamakohtainen tietopaketti laivoille			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1		Tiedon esittäminen eri satamissa yhdenmukaisella tavalla ja selkeästi	
Ryhmä1	Satamaliitto, laivameklarit	Tiedon jakaminen helposti (sähköinen ja paperi)	
Ryhmä1		Hinta, aika, paikka, palvelun tilaaminen	
Ryhmä2		Vesien purkumahdollisuus	Kansallisen harmonisoinnin aikaansaanti
Ryhmä2	Satama/satamaliitto, ELY	Standardi formit	
Ryhmä2	Fintraffic Nemo-hanke	Tiedon jakaminen osana VTS Master's guide tietoa	
Ryhmä3		Yhtenäiset merkinnät jätepisteille (jätelajit)	
Ryhmä3	Yhtenäinen malli / yhteistyössä eri toimijoiden kanssa	Edesauttavia asioita: tiedot riittävän ajoissa (koska noudettava), riittävän yksilölliset tiedot (laji, määrä)	
Ryhmä3	Yhtenäinen malli / yhteistyössä eri toimijoiden kanssa	Yhteneväiset tiedot: no-special-fee sisältävät jakeet, jätepisteiden tiedot ja sijainti, mistä saa lisätietoja	
Ryhmä3	Euroopassa esim. Ecoports (European Sea Port Association) ESPO alaisuudessa. IAPH (International Association of Ports and Harbors)	Hyvien esimerkkien kerääminen muista satamista maailmalla	Jonkun pitää seuloa vaihtoehtoja, jotka voisivat sopia Suomeen --> erilliset yhteistyöryhmät
Ryhmä3	Agentti	Tiedottaminen hyvissä ajoin ennen, kuin laiva saapuu satamaan	Miten varmistetaan, että päätyy oikealle henkilölle aluksella
Ryhmä3	World Maritime University	Tietoisuuden lisääminen ravinteiden poistosta	Merenkulun pakolliset koulutusvaatimukset
Tiedonkulun parantaminen uusilla tai olemassa olevilla järjestelmillä (Nemo, Port Activity)			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1		Mahdollisimman paljon tiedonkulusta sataman järjestelmään mm. noutopalvelun tilaaminen	
Ryhmä1	NEMO + toimijat	Alusjäteilmoitukset --> suorat tilaukset jätehuollon toimijoille	
Ryhmä1		Jätepistekartta	
Ryhmä1		Jätehuollon toimijan tiiviimpi suhde agentteihin ja varustamoihin	
Ryhmä2	EMSA,IMO, Traficom	Standardit formit	Pitkä aikajänne
Ryhmä2	Satamaliitto, Fintraffic Nemo hanke	Rajapinnan ja prosessin digitalisointi	
Ryhmä2	Fintraffic Nemo hanke	Standardisoidut palvelut ennakkoilmoituksen ja kuitin tekemiseen, säilömiseen ja jakamiseen	
Ryhmä3	Port Activity / Unikie: kehitys siihen suuntaan, mitä satamat ja toimijat yhdessä haluavat	Ruumien pesuvesien sisältämät lastijäämät ja pesuaineet --> kuka tietää? Kuka tarvitsee tiedon?	Kenen kautta tieto "tuutataan" eteenpäin ja kenelle viime kädessä - "loppukäyttäjää" usein vaikea tunnistaa henkilö-/yritys-/toimenkuvatasolla
Ryhmä3	Jätehuoltoyritykset --> satamat --> agentit --> laivat	Ajoituksen ennakointi, riittävä tarkkuus - mahdollisuus tiedolle, "älykkäät lomakkeet"	
Ryhmä3		Tiedonkulku varustamon ja laivojen välillä! Varustamo maksaa, laiva tuottaa jätteet	
Ryhmä3	Finntraffic	Port Activity palvelutilaus ja rajapinta Nemoon	
Ryhmä3		Palvelutilauksissa myös aika, milloin palvelua tarvitaan	
Ryhmä3		"You are entering Baltic Sea - no shit to sea!"	
Ryhmä3	BSAG tai muu tutkimusta tekevä instanssi --> agentit --> laivat	Tieto varustamolle siitä, mikä ympäristökuorma aiheutuu laivojen puhdistetuista käymäläjätevesistä	

Kiertotalouden edistäminen ja jätteiden hyötykäyttö			
Syntyvän jätteen vähentäminen arvoketjun alkupäässä			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1	Varustamot (vrt. Maersk)	Asennekasvatus/tiedon lisääminen (käytännön kokemus: vesipulloista luopuminen on ollut vaikeaa, koska epäillään, voiko tankki/hanavettä juoda)	Lajittelun onnistumisen seuraaminen laivalla
Ryhmä1	Aluksen päälliköt	Suositukset varustamoille, tieto halvoista jätejakeista vs. kalliista --> optimointi	
Ryhmä1		Jäteraportoinnin hyödyntäminen / jätejaeanalyysit --> suositukset	
Ryhmä1		Kannustimet, jos toimit oikein saat alennusta	
Ryhmä1		Laivojen jätteen sisälogistiikka	
Ryhmä2	Rahtaajat, sopimukset (Bimco)	Lastiruumien "turhat" pesut (pestään ruuma sopimuksen velvoittaessa, vaikka ei olisi lastin puolesta välttämätöntä)	Kustannusten jako
Ryhmä3	Lainsäädännön kautta	Muonitusyritysten vastuuta pitäisi parantaa	Asian vastustaminen yritystasolla
Ryhmä3		Tilausten optimointi, jotta jätettä/pakkausjätettä syntyisi vähemmän	
Ryhmä3		Muovipakkaukset vain sitä laatua, mitä kotitaloudet keräävät tai sitten uusiutuvia pakkauksia	
Ryhmä3		Pakkausmateriaalin korkeampi verotus	
Jätteiden hyötykäyttö biokaasun tuotannossa			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä2	Ruokavirasto, LVM, Syke, EU parl. - Asiasta keskustelu komission alatyöryhmässä	KV-ruokajäte asetusten muuttaminen EU parlamentin kautta	Koordinaatio, jäsenmaiden konsensus asiassa
Ryhmä2		Satamien kiinteä viemäröinti tai jätevesisäiliö mustille ja/tai harmaille vesille --> kunnalliseen jätevesiputsariin	
Ryhmä2	Satama	Sataman ruokajäteastiat lähelle aluksen laituria - pussit ovat painavia	Halu
Ryhmä2	Komissio - EFSA	KV-ruokajätteen riskiarviointi	Jäsenmaiden tahtotila, eläintautitilanne
Ryhmä3	Hallitusohjelmaan? Kuka?	Biojätteen hyödyntäminen (ruokajäte)	
Ryhmä3	Eri lainsäädäntöjen yhteensovittaminenmerenkulun ja satamien asioissa sekä KV & kansallisella tasolla viranomaisten kesken	Kansainvälinen vaikuttaminen EU-tasolla --> lainsäädännön muutokset	
Ryhmä3		"Miniputsarin" käyttäminen satamassa --> vähentäisi jäteveden kuljetuksen ympäristövaikutuksia	
Ryhmä3	Parempi lajittelu laivalla --> puhdasta ruokajätettä	Tuoko välivarastointi satamissa lainsäädännöllisiä lisävelvoitteita? Auttaisi tehostamaan kuljetuksia	
Ryhmä3		Jätevesiverkoston hyödyntäminen pumppaamojen sijaan jäteveden purkupaikkana putsarin sijaan	
Lajittelun helpottaminen satamassa			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1	Satama + meklarit kahville	Lajitteluohjeistus - manuaali, joka kaikkien satamien käytössä / monikielinen --> voi lähettää varustamoille ja laivoille	
Ryhmä1		Opasteiden yhdenmukaisuus satamissa. Symbolit / värit. Yhdenmukaisuus MARPOLin kanssa	
Ryhmä1	Satamaliitto, laivameklarit, jätehuoltoyhtiöt	Yhtenäinen ohjeistus lajitteluun (kuvallinen --> ei kielimuurihaasteita)	
Ryhmä1	Jätehuoltoyhtiöt	Yhteispohjoismaiset symbolit	
Ryhmä1	Varustamon aktiivinen palaute satamille, laivojen aktiivinen palaute varustamoille	Säännöllinen valvonta & jatkuva kehittäminen (jätekoordinaattori)	
Ryhmä2	Satamat yhdessä	Yhtenevä konsepti satamille: symbolit, värit, tekstit	
Ryhmä2		Naantalin sataman mobiilikontti - nähdään hyvänä esimerkkinä muille satamille	Kustannus
Ryhmä2		Jätehuolto palveluna laivalle - nouto alukselta	Kustannus
Ryhmä2		Lajittelu ja vastaanotto tulee olla samalla tavoin toteutettu	Tahto
Ryhmä3	Esim. valmiita piktogrammeja on - pitäisi vain päättää, mitä käytetään --> riittävän iso alueellinen taso (Helcom?)	Kansainväliset piktogrammit käyttöön laivoilla ja satamissa	
Ryhmä3	Satamaliitto veturina	Selkeät yhteneväiset merkinnät, kansainvälisyys huomioitava	
Ryhmä3	Tuotteiden valmistajien tiedot ainesosista ja/tai "tyyppiluokittelu"	Kiinnitysköysien kierrättäminen	Kierrätysfasiliteetteja ei Suomessa
Ryhmä3	Satama tai ulkoistettu palveluntarjoaja	Kiertävä jätteiden vastaanottoauto hakee jätteet laivoilta	Kuluerä, auto ja kuski. Aikataulut ja päivystys.
Kannustimet ympäristöystävälliseen jätteidenkäsittelyyn			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1		Laivoille alennukset jätemaksuista --> yhteneväiset käytännöt	Verifiointi - käytännön ohjeistus satamille
Ryhmä1		Mielummin porkkana, kuin keppi. Kuitenkin hallinnollinen taakka kasvaa, mitä enemmän myönnettäviä alennuksia --> toimivat alennukset käyttöön	Kaikille yhteidet vaatimukset paremmin tietoon
Ryhmä1	Jätehuolto-operaattori	Tietyille jakeille kiertotalousratkaisujen etsiminen (muovit, kuidut..)	
Ryhmä1		Alennukset!	
Ryhmä2	Satamaliitto	Yhteneväiset alennuskriteerit jätehuoltomaksuissa Itämeren satamissa - PRF asetukset 2022	Koordinaatio
Ryhmä2	Viranomaiset ELY, Traficom	Ympäristösertifikaattien hyödyntäminen	Asenne
Ryhmä2	Satama	Hyvin toimiviin satamiin jätetään paljon jätettä --> kustannus satamalle --> voiko satama taktikoida	
Ryhmä2		Hyvät alennukset ja edut varustamoille	
Ryhmä3	Viranomaistaho, kansainvälinen	Toimijoille "green" merkintä, joka tuo verohelpotusta tai alennusta väylämaksuista	"green" määrittely ja valvonta
Ryhmä3	Satama/satamat yhteistyössä	Jäteneuvontaa satamassa asioiville aluksille (jätetalkkari)	Voiko kulun sisällyttää aluksien jätemaksuihin?
Ryhmä3	Satama/jätehuoltoyritys yhteistyössä	Vasrustamo-/aluskohtaista palautetta ystävällisessä hengessä?	
Ryhmä3	Yhteistyö ohjelmana/hankkeena --> erillisiä ympäristöohjelmia/rahastoja	Investointituki satamille jätevesien jättemisen infran kehittämiseen	Mistä rahat? Tarvitaan usein myös esim. projektien konsortioiden yhteentuomista
Ryhmä3	Ympäristötunnustuksia jakavien tahojen listaaminen	Edelläkävijyydestä tunnustus	Indeksejä ja serttejä alkaa olla paljonerilaisia ja niiden saamisessa eri kriteerit - paljon paperityötä
Ryhmä3	Tiedot sertifikaateista NEMOon	Green shipping - jätehuollon näkökulmien vieminen näihin / korvaava yksi ovi	
Ryhmä3		Merenkulun ympäristöystävällisyys - kriteerien standardointi	

Tietoisuuden lisääminen eri toimijoiden keskuudessa			
	Mitkä tahot voisivat toteuttaa toimenpiteen	Tarvittavat toimenpiteet	Mikä on suurin haaste toimenpiteen toteuttamiseksi
Ryhmä1	Satamat / agentit	Edelleen lisää tietoa laivoille no-special-fee-järjestelmästä	
Ryhmä1	Satamat / agentit	Jätekoordinaattori / kiertotalouskoordinaattori	
Ryhmä1		Tehdään tämäkin hauskaksi: kisoja, palkitaan parhaat yritykset	
Ryhmä2	Satama	Aluksen kuittaus tiedon vastaanottoon	Tahto
Ryhmä2	Satama, alus, jätehuoltoyhtiö	Tavanomaisissa jätteissä biojäte aina ongelma	
Ryhmä2	Satama, Fintraffic - Nemo-projekti	Tiedon jakaminen osana muita satamakäyntiin liittyviä tietoja	Halu
Ryhmä3	IMO, EU, Helcom, Satamavaltio	Lainsäädännön kautta	Pitkä prosessi, konsensuksen löytäminen
Ryhmä3	Satamaliitto, Suomen varustamot	Toimialajärjestöt, yhteistyö	
Ryhmä3	Satama ja agentit	Laivainfon tehokkaampi jakaminen	Pitää täsmentää vielä, minne jaetaan ja miten
Ryhmä3		Tarinoita siitä, mitä eri jätejakeista tehdään kierrätettäessä	