

## EFFECTIVE MANAGEMENT OF WASTE IN THE URBAN ENVIRONMENT IN THE CONTEXT OF A SUSTAINABLE DEVELOPMENT

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**Abstract:** *Since the beginning of 2002, European law requires selective waste collection in urban areas. The aim of the paper is to present ways of efficient waste management in urban areas according to European regulations. Data will be presented from the urban waste management (City of Timisoara) for 2008, 2009 and first half of 2010, for the following categories of waste: municipal waste, waste paper / cardboard, tires, car batteries, spent oils, waste from wood processing, plastic waste, hazardous medical waste, glass, textile waste, electrical and electronic equipment waste. Research methods used are statistical collection and interpretation of results and the materials used consist of questionnaires completed by businesses and environmental agency reports. The novelty of the paper is a presentation of the urban image of an efficient management of waste, not just those of the municipal recyclable but also the valuable recyclable, in the context of sustainable development. The research is limited to providing*

*waste collection methods and amounts for each category of waste, without getting into the processes of recycling / recovery of waste. From a practical point of view, the research shows the degree of education with the population and with the economic agents at the urban level regarding waste collection as shown by the data regarding the amount of waste collected already. The importance of the research is mainly in respecting the principles underlying the waste management activities: the principle of primary resources protection, the principle of using the best available techniques, the principle of prevention, the polluter pays principle, the principle of substitution, the principle of subsidiarity, the principle of integration proximity and of integration. The originality of this paper is given by combining the methods of waste management conditions with the conditions that have to be complied under environmental legislation in force and interpretation of existing data on the types of waste to provide a complete picture of the urban waste management efficiency.*

**Key words:** *mediu urban, deseuri, dezvoltare durabila*

### INTRODUCTION

Waste is one of the most acute problems of environmental protection. Every year large quantities of waste is generated from both production and from the public, non-hazardous and hazardous municipal waste (household and similar waste from commerce, industry and institutions), plus several special types of waste streams: packaging waste, construction and demolition waste, sludge from wastewater treatment, end of life vehicles and waste from electrical and electronic equipment that have a specific management.

Waste management includes all activities of collection, transport, treatment, recovery and disposal.

According to the National Waste Management Strategy, the principles underlying the waste management activities are:

- primary resource protection principle based on the concept of sustainable development that establishes the need to minimize and streamline the use of primary resources by using secondary raw materials;

- principle of using best available techniques not entailing excessive costs, according to which waste management activities should take into account the current state of technology development, environmental protection requirements and the economic feasibility;
- prevention principle, which establishes the hierarchy of waste management activities in the following order: minimize quantities of waste, treatment for recovery, treatment and disposal in a safe environment;
- polluter pays principle, linked with the principle of producer responsibility and the responsibility of the user, which establishes the obligation of carrying the waste management costs by their generator;
- substitution principle, which establishes the need to replace raw hazardous materials with other non-hazardous to reduce quantities of hazardous waste generated;
- proximity principle, linked with the principle of autonomy, under which waste should be treated and disposed of as close to their place of generation and the export of hazardous waste is only possible in those countries that have appropriate disposal technologies;
- principle of subsidiarity, which establishes the granting powers on waste so that decisions are taken at the lowest administrative level at the source of generation, but on the basis of uniform national and regional levels;
- integration principle, which states that waste management activities are an integral part of socio-economic activities that generates them;

#### **MATERIALS AND METHODS**

Underlying research methods consist of statistical methods of data collection and interpretation and the materials used consisted of questionnaires completed by companies and environmental agency reports. Data collection is based on H.G. no. 856/2002 on the evidence of management approval of the list of waste, including hazardous waste, which requires that both business units that generate (produce) waste, and the units authorized to collect, transport, temporary storage, recovery and disposal waste, shall keep a record of their management.

#### **RESULTS AND DISCUSSIONS**

The overall objective of the National Waste Management Strategy is to develop an integrated waste management system effectively and economically to protect human health and the environment.

Obligations of local government waste management are:

- a) monitoring and ensuring the provisions of regional and county plans of waste management;
- b) develop their own strategies and programs for waste management;
- c) association with other local government authorities for carrying out public works on waste management, as provided by law;
- d) providing selective collection, transport, neutralization, recovery and final disposal of waste, including hazardous waste, in accordance with law;
- e) providing the necessary facilities for selective waste collection, providing them with specific types of waste containers and their functionality;
- f) provide adequate means of informing people about the system of waste management in the localities.

Average composition of waste in urban and rural areas, according to the Regional Waste Management Plan and the county average as centralizing data from surveys is presented in Table number 1.

Collection methods are most often divided into schemes such as "collection in collection points " (or voluntary contribution) and "collection from door to door".

The method of collection points where the collection is "tenants are required to take waste to one of the designated collection facilities" by local authorities or the company responsible for sanitation. For this method one or more containers of waste containers of greater capacity, are located in the street or in facilities near densely populated areas. Specific to this method of collection is that these containers are positioned on the outside and not inside the inhabitants' properties.

Table no.1.

Waste composition in Timiș county (rural-urban)

Waste composition %	Paper and carton %	Glass %	Metals %	Plastice %	Organic matter %	Others %	Total
Urban area	11,0	4,9	4,6	8,6	54,0	16,9	100
Rural area	9,0	4,2	3,9	7,9	65,9	9,1	100

In the case of selective waste collection, in a collection point as such we find special containers for recyclables and mixed waste containers.

In the collection schemes "from door to door", residents put waste in a bin / bag placed in a specific place in a given day, outside their home.

Also, in selective waste collection there will be more of such bins / bags which are filled with certain types of waste and will be taken by the sanitation companies on different days of collection.

We can say that, contamination in particular, depends more on the fact that the material is collected separately or not, than the collection method used.

Collection modes:

Collecting the mixture is the simplest method of collection. However, this method restricts the subsequent collection and waste recycling. Collection of mixed waste does not involve any effort from the waste generator, in terms of selecting the types of waste.

To sort recyclable materials from mixed waste collected is needed mechanical sorting plant. This facility will be sorted in various stages of the waste components, with appropriate equipment or manually. Subsequent sorting recyclable materials from waste requires less attention and less interest in preparing and collecting them from those who produce waste and also involves extra work to sort energy, manpower and technical means. The quality of sorted materials is lower after they were mixed in the bin collection vehicles sometimes compressed or crushed. Sorted recyclable materials may be dirty or wet, making them difficult to process and further exploited. Acquisition of all groups of mixed recyclable materials has shown that paper, plastic and glass are hard to sort in the sorting facilities only partially achieving material for the recycling process.

Selective collection: in the case of the selective collection of recyclable materials and waste in the mixture, collection intervals must correspond to the collection system used. Periods of successive collections of mixed waste may be shortened with regard to hygiene, with the reduction in waste by taking recyclable materials in parallel. In case of dry recyclables such as glass and paper, the collection rate is only determined by the size of the dumpsters. Waste bins with separately collected biodegradable will be emptied on grounds of hygiene, at least once a week.

The acquisition of recyclable means the collection of materials from waste components from which materials can be recovered. The objective of taking over these materials from waste and their reintroduction into the production processes as secondary raw material is the primary raw material savings and reduction in waste disposed. At the same time,

it can save large amounts of energy. For example, for melting of fragments (secondary raw materials) for the production of glass are required only two thirds of the energy needed to manufacture glass from raw materials. Acquisition of these materials is part of the waste recycling and involves a reduction in the quantity of waste disposed. Besides saving energy and raw materials, it is obtained indirectly a reducing of waste production by reducing the amount of specific auxiliary and supplementary materials. Besides taking recyclables from garbage is required to collect and sort recyclable materials from waste resulted from commerce, industry and institutions and also from the production of waste.

Regarding hazardous waste from the municipal waste, it must be collected separately (the colors are represented in the table number 2). Although this quantity is less than 1-3% of municipal waste, the waste must be separated from the municipal waste stream. Health agencies can organize special campaigns by periodic collection of hazardous municipal waste collection by the method from door to door, or designate specific bins for the waste collection points. Also, there is the possibility of returning hazardous waste to the centers where they were purchased from or directly to producers of such products. A fourth option would be the collection of hazardous municipal waste by request, for example, housing associations can organize a campaign for collecting waste and can call upon sanitation agents for their removal. In all such cases, it must be considered that such waste has to be collected on the types of solid or liquid waste, so as not to reach different chemical reactions endangering human health or the environment.

Table no. 2.

Colors, for containers and jar identification for packs waste selective collection (www.retim.ro )

White glass	Colored glass	Paper and carton	Metal and plastic mass
White	Green	Blue	Yellow

Regarding the quantitative situation of waste collected / recovered / disposed in the city, it is shown in Table 3.

To succeed in such campaigns of waste collection, first they must be free of charge from the population generating waste.

The waste collection includes also their way from filling into the bin to filling the collecting vehicle and the filling of transport motor vehicles. In this context, a collection system will be based on the combination of technical means of work and human labor, in particular:

- the collection procedure;
- types of bins used;
- used cars;
- staff.

In an area with different types of constructions and a number of larger companies and institutions, the collection can be done only by using a single system. According to space conditions will be used also different types of collection systems.

Evaluating a system for collecting and testing the organization according to the requirements can be made based on the following criteria:

- economic level;
- safety at work;
- hygienic conditions;

- effects on the collection of recyclable materials;
- requirements of the recycling stations, waste treatment and disposal;
- urban issues;
- user comfort;
- frequency of necessary repairs;
- the level of physical load of personnel.

Table no. 3.

Situation of the collected/recovered/disposed waste				
Nr. Crt.	Waste type Collected/Recovered/Disposed	Year 2008 (t)	Year 2009 (t)	january-june 2010 (t)
1	<b>Municipality waste</b>			
	-collected	233,565,38	285,144	114,483
	-disposed	233,565,38	150,170	44,084
	<b>Paper/carton waste</b>			
2	-collected	13,880,19	13,772,068	6,200,16
	-recovered	13,870,38	13,870,859	6,317,08
3	<b>Used tire</b>			
	-collected	193,676	1,287,084	84,707
	-recovered	194,983	905,040	82,651
	<b>Used oils</b>			
4	-collected	152,171	266,200	98,152
	-recovered	148,464	266,084	109,945
5	<b>Used auto battery</b>			
	-collected	512,663	546,638	711,472
	-recovered	531,640	559,952	614,212
	<b>Waste from wooden mass manufacture</b>			
6	Saw - collected	1,924,330	3,893,954	1,376,253
	Saw- recovered	1,849,327	3,490,652	1,420,489
	Others - collected	1,503,666	3,268,624	748,658
	Others - recovered	1,650,016	3,218,007	557,098
7	<b>Plastic waste</b>			
	Collected from which	1,905,74	3,436,249	1,125,812
	PET collected	336,332	837,310	304,152
	Recovered, from which	1,778,622	3,500,616	1,102,162
	PET recovered	442,512	848,030	265,412
	<b>Dangerous medical waste</b>			
8	-collected	397,59	300,954	165,459
	-disposed	397,59	300,954	165,459
9	<b>Glass</b>			
	-collected	182,98	7,716,700	264,5
	-recovered	182,98	8,141,400	321,8
10	<b>Electronical and electric equipment waste</b>			
	-collected	291,39	925,976	164,797
	-recovered	579,359	693,216	109,085
11	<b>Textile waste</b>			
	-collected	478,430	220,886	39,369
	-recovered	394,561	272,441	31,993

These criteria must always be analyzed together in a balanced relationship, to avoid neglect of areas and thereby harm the entire system.

#### Collection Procedures

There are three types of collection procedures:

- the collection by emptying the bin;
- by changing the bin collection procedure;
- the collection of non reusable bags.

To these are added the collection without a specific system, which is used in the transport of bulky waste. For each part of the process of collection there are containers and systems of special equipment, with appropriate charging systems.

Emptying the bin collection procedure: in the procedure by emptying the collection bin, especially in transporting the domestic waste and assimilated waste from businesses, wheeled bins are used which are emptied through an installation of lift and overturning in a collection vehicle and then put back in the same place. Carrying the bins from their place to the sidewalk and back will be made by the user or by the sanitation company employees. Fastening system provided on the bin makes it easy for charging staff. For this, different bins are used, mainly standardized, which will be emptied in vehicles, fitted with a combined system for holding several types of bins.

Depending on the amount of waste and the conditions of space, bins of different types and sizes are used. In addition to the mounting collection, the vehicles are currently provided with a waste compaction mechanism, so you can load two or three times more garbage. Vehicles are used with a space for waste collection up to 23 m<sup>3</sup>.

Types of waste collected:

- household or similar waste, collected in the mixture;
- fraction of household waste (glass, paper, plastics, biodegradable and the rest);

Advantages:

- ease of handling;
- does not require a vast deployment;
- lower operating costs.

Disadvantages:

- relatively high investment costs;
- relatively large staff;
- relatively high during the collection.

Hazardous waste collection systems in municipal waste can be organized as:

- fixed collection by setting up facilities for collecting, people need to sort this waste within their own household and carry them to the point of collection;
- or mobile collection system using special vehicles that collect in a given day of the month this waste, this system is indicated for rural areas as well;

## CONCLUSIONS

This paper presents effective ways of waste management in urban areas according to European requirements and quantitative status of waste collected / recovered / disposed of at the city. These data show that the percentage of recovery of waste is increasing year by year; 2009 was very good for collecting and recycling electrical and electronic, waste from wood processing, waste tires, waste oil, waste plastic and glass waste. It shows a decrease in the quantity of medical waste collection and disposal, waste paper and cardboard and textile wastes. To a better waste management in urban and not only, an important role is played by institutions with environmental tasks for checking the law abiding.

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