

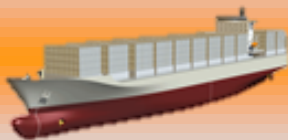
# COMPLETE SOLUTIONS

for all types of wet & dry waste  
on board of:

**Luxury Cruise Vessels & Yachts**

**Merchant Vessels & Ferries**

**Navy Vessels & Offshore Platforms**



**State – of – the – art Waste Management Systems  
for the most challenging marine applications:**

**More than 20 years of experience in the maritime industry**

**Experience of more than 50 installations in all maritime segments**

**Solid, efficient & reliable equipment quality**

**The Environmental Systems bottom line is:**

**FIRST CLASS QUALITY & CUSTOMER SERVICE**

**6 GOOD REASONS TO USE ENVIRONMENTAL SYSTEMS EQUIPMENT**

- 1. Long lifetime**
- 2. Proven Technology**
- 3. Handling of all types of waste**
- 4. Taylor made components**
- 5. Designed according to customers' needs and requirements**
- 6. Long term experiences in DESIGN , MANUFACTURING & OPERATING**

# Environmental **ES** Systems

## Complete Waste Treatment Systems from one hand for:

- Incineration Systems
- Food & Biosludge Drying Systems
- Sludge Oil Treatment & Incinerating
- Food Waste Handling, Transport & Processing
  - Pulper Systems
  - Vacuum Systems
  - Grinder – Vacuum – Systems
  - Food Waste Converter
- Recycling Equipment



**Incinerator**



**Food Press**



**Food Waste Vacuum Transport System**



**Bale Press**



**Heavy Duty Shredder**

## System Configuration

- Taylor-Made Systems
- Separate components- flexible arrangement
- Flexible system
  - Incinerating
  - Food Waste Treatment
  - Recycling
- All critical waste and hazardous waste, like
  - Medical Waste
  - Food Waste
  - Black Water (fecal coliforms)

will be processed immediately

- Ash from incineration process is bacteria free and non hazardous

## Different types of waste to be treated

### **Solid Municipal Waste**

- ✓ Paper
- ✓ Cardboard
- ✓ Plastic
- ✓ Rags/ Textiles
- ✓ Wooden pallets
- ✓ Medical waste
- ✓ Glass
- ✓ Tins

### **Waste Water**

- ✓ Black water
- ✓ Grey water

### **Food Waste**

- ✓ Food waste from canteen
- ✓ Food waste from galleys
- ✓ Food waste from accommodations

### **Burning materials which cannot be recycled**

- ✓ Oily filters
- ✓ Oily rags
- ✓ Waste oils
- ✓ Wood
- ✓ Paper
- ✓ Rags

## Rules & Regulations

The following Rules & Regulation must be fulfilled by the installed waste treatment equipment and systems:

- Revised MARPOL Annex V
- Special Areas
- Operation of Incinerators
- Waste Water Regulation
- Waste Water Discharge Limits

**Our know-how ensures a safe and reliable operation for the customer and the operator on-site.**

**Our equipment ensures a safe and reliable operation for the customer and the operator on-site.**

## Simplified overview of the discharge provisions of the revised MARPOL Annex V (resolution MEPC.201(62)) which will enter into force on 1 January 2013

Type of garbage	Ships outside special areas	Ships within special areas	Offshore platforms (more than 12 nm from land) and all ships within 500 m of such platforms
Food waste comminuted or ground	Discharge permitted ≥3 nm from the nearest land, en route and as far as practicable	Discharge permitted ≥12 nm from the nearest land, en route and as far as practicable	Discharge permitted
Food waste not comminuted or ground	Discharge permitted ≥12 nm from the nearest land, en route and as far as practicable	Discharge prohibited	Discharge prohibited
Cargo residues <sup>1</sup> not contained in wash water	Discharge permitted ≥12 nm from the nearest land, en route and as far as practicable	Discharge prohibited	Discharge prohibited
Cargo residues <sup>1</sup> contained in wash water		Discharge permitted ≥12 nm from the nearest practicable and subject to two additional conditions <sup>2</sup>	Discharge prohibited
Cleaning agents and additives <sup>1</sup> contained in cargo hold wash water	Discharge permitted	Discharge permitted ≥12 nm from the nearest land, en route, as far as practicable and subject to two additional conditions <sup>2</sup>	Discharge prohibited

Type of garbage	Ships outside special areas	Ships within special areas	Offshore platforms (more than 12 nm from land) and all ships within 500 m of such platforms
Food waste comminuted or ground	Discharge permitted ≥3 nm from the nearest land, en route and as far as practicable	Discharge permitted ≥12 nm from the nearest land, en route and as far as practicable	Discharge permitted
Food waste not comminuted or ground	Discharge permitted ≥12 nm from the nearest land, en route and as far as practicable	Discharge prohibited	Discharge prohibited
Cargo residues <sup>1</sup> not contained in wash water	Discharge permitted ≥12 nm from the nearest land, en route and as far as practicable	Discharge prohibited	Discharge prohibited
Cargo residues <sup>1</sup> contained in wash water		Discharge permitted ≥12 nm from the nearest practicable and subject to two additional conditions <sup>2</sup>	Discharge prohibited
Cleaning agents and additives <sup>1</sup> contained in cargo hold wash water	Discharge permitted	Discharge permitted ≥12 nm from the nearest land, en route, as far as practicable and subject to two additional conditions <sup>2</sup>	Discharge prohibited



# Environmental Systems

Type of garbage	Ships outside special areas	Ships within special areas	Offshore platforms (more than 12 nm from land) and all ships within 500 m of such platforms
Cleaning agents and additives <sup>1</sup> in deck and external surfaces wash water	Discharge permitted	Discharge permitted	Discharge prohibited
Carcasses of animals carried on board as cargo and which died during the voyage	Discharge permitted as far from the nearest land as possible and en route	Discharge prohibited	Discharge prohibited
All other garbage including plastics, synthetic ropes, fishing gear, plastic garbage bags, incinerator ashes, clinkers, cooking oil, floating dunnage, lining and packing materials, paper, rags, glass, metal, bottles, crockery and similar refuse	Discharge prohibited	Discharge prohibited	Discharge prohibited
Mixed garbage	When garbage is mixed with or contaminated by other substances prohibited from discharge or having different discharge requirements, the more stringent requirements shall apply		

<sup>1</sup> These substances must not be harmful to the marine environment.

<sup>2</sup> According to regulation 6.1.2 of MARPOL Annex V the discharge shall only be allowed if: (a) both the port of departure and the next port of destination are within the special area and the ship will not transit outside the special area between these ports (regulation 6.1.2.2); and (b) if no adequate reception facilities are available at those ports (regulation 6.1.2.3).

## IMO SPECIAL AREAS

Special Areas	Adopted #	Date of Entry into Force	In Effect From
<b>Annex IV: Sewage</b>			
Baltic Sea	15 Jul 2011	1 Jan 2013	**
<b>Annex V: Garbage</b>			
Mediterranean Sea	2 Nov 1973	31 Dec 1988	1 May 2009
Baltic Sea	2 Nov 1973	31 Dec 1988	1 Oct 1989
Black Sea	2 Nov 1973	31 Dec 1988	*
Red Sea	2 Nov 1973	31 Dec 1988	*
"Gulfs" area	2 Nov 1973	31 Dec 1988	1 Aug 2008
North Sea	17 Oct 1989	18 Feb 1991	18 Feb 1991
Antarctic area (south of latitude 60 degrees south)	16 Nov 1990	17 Mar 1992	17 Mar 1992
Wider Caribbean region including the Gulf of Mexico and the Caribbean Sea	4 Jul 1991	4 Apr 1993	1 May 2011
<small>* The Special Area requirements for these areas have not yet taken effect because of lack of notifications from MARPOL Parties whose coastlines border the relevant special areas on the existence of adequate reception facilities (regulations 38.6 of MARPOL Annex I and 5(4) of MARPOL Annex V).  ** The new special area requirements, which will enter into force on 1 January 2013, will only take effect upon receipt of sufficient notifications on the existence of adequate reception facilities from Parties to MARPOL Annex IV whose coastlines border the relevant special area (regulation 13.2 of the revised MARPOL Annex IV, which was adopted by resolution MEPC.200(62) and which will enter into force on 1 January 2013).</small>			



# Operation of Incinerators

## Shipboard Incineration

The Regulation applies to all incinerators installed on or after 01 January 2000.

Existing incinerators installed before 01 January 2000 are acceptable provided they are type approved in accordance with IMO MEPC.59(33) or MEPC.76(40). Existing incinerators that are not type approved may still be used, however they may not be used for the incineration of polyvinyl chlorides (PVCs).

### Shipboard incineration of the following substances is prohibited:

- i. Residues of cargoes subject to MARPOL Annex I, II or III or related contaminated packing materials;
- ii. Polychlorinated biphenyls (PCBs);
- iii. Garbage, as defined by MARPOL Annex V, containing more than traces of heavy metals;
- iv. Refined petroleum products containing halogen compounds;
- v. Sewage sludge and sludge oil which is not generated on the ship; and
- vi. Exhaust gas cleaning system residues.

Shipboard incineration of sewage, sludge and sludge oil generated during the normal operations of a ship may also take place in the main or auxiliary power plant or boilers, but in those cases, shall not take place inside ports, harbours and estuaries.

Operation of incinerators within SECAs must be agreed with individual port States and affected coastal States in all cases.

Generally the use of incinerators in ports and territorial areas may not be permitted without authorization from the local regulators.

# Waste Water Regulations

## Prevention of Pollution by Sewage from Ships

Regulations for the prevention of pollution by sewage are contained in Annex IV of MARPOL.

The discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land. Sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land.

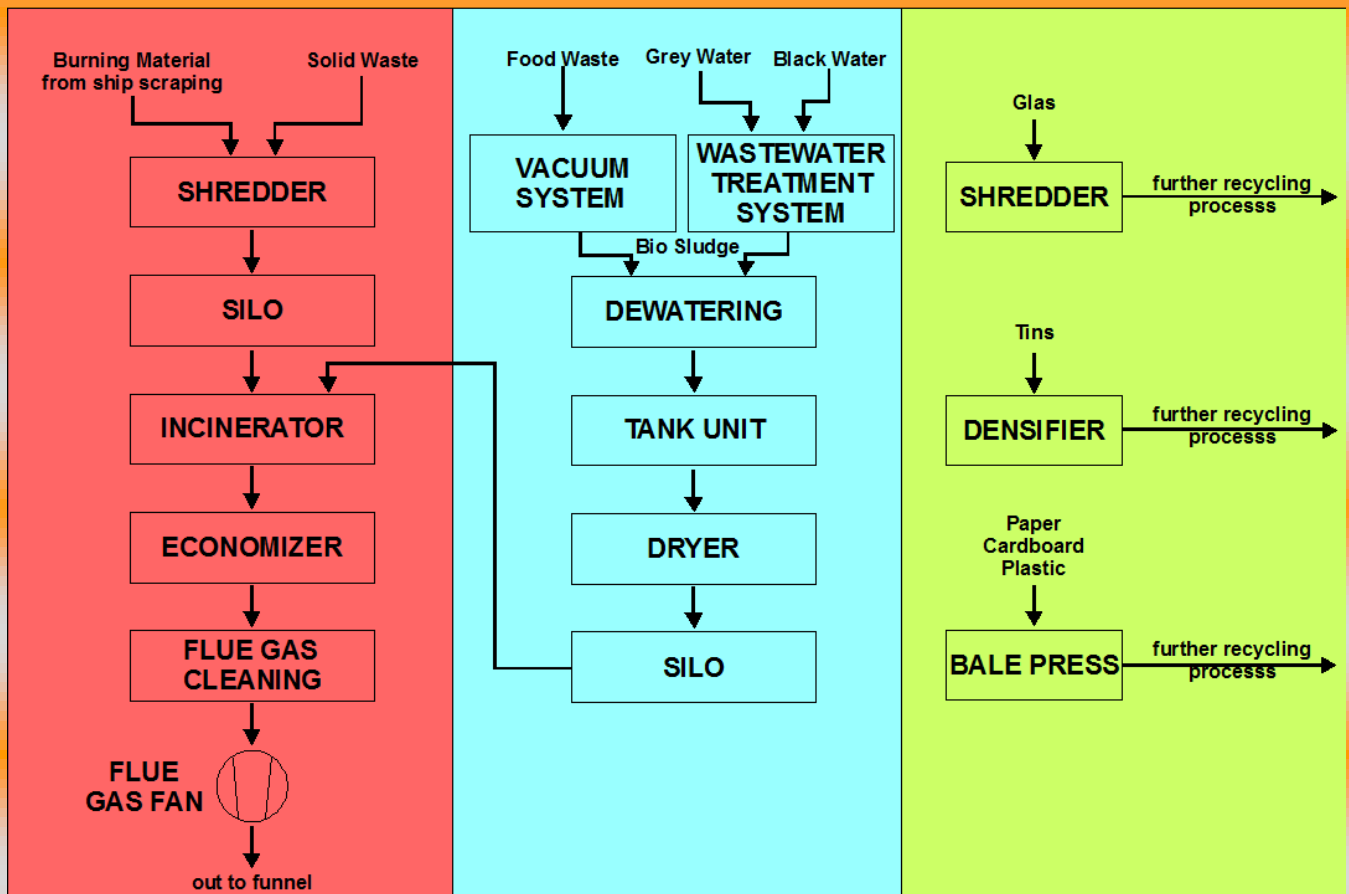
The MEPC also adopted a standard for the maximum rate of discharge of untreated sewage from holding tanks when at a distance equal or greater than 12 nautical miles from the nearest land (see resolution [MEPC.157\(55\)](#)).

In July 2011, the Marine Environment Protection Committee, at its sixty-second session, adopted the most recent amendments to MARPOL Annex IV by resolution [MEPC.200\(62\)](#) which will enter into force on 1 January 2013. The amendment introduces the Baltic Sea as a special area under Annex IV and adds new discharge requirements for passenger ships while in a special area. The discharge of sewage from passenger ships within a special area will generally be prohibited under the new regulations, except when the ship has in operation a sewage treatment plant which shall be of a type approved by the national Administration (see section below).

# Waste Water Discharge Limits

Parameter	Unit	IMO MEPC	Alaska Legislation	USCG	Navy NIAG	Helcom	MARTIN
Standard	-	159(55)	2009DB0026	33CFR 159 PT1-300	2015 target	Expected in 2013 New built 2018 Cruise	IMO Certification value
TSS	mg/l	35 Test 70 at sea	150 Daily max.	150	50	IMO	1
BOD5	mg/l	25	30 Monthly average 60 Daily max.	N/A	15	IMO	2
COD	mg/l	125	N/A	N/A	N/A	IMO	25
pH		6-8,5	6,5-8,5	N/A	N/A	IMO	7,6
Residual Cl2	mg/l	0,5	0,01	N/A	0	IMO	None
Fecal Coliform	per10 0ml	100	14 Monthly geom. mean 43 daily max	200	100	IMO	7

## Principle diagram for complete dry & wet waste treatment



- Each system will be adapted and designed according to the customer's specification and requirements
- Each Component and each system fulfils the before listed rules and regulations without any problems!!!

## Incineration - System

### Burnable Waste Shredder

For shredding of:

- paper
- Cardboards
- Plastic
- Wood
- Pallets
- etc.



### Burnable Waste Silo

For temporary storage of shredded waste

Typical capacities: 5-25 cbm



### Incinerator

Optional with heat recovery

for burning of:

- shredded waste / dry waste
- dewatered food waste
- sludge oil
- medical waste



# Environmental Systems

## Hydraulic Unit

Central Unit for the operation of all hydraulic components of the complete waste treatment system



## Burning of Sludge Oil

## Burning of Waste Oil



## Wet De-Ashing

Dust-free de-ashing





## Food Waste Treatment

### Food Waste Feeding Station

#### **Option 1:**

- without macerating the food waste at the feeding station
- Without the need of transport water
- Pipe diameter: DN150



### Food Waste Feeding Station

#### **Option 2:**

- Grinder / Vacuum-System
- transport water needed
- Food waste will be macerated at the feeding station
- Pipe diameter: DN50-85



### Food Waste Shredder

- For shredding of food waste for further processing (dewatering or drying) for the incineration process
- Used for food waste feeding station option 1



# Environmental Systems

## Food Waste Tank

- For temporary storage of food waste
- Strong stirrer and Pumps for homogenising recommended
- Typical Capacities: 1-15 cbm



## Dewatering Unit

- For dewatering of grinded food waste
- Used as a first dewatering step if food waste should be incinerated
- Capacities: 150-200 kg/h



## Decanter

- For dewatering of grinded and shredded food waste
- Used as a second dewatering step if food waste should be incinerated
- Capacities: 0,5-10 cbm/h





# Environmental Systems

## Dryer

- For drying of dewatered food waste
- After drying process incineration of dried food waste possible
- Moisture of dried food waste approx.25%
- Typical capacities: 1000 – 6000 kg/batch



## Vacuum Station

- For generating the vacuum for transport of food waste
- A vacuum tank is needed for evacuating the complete transport pipe system
- Used for food waste feeding station option 1 (without macerating)



## Vacuum Pump

- For generating the vacuum for transport of food waste
- Used for food waste feeding station option 2 (with macerating)



# Environmental Systems

## Grease Trap

- For separation of grease, fat & solids from water
- Different sizes available
- Manual, semi-automatic or fully automatic operation



## Food Waste Processing Unit

- For ships with up to approx. 500 persons on board
- Food Waste Holding Tank with integrated food Press and Tank for separated water
- Operator can choice between:
  - Discharge of food waste to sea (where it is allowed)
  - Discharge of food waste to onshore
  - Dewatering of food waste for volume reduction and storage of dewatered food waste in cold room
- Ready-to-install-unit



## Recycling Equipment

### Bale Press

- For recycling and compacting of:
  - Paper
  - Cardboards
  - Plastic
- 1 or multi-chamber type
- Different types available



### Glass Crusher

- For recycling of glass
- Volume reduction up to 80%
- Different types available



## Tin Densifier

- For compacting of tins
- Volume reduction up to 25-50% Depending of type and material to be densified)
- Different types available





## REMARKS TO FOOD WASTE CONCEPT

### Grease Trap:

- Automatic cleaning of filter for solids necessary
- Easy access to the filter for cleaning purposes

### Food Waste Shredder

- It must be ensured that no hands can enter the cutting device of the shredder
- Inlet of shredder must be high to prevent that hands can come in contact with cutting device
- Big opening and high volume in order to handle also big bones, etc.

### Food Waste Tanks

- Long holding capacity => - Undefined growing of biomass
  - Creation of CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>S
  - Ugly odor
- During long holding times a separation process of food waste and water takes place. This can result into problems for pumping of food waste
- A strong stirrer for homogenizing of food waste and water is recommended
- A strong food waste pump is necessary
- Efficient ventilation for food waste tank
- No GPS in order to operate the system and not the system the personal
- General: Decisions to discharge to sea only can made from Crew and not from a GPS

### Disposer

- To be equipped with an additional cutter to reduce blockages and to cut critical parts of food waste save and easy.

# Environmental Systems

---

## Interfaces

- Wärtsilä offers a complete system without any interfaces  
Food Waste System -> Grease Trap -> Sewage Treatment Plant
- Only one contact person
- Systems are adapted to each other
- Clear instruction manual due to one complete system
- Financial strong company
- For maintenance contracts only one person has to come for the complete system instead of one for each single component

## REFERENCES

### • 31 Systems on Yachts

<b>Customer</b>	<b>Project</b>	<b>Equipment</b>
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Lemwerder	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Lürssen Rendsburg	Megayacht	Food Waste Handling + Recycling
Tankoa Italy	Yacht	Recycling
Vittoria Italy	Yacht	11 x Food Waste Handling + Recycling

### • 5 Systems on Merchant Ships

<b>Customer</b>	<b>Project</b>	<b>Equipment</b>
Meyer Werft Germany	Research Vessel Meteor	Food Waste Handling + Recycling
Meyer Werft Germany	Research Vessel Sonne	Recycling
Nobiskrug	Offshore	Food Waste Handling + Recycling
BVT Germany	3 Mast Sailing Ship	Food Waste Handling + Recycling
B+V Germany	Fairplay	Recycling



- **8 Systems on Cruise Vessels**

**Vessel****Equipment**

1 x Azura

Incineration System

Food Waste System

Recycling Equipment

5 x Seaborn

Incineration System

Food Waste System (Grinder/Vacuum)

Recycling Equipment

1 x Horizon

Incineration System

Food Waste System (Grinder/Vacuum)

Recycling Equipment

1 x SAGA Newbuilding 2016

Incineration System

Food Waste System (Grinder/Vacuum)

Recycling Equipment

- **4 Systems on Ferries**

**Ferry****Equipment**

2 x Stena

Food Waste Vacuum System

Recycling Equipment

2 x Color Line (Fantasy & Magic)

Food Waste Vacuum System

Recycling Equipment

- **8 Systems on large Navy Vessels**

**Navy**

**Equipment**

2 x French Aircraft Carriers

Incineration System

Food Waste Vacuum System

Recycling Equipment

2 x British Aircraft Carriers

Food Waste Vacuum System

Recycling Equipment

2 x German Frigate

Recycling Equipment

2 x Dutch Navy

Food Waste Grinder System with Food

Waste Holding Tank

Recycling Equipment