

Feasibility study

1. Introduction

The shipping industry is the blood system of the global economy. According to UNCTAD, more than 80% of the world's trade is carried by sea [1], and other sources speak of more than 90% [2] (also ILO 2001; ICS 2020). The entire fleet must operate safely, securely, efficiently and in an environmentally compatible manner [2].

Waste generated by shipping and its proper disposal and treatment is one of the most important issues for a sustainable global transport system. According to Directive on port reception facilities for the delivery of waste from ships (EU, 2019/883) "ship-generated waste" means all waste, including cargo residues, generated during the operation of a ship or during loading, unloading and cleaning operations and falling within the scope of Annexes I, II, IV, V and VI of MARPOL, as well as passively fished waste; while "cargo residues" means the remains of cargo material on board which are left on the deck or in holds or tanks after loading or unloading, including surpluses or spillages resulting from loading or unloading, whether in a wet or dry condition or carried away by the wash water, with the exception of cargo dust remaining on the deck after sweeping or dust on the external surfaces of the ship.

The Port of Koper is the only Slovenian multipurpose port and its activities influence the development of the region, the Slovenian economy and logistics in this part of Europe. The Port of Koper is operated by the public/private company Luka Koper. The company Luka Koper INPO (wholly owned by Luka Koper) facilitates the collection of ship waste by providing its PRF's (port reception facilities).

Port of Koper covers an extensive water and coastal area where port activities for the freight transport and activities for passenger transport are carried out. The main activity of the port is the handling and storage of all kinds of goods. The Port of Koper offers eleven basic services (loading and unloading of ships, loading and unloading of trucks, loading and unloading of wagons, embarkation and disembarkation of passengers, storage, delivery, berthing of ships) and a number of additional services for goods and other services that provide comprehensive logistic support to customers. The Port of Koper has twelve specialized terminals for carrying out the basic port activities of handling and storage. They are divided into five profit centers. The terminals are organized according to the goods or cargo they receive:

- Container Terminal: The terminal performs all kinds of manipulations with ordinary, refrigerated, grouped and other special containers. The total area of the terminal is 270,000 m², of which 180,000 m² is storage area. The coastline is 596 m long. The terminal has 4 berths and the maximum permissible draft is 14.5 m. In addition to handling and storage, the terminal also provides various auxiliary services (filling and emptying of containers (CFS), disinfection, chemical cleaning of containers and cleaning of containers with steam, PI or pre-trip inspection of containers before the voyage, container repairs and other work on containers). They also organize the maintenance of refrigerated containers.

- **Car and RoRo Terminal:** The Port of Koper operates one of the most modern and largest car terminals in the Mediterranean. It handles vehicles from more than twenty manufacturers from all over the world, as it manages the flow of goods from European production for export and mainly from Japanese, South Korean and Turkish production for import. In addition to new and used passenger cars, the terminal also handles trucks and other specialised vehicles. The operational coastline is 800 m long. The terminal has 8 berths and 4 ro-ro ramps. The one-time capacity of the open areas is 33,000 vehicles and that of the covered areas 6,000 vehicles.
- **General cargo Terminal:** In the Port of Koper they are trained for transshipment and storage of various cargoes: Coffee, sugar, rice, paper, cellulose, magnesite, aluminium, pipes, rails, white goods, project cargoes and many others that differ in weight, volume, shape and other characteristics. They manage about 100 product groups every day. The goods can be in bags, boxes, cartons, bales, rolls, bindings, barrels, on pallets, in big bags and similar units. For high-quality, fast and safe handling of goods, their storage and packaging, the terminal is equipped with special machines, modern equipment, grabs, accessories and tools, as well as appropriate warehouses, and the services are performed by professional and qualified personnel. The operational shore of the terminal is 840 m long. The terminal has 6 berths with a depth of 7 to 10 m, or up to 12.5 m by prior arrangement. The total area of closed multi-purpose warehouses is 139,400 m², open warehouses 40,000 m² and covered warehouses 3,600 m².
- **Refrigerated cargo Terminal:** The terminal is equipped with modern, computer-controlled warehouses where temperature, humidity and air circulation can be regulated. This ensures that the quality of the goods remains unchanged even during prolonged storage. The length of the coast is 450 m. The terminal has 3 berths, the sea depth is 8-10 m. The air-conditioned warehouse with the possibility of regulating humidity and temperature from 0-20 °C is 25,800 m², and the freezer room up to -18 °C is 2,000 m².
- **Timber Terminal:** The port of Koper has been handling timber for more than 30 years. The terminal is technically and professionally trained for the handling and storage of sawn timber and semi-finished wood products. Under the extensive covered storage halls, the timber is protected from precipitation, and the favourable climatic conditions create ideal conditions for natural drying and thus an increase in the quality of the timber. The area of the closed storage areas is 60,500 m² and the area of the open storage areas is 90,000 m². The annual capacity is 1,500,000 m³.
- **Bulk Cargo Terminal:** The terminal handles minerals, industrial minerals, and other bulk commodities. These are mainly bauxite, borax, cement, phosphates, ilmenite, clinker, perlite, sintered magnesite, scrap iron and others. Up to four trains a day are loaded and unloaded with this cargo. The operational coastline is 525 m long. The terminal has 3 berths and the sea depth is 6-12.5 m. The closed and covered storage capacity is 80,000 tons and the open storage capacity is 40,000 tons.
- **Silo Terminal:** Various types of grains and feeds are handled and stored at this terminal.

The operational coastline is 500 m long and the sea depth is 13.5 m. The storage capacity of the silo is 60,000 tons and the storage capacity of the triangular/floor sheds is 55,000 tons.

- Alumina terminal: The alumina terminal is an organizationally and technologically complete unit where the handling and storage of sandy alumina, which is in the direction of import, takes place. The coastline is 250 m long. The terminal has one berth and the sea depth is 14 m. The warehouses have a capacity of 20,000 tons.
- Coal and iron ore Terminal: bulk cargo, coal and iron ore are handled and stored at the terminal. Transshipment is from ships, trucks, and railcars, and to all listed modes of transportation. The operational coastline is 630 m long. The terminal has 3 berths. The maximum permissible draft is 17.2 m. The storage capacity for both coal and iron is 400,000 tons each.
- Liquid cargo Terminal: The terminal specializes in the handling and storage of chemicals, mineral and vegetable oils. It has the status of an excise warehouse for mineral oils and alcohol. The terminal has 5 berths. The terminal has a total of 51 tanks with capacity ranging from 300 to 20,000 m³, and the total capacity is 203,000 m³.
- Livestock Terminal: This terminal has 2 modern stables and equipment for livestock transport. There are also facilities for the maintenance of veterinary and sanitary order and for the prescribed care and rest of the animals. The terminal is physically separated from the other parts of the port, which ensures conditions for friendly and peaceful transshipment and the welfare of animals during rest periods. The terminal has 2 berths, the water depth is 4-8 m. It can accommodate 1,300 head of livestock at a time.
- Passenger Terminal: Since 2005, Koper and Slovenia can boast of a new achievement - a maritime passenger terminal. It is considered a new, attractive and undiscovered destination for passenger ships sailing the Mediterranean in the maritime passenger transport market.

2. State-of-the-art (implemented) port waste management systems/solutions

2.1 Legislation (International/EU/national/local)

Globally, the most important regulation for the prevention of pollution from ships is the MARPOL Convention or the International Convention for the Prevention of Pollution from Ships [3]. The Convention was adopted in 1973 to protect the marine environment following a series of serious tanker accidents involving large oil spills. MARPOL consists of six annexes, which have been updated through amendments over the years. Waste on board ships comes in a variety of forms, so each annex contains specific management requirements for that particular form of waste. In connection with MARPOL, the International Maritime Organization (IMO) has adopted two important guidelines.

In July 2017, the IMO Marine Environment Protection Committee (MEPC) adopted Guidelines

for the implementation of MARPOL Annex V through Resolution MEPC.295(71) [4]. The guidelines replaced the Guidelines for the Development of Garbage Management Plans (Resolution MEPC.220(63) [5]. The main objectives of these guidelines are to assist (1) governments in developing and adopting national legislation to implement MARPOL Annex V; (2) ship owners, ship operators, ship crews, cargo owners and equipment manufacturers in complying with the requirements set out in MARPOL Annex V and relevant national legislation; and (3) port and terminal operators in assessing the need for, and providing adequate reception facilities for, waste generated on all types of ships.

In March 2018, IMO published circular MEPC1/Circ.834/Rev.1 containing the Consolidated guidance for port reception facility providers and users (IMO, 2018). This guidance replaces MEPC.1/Circ.671/Rev.1 Guide to good practice for port reception facility providers and users (IMO, 2013). The guide was developed as one of the working points of Action Plan as a practical user guide for ship crews attempting to land MARPOL waste/residues and for port reception facility providers attempting to provide timely and efficient port reception services to ships.

In 2019, the European Parliament and the Council adopted DIRECTIVE (EU) 2019/883 on port reception facilities for the delivery of ship-generated waste, amending Directive 2010/65/EU and repealing Directive 2000/59/ EC). Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 28 June 2021. However, to our knowledge, this has not yet been done in Slovenia. In all other respects, this directive is largely followed in the Port of Koper. Article 16 also states that Member States shall lay down the rules on penalties applicable to infringements of the national provisions adopted pursuant to this Directive and shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive. Directive(EU) 2019/883 contains two important forms: the form that a ship must send to the authorities at least 24 hours before entering port (Annex 2) and the form that the port reception operator must complete, specifying the type and quantity of waste received, which must be given to the master of a ship (Annex 3). Annex 4 lists the costs (direct costs, indirect costs and net revenue).

Regarding the alignment of the current waste management with the old (and repealed) Directive EU 2000/59, we can clearly say that this alignment is in place, as evidenced by numerous (more than 15) annual reports of the Port of Koper. However, we must add that this directive is not so much in the foreground of consideration. It is DIRECTIVE (EU) 2019/883 on port reception facilities for the delivery of ship-generated waste, which amends Directive 2010/65/EU and repeals Directive 2000/59/ EC (Directive, 2019). The transposition of this Directive into Slovenian legislation was the main concern, as it should be done by 28 June 2021 at the latest. On 9 July 2021, only an amendment to the Decree on Reporting Formalities in Maritime Transport was adopted (Official Gazette of the Republic of Slovenia, Nos. 69/12 , 78/19 and 109/21). In July 2021, Slovenia received from the European Commission the letter of formal notice for the Lack of transposition by Slovenia of Directive (EU) 2019/883. To our knowledge, the infringement procedure is still ongoing.

The above directive is based on categories of ship waste defined by MARPOL (IMO, 2018). MARPOL Annex V generally prohibits the discharge of all garbage into the sea, except as provided otherwise in regulations 4, 5, and 6 of the Annex, which are related to food waste, cargo residues, cleaning agents and additives and animal carcasses. An overview of the MARPOL Annex V discharge provisions can be accessed [here](#). Exceptions with respect to the safety of a ship and those on board and accidental loss are contained in regulation 7 of Annex V. Under MARPOL Annex V, garbage includes 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. Garbage does not include fresh fish and parts thereof generated as a result of fishing activities undertaken during the voyage, or as a result of aquaculture activities. The European commission issued the Decision (2000/532/ EC) on 3 May 2000 establishing a List of wastes. This list has been subsequently amended several times. Last amendment is (2014/955/EU) of December 2014.

Luka Koper is obliged to act in accordance with the Decree on port reception facilities for ship-generated waste and cargo residues (Official Gazette of the Republic of Slovenia, No. 78/2008) as well as to provide adequate port facilities for the collection of ship-generated waste, according to the EU Directive 2019/883 as mentioned above.

The REMPEC report [6] states that by signing a concession agreement for the performance of port activities, management, development and regular maintenance of port infrastructure (No. 2411-08-800011 of 8 September 2009), Luka Koper obtained the exclusive right to operate ports for the handling of goods and maritime transport in the port area, as well as the exclusive right to manage the port, including the management and development of the port infrastructure, which is not intended for public transport.

Pending the grant of a concession for the provision of the state commercial public service for the collection of ship-generated waste in the port of Koper, the said activity shall be carried out by the company Luka Koper, in accordance with Article 26 of the Regulation in this matter. Luka Koper is subject to the conditions for the provision of the state public service (non-profit) for the collection of ship-generated waste in the port of Koper (Official Gazette of the Republic of Slovenia, No. 59/2005).

For the performance of these waste collection activities, Luka Koper has subcontracted the contractual liability of the subsidiary to Luka Koper INPO (the collector of ship-generated waste). Since 1 January 2017, these two companies have also concluded an annex to the contract, which stipulates that the Collector of Ship's Waste, as a vicarious agent, provides an economic public service for the collection of ship's waste on the territory of the Port of Koper in the name and on behalf of Luka Koper.

The annual quantities of collected ship-generated waste are reported annually to the Slovenian Environment Agency of the Ministry of Environment and Spatial Planning. Twice a year, Luka Koper reports to the Ministry of Infrastructure on the performance of the public service for the

collection of ship-generated waste. The Port of Koper is obliged also to comply with the Fire Protection Ordinance in the Waste Management Center, namely the Decree on the outdoor storage of solid combustible waste (Official Gazette of the Republic of Slovenia, No. 53/19).

2.2 Implemented/existing port waste management systems/solutions

In the annual report of Luka Koper for the year 2020 [7] one can find important information about the current waste management (section 3.8), according to their waste management plan. Let us start with the waste groups that are separately collected, recycled and recovered or transferred to authorized organizations during the port operations. There are three groups of waste generated in the port:

- i. waste from port operations (e.g. cargo residues, wood waste, packaging waste, metal waste, mixed municipal waste);
- ii. other wastes generated in the port area (wastes generated by users of the economic zone); and
- iii. vessel waste left behind by vessels berthed in the Port of Koper (e.g. sewage, oily water, kitchen waste, packaging waste, medicines, ash, mixed municipal waste).

Details on infrastructure and operations related to (ship) waste were described in report T1.2.2 Joint report on the availability and use of port waste reception facilities, which also mentioned the link to European directives. Report T1.4.1 SWOT Analysis of Available Port Regulations described the waste management action plan, which largely follows the REMPEC report (2019). Report T.1.2.2 describes the waste separation center and composting facility, which are important infrastructure for waste management, and we briefly summarize them here.

Waste separation center and composting plant

The importance of waste management is constantly increasing, especially with regard to the collection, separation, processing and disposal of waste. The waste generated in the Port of Koper can be divided into three main categories:

- i. non-primary products generated by port operations (cargo residues, wood waste, packaging, metal scrap, mixed municipal waste).
- ii. waste generated by other companies operating in the free zone, and
- iii. waste generated by ships docking in the Port of Koper (ranging from sewage sludge, oil-contaminated waters and food waste to packaging waste and mixed municipal waste).

The collection and disposal of ship-generated waste and cargo residues begins when the ship moors at the berth. During regular working hours, waste collection and disposal is carried out as follows: Vessel waste officers visit vessels moored at the port. The waste is collected in the

presence of the Master in the prescribed manner. Sorted waste, each type of which must be of the prescribed format, is collected separately and the master of the vessel certifies the types and quantities of waste collected on a form submitted. If the vessel using the port cannot be reached from the quayside, the same procedure is carried out using a watercraft.

Luka Koper offers separate collection of waste, namely: plastics, waste wood, paper, metals and hazardous substances are all collected separately by a vehicle (on the quayside) or a watercraft (in the harbour), which then disposes of the waste in the port's Waste management centre. Organic waste is collected in special sealable 50-litre casks (empty casks are supplied by the ship-generated waste disposal service), which prevent the spread of infection thanks to an adapted seal.

Oil-contaminated bilge water is collected by a tanker and then pumped back to the collecting facility, from where it is forwarded to an authorised provider for further treatment. The vessel's agent is required to inform the Master that a representative or crew member must supervise the pumping of the waste and ensure that the pumping process is stopped immediately in the event of a hazard or spill. If the vessel using the port cannot be reached from the quayside, the same procedure is implemented by means of a watercraft.

Faecal (grey) waters from vessels are collected either by a harbour launch or a vehicle at the quay. This sewage is collected untreated and discharged into the municipal sewage system. Cargo residue wastes are collected by vehicle or watercraft and transported to the Waste management centre for reprocessing.

All waste is collected in the Waste management center of the Port of Koper, which has been in operation since 1997. Some categories of waste are processed at the center, while others are delivered to authorized organizations for further processing. The center also includes a facility where biodegradable organic waste is processed into compost. Out of concern for the environment, the company ensures regular waste sorting, recycling, processing and delivery for further treatment. Waste is sorted at all terminals, at users of the economic zone and on ships. All collected waste is transferred to authorized waste management companies, while organic waste is processed into compost at the composting plant in the port.

In recent years, the introduction of modern waste management methods has led to a reduction in the total amount of waste per ton of cargo handled. This reduction not only underlines the Port of Koper's efforts to keep the environment clean, but also improves the company's operational efficiency. All Port of Koper employees participate in ensuring waste separation by type and all facilities within the port zone have material-specific collection bins that are collected separately.

Management and quantities of the different types of waste

The composting plant processes between 4,000 and 5,000 m³ of waste per year. Biodegradable waste (including green waste from parks and gardens) is also delivered by the municipal utility (Javno podjetje Marjetica Koper). Although the annual amount varies (between 500 and 1,700 tons), this source still accounts for the majority of composted waste. The processed compost is then used by Javno podjetje Marjetica Koper for landscaping the city parks. In this way, the expertise and facilities of Luka Koper are being used to meet the needs of the local community. However, the latest information on this topic states that 2021 will be the last year that the Port of Koper will use composting within the port area. The organic waste will be taken to another company in Slovenia outside the port area for composting (Franka Cepak, private communication).

A total of 21,491 tons of scrap metal with classification number 19 12 02 (ferrous metals) and several tons of metal with classification number 17 04 02 (aluminum) were handled. In accordance with the environmental permit issued, the scrap shipments were measured for radioactivity to verify the legality of the shipments. Detailed records are kept of all metal scrap transshipments, which are reported annually to the Slovenian Environment Agency in accordance with legal requirements.

Luka Koper also has an environmental permit for processing waste paper pulp mixed with water and applied over coal and iron ore to reduce dust. In 2020, 1,521.64 tons of paper sludge was used, which is more than 200 tons more than the previous year.

Waste generated in the port includes waste from port operations (e.g. cargo residues, wood, packaging and metal waste, mixed municipal waste), waste generated by users of the economic zone, and ship waste left behind by ships docking in the Port of Koper. Some hazardous waste is generated during emergency cleaning, mainly absorbent materials used in repairing damage to hydraulic systems of trucks.

In 2020, a total of just over 3,883 tons of waste was collected from the port area, including 2,367 tons of sorted waste (hazardous and non-hazardous), 233 tons of mixed municipal waste and 1,283 tons of marine waste (hazardous and non-hazardous, including mixed municipal waste). Construction waste is reported separately. Subsequent disposal of waste is largely dependent on disposal capacity at national level; choice and options are limited.

Hazardous and non-hazardous waste collected is transferred by the Waste management center for subsequent disposal to specialized companies that have the relevant permits for the transport, processing or disposal of waste and are on the lists of the Slovenian Environment Agency of the Ministry of Environment and Spatial Planning for waste management companies within their jurisdiction. Luka Koper reports the collected marine waste annually to the Ministry of Environment and Spatial Planning.

2.3 SWOT analysis

The SWOT analysis was carried out in the report T1.4.1 SWOT Analysis of available port regulations, considering two aspects. The first SWOT analysis was performed for the Port Regulations, which, among other areas, set internal rules for environmental protection and waste treatment in the Port of Koper. The second SWOT analysis was conducted for the Waste Management Action Plan, which was adopted in September 2021. The plan specifies the capacity of the ports for the collection of ship-generated waste and cargo residues, the type and size of equipment and other conditions for the use of this equipment, as well as a description of the tariff system and sources of funding for waste collection. Here we summarize the SWOT analysis concerning the waste management system of the Port of Koper (Table 1).

Table 1. Summary of the SWOT Analysis of the waste management system in the Port of Koper

<u>STRENGTHS</u>	<u>WEAKNESSES</u>
<ul style="list-style-type: none">- Luka Koper provides the mandatory national non-profit service of collecting solid and liquid waste from ships in the port area. The company Luka Koper INPO (wholly owned by Luka Koper) is in charge for the collection of ship waste by providing the port reception facilities. This synergy facilitates the system of ship waste disposal.- The adopted system of ship-waste treatment achieves 91% of separate collection of waste. The target of action plan is to achieve 100% of separately collected waste by the year 2025.- The tariff system which is line with the Directive (EU) 2019/883 has already been prepared by Luka Koper and now waits only the transposition of the directive into Slovenian legislation.	<ul style="list-style-type: none">- The equipment and infrastructures for the collection, treatment and temporary storage of ship-generated waste are to be compensated by the shipping companies through the tariff system. However, shipping companies are naturally reluctant to pay more for waste treatment, and these costs may also determine which port the ship calls at or at which port the ship's waste is to be 'delivered'. Therefore, the economics of handling ship-generated waste are weak, not stable and susceptible to fluctuations in tariffs in other ports.- Slovenia, as a country of two million inhabitants, has limited capacity to deal with waste and cannot introduce a circular economy for most waste.- The tariff system and sources of funding for waste collection in the Port of Koper is currently not in compliance with Directive (EU) 2019/883. So, the first step for Slovenia is to transpose the Directive into national legislation. The new tariff system has then to be approved by the government, which is a lengthy process in Slovenia.

<u>OPPORTUNITIES</u>	<u>THREATS</u>
<ul style="list-style-type: none"> - Regional agreement(s) between the ports of the Adriatic-Ionian area on the joint plan for ship-generated waste. - Regional agreement(s) on tariffs for charging for public services related to ship-generated waste management. - Fire safety modernization is carried out at the Waste Management Centre, which is now required by the Decree on the outdoor storage of solid combustible waste, as waste wood is stored outdoors in part of the centre. As construction updates are needed, the legal deadline is September 2022. 	<ul style="list-style-type: none"> - In Slovenia, there is a lack of infrastructure facilities for recycling waste and the cost of treating waste in other (EU and non-EU (Asian)) countries can increase significantly. In this case, these costs may pose a serious threat to the reduction of shipping. - Slovenia has not yet implemented Directive (EU) 2019/883 on Port reception facilities for the delivery of ship-generated waste. Until this resolved, this poses a threat to the management of ship-generated waste, as the EU Directive regulates the collection and treatment of ship-generated waste. - The lack of regional training programs that would help to harmonize the treatment of ship-generated waste in the Adriatic-Ionian area certainly poses a threat. Ships should face a common treatment of ship-generated waste at least in the Adriatic-Ionian basin in not on the Mediterranean level.

3. Port environmental risk assessment

3.1 Legislation

A comprehensive management system is maintained in the Port of Koper, which includes requirements of various systems and other specific requirements to achieve certain levels of quality, that follow international legislation and guidelines, which could be found already in earlier reports [8]:

- occupational health and safety management system ISO 45001,
- NON GMO system for separate handling and warehousing of non-genetically modified soya,
- the AEO certification testifies to the fact that the Luka Koper customs zone is a safe area, and that cargo transported via the Port of Koper is subject to a very low degree of risk,
- liquid cargoes terminal is ISCC EU certificated for all type of biomass, which are included in ISCC EU system following the EC Directive on the promotion of the use of energy from renewable sources,
- the SEVESO directive, which deals with major accident hazard, and
- the ISPS Code (International Ship and Port Facility Security).

To stay in compliance with environmental legislation, the Luka Koper primarily refers to the Environmental Protection Act (ZVO-1, Official Gazette of the Republic of Slovenia, No. 41/04), on the basis of which the following environmental permits have been granted:

- No 35451-1/2018-5 of 28 Feb 2019 regarding noise emissions,
- No 35444-2/2016-13 of 15 Jun 2017, amendment No 35440-50/2019-10 of 21 Oct 2020 regarding atmospheric emissions, waste water emissions and storage of non-hazardous waste,
- No 35415-1/2006-15 of 8 Jan 2008 with amendments regarding the operation of a facility that may cause a major accident (Seveso).

In March 2021, the SIQ Slovenian Institute of Quality and Metrology verified the assertions and established that the environment management system on the Port of Koper meets the requirements of the Regulation (EC) No 1221/2009 on the voluntary participation by organizations in a Community eco-management and audit scheme (EMAS). The Regulation EMAS states that significant direct and indirect environmental aspects have to be reported together with the main performance indicators for the following environmental areas: energy, materials, water, waste, Land use related to biodiversity and emissions.

3.2 Port waste sources identification

The shipping industry, like any industry, produces waste during its operation. The wastes come from different sources (Figure 1), but in general can be grouped into wastes generated by:

- Operation and maintenance of marine engines (main and auxiliary) and equipment,
- cargo, and
- people (crew, passengers).

The Port of Koper with its subsidiary handles all these types of wastes.

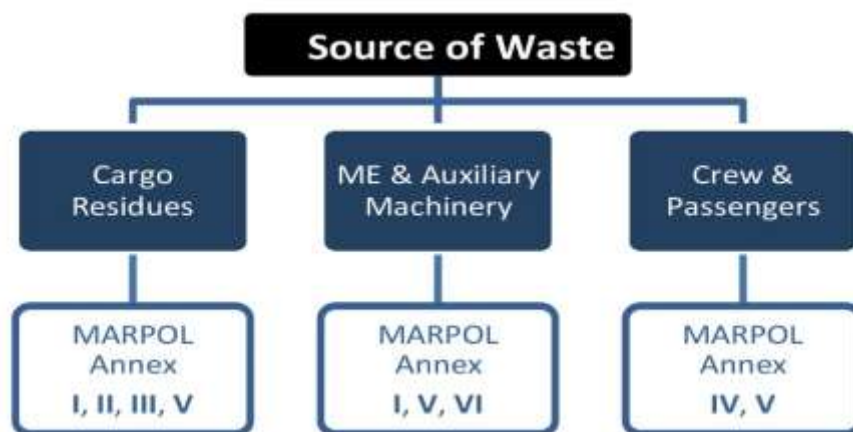


Figure 1. Scheme of ship's waste sources, classified by MARPOL.

The 2019 REMPEC report [6] describes waste management plans at the Port of Koper, as one of six targeted pilot projects in accordance with the Cooperation Agreement between UNEP and IMELS (REMPEC, 2020) and the corresponding mandate. REMPEC is leading efforts that contribute to the improvement of Marine Litter Management specifically focused on the management of marine litter generated by ships. In the report of the Port of Koper [9], three groups of waste generated in the port can be found:

- vessel waste left by ships moored in the Port of Koper (e.g. sewage, oily water, kitchen waste, packaging waste, medicines, ash, mixed municipal waste),
- waste from port activities (e.g. cargo residues, wood, packaging and metal waste, mixed municipal waste, and
- other waste in the port area (waste generated by users of the economic zone).

During the operation of the port, different types of waste are collected separately, recycled and recovered or transferred to authorized organizations. Luka Koper provides the mandatory national non-profit service of collecting solid and liquid waste from ships in the port area. The activities related to this service are carried out in the Waste Management Center.

4. Feasible port waste management systems/solutions implementation

4.1 Port specific waste management prerequisites

REMPEC [6] also summarizes the infrastructure about the storage of waste that follows the waste categories and as such the Port of Koper has several designated areas for the storage of marine waste:

- Waste management centre with several compartments for the storage of segregated waste, with a refrigerated container for the storage of quarantine food waste,
- hazardous waste storage facility that is sealed and covered and contains a liquid-tight floor,
- refrigerated container for the storage of quarantine waste, and
- tank farm for liquid oily waste, whose storage capacity was increased to 201 m³ in 2019.

After collection, the wastewater is pumped directly into the municipal sewerage system.

4.2 Accordance with International/EU/national/local waste management legislative

Slovenia has not yet implemented the Directive (EU) 2019/883 on Port reception facilities for the delivery of ship-generated waste. Until this resolved, this poses a threat to the management of ship-generated waste, as the EU Directive regulates the collection and treatment of ship-generated waste. However, Luka Koper already prepared a waste management system, which is line with the Directive (EU) 2019/883 and now waits only the transposition of the directive into Slovenian legislation.

In the document Port Regulations applying to the Freight Port of Koper (https://www.luka-kp.si/wp-content/uploads/2021/06/ENG_Port-Regulations_12.3.2020.pdf) the Articles 16-20 sets the rules for the waste handling, and Articles 21-23 set the rules for handling with dangerous goods and hazardous substances, all in line with the applicable legislation.

4.3 EU/International port waste management good practices review

The importance of sharing good practices among ports is clearly highlighted in the recent Green Guide of ESPO [10, <https://www.espo.be/practices>], the European Sea Port Organization, which has been a driving force for significant improvements in environmental management in ports since 1993. Therefore, most of the good practices fall within the scope of greening activities. The guide makes clear what its role is:

- It is first and foremost a handbook by ports, for ports. It is a living, interactive and practical document that supports ports on their journey towards greening, from vision to implementation and good practices;

- Distinguishes between the port authority, the port area and the community surrounding the port and outlines the responsibilities of each of these actors;
- Explains how ports can positively contribute to the energy transition and greening the entire economy, and how ports can mitigate negative externalities;
- Includes an extensive database of over 604 good examples of environmentally friendly practices in European ports.

Many of the above should be part of the good (environmental) management practices of any port, and good examples (practices) could be found in ESPO's extensive database. The top ten priorities of European ports in 2020 are air quality, climate change, energy efficiency, noise, relationship with the local community, ship waste, water quality, dredging operations, and port development (land based).

The following important thoughts can be taken from the guide, which consists of three parts. Part 1 outlines the responsibilities of port authorities and the scope of greening activities. Understanding the governance and competences of port authorities is crucial in preparing their path towards a green future and outlining the roles they can play with regard to the different sectors and specific activities in the port. Here, the following topics are singled out and described in more detail:

- Different roles of the port authority: Cargo handling services are usually in the hands of private operators who are often granted the use of port land through lease agreements or public domain concessions. In a limited number of cases, port authorities act as operators. In some cases, they provide services of general economic interest and/or commercial services (including cargo handling).
- Greening the port authority: The port authority is fully responsible and in charge of reaching the emissions reduction goals and reducing its environmental footprint for all activities falling within its own remit.
- Greening the port area: The port area comprises all actors within the port area. These include terminal and transport operators, but also industries, the energy sector and other stakeholders present in the port. The port authority's role is to coordinate all actors, wherever necessary, in order to enable smooth and efficient port operations in complex logistics chains.
- Greening the community around the port. Ports have a restricted role in the mitigation of negative externalities beyond the port area. Nonetheless, ports contribute significantly to addressing the challenge of climate change through positive actions related to their roles as hubs of energy, transport, and innovation. Ports can be a partner in achieving the energy transition in the wider region or country they are located in and thus positively contribute to the decarbonisation of Europe's economy.

Part 2 contains the actual manual for greening the port. The ESPO Green Guide 2021 outlines a shared vision of the role of port authorities in shaping a green future in Europe. Ambitious targets are set out for how port authorities intend to move forward to 2050 and beyond, leaving it to each individual port authority to determine the steps required to achieve their goals, based on a port-specific roadmap. Finally, Part 2 presents a number of tools available to port authorities. Together with the 2021 Guide, a database of good green practices of European ports has been developed. The flow starts with vision, continue with ambition and roadmap and ends with tools for greening the port.

- Vision: port authorities as partners for a green future.
As mission-driven entities, European port authorities want to be an active PARTNER in Europe's green future. In order to remain resilient in the long run, they aim to ensure that all port activities under their responsibility are as green as possible. In practice, this means becoming environmentally sustainable and achieving net-zero pollution over time.
- European ports' ambitions for a green future (= declarations of intent).
The guide provides more concrete ambitions on the European level. These ambitions serve as a declaration of intent, a commitment from ESPO's member ports, which should guide and provide directions to ports when drafting their individual port roadmaps.
- Creation of a roadmap for green activities in ports (with a list of "to-do's").
ESPO encourages each port authority to develop a port-specific roadmap, which provides a path towards their green future, whilst taking account of the port's resources and circumstances. It suggests a list of steps and activities to achieve the goal: 1. Measure, 2. Prioritize, 3. Set the targets, 4. Tools and tasks, 5. Share, 6. Time it, 7. Monitor, 8. Communicate.
- Overview of the greening tools available to port authorities.
This section provides the tools available to port authorities to achieve this include legislation, norms and rules, as well as efforts to promote and encourage greening in the port area and wider port community.

Part 3 shows how ports not only work to mitigate negative externalities, but also contribute positively to the greening of the European economy and act as an important partner in achieving energy transition and green transition. Ports will increasingly have to deal with unfamiliar and novel issues as part of the transition to a greener future. Sharing experiences, identifying good practices and learning from each other is more important than ever for ports. Two pillars are highlighted:

- i. Reducing pollution and other externalities:

A number of mitigation efforts is provided for port authorities for each of the environmental priority: air quality management, climate change - greenhouse gasses (energy efficiency, CO2 emissions reduction), climate change - climate adaptation, noise management, relationship between the port and local communities, sediment management, waste management, water quality and biodiversity,
- ii. Ports as partners in the search for green solutions:

Ports are not only areas where the emissions from various maritime and industrial activities come together, they also have a pivotal role in bringing Europe closer to its decarbonisation and zero pollution targets. Since 90% of Europe's port are urban ports, they are ideally placed to engage in a positive interaction between port and city and provide green solutions for the latter. This second pillar therefore elaborates on areas where ports make positive contributions to the greening of the wider European economy.

 - a. Energy transition: the continued importance of European ports as crucial partners. For example, ports increasingly provide the link to the supply of offshore renewable energy generated by wind and wave power and play a similar role for onshore renewable energy generated by biomass, wind or solar power in port areas. Ports are also strategically placed to act as key hubs for the production, deployment and trade of renewable energy.
 - b. Nature and blue biodiversity: ports as stewards of valuable natural ecosystems in ports. For example, many ports in Europe have developed active strategies that go beyond compensating habitat loss, promoting further improvement of the quality of the nature, enhancing the biodiversity in the port, and sharing these precious nature spots with port workers and the wider surrounding community.
 - c. Circular economy: Port authorities as matchmakers for circularity players. For example, European ports are often situated in or near metropolitan areas, where huge amounts of end-of-life products are available. Ports are also crossing-points of all types of waste and industrial flows, logistical hubs for the export and import of waste materials, active promoters of innovation, and the sites for waste management industries. In a unique interaction between port and city, the waste for one becomes the resource for the other, and vice versa.
 - d. Blue economy: where port authorities can foster growth. For example, European ports can facilitate, enhance and reinforce those blue economy sectors that by definition contribute to delivering the green deal ambitions (such as offshore energy, maritime circular economy, and carbon capture and storage – CCS).

4.4 Applicable EU/International port waste management good practices at port

Good practices in the Port of Koper include the following:

- i. The implemented system for the treatment of ship-generated waste achieves a 91% rate of separate waste collection. The target of the action plan is to achieve 100% separately collected waste by 2025.
- ii. There is continuous cooperation between the Regional Civil Protection Authority in Slovenia and the Port of Koper, which is reflected in regular updating of fire safety equipment and regular fire safety training.
- iii. The modernisation of fire protection in the center, which covers an area of 12,700 m², has started and construction will be completed in 2021.
- iv. Activities related to the greening of the port are constantly underway and investments are also channelized in these activities.
- v. In its latest report [9], the Port of Koper mentioned the problem of oil spill treatment (onshore and in port). It is about the innovative approach studied in the project CAPS (EC, 2020) aimed at using sludge from paper mills for the production of absorbents that can be used in the removal of oil spills and are stable both on land and at sea. The innovative technology used in the production of the CAPSorb product (TEC, 2021) to convert paper mill sludge into absorbents for water surface cleanup (CAPS) is based on a cross-industry approach that uses a waste material from one industry to produce a valuable product in another.

4.5 Implementation assessment

4.5.1 Shortcomings (legal, technological, technical, i.e.)

One of the general shortcomings is related to the general attitude of ports to be competitive within the region in which they operate. Here it seems very useful to quote thoughts from the recent ESPO Green Guide report [10]:

- It is clear that ports can and will benefit from collaboration on strategic environmental and investment decisions. This can be done by sharing tools and good practices or by taking the lead and leading the way.
- For port authorities, the goal is to achieve environmental excellence through COOPERATION while engaging in friendly competition in a cooperative race to the top. To ensure that no port is left behind, European port authorities will share best practice and experience between European ports and within port clusters.

The Port of Koper otherwise has excellent port-city relations that enable its greening and development. However, gaps, i.e. technical and management shortcomings, were also identified in this study.

Shortcoming in trained personnel

The annual report of the Port of Koper [9] also shows that the following was not implemented in 2020:

The depreciated port machinery and vehicles have not yet been removed from the port premises and sent for destruction, as the matter is extensive and complex. The process is actively underway and is expected to be completed in 2021. This problem has existed for several years and is usually related to the lack of documentation for the depreciated machinery. Manufacturers were usually decommissioned years ago and are unable to provide the missing documentation. In addition, there are other problems related to the national tax system when the procedure for the disposal of machinery is initiated. Despite the "complexity" of the matter (the heavy machinery cannot be disposed of in the car landfill), this seems to be related to the lack of personnel in the Port of Koper.

The ecological areas for separate waste collection have not yet been modernized and systematically organized. This gap also seems to be related to the management and organization, i.e. the gap in personnel.

Shortcoming in infrastructure

One also reads from the report of 2020 [9] that:

Ecological areas for separate waste collection have not yet been modernised and systematically organised.

This matter is related to the gap in fire safety infrastructure for outdoor storage of combustible (dust) waste material, as a new national regulation on this subject will come into force in 2020. However, this also means that staff will need to be further trained in the use of the new equipment to fill the gap in trained staff at the port.

Another gap in infrastructure relates to the issue of downstream treatment of hazardous ship-generated waste. As stated in the report [6] (page 16): Slovenia has no facilities for the downstream treatment of hazardous ship-generated waste. Luka Port INPO (the provider of PRF's in the Port of Koper) has a biological treatment facility for compostable waste and is able to pre-treat some recyclable materials such as glass, paper, plastics and metals. Similarly, recyclable waste is currently treated by private companies specialising in this type of material, all of which carry out mechanical pre-treatment on site (scrapping, compaction, etc.), as well as hazardous ship-generated waste. Most of the hazardous ship-generated waste (65%) cannot be biologically treated, landfilled and/or recycled and is therefore currently exported to Austria (in accordance with the provisions of EU Regulation 2006/1013 on the transfrontier shipments of waste).

Shortcoming in subcontractors

The latest annual report of the Port of Koper [9] (Figure 41) shows that the amount of sorted waste collected in the port decreased from 2017 (4800 tons) to less than 2400 tons. However, since 2018, ship-generated waste has also decreased significantly, from 1895 tons to 1283 tons (decrease of 612 tons). Over the same period, the amount of separated waste in the port decreased by 806 tons (3173 to 2367). The decrease in separated waste is therefore related to the decrease in waste transported by ships to the port. This trend in the last three years is related to improved facilities on board ships (incinerators) and also to the delivery of waste in the port before or after the arrival of ships in the Port of Koper. Official data on waste capacities (port control authorities) on ships support this statement. It could also be related to delivery costs.

Therefore, we can only guess whether the declining trend in segregated waste disposal is related to some gaps, such as lack of infrastructure capacity or subcontracted delivery of ship-generated waste. The data also show that the percentage of sorted waste has been fairly constant since 2017 (89-92%), with inter-annual fluctuations of a few %. The percentage of sorted waste is practically not decreasing, but also not increasing, and is similar to sorted waste excluding ship-generated waste. This point deserves further attention in the future. The strategic goal of the Port of Koper is to achieve 100% sorting (private communication Franka Cepak).

Shortcoming in training

Although this gap is not specified in this section, it certainly deserves attention. The proper way to train, educate and inform on waste management is prescribed in the Guidelines for the implementation of MARPOL Annex V (IMO 2017b) subsections:

4.1 Governments should develop and implement public education, training and information programs appropriate for all seafaring communities under their jurisdiction, prepared and presented in a manner that communicates with that segment of the community

4.8 Vessel and reception facility operators should establish detailed training programs for personnel who operate and maintain vessel waste reception or processing facilities. It is suggested that the program include instruction on what is garbage and what regulations apply to the handling and disposal of garbage. Such training should be reviewed annually and updated as necessary.

4.9 General public information programs are required to inform non-professional seafarers and others concerned about the health and stability of the marine environment about the impact of litter at sea. Governments and participating commercial organizations are encouraged to use the Organization's library and share

resources and materials as appropriate to initiate internal and external public education programs.

4.9.2 Target audiences include recreational sailors and fishermen, port and terminal operators, coastal communities, ship suppliers, shipbuilders, waste disposers, plastics manufacturers and processors, professional associations, educators, and governments.

Part of the lack of training mentioned above is due to the gap in trained personnel in the Port of Koper, but the government is cited first.

Shortcoming in waste management from ships: delivery system in bags

Many ships separate the waste, but then put it (separately, of course) into the same-coloured bags with no external marking. Problems arise during delivery because the recipients on shore cannot quickly identify the contents of the sacks. They have to check the waste (open sacks!) at the separation centre (Waste Management Centre) one by one for their contents, which is time consuming. This is the fault of the system, but, nevertheless the authors suggest that the port should advise the ship before arrival to mark the bags with appropriate signs. Bags of different colours would be welcome. Hopefully, in the future there will be a Marpol recommendation to standardise the colours of bags of different waste.

Shortcoming in Reporting form

In accordance with Marpol Convention, the Port of Koper is recommended to use the form Appendix 1- IMO Circular MEPC.1/Circ.469/Rev.1 for reporting alleged inadequacies of port reception facilities for ship-generated waste, see Luka Koper (2020). The authors propose to amend the form as recommended in Annex 2 of Directive (EU) 2019/883, despite the fact that this Directive has not yet been transposed into the national (Slovenian) legal framework.

4.5.2 Feasible/proposed solutions for overcoming identified shortcomings

Again, the thinking from the most recent report of ESPO Green Guide [10] offers solutions for overcoming shortcomings:

- The idea is to compete on business matters, whilst collaborating on sustainability. Europe's port authorities seek to be innovation hubs, using their resources and ingenuity to drive innovation and digital transformation for the benefit of the environment and the global climate.
- Communicate priorities, progress and failures transparently (share good practices and problems, and their background).
- Port-port "co-opetition" by setting similar rules for stakeholders (amongst several ports)

Examples: standards for fuel bunkering, risk-sharing, voluntary speed/emission reduction zones for ships, exchange of experiences and good practices in European or international organizations.

- Seeking for good practices in the vast ESPO database in solving the shortcomings.

4.5.3 Investment (costs) assessment

The Management board issued the Annual report for year 2020 [7, <https://www.luka-kp.si/wp-content/uploads/2021/06/Annual-report-2020-ENG.pdf>] in which tables of financial indicators are released. One finds on page 12 the following 'summary' of performance in year 2020:

"The earnings before interest and taxes (EBIT) and net profit or loss in 2017 were affected by formed provisions for liabilities from legal obligations amounting to EUR 15.7 million, whereas the 2018 results were affected by the single event of received reimbursement of EUR 9.3 million. The earnings before interest and taxes (EBIT) and net profit or loss in 2019 were mainly affected by two factors: implementation of the port service provision strategy and the related increase of labour costs by EUR 14.4 million, and transshipment fee costs under the Act Regulating the Construction, Operation and Management of the Second Track of the Divača-Koper Railway Line amounting to EUR 4.8 million. Earnings before interest and taxes (EBIT) and net profit in 2020 were affected by lower net sales revenues, which resulted from a decline in maritime throughput. The transition to the new business model of providing port services, which the Group began to implement gradually in 2019 and finalized the implementation by the end of the year, was reflected in the results of operations throughout 2020. In addition, the Luka Koper Group reduced operating expenses in 2020 compared to the previous year."

In the interval 2016-2020 the net sales was around 200 million € (Figure 2 in the report [7]) and as stated "it decreased for over 10 % in 2020 with respect to the sales in 2019 due to a decrease in maritime throughput, which was significantly influenced by the outbreak of the COVID-19 pandemic." This influenced also the net profit of Luka Koper d.d. and Luka Koper Group (Figure 4 in the report [7]), which was for each of them around 21-22 million € in 2020 (with respect to 58-59 million € in 2018), which "was also affected by the lower effective corporate tax rate".

However, the key figure of interest for this report is the investment expenditure, which is presented on Figure 5 in the report [7], also copied here (Figure 2).

Figure 5
Investment expenditure
in EUR

■ Luka Koper, d. d.
□ Luka Koper Group

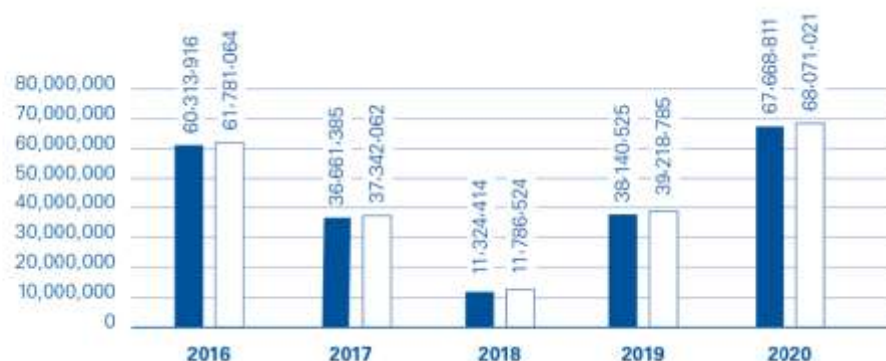


Figure 2. The investment expenditure in the Port of Koper for the period 2016-2020.

The explanation of this volatility of investments is as follows:

“A smaller volume of investment was implemented in 2018, which was due to lengthy procedures for acquiring the required permits and unpredictable public procurement procedures. In 2019, the volume of investments was higher than in 2018, but still lower than expected due to longer public procurement procedures. In 2020, the Luka Koper Group allocated the amount of EUR 68 million to investments, which was an increase of 74 percent from 2019. The Luka Koper Group used the pandemic year 2020 to continue implementing investments in increasing port capacity, as after the improvement of health and economic situation related to the pandemic, throughput is expected to increase again.”

The financial structure of investments is not clearly written in the report [7], however, from the activity of the Business Operations Committee (page 45) one finds which were key investments in the Port of Koper:

“The Committee monitored the implementation of the investment plan and the status of projects with a special focus on key projects of extending Pier I, constructing a parking garage and a new Bertoki entrance, acquiring additional land for car storage, and implementing information support. It monitored measures to increase productivity, reviewed regular reports on occupational safety and health and fire safety...”

5. Port waste management systems/solutions action plan

In the 2019 REMPEC report [6, page 6] it is written that “information available in English (which was also available through the website) is the tariff lists and procedural information regarding the delivery of waste in ports and marina. Detailed information on the management of waste from ships, such as the port and marina’s waste handling plan, was not available in English.” In the list of collected documents it is pointed out that the Port Waste Handling Plan is written in Slovenian. It is also stated (page 18) that the Port of Koper had a new waste reception and handling plan (WRHP), issued in December 2018, and was approved by the ministry and issued in September 2021. It is also written (page 23) that “the relevant parts of the WRHP for the Port of Koper, such as the procedures to deliver the ship-generated wastes, the tariff list, and relevant contact information were translated in English and have been made publicly available. Both texts can be found through the website of Luka Koper.” Key statement of the ‘REMPEC visit’ is condensed in the following statement: “It can be concluded that the Port of Koper has an adequate WRHP meeting the requirements of both the current and new PRF (Port Reception Facilities) Directive, so there are no specific proposed revisions.”

5.1 Proposed activities (legal, technological, technical, i.e.)

Activities related to the collection of waste can be deduced from tables from the ANNEX 1 of the report of REMPEC (2019) that follow from the waste management plan (Table 2).

The content of the waste management plan of the Port of Koper is in accordance with the requirements of the Decree on port facilities for the collection of ship-generated waste and cargo residues (Official Gazette of the Republic of Slovenia, No. 78/2008 and amendments) and Directive (EU) 2019/883.

The plan for the collection of ship-generated waste and cargo residues shows the capacity of the port for the collection of ship-generated waste and cargo residues, the type and size of equipment and other conditions for the use of this equipment, as well as a description of the cost recovery system.

Table 2. Summary of the activities for collection of ship-generated waste and cargo residues according to waste management plan of the Port of Koper

Waste type	barge	truck	direct pumping	skips/ container	other
Oily waste from machinery space (MARPOL Annex I)	in combination with tank container	24 (2x tank trucks)	N	48	N
Dirty ballast water	in combination with closed skips	N	N	10	N
Oily cargo residues (MARPOL Annex I)	in combination with tank container	24 (2x tank trucks)	N	48	N
Noxious liquid (MARPOL Annex II): Type X Type Y Type Z Other substances	in combination with tank container	N	N	48	N
	in combination with tank container	N	N	48	N
	in combination with tank container	N	N	48	N
Sewage (MARPOL Annex IV)	N		N	N	52
Garbage (MARPOL Annex V)	in combination with open skips	in combination with open skips	N	10	N
Quarantine waste (according to animal by-products Regulation No 1774/2002/EC)	Y	0,3 (in closed van)	N	N	N
Residues from dry bulk cargo including liquid form (MARPOL Annex V)	Y	In combination with semi-trailer	N	N	50
Ozone Depleting Substances (MARPOL Annex VI)	Y	Y	N	N	N
Scrubber waste (MARPOL Annex VI)	Y	Y	N	N	N

The plan describes the procedures for receiving the types and quantities of ship-generated waste and cargo residues from vessels normally calling at the port, taking into account the operational needs of port users, the size and geographic location of the port, and the types of vessels calling at the port:

- municipal sewage,
- waste oil (bilge oil),
- animal by-products generated in ships' galleys,
- mixed municipal waste,
- separately collected fractions,
- hazardous waste,
- cargo residues.

Tables 3 and 4 show the estimated quantities of hazardous and non-hazardous waste to be collected from the Port of Koper in the coming years. The estimated annual collection quantities are given in tonnes. The Port of Koper has not accepted some waste to date and has not included some in the table because it generally does not expect to accept it. However, should the ship wish to deliver waste that is not on the list, it would also arrange for its collection if a suitable transferee is found in Slovenia within 24 hours.

The Port of Koper is planning to collect waste from sewage treatment plants installed on the ship's funnel (Marpol Annex VI) in the future, but there are no estimated quantities. Demand for the collection of wastewater generated from the washing of ships' tanks for liquid cargo (Marpol Annex II) can also be expected in the future. The volumes can be large, up to 400 m³ per ship, but these volumes cannot be precisely determined. The Port of Koper has not yet established these capacities.

Future plans of the Port of Koper concerning the waste management are:

- The company has included the requirement to collect waste from the Marpol Annexes II and VI in the port development program as an investment in increasing port capacity. The port development program has to be approved by the government.
- By 2025, the Port of Koper plans to acquire several devices:
 - Trailers for the collection of ship-generated waste. The value of the investment is estimated at EUR 3,500.
 - Equipment for weighing ship-generated waste. The value of the investment is estimated at EUR 20,000.
 - vans for the removal of waste from ships. The value of the investment is estimated at EUR 25,000.
 - trucks with lifting platform for the collection of waste from ships. The value of the investment is estimated at EUR 150,000.

- Personal vehicle. The value of the investment is estimated at EUR 14,000.

Table 3: Estimated quantities and types of hazardous waste from ships for the next three-year period

Classification number	Name of waste	Estimated annual collection quantity for the next three years [in tonnes]
I. category	Kitchen waste from ships	85
08 01 11*	Waste from paints and varnishes	1
13 02 08*	Other engine, gear and lubricating oils	1
13 04 03*	Ship oils (bilge oils) from other shipping	950
13 05 06*	Oil from oil - water separators	10
13 05 07*	Oil - contaminated water from oil - water separators	280
15 01 10*	Packaging containing residues of hazardous substances or contaminated with hazardous substances	20
15 02 02*	Absorbents, filter media, cleaning cloths, protective clothing contaminated with hazardous substances	40
16 01 07*	Oil filters	1
16 06 01*	Lead Batteries	2
16 07 09*	Wastes containing other dangerous substances	60
16 10 01*	Wastes from aqueous solutions containing dangerous substances (wastes from sewage treatment plants installed on the exhaust gasses of the ship)	40
19 01 13*	Ash containing hazardous substances	7
20 01 21*	Fluorescent tubes and other wastes containing mercury	3
20 01 31*	Cytotoxic and cytostatic drugs	0.5
20 01 33*	Batteries and accumulators classified as 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries and accumulators	2
20 01 35*	Discarded electrical and electronic equipment containing dangerous substances other than those mentioned in 20 01 21 and 20 01 23	3
	Fecal water	80

Table 4: Estimated quantities and types of non-hazardous ship-generated waste for the next three-year period

Classification number	Name of waste	Estimated annual collection quantity for the next three years [in tonnes]
02 03 04	Substances unsuitable for use	10
15 01 01	Paper and cardboard packaging	5
15 01 02	Plastic packaging	5
15 01 03	Wood packaging	80
15 01 04	Metal packaging	100
15 01 07	Glass packaging	15
16 01 17	Ferrous metals	5
16 01 18	Non-ferrous metals	5
19 01 14	Ash, other than those mentioned in 19 01 13	7
20 01 01	Paper and cardboard	1
20 01 02	Glass	1
20 01 28	Inks, printing inks, adhesives and resins other than those mentioned in 20 01 33	1
20 01 32	Pharmaceuticals other than those mentioned in 20 01 31	1
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	2
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	3
20 01 39	Plastics	45
20 01 40	Metals	1
20 03 01	Mixed municipal waste	150
20 03 07	Bulky waste	15
20 03 99	Other municipal waste of this type	1

5.2 Time plan

In documents of the Port of Koper there are vague goals in a time plan about activities that the Port of Koper should accomplish. The Port of Koper follows for decades the strategy of reducing the waste, and was engaged in projects in this respect. One of such project, 'No Waste, Just Resource', which aimed to reduce the amount of waste by reuse and recycle refuse into useable products, received the ESPO (European Sea Port Organisation) 2014 award. However, we may read that in the Environmental strategy of Port of Koper until 2030 the following plans for the future are listed:

Land and water use:

- construction of a garage house
- renovation of the water supply system
- modernization of treatment plants with built-in waste water reuse systems

5.3 Funding sources

Although the accounting and financial issues have many aspects and details, we shall extract from the Annual report [7] for 2020 the net sales revenue of Luka Koper d.d. and Luka Koper Group. On page 258 one finds that the in the Additional notes to the income statement that the revenue generated on sales with domestic customers from contracts with customers was almost 60 million € in 2020 (with respect to 70.2 millions € in 2019) for the Luka Koper, d.d. and around 63 millions € in 2020 for the Luka Koper Group (with respect to 73.6 millions in 2019). Nearly 90 % of these values represent revenues from services, the rest is from goods and materials. The revenue generated on sales with foreign customers from contracts was 138.7 million € in 2020 for the Luka Koper d.d. (145.5 million € in 2019), while for the Luka Koper Group numbers are similar (139.4 million € in 2020 and 146.3 million € in 2019). The total revenues generates on sales with customers from contracts is therefore around 200 million € in 2020 (216-2020 million € in 2019). The rest of revenues (port dues and rentals) represents less than 4 % of the total revenue (206-209 million € in 2020, 224.7-228.7 millions in 2019 €).

6. Conclusion

Waste management is a complex and important task in the operation of any port. One of the main priorities of the Port of Koper is the sustainable development of the port through a focus on ecology, health, human rights, business integrity and care for employees, based on various initiatives and European policies.

The Port of Koper strives to implement innovative environmental projects and participated in the tender with the project "No waste, just resources!", which deals with good practises in waste management in the Port of Koper. In the port's web newsletter GreenPort visitors can express their opinions and interests (Luka Koper, 2021b; in slov.). It points out that it is a green port and that "concern for the environment is an essential part of the Port of Koper's management policy and organisational culture."

The systematic approach in each area leads to the goals and objectives achieved. In waste management, various measures and procedures have been and are being implemented to improve the process. But the most important thing, as in other areas, is to make all employees and shareholders aware of efficient waste management. This was the most important step that enabled further activities and led to better results.

The Port of Koper is active in the field of waste management through various activities and measures. The results of the activities and measures are analyzed every year (and more often if needed).

Based on the results and needs, the measures and activities are planned for each year.

The Port of Koper is also integrated with the local community, with whom they share experiences and know-how. The close connection also helps to properly manage some interdependencies in the field of waste management and thus be more effective and efficient. The Port of Koper is also connected with organizations that take waste from the port for further disposal and recycling. There are different organizations for different types of waste (organic waste, hazardous waste, municipal waste,...). The reduction and successful management of waste will continue to be one of the priorities of the Port of Koper in the future.

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