
**Ships and marine technology —
Marine environment protection
— Management and handling of
shipboard garbage**

*Navires et technologie marine — Protection de l'environnement
marin — Gestion et manutention des déchets à bord du navire*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO TC 8, *Ships and marine technology*, Subcommittee SC 2, *Marine environment protection*.

This second edition cancels and replaces the first edition (ISO 21070:2011), which has been technically revised.

Introduction

The management of shipboard garbage is extensively controlled by MARPOL, Annex V. Additionally, States party to the MARPOL Convention have undertaken regional and national implementing legislation to regulate and enforce provisions for handling ships' waste and for providing adequate reception facilities at ports and terminals subject to Parties' flag state and port state control authorities.

This document has been prepared to reflect the amendments of MARPOL, Annex V of January 2013.

This document provides for the minimization, management and segregation of a ship's garbage, so that it can be managed on-board and offloaded efficiently to the relevant reception facilities onshore.

To obtain the most efficient management of waste and to reduce the time and resource burden in segregating and handling waste on the ship and in the ports, the concept of waste minimization has been integrated into this document by incorporating the following basic principle: **Prevention before recycling before energy recovery before disposal.**

This document concentrates on

- the prevention/elimination/minimization of waste prior to sailing,
- the minimization of waste at the source on the ship,
- the garbage collection at the source,
- the waste segregation on the ship into defined categories that are recognized globally and fit into the many different waste categorization systems around the world,
- the waste minimization once segregated,
- the waste storage on board ship, and
- the health and safety concerns surrounding the handling, storage and offloading of waste.

Both ship owners and coastal states are more aware of the importance of well-organized and managed waste collection and its benefits, especially with respect to health and safety on board ships, the reduction of pollution and the potential cost benefits for ship owners and national governments. This document provides a fixed standard for segregated garbage that any harbour facility worldwide may expect when a ship arrives in port. However, it cannot work alone. ISO 16304 works in conjunction with this document. This document does not consider the available various (and numerous) shore-side waste handling systems that exist, but may encourage the provision of recycling facilities for shipboard waste in ports.

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Ships and marine technology — Marine environment protection — Management and handling of shipboard garbage

1 Scope

This document specifies procedures for the shipboard management of garbage, including handling, collection, separation, marking, treatment, and storage. It also describes the ship-to-shore interface and the delivery of garbage from the ship to the port reception facility. MARPOL, Annex V sets the minimum standard for garbage management that apply to ships. This document applies to the management and handling of shipboard garbage during the period the garbage will be on board. The definition of garbage in this document is as defined in MARPOL, Annex V.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

International Convention for the Prevention of Pollution from Ships, (MARPOL) Annex I to VI, as amended, IMO, consolidated edition 2011

Guidelines for the Implementation of MARPOL Annex V, IMO, 2012

MEPC.1/ Circ. 834, *Consolidated guidance for port reception facilities providers and users*, IMO, 15 April 2014

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 General terms

3.1.1 discharge

any release, however caused, from a ship including any escape, disposal, spilling, leaking, pumping, emitting or emptying

[SOURCE: MARPOL Article 2 (3)(a)]

3.1.2

harmful substance

substance which, if introduced into the sea, is liable to create hazards to human health; harm living resources and marine life; damage amenities or interfere with other legitimate uses of the sea, and; includes any substance subject to control by the present MARPOL Convention

[SOURCE: MARPOL Article 2 (2)]

3.1.3

hazardous waste

waste which, due to its nature, physical, chemical or infectious properties, is potentially hazardous to human health and/or the environment during use, handling, storage or transportation, including any material which may require special handling, disposal or recycling techniques to eliminate or reduce the hazard

3.1.4

port reception facility

PRF

any fixed, floating or mobile facility capable of receiving MARPOL residues/wastes from ships and fit for that purpose

[SOURCE: Circular MEPC 1/Circ.834]

Note 1 to entry: For the purposes of this document, this relates to reception facilities for garbage as defined by MARPOL, Annex V. An adequate port reception facility is a facility that mariners use and fully meets the needs of the ships regularly using it and the port and does not provide mariners with a disincentive to use it. Furthermore, it should contribute to the improvement of the marine environment. It should also allow for the ultimate disposal of ships' wastes to take place in an environmentally appropriate way.

[SOURCE: IMO Resolution MEPC.83(44)]

3.1.5

recycling

activity of segregating and recovering components and materials for reprocessing

3.1.6

reuse

activity of recovering components and materials for further use without reprocessing

3.2 Terms relating to garbage

3.2.1

cargo residue

remnants of any cargo material which are not covered by other annexes to the present MARPOL Convention and which remain on the deck or in holds following loading or unloading, including loading and unloading excess or spillage, whether in wet or dry conditions or entrained in wash water but does not include cargo dust remaining on the deck after sweeping or dust on the external surfaces of the ship

Note 1 to entry: Dry bulk cargo residues may include substances that are harmful to the marine environment (HME) with special restrictions for *discharges* (3.1.1) including HME entrained in cargo hold wash water. *Port reception facilities* (3.1.4) for cargo residues considered to be HME may be required at loading or discharge ports handling bulk dry cargoes.

[SOURCE: MARPOL Annex V reg. 1.2]

3.2.2

domestic waste

all types of waste not covered by other annexes to the present MARPOL Convention that are generated in the accommodation spaces on board the ship

Note 1 to entry: Domestic wastes does not include grey water.

[SOURCE: MARPOL Annex V reg. 1.4]

3.2.3**garbage**

all kinds of food waste, *domestic waste* (3.2.2) and *operational waste* (3.2.5), all *plastics* (3.2.11), *cargo residue* (3.2.1), cooking oil, fishing gear, and animal carcasses generated during the normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in other annexes to the present MARPOL Convention.

Note 1 to entry: 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 which involve the transport of fish including shellfish for placement in the aquaculture facility and the transport of harvested fish including shellfish from such facilities to shore for processing.

[SOURCE: MARPOL Annex V reg. 1.9]

3.2.4**incinerator ashes**

ash and clinkers resulting from shipboard incinerators used for incineration of *garbage* (3.2.3)

[SOURCE: MARPOL Annex V reg. 1.10]

3.2.5**operational waste**

all solid waste (including slurries) not covered by other annexes in the present MARPOL Convention that are collected on board during normal maintenance or operations of a ship, or used for cargo stowage and handling

Note 1 to entry: Operational waste includes, but is not limited to, the following wastes associated with cargo storage and handling: dunnage, shoring, pallets, lining, transit and packing materials, plywood, paper, cardboard, wire, plastic wrapping, and steel strapping.

Note 2 to entry: Operational waste also includes cleaning agents and additives contained in external wash water.

Note 3 to entry: Operational waste does not include grey water, bilge water, or other similar *discharges* (3.1.1) essential to the operation of a ship.

Note 4 to entry: Wooden material may be defined as quarantine waste in certain countries.

[SOURCE: MARPOL Annex V reg. 1.12]

3.2.6**oily rag**

rag which has been saturated with oil and controlled in MARPOL, Annex I

3.2.7**contaminated rag**

rag which has been saturated with any substance defined as potentially hazardous or harmful to human health and/or the environment

3.2.8**maintenance waste**

materials collected by the crew while maintaining and operating the ship

3.2.9**medical waste**

solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biological materials, including but not limited to isolation wastes, infectious agents, human blood and blood products, pathological wastes, sharps, body parts, contaminated bedding, surgical wastes and potentially contaminated laboratory wastes and dialysis wastes

Note 1 to entry: Medical waste is distinguished into two categories: infectious and non-infectious as defined by the World Health Organization.

3.2.10

quarantine waste

solid or liquid waste determined by local or regional legislation to require special handling, segregation and disposal due to its potential to spread disease, diseases, or plant and animal pests when discharged or delivered ashore

3.2.11

plastic

solid material which contains as an essential ingredient one or more high molecular mass polymers and which is formed (shaped) during either the manufacture of the polymer or the fabrication into a finished product by heat and/or pressure

Note 1 to entry: Plastics have material properties ranging from hard and brittle to soft and elastic.

Note 2 to entry: For the purpose of this document, plastics include plastic in any form, including synthetic ropes, synthetic fishing nets, plastic *garbage* (3.2.3) bags and *incinerator ashes* (3.2.4) from plastic products.

[SOURCE: MARPOL Annex V, reg. 1.13]

4 Requirements

4.1 General

This clause specifies the minimum requirements for waste treatment on board, including waste separation, marking, collecting, storing and offloading to port reception facilities.

While it is recognized that on board waste management should be standardized, it shall be noted that offloading procedures depend on the ports and the port reception facilities available.

4.2 Classification of garbage

The following categories and garbage types covered in this document are listed in [Table 1](#).

Table 1 — Categories and garbage types

Type	MARPOL Annex V category	Industry recognized symbol (available through a simple internet search)	Description
Plastics	A	 For recyclable plastics only	All garbage that consists of or includes plastic in any form, including synthetic ropes and fishing nets, shall be retained on board and disposed of ashore.
Food wastes	B		—
Domestic waste	C		—

Table 1 (continued)

Type	MARPOL Annex V category	Industry recognized symbol (available through a simple internet search)	Description
Cooking oil	D		—
Incinerator ashes	E		NOTE Incinerator ash from plastic products may contain toxic or heavy metals.
Operational wastes	F		Examples of (non-hazardous) wastes are dunnage, shoring, pallets, lining, transit and packing materials, plywood, paper cardboard, wire, plastic wrapping, and steel strapping. NOTE 1 Some regional or national legislation may require even further separate identification and handling. NOTE 2 Operational waste can be considered hazardous. Examples of hazardous waste are batteries, fluorescent lamps, garbage contaminated with hazardous waste, and any other waste that is considered hazardous waste. This kind of waste is handled and treated separately. NOTE 3 Oily waste and rags are MARPOL, Annex I waste. NOTE 4 Medical waste is a separate item.
Cargo residue	G		See 4.3. NOTE Dry cargo residues may include deck or cargo hold sweepings and wash water containing such residues.
Animal carcasses	H		—
Fishing gear	I		—
Glass	C		NOTE May require separation by colours.
Paper Products	C		—
Medical waste	—		Reference is made to guidelines to MARPOL, Annex V 2012, 5.2.5.

Table 1 (continued)

Type	MARPOL Annex V category	Industry recognized symbol (available through a simple internet search)	Description
Oil contaminated waste	F		For example, cargo securing materials, etc.
Wood	C		—
Metal	C		—
E-waste	C		

Garbage that is contaminated by another category of garbage shall be handled in accordance with the more stringent disposal requirements that are applicable.

4.3 Colour codes

Inexpensive and readily available standard label software and a colour printer may be useful for creating labels/markings, as shown in Table 1 and according to the colour scheme in Table 2, aboard ship for collection and storage container labelling. Coloured signage/labels could be affixed to appropriate portable containers such as drums, boxing or bagging for retention and storage aboard. Such a colour coding system would be useful for easy identification when offloading at a reception facility. Furthermore, such a labelling scheme will facilitate efficient segregation of wastes by type, for further handling and recycling by port reception facility operators. Additional or supplemental labels could be affixed to those types of waste requiring special handling such as hazardous or harmful, quarantine, or medical wastes and incinerator ashes for ships equipped with such equipment, as appropriate.

Table 2 — Colour codes for waste

Waste	Colour
Plastics	Yellow
Food waste	Green
Domestic waste	Grey
Cooking oil	—
Incinerator ashes	Black
Operational waste	—
Cargo residue	—
Animal carcasses	—
Fishing gears	—
Glass	Blue
Paper products	White on black
Medical waste	Yellow
Oil contaminated waste	—
Wood	Brown
Metal	Grey
E-waste	Orange

4.4 Cargo residues and operational waste from cargo stowage and handling operations

Ships shall have procedures in their garbage management plan to deal with cargo residues and operational waste from cargo storage and handling operations.

4.5 Collection and segregation of garbage

4.5.1 General

Garbage shall be regularly collected in the areas where it is generated. At the point of collection, the garbage should be appropriately segregated into the types according to [Table 1](#). The garbage shall be transported to a storage site on board the ship appropriate for that category (see [Table 1](#)), where it may be segregated further as necessary.

4.5.2 On board collection containers

Collection containers of suitable size, design, and number as appropriate for the volume and category of garbage anticipated should be available where the garbage is generated. The collection containers shall also comply with the applicable safety requirements (such as metal safety containers used for collection of oily rags or sealed/covered containers used for quarantine wastes) and shall be easy to transport manually. For hygiene reasons, the containers shall be emptied regularly.

Collection containers shall be marked to clearly identify their use (see [Table 1](#) for categories and [Table 2](#) for colours) as appropriate. See examples of standardized marking/labelling of collection containers.

4.6 Storage

4.6.1 General

Collected garbage shall be appropriately stored on board until it is disposed of in accordance with the applicable international, regional and/or national legislation.

The capacity of the designated storage site(s) shall be commensurate with the number and size of storage containers required to accommodate shipboard garbage.

4.6.2 Storage containers

4.6.2.1 General

Storage container volumes shall be commensurate with the amounts and categories (see [Table 1](#)) of garbage anticipated based on factors such as ship type, size, number of persons on board and sailing schedule.

Storage containers may be either built into the ship or movable and shall be marked to clearly identify the use as appropriate. See examples of standardized marking/labelling and colours of storage containers by waste category in [Table 1](#) and [Table 2](#).

4.6.2.2 Movable storage containers

Movable storage containers shall be fit for use based on storage site, ship type, and garbage category.

- a) The containers shall be leak-proof where appropriate and be equipped with a suitable cover. Containers arranged on deck shall be provided with securable covers.
- b) SOLAS requires the use of combustible materials to be restricted; the containers should be made of non-combustible material and resistant to oil and chemicals as appropriate to the material to be stored.
- c) Manually handled containers shall be fit for use and easy to transport. Containers to be lifted manually may not exceed a volume of 50 l or, depending on the density of the waste, a total weight of 35 kg. Larger containers shall be provided with rollers.
- d) Containers provided with wheels and rollers shall be equipped with locking brakes or equivalent means of securing against movement. Containers to be moved mechanically shall be provided with a safe transportation means. They shall be designed so that they can be lifted safely and emptied by tilting, or opening the bottom, so as to ensure a safe and quick emptying.

4.6.2.3 Containers built into the ship

Containers built into the ship, such as tanks and silos, shall comply with applicable design and construction requirements.

4.6.2.4 Dedicated garbage storage sites

The garbage containers as described in [4.6.2.2](#) and [4.6.2.3](#) shall be located in dedicated garbage storage sites.

4.6.2.5 General requirements of garbage storage sites

The locations for garbage storage on board shall meet the following requirements.

- a) Access to the site shall be free from obstructions, as far as practicable.
- b) The transport route to manually land the garbage to shore shall be free from thresholds, coamings, and other obstructions, as far as practicable.
- c) A means for securing the storage containers shall be provided.
- d) Storage sites, associated passageways, shafts and hatchways for vertical transport, and entrances shall be adequately sized for easy use, handling, and transport of storage containers.
- e) Relevant fire protection equipment shall be provided at the storage sites.

- f) For internal sites, ventilation with a forced exhaust and natural supply with at least five complete air exchanges per hour shall be provided.
- g) A water connection shall be provided for wet cleaning.
- h) Inside scuppers shall be provided with a strainer. Wash water and escaping liquids from inside spaces shall be directed to an appropriate waste liquid system.
- i) Separate storage sites or rooms should be considered for hazardous material storage. These spaces shall have drainage relevant to the material being stored and shall have an eyewash station for personnel in a readily accessible location.

4.6.2.6 Additional requirements for garbage storage

Taking into account any potentially hazardous characteristics, garbage shall be stored on board only in suitable, appropriately sized containers.

The containers shall be marked appropriately by a relevant recognized colour and/or sign depicting the garbage it contains (see [Tables 1](#) and [2](#) for an example).

The garbage storage site shall be equipped in such a way that any hazards arising from the waste are minimized.

In addition to the basic outfitting detailed above, the garbage storage site should be equipped as follows:

- a) suitable absorbent material for oil-containing waste;
- b) temporary storage in the event of broken containers, e.g. pans and barrels;
- c) broom, shovel;
- d) locks, locking strips, cargo netting or other suitable protections against sliding, tilting, leaking or falling of stored garbage;
- e) first aid kit;
- f) sorting and handling procedures;
- g) machinery operating instructions;
- h) adequate lighting.

The installed outfitting of a garbage storage site shall depend on the categories of garbage stored and the related hazards. Relevant criteria considered in selecting the outfitting shall be documented in the garbage management plan.

4.6.2.7 Additional requirements for storage sites on deck

- a) The storage site(s) should be sheltered from the weather and sea water as far as possible;
- b) The deck storage site(s) shall be permanently marked and be of sufficient size to accommodate the garbage containers;
- c) The location of the garbage storage site(s) shall be appropriately selected according to categories of garbage to be stored, and located so as not to interfere with normal ship operations;
- d) Means for securing outside garbage containers against movement shall be provided.

4.7 On board processing of wastes

Segregated garbage to be offloaded to port reception facilities should not be treated, changed, or mixed in any manner that cross-contaminates and increases environmental damage and makes it impossible

to recycle by shore facilities. Equipment such as shredders, pulpers, and compactors can be used as appropriate to reduce the volume and make handling of solid wastes more efficient.

4.8 Offloading waste

Check the GISIS PRF database for the intended port reception facility (<http://gisis.imo.org>).

To ensure efficient offloading of ships to port reception facilities, the following conditions should be met:

- a) Waste offloading operations should be conducted in such a way that safe handling, movement of waste, and emptying of garbage containers is possible in any normal loading condition of the ship;
- b) Waste offloading operations should be conducted in such a way that manual handling of garbage containers is minimized. Mechanical handling of garbage containers is preferred. Equipment used for offloading waste should have direct access to the storage site. If this is not possible for design reasons, manual horizontal transport greater than 10 m should be avoided;
- c) The procedures to offload garbage should take into account the type and location of the port reception facilities. They should also take into account the specific port procedures for notifying and arranging for port reception facility services.

5 Garbage management

5.1 Garbage management plans

MARPOL, Annex V states that ships shall have a garbage management plan. This document may be used to develop a garbage management plan on all ships.

The ship shall be managed, arranged and equipped with the necessary facilities and resources to implement its garbage management plan effectively. The garbage management plan shall take into account an estimate of the waste volume, duration of the voyage, a review of potential waste management options, the operation of the ship, the number of persons on board, additional regulations and any other relevant considerations.

The health and safety of passengers and crew, and protection of the environment shall be given priority when developing procedures and designing, constructing and sourcing equipment used for the management of waste. Problems such as odours, liquid residue, unnecessary grey water generation, health hazards and hygiene issues shall be considered and should be avoided by corresponding design measures. The basis of any decisions shall be appropriately documented in the garbage management plan.

5.2 Garbage volume

An estimate of the garbage volume should be calculated using factors such as the number of persons on board, anticipated length of voyage, the application of minimization technology, type of ship operational considerations. Examples can be found in [Annex A](#). Estimated volumes should be updated as necessary.

5.3 Garbage management techniques

5.3.1 General

Segregated garbage is stored on board until a port is reached where it can be offloaded. Ships should maximize the segregation of garbage (see [Table 1](#)) in order to facilitate efficient recycling at the port reception facility. On board conditions such as space, garbage amount, number of persons on board, equipment, length of voyage, and route should be taken into account and may allow for design of smaller storage capacity and alternative containers.

[Figure 1](#) contains a chart showing an internationally recognized on board garbage management scheme with possible waste management options.

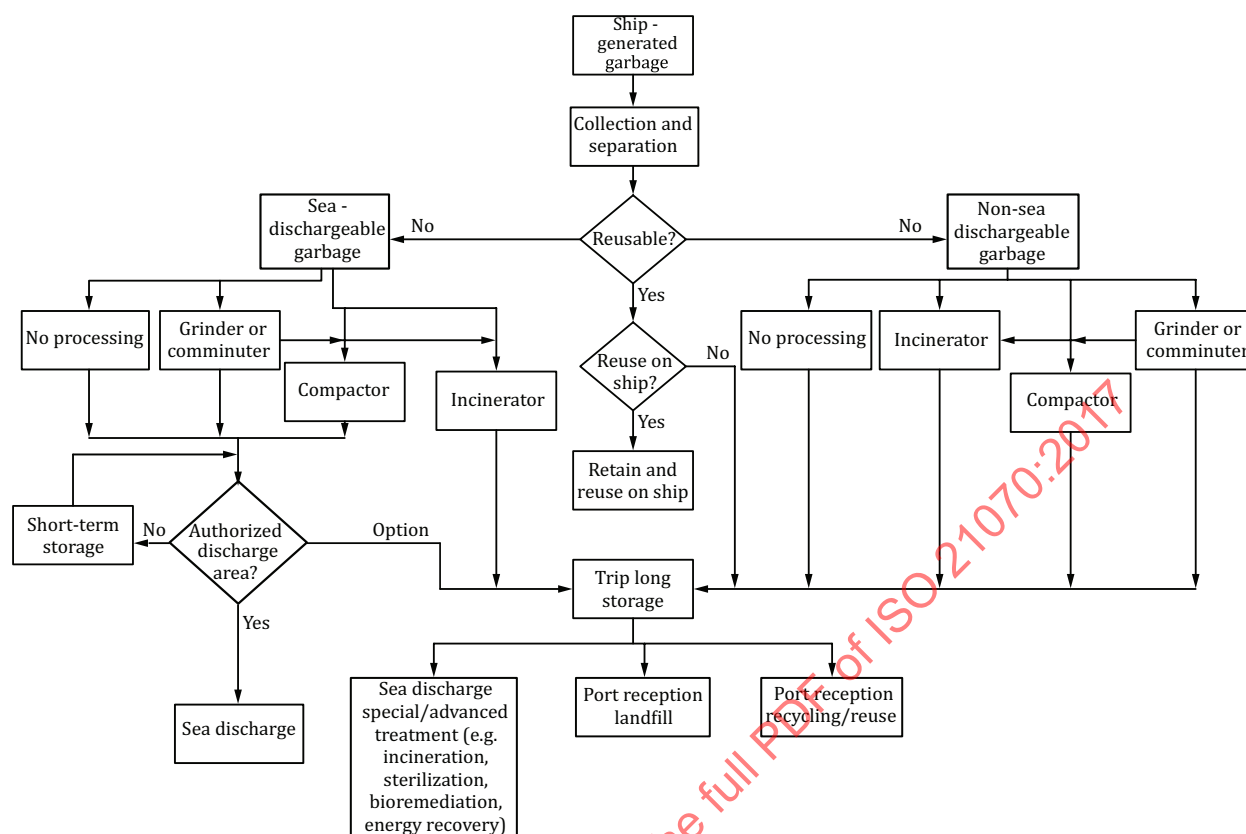


Figure 1 — Options for on board handling and disposal of garbage in accordance with MARPOL, Annex V

5.3.2 Discharge into the sea

MARPOL, Annex V prohibits, with few exceptions, discharges of waste into the sea. For health and safety reasons, the discharge of food waste and animal carcasses is allowed only under limited conditions. Cargo residues, determined not to be harmful to the marine environment, may be allowed to be discharged outside special areas, taking into consideration the guidelines for implementation of MARPOL, Annex V.

5.4 Facilities to offload garbage

The arrangements and facilities provided on board shall be appropriately equipped, sized and planned to offload garbage from the ship to the port reception facility. Procedures shall be in accordance with the requirements of 4.8. The loading and unloading procedures shall ensure that the garbage offloading operation and any set down areas are readily accessible and free from obstruction.

5.5 Documentation

For the purposes of documentation, the types of segregated garbage, with the exception of hazardous waste which should be recorded separately, should be recorded as the total quantity of the appropriate MARPOL, Annex V category of garbage. The quantities, by category, and disposal method shall be recorded in the Garbage Record Book as required in MARPOL, Annex V. A ship's officer shall be designated responsible for the management of garbage in accordance with the garbage management plan. Advance notification of the garbage to be offloaded or retained on board, and any other required information, shall be given to the port as appropriate. MEPC.1/ Circ. 834 incorporates approved forms in standard formats for advance notification and delivery receipts. A copy of the completed advance

notification form and/or the waste delivery receipts should be retained on board with the Garbage Record Book for two years from the date of the last entry in the Garbage Record Book.

5.6 Waste minimization

In accordance with the following principles, efforts shall be made to minimize the amount of garbage produced on board the ship:

- a) reduction of the amount of garbage generated;
- b) its re-use (either for the same or a different purpose);
- c) segregation for recycling or composting ashore;
- d) on board energy recovery/incineration (subject to incineration regulations for ships).

Garbage reduction methods with respect to quantity and quality shall be identified and implemented. This could include avoiding the generation of garbage through the deliberate purchase of products that do not have excess packaging, are easily biodegradable and do not produce hazardous substances (e.g. toxic, corrosive or dangerous to the environment) when disposed or recycled.

Information about the hazards of materials and products used on a ship can be obtained from material data sheets and information on the packaging. These inform the user about the composition of the product, the hazards, environmental characteristics and disposal options. From this information, decisions on the substitution of products generating less garbage or environmental impact can be made.

Measures to minimize garbage quantities could include

- the selection of suppliers whose products minimize waste,
- the selection of suppliers who provide a refill or replacement service for their product,
- the purchase of products in larger packing units,
- the removal of excess packaging before loading,
- the returning old and out-of-date unused equipment (e.g. time-expired pyrotechnics and pharmaceuticals) to the manufacturers or sellers for reuse, recycling, refilling, or disposal as appropriate),
- the complete emptying of containers and full use of the contents,
- the optimization of waste-producing processes so as to reduce waste,
- the evaluation of product-specific waste quantities to identify means to reduce waste,
- the use of products with a long lifespan and/or shelf life,
- the use of equipment that can be repaired, and
- the repair rather than replacement of the equipment.

To optimize garbage management on board, the crew should be actively engaged in the process as the success of any measures put in place depends to a large extent on their acceptance and implementation by the crew. Means to achieve effective crew involvement may include

- a definition and allocation of responsibilities,
- the training of personnel, and
- the regular information briefings for all crew members.

Effective procedures should include

- the description of the reason for the procedure,
- the scope of the application (entire ship or only specific areas),
- the naming of responsible parties,
- the description of the garbage management process (e.g. process chart), and
- the auditing and reassessment provisions.

5.7 Garbage management audits

The efficient implementation of garbage management procedures requires auditing and quantification of waste. A regular assessment (at least once a year) of the Garbage Record Book provides an opportunity to analyse waste-related issues. An example is the identification of significant quantities of waste, the production of which could be assessed with the aim of reducing the amount and cost of garbage disposal.

A well-prepared garbage management plan will serve as a basis for assessment. It is recommended that a garbage data sheet be prepared for each category of garbage as part of any audit. Such a data sheet should provide information about the area where this category of garbage is produced, the source (e.g. packing), the garbage characteristics, the disposal methods, disposal costs, and the disposal quantities. An example of such a data sheet can be found in [Annex C](#).

The document summarizing the garbage audit should be in a form that can serve as a basis for the development of future waste minimization procedures and methods.

Annex A (informative)

Examples of calculating the expected amount of waste

A.1 Calculation basis

A.1.1 General

The formulae mentioned here are based on empirical values and are only estimates. The categories of waste mentioned in this document can be estimated using the following factors.

[Formula \(A.1\)](#) is used for calculation of volume:

$$V_{\text{Type of waste}} = \text{Factor} \times d \times P = V \text{ dm}^3 \quad [(dm^3/d \times P) \times d \times P = dm^3] \quad (\text{A.1})$$

where

V is the volume of the relevant type of waste in dm^3 ;

d is the duration of journey in days (at least 30 days);

P is the number of persons on board.

A.1.2 Glass

$$V_{\text{glass}} = 1,84 \times d \times P$$

Density in t/m^3 , e.g. $\approx 1,2$ for waste glass¹⁾.

A.1.3 Paper, cardboard, cartons

$$V_{\text{paper}} = 1,05 \times d \times P$$

Density in t/m^3 , e.g. $\approx 0,5$ for waste paper¹⁾.

A.1.4 Packaging, plastics

$$V_{\text{plastics}} = 1,0 \times d \times P$$

Density in t/m^3 , e.g. $\approx 0,2$ for plastic containers¹⁾.

A.1.5 Wood

As waste wood normally is a result of cargo residues, no general quantity calculation can be made.

Density in t/m^3 , e.g. $\approx 0,48$ m^3 for dunnage, waste wood¹⁾.

1) Data according to Landesumweltamt NRW (Germany), density table of LAGA kinds of waste.