

## DEVELOPMENT OF WASTE MANAGEMENT SYSTEMS IN AN INTEGRATED SHIPYARD

**Daniela Buruiana**

<sup>1</sup> „Dunărea de Jos” University of Galati, *dnegoita@ugal.ro*

**Abstract.** This paper aims to present a waste management system in the shipyard industrial area and the solutions adopted to reduce the environmental impact caused by wastes from ship repair and maintenance work. The waste impact (material resulting from the hull blasting, oil and paint wastes) implies the occupation of the land in the vicinity of the shipyard studied, soil and water contamination and landscape change. Even if some of them are inert, solid naval wastes cause storage problems, primarily because of the large quantities resulted. Identifying solutions for reuse of solid waste leads to reduced costs and superior capitalization of those materials. The waste management policies to be adopted by a shipyard must find solutions to their very source involving both reduction and recycling. It is also necessary to limit the negative environmental impact by greening works in the already affected areas by the uncontrolled deposits

**Keywords:** *management, wastes, recycling, environment, efficiency*

### 1. General

An effective integrated waste management must focus on the following purposes: identifying the sources/activities generating emissions, emissions monitoring and management, measures to reduce emissions through the application of the best practices in the sector concerned

Waste elimination and/or minimization should be a priority in any integrated environmental management plan. Full or partial recycling leads to reducing the amount of waste being deposited, as well as reducing the amount of raw materials used in any technological processes

When referring to an efficient solid wastes management in shipyards, it is necessary to first conduct a thorough analysis of the processes of construction, repair and maintenance of vessels and the volume of materials used in shipbuilding industry. The results of such an analysis would provide for the knowledge, appreciation and application of the best integrated waste management solutions. For most shipyards, these solutions would allow the recovery of waste in other applications, cleaning the areas affected by uncontrolled waste disposal.

The evolution of marine industrial systems in the context of the modern concepts of total quality and sustainable development promoted by any environmental policy is based primarily on the

understanding of technological processes related to marine environmental problems and restoring the balance, particularly through recycling in the relationship repair / maintenance- vessels-environment – recycling- material – energy.

An issue of increased interest in the world today, also supported by environmental policy applied to a shipyard, is represented by wastes from both an environmental and economic points of view

Environmental concerns in the strategies pursued and applied to shipyards around the world fall into two directions:

- development of advanced technologies that significantly reduce emissions;
- increasing waste recycling and recovery output to levels close to 100%

### 2. Defining and identifying pollution sources in a shipyard

Shipyards all over the world are faced with the need to restructure their work so as to meet the sustainable development requirement by protecting the environment as efficiently as possible since the activity in this sector requires a major consumption of raw material and energy while generating considerable amounts of polluting emissions such as gas, solid waste and waste waters. Compared with the practice and global

trends, Romanian shipbuilding industry features deficiencies both in the collection, transport and storage of all categories of waste and waste recycling and /or reuse. The tendency to dismantle hundreds of ships each year occurs continuously. This is a consequence of rapid development in the field of naval technology, the competition between the carriers and the current crisis. We can give as an example the situation in some Asian countries where more than 80% of the ships are dismantled in shipyards located on beaches in India, Bangladesh, Pakistan and Turkey. Bangladesh is the country where most ships are dismantled.

Most shipyards use the cheapest method, but also the most harmful to the environment: "failed on the beach" for dismantling ships. This method has a high price in human lives and causes many diseases due to exposure of workers to toxic action. The European Economic and Social Committee is aware that in the foreseeable future, the failure of ships for dismantling on the beach will remain the preferred method. Therefore, current conditions in shipyards must be improved so that they operate in a safe and ecological environment

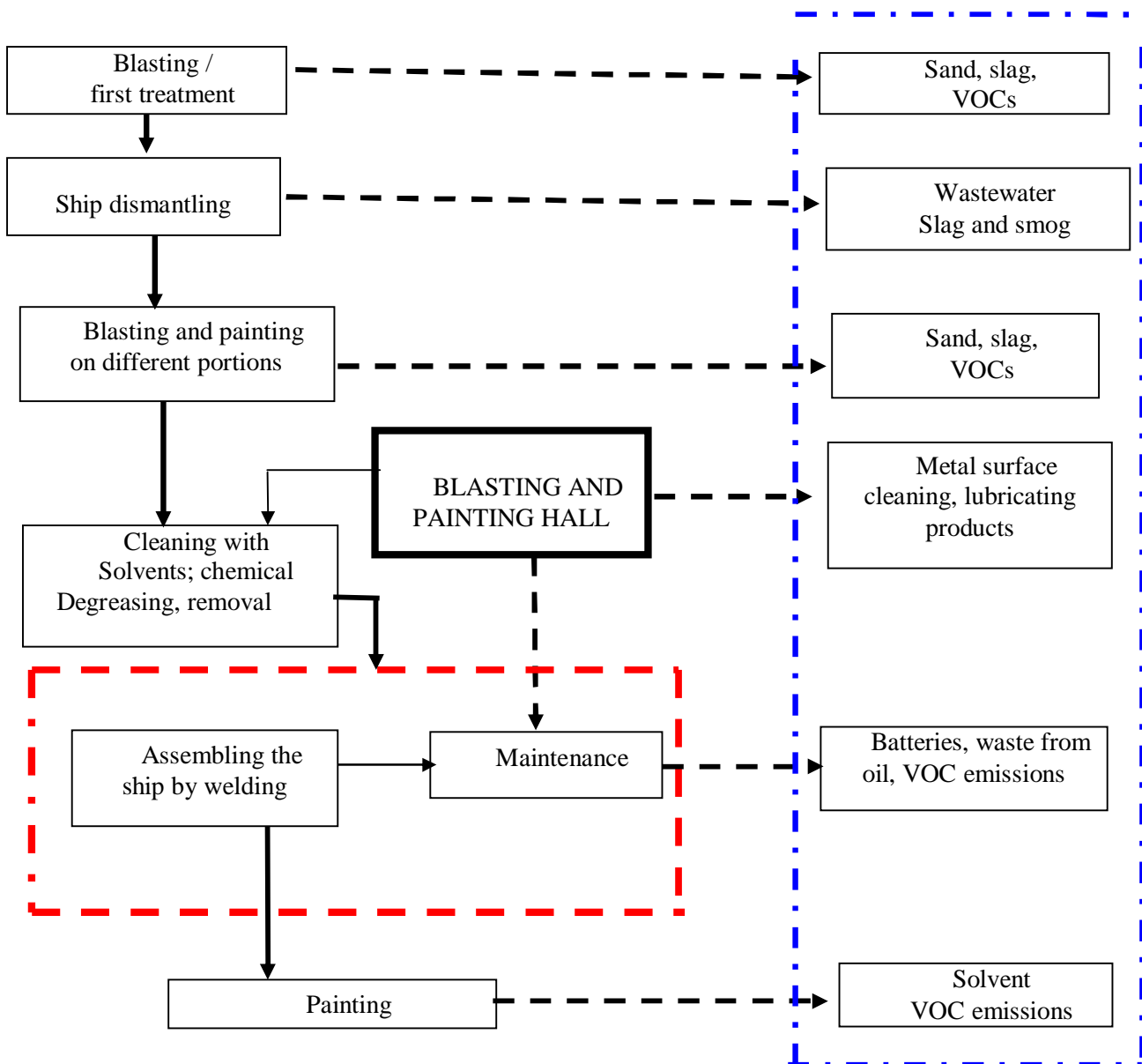


Figure 1: Technological processes specific to ship repair and maintenance sector and specific pollutant emissions

Conditions relating to environmental and social protection are disastrous in South Asian shipyards.

They result in unfair competition against their European counterparts. Moreover, high local demand for recycled steel is an additional problem for European competitiveness [2].

Worldwide, the shipbuilding technique in the last decade has reached a high level of performance, demonstrating a great capacity to adapt to changes brought in by raw materials and energy conditions, the need to increase productivity, reduce consumption and comply with the environment legislation that is becoming more severe.

It can be considered the most representative technological processes generating pollutant emissions from a shipyard are those in the sectors of dismantling, repair and maintenance of ships. Pollutant emissions generated by the blast cleaning of metal surfaces as well as the process of painting or welding of metal components are the most important Figure 1 illustrates the technological

processes in a sector of ship repair and maintenance along with their pollutant emissions and specific wastes.

Monitoring pollutant emissions in conjunction with the process that generate them calls for, and simultaneously allows for, the implementation of an integrated environmental management in these sectors.. Today it is accepted that, at the current level of knowledge, is not yet possible to establish a balance of environmental pollutants on global development in the shipping industry. This the main reason why, in their analysis on the correlation energy-environment-waste or recycling-environment, they still use energy balances, material balances respectively, for the process being analyzed

Material balances are made in companies in order to be able to monitor the emissions based on material inputs (Table 1). This model is promoted by the shipyards in Japan, which managed to reach what is found in the literature as " waste-free industry" or "zero waste":

**Table 1:** Balance sheet materials – emission and waste

Process	Raw materials/materials	Emissions		
		emissions to air	waste water	solid waste
Ship dismantling – assembling by welding	Electrodes	Smoke CO2	-	Slag from welding electrodes
Surface Preparation	Sandblast Grit Solvents Degreasing Alkaline and acid agents	Sandblast Grit Solvents Dust emissions from the cleaning process	Solvents and acid water	Recyclable waste grit Slag Residues from cleaning areas
Surface Finishing	Sandblast Grit Solvents Paint Primer	-	-	Waste Water Containers of paint, brushes

Reducing water pollution by increasing the recovery of all categories of waste and their controlled storage is a priority in environmental policy analysis proposed in a yard analysis. As a first step, it should be made rigorous management of the waste generated at source with particular focus on reducing the quantity and harmfulness of

waste, advanced recycling of waste by reintroducing them into various stages of the same technological flow

This ensures protection of natural resources, increase reuse of waste materials by converting them into raw materials for their own flows or of

other industries, controlled storage of all categories of waste.

All these objectives are proposing an action of inventory and management of sources generating wastes and monitoring the pollution they cause. Monitoring means the acquisition, storage and processing input data to assess some processes within the shipyard. This would allow making correct decisions, argued on reconsideration of technology and design in relation to each part of the technological process

### 3. Peculiarities of waste management in a shipyard

Waste management is a complex issue consisting of a multitude of components. In particular, waste management in a shipyard in the European Union represents a particular challenge in that it should not disrupt the European market of ship construction and repair. Although there is no single recipe that can be applied in all cases, the European Union has firm principles underlying the different levels of waste management systems [3]:

- principle of prevention - the production of waste should be minimized and avoided if possible;
- principle of responsibility for polluting generation and payment – he who produces waste or contaminates the environment must pay the cost of his actions; precautionary principle
- potential problems must be anticipated proximity principle - waste should be stored as close as possible to the place where they were produced

The Romanian legislation stimulates the “polluter pays” principle (Article 3 of Law 137/1997). The Ministry of Environment and Water has transposed into national legislation on the environment, which fully complies with this principle. The basic principle of the Directive 96/61/EC on integrated pollution prevention and control is best reflected in the concept of sustainable development, which requires measures to prevent. The concept of best available technique involves taking all measures to prevent pollution from the plant design phase and continue in the construction, operation and decommissioning stages. Also, the holder of activity is directly responsible for any environmental damage he may cause

In an environmental policy, waste management is an essential component due to increased production and subsequent increase in the wastes with negative impact on the environment. The negative effects of waste on the environment and on human health are well known and publicized

throughout the world, and failure to adequately approach this issue can have catastrophic consequences

Therefore solutions must be found to reduce the amount of waste generated and to limit their negative effects, by reusing the recyclable wastes in the production processes as secondary raw materials (such as those resulting from the grit blasting) or by neutralization and final controlled disposal of those who can't be recovered. Waste management is the model of industrialization which allows increasing the contribution of industry to achieve economic and social benefits for the present and future generation's resources without damaging the environment.

In most cases, the dynamics of industrial waste amount generated in a shipyard can't be precisely determined due to lack of a consistent database and change of the definitions. This problem is particularly serious, because to find the total volume of industrial waste generated, we should know exactly correlated with the waste evolution correlated with naval dynamics, then to develop a coherent policy with objectives, criteria, measures and investment costs.

The importance of cost / benefit analysis to determine the overall economic efficiency of the investment consider the direct economic efforts (investment costs) and indirect economic efforts (for example, pollution costs, costs allocated for affected human health, environmental rehabilitation costs , costs that are usually overlooked or minimized).

### 4. Conclusions

A special chapter in the world today and supported by the current environment policy of a shipyard is represented by the wastes, both in terms of environmental and economic points of view. A successful management will lead to finding the best solutions for the recovery of waste generated and thus both costs and environmental impact can be reduced.

The Concern for compliance with legislative requirements on environmental protection and the need for harmonization of the economic progress with rational management of material and energy resources should lead to the recovery of waste by technologies that offer both economically and ecologically optimal solution:

- rigorous management of waste and reduction of waste quantity at source;
- controlled storage of all categories of waste

generated on the platform of a shipyard;  
 - advanced recycling of the waste produced by their reintroduction into the various stages of the process flow, thus ensuring protection of the natural resources of raw materials;  
 - increased use of wastes by converting them into raw materials for other industries.

We believe that a focus on a strong management for the environmental protection as part of the administration and operation of a shipyard will enhance the environmental quality performance. The evolution of marine industrial systems in the context of modern concepts of total quality and sustainable development promoted by the proposed environmental policy is based primarily on the understanding of specific technological processes in conjunction with environmental issues focused on restoring the balance, particularly through recycling: process-environment-recycling-energy. Environmental excellence, incorporated into all processing activities, can be promoted through the principles supported by:

- continuous improvement of the environmental performance through systematic monitoring of the environment factors, minimizing the environmental impact and using the principle of pollution prevention;

- reducing waste at source, and where they inevitably occur, they should be capitalized or if this is not technically and economically feasible, they must be controlled stored while avoiding or reducing any impact on the environment;

- implementing clean technologies and best practices in the field by investments leading to environmental protection and savings of both energy and raw materials.

### References

- [1] Negoită D, *Contribuții la reducerea poluării provocate prin funcționarea unui șantier naval*, Teza doctorat 2007;
- [2] Avizul Comitetului Economic și Social European privind Comunicarea Comisiei către Parlamentul European – O strategie a UE pentru ameliorarea practicilor de dezmembrare a navelor, <http://www.eurlex.europa.eu>;
- [3] *Recycling Spent Sandblasting Grit and Similar Wastes as Aggregate in Asphaltic Concrete Naval Facilities Engineering Service Center Port Hueneme, California 93043-4370*.
- [4] Rojanschi ,V, Bran, F., *Politici și strategii de mediu*, Editura Economică, București, 2002.
- [5] Negoită D., *Dispersion of the atmospheric pollutants on the platform of a shipyard*, published at the Sustainability for Humanity & Environment in the Extended- Connection Field Science-Economy Policy, Timișoara, 24-25 Febr. 2005, pp. 115-119.

