

A ship's waste reception facility for the marine environment

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Abstract

Hydrocarbon spills cause marine pollution and those spills occur due to tanker accidents, ballasting, flushing of refinery plants, offshore drilling and pumping, shipping activities, petroleum transporting, polluted rivers, industrial and domestic effluent. Various marine organisms such as plankton, algae and fish may be affected by marine pollution.

As a signatory to the International Convention for the Prevention of Pollution from Ships, (MARPOL 73/78), and as a member state of the International Maritime Organization (IMO); Turkey is obligated to establish port reception facilities for ship-generated waste. As an initial step, Turkey is considering the establishment of such facilities in all Turkish ports. At present, even in some European countries that are parties to the MARPOL 73/78 Convention lack port waste facilities, leaving the countries vulnerable to pollution from solid and oily wastes that may be disposed at sea. These wastes are transported by wind and currents to shores often in locations distant from the original source, causing serious pollution. In this paper authors discuss the establishment of a port reception facility in the Republic of Turkey. The authors collaborated to develop a waste reception facility for the Port of Izmir and its immediate environs.

Keywords: *Ship's waste, port reception facilities, marine pollution, MARPOL convention, port operation, waste treatment.*

1 Introduction

Since the maritime industry is achieving its goals by developing itself, marine pollution has been increased steadily due to heavy maritime operations. The first step to prevent marine pollution was the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), accepted by International Maritime Organization (IMO) in 1973, modified later in 1978. The MARPOL 73/78 Convention has a purpose of reducing marine pollution caused by ships. According to the new regulations, the International Maritime Organization (IMO) requires all member states to build port reception facilities or renew the present one(s), in order to reduce marine pollution. MARPOL 73/78 obviously requires member states to take serious precautions to eliminate marine pollution.

Since import/export involvements have been increased dramatically, marine transportation has been required to enlarge its routes in order to respond to the transportation demand. The Maritime industry develops itself by enlarging its fleet and involving joint ventures with multinational shipping carriers. On the other hand, major ports are being renovated in order to handle an increased number of tonnage/container and increasing ship traffic. Due to the mentioned reasons, ports are being kept busy with handling cargo. A large volume of shipments forces port authorities to outsource their business. In addition to this, port authorities do not prefer to deal with secondary tasks. Port managements outsource the business into segments in order to focus on their core business which is how to improve their cargo flow. As a result, this paper will focus on the selection of a suitable site for a treatment facility for ship-generated waste collected at waste reception facilities at the Port of Izmir.

2 Marine Pollution and Port Reception Facilities

It is common knowledge that “pollution” is the environmental damage caused by wastes discharged into the sea; the occurrence of wastes at sea and the wastes themselves. But marine pollution is defined by GESAM as: “Marine pollution is introduction by man, directly or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as: hazards to human health, hindrance of marine activities, including fishing, impairment of the quality for the use of seawater and reduction of amenities (IMO, 1999). Tanker accidents are the major reason for the oil pollution. Besides tanker accidents, oil pollution may be generated by noxious liquid substances in bulk, pollution by harmful substances carried by sea in packaged form, sewage from ships, garbage from ships and air pollution from ships. Pollution from ships is one of the inputs of marine pollution, all inputs of the marine pollution (IMO, 1999).

Port reception facilities will significantly contribute to the protection of the country's marine resources and the preservation of its ecosystem and the general marine environment. It will also separate hazardous from non-hazardous waste in general and reduce pollution levels of the harbor and its environs. On the other hand, port reception facilities will be contributing to GDP in an economical way by marketing the recycled oil to the market. Facilities will contribute to the creation of long-term economic benefits through income generation and employment opportunities. Oily mixtures from feeder or oceangoing ships will generate a final disposal for market use.

The IMO has been working on MARPOL for more than 25 years in order to make it more efficient for member states. MARPOL Annex I, II and V were accepted by the Republic of Turkey on June 24, 1990. Regulations are now being enforced by the Turkish government after several modifications. For several years different models for reception facilities were developed by IMO. Member states are now to apply one of those models for reception facilities.

In Turkey most of the ports have their own reception facilities but most of the facilities lack efficient handling, technology and support services. For many years the government couldn't invest enough to improve the quality of port reception facilities. In Turkey a significant number of ports belong to the government or its agencies. Due to the new requirements of MARPOL, port authorities are now willing to privatize the recycling process to privately held companies. That is because the port aims for effectiveness in its core business rather than dealing with recycling process; and of course port authorities are to supervise the ongoing recycling activities in its boundaries. That means port reception facilities will be handled by entrepreneurs. MARPOL 73/78 does not only require ports to have reception facilities but also requires any facility that has activities with oil and its products, such as ship breaking facilities and factories produce chemical products or leather etc.

There are 295 port facilities including tanker terminals, bulk terminals, fishing and yacht ports in Turkey. Twenty of them are the major ports in Turkey. Most of the ports are managed by government service Turkish National Railway Systems (TCDD). Lack of investments in port reception facilities have generated a significant shortage for the regulations, but generated an important investment opportunity for entrepreneurs.

A reception facility must have proper equipments and should be able to get involved with recycling procedures according to the international regulations. There are different types of facilities that follow different recycling techniques. Those different types are: oily treatment equipment facility, noxious liquid substances treatment equipment facility, sewage treatment equipment facility, garbage treatment facility, laboratory and other equipment. In Turkey, according to regulation 8 and 11 of the Environmental Act, every organization must establish and operate collecting and treatment facilities. In December 2004 the Regulations of Collecting Waste from Ships came into force in Turkey. These regulations arrange collecting waste from ships, and establishing and managing

reception facilities in Turkish Ports. According to the new regulations, existing reception facilities will be upgraded and new reception facilities will also be established within a year.

3 Port of Izmir

Port of Izmir is operated by General Directorate of Turkish State Railways and located in $38^{\circ} 25' 00''$ N, $27^{\circ} 09' 30''$ E. Izmir is situated at the east end of Izmir Bay. To reach the main facilities of the port of Izmir, a ship must enter Izmir Bay (inlet) from the Aegean Sea on a southeasterly course for about 20 nautical mile, then turn eastward through Izmir Bay for about 10 nautical mile. The port of Izmir is Turkey's third largest port and has the best natural harbor. Traffic at the harbor is not congested; the ships transit the channel each day. Plenty ships can load/unload simultaneously (TCDD, 2006).

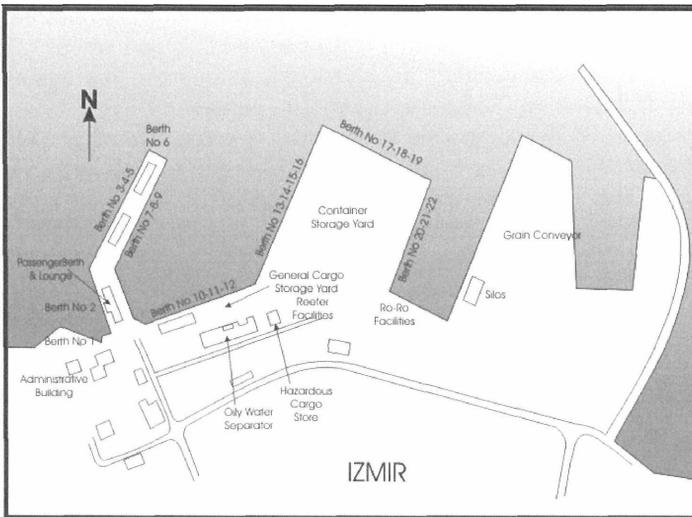


Figure 1: Plan of Izmir Port

The current recycling plant in Izmir was established with the fund supplied by World Bank foundation in 1986. The present facility has currently no recycling activities due to the outdated technology and old equipments. The only current activity is the storage of inflow oil waste. There is an international company that collects ship-generated wastes from the port of Izmir. This company uses a wet bulk carrier to load the wastes and carry it to the plants. Since there has been no competitor against this international firm, the port of Izmir was exposed to accept any offer that had been made by this company. A

new establishing company will increase the amount payable to the port such as lease payment which is significantly valuable for any port/terminal. Paying lease to the port authority will lead the new establishing company to do the marketing job very well in order to expand its total revenue from its total costs. This process will lead both firms to get involved in a perfect competition.

4 Treatment of Oil Waste

The goal of this section is to define the existing treatment technologies that are used for recycling, destroying, and recovering energy from oil waste. Oil waste treatment is performed extensively. Currently in Turkey, thousands of tons of used oil are generated. Most of the waste doesn't go through the treatment process; however significant number of oil wastes is used as fuel oil. Some of the other categories that oil wastes are used for such as; asphalt, lube oil and other products.

Specifically, the discussions will summarize:

- Technological concepts
- Applicability to oil waste streams
- Extent of use
- Advantages and disadvantages
- Product streams.

4.1. Final Product

Ships generate a serious portion of oil wastes. Oil wastes consist of water or the other materials to be separated during the recycle process. This greatly increases the volume of oily waste for treatment and disposal. Ideally collected oil should be reprocessed through an oil refinery or recycling plant. Unfortunately this is not often possible as the oil may have weathered or been contaminated with debris and seawater. As far as possible the different types of oily waste should be collected and stored separately as each type of waste may demand the use of different disposal options. Various methods of disposal are available including direct disposal to controlled landfill sites; use in land reclamation, road building, factory use or similar activities; and destruction by incineration or biological processes.

The waste oil re-refining operation in the Port of Izmir has fortunately no activity. Besides ship-generated oil wastes, used oil is also generated through various activities including auto repair, metal working, machine lubrication, hydraulic equipment repair, and ship operations. Ship operations is our first goal to achieve and as a long term goal the company should be willing to spread the idea of recycling any kind of oil waste that can be collected from manufacturing plants that are located all over the city of Izmir. Oil can be recycled to make new lubricants or industrial fuels. If properly recycled, used oil can no more be

considered as a hazardous waste. Companies that are dealing with waste management have to be familiar with different types of wastes given below.

Ship generated wastes:

- Used lubrication oil,
- Fuel residues,
- Sludge,
- Oily water,
- Dirty ballast water,
- Oily tank washing.

Ship generated wastes do not wear out, they just get dirty. they can be used over and over again. 14% of used oil that is reclaimed is re-refined to its original virgin state. Re-refining base oil is the end product of a long process. The oil is first cleaned of its contaminants, such as dirt, water, fuel and additives. This is done through a process of vacuum distillation. The re-refined oil is blended with a fresh additive package to make the finished lubricant. 75% of used oil which is reclaimed is reconditioned and marketed to:

- Asphalt Plants
- Industrial Boilers
- Power Plant Boilers
- Steel Mills
- Cement/Lime Kilns
- Marine Boilers (Bunker Fuel)
- Pulp & Paper Mills
- Other

5 Business Structure

Recycling facilities will be handled by a privately held firm(s) located in the Port of Izmir. The new company may be seeking to be at the top of oil recycling industry in Izmir. Since there is no oil waste recycling company in Izmir, it is a logical opportunity to establish a facility that recycles collected oil wastes from ships and sells it to potential customers. The new company will be working in teams, including; administration, accounting engineering, marketing, and port operations.

The engineering division will handle the recycling process and production process, the marketing division will handle communication with ship owners and potential customers who are willing to buy the outflow oil waste. The accounting department will deal with financial analysis for use of the

administration and the public. Port operations will deal with daily port operations including the process of collecting oil wastes from ships and transporting them to the facility. Administration will be the top management that makes sure all activities fit their purposes.

As we mentioned before, used oil has a significant value for the companies that are willing to cut heating oil costs. The first target is to find out all the potential customers and build long a term relationship with them. The plant has to be extensively equipped and its machinery for recycling oil waste should match the requirements. Recycling process, assembly, and testing all technical activities should take place in the plant. Systems and procedures must be in place and geared towards high standards of quality control and willing to meet the acceptance criteria of oil waste processing.

6 Establishing the Facility

In a port reception facility, for the start up process, there must be one vertical reactor (mixer), one reactor, two heated oil boilers, two condensers, vacuum-pump units, raw materials and product storage tanks, and generator and purification units. In the facility electricity is ideal used for production process. According to port statistics, the estimated electricity consumption will be 100 KW per day. Twelve personnel are ideal for the planning process of the facility and 18 personnel is ideal for the operation process in the Port of Izmir.

In this facility, there should be at least two 150 ton capacity storage tanks (inflow) for oil wastes and three 100 ton capacity product storage tanks (outflow) for the final disposal. All types of tanks must be made of special steel that has a proof of quality from the Turkish Standards Institute (T.S.E). The facility must be working 24 hour/day and 365 days/year in the Port of Izmir. Total capacity estimated of inflow is 200 ton/day ($200 \text{ ton} \times 365 \text{ days} = 73000 \text{ ton/year}$). Raw materials are the oil wastes that are collected from ships.

Since the facility will be located in the port of Izmir, transportation has to be handled either by licensed trucks, pipelines or barges from ship to facility. As we mentioned before, the transportation system may vary according to the company's financial aspect. If a company focuses on short term benefits, then transportation must be handled by licensed trucks. Transportation of the inflow depends on the location of the facility. The most suitable system for transporting the wastes from ships to the facility is pipelines.

As an initial step of the recycle process, two reactors are used to separate the raw materials. Oil waste is heated to 300-350°C by using a distillation method in order to separate the raw materials. Some parts of the oil wastes cannot be evaporated. Those parts are called deep product which are raw materials for asphalt production. Deep products are pumped into product tanks. Right after that, products stay in the distillation column which is a part of reactor, in order to be cooled down. The cooling down process is handled by

condensers. A vacuum pump is the equipment to vacuum the condensed material and transfer it to the tanks.

Separated products should be taken to the product tanks and will be stored there until the analysis results prove the quality of the products. Analysis is a very important step for the recycling business. Analysis reports identify the type of product and its quality level. After the analysis process, the product is to be filtered by a one micron size gland. This step is needed to collect very small compounds or particles from the oil waste in progress. This is one of the important procedures of the recycling process because factories that use oil wastes as heating oil may encounter problems with the production cycle due to the small particles. Those particles have to be cleared out from the refined oil waste. Those tiny particles may even cause serious damage to the factory's machinery and may cause a production stoppage. After the filtering process, products will be available for market use. Filters are to be placed in pouring exit of the tankers in order to collect little particles. Three glands will be used for this process and glands are to be changed every six months or every year depending on the capacity of the facility.

7 Business Strategy

The new company will be established on a strategy that consists of continuous improvement that seeks improved efficiency and lower cost through better discharge operation, recycle process, products and services. The goal is the perfection in the core business of collecting oil wastes from ships, recycling them and selling the final product to the market as well as maintaining the operations while preventing the blue from pollution.

The new establishing company should have a vision that makes the flow process more efficient and beneficial in terms of achieving the organization's goal. In order to establish an efficient flow process, the company's marketing department should seek to stabilize the inflow and outflow in terms of building long-term business relations with the ship owners as well as with the buyers of outflow. The company's marketing department should follow the given given principals in order to stabilize the flow process.

- Marketing research must have straight information in order to design, collection, analysis, and reporting of data to the recycling business.
- The company should decide what customers to serve.
- Prices should be in accordance with the competing ports in order to gain more inflow oil waste.
- Advertisements should be spread out through the company's website or media mass.
- Customers are to be satisfied by supplying qualified products because customer equity is the main element that leads businesses grow.

8 Conclusion

In this paper we discussed the concept of a port reception facility in the Republic of Turkey. With the International Convention of MARPOL 73/78, port reception facilities have become an important function of a port. Due to the new regulations of MARPOL 73/78, a new business sector is now available for entrepreneurs.

The final oil waste has always been a specific need in developing countries. Comparing to the refinery fuel oil, recycled wastes have always been much cheaper. Before MARPOL 73/74, ship-generated wastes had been used without reutilization process which caused serious damages to machinery of the factories and the production units. From now on oil wastes cannot be sold without a proper refinery process and all facilities that process oil waste have to meet the requirements of MARPOL 73/78.

Recycling oil waste throughout a proper recycling environment had never been performed in Turkey until 2000. Before 2000, obviously entrepreneurs never tried to enter this business because of the economic environment in Turkey. That effect has imposed entrepreneurs to invest in sectors that have lower risks. Buying a ship is always a common business area in terms of having more experience, high volume demand, and low risk. However, investing a significant amount of capital in a reception facility has always been a risk since there had been no enforcement for the proper processing of oil waste. Financial and technical support from International Maritime Organization is another driving force for the entrepreneurs. They should rethink how profitable the recycling business may potentially be. This sector may be much more complicated than other industries because of the new established regulations and new technology; however, by the help of those facilities our coasts and harbors will be saved while investing a new developing business.

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