

## STRUCTURE AND COMPOSITION OF WASTE IN THE LANDFILL IN WOLA SUCHOŻĘBRSKA

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**Summary.** Landfill in Wola Suchożębrska accepts waste from the area of Siedlce and few neighbouring municipalities. A strict monitoring has been carried out on the landfill since 2007. The objective of the research was to analyse the amount and the morphological composition of municipal waste in the landfill in Wola Suchożębrska and on this basis to assess the efficiency of actions related to limitation of waste. Segregation of waste in the landfill caused that despite the increase of the total weight of waste a storage weight has not increased and even it decreased. Efficiency of undertaken activities was often limited due to the reasons not depending on the persons who manage the landfill. Changes in the structure of waste do not allow careful planning of future use, however, an increasing participation of plant waste makes a composting process more popular.

**Key words:** waste, waste morphology, landfill, sorting

### Introduction

In 1999 the European Union Council issued Directive No 1999/31/EC on waste disposal (Official Journal EC, 1999). The directive recommends that member states take up all measures aiming at the reduction of both the amount and dangerous nature of waste and improvement of recovery through inter alia selective collection and sorting of already collected waste. The Member States have been obliged to control and manage waste disposal in order to prevent negative effects of their influence on human and environment (Boer and Boer, 2007; Kotovicová, 2010). However, as Köller (1996) states, preventing formation of waste wherever possible, is the most desired in the hierarchy of dealing with waste.

In Poland waste management and thus principles concerning waste disposal is governed by the Act of 14th December on waste (Dz.U. [Journal of Laws] item 21, 2013). Article 105 of this act states: "Waste before placing them in the landfill are subjected to the process of physical, chemical, thermal or biological conversion, including segregation in order to limit threat for people's life and health or for environment and to limit the amount or volume of the stored waste and to facilitate dealing with them or carrying out recovery". How-

ever, particular self-governments considerably earlier undertook activities aiming at the best preparation for meeting the future requirements (Kwapisz, 2005; Petrus, 2006; Wota and Woźniak, 2006). Such activities were also undertaken by Zakład Utylizacji Odpadów Sp. z o.o. in Siedlce in the landfill in Wola Suchożebrska.

Landfill in Wola Suchożebrska is located in the east part of Mazowieckie Voivodeship in Siedlecki Province. It accepts waste from the area of Siedlce and neighbouring municipalities. Monitoring of landfill has been carried out since 2007. It results from directives included in the Ordinance of the Minister of Environmental Protection of 9th December 2002 on the scope, time, manner and conditions of carrying out the monitoring of the waste landfill (Dz.U. No. 220, item 1858, 2002).

### **Objective of the paper and methodology of research**

The objective of the research was to analyse the amount and the morphological composition of municipal waste on the selected landfill and on this basis to assess the efficiency of actions related to their limitation.

Analysis of the structure and weight of waste is carried out in order to confirm compatibility with a decision confirming the instruction of exploitation of a given landfill.

Marking the morphological composition ordered by ZUO in Siedlce was carried out by SGS EKO - Projekt Sp. z o.o. from Pszczyna pursuant to the Polish Norm PN-93/Z-15006 concerning marking the morphological composition of solid municipal waste. A 5 kg sample was weighted out from an average laboratory sample. It was divided into 2 fractions with the use of a sieve: first fraction of the particles size less than 10 mm and the second fraction of the particles size equal to and exceeding 10 mm. Particular groups of waste components were selected from the second fraction: food plant waste, food animal waste, paper and cardboard waste, plastic waste, textile waste, glass waste, metal waste, remaining organic and remaining mineral waste. All selected groups were weighted with accuracy to 0.5 g. Then, their percentage content was calculated.

Landfill in Wola Suchożebrska pursuant to the Act on waste of 14 December 2012 (Dz.U. item 21, 2013) is determined as a landfill of other waste than dangerous and neutral. The surface area of the landfill is 6.204 ha, including 1.3 ha is a non-used part since 1992 (quarter 1) and the surface area 4.904 ha is a currently exploited basin. Waste disposal is carried out with an escarpment – range method, placing waste in the horizontal system from the bottom. The disposed waste are compressed in order to increase the stability of base and after obtaining the layer thickness of 2.00 m, an insulation central layer 0.2 mm thick is made. Waste will be disposed when it achieves ordinate height of 169 m above the sea level with declination of outside escarpments 1:2-1:2,5.

### **Research results and discussion**

Waste management is one of the basic problems with which governments have to deal today. Although the new act introduced many regulations, which define principles of dealing with waste, adjusting everything to provisions of this act requires extensive actions to be taken.

Opening a waste sorting plant in Wola Suchożebrska in August 2007 allowed gradual decrease of the amount of non-segregated waste, which are disposed directly at the landfill. As early as in the first year of operation of the sorting plant, 75% of waste disposed in the landfill had gone through installations of the sorting plant earlier. In the following years, a percentage of segregated waste increased gradually and in the end of 2012 achieved 100% (table 1). In the current year, all waste, which reach the landfill are subjected to the sorting process or as in case of waste, emphasised in the line, the remaining are used in majority to deliver insulations layers between particular waste layers (the following belong to the group of remaining waste: brick rubble, sand, rocks and mixed waste of concrete, ceramic materials or elements of equipment).

Segregation of waste in the landfill caused, that despite the increase of the total weight of waste a storage weight has not increased and even it decreased. Undoubtedly, it is very favourable from the point of view of environment. Unfortunately, the fact that huge amounts of waste are still deposited in the landfill obliges to undertake further actions. Simultaneously, particularly in the first three years of carrying out research, weight of accepted waste to the landfill decreased considerably (despite a gradual covering of the biggest area to be served). Popularization of the selective waste collection influenced it particularly.

Improvement of the sorting process and composting organic waste influenced a considerable limitation of the finest remains from the mechanical waste treatment (table 2). One of the main objectives of opening the sorting plant was to prepare waste in a way that enables their composting, therefore, a considerable part of the smallest fraction reached a composting plant. As a result, the amount of biodegradable waste deposited in the landfill was limited. Unnecessary organic waste has become the source of compost production.

Table 1.

*Percentage share of particular types of waste, which are disposed in the landfill in Wola Suchożebrska*

Type of waste	2007	2008	2009	2010	2011	2012
Other from mechanical processing	20.3	75.0	82.0	86.2	85.3	88.6
Non-segregated municipal	67.7	5.8	8.9	7.5	5.1	3.9
Remaining	12.0	19.2	9.1	6.3	9.6	7.5
Total (Mg)	25878	21005	19184	18273	18795	18304

*Source: Monitoring Składowiska Odpadów w Woli Suchożebrskiej. Reports for 2007-2012. SGS EKO-PROJEKT Sp. z o.o. Pszczyna.*

Separation of secondary raw materials from the whole mass of waste, their recovery, purification and division into commercial fractions in order to prepare for later use is the next objective of the sorting process. However, as it may be seen from the results presented in table 2, not always the actions brought the expected results. It resulted from different reasons. The increase of paper and cardboard waste in the landfill was related to inter alia a big number of atmospheric precipitations in 2011-2012. Even, at properly segregated

paper or cardboard, flooding with water excluded in practice its further use. Situation relating to leaky tanks was intensified by concious devastations. Increase of the content of plant and glass food waste in the disposed mass resulted, most probably from waste of the one of big supermarkets net. Mixing expired food with damage packages disabled segregation of the considerable mass of waste.

Other events, such as closing small landfills, which do not meet requirements in the neighbourhood and disposing waste in the mentioned landfill as well as liquidation of "wild landfills" remains essential for the changes in the stored mass. Everything that was abandoned in forests or wastelands e.g. excavations is brought to the landfill, most frequently mixed with soil or plant remains. Unfortunately, the problem with "wild landfills" is still considerable, even despite an organized waste collection in a given area. The area of the landfill operation is not however an exception in this case, because similar problems occur in the whole country (Kwapisz, 2005; Mizgajski and Lankiewicz, 2007; Wota and Woźniak, 2006). As Bergel and Kaczor (2006) state, disproportions between the estimated and actual amount of waste are great.

Table 2.

*Morphological composition (%) of waste, which are deposited in the landfill in Wola Suchożebrska*

Name of the component	2007	2008	2009	2010	2011	2012
Fraction <10 mm	64.8	76.9	33.1	52.2	33.9	23.7
Food plant waste	0.0	0.0	5.3	1.2	15.6	17.4
Food animal waste	0.0	0.0	0.0	0.0	0.0	0.0
Paper and cardboard waste	1.5	4.4	5.7	1.6	8.3	14.0
Plastic waste	21.6	6.2	12.8	19.2	12.9	11.8
Textile material waste	0.0	0.0	0.0	0.0	0.0	4.3
Glass waste	1.1	1.8	6.4	2.3	10.9	16.0
Metal waste	4.0	0.0	2.2	0.0	0.7	0
Remaining organic waste	0.0	10.7	29.9	20.0	9.92	4.6
Remaining mineral waste	7.0	0.0	4.6	3.5	7.8	8.2

*Source: Monitoring Składowiska Odpadów w Woli Suchożebrskiej. Reports for 2007-2012. SGS EKO-PROJEKT Sp. z o.o. Pszczyna*

Considerable changes in the structure of waste do not allow detailed determination of the possibility of the future use. Still, it is too often that in many cases the efficiency of recovery is worsened. Whereas, the increasing participation of plant waste increases the amount of waste which can be composted.

## Conclusions

1. Starting waste sorting and composting processes allowed decrease of the mass disposed permanently in the landfill.
2. Efficiency of the undertaken actions was unfortunately frequently limited due to various reasons, not depending on the persons managing the landfill.
3. Changes in the morphological composition of waste disposed in the landfill impede planning more efficient actions.

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## **STRUKTURA I SKŁAD ODPADÓW NA SKŁADOWISKU W WOLI SUCHOŻEBRSKIEJ**

**Streszczenie.** Składowisko odpadów w Woli Suchożebrskiej przyjmuje odpady z terenu miasta Siedlce oraz kilku gmin ościennych. Od roku 2007 prowadzony jest na składowisku ścisły monitoring. Celem prezentowanych badań była analiza ilości i składu morfologicznego odpadów komunalnych na składowisku w Woli Suchożebrskiej oraz na tej podstawie ocena skuteczności działań związanych z ich ograniczeniem. Segregacja odpadów na składowisku sprawiła, że pomimo wzrostu ogólnej masy odpadów przywożonych nie wzrosła a nawet zmalała masa składowana. Skuteczność podejmowanych działań była często ograniczana ze względów niezależnych od prowadzących składowisko. Zmiany w strukturze odpadów nie pozwalają na dokładne zaplanowanie przyszłego wykorzystania jednak wzrastający udział odpadów pochodzenia roślinnego stwarza możliwość powszechniejszego procesu kompostowania.

**Słowa kluczowe:** odpady, morfologia odpadów, składowisko, sortowanie

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