REGIONAL MARINE POLLUTION EMERGENCY
RESPONSE CENTRE FOR THE MEDITERRANEAN SEA
(REMPEC)

ASSESSMENT OF THE EXISTING SITUATION AND NEEDS OF THE GSP LIBYAN ARAB JAMAHIRIYA REGARDING PORT RECEPTION FACILITIES FOR COLLECTING SHIP-GENERATED GARBAGE, BILGE WATER AND OILY WASTES IN THE PORTS OF TRIPOLI, MISURATA, KHOMS AND ZAWIA TERMINAL

ACTIVITY 2

COLLECTION AND TREATMENT OF OILY BALLAST WATERS FROM TANKERS

FINAL REPORT

August 2004

ENVIRONMENTAL PROTECTION ENGINEERING S.A.

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This study was executed by Environmental Protection Engineering (E.P.E.) S.A., Greece, contracted by and under the responsibility of REMPEC. E.P.E. S.A. were also contracted by REMPEC to carry out a parallel study on the collection and treatment of solid and liquid wastes (Activity 1), which is the subject of a separate report.

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1. GENERAL

1.1 Subject and scope of the Activity 2 of the project

The Activity 2 of the project entitled "***Port Reception Facilities for Collecting Ship-Generated garbage, bilge water and oily wastes***", is concerned with the identification of the required capacities for collection and treatment of oily ballast water from tankers, taking into consideration the type and capacity of existing installations and specific nature of traffic of oil tankers in the ports and oil terminals of the GSP Libyan Arab Jamahiriya.

The project specifically aims at promoting, in accordance with the Annexes I and V of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), the installation of port reception facilities for the collection of ship-generated oily wastes and garbage, as well as at identifying the present situation and needs regarding the reception facilities for oily ballast waters in the ports of the country.

The ports that were visited and studied in the framework of the Activity 1 and 2 of the project are those of **Tripoli, Misurata, Khoms and Zawia terminal**. However, only the terminal of Zawia due to its exclusive oil - related activities, is discussed in this Report, while the ports of Tripoli, Misurata and Khoms are discussed in the Report of the Activity 1.

1.2 Definitions

Water ballast taken and discharged from oil tankers, in accordance with the Regulations of Annex I of MARPOL 73/78, is distinguished into clean, segregated and dirty ballast water with respect to its contamination with hydrocarbons and also the shipboard spaces where in principle water ballast is carried.

It was deemed as appropriate to provide definitions for those terms related with the identity of different oily mixtures and residues produced onboard oil tankers, as well as those related with the age, the structural and operational requirements of tankers that influence the volume and kind of the abovementioned mixtures.

The following terms and definitions have been extracted basically from the Regulations and Unified Interpretation of Annex I of MARPOL 73/78.

Oil means petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products (other than petrochemicals) including at least those substances listed in the Appendix I to the Annex I of MARPOL 73/78.

Oily mixture means a mixture with oil content.

Oil tanker means a ship constructed or adapted primarily to carry oil in bulk in its cargo spaces and includes combination carriers and any chemical tanker when they carry a cargo or part of cargo of oil in bulk.

Clean Ballast means the ballast in a tank, which since oil was last carried therein, has been so cleaned that effluent there from, if it were discharged from a ship which is stationary into clean calm water on a clear day would not produce visible traces of oil on the surface of the water or on adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

If the ballast is discharged through a type approved Oil Discharge Monitoring and Control System, evidence based on such a system to the effect that the oil content of the effluent did not exceed 15 parts per million shall be determinative that the ballast was clean, notwithstanding the presence of visible traces.

Segregated ballast means the ballast water introduced into a tank which is completely separated from the cargo oil and oil fuel system and which is permanently allocated to the carriage of ballast or cargoes other than oil or noxious substances.

Mediterranean Sea area means the Mediterranean Sea, including the gulfs and seas therein with the boundary between the Mediterranean and the Black Sea constituted by the 41^0 N parallel and bounded to the west by the straits of Gibraltar at the meridian of 5^0 36' W.

Instantaneous rate of discharge of oil content means the rate of discharge of oil in litres per hour at any instant divided by the speed of the ship in knots at the same instant.

Slop tank means a tank specifically designated for the collection of tank drainings, tank washings and other oily mixtures.

New oil tanker means an oil tanker delivered, in practice, after 1/6/1982 or an oil tanker that has undergone a major conversion completed after the above mentioned date.

Crude oil tanker means an oil tanker engaged in the trade of carrying crude oil.

Product Carrier means an oil tanker engaged in the trade of carrying oil other than crude oil.

2. REGULATIONS AND RULES

2.1 Criteria for discharging oily mixtures at sea from cargo spaces of oil tankers

Regulation 9 of Annex I of MARPOL 73/78 provides requirements with respect to the control of discharges of oily mixtures produced in the cargo and ballast areas of oil tankers.

In principle, this kind of discharge is prohibited within the Mediterranean Sea, as a designated Special Area, except of clean or segregated ballast. In addition, outside Special Areas and at a specific distance from the coastline, oily mixtures from tankers proceeding en route, can be discharged at sea provided that:

(i) the instantaneous rate of discharge of oil content does not exceed 30 litres per nautical mile;

(ii) the total quantity of oil discharged into the sea does not exceed for existing tankers the 1/15,000 of the total quantity of the last cargo from which the residue formed a part, and for new tankers the 1/30,000 of the total quantity of the cargo respectively,

(iii) the tanker has in operation an oil discharge monitoring and control system as well as slop tank/s arrangements as required by the respective Annex I Regulations.

No discharge at sea shall contain chemicals or other substances in quantities or concentrations which are hazardous to the marine environment or similar substances, introduced for the purpose of circumventing the conditions of discharge outlined above. The oily mixtures discharge criteria related with oil tankers engaged in voyages within the Mediterranean Sea and Special Areas in general (that is important for oil tankers engaged in voyages within the adjacent to the Mediterranean Special Areas of Black and Red Sea) or outside them are presented schematically into the next table:

Sea Areas		Discharge Criteria
Within a Special Area		No discharge except Clean or Segregated ballast
Outside a Special Area	Within 50 n.miles from the nearest coast	No discharge except Clean or Segregated ballast

	More than 50 n. miles from the nearest coast	No discharge except either: (a) of clean or segregated ballast (b) When: (1) the tanker is en route; and (2) the instantaneous rate of discharge of oil does not exceed 30 litres per nautical mile; and (3) the total quantity of oil discharged does not exceed 1/15.000 (for existing tankers) or 1/30.000 (for new tankers) of the total quantity of cargo which was carried on the previous voyage (4) the tanker has in operation an oil discharge monitoring and control system and slop tank arrangements

2.2 Applicable regulations dealing with the provision of Reception Facilities in ports and terminals

The table below summarizes the relevant requirements for the provision of Reception Facilities both for dirty ballast, tank washings from oil tankers as well as for other oily residues and oily mixtures from all ships.

Regulations of Annex I of MARPOL 73/78	**Summary of the requirements**
Regulation 10 ***Methods for the prevention of oil pollution from ships while operating in Special Areas***	All oil loading terminals and repair ports within a Special Area should be provided with facilities adequate for the reception and treatment of all the dirty ballast and tank washings from oil tankers.
	All ports and terminals within a Special Area shall be provided with adequate reception facilities for other residues and oily mixtures from ships. Reception facilities adequate to meet the needs of the ships using them without causing undue delay should be provided in: - All ports and terminals in which <u>crude oil is loaded into oil tankers</u> where such tankers have immediately prior to arrival completed a ballast voyage of not more than 72 hours or not more than 1,200 nautical miles
Regulation 12 ***Reception Facilities***	- All ports and terminals in which oil other than crude oil in bulk is loaded at an average quantity of more than 1,000 metric tons per day - All ports having ship repair yards or tank cleaning facilities. These ports should have sufficient reception facilities to receive all residues and oily mixtures which remain on board for disposal from ships prior to entering such yards or facilities.

Regulation 12 ***Reception Facilities***	In addition reception facilities should be provided in: - All ports and terminals which handle ships equipped with sludge tanks as required by Regulation 17 of Annex I. All facilities provided to the above-mentioned ports and terminals shall be sufficient to receive all residues retained as above from all ships that may reasonably be expected to call at such ports and terminals. - All ports in respect of bilge waters and other residues, which cannot be discharged in accordance with Regulation 9 of Annex I. All facilities provided to these ports and terminals shall be sufficient to receive oily bilge waters and other residues which cannot be discharged in accordance as mentioned above. All loading ports for bulk cargoes in respect of oil residues from combination carriers which cannot be discharged in accordance with Regulation 9 of Annex I.

2.3 Applicable regulations dealing with Segregated Ballast Tanks and Double Hull arrangements for oil tankers

A summary of the requirements of Annex I, Regulations dealing with the segregated ballast tanks arrangements, as adopted by Resolution MEPC.52(32), before the adoption of the Resolution MEPC.95(46), on 27 April 2001 is illustrated in the next table:

Type of oil tanker	**Deadweight (t.dw.)**	**Time of delivery**	
		Before 1/ 6/1982	**After 1/6/1982**
Crude oil tanker	< 20.000	No any relevant requirements	No any relevant requirements but 13 F provides that all oil tankers of 600 t.dw and above delivered after 6/7/1996 should have hull spaces and tanks that can potentially take ballast water
Crude oil tanker	20.000 – 40.000	No any relevant requirements but in practice, due to the effect of Regulation 13G (4), this class of tankers, becomes PL/SBT tankers 25 years after delivery	Every tanker should be provided with segregated ballast tanks

	> 40.000	They should be provided with SBT, or they can operate with COW in accordance with Regulation 13B (similarly the abovementioned 13 G (4) Regulation applies)	Every tanker should be provided with segregated ballast tanks
Product Carrier	< 30.000	No any relevant requirements but in practice, due to the effect of Regulation 13G (4), this class of tankers, become PL/SBT tankers 25 years after delivery	No any relevant requirements but 13 F provides that all oil tankers of 600 t.dw and above delivered after 6/7/1996 should have hull spaces and tanks that can potentially take ballast water
	30.000 – 40.000	In practice, due to the effect of Regulation 13G (4), this class of tankers, become SBT tankers 25 years after delivery	Every tanker should be provided with segregated ballast tanks
	> 40.000	Alternatively of the provision of segregated ballast tanks, they can operate with dedicated clean ballast tanks in accordance with the requirements of 13 A Regulation (same effect of Regulation 13 G (4))	Every tanker should be provided with segregated ballast tanks

On crude oil tankers of 20.000 tons deadweight and above and product carriers of 30.000 tons deadweight and above, the aggregate capacity of wing tanks, double bottom tanks, forepeak tanks, and afterpeak tanks is required to be not less than the capacity of the segregated ballast tanks necessary to meet the requirements of the relevant Regulation 13 of the Annex I of MARPOL 73/78.

In addition wing tanks, or spaces and double bottoms tanks used to meet the requirements of the abovementioned Regulation shall be located as uniformly as practicable along the cargo tank length. Additional segregated ballast capacity provided for reducing longitudinal hull girder bending stress, trim, etc. may be located anywhere within the ship.

In April 2001, during the 46th session of the IMO Marine Environment Protection Committee, amendments to the 13 G Regulation of Annex I, were adopted which entered into force on the 1st September 2002. The impetus for the revision of the abovementioned Regulation was caused by the effects of the serious pollution that the total loss of the 23 year old product tanker

Erika in December 1999 caused, along with other subsequent casualties particularly in European waters.

The new requirements are expected to have a dramatic impact on the world' tanker fleet since the adopted phase out criteria guide a significant number of oil tankers not only those built before 1982 (pre MARPOL tankers) but also new ships out of service.

For the purpose of the revised 13 G Regulation, oil tankers are classed into three categories, as follows:

- Category 1 oil tanker means an oil tanker of 20.000 tons deadweight and above carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo, and of 30.000 tons deadweight and above carrying oil other than the above, which does not comply with the requirements for new oil tankers as defined in Regulation 1(26) of Annex I.

- Category 2 oil tanker means an oil tanker of 20.000 tons deadweight and above carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo, and of 30.000 tons deadweight and above carrying oil other than the above, which complies with the requirements for new oil tankers as defined in the Regulation 1(26) of Annex I.

- Category 3 oil tanker means an oil tanker of 5.000 tons deadweight and above but less than the sizes previously mentioned.

Category 1 oil tankers

This category of oil tankers represent those, pre Protectively Located - SBT and non double hull oil tankers, which in practice, should be withdrawn by their anniversary date occurring between 2003 and 2007. Every oil tanker falling under this category, shall comply with the requirements of the Regulation 13 F of the Annex I, not later than the anniversary of the date of delivery of the ship in the year according to the following table:

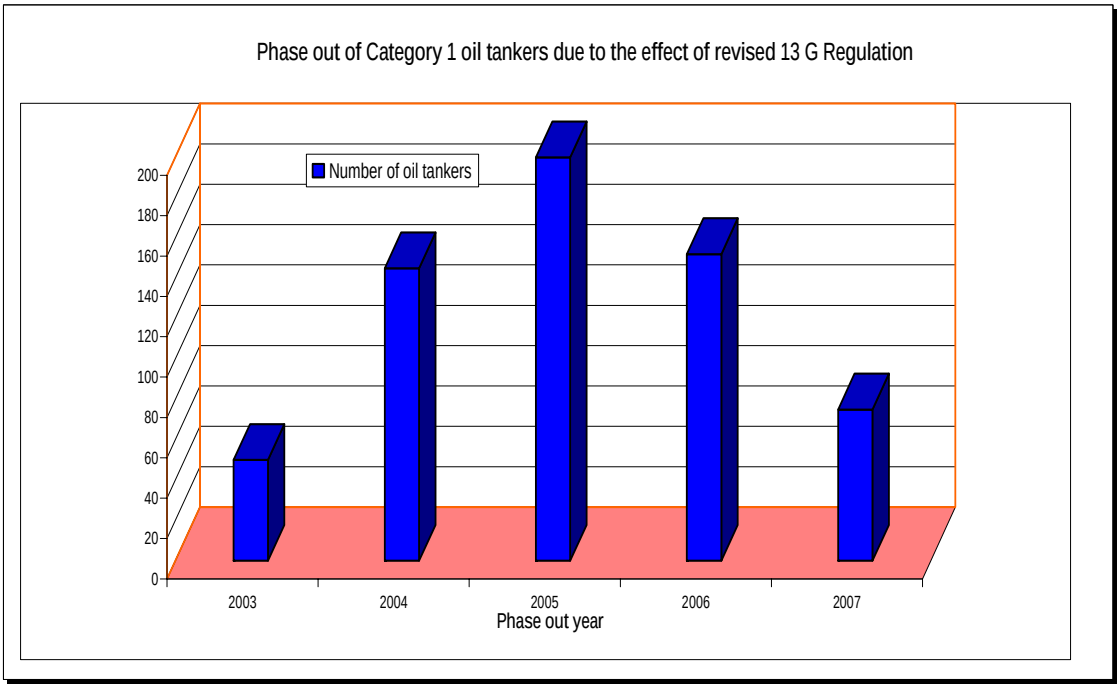
Category of oil tankers	Phase out Year
Category 1	2003 for ships delivered in 1973 or earlier 2004 for ships delivered in 1974 and 1975 2005* for ships delivered in 1976 and 1977 2006* for ships delivered in 1978, 1979 and 1980 2007* for ships delivered in 1981 or later
	* Subject to compliance with the Condition Assessment Scheme, in accordance with MEPC Resolution 94(46)

According to an INTERTANKO study, incorporated in an another study titled *"Oil Tanker Outlook, Assessing the impact of the revised IMO MARPOL 13G Phase out"* produced by ABS, it is estimated that about 600 oil tankers falling under the Category 1 representing in total 73 million tons deadweight, will

be phased out between 2003 and 2007, reflecting the combined impact of the remnants of the 1970s VLCC fleet and a large number of pre-MARPOL product tankers.

The obvious impact of the revised 13 G to the non SBT oil tankers is the accelerated schedule of their compliance with the requirements of 13 F, since the option to extent the time period for complying with 13 F up to 30 years after the date of delivery (provided that wing tanks or double bottoms not used for the carriage of oil, covering 30% of the side or the bottom) is lost and thus the 2007 year is determined as a key date where the presence of this size non-SBT tankers is fully eliminated.

The following graph shows the number of Category 1 oil tankers phased out in the period between 2003 and 2007.



Category 3 oil tankers (oil tankers of 5.000 t.dw and above but less than 20.000 t.dw)

Taking into account the 13F (2) Regulation, every new oil tanker of 5.000 tons deadweight and above has been provided with the following alternative structural and operational choices to comply with the requirements aimed at the prevention of oil pollution in the event of collision or stranding:

- Segregated ballast tanks and spaces other than oil tanks within the cargo tank length to be arranged as to comply with specific requirements,

- The entire cargo tank length to be protected by ballast tanks or spaces other than cargo and fuel oil tanks (double hull requirements),

- Other methods of design and construction accepted as alternatives including hydrostatic ballast loading that ensure at least the same level of protection against oil pollution in the event of collision or stranding.

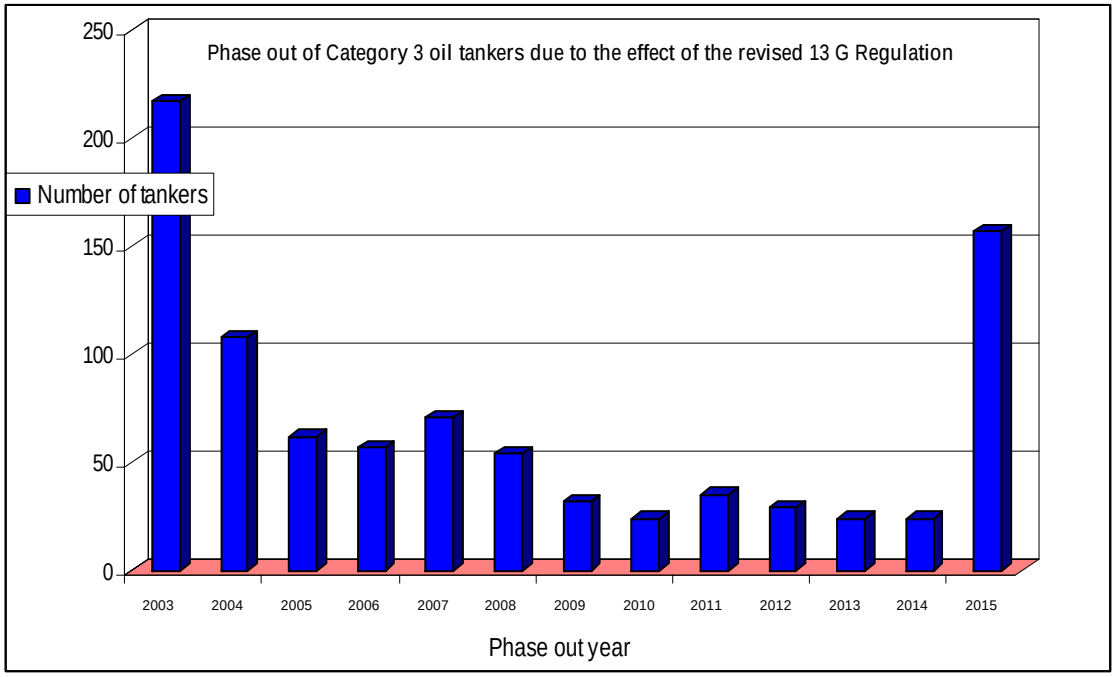
Since through the Resolution MEPC.52(32) adopted on 6 March 1992, the new Regulations 13 F and G entered into force on 6 July 1993, it is concluded that while the new oil tankers more than 5.000 tdw but less than 20.000 tdw, are built and operated with arrangements for segregated ballast tanks, the existing oil tankers of this size should comply due to the effect of the revised 13 G with the abovementioned requirements not later than their 26th anniversary date, effective from 2003 forward.

Phase out by Anniversary of delivery date in	Year of delivery	Tanker age
2003	earlier than and including 1973	30
2004	1974 – 1975	30 – 29
2005	1976 – 1977	29 – 28
2006	1978 – 1979	28 – 27 – 26
2007	1980 – 1981	27 – 26
2008	1982	26
2009	1983	26
2010	1984	26
2011	1985	26
2012	1986	26
2013	1987	26
2014	1988	26
2015	later than and including 1989	26 – 19

The most important peaks in the abovementioned phase out, coincide with the beginning and end of the whole period when a large number of oil tankers that do not meet the double hull standards will be forced out of service.

In 2003 and 2015 respectively, 217 and 157 of these tankers will have to be withdrawn. The impact of phase out to the small tankers which most of them are product carriers of between 5.000 and 20.000 tons deadweight is considered as significant due to the large number of these tankers.

It can be projected that by 2007 (which was the beginning of the phase out process of the previous 13 G Regulation) 515 oil tankers of this size should be withdrawn.



On 4th December 2003, the Marine Environment Protection Committee of IMO adopted the Resolution MEPC.111(50) which among others amended the existing Regulation 13 G of Annex I of MARPOL 73/78 and added a new Regulation (13 H) regarding the carriage of heavy grade oil as cargo from oil tankers. An oil tanker to which this regulation applies shall comply with the requirements of Regulation 13 F of this Annex not later than 5 April 1005 or the anniversary date of the date of delivery of the ship on the date or in the year specified in the following table:

Category of oil tanker	Date of Year
Category 1	5 April 2005 for ships delivered on 5 April 1982 or earlier 2005 for ships delivered after 5 April 1982
Category 2 & 3	5 April 2005 for ships delivered on 5 April 1977 or earlier 2005 for ships delivered after 5 April 1977 but before 1/1/1978 2006 for ships delivered in 1978 and 1979 2007 for ships delivered in 1980 and 1981 2008 for ships delivered in 1982 2009 for ships delivered in 1983 2010 for ships delivered in 1984 or later

It is obvious that the final phasing out date of the Category 1 tankers is brought forward to 2005 from 2007 while the final phasing out date for Category 2 and 3 tankers is brought forward to 2010 from 2015.

2.4 Dirty ballast and other oily mixtures produced from oil tankers

Activity 2 of the project is concerned with the dirty ballast from tankers, however it was considered as advisable to incorporate in this Report and the work done, tank washings and other oily mixtures and residues produced in areas other than the machinery spaces of tankers for the following two reasons:

1. Due to the already significant decrease of non SBT tankers and the anticipated dramatic decline in the future, the potential quantity of dirty ballast to be received at the oil loading terminals in the Mediterranean Sea Area is expected to be minimized, therefore the next most important - in terms of quantity - oily mixtures are tank washings collected in the nominated slop tanks or other shipboard areas (1.5 - 8 % of tankers deadweight).

2. MARPOL 73/78 Regulations related with the reception facilities in oil terminals and ports, provide in practice, that these facilities should be capable to receive all oily wastes including - apart dirty ballast and tank washings - oily wastes from the machinery spaces of ships. Calculations of dirty ballast and tank washings waste streams for each port and oil terminal, have been made also in this Report for the other two oily wastes streams (oil residues and oily bilge water).

IMO has provided guidelines for estimating the quantities of oily wastes in general, which would be required to be retained on board and discharged to reception facilities within the constraints of the:

- origin of oily wastes or residues;
- the type and design of ships;
- ships' operating route; and
- various types of ports and terminals required to provide reception facilities to ships.

Dirty ballast water can't be discharged to the sea at oil terminals, while discharge of clean ballast might be carried out provided that local or national regulations allow this operation, usually under control and supervision. The discharge of the bulk of the settled dirty ballast is characterized by a high flow rate, large in quantity but of low oil content. Oil content is typically (during for instance discharge in good weather outside a Special Area) around 30 ppm but higher oil content may be expected if there is substantial ship movement and disturbance of the water - oil interface.

The amount of dirty ballast aboard a tanker on arrival in the appropriate categories will vary from ship to ship and also with weather conditions. Generally, the total ballast weight on average might exceed 30 per cent of deadweight. Invariably, oil tankers arriving with dirty ballast may also have

on board tank washings from tank cleaning performed en route which needs to be received ashore in any available reception facilities.

According to CONCAWE (the Oil Companies European Organization for Environment, Health and Safety, October 2000 Review), during studies focused on the emissions control at marine terminals, data from seven terminals indicated that in 1999, the share of involvement of non-SBT tankers in the loading operations of oil, in particular volatile products was less than 20%. Other studies mentioned therein, showed a gradual downward trend in the use of non-SBT tankers from 45 per cent in 1993 to 13 per cent in 1999.

Oily mixtures accumulated in slop tanks (the content of which is not allowed to be discharged within the Mediterranean Sea Area), are produced basically during the following operations:

- Washing of cargo tanks in crude oil tankers before loading ballast or in product carriers before changing the type of cargo. Crude oil washing has significantly reduced the amount of water needed for washing of cargo tanks required for clean ballast or not. If crude oil washing is undertaken in all tanks during the cargo discharge immediately prior to entering a ship-repairing yard for repairs, the total quantity of slops and sludge for disposal at the tank cleaning berth will be substantially reduced.

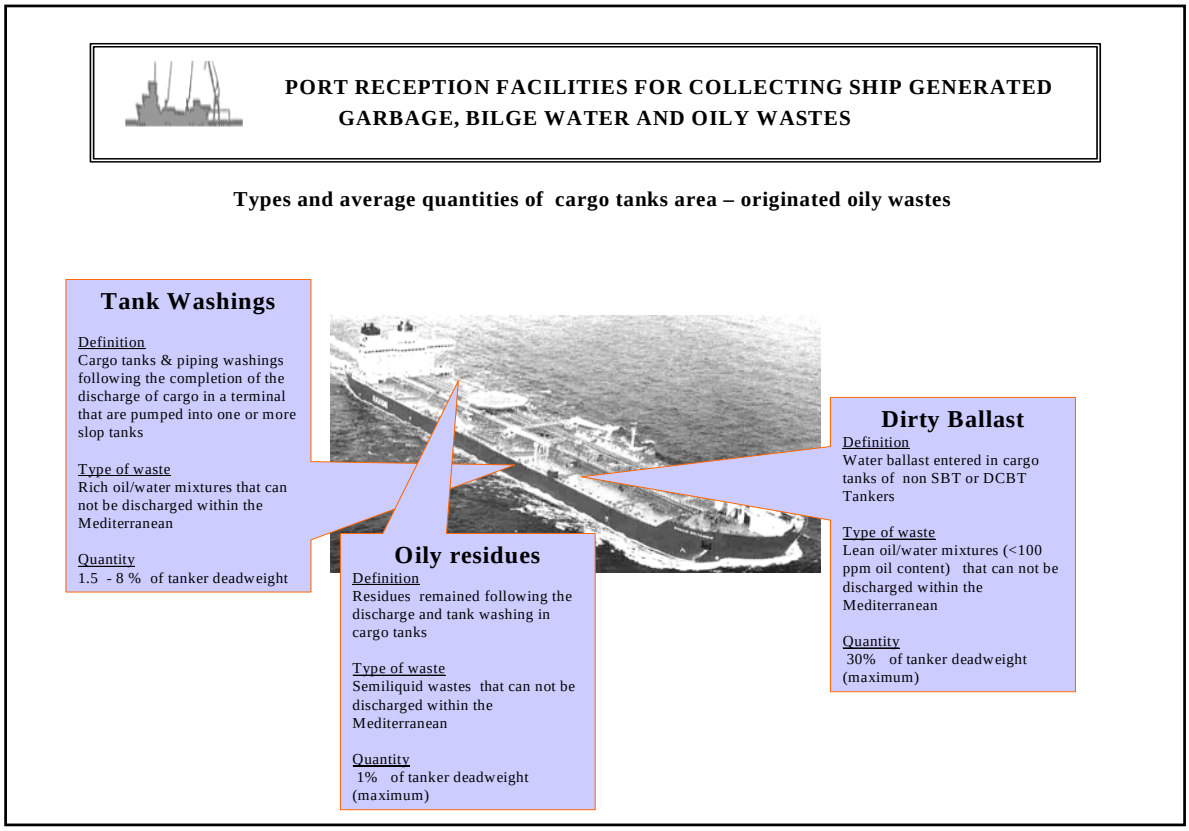
- Drainage and stripping of the cargo pumping system, flushing of cargo lines and pumps, stripping of oil residues of dirty ballast to slop tanks. The discharge of the bulk of settled water from a slop tank is characterized by a moderate discharge rate and oil content which could be typically around 150 ppm while the slow discharge (outside Special Areas) of slop tank water as the oil-water interface approaches the tank suction is characterized by very slow discharge rate but usually of a higher oil content, on average 500 ppm which can rise more during the discharge.

The wash water quantity, however, will be small in comparison with the quantity of dirty ballast (probably less than 5 per cent). Retention of oil onboard requirements, provide that adequate means shall be provided for cleaning the cargo tanks and transferring the dirty ballast residues and tank washings from the cargo tanks into slop tank or a combination of slop tanks.

The arrangement of the slop tank or tanks (new oil tankers of 70.000 t.dw and above are provided with at least two tanks) shall have a capacity necessary to retain slops generated by tank washings, oil residues, and dirty ballast residues.

The total capacity of the slop tank/s shall not be less than 3% of the oil carrying capacity of the oil tankers. However, the abovementioned capacity can be reduced up to 1.5 % for oil tankers and 1% for combination carries provided that specific conditions apply accepted by the Flag State

Administration of ships. The different oily wastes from the cargo areas of oil tankers are shown schematically below:



While, in general, a tank, the content of which has been discharged to a terminal, should be washed and all contaminated washings should be discharged to a reception facility before the ship leaves the port of discharge for another port, however there are some exceptions from this rule such as:

1. The tanks that are discharged are to be reloaded with the same substance or another substance compatible with the previous one and that the tanker will not be washed or ballasted prior to loading,

2. The tanks that are discharged are neither washed or ballasted at sea if the tanker is about to proceed to another port unless it has been confirmed in writing that a reception facility at that port is available and adequate for the purpose of receiving the residues and solvents necessary for the cleaning operations.

For many of 25 year old and older pre-MARPOL tankers, the most attractive option for meeting the requirements of Regulation 13G is to utilise Hydrostatically Balanced Loading. It's estimated that this kind of option to comply with the requirements of the abovementioned Regulation, was of preference for most of the tankers over 50.000 t.dw. currently operating worldwide.

It should be noted that according to OCIMF (Oil Companies International Forum), the application of the Hydrostatically Balanced Loading process to a tanker engaged in performing multi port operations, requires that tanks covering at least 30% of the side of the length of the cargo section should remain empty until the last loading location or they should be unloaded at the first discharge port. The result of the condition of a tanker in ballast upon its arrival at a loading oil terminal, is the need for a distribution of ballast in such a way to enable the centre tanks and some of the wing tanks to be loaded first.

Consequently, clean ballast should be loaded to wing tanks, which have a higher percentage of shadow sectors which make them more difficult to clean to enable clean ballast to be hosted into them and due to the greater surface area to tank volume ratio, generation of bigger quantities of oil slops would be produced at the end of tank washing, that should be retained onboard and discharged to a suitable reception facility. Oil tankers which are not provided with segregated or dedicated ballast tanks, carry dirty ballast water during voyage without cargo, which corresponds to about 25% of the deadweight, however during adverse weather conditions, additional ballast up to 10 - 15% of the deadweight may be required (a 30% of the deadweight factor was considered as a safe margin for the abovementioned cases). Although uptake of water ballast in cargo tanks of SBT tankers can not be excluded in similar weather and sea state conditions, the respective column in the following table it was intentionally left without any entry. In the following table, a synopsis of the quantities of dirty ballast, tank washings and other oily residues produced from cargo and ballast operations in oil tankers is illustrated.

Types and quantities of oily mixtures generated from cargo and ballast operations on oil tankers at oil terminals

Type of oil mixtures & residues	**Oil contaminated ballast** *(dirty ballast)*	**Tank Washings**	**Oil Residues**
	Loading Terminals, Ship-repairing Ports & Tank Cleaning Facilities	Loading Terminals, Ship-repairing Ports & Tank Cleaning Facilities	Loading Terminals, Ship-repairing Ports & Tank Cleaning Facilities
Crude oil tankers	30% of Dwt for non-SBT oil tankers	1.5 - 8 % of Dwt The minimum quantity is related to tankers performing tank cleaning en route to the terminal and arriving with washings wholly accumulated in the slop tanks	1 % of Dwt
Product Carriers	30% of Dwt for non-SBT oil tankers	1.5 - 8 % of Dwt The minimum quantity is related to tankers performing tank cleaning en route to the terminal and arriving with washings wholly accumulated in the slop tanks	0.5 % of Dwt for black oil products 0.1 % of Dwt for white oil products

3. METHODOLOGY

3.1 Methodology for estimating the volumes of oily mixtures wastestreams

The methodology used for calculating the volumes of dirty ballast and other relevant oily wastestreams from tankers at the ports and oil terminals of the project involved the following tasks:

1. Calculation of the volumes of wastestreams by means of a series of formulas, that were developed taking into account:

1a The Guidelines developed by the International Maritime Organization to determine the adequacy of reception facilities for oily wastes from ships, based on the permissible discharge criteria at sea, oil retention onboard requirements and practices, as well as assumptions on waste production onboard ships.

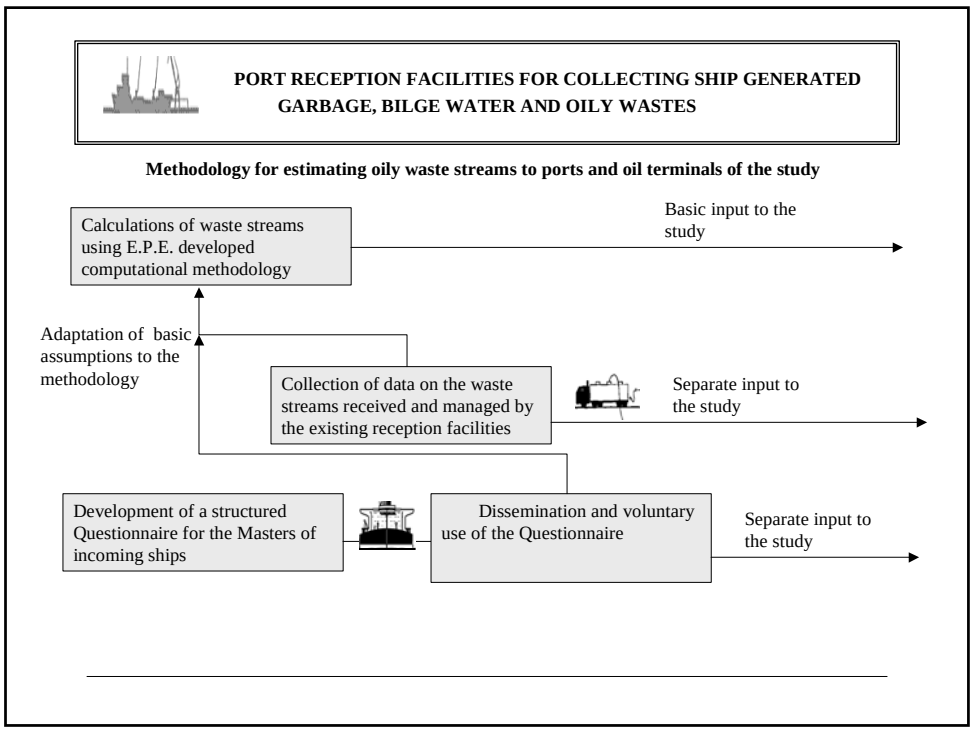
1b Data on terminals specific traffic, collected from the responsible port authorities and/or other maritime-related sources, the berthing infrastructure in relation with the permissible and average sizes of ships, the volume of oil as cargo handled on average, any operational requirements imposed to tankers, etc. Where difficulties were faced with regard to the collection of proper, accurate and detailed data, maximum values were considered to provide safer estimates.

2. Collection of data maintained and provided by the operators of the existing reception facilities with the aim to compare the results taken from the first step and also to adapt better the formulas to the local conditions. In parallel, these data provided a separate input to this Report.

3. A structured questionnaire based on the IMO relevant Guidelines was developed to be disseminated on a voluntary basis, to a number of oil tankers with the aim to capture as much as possible information for their actual needs.

   It should be noted that a number of factors effected to have a limited input from this task including those related with the specialized and demanding operation of oil tankers in particular at offshore mooring systems, the limited time spent at the terminals, etc.

   The methodology outlined before is presented schematically below:



The basic formulas used, before any adaptations as explained earlier, in estimating the different oily wastestreams are provided below:

$$\mathbf{D_b = \frac{0.3 \times N_t}{365} \times D_m} \text{ (tons)}$$

D_b = Reduced daily quantity of dirty ballast (tons)

N_t = Average annual number of oil tankers calling at the terminal

D_m = Maximum permissible deadweight of non-SBT oil tankers at the terminal (tons)

$$\mathbf{T_w = \frac{C_t \times N_t}{365} \times D_m \text{ (tons)}}$$

where

T_w = Reduced daily quantity of tank washings (tons)

N_t = Average annual number of oil tankers calling at the terminal

D_m = Maximum permissible deadweight of oil tankers at the terminal (tons)

C_t = Tank washings Coefficient factor varying from 0.015 – 0.08

$$O_w = \frac{C_r \times N_t}{365} \times D_m \text{ (tons)}$$

where

O_w = Reduced daily quantity of oily liquid residues (tons)

N_t = Average annual number of oil tankers calling at the terminal

D_m = Maximum permissible deadweight of oil tankers at the tank cleaning facility or ship - repairing port (tons)

C_r = Oily residues Coefficient factor varying from 0.001 – 0.01

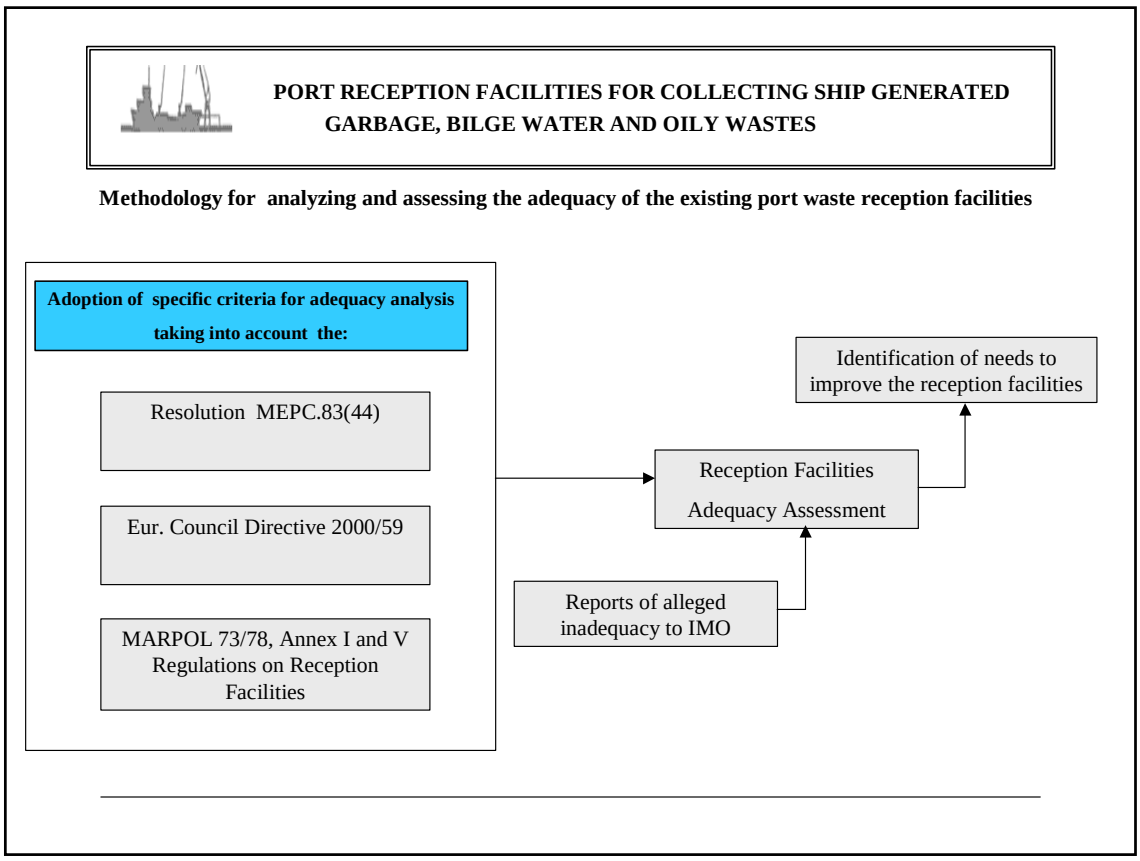
3.2 Methodology for analysing and assessing the adequacy of the existing reception facilities

Criteria for assessing the adequacy of the capacity and the whole operation of the existing port waste reception facilities were adopted for audit purposes, taking into account the IMO relevant Guidelines provided with the Resolution MEPC.83(44), the requirements of the European Council Directive 2000/59/EC, and the provisions of those MARPOL 73/78 Regulations of Annex I and V that deal with the establishment and operation of port reception facilities within Special Areas.

As explained later, the Sample Assessment Procedure annexed in the abovementioned Resolution was adapted for use during the port surveys and data collection phases, taking also into account the preceding preparatory work.

Recent documentation on the reports of alleged inadequacy provided to IMO by Flag States was requested by the Organization in reviewing and capturing information regarding the ports of the project to enable the further assessment of the adequacy of the existing reception facilities.

The methodology used is presented schematically below:



Resolution MEPC.83(44), provides Guidelines for ensuring the Adequacy of Port Waste Reception Facilities, with the aim:

- to assist Member States in planning and providing adequate port waste reception facilities and,

- to encourage them to develop environmentally appropriate methods of disposing ship – generated waste ashore.

These Guidelines which complement the IMO Comprehensive Manual on Port Reception Facilities, provide information relating to the on-going management of existing facilities but also for the planning and establishment of new facilities.

The Guidelines have incorporated an Assessment Form as an Appendix (Sample Assessment Procedure for Ports - Management/Strategy for waste reception facilities at ports, marinas, and boats harbours), the use of which is encouraged by the responsible State Authorities, independent bodies or assessors. The procedure provides an example of a detailed audit that might be conducted by a consultant, offering a systematic check list of questions designed to obtain information with respect to existing port waste reception facilities, the level of waste collection service provided to port users, the level

of environmentally sound waste handling, valorisation and final disposal practices and methods, etc.

It was deemed as advisable to use in a properly adapted way for the scope of the project, the abovementioned assessment procedure, as an integral element of both the collection of data process as well as of the site surveys at the areas of the ports and oil terminals of the project.

Since, the operation of fixed ship-generated waste reception facilities or more flexible collection and management schemes in the port area is not isolated from the rest of the port infrastructure and the services provided by the ports authorities and operators, many of the Sample Assessment items were incorporated among other things within the two port - specific questionnaires No. 2 (Questionnaire for Oil Terminals involved in the Project) and No. 3 (Questionnaire for Ports involved in the Project) which represent the basic means for collecting input for most of the needs of the project.

- **Criteria for assessing the adequacy of the existing reception facilities**

Two major sets of criteria were identified as more suitable and at the same time critical to assess the adequacy of the existing reception facilities, one dealing with the ship-port interface and a second dealing with the protection of the environment from the secondary wastes or potential pollution produced by the waste collection, treatment and disposal processes.

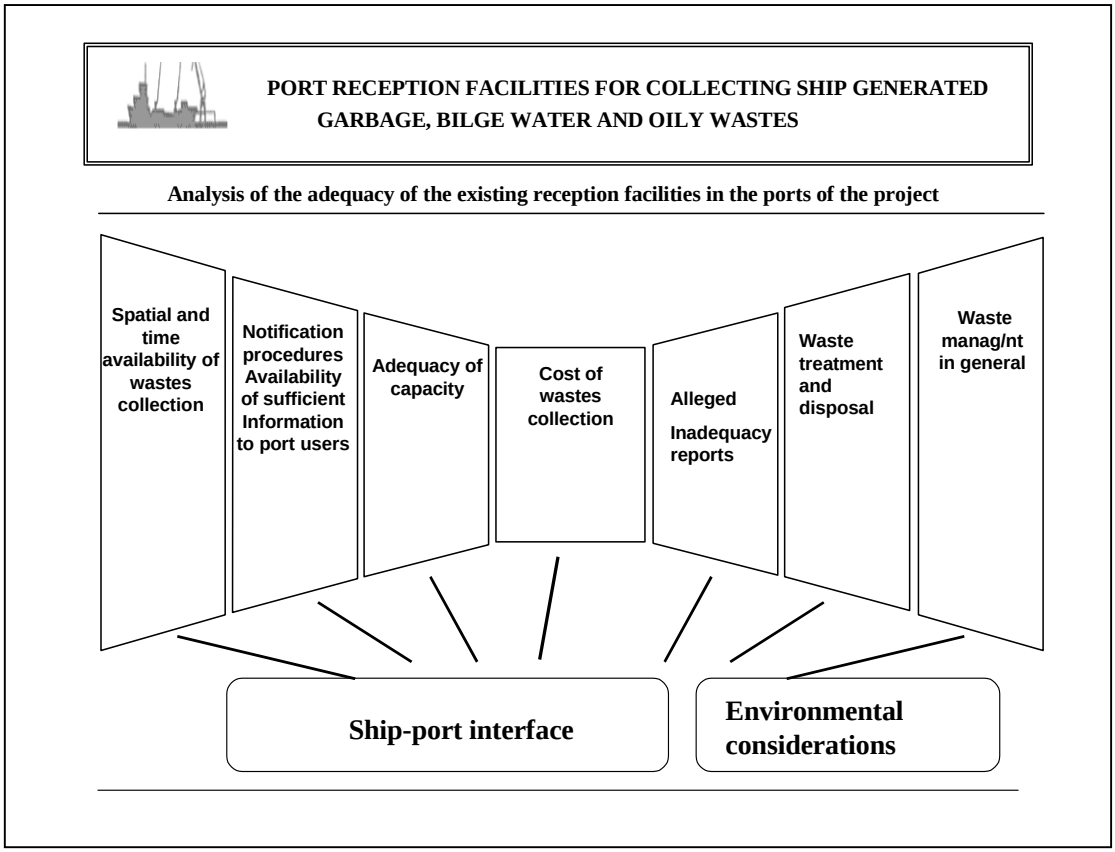
The first set provides a series of criteria emphasizing on the operational needs of ships normally calling at the ports and terminal of the project. There is no doubt that a port to become successful and adequate in providing reception facilities for ship-generated waste, should have regard to the operational needs of its users supplying all the appropriate means to collect and further manage the different types and volumes of wastes from ships normally engaged in operation at its terminals or wider area such as designated anchorages, etc. In parallel, the operation and the management of the existing facilities should not provide any disincentives for incoming ships to use them.

The second set of criteria concentrates on environmental and technical considerations regarding the way that waste collected is managed and finally disposed of, including procedures enabling the wastes' traceability, procedures for complying with national or other standards related with the discharge of effluent water, etc.

The second series of criteria used to enable the assessment of the adequacy of the existing reception facilities, supplements the first one related with the provision of sufficient services to shipping, by attempting to identify whether or not the waste management after the collection in the port or the terminal area is environmentally sound.

Whenever, during the missions in the beneficiary countries or during the information collection process, details of the local or wider waste management strategy and relevant requirements were known, it was almost always feasible to result in safe conclusions on that.

The criteria used to assess the adequacy of the existing reception facilities are, schematically, presented in the following diagram:



- **Spatial and time availability of wastes collection**

This criterion can apply to both dock side port areas as well as to jetties, SPMs or other type of berthing or mooring systems provided in a port or an oil terminal, simply determining the availability of reception facilities in terms of the nominal berthing sites and the immediacy of wastes collection upon the request of a ship to deliver its wastes or residues.

A dirty or clean ballast reception line provided, ideally, at each one of the buoys of a terminal where de-ballasting can normally take place in parallel to the loading of crude oil or oil products represents an example of adequate availability of reception facilities.

In commercial and multipurpose ports this availability can be achieved when almost every nominal berthing place can operate as a site where reception of oily wastes or garbage can take place by either navigable or land-based mobile means. It's important for ships that wish to deliver wastes to an existing reception facility, that the collection process does not entail any

undue delays forcing the ships to change berthing site or in general to spend time beyond the time of their port operation since it is unlikely that a ship would enter a port solely to deliver wastes.

- **Notification procedures – Availability of sufficient information**

Those that provide collection of ship-generated wastes in the ports areas, require, in principle, advance notification of the intention to use the existing facilities, in particular, when a number of qualified and licensed, privately operating, waste contractors provide some or all of the port's waste collection services. Providing advance notification of the type and quantity of wastes onboard for delivery to a reception facility should minimise the risk of undue delay to ships. The importance of prior notification has been already acknowledged in the relevant legislation of the European Communities, resulting in the development and use of a uniform system by the Masters of ships bound for a port located in the Eur. Community.

Prior notification in the form of a standard message (incorporated as Annex II of the 2000/59/EC Directive) should be provided to the port authority or other entity designated to receive this information. It was witnessed during the missions in the ports of the project, that several port authorities have adopted some kind of notification both to provide and receive information from ships with respect to the potential receipt of wastes from them. In any case, it is considered as essential for the Masters of ships that call to a port, to receive information well in advance on the availability or reception facilities, any perhaps operational or waste transfer requirements, fees incurred, etc.

- **Adequacy of collection capacity**

The initial reception capacity that reflects the volume of liquid or solid waste that can be received from a ship without causing undue delay, is of predominant importance for ships wishing to deliver their wastes at a port. While the type and characteristics of ship-generated waste determine in principle which treatment method should be applied, the type and volume of wastes expected to receive at a port determine the capacity of the reception facility. Since, the inflow of ship-generated waste is not constant, the abovementioned capacity, in particular for fixed reception facilities reflects the volume of holding tanks or buffering and equalization tanks in which massive oily wastes such as dirty ballast or tank washings are collected before treatment. The holding capacity of these tanks is determined by the average or peak inflows and also the capacity of the subsequent treatment process.

In respect of ship-generated garbage, the collection capacity invariably should match the volumes requested to be delivered and also the segregated kinds of solid wastes as a result of the daily garbage management practices onboard ships or of the port requirements for hygiene or sorting and recycling purposes. In the same criterion, it is also taken into consideration

the interface between the ship and the reception facility to permit a timely delivery of wastes.

- **Cost of waste collection service**

One of the demanding financial aspects of the establishment and operation of reception facilities for collecting ship-generated waste, is the ships' charging system and in general the operational cost. Two principles dominate the basis on which a charging system is built and operates, the selection and use of which requires due consideration of several, mainly local factors.

The first one is the "polluter pays" principle which implies that, those produce the wastes should pay for their reception, treatment and disposal and the second one is the "shared costs" that implies that all costs are covered by governmental financing and other contributions which clearly does not represent a cost recovery scheme. In line with "the polluter pays" principle, the new European Community legislation on port reception facilities, requires the establishment of a fair, transparent and reasonable cost recovery system through which fees collected from ships would be able to cover the cost of the port reception facilities including the treatment and disposal of wastes.

To ensure that the cost recovery systems do not provide any incentives for ships to discharge illegally their waste at sea polluting the marine and coastal environment, three basic rules are adopted to apply to all ocean-going ships calling at a port in the area of a Member State jurisdiction, which are as follows:

Fees for ship-generated waste *(in accordance with Article 8 of the 2000/59/EC Directive)*
▪ All ships calling at a port of a Member State shall contribute significantly to the costs of reception facilities including the treatment and the disposal of waste received, irrespective of the actual use of the facilities. Arrangements to this effect, may include incorporation of the fee in the port dues or a separate standard waste fee. The fees, may be differentiated with respect to factors such as the category, type, size of the incoming ships, etc. ▪ The part of the costs which is not covered by the abovementioned fee, if any, shall be covered on the basis of the types and quantities of ship-generated waste actually delivered by the ships. ▪ Fees may be reduced if the ship's environmental management, design, equipment and operation are such that the Master of the ship can demonstrate that it produces reduced quantities of ship-generated waste.

In the adequacy assessment procedure, it was not intended to assess or comment on the current charging system at the ports of the project, since numerous, local factors (economic, social, administrative, etc.) should be taken into account to determine whether or not fees collected by ships are reasonable and effective for the level and adequacy of the service provided. However, in every case where completed questionnaires from ships were collected with the assistance of Port Authorities and analysed, the judgement

of their Masters with respect to the sensibility of the fees was only taken into account to provide an input to the assessment.

- **Reports of alleged inadequacy of reception facilities**

The International Maritime Organization has established a reporting system for alleged inadequacies and observed lack of adequate reception facilities under the provisions of MARPOL 73/78. All Parties to MARPOL 73/78, apart from their obligations to communicate to the International Maritime Organization a list of the existing reception facilities in their ports and territories able to collect wastes from ships as defined in the Annexes I and II (in accordance with the Article 11(1)(d) of the Convention), are also recommended to notify the Organization for subsequent transmission to the Parties concerned, of all cases where facilities are alleged to be inadequate.

The format currently used by Flag States for reporting alleged inadequacies of port reception facilities is provided in the MEPC/Circ.349 that revised the previous MEPC/Circ.318. In practice, Flag States are encouraged to distribute the abovementioned format to ships, recommending to Masters to use it to report to their Administration, and preferably to the Authorities of the Port State. Flag States are required to notify IMO of any case where facilities were alleged to be inadequate. It should be pointed out that the response rate of IMO Member states is apparently quite low.

In accordance with the above-mentioned procedure, information on reports concerning inadequacy of reception facilities in the area of the project, was requested and collected by IMO, for the period of the last three years.

- **Serious operational restrictions**

Under this criterion, an effort was made to identify and assess serious operational restrictions (other than those related with the initial reception capacity of the facilities) that could influence the waste collection service provided to ships that normally call at a port. The disposal of oil residues containing for instance lead compounds which can be found in some refined oil products or concentrations of tank cleaning chemicals, entails an advanced treatment which is not always available at the existing reception facilities.

- **Port – based waste treatment**

The collection predominantly, and any subsequent waste management activity in a port area should be carried out in such a way as to prevent pollution of the environment and enhance its protection from secondary pollutants produced during the waste storage and pre-treatment phases that can take place in the port area before the transportation and final disposal of wastes.

The operation of a port facility for collecting oily wastes or garbage from ships should ensure that, in particular, the pre-treatment, or even disposal

should be carried out in accordance with any applicable local, national or regional requirements. For the candidate countries to join the Eur. Union, the coherent European Community legislative framework dealing with the disposal of waste oils, the management of hazardous waste and non-hazardous waste, provides already those requirements, standards and recommended options that the treatment, recovery or disposal of ship-generated waste and cargo residues should meet.

As expected, oily wastes reception in most of the ports and oil terminals of the project, was combined with storage, primary separation and treatment aimed to remove oil from water to produce a water effluent that could be discharged at sea provided that any applicable discharge standards are met. At the same time, the second objective of the port passed treatment was the recovery of oil for recycling or re-use. Appropriate technologies or sequences of water effluent treatment steps, can, invariably, ensure the preferable compliance with local or national regulations since discharge of oily wastes into surface waters or in general uncontrolled discharge is prohibited in every country of the project.

While, reception facilities for ship-generated garbage act as a link between the incoming ships to a port and the final disposal sites of the nearby area, oily wastes collection at on-shore facilities and in navigable means such as barges, is combined with storage and primary treatment. What was really assessed to indicate the adequacy of the treatment of oily wastes in a port, was the efficiency of the method and the infrastructure used in relation to the identity of the type of oily wastes collected and processed.

It is widely known that oil derived liquid wastes such clean or dirty ballast, washings from tanks where crude oil or oil products carried, oily bilge water, sludge mainly produced from fuel and lubricating oils purification, used lubricants, etc. make particularly demanding the collection and treatment process since the above mentioned types of oily wastes may include numerous chemical compounds and may have different physical and chemical properties.

Generally speaking, only free oil in oily water mixtures can be removed through simple buoyancy separation techniques while it has been demonstrated that mechanically (produced by mechanical shear forces during mixing or pumping) or chemically emulsified oil (produced due to chemical bonding from the use of surfactants or cleaning agents) needs further treatment.

- **Waste final disposal and valorisation**

Since, disposal of wastes collected from ships is an integral component of the entire waste management system applied in a port or a wider area, the identification and assessment of the existing uses of recovered oil and separated garbage able to be recycled, along with their final disposal, were the objectives set upon the incorporation of this criterion to the assessment process.

Recovered oil can be used with or without blending with regular fuel oils (provided that its quality meets specific criteria related with the intended use) as supplementary fuel for either the land-based industry or shipping. Certainly, this perspective depends on the local industrial needs including also the operational needs of the combined reception-treatment facilities themselves.

The co-existence of treatment facilities with bunkering stations in the port areas, makes possible the blending of recovered oil with standard types of marine fuels and therefore the supply of a recovered oil based fuel oil, provided that it's accepted from an environmental point of view (absence of hazardous substances the combustion of which could result in harmful air emissions, etc.) and also from a operational safety point of view (e.g. production of potentially corrosive mixtures and sub-products during the combustion process that could cause significant failure at the ships engines and fuel distribution systems). It's worth mentioning that a trend is appearing, initiated by national standardization bodies (e.g. ASTM) to provide standard compositional specifications for recycled oils that are intended to be used as fuel oils.

The fact that modern ships are provided with tanks for retaining used lubricating oils segregated from other oily wastes holding tanks, enables the separate collection and regeneration of used lubricating oils that have gone through their intended use cycle, in areas where local or central infrastructure exists for waste oils re-refining to produce mineral based oils with similar characteristics as the original base oils. Additionally, other requirements are provided with respect to the authorization of those disposing waste oils, the operation of treatment plants, etc. A look at the waste oils management in the European Union countries, demonstrates that 75% of the waste oils generated are collected (including waste oils collected in ports from marine sources), with 50% (of the generated volume) to be used in combustion with energy recovery and the 25% in regeneration processes *(European Topic Centre on Waste and Material Flows, E.E.A., 2002).* In respect of garbage collected from ships, it was endeavoured to identify and assess the disposal route in relation with the available locally recycling options and controlled land-filling facilities since the disposal of garbage is strongly associated with the municipal domestic collection, transportation and disposal systems. The option that dominates the final disposal of the non-hazardous ship-generated garbage in the ports of the project is land-filling in the nearby area around the port.

- **Waste management in general**

Under this last criterion, a number of issues that compose an environmentally sound waste management were attempted to be identified and assessed jointly or on a separate basis, including at least:

- Permit requirements for those that collect, transport, treat and dispose of ship-generated waste collected in ports,

- Procedures for performing surveys of the waste collection providers that operate in the port area,

- Procedures for record-keeping requests from ships to deliver wastes at the port, quantities and types of wastes received and handled,

- Procedures for enabling the traceability of wastes collected from the area of their reception to their final disposal site.

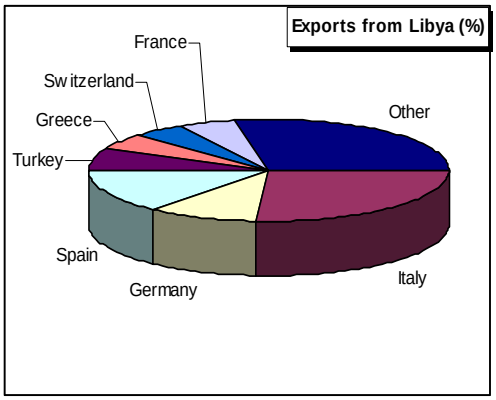
The Directive 2000/59/EC places emphasis on the continuous improvement of the adequacy of facilities by up-to-date waste reception and handling plans in consultation with all relevant parties in particular the port users. In addition, it is recommended that the procedures carried out for the reception, collection, storage, treatment and disposal should conform in all respects to an environmental management scheme suitable for the progressive reduction of the environmental impact of waste handling activities.

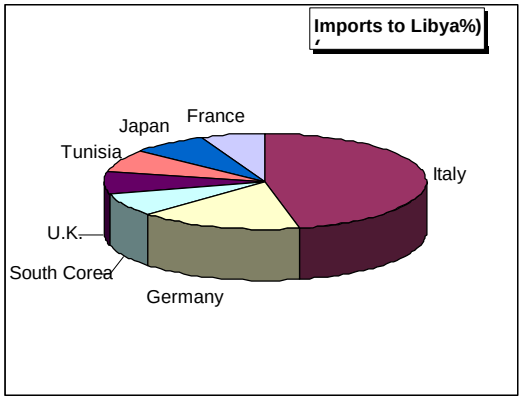
4. ANALYSIS & RESULTS

4.1 Introduction – Legal framework

Since 1969 when the government of Libya, officially Great Socialist People's Libyan Arab Jamahirya, reformed the national industry including production and manufacturing by adopting and implementing a new policy, the country has been constantly developing to a predominantly, major producer of crude oil and natural gas. The maritime trade from/towards the main ports of the country reflects perfectly the fact that crude oil and petroleum products account for around 90% of the exports contributing significantly to the national income. This export activity is expected to increase in the near future following the planning of the development of a number of oil and natural gas offshore fields off the Libyan coastline resulting in the delivery of crude oil and natural gas to coastal terminals or directly through pipelines to neighboring or remote countries. So far, European countries seem to be the most important import and export partners for Libya, providing machinery, transport equipment, food and manufactured goods and receiving crude oil as well as refined petroleum products. Libya, currently exports about 1.2 million bbl/day of oil with nearly all (about 90% of which) to be sold to European countries like Italy, Germany, France, Spain and Greece.

The following two diagrams illustrate the current export/import patterns for Libya:





Further industrial development after 1985 diversified the range of products destined for exports from the country such as textiles, petrochemicals, and other manufactured goods.

Information with regard to the existing legislative framework of the country relating in general to the policy and the regulations for the protection of the environment, the administration of the ports and the responsibilities for the prevention of pollution from ships was provided from Dr. M. M. Amer, Head of the Office of Planning and Emergency Committee of the Environment General Authority. The Environment General Authority has a leading role in the process of setting up and maintaining a framework for integrating the country into international and regional agreements dealing with the protection of the environment from land based and maritime sources.

Sustainable development in Libya during the ongoing phase of transition and economic reform was understood to be a strategic target for the Environmental General Authority, making necessary a planning for addressing the issues of ratification and enforcement of international treaties, for delivering changes in the policy and legislative framework and setting certain objectives. Libya is not a Signatory Party to the international Convention of MARPOL 73/78 and its Protocols up to now. It was reported to the Consultant during the mission that the government of Libya through the concerted action of the Administration of Maritime Transport and Ports and the Environment General Authority has been examining the possibility to ratify the Convention. The potential implications to the port industry with respect to their waste handling capacity management as far as the ship generated waste is concerned, are not seen as a constraint.

Libya has ratified, by approval, since June 6th 1983 the Protocol for the Protection of the Mediterranean Sea against Pollution from Land – Based Sources and Activities that entered into force on June 17th 1983. It is worth mentioning that Libya as a Party of this Protocol has undertaken, among others, to take a series of measures that are strongly related to the operation of land-based facilities engaged in receiving and treating of hazardous wastes or managing solid waste.

That means that sectors of activity such as port operations, the waste treatment and recycling industry, etc., need to be provided with action plans aimed at controlling any point source discharges at sea, at identifying and selecting for use sound methods of waste treatment and disposal, and in general, at steering their efforts to ensure the environmental sound character of their operations. It should be mentioned that used lubricating oils and litter regardless of their origin have been incorporated in the list of substances of the Annex I of the Protocol, which provides a reference basis for those substances, the development and implementation of action plans and measures for which is necessary.

Libya has also signed and ratified the Protocol on the Prevention of Pollution of the Mediterranean Sea by Trans-boundary movements of hazardous wastes and their Disposal. It should be stressed that the Protocol provides a coherent framework for the country to institutionally and legislatively deal with the management and disposal of hazardous waste. Although, wastes produced during the routine operation of ships are out of the scope of the Protocol, its provisions with regard to the safe and environmental disposal of wastes produced from the treatment of ship-generated wastes in authorized reception and treatment facilities could certainly have a significant impact in guiding the responsible Authorities of the country to establish a proper system for controlling the hazardous wastes final disposal and export operations.

Port Authorities and oil terminal Operators are basically responsible to provide reception facilities for ship-generated waste in the country. The oil terminal of Zawia which is a crude oil discharging terminal and a combined loading-unloading one for refined products is discussed in this Report with regard to the assessment of the its existing needs to provide reception facilities for dirty ballast and other oily wastes from tankers.

4.2 Zawia oil terminal

4.2.1 Type and operation

The Zawia oil terminal is operated by the Azzawiya Oil Refining Co. a subsidiary of the state - owned National Oil Corporation, which was established in 1970 by the Libyan government with the mandate to deal with the crude oil research and development activities at every level, from exploration, drilling, refining, exporting and marketing aimed at supporting the national economy. The terminal is located in the north - western Libya at $32^0$49' N, $12^0$43' E constituting the harbour facility of the refinery (the second larger refinery of the country after that of Ras Lanuf) which has been operating since 1974. The refinery has two atmospheric distillation plants with a total, nominal capacity of 120.000 bpd, a catalytic hydrotreater (16.500 bpd), a vacuum unit (7.500 bpd) and other facilities. Naphtha, gasoline, kerosene light, vacuum gas oil, fuel oil, base lubricating oils, asphalt and other oil products constitute the range of the production line of the Zawia oil refinery.

View of the oil refinery in Zawia

The terminal comprises three offshore berths, located north-east of the refinery, as follows:

Berths	Depth (m)	Remarks
1	27	The berth is provided for fuel oil, naphtha and gas oil exporting activities, accommodating ships of 10.000 – 100.000 tdw
2	23	For loading and unloading of oil products such as gasoline, jet kerosene, etc. able to accommodate tankers of 5.000 – 20.000 tdw
3	30	For oil tankers up to 140.000 dwt engaged in crude oil discharging activities

On average, more than 200 oil tankers call at the terminal annually. In 2000, 195 tankers called at the terminal, 213 in 2001 and 215 in 2002 respectively. The volume of crude oil and oil products handled at the terminal in 2003, destined for local consumption purposes or exports abroad is illustrated below:

Type of oil discharged/loaded to/from the refinery	**Volume (x 10^3 m^3)**
Crude oil	6.000
Fuel oil	685
Gas oil	692
Kerosene	755
Gasoline	452
MTBE	81,5
Other	676

Cargo throughput at Zawia terminal (2003)

4.2.2 Needs' Assessment & Recommendations

In the absence of any reception facilities for dirty ballast and other oily wastes, the terminal operator requires from the oil tankers calling at it, to arrive with only clean or segregated ballast in accordance with the Zawia Marine Rules. To this effect a well produced, Ballast Water Discharge Data Sheet should be completed in advance by the Master of each tanker that wishes to load oil as cargo, indicating among other details regarding the following items:

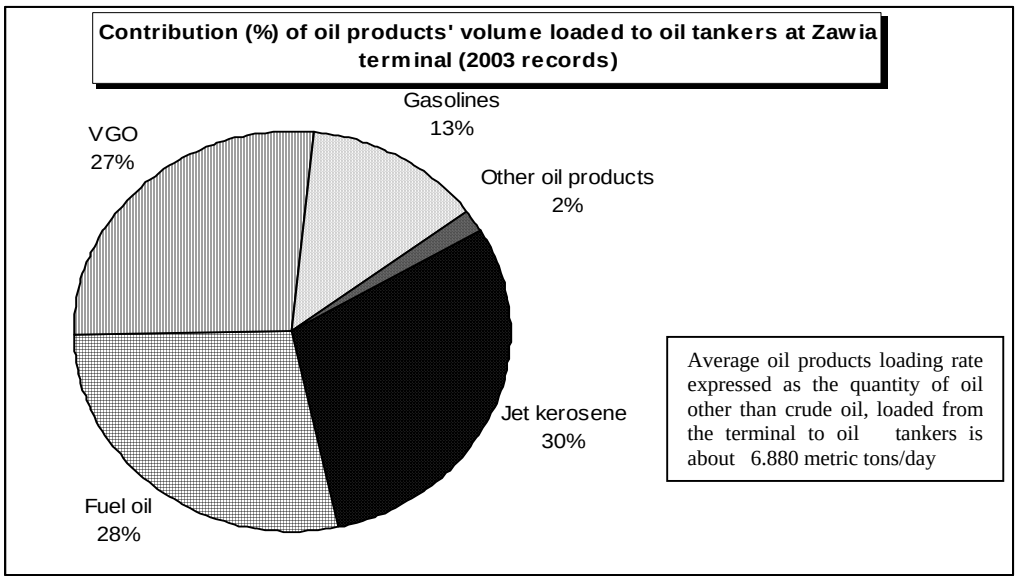
- The quantity of ballast water to be discharged at sea
- The concentration of oil in ballast water
- The kind of ballast water and the associated ballast water system (tanks and piping) in accordance with MARPOL 73/78, Annex I definitions
- The date and time that de-ballasting will commence and be completed
- The number and the storage capacity of the sludge tanks as well as the quantity of sludge retained onboard prior to arrival
- The number and the storage capacity of the oily bilge water tanks as well as the quantity of such mixtures retained onboard prior to arrival

It is obvious that the terminal operator has set in place an effective procedure to collect information from the incoming tankers with regard to the their need to discharge ballast water at sea and also information on the quantities of oily wastes

from the machinery spaces retained onboard prior to their arrival at the offshore installations. Custom, safety related information is provided for the incoming oil tankers with regard to the approach, mooring and loading-discharge operations from the terminal operator. It is understood that following the examination of the Ballast Water Discharge Data Sheet from the responsible terminal representative and the agreement on the operational details submitted, de-ballasting at sea can be commenced.

It was also verified that crude oil tankers fitted with inert gas system and crude oil washing arrangements which call at the terminal to discharge crude oil, invariably perform tank washing using the crude oil carried either at the terminal or at sea prior to the arrival. The need for water washing the emptied tanks during the ballast voyage for the removal of residues is much reduced, if not entirely eliminated.

The Services Dept. of the Azzawiya Oil Refining Co., in special occasions and upon request, can manage to collect garbage directly to the service tugs that are employed in the mooring and assisting of oil tankers.



The terminal is engaged, so far, in importing crude oil to feed its distillation activities. Therefore there is no need to provide reception facilities for dirty ballast to the incoming fully loaded or semi-loaded crude oil carriers. From the discussions held during the mission with the representatives of the terminal with regard to the development of national oil fields and the forecasts for the increase of Libya' oil production capacity, it was understood that the terminal in the near future will not change its crude oil receiving character.

The emphasis on the assessment of the needs of the terminal was shifted to those oil tankers that load oil products in excess of the average quantity of 1.000 metric tons set by the respective Regulation 12 of the Annex I of MARPOL 73/78, and particularly those engaged in handling fuel oil and other "black" oils at the 1st

offshore berth. Regulation 12(2)b requires reception facilities at such product oil loading terminals to receive tank cleaning wash water, dirty ballast water from tankers on short ballast voyages and concentrated oily wastes.

Since the policy of the operator of the terminal is to accept only tankers fitted with either segregated ballast tanks or dedicated clean ballast tanks, and taking also into account that the average deadweight of tankers that call to the terminal exceed the 20.000 tdw margin, it is expected that the revised 13 G Regulation of the Annex I of MARPOL 73/78 will progressively eliminate pre MARPOL, non SBT oil tankers (Category I tankers) from the world scene and the operation as well, at the Zawia oil terminal.

It should be mentioned that where product oil is to be carried for which contamination with the oil previously carried is not allowed, cargo tanks should be cleaned. Requirements on retention of oil on board, provide that adequate means shall be provided for cleaning the cargo tanks and transferring the dirty ballast residues and tank washings from the cargo tanks into a slop tank or a combination of slop tanks. Oily residues generated during the cargo voyage can be mixed with the next cargo to the extent that it can be loaded on top of the contained residues in the designated slop tanks.

Lean mixtures with a low oil content such as those produced from tank washing activities performed in particular in open cycle and rich mixtures such as slops originated from the concentration of washing waters onboard the tanker constitute the identity of the anticipated oily wastes that should be taken into account, in the event a reception and treatment facility is to be established at the terminal of Zawia.

In the absence of information regarding the previous cargo carried by product tankers calling to the terminal to load either "black" or "white" oil products, the basis used in estimating the anticipated volume of tank washings and consolidated slops produced from the tankers that call at the 1st and 3rd berth was based on the following assumptions, taking into account the prevailing routine practices referring to the carriage of such cargoes in shipping:

- One third of the annual number of product tankers of the maximum permissible displacement calling at the 1st berth to be loaded with naphtha, vacuum gas oil and fuel oils need to deliver tank washings and accumulated slops following tank cleaning and oil retention on-board prior to their arrival.

  The range of products discharged from the terminal in this case covers straight run products (produced through atmospheric distillation at the refinery) as well as other from secondary processing of heavier fractions, which to a considerable extent reflect the previous cargoes of the tankers accommodated to this berth.

- one third of the annual number of product tankers of the maximum permissible displacement calling at the 2st berth to be loaded with "white" oil products need to deliver tank washings following tank cleaning and oil retention onboard prior to their arrival.

Terminal: Zawia oil terminal
Country: Libya

Estimates of ship-generated oily wastes and residues

Oily wastes	Dirty ballast	Tank washings	Oily bilge water	Oil residues *(sludge)* and other waste oils
Reduced daily volume *(m^3/day)*	-	31,5	5,1	4,2
Average annual volume *(m^3/year)*	-	11.550	1.863,0	1552,5
Maximum volume to be received per ship/arrival *(m^3)*	-	1.650	30.0	25,0

The calculations of the volume of the machinery spaces' oily wastes were carried out in accordance with the methodology outlined in the Report of the Activity 1 of this project.

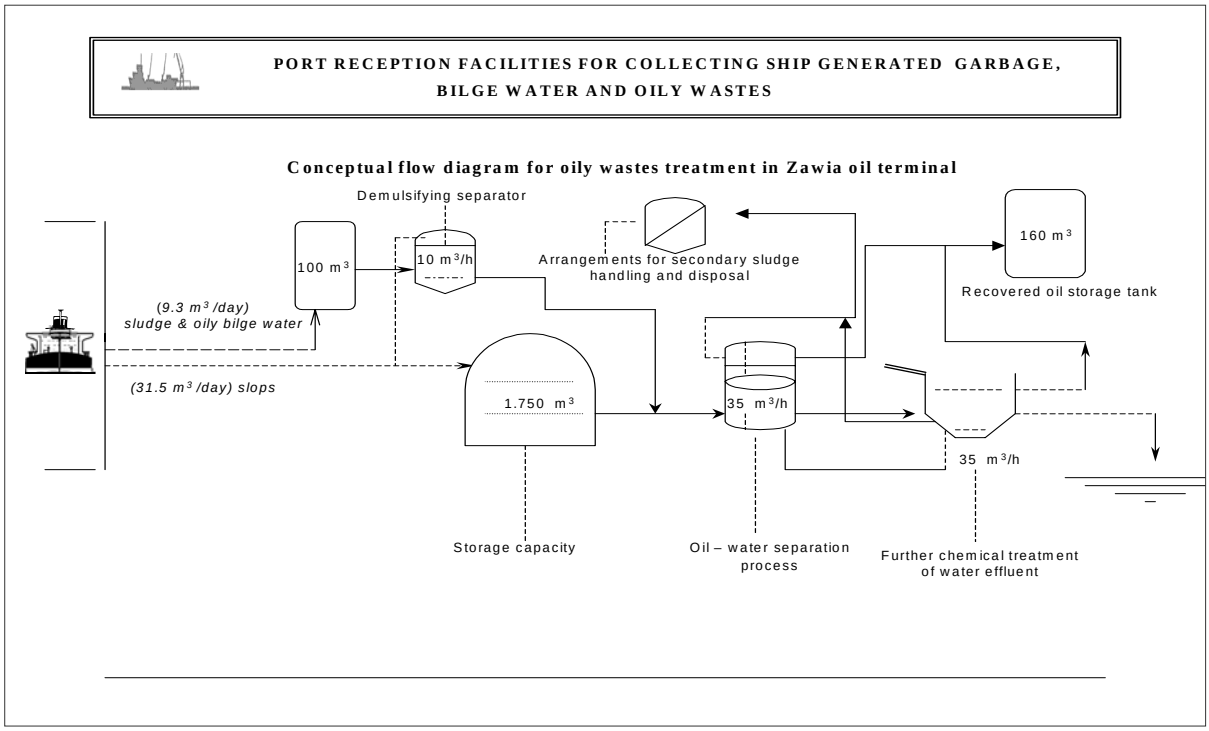
On average, 11.550 m^3 of tank washings and slops, around 1865 m^3 of oily bilge water and 1.550 m^3 of sludge and other waste oils, are likely to be delivered to the terminal taking into account its existing traffic and berthing infrastructure.

Due to the flexibility of the terminal to discharge and load oil products from different berths and a preliminary assessment of the considerable cost to install to the 1st and 2nd berth, separate piping and associated machinery for transferring oily wastes towards the proposed below, storage and treatment plant, it was estimated that two alternative, technical solutions are more suitable for the reception process:

a. the building of a special berth or of an offshore platform with the necessary loading gear, hoses, and piping to the storage and treatment plant, that will accommodate tankers of the maximum, nominal displacement that can be accommodated in the terminal, where the incoming tankers will berth to discharge their tank washing, slops or any machinery spaces' oily wastes,

b. the building of a special berth with the necessary machinery, to accommodate only the abovementioned collecting tanker that will be engaged in receiving following ship to ship transfer operations, oily wastes from the incoming tankers.

In addition, as far as the subsequent treatment is concerned, a conceptual scheme is illustrated below, which demonstrates the estimated storage capacity for wastes equalization and buffering purposes, the treatment capacity, etc.



It is obvious from the estimation of the anticipated volumes of wastes, that there is no need for dirty ballast deliveries at the terminal, a fact which is strongly related with the elimination of non SBT oil tankers from the local scene driven from the requirements of the revised Regulation 13 G of MARPOL 73/78 in addition to the established policy of the terminal to accept tankers without oil contaminated ballast.